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On Proliferation and Containment

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PhD Series 9.2020

Kai Basner

SERVITIZATION AT WORK

ON PROLIFERATION AND CONTAINMENT

Doctoral School of Business and Management | **PhD Series 9.2020**

CBS COPENHAGEN BUSINESS SCHOOL
HANDELSHØJSKOLEN

Servitization at work – on proliferation and containment

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English Abstract

This is a paper-based dissertation, consisting of a 'cape' and three articles, one of which is single-authored. The topic is servitization at work.

Servitization is a competitive strategy that, typically, Western industrial manufacturing companies implement in order to secure their continued existence in increasingly competitive markets. Servitization means combining products with a service component. With increasing servitization implementation, companies move away from focusing on the sales of products and instead emphasize their use, for example by repairing them, renting them out or by operating and maintaining machines for clients. But more recent literature also highlights that companies face many challenges when implementing servitization, up to the point where some close their service business again. This indicates that servitization has important implications to it other than 'just' selling services.

This dissertation argues that some of these implications have gone by unnoticed because much of the literature is both rooted in and itself perpetuating a number of widely-held assumptions. Taking on a pragmatic stance, it explores how servitization is at work, despite the challenges associated with it. In so doing, it challenges three taken-for-granted notions in the literature, namely that customers demand services by default, that products are stable and that servitization is one definite thing. It draws on the infralanguage and methodology provided by Actor-Network Theory. In particular, it mobilizes the ideas around *qualification*, *inscription* and *multiplicity*.

Empirical research was undertaken in a Western manufacturing firm implementing servitization and the findings are presented in the three articles. Here, the first article shows that there is no default demand for servitized offerings and sheds light on the so far ignored qualification work

required in order to create demand for such offerings in the first place. But, as is argued in the second article, this can also lead to a proliferation of service qualities. The case company was found to experiment with the scalability of their service offerings, creating inscriptions in order to facilitate the containment of their qualities. The third paper investigates the servitized product and finds that, far from it being stable, servitization practice renders it multiple. It further explores the so far undocumented coordination work that allows us to nevertheless think of it as being one.

Taken together, these articles show that servitization at work is not a definite thing with clear boundaries, rather it is a dynamically unfolding process that is marked by proliferation and containment. This dissertation contributes to the extant servitization literature by emphasizing the importance of so far unrecognized efforts in order to make servitization work as well as the proliferating implications such a strategy has, which themselves call for even more work in order to contain them.

Dansk Resume

Dette er en papirbaseret afhandling bestående af en ramme og tre artikler, hvoraf én har en enkelt forfatter. Emnet er servitization på arbejdet.

Servitization er en konkurrencedygtig strategi, som typisk vestlige industrielle fremstillingsvirksomheder implementerer for at sikre deres fortsatte eksistens i et stigende konkurrencedygtigt marked. Servitization betyder, at man kombinerer et produkt med en servicekomponent. Ved at øge implementeringen af servitization bevæger virksomheder sig væk fra kun at fokusere på salg af produkter til i stedet at fremhæve anvendelsen af produkterne. Virksomheder kan for eksempel tilbyde reparation, udlejning eller drift og vedligeholdelse af maskiner for deres kunder. Dog fremhæver den seneste litteratur, at virksomheder møder mange udfordringer, når servitization skal implementeres. Endda til en grad hvor virksomheder er nødsaget til at lukke deres servicevirksomhed ned igen. Dette indikerer, at der ligger betydeligt mere bag servitization end bare at sælge service.

Denne afhandling argumenterer, at flere af disse implikationer er gået litteraturen forbi ubemærket, fordi meget af litteraturen selv er baseret på en række vedvarende og vidtgående antagelser. Ved at tage et pragmatisk ståsted, udforsker denne afhandling, hvordan servitization fungerer på arbejdet, selvom der er udfordringer associeret med det. Således udfordrer den tre forudindtagede antagelser fra litteraturen, nemlig at kunden efterspørger services pr. default, at

produkter er uforanderlige, og at servitization er et utvetydigt begreb. Denne afhandling trækker på "infralanguage" og metodologi leveret af Actor-Network Theory. Især mobiliserer den ideerne omkring *kvalifikation*, *inskription* og *multiplicitet*.

Empiriske undersøgelser blev foretaget i en vestligt industriel fremstillingsvirksomhed, der undergik implementeringen af servitization. Resultaterne er præsenteret i de tre artikler. Den første artikel argumenterer, at der ikke findes en standard efterspørgsel efter "servitizerede" tilbud, og belyser det hidtil ignorerede kvalifikationsarbejde, der i første omgang er nødvendig for at skabe efterspørgsel efter disse tilbud. Dog, som argumenteres i den anden artikel, kan dette også føre til en eskalation af servicekvaliteter. Det viste sig, at virksomheden, der blev undersøgt, eksperimenterede med skalerbarheden i deres servicetilbud, ved at skabe inskriptioner, så virksomheden kunne facilitere en inddæmning af deres kvaliteter. Den tredje artikel undersøger det "servitizerede" produkt og udleder, at selvom det langt fra er stabilt, så gør brugen af servitization produktet mangfoldigt. Artiklen udforsker endvidere det hidtidige udokumenterede koordinationsarbejde, der får os til at tro, at den er én ting.

Tilsammen viser disse tre artikler hvordan servitization på arbejdspladsen ikke er en definitiv ting med klare grænser. Det er hellere en dynamisk og udfoldende proces, der er markeret af eskalation og inddæmning. Denne afhandling bidrager til den nuværende servitization litteratur ved at fremhæve betydningen af hidtidige ukendte anstrengelser på at få servitization til at fungere, og hvilke implikationer sådan en strategi har, der på samme tid skaber endnu mere arbejde for at kunne inddømme den.

Chapter 1: Introduction

Changing competitive environments lead companies to adjust the ways in which they conduct business. Under such circumstances, companies have been advised to focus on providing unique and innovative offerings (Porter & Ketels, 2003). However, recent developments are undermining what we have come to think of as normal. This particularly affects global companies active in the heavy industries. Seemingly far removed from people's everyday lives, the fact that they deliver the materials essential for our daily needs is easily forgotten. Nevertheless, oil, steel, coal, copper and cement are crucial for supplying the growing global population with, for instance, infrastructure and electric cars as well as power for the factories that produce them. After recovering from the 2008 financial crisis,[1] these industries now need to cope with trade barriers and tariffs,[2] which challenge how their industrial products are produced, sold and bought.

For the heavy industries, one important way of addressing these challenges is to offer services –a phenomenon commonly referred to as *servitization* (Vandermerwe & Rada, 1988). On a general level, servitization entails a shift in focus from the product to the customer (Huikkola, Kohtamäki, & Rabetino, 2016a). Product-centric industrial companies, such as those active in heavy industrial manufacturing, may wish to implement servitization for a number of reasons. From a financial standpoint, service revenues offer attractive margins as well as smaller, but more stable, revenue streams than large-scale equipment sales (Gebauer & Fleisch, 2007). This is particularly relevant for more complex industrial equipment with longer lifespans, where significant revenues can be realized 'downstream' through the provision of services (Ward & Graves, 2007). From a strategic standpoint, services are difficult to copy and allow organisations to compete on dimensions other than price (Kastalli, Van Looy, & Neely, 2013). Moreover, services enable companies to differentiate their offerings and counter commoditization pressure in their markets (Matthyssens & Vandenbempt, 2008). From a marketing standpoint, customers demand services and other integrated offerings in order to satisfy their own increasingly sophisticated needs (Wise & Baumgartner, 1999). Furthermore, services shift the supplying organisation's focus from transactions towards the establishment of relationships with customers. As such, they create operational linkages as well as opportunities for information sharing and increased cooperation (Penttinen & Palmer, 2007). Last but not least, the use of services to extend a product's lifespan

[1] https://www.economist.com/business/2008/10/15/hurting-the-real-economy.

[2] https://www.strategyand.pwc.com/trend/2019-industrials.

fosters sustainable development (Sauvé, Bernard, & Sloan, 2016). All in all, servitization is depicted as a way for industrial manufacturing companies to not only survive but also thrive in difficult times.

However, there is also mounting evidence that servitization is difficult to implement for a number of reasons. For instance, manufacturing companies struggle to understand what their customers want or need (Johnstone, Dainty, & Wilkinson, 2009; Trkman, Mertens, Viaene, & Gemmel, 2015). As a label, 'customers' is used to refer to a range of heterogeneous groups that can be difficult to service with standardized offerings (Valtakoski, 2017). This makes it harder to achieve economies of repetition from new service capabilities or routines (Davies & Brady, 2000). Service provision is also challenging because providers and customers can have very different understandings about essential aspects, such as what constitutes value (Pawar, Beltagui, & Riedel, 2009). Other research points to the difficulty of servitizing and remaining profitable (Gebauer, Fleisch, & Friedli, 2005).

Although these difficulties have been analysed in the extant literature, the majority of this research has adopted a predominately positivist understanding (Luoto, Brax, & Kohtamäki, 2017; Tronvoll, Brown, Gremler, & Edvardsson, 2011). This means that it has emphasized a search for more or less universal servitization 'guidelines' or 'rules'. Consequently, much of the available research also has a tendency to provide suggestions for successfully implementing servitization (Fliess & Lexutt, 2019; Huikkola et al., 2016a; Rönnberg Sjödin, Parida, & Kohtamäki, 2016). Over time, many of the so created understandings have become widely accepted–without much interrogation or challenge. Notably, this has directed attention away from companies' inner workings and the everyday practices associated with servitization as well as the dilemmas and tensions that those practices create. Moreover, we know little about the ways in which those tensions are resolved.

In order to shed light on these issues, this dissertation asks:

RQ: How does servitization work in practice despite the difficulties associated with it?

In answering this question, I explore how servitization as a phenomenon 'works' in the first place. Whereas much previous literature tended to focus generally on the difficulties of developing and

implementing servitization, this dissertation focuses on the specific difficulties of making servitization a practice – and how such difficulties are dealt with when practicing servitization. In order to provide an answer, the research presented here moves between puzzling notions encountered in the literature and in the empirical data. The findings are presented in the form of three independent articles.

By moving between the empirical and theoretical worlds, I was able to discover and mobilize new concepts and ideas emanating from the rich repertoire of actor-network theory (ANT) that have not received much attention in the servitization literature. More specifically, I treat servitization as the research domain – a topic area that is part of a larger field (Lukka & Vinnari, 2014). My findings contribute to this domain. In order to do so, I treat ANT as a method theory, which is defined as a "meta-level conceptual system for studying the substantive issue(s) of the domain" (Lukka & Vinnari, 2014, p. 1309).

The rest of this dissertation is structured as follows, In Chapter 2, I present the theoretical linkages between the extant servitization research and the ANT approach. In so doing, I show how the ANT approach can help problematize notions that are taken for granted in servitization research and, thereby, provide a different understanding on the matter. Chapter 3, which is the methodology chapter, explains how I went about investigating servitization at work. In particular, it emphasizes how doubt allowed me to move between the empirical and theoretical worlds in order to find more appropriate ways to conceptualize and understand the focal phenomena. In Chapter 4, I present my case report, which illustrates servitization in ManCo, an industrial manufacturing company active in the heavy industries. Chapter 5, which collects the empirical articles, is the heart of the dissertation and presents my findings. Chapter 6 details my contributions to the servitization domain, offers a concluding discussion across the three articles and provides an outlook for future research in this domain.

Chapter 2: Theoretical linkages

One way in which we understand and make sense of the world is outlined by the American philosopher Charles Sanders Peirce (1878), who wrote that meaning is consequence. This means that we cannot read any research independent of the practical bearings we perceive in the empirical world. Moreover, we cannot read any literature independent of the conceptions that we have gained from reading other streams of literature. Therefore, the examination of the domain

theory presented in this chapter is guided by my methods theory, which is presented next. This allows me to contrast the idea that servitization is a static thing that is determinable with the understanding that servitization is practically achieved, such that it is negotiable, changeable and fluid (Latour, 1984). This enables a more critical reading of the domain literature and an examination of its implicit assumptions, which render it susceptible to the research question posed in this dissertation: How does servitization work in practice despite the difficulties associated with it? Consequently, this chapter presents the main theoretical considerations and concepts from the servitization domain, which are problematized and questioned from the viewpoint of actor-network theory (ANT).

The ways in which I located the research covered in this chapter developed over time. I was familiarizing myself with the servitization domain long before I began working on this dissertation, which meant that I already had an understanding of the domain and the seminal papers within it. I built on that understanding to compile this review of extant theories. The studies were found using Google Scholar searches. Servitization plays out across different academic communities (see, e.g., Rabetino et al., 2018a). Therefore, it was important to use a search engine that provided broader search results than, for instance, the more management-minded EBSCOhost database. I found the articles using keyword searches for "servitization" or "servitization", "industrial services" or "service, manufacturing" in the title, abstract or body of the text. Subsequent literature was found by examining the references listed in these articles. As my understanding of the domain developed, I increasingly began searching for ANT accounts. In this regard, I started with backwards searches for publications that cited seminal work (such as Callon, Méadel, & Rabeharisoa, 2002, or Latour, 2005) and searched all of those articles that mentioned "industrial services". As my understanding evolved, I broadened this search by including articles with the keywords "Callon" or "Latour" or "Mol" and "service".

The remainder of this chapter is structured as follows. First, I introduce the extant servitization literature, present the extant insights on servitization challenges and highlight some of the widely accepted assumptions found in this stream of literature. Second, I introduce ANT and highlight its relevance as a method theory for reconsidering three taken-for-granted notions that have been highly influential in servitization research.

Servitization

Different theoretical approaches to services in industrial manufacturing

The topic of services within industrial manufacturing has been taken on across different research domains, but it typically occurred rather isolated. This is why some researchers have called for more discussions across domains (Raddats, Kowalkowski, Benedettini, Burton, & Gebauer, 2019). The general argument states that industrial manufacturers are increasingly offering services – a move that is largely deemed to be beneficial for them (Baines & Lightfoot, 2013a). This move toward services affects these companies in a number ways, which have been researched from a variety of perspectives, such as operations management (Baines & Lightfoot, 2013b), general marketing (Tuli, Kohli, & Bharadwaj, 2007), industrial marketing (Ulaga & Loveland, 2014), general management (Agrawal & Bellos, 2017) and service management (Lay, Copani, Jäger, & Biege, 2010).

A plethora of interrelated terms has emerged from this stream of research:

- *Servitization*: Servitization describes the trend of product-centric companies moving towards selling more services and adding services to products while retaining their product-based core offerings (Baines, Lightfoot, Benedettini, & Kay, 2009b; Nudurupati, Lascelles, Wright, & Yip, 2016; Parry & Tasker, 2014; Vandermerwe & Rada, 1988).

- *Integrated products and services*: This term refers to a combination of products and services (emanating from servitization) that counters competitors' offerings by, for instance, being more distinct and offering a longer lifespan (Baines et al., 2009b; Pawar et al., 2009).

- *Servicizing*: Servicizing implies that suppliers change their business models from selling products to providing services in order to use less materials and operate more sustainably (Agrawal & Bellos, 2017; Reiskin, White, Johnson, & Votta, 1999; Rothenberg, 2007).

- *Service infusion*: This term, which refers to theories pertaining to strategic management, emphasizes obtaining a competitive advantage through customized solutions by seeking to increase service offerings and customer orientation within an organization. It is sometimes

used together with ‘servitization’ (Eloranta & Turunen, 2015; Ostrom et al., 2010; Rabetino, Kohtamäki, Lehtonen, & Kostama, 2015).

- *Service growth*: This term refers to products firms shifting from selling products to selling and delivering services as a response to product maturity and in order to grow from service (Kowalkowski, Gebauer, & Oliva, 2017; Kowalkowski, Windahl, Kindström, & Gebauer, 2015; Ulaga & Loveland, 2014).

- *Product-service systems (PSS)*: A product-service system is a set of products and services that fulfils user’s needs (e.g., by offering a customer the right to use a product rather than the product itself). The product-service ratio can be adapted to the level that is most beneficial in terms of function and economic viability (Martinez, Bastl, Kingston, & Evans, 2010; Mont, 2002a; Reim, Sjödin, & Parida, 2018).

- *Solutions*: There is no unanimously accepted definition of ‘solutions’, but there is agreement that solutions are highly customized bundles of products and services that result in better customer outcomes than the sum of their respective components. Solutions have a long-term orientation and require long-term relationships with customers (Davies, 2004; Nordin & Kowalkowski, 2010; Shepherd & Ahmed, 2000).

- *Productization*: Productization involves turning abstract and difficult-to-grasp professional services into exchangeable objects by defining and standardizing these offerings and underlying processes (Harkonen, Tolonen, & Haapasalo, 2017; Jaakkola, 2011).

- *Service-dominant (SD) logic*: Marketing scholars argue for taking on a service perspective, which entails considering everything that is traded as a service, including tangible goods, which are understood to be a means in order to achieve a desired effect from their usage (the service) and, in so doing, creating value (Vargo & Lusch, 2004).

Despite their differences, these terms overlap, as they each are used to treat and to conceptualize the complex relations between industrial products and services. In particular, the notions of servitization, integrated products and services, servicizing, service infusion, service growth, PSS,

and solutions are used to talk about a shift from producing and selling industrial offerings to a new business orientation concerned with how customer benefits can be delivered by selling both products and services (Barquet, de Oliveira, Amigo, Cunha, & Rozenfeld, 2013). This overlap among the different terms constitutes what I refer to as the "servitization domain".

In the servitization domain, it is not always easy to clearly distinguish among different streams of thought. For example, Raddats and colleagues (2019) understand *service infusion* as occurring when the relative importance of services to products increases within the company, which is precisely what Oliva and Kallenberg (Oliva & Kallenberg, 2003) describe as servitization. Clear demarcations are further complicated by contentions between different approaches to the topic. For example, some researchers treat terms such as 'service growth' as umbrella terms that also cover PSS, solutions or servitization (Kowalkowski, Gebauer, & Oliva, 2017). However, the term 'service growth' can be contentious in itself, as not all firms are able to grow by offering services (Neely, 2008). More recent papers cross these divides by presenting terms such as 'servitization', 'service infusion' and 'service growth' as united in their emphasis on an organizational change (e.g., Palo, Åkesson, & Löfberg, 2018).

In the context of this dissertation, I use the terms 'servitization' and 'servitized offerings'. 'Servitized offerings' are combinations of products and product-related services (Turunen & Finne, 2014). The term has recently gained traction across research disciplines in the servitization domain (Green, Davies, & Ng, 2017; Wilkinson, Dainty, & Neely, 2009; Wynstra, Spring, & Schoenherr, 2015; Zhang & Banerji, 2017). It is an inclusive term that refers to the overlapping ideas and concepts proposed by such terms as servitization, integrated products and services, servicizing, service infusion, service growth, solutions and PSS. At the same time, it emphasizes the relation to and around the product. As such, it excludes the less product-focused understandings propagated, for example, by the SD logic or the idea of productization. Furthermore, the terms servitization and servitized offerings are relatively descriptive, neutral and widely accepted in the servitization domain. Unless otherwise stated, whenever I refer to "services", I am referring to services as part of a servitized offerings.

What is servitization

Servitization is interchangeably described as a type of organizational change (Baines & Lightfoot, 2013) and a competitive strategy (Baines, Lightfoot, Benedettini, & Kay, 2009) that leads

industrial companies, typically product manufacturers, to offer services. More specifically, the term implies the maintenance of a core portfolio of product offerings along with a continual increase in the proportion of service sales (Vandermerwe & Rada, 1988). Such moves affect companies of all sizes (Kowalkowski, Witell, & Gustafsson, 2013). Importantly, servitization means not only selling and providing servitized offerings but also servicing a pre-existing installed base of equipment (Davies, Brady, & Hobday, 2006).

Some authors write about the move to services in general and to servitization in particular as a service *transition*, which indicates that providers are moving away from products in order to sell services (Gebauer et al., 2005; Oliva & Kallenberg, 2003; Ulaga & Loveland, 2014). The common argument is that companies find it easier to start servitizing by offering 'basic' (i.e., product-related) services, such as the provision of spare parts or repairs of installed equipment (Matthyssens & Vandenbempt, 2008). As companies learn about their customers' needs and become better organized, they may build on this experience to provide more advanced, client-centric services, such as training, consultancy or process optimization (Mathieu, 2001a; Tuli et al., 2007).

This also implies that an assumption of linearity is associated with a service transition. In this regard, researchers argue that companies follow a clear progression of steps over time (Baines, Lightfoot, Benedettini, & Kay, 2009a; Oliva & Kallenberg, 2003a; Tukker, 2004). However, recent research shows that such conceptualizations do not necessarily correspond with empirical observations, which suggest more iterative pathways as well as reversed pathways in which companies may even move away from offering services (Finne, Brax, & Holmström, 2013; Kowalkowski et al., 2015; Turunen, 2011). Therefore, a manufacturing company's shift towards services might be more fittingly described as continuously emergent and exploratory in nature (Spring & Araujo, 2013).

Kowalkowski et al. (2015) propose that servitization, by default, ends when the servitizing company completely lets go of or remodels its product business in order to sell predominately advanced, customer-centric services. However, such a clear endpoint is not indicated by Vandermerwe and Rada (1988), who coined the term 'servitization', nor does it seem to be a helpful addition to the term. To the contrary, it makes it more difficult to understand manufacturing companies' efforts to succeed with a service business. In other words, if

servitization can only be achieved if a company strives for and achieves such an 'ultimate' and elusive state, there is little room to consider companies that might not be interested in de-emphasizing their products or that have moved away from such a state. In short, this view would exclude most companies from consideration. Therefore, it might be more useful to understand servitization without a designated endpoint and to allow companies to follow their own servitization trajectories, which may have the potential (but not the obligation) to lead them toward providing only advanced services.

Over time, 'servitization' has become one of the most prominent terms used to refer to this research domain, as evidenced by the fact that this term has its own academic conference (the Spring Servitization Conference), designated streams at other conferences (e.g., EurOMA) and special issues dedicated to the topic (e.g., the 2017 special issue of the *Industrial Marketing Management* journal). Given its popularity, this dissertation disregards the difficulty of knowing a company's service trajectory a priori and uses the term 'servitization' in the sense that it also entails companies devising, selling and delivering servitized offerings.

The theoretical challenge of defining services

Before discussing the ways in which research has addressed the drivers and challenges of servitization, it is helpful to establish what is meant by 'products' and 'services'. The difference between products (or 'goods') and services has long been a contentious issue in the literature, with the debate stretching across domains such as economics, institutional theory and service marketing. In particular, new technologies are challenging long-standing ideas about what makes a product or a service. Intangible goods, such as software, may be considered a product, just like a machine or a ton of copper. Hill (1999; 1977) suggests that products are entities that have economic value and over which it is possible to establish ownership rights. Such rights make it relatively easy to define ownership and sales of products. However, the definition of services remains contentious. Criteria such as IHIP (intangibility, heterogeneity, perishability and inseparability; Lovelock & Gummesson, 2004) have proven to be too essentialist to adequately describe what researchers find in practice (Vargo & Lusch, 2004) and are falling out of use. There are simplified approaches, such as that of Grönroos (2011, p. 245), who suggests that "[s]ervice as a phenomenon means support by one party for another party's practices and processes". However, such simplicity glosses over some of the complexities of service provision.

Gadrey (2000) offers a more nuanced classification, which classifies services as centring around three demand rationales: 1) performance 2) assistance and 3) requests for intervention. More specifically, Gadrey (2000) draws attention to the service triangle, which involves a provider, a customer and a product (see Figure 1).

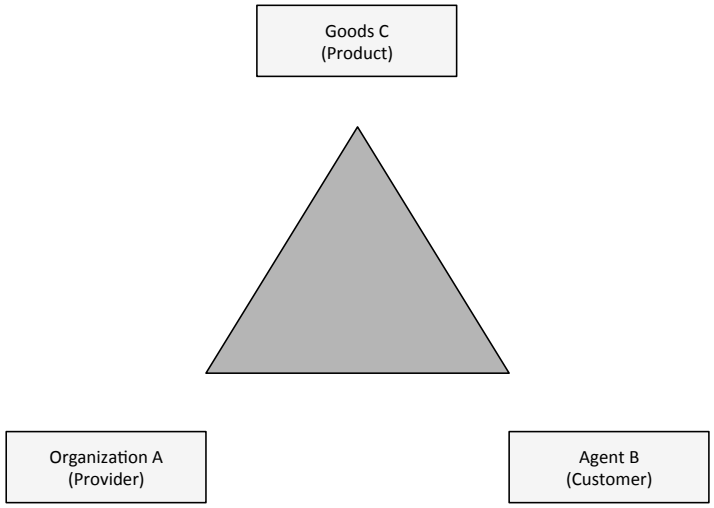

Figure 1: Gadrey's (2000) service triangle

Accordingly, services occur whenever:

> "…an organization A, which owns or controls a technical and human capacity (this latter can also be denoted by the term "competencies"), sells (or offers without payment in the case of non-market services) to an economic agent B the right to use that capacity and those competencies for a certain period in order to produce useful effects on agent B himself or on goods C that he owns or for which he is responsible." (Gadrey, 2000, p. 384)

This definition has found acceptance in the broader literature on services and servitization (Callon et al., 2002; Carlborg, Kindström, & Kowalkowski, 2014; Kreye, Roehrich, & Lewis, 2015; Nordin, Kindström, Kowalkowski, & Rehme, 2011; Pereira, Kreye, & Carvalho, 2019; Spring & Araujo, 2009). It also points to some of the complexities that may affect servitizing companies: What does it mean for the provider to control a *technical and human capacity*? How can *the right to use a capacity* be sold? What is a *useful effect* on the product? It is questions such as those that play out in on-going servitization relationships between companies.

Servitization drivers

The extant literature presents four major forces that lead companies to implement servitization. First, economic pressures and mature markets force companies to find new ways to make profits (Neely, 2008; Vandermerwe & Rada, 1988; Wikhamn, Ljungberg, & Styhre, 2013). Global recessions or political turmoil present difficult challenges, especially for companies active in the globalized industrial manufacturing industries. Consequently, it can be difficult for them to operate profitably based solely on product innovation (Baines et al., 2009). In this regard, servitization appears to be a feasible countermeasure, as it enables suppliers to grow in otherwise saturated markets. It also allows companies to thrive in tough market environments, such as the commodity markets (Gebauer & Fleisch, 2007; Robinson, Clarke-Hill, & Clarkson, 2002). This is because services are ascribed to have higher profit margins and because service revenues are more stable, predictable and resilient to outside shocks than the cycle-dependent sales of industrial equipment (Gebauer & Friedli, 2005; Oliva & Kallenberg, 2003; Wise & Baumgartner, 1999). In short, services can help defend a provider's ailing product business (Kowalkowski, Gebauer, Kamp, & Parry, 2017).

Second, offerings involving combinations of services and products can help offset the commoditization of a company's traditional product offerings. The commoditization of traditional product offerings is an acute concern in the literature (Böhm et al., 2017; Coyne, 1989; Gebauer, 2008; Gebauer & Fleisch, 2007; Huikkola et al., 2016), where commoditization is understood as a decline in the differentiation of a company's offerings from those of its competitors (Matthyssens & Vandenbempt, 2008). Servitization is largely assumed to help differentiate products (Bustinza, Bigdeli, Baines, & Elliot, 2015; Mudambi, Doyle, & Wong, 1997; Oliva & Kallenberg, 2003; Porter & Ketels, 2003). For example, service provision allows providers to communicate the distinct capabilities that enable service provision in the first place. They can subsequently link those capabilities back to their product offerings (Davis, Golicic, & Marquardt, 2008; Reim, Parida, & Örtqvist, 2015). This helps companies escape the threat of commoditization (Robinson et al., 2002).

Third, increased competition has many companies struggling to remain competitive in markets that they once dominated, a condition that they seek to mitigate by offering services (Gebauer et al., 2005; Kowalkowski et al., 2015; Neely, 2008; Oliva & Kallenberg, 2003; Turunen & Finne, 2014). The mounting competitive pressures are argued to be the result of such developments as

product maturity (Kowalkowski et al., 2017), new market entries and increasing price competition (Cova & Salle, 2007; Vandermerwe & Rada, 1988; Vendrell-Herrero & Wilson, 2017; Visnjic Kastalli & Van Looy, 2013). Advanced service offerings are believed to help insulate suppliers from such pressures because they help to lock in clients through long-term, high-margin service contracts. Moreover, those contracts provide an opportunity to follow up with even more services (Shepherd & Ahmed, 2000). As competition in suppliers' home markets can lead to decreasing product margins, providers servitize in order to secure increases in revenues and profits (Gebauer et al., 2005), especially as services tend to provide more stable and reliable revenues than product sales (Neely, 2008).

Fourth, companies servitize because customers demand such offerings to fulfil their own increasingly complex needs (Baines et al., 2009a; Oliva & Kallenberg, 2003a; Vandermerwe & Chadwick, 1989). The implementation of servitization brings about new ways for the company to create customer centricity and to engage with clients in a less transactional, more relational manner (Neely, Kastalli Visnjic, & Van Looy, 2013; Shepherd & Ahmed, 2000). More specifically, in offering and providing services, providers find new opportunities to interact with clients (e.g., when negotiating the service sales; Geiger & Finch, 2016). Over time, this creates a deep understanding of customers, their operational setups and their technologies. This allows for the establishment of lasting relationships (Tuli et al., 2007), which act as a competitive advantage for the supplier, as its competitors might not have access to such insights (Cohen, Agrawal, & Agrawal, 2006). Importantly, servitized offerings can also help enhance customer satisfaction (Raja, Bourne, Goffin, Çakkol, & Martinez, 2013), thereby opening up possibilities for future transactions.

As these four drivers are interconnected, it is often difficult to point to one of them as the main reason for servitization. As Cusumano et al. (2015) show, some companies may embark on a servitization journey even when their markets are not threatened by maturity-related challenges. However, such undertakings are also associated with significant challenges.

Servitization implementation

The topic of servitization implementation is not without contention. Vandermerwe and Rada (1988) originally suggested that companies implement servitization in stages, with each stage adding more services to the previous. This view has since been refined. In their seminal paper,

Oliva and Kallenberg (Oliva & Kallenberg, 2003) suggest that companies follow a continuum when they transition from products towards offering services, whereby the importance of tangible goods gradually decreases and services become increasingly important. The end of this continuum is reached when services have become so important that the good has become an "add on" (Oliva & Kallenberg, 2003). In this regard, Davies, Brady and Hobday (2007) name two options for servitizing companies: system integration, which means that a company produces all product and service components itself, and vertically integrated system selling, which means that the focal firm becomes a systems integrator, as it combines components delivered by external companies.

As research has progressed, this conceptualization of a relatively smooth implementation that follows a continuum has been considered more critically. Recent research speaks of servitization not as a singular transition but in terms of different trajectories (Kowalkowski et al., 2015; Matthyssens & Vandenbempt, 2010). For example, Paiola et al. (2013) propose that there are different strategic approaches to implementing servitization, which they relate to the service components and to the service capabilities required to design, sell and deliver servitized offerings. Notably, even the idea of a linear progression from selling a few basic services towards selling more advanced services has been criticized, with authors arguing that such linearity is not a given and that service providers might even move backwards (Finne et al., 2013; Fundin, Witell, & Gebauer, 2012). However, in their review of 154 servitization articles, Brax and Visintin (2017) confirm that most published research indicates a pattern of continual increase in service-based, complex offerings.

Another factor relevant for implementing servitization is the management of the overall transition process. Given the far-reaching implications of such a strategy, the transition process touches upon almost all aspects of the servitizing firm. For example, there is a need for a certain service awareness to be instilled across hierarchical levels, and employees need to change roles from selling products toward selling services (Gebauer & Friedli, 2005). Such a shift also implies that companies need to develop a deep understanding of their customers (Heinonen et al., 2009) and build long-term relationships with them (Payne, Storbacka, & Frow, 2006). More recently, researchers have suggested that companies should implement servitization over time and try to achieve more balanced growth by letting basic, product-based services run in tandem with more service-based approaches, so that basic services can serve as a platform for more advanced service offerings (Sousa & da Silveira, 2018a). Nevertheless, there does not seem to one best solution for

implementing servitization, which is not surprising given the breadth of its applicability across industries.

Servitization implementation also affects the areas in which servitization occurs. Scholars' understanding of this issue has developed over time. Whereas earlier studies tended to focus on implementation strategies within service-providing organizations, newer research has emphasized the customer as an important entity (Penttinen & Palmer, 2007; Pereira et al., 2019; Petri & Jacob, 2016). This is reflected in the interest in how servitization issues, such as joint problem solving, play out in the provider-customer dyad (Aarikka-Stenroos & Jaakkola, 2012). Notions, such as 'co-creation' are used to indicate that customers become heavily involved in certain processes, including service and product development, design, and implementation (Grönroos & Helle, 2010). Many capabilities necessary for servitization may be interactive, that is, they are created when two (or more) companies interact in order to create value (Raddats et al., 2017). Servitizing companies may also form bonds with their own suppliers, from whom they may source services themselves. In this sense, another interesting perspective is that of service triads in which one entity A contracts another entity B to directly deliver services to A's customer C, which allows for a range of service-delivery configurations (Wynstra et al., 2015). When many suppliers source from one another and collaborate, a service network emerges. Notably, there may not be one best way to manage such a network (Saccani, Visintin, & Rapaccini, 2014).

Overall, this means that servitization requires simultaneous implementation, re-calibration and execution of a servitization strategy. We can also glean from the literature that servitization implementation is complex and that it has certain implications for manufacturers. Therefore, the next section addresses the challenges emanating from such servitization 'at work'.

Servitization challenges and complexities

Although servitization is widely assumed to offer many benefits, it is also difficult to implement, as it carries numerous challenges and unanticipated consequences (Zhang & Banerji, 2017). Not all companies succeed with implementing servitization and there is mounting evidence of its negative effects (Benedettini, Neely, Swink, & Swink, 2015; Benedettini, Swink, & Neely, 2017). As these negative effects appear to contradict the assumed benefits of servitization, they are

sometimes referred to as a 'service paradox' (Brax, 2005; Gebauer, Fleisch, & Friedli, 2005b) – a term used to indicate that the investments companies make in order to foster a service business can be difficult to offset with the revenues resulting from that business. The extant research does not offer a clear answer for why some companies fail and others succeed with implementing servitization (Fliess & Lexutt, 2019). Overall, servitization challenges arise from three factors: (1) servitization implementation depends on multiple factors; (2) services are difficult to manage in product-centric environments; and (3) service provision tends to interact with the traditional product-centric company setup in unexpected ways.

Servitization implementation depends on multiple factors. While early studies primarily highlighted cases of successful servitization implementation, over time the literature has taken an interest in factors that can inhibit such success. For example, there is an increasing awareness of factors outside the control of the focal company and its customers that can profoundly affect a servitization journey. Turunen and Finne (2014) draw on the theory of organizational ecology to explain how a company's operating environment influences its servitization journey. They highlight the effects of such factors as resource dependency, institutional linkages and political forces. Mo (2012) analyses the risks that servitizing companies face when they engage with customers in long-term contracts in order to deliver servitized offerings. The provision of such servitized offerings, especially at pre-determined prices, presents the provider with new and important risks, such as the risk of being penalized if it is unable to perform as agreed or the risk of lost profits if sudden environmental changes render the service provision more costly than originally anticipated. There are also other, more immediate factors that affect how companies fare with servitization. For example, Gebauer et al. (Gebauer et al., 2005) point to flaws in managerial decision-making and strategy execution. In particular, the authors argue that managers' risk aversion and an overemphasis on tangible (product) aspects can inhibit their commitment to and investments in extending their service businesses, which, in turn, reduces the momentum in implementing servitization. Even if such momentum is achieved, many companies still need to reach a critical mass of services. Some research suggests that a failure to reach that critical mass may mean that servitization's effect on the firm's value will be very small or even negative (Fang, Palmatier, & Steenkamp, 2008). However, achieving a critical mass is difficult. Companies may struggle to find and maintain a balance between expanding and standardizing their portfolios of servitized offerings (Kowalkowski et al., 2015). Moreover, offering more services does not necessarily increase the chances of a firm's survival (Benedettini et al., 2017).

In light of these findings, it is not surprising that companies may decide to de-servitize by abandoning their service businesses altogether (Kowalkowski, Gebauer, Kamp, et al., 2017; Valtakoski, 2017).

Services are difficult to manage in product-centric environments. It is difficult for providers to know what customers actually need, especially when it comes to more sophisticated offerings, such as selling outcomes (Johnstone et al., 2009). In general, providers struggle to understand which services they should offer and when (Cusumano et al., 2015). In addition, not all customers may be prepared or even motivated to engage with a servitizing company (Brax, 2005), particularly when service provision has customers' employees fearing that their work may be outsourced. Moreover, servitized offerings need to be developed differently from existing, typically product-centred offerings (Kowalkowski et al., 2015) and the provider needs to build new capabilities for service development. Specifically, manufacturing companies need to develop their problem-solving capabilities in order to provide more advanced service offerings (Skarp & Gadde, 2008). Such capabilities can be configured in different ways, and companies need to be mindful of the trade-offs between the costs and benefits associated with their development (Rönnberg Sjödin et al., 2016). Spring and Araujo (2013) investigate how production-related knowledge can be leveraged for service development and provision. Turning conventional wisdom on its head, the authors contend that "the firm's task can sometimes be to reveal services and detach them from manufacturing rather than adding services to manufacturing" (Spring & Araujo, 2013b, p. 68). There are also different ways to assess and evaluate the performance of such offerings, as the existing product-centric measurements are unlikely to suffice (Mo, 2012). All of this points to the inherently difficult task that product-centric companies face as they attempt to transcend a manufacturing mindset and adopt a service culture (Dubruc, Peillon, & Farah, 2014; Johnstone et al., 2009; Martinez et al., 2010). Consequently, there is a tendency among employees to regard service provision as less important than product manufacturing. This often leads them to provide services free of charge with the aim of supporting product sales (Kujala, Ahola, & Huikuri, 2013; Oliva & Kallenberg, 2003). However, customers might not be able to correctly evaluate the value of services and the outcomes they achieve owing, for example, to a lack of expertise or knowledge (Datta & Roy, 2011).

Service provision tends to interact with the company's overall business in unexpected ways. In general, servitization implementation is difficult because it requires far-reaching changes in

manufacturing companies. These companies need to adjust to the much quicker pace of service delivery and they need to adjust their business models to enable servitization (Neely, 2008). Unintended consequences can arise when the pre-existing product orientation competes with the newly developed service orientation (Salonen, 2011). For example, manufacturers may view the development of advanced service offerings not as a goal in itself but, in contrast to the early understanding of service transitions (Ulaga & Loveland, 2014), as a platform to engage with customers and, in so doing, primarily as a means to boost product sales (Salonen, Saglam, & Hacklin, 2017). Servitization also affects suppliers' organizational structures. In this regard, researchers suggest that new service businesses can be better supported by adapting organizational structures (Gebauer, Fischer, & Fleisch, 2010). For instance, a service business may be run as its own organizational unit in order to create momentum and ensure a service-oriented management approach (Oliva & Kallenberg, 2003). However, it is difficult to anticipate the best way to structure a company to handle its servitization activities. Some argue for establishing a separate service organization, especially when premium providers enter lower-end market segments (Gebauer, 2006), while others advise firms to change their structures so that they emphasize cooperation within the firm (Neu & Brown, 2008). A change from selling products to offering services and integrated offerings also implies changes in the company's business model. Companies can choose, for example, between product- or customer-oriented models (Visnjic, Wiengarten, & Neely, 2016) or use- or result-oriented models, each of which demand distinct operational tactics in order to be successful (Reim et al., 2015). However, companies are likely to utilize more than one business model, which may lead to conflicts between the resulting practices (Palo et al., 2018). For example, servicing equipment and, thereby, prolonging a product's lifespan decreases the potential for new equipment sales (Sousa & da Silveira, 2018a).

Tending to servitization at work by challenging three implicit assumptions in the literature

Research on servitization is maturing, but it remains prescriptive, and offers (relatively) mechanistic views and unchallenged assumptions about what it means if servitization is at work and what such work entails and achieves. In a recent reflective turn, this stream of research has begun to articulate its largely taken-for-granted assumptions (Kowalkowski, Gebauer, & Oliva, 2017; Kowalkowski et al., 2015; Luoto et al., 2017; Rabetino et al., 2018a). While much of the published body of literature is dominated by qualitative research and case studies, the ruling paradigmatic assumptions are rooted in positivism, such that they take on a realist ontology and

positivist epistemology (Luoto et al., 2017; Tronvoll et al., 2011). In terms of ontology, one real world is assumed to exist 'out there' – outside of human experience. In terms of epistemology, or what is knowable, there is objectivity, and research can find universal laws and demonstrate their applicability (Lincoln, Lynham, & Guba, 2018). The reliance on exclusively understanding the world and approaching servitization research in this way is increasingly being met with criticism. Consequently, researchers have called for more studies that go beyond the established positivist paradigm (Rabetino et al., 2018a).

This dissertation aims to contribute to the servitization domain and its ontological diversity by challenging three widely accepted and taken-for-granted theoretical assumptions:

- *Customers demand services from the outset.* Customer demand is widely understood to exist 'out there' and it is often utilized as an argument for why manufacturing companies should implement servitization in the first place (Berry, Shankar, & Parish, 2006; Davies et al., 2007; Kowalkowski et al., 2015; Oliva & Kallenberg, 2003; Vandermerwe & Rada, 1988). However, if customers really demand services, why do some companies nevertheless de-servitize (Finne et al., 2013; Kowalkowski, Gebauer, Kamp, et al., 2017; Valtakoski, 2017)?

- *Servitization is a definite thing*. There is a pervasive tendency in the literature to talk about servitization as a noun, for example in terms of a strategy (Lee, Yoo, & Kim, 2016; Rabetino, Kohtamäki, & Gebauer, 2017; Ruiz-Alba, Soares, Rodríguez-Molina, & Frías Jamilena, 2018), a journey (Martinez et al., 2010), transition (Bustinza et al., 2015; Kohtamäki, Baines, Rabetino, & Bigdeli, 2018a; Kowalkowski et al., 2013) or suggesting that servitized offerings follow a 'logic' (Reim et al., 2018). This implies that servitization is a definite thing that can be clearly defined and that has relatively clear borders. In other words, either a company is servitizing or it is not. However, the multitude of terms that are used to characterize the phenomenon as well as the many research domains involved in investigating and positioning it give rise to doubts about the definiteness of servitization. In addition, research finds that servitization is, at least in terms of locations, not necessarily neatly contained within the implementing company. Instead, it plays out within a network of companies over time (Ekman, Raggio, & Thompson, 2016; Gebauer,

Paiola, & Saccani, 2013; Kowalkowski et al., 2013), meaning between customers and one or more suppliers and their sub-suppliers.

- *Products are stable*. This more implicit notion is evident when, for example, research assumes that services can be added to an underlying product (Parry & Tasker, 2014; Salonen et al., 2017; Vandermerwe & Rada, 1988). In other words, products are understood as acting like a canvas that can be improved or enhanced by services. However, some researchers have begun to bring products more into the foreground and to conceptualize them as more difficult and unstable than previous research suggests (Spring & Araujo, 2017).

These three points indicate that central tensions in the servitization domain have yet to be investigated. To a great extent (Raddats et al., 2019), this domain has employed theories around resources (Barney, 2000; Peteraf, 1993) and capabilities (Teece, Pisano, & Shuen, 1997) to answer more normative questions about how to implement and evaluate servitization. In so doing, it has been particularly concerned with topics such as the re-allocation of existing resources (Huikkola et al., 2016a), new resource configurations involving digital technologies (Coreynen, Matthyssens, & Bockhaven, 2017), the development of new capabilities (Raddats et al., 2017) and the development of guidelines for servitization success (Fliess & Lexutt, 2019). This has yielded some interesting insights. For example, Lovelock and Gummesson (2004) explain how service provision can be understood as a form of resource sharing, which has important implications for conducting business in a more sustainable manner (Mont, 2002a; Reim et al., 2015; Tukker, 2015). Moreover, it allows to make evaluating claims on servitization implementation and derive from them directly actionable points for practitioners (Fang et al., 2008; Lexutt, 2019). At the same time, such theories are neither equipped to nor meant for investigating points as the ones outlined above.

Nevertheless, theories are not disconnected statements about the world, but root within researcher's own assumptions both on the world and the research topic in particular, which is why new insights can be gained by challenging such assumptions and developing alternatives (Alvesson & Sandberg, 2013b). Therefore, this dissertation is similar to some of the more recent studies that have begun mobilizing other theories, such as theories regarding entrepreneurship (Cui, Su, Feng, & Hertz, 2019), portfolio management (Benedettini et al., 2017) or the

configuration of multiple conditions (Böhm et al., 2017). The aim in this regard is to increase the theoretical diversity in the domain and to produce more nuanced research. As part of this trend, a small stream of less normative research has emerged that employs the thinking surrounding actor-network theory (ANT) (see Geiger & Finch, 2016; Simmons, Palmer, & Truong, 2013; Spring & Araujo, 2017). That research breaks with the dominant positivist stance. This dissertation aligns with those studies and seeks to build on them. In particular, it combines ANT with the issue of servitization by considering the different entities involved in the phenomenon in order to challenge the three assumptions outlined above (Callon et al., 2002; Latour, 2005; Orlikowski & Scott, 2015). I argue that servitization at work does not exclusively entail selling more and increasingly advanced services. Instead, it involves managing the consequences of the different (new) ways in which these materials (technical or human) relate to each other.

ANT: A way to attend to the dynamics and materiality of servitization

I argue that because the extant servitization literature offers a rather narrow and endemic understanding of how products and services relate to each other, it can be fruitfully enhanced by thoughts emanating from elsewhere. This is in line with other calls for expanded servitization research (Rabetino, Harmsen, Kohtamäki, & Sihvonen, 2018b). In order to provide for a new assumption of what makes servitization so challenging, I will next introduce a stream of thought that negates the idea that things have a static and pre-determined nature. This stream of thought, which is particularly concerned with materiality and the relationship between different entities, is centred in (and around) actor-network theory.

What is ANT?

On the most general level, ANT is a label used to refer to a collection of concepts and ideas. It revolves around and, over time, has come to transcend the writing from authors as Michel Callon (1986), John Law (1992) and Bruno Latour (2005), whose research contributes to a body of work that we might think of as classical ANT literature. Latour (1999b) refers to ANT as an "anti-essentialist movement" that tries to break down the taken-for-granted understanding that things have an essential nature. Hailing from Science and Technology Studies, ANT was initially drafted as an alternative way to study how 'science' is achieved (Bueger & Stockbruegger, 2017). However, ANT has since been used to develop new understandings in other domains, such as

accounting (Justesen & Mouritsen, 2011) or healthcare (Greenhalgh & Stones, 2010). More recently, this stream of thought has begun seeping into servitization research (Geiger & Finch, 2009; Spring & Araujo, 2009, 2017).

ANT fuses together three different preoccupations (Latour, 1996, paraphrasing p. 373):

- A definition for entity building,
- A methodological framework for recording the heterogeneity of such entity building and
- An ontological claim about the 'networky' character of those who act.

ANT expresses a number of assumptions about how different entities enter into relations. It posits that what we might think of an entity's essential characteristics are derived from how those *entities are built*. In his article on Amazonian rainforest soil, Latour (1999a) asks how scientific papers are produced. As such, that paper offers a prime example of how many different things (e.g., the rainforest, a finger on a map, a pedocomparator, a laptop computer) come together in order to produce a report, drafts and, ultimately, a published article.

In this way, ANT builds on a number of words, which form an 'infralanguage' (Latour, 2005). This language and the intention with which it is used, presents a way to know the world differently, and to uncover activities and developments that other words might obfuscate or remove. ANT was deliberately designed to be very open to allow it to spread and become something different in different places (Law, 1999). Furthermore, ANT can be understood as a "method to learn from the actors without imposing on them an *a priori* definition of their world-building capacities" (Latour, 1999b, p. 20). This method is rooted in an ontological understanding that does not recognize any a priori differences between humans and non-humans. These three preoccupations are intertwined, as is explained in more detail in the next section.

Some key tenets from ANT

Over time, the body that makes up ANT has grown and changed (Law, 1999). Therefore, I present some ideas that are idiosyncratic to ANT and can help us think differently about what we mean by 'servitization at work'. My aim is not to mobilize as many ANT ideas as possible, but to explore what might help overcome essentialist and taken-for-granted assumptions.

One tenet of ANT is that entities have no inherent or a priori attributes (Law, 1999). This does away with essentialist thinking and the division of things – what is true or false, close or far, human or non-human, product or service, customer or buyer is not a given. Second, according to ANT, entities are produced in and achieve their form from the relations in which they are located (Law, 1999). They gain attributes as a result of how they relate with other entities. Law (1999) argues that what we might think of as given divisions might be much better understood as outcomes, achievements or something *done*. Therefore, the task is to characterize how different entities come together to produce the patterns that we observe. Important are the connections between entities, it is they that can impact action and how it comes about (Latour, 2005).

Whereas one might commonly think about a network as something that human planners–an actor maybe?–might create, ANT turns this on its head to say that rather, it is the network that creates the actor. In this, it is also revealed how ANT takes on materiality.

Using the infralanguage of ANT to tend to servitization at work

ANT offers a different perspective on materiality in the sense that it does not give preference to human or non-human entities. Instead, it allows for the heterogeneity of materials (Latour, 2005). Machines, service engineers, talk, brochures, emails and other texts are some of the materials that we might expect to be involved in servitization. As these heterogeneous materials are entangled, new insights can be gained when we look at how they are combined (Orlikowski, 2007).

ANT grants agency to non-human things, where agency is understood as anything that makes a difference. When the scallops of St Brieuc Bay do not anchor and, therefore, undermine a scientific research project, that is understood as agency (Callon, 1986). In this perspective, agency is a network effect that comes from the connections among different entities. However, such actors cannot act on their own. Networks give them their shape and establish them as actors: “any thing that does modify a state of affairs by making a difference is an actor–or, if it has no figuration yet, an actant” (Latour, 2005, p. 71). Action is a socio-material achievement that results from connections between humans and non-human things. In other words, ANT has no pre-established understanding of what an actor is (Callon, 1999). Law (1992, p. 383) even goes so far as to say that “what counts as a person is an effect generated by a network of heterogeneous, interacting materials”. The same could be said about servitization, machines or companies.

If action is a network effect, why is action not accredited to the entire network? This is the result of translation processes: "'translation' is a verb which implies transformation and the possibility of equivalence, the possibility that one thing (for example an actor) may stand for another (for instance a network)" (Law, 1992, p. 386). The important word here is 'possibility' because often it only *seems* that one thing is neatly translated into something else. A closer look might reveal that translations also *change* things into something else – that one thing speaks for others that have been silenced (Callon, 1986). In a servitization context, this might mean that we think about the machine as being one thing. However, as soon as it stops working, we become aware of the mechanics, which were previously translated into something else – a summary that was not quite the same as the whole (Law, 1992).

ANT is interested in unravelling what 'things' consist of and unveiling the dynamics at work. It also offers a unique perspective on materiality. As such, it provides a way of understanding the world that is very different from more orthodox servitization research and well equipped to attend to servitization's ensuing man-machine interactions in the name of providing services.

Three important concepts for this dissertation

In the following, I briefly outline three important concepts for this dissertation, which feature in the three articles presented in Chapter 4.

- *Qualification* (articles 1 and 2): A seemingly benign term, to qualify means to determine the characteristics (or qualities) of an entity (Callon et al., 2002). However, as Callon et al. (2002) outline, qualities are not a given. They are constructed and they need to be found out. Qualification is therefore work; it requires effort, time, measurement instruments and much more. The ways in which we measure determine what we find and can act upon. When the divides between products/services or buyers/sellers are understood as achieved rather than given, the notion of qualification is useful because it sensitises us to how things become separated from other things. This term is important for the investigations in articles 1 and 2, where servitization provides a useful background for investigating how bespoke services become separated from all other things that they could have been.

- *Inscription* (article 2): Latour and Woolgar (1986) explain that inscription devices are any apparatus (or combinations of apparatus) that transforms things and parts of things into written documents that are directly usable. In tracing how scientific facts are constructed, the authors come across the phenomenon of material things, such as parts of laboratory rats, being transformed into usable figures or diagrams. How the apparatus that make up the inscription devices are arranged has implications for how useful an inscription may be. The resulting inscription is then understood as directly related to the original thing (e.g., the part of a rat). However, although the inscription is about some properties of the rat, it is no longer the rat itself. Inscriptions are about removing thing-ness. Using inscriptions, scientists no longer act on the rats or some part of a rat, but rather on the inscriptions produced by inscription devices. In so doing, much of the materiality in the process is removed, which might be one reason why we have come to think about constructing facts as a purely human activity (Law, 2004). Article 2 focuses on such inscriptions and on experimentation with inscription work. In that regard, servitization provides a useful background for investigating how service workers try to create service inscriptions in order to allow the service to travel further than a bespoke service could.

- *Multiplicity* (article 3): While words like qualification and inscription are concerned with the making or removing of materiality, the word multiplicity is related to both of these terms, as multiplicity can come from both qualification and inscription. Overall, it treats materiality and reality somewhat differently:

  > "Talking about reality as multiple depends on another set of metaphors. Not those of perspective and construction, but rather those of intervention and performance. These suggest a reality that is done and enacted rather than observed. Rather than being seen by a diversity of watching eyes while itself remaining untouched in the centre, reality is manipulated by means of various tools in the course of a diversity of practices." (Mol, 2002, p. 77)

  Mol (1999, 2002) describes how different practices of diagnosing and treating atherosclerosis enact different ontological versions of the disease. This means that although we may understand something as a certain thing (e.g., atherosclerosis), doctors and patients enact it in different ways (e.g., under a microscope, in talks with the doctor in

the examination room), which creates multiple versions of the thing in question. Sometimes, this does not matter too much, because the different versions never meet. At other times, they meet and clash. How do doctors, despite enacting multiple versions of the disease, arrive at a single diagnosis and treatment plan? Mol (2002) explains that this is due to coordination, whereby different atheroscleroses may be aggregated into one, for example, explaining one disease away or combining them. In diagnosing and treating the patient, not only is the disease enacted as multiple but so is the patient's body (e.g., as cold feet in one part of the hospital and a clogged vessel elsewhere). Multiplicity is about proliferating creation and subtraction of thing-ness. Coordination is required for all of these different bodies to be contained within one, which Mol (2002) suggests can be thought of as a body multiple. The notion of multiplicity and the associated notions of enactment and coordination are helpful for investigating the implications of servitization practices and the work employed in treating machines and providing services.

These concepts are valuable for studying servitization for a number of reasons. First, they do not favour humans over other materials. Therefore, they can shed new light on the overall materiality involved in creating product-service combinations. Second, these terms were devised to overcome assumptions about what things are, thereby rendering them useful for investigating what is really at work when we talk about servitization. In so doing, these concepts are useful for challenging taken-for-granted assumptions and providing an alternative understanding that is orthogonal to more established views. Talking about servitization in terms of qualification, inscription and multiplicity can shed light on the work and practices involved in servitization. In order to explain how I went about applying the ANT toolbox in general and these concepts in particular, I discuss my methodological considerations and explain how the study was conducted in the next chapter.

Chapter 3: Studying servitization at work

My inquiry took place in two worlds: the empirical world of servitization practitioners through an externally funded research project and the world of books, articles and research in general. Consequently, this chapter has two parts. The first covers my interest in this area and my work with the Servitization Project at the Copenhagen Business School (CBS). The second describes my methodology as I moved between different theories. In so doing, this chapter provides a detailed account of how I went about studying servitization at work by moving between these two

worlds.

Methods from the empirical world: Getting in, getting on, getting out and getting (back) in

While much of the existing body of knowledge on servitization is based on qualitative inquiry, stories of how researchers go about conducting their work (beyond their papers' methodology sections) are rarely found in published research. This may be a side effect of attempts to render qualitative research more palatable to a quantitatively-oriented audience (Pratt, 2008). Such stories are nevertheless informative and worth telling, regardless of the domain (Buchanan, Boddy, & McCalman, 1988; Irvine & Gaffikin, 2006; Sloan & Wright, 2016).

This section describes how I navigated the empirical world that I was studying. I elaborate on how I gained access to the case company (*getting in*), describe some of the intricacies of the research (*getting on*), how I (almost) exited the case company (*getting out*) and later re-entered the company (*getting back in*).

In so doing, I aim to illustrate how I became a researcher and how the inquiry developed over time as well as my learning process. It is increasingly acceptable to account for the mess and complexities of qualitative inquiry (Czarniawska, 2014; Law, 2004). Therefore, I believe that telling about serendipitous occurrences I encountered in the empirical world and how I tried to transform them into research opportunities can help explain my process of generating abstract theoretical ideas from empirical material (Irvine & Gaffikin, 2006; Klag & Langley, 2013).

Getting in

The process of negotiating access to the case company, ManCo, started in 2015 when I was hired by CBS's Department of Operations Management as a graduate student researcher to support the CBS Servitization Project. The project, which ran from 1 August 2014 to 1 December 2018, was an applied research initiative that investigated servitization in industrial companies in Denmark. It was designed and led by Associate Professor Thomas Frandsen, Associate Professor Jawwad Raja, Professor Juliana Hsuan and Professor Christer Karlsson.

Funded by the Danish Industry Foundation, the project's main aim was to provide an understanding of how industrial companies could reap maximum benefits from their servitization efforts and cope with the challenges associated with such an undertaking. In so doing, the project emphasized knowledge-building across industries and academia, and the establishment of a

network between practitioners and academics to generate novel insights and disseminate practical guidance. As a result, the project also offered opportunities to gather empirical material from a number of case companies. That material was used to contribute to the domain of servitization research, which was still relatively new. From a theoretical perspective, the project sought to provide a more nuanced perspective in a stream of literature that largely focused on the implementation of servitization.

I joined the project a few months after its official kick-off. Therefore, I was propelled into an established methodological setup that had been devised without my involvement. The project's research design leaned toward a social constructivist worldview that emphasized case-based research, and largely focused on gathering interview data. For these interviews, a standard interview guide had been developed, which was continually adjusted in order to accommodate the idiosyncrasies of the different companies and any emerging insights. As a student researcher, I read and summarized servitization theory, helped with the gathering and analysis of the empirical material, and supported researchers in their writing tasks. In short, my work was similar to an apprenticeship as a junior researcher.

My work with the project led to my introduction to ManCo and some of its leading servitization practitioners. As part of the project's network-building efforts, I attended industry events at which managers from select organizations discussed new research insights with leading servitization scholars, exchanged ideas and entered into general dialogues on the practical implications of servitization. As part of my employment, I helped ensure that these events ran smoothly, but I was also encouraged to meet and mingle with the invited guests. When I met several ManCo employees at an industry event in early 2015, I could not have foreseen that I was working on 'getting in'.

The rapport established between the project's leading researchers and ManCo in the past continued during my employment, eventually leading to a joint decision that project researchers would enter ManCo for in-depth fieldwork. I was invited to take part in this endeavour, which provided an opportunity to simultaneously further the aims of the project and gather empirical material for my master's thesis. The only condition was that my thesis research had to follow the project's pre-existing design and methodology. I was happy to align myself with the project – through my work, I had grown acquainted with the project's setup. Moreover, having analysed much of the empirical material gathered in other companies, I felt comfortable utilizing the

existing research design for my own research. My work also focused my attention on the nuanced ways in which servitization challenges could play out. All in all, I had become familiar with the topic of servitization in a way that was particular to the project. Adopting its approach for my thesis and utilizing it to gather data that would otherwise have been out of reach provided a unique opportunity to embark on an inquiry that would transcend my thesis project. Research is more than collecting and analysing data – it is also about how to make and present an argument. Such insights are not easily accessible, and I was fortunate that the project's leading researchers explained this to me so that I could employ these skills this in my master's thesis.

I also discovered that academic research projects are not immune to the challenges of securing access. Our inquiry into ManCo suffered a number of delays, especially delays related to the difficulty of setting up a project plan that satisfied all of the involved parties. For the academics, investigating servitization inside ManCo had to yield usable empirical material. ManCo needed immediate, measurable output and assurance that it would find this output valuable. For the overall project, it was important that the inquiry matched the efforts being undertaken in other companies and the inquiry had to yield more general insights that could be disseminated among Danish industrial companies.

The agreement, which was reached in late 2015, not only allowed project researchers to conduct interviews on site but also enabled me to physically enter ManCo's service-development unit, where I was given a workspace from which I could observe my new colleagues as they went about their servitization work. I quickly realized that after we were granted access, there was a need to capitalize on this opportunity in the best possible way. Companies rarely allow researchers to examine their innermost workings, and I was prepared to gather as much material as possible, even when it seemed unrelated to my inquiry.

Getting on

From February to June 2016, I was listed in ManCo's personnel files as a non-salaried employee in the service-development unit. This unit collected, aggregated and evaluated new service ideas, which it sourced from everyone who had regular contact with customers. These ideas were developed in a stage-gate process in which certain milestones had to be reached and a committee met regularly to decide whether the achieved results merited continued investments. Although this appeared to be routine work at first glance, a closer look revealed that the projects were highly creative endeavours. I discuss the practices that I could observe in greater detail in my third article.

Notably, I was fully equipped with a computer, access to the company's Wi-Fi and intranet, and an all-access key card, which allowed me to move freely through ManCo's buildings. This shows that I was trusted with a great deal of access, which came with the obligation to treat it respectfully.

My desk (see Figure 2 below) was located at the intersection of the paths to the kitchen and the washrooms. This placement was fortunate for my purposes, as employees frequently passed my desk, making it easy for me to strike up informal conversations and to ensure that my colleagues included me when they took their lunch breaks. After each such informal conversation, I would hurry back to my desk to capture any new insights in my research log.

Figure 2: My desk, with cup and lamp, on the right, in the open corridor

Officially, my main task at ManCo was to help coordinate an extensive round of interviews with informants across the globe. These interviews were conducted by a team of servitization researchers and it was made clear to ManCo's employees that I belonged to this team. In order to ensure that I would be taken seriously, a conscious effort was made to avoid referring to me as a 'student'. Instead, my role as a researcher and the fact that the collected material was to form the empirical basis for my final thesis were stressed.

Almost all of my colleagues at ManCo were engineers. Most of them had PhD degrees in such disciplines as physics, chemistry, mechanical engineering or electrical engineering. Therefore, the practices I could observe were oriented towards problem-solving. However, too many service projects were underway across ManCo's locations to track. Moreover, as I grew comfortable

walking up to people and inquiring about their work, I realized that I could not completely understand what they told me. Their work revolved around, for instance, formulae used to calculate material requirements, the importance of the curvature of a certain nook in a spare part and the influence of temperature changes on chemical production processes. Therefore, my proximity to practice was also frustrating in that this engineering-heavy environment was one in which my business degree was of little help. Even though I could see that things were happening around me, it was sometimes difficult for me to grasp what they meant. In my fieldnotes, I made a number of remarks on this, such as:

> [Name omitted] tried to explain his current work, but found it difficult to "dumb it down" enough so I could understand. Something about vectors and trying to find an unspecified number sequence in a large amount of data. I did not understand.

I realized that although certain mathematical operations would remain opaque to me, there were other things on which I could concentrate, such as gaining an understanding of how the department worked, who was responsible for certain tasks, how new service ideas came into the department and how those ideas were developed. That led me to a learning point: it is easy to be swept up by a new environment. Although I broadened my knowledge about industrial production processes, I did not need to become an engineer in order to conduct the inquiry. I needed to be an observer, something for which my training was useful.

At the same time, I was busy writing my master's thesis and working as a student researcher at CBS. Initially, finding a balance was difficult. I therefore decided to find my own way of navigating my work at ManCo in order to make the best use of my time there. I tried to be at my workplace as often as possible, prioritizing Fridays owing to the informal team breakfasts that occurred on that day and days when official team meetings were scheduled. As I was still employed by CBS, I attended to that work on days when I knew that most of my ManCo colleagues were travelling or working from home.

'Getting on' within ManCo meant that I had to hunt for free time slots in informants' calendars, calculate time-zone differences, book meeting rooms and organize other aspects of the interviews, including batteries for recording devices. After the first two interviews, which were set up by our key contact person, it was my task to coordinate and arrange the interviews, which proved to be

a considerable task given that informants were located across all time zones, travelled frequently and had to be interviewed at times that fit both their schedules and those of the other researchers. The interactions necessary to set up the interviews turned out to be highly beneficial. I quickly became acquainted with a number of ManCo's employees, who helped me decipher the travel schedules of high-ranking individuals, such as team managers. Whenever we finally 'met' (in person or online) for an interview, I felt that I already had a connection to the informant, which made it easier to interview them.

While we tried our best to be respectful of informants' time, informants were sometimes happy to speak with us for longer than originally scheduled. This flexible, open-ended setup allowed us to gain new insights.

As I learned more about the company through these interviews, I also grew more comfortable in my role as a non-engineer observer. I learned to inquire not only about the finer mathematical details but also about my colleagues' more general activities. I found the majority of ManCo employees to be friendly and willing to explain in a way that I could comprehend. In fact, I was received so openly that it soon became clear that I had to focus on protecting informants' anonymity to ensure that their trust in me would not be betrayed, which I understood as a pressing responsibility.

This also coloured my approach to data collection. For example, I always asked for permission before taking a picture on ManCo's premises. As a result, I learned what was considered to be sensitive information. For instance, I was not allowed to photograph a whiteboard on which different service projects were tracked, but I was allowed to photograph my desk and promotional material. Sometimes it was difficult to keep my colleagues out of the photos, as it seemed rude to ask them to move away or decline their invitations for joint photos. Therefore, I went to the office one Sunday afternoon when I knew that I would be alone in order to take photos of my workspace. However, when I tried to exit the compound again, I took a wrong turn and inadvertently triggered an invisible laser security system. Hurrying through the building, I came across the only other person working that weekend. He did not know how to turn off the alarm but he graciously helped me deal with the fast-approaching security team and even offered to take the blame. That evening, I wrote an email with an explanation and an apology to my key contact and the head of the service unit, both of whom were amused rather than angry. They used the opportunity to educate the entire unit on how to turn off the alarm. This was another learning point. As news of my

"alarming" Sunday adventure travelled, I found myself being good-naturedly teased by my colleagues. Adopting a humorous approach, I joked about my impeccable work ethic that had me coming in on weekends. I found that this reduced my personal embarrassment and made me more approachable. Within a few weeks, I had formed a number of friendly bonds, and I was able to talk with colleagues about weekend plans during lunch and learn about company politics over coffee. We also talked more about how servitization played out within ManCo, which led to recommendations of other possible informants. Before I knew it, it was my last day. I brought in treats from the bakery for a farewell coffee break with the entire service-development unit.

In the ensuing months, I worked on my master's thesis while remaining a part of the CBS Servitization Project. As a student, I analysed the ManCo material, wrote up my findings and submitted my thesis. As a project member, I participated in interviewing ManCo employees working in foreign locations for which we used an online communication tool instead of meeting in person. In so doing, I gathered additional material that went beyond the scale and scope of my master's thesis, oversaw its transcription and worked on its analysis.

Getting out

I defended my master's thesis and obtained my M.Sc. in August 2016 and thereafter terminated my work as a student researcher. On the next day, I started in my new position as a CBS PhD Fellow. The subject of my doctoral project was similar to that of my master's thesis, as I was still interested in the challenges of servitization. However, the broader scope of a dissertation allowed me to address the issue in more detail and attend to some of the many nuances found in the interviews with greater theoretical precision. It was clear early on that ManCo would remain the focal company in my research. As I had already gathered so much empirical material, I found myself in the unusual position of starting my PhD work by trying to wrap up my inquiry within ManCo. I needed some distance from the company in order to re-read and analyse the material in its entirety and to write up our overall conclusions. Together with the other researchers, I crafted a report to provide ManCo with our final analysis as well as a number of possible points for consideration. We presented the results of our work to ManCo in a workshop in December 2016. With the delivery of the report, we had reached a clearly defined milestone and fulfilled our obligations. This was helpful for managing expectations on the company's side. At the same time, we agreed to remain in touch and ensured to not completely shut down the lines of communication.

My academic work on the ManCo material remained in full swing. I worked on refining the coding templates and trying to understand how different issues connected across informants. Together with my co-authors, I crafted conference submissions with the aim of exploring how the material might be related to the extant literature. We attended a number of conferences, which enhanced the conversations I had with researchers in the department. In the ensuing months, I worked on developing the first two articles of this dissertation. In this regard, I benefitted from the advice of my co-authors, who guided me on ways of communicating the insights emanating from the empirical material. We extensively discussed the research and I wrote numerous drafts on which I received detailed critique. As I repeatedly rewrote the articles, I noticed changes in both my prose and my thinking.

Nevertheless, I had academic interests beyond the scope of the project that I wanted to address in my doctoral research. In particular, I wanted to experiment with the claims that could be made regarding the performativity of servitization. I decided to pursue this interest in my third article. Consequently, I realized that I had to get back into ManCo in order to gather data on practices which could complement what I could learn from the data on experiences and opinions that had already been gathered by the project. Therefore, I devised a new inquiry that was separate from this and focused on investigating *servitization* in the form of servitization practices.

Getting (back) in

Entering ManCo a second time proved difficult. Our key contact had changed jobs. A request I sent to someone else was turned down because there was a feeling that I could not provide enough in return. Moreover, ManCo was about to undergo an extensive restructuring process, which rendered research endeavours such as mine a lower priority.

Paradoxically, this setback was conducive to my inquiry because it led me to reflect on the type of empirical material that would be helpful in answering my research questions. Previously, I had focused on the interviews and viewed them as my primary data sources. Now I wondered whether other materials that I previously treated as secondary data could be more insightful than I had expected. Such materials were not only easier to gather but they could also provide meaningful evidence of servitization at work. ManCo's service brochures, videos on its official YouTube channel and service-related patent listings were part of a large array of publicly available documents that showed a side of servitization that had not received much attention in the literature. However, as there still was a need to meet with practitioners to inquire about their

practices, the problem of getting back in remained.

In 2018, another project-organized industry-academia event provided an opportunity to meet ManCo's employees in person, which made it easier to ask for a favour. After some small talk at the event and a quick email exchange, I was invited to meet with an employee working on servitization. When I arrived, I was surprised to learn that I was to meet with two people, both of whom worked with servitization issues. As I was aware that such an opportunity might not present itself again, I decided to try interviewing them at that time.

I explained that I had some questions related to my PhD research and that I would adhere to the same confidentiality rules as before. I was allowed to record our conversation and asked questions that fit the flow of our conversation. Importantly, by the time I left, I had permission to email both of my informants, who promised to connect me with other colleagues working on specific servitization issues. As it turned out, I had come across a network of highly educated employees inside ManCo who were sympathetic to my research endeavour and willing to spend their lunch hours speaking with me. Whenever I met one of them, they would gladly refer me to someone else for another meeting. This technique enabled me to carry out a total of eight additional interviews at ManCo, each of which I transcribed and analysed. During that time, I set up bi-weekly appointments with my PhD advisor in order to talk about my ideas and the emerging patterns. The material I gathered was very rich and I learned that it is not always necessary to interview high-ranking individuals in order to learn something interesting.

Given that my research interest for the third article focused on servitization practices, I needed to collect more than mere talk about 'doing' servitization. In the interviews, I had to therefore make sure to hone in on informants' *doing*. As such, I probed them for specific examples and asked to be shown in person whenever possible. In this process, it became clear that servitization went beyond ManCo's factory gates and stretched well into customers' organizations. This insight presented the need to inquire about servitization within one of ManCo's customers in order to see how it was 'on the other side'. However, I learned that, at that time, my informants, while not being opposed to me talking to their clients, were nevertheless not in a position to help me gain access to one of their customers. I therefore tried to secure access to ChinCo, a major player in producing industrial materials, on my own accord. In order to not breach any confidentiality agreements, I secured this access and conduced the ensuing data collection without making any reference to ManCo, only stating my general interest in how industrial services are bought. This

meant that neither ManCo nor ChinCo were aware of the regarding other participating in my research.

Serendipitously I knew one person who had worked for ChinCo in a leading managerial position. As such, they had been involved with ChinCo's strategic technical developments. I knew from my interviews that a number of joint, high-profile strategic development projects involving ManCo and ChinCo were underway, so this person seemed likely to be a good starting point. I reached out to my contact and explained having a general interest in the perspective of a service buyer. My contact agreed to an interview. However, on the day of the interview, I did not hear from them. I later received a message of apology, which was the last time I ever heard from them.

Whatever pre-existing industry information I could find relating to ChinCo was either too general or too technical, making it inadequate for my needs. Neither ChinCo's website nor the websites of other customer organizations were of much help. My messages addressed to the various info@.... email addresses listed on those websites were, unsurprisingly, ignored. This could have likely been the end of my efforts, had I not one evening mentioned my struggles to a friend, who, as it turned out, knew someone who once worked with someone who now worked at ChinCo. I was doubting that such a weak connection could provide me with the necessary access, but my friend nevertheless liaised on my behalf. This became another learning point: I needn't had waited until I was at my wit's end. Gaining access by asking others for help was permissible and, in hindsight, I should have asked much earlier.

Introductions were made via email. Within hours, I learned that I was welcome to reach out to my new contact, who held a leading managerial position at ChinCo. I introduced myself, outlined my research in general terms and taking great care to not reveal any linkages to ManCo. In late 2018, I conducted a phone interview with this contact, who provided me with important background information on ChinCo, the company's structure, and the outsourcing of different tasks, such as the monitoring and maintenance of industrial sites. It turned out that this informant was also well-connected with the central purchasing department and they connected me to two additional informants: one in a local purchasing unit and the head of the global purchasing department who worked with service contracts. . To my surprise, my offers to sign an NDA with them were ignored. To the contrary! There was an eagerness to help that resembled what I had experienced in ManCo. In particular, respondents were indeed working with larger scale industrial service contracts, of which I knew were sourced from many suppliers, so that I could inquire about them

without needed to make any reference to ManCo. Serendipity came in once more when it turned out that the purchasing process had recently been standardized, so that all offers (including those from ManCo) moved through the same procurement process. Asking general questions about their practices, I could therefore learn much about how they gathered, evaluated and ultimately agreed upon buying industrial services. What is more, informants remembered well when they, as a student or for their own doctoral research, struggled to gather data and all tried to help me, allowing me to record our conversations, trying to answer my questions as best as they could, explaining in more detail when I probed for it and even sending me internal documents, explaining in depth how they went about their work and why.

The conclusion of these interviews also marked the end of my inquiry. Given these changing circumstances, the particular ways I in which I went about gathering the empirical material similarly evolved. I turn to this in the next section.

Methods from the books

Similar to my movements in the empirical world, the methods I gathered 'from the books' were constantly being developed. This section describes how I moved across different theories, academic papers and books while conducting my inquiry. In so doing, my approach to research design, data collection and analysis did not follow a standardized recipe. Rather, it shifted as my understanding of servitization at work changed over time. For example, the doubt I experienced in the empirical realm often led to a movement in the theoretical realm and vice versa.

In order to explain the process in which doubt drove my understanding, I will detail the particular movements between empirics and theory as they unfolded during the process of conducting the inquiry. First, I explain how I think about doubt and how it was a motor for the inquiry. Next, I present the doubt-powered process behind articles 1 and 2 (which are co-authored) and how I, as part of the project, inquired about servitization *practitioners*. But may doubt carried me also towards conducting an inquiry separate from the project, a flat study of servitization *practices*, which I talk about next. The end of the chapter then provides reflections on the merit of this process and finishes with an explanation of how I navigated ethical concerns.

Harnessing doubt as a motor for the inquiry

For this inquiry, I adopted a pragmatic stance that was informed by American Pragmatism. Generally speaking, pragmatism provides a reasoning for how we think, how we learn about the world and how we make decisions (Menand, 2001). In recent years, a methodological process for inquiry has been derived from this understanding.

The reasoning of pragmatism

The pragmatic stream of thought goes back to the works of Charles S. Peirce (1905) and John Dewey (1910), and it is the result of their combined efforts, which started in the "Metaphysical Club" at Cambridge (Thayer, 1982a). Their ideas have changed over time, with researchers focusing chiefly on practical consequences and on what works (Denzin & Lincoln, 2018). Today, the differences and overlaps between Peirce and Dewey are widely discussed (Burke, 1994; Prawat, 1999). Given his emphasis on "dissolving puzzlement" (Paavola, 2015, p. 232), this research generally follows Peirce's conceptualization. Peirce (1878) summarized his understanding of pragmatism in what is now known as the pragmatic maxim, which reads as follows:

> Consider what effects, that might conceivably have practical bearings, we conceive the object of our conception to have. Then, our conception of these effects is the whole of our conception of the object. (This quote stems from the end of Section II of the article: "How to Make Our Ideas Clear")

In Peirce's view of pragmatism, the meaning and value of any concept is the set of its (possible) effects. Moreover, our experiences support the concepts that we hold in our minds (Campbell, 2005). Peirce's reasoning offers a procedure for reconstructing meaning as well as a way to change or replace unclear concepts with clear ones (Thayer, 1982). For example, we know the concept of 'chocolate' and that it is an edible substance. We think pragmatically when we use this concept to explain our experience when we see, smell and consume the substance. Furthermore, we can derive hypotheses on this basis, such as 'chocolate is sweet'. We can identify clear practical consequences that should occur if this hypothesis turns out to be true (Legg & Hookway, 2019). For instance, if chocolate is sweet, we might enjoy eating it. According to Peirce, these consequences have implications for our subsequent actions – if we find enjoyment in eating chocolate, we might eat more of it. As we have new experiences with chocolate, we pragmatically

update our concept of it. For example, when we have an experience with unsweetened chocolate, we can adjust the existing concept to make room for the fact that chocolate can be bitter and adjust what types of chocolate we consume. Accordingly, experience can guide inquiry, turning Peirce's pragmatism into what some describe as a 'laboratory philosophy' (Hookway, 2000).

Pragmatism as a methodological process for inquiry

Pragmatism builds on the pragmatic logic and provides a way to shed light on puzzling observations (Paavola, 2015). Peirce calls the process of creating new explanatory hypotheses *abduction* (Burks, 1946). Abduction is a process that contains all of the operations through which theories and concepts are engendered and lead to new ideas (Peirce, 1931). I adopt this understanding of abduction as 'all operations that create new ideas' because it allows much room for researchers to creatively come across topics for their inquiry. Others interpret this definition differently. For example, for Reichertz (2014), the starting point of abduction lies in empirical material, which is de-contextualized and re-contextualized in order to remove the element of surprise from a new experience. This is one way to go about an inquiry, but it excludes the discovery of puzzles through the use of existing theory. Timmermans and Tavory (2012) are more attuned to this, indicating the importance of a "theoretically sensitized observer" (p. 173) who is knowledgeable about the extant literature. If anything that creates new ideas is abduction, and if new ideas emerge because the researcher is simultaneously knowledgeable about theories and engaged in an empirical setting, then starting with a puzzle derived from critically engaging with the literature and developing it empirically is an acceptable way of discovering new topics for inquiry. This is the perspective I adopt when I talk about abduction.

The arguments surrounding abduction have also extended the language around theory development. *Induction* starts with the evidence (i.e., an examination of the data in order to find a theory), while *deduction* starts with a theory and tests that theory against the evidence. *Abduction* was added to indicate movement between these two modes (Easterby-Smith, Thorpe, & Jackson, 2013; Haralambos & Holborn, 1995). However, Peirce's idea of abduction is different from these inductive/deductive movements, aiming to refine theories rather than finding new ones. As such, Peirce's approach is more similar to induction (Dubois & Gadde, 2002). This is not to say that Peirce does away with induction and deduction completely. However, for Peirce, they enter later in the process of theory assessment, where deduction tries to identify researchable consequences and induction helps to reach a verdict on the abductively generated hypothesis (Douven, 2017).

In this sense, Cooke (2006) proposes that abduction suggests that something may be, induction shows that something actually is and deduction proves that something must be.

This leads to an important question: How should we go about the abductive process in order to come to the insight that something may be? In other words, how do we come up with new ideas? In this regard, Peirce points to the power of doubt. In his view, resolving genuine doubt and arriving at a stable belief is inquiry (Burks, 1946). Locke, Golden-Biddle and Feldmann (2008) build on Peirce by acknowledging that doubt is the starting point of any question. They then highlight the role of doubt as "as abduction's engine in theorizing efforts" (Locke, Golden-Biddle, & Feldmann, 2008, p. 916). They offer three principles for mobilizing the power of doubt for inquiries:

1) Embracing the not knowing,
2) Nurturing suspicions and "pursuing notions that may only express themselves as an intuitive feeling about something" (Locke, Golden-Biddle, & Feldmann, 2008, p. 913), and
3) Disrupting the prevailing order and losing the willingness to believe that we already know all the facts.

These principles helped me use doubt to drive my inquiry process, which I viewed as occurring in iterations between abduction, induction and deduction. In so doing, pragmatism offered both a way of reasoning and a methodological process. It also allowed me to critically engage with both the literature and the empirical material, where doubt emerges in moving *across* (i.e., it forced me to consider explanations from other disciplines and gather different materials) rather than *within* (i.e., considering or collecting more of the same).

A study of practitioners

I reviewed of the servitization literature while I was also taking a course rooted in market studies, which had me reading such authors such as Callon (1998) and Ehrenstein and Muniesa (2013). These authors treated markets as man-made or thing-made entities (Garcia-Parpet, 2007). The more I delved into this work, the greater my unease with the argument that customers demand servitized offerings a priori became (Berry et al., 2006; Davies et al., 2007; Kowalkowski et al.,

2015; Oliva & Kallenberg, 2003; Vandermerwe & Rada, 1988). If markets are elaborate constructs, how can they exist 'just' for manufacturing companies to sell their servitized offerings? This seed of doubt grew when I came across a paper on servitization failure that seemed to directly contradict the a priori interested customer (Benedettini et al., 2015). At the time, exploring the difficulties surrounding the implementation of servitization was becoming a research trend (Finne et al., 2013; Kowalkowski et al., 2015; Martinez, Bastl, Kingston, & Evans, 2010) and I understood these difficulties as a central problem. This had not received much more attention in the literature beyond the argument that companies likely struggle in achieving the anticipated returns from their investments into setting up a service business (Gebauer et al., 2005). Conversations with servitization practitioners at project-related events lent further gravitas to my suspicions and provided me with my first empirical material indicating the difficulty of selling services to customers. This led me to a general interest in how companies go about servitization work and whether those activities created–or not–actual customers who are willing to pay for a servitized offering.

As I carried out the research under the auspices of an academic research project, my inquiry had to be aligned with the project's methodological setup. This was not a problem because there was a shared interest in servitization practitioners and what they said about their work. As such, my aim was to investigate the processes through which practitioners devised, sold and delivered servitized offerings. Somewhere in these processes, I hoped to find a point where customers said 'yes' and signed a contract or agreed to a purchase in some other way. Qualitative inquiry, as conducted within the project, appeared to be the most suitable method for achieving this aim.

As a project researcher, I had a pre-defined understanding of servitization, which largely resulted from familiarizing myself with the relevant theoretical concepts. Guided by the literature and my previous interactions with ManCo and other servitization practitioners, I knew what I was looking for: information on the daily work of those developing, selling and managing servitization. Moreover, I moved fast (Latour, 2005) in that I took for granted what servitization was and accepted it as a *three-dimensional thing* instead of piecing together how it came to be a phenomenon in the case company, as doing so was neither my aim nor that of the project. In Peirce's words, I needed to learn about the *effects that had practical bearings*. Inspired by Orr's (1996) in-depth accounts of service technicians' work, I decided that focusing on servitization practitioners would be a good starting point.

Research design

In order to study how servitization practitioners devise, sell and deliver services, the inquiry for articles 1 and 2 relied on an exploratory, qualitative case study approach. This research design was developed by the leading researchers on the project and I was happy to align myself with it, as it fit my research interests.

Exploratory research: The project aimed to explore under-researched issues, especially issues pertaining to servitization challenges, as well as servitization contexts that had received little attention. As my own research interest developed from doubting and problematizing widely accepted assumptions on servitization, it was appropriate to break away from the established lines of thought by exploring other, more appropriate avenues to understanding beyond the mainstream conceptualizations offered in the extant literature (Alvesson & Sandberg, 2011, 2013a). This also aligned with a pragmatic focus on how practitioners understand and act on a phenomenon (Ritchie, 2003). To this end, articles 1 and 2 explore how servitized offerings are qualified and shed light on practitioners' attempts to render service qualities modular.

Qualitative inquiry: In order to gain new knowledge, exploratory research typically makes use of non-numerical data. Qualitative research allows researchers to capture nuances and exploit spontaneously arising situations in a way that quantitative inquiries cannot. As such, this type of research was best aligned with my overall interest in practitioners' qualification efforts.

Case study: Articles 1 and 2 exploratively inquire about a case of servitization –and in so doing, a case study is produced (Stake, 2008). The term *case study* means the "study of the occurrence of a phenomenon" (Czarniawska, 2014, p. 21), which implies an intensive examination of a setting in which the researcher uncovers relevant , unique or otherwise distinguishing features (Bryman & Bell, 2015). Arguably, our current understanding of servitization is largely case-based. Nevertheless, the vast majority of the extant research is rooted in the positivist paradigm of case-study research as propagated by Yin (2009) and Eisenhardt (1989). My doubts about the proposition that had emanated from that stance led to my desire to provide a different account of servitization by emphasizing the work of servitization practitioners. However, as Stake (2008)

would argue, such servitization work lacks the specificity or boundedness needed to be called a 'case'.

Therefore, I started by investigating servitization work within the boundaries of one industrial company implementing servitization, which I call ManCo. The aim of investigating servitization in ManCo was to provide a deeper understanding of servitization at work in order to illuminate the difficulties associated with selling servitized offerings (i.e., an *instrumental case*, as it emphasizes an *issue*; Stake, 2008). This company was purposefully chosen in order to ensure a particularly information-rich setting (Patton, 2002, p. 230) that allowed for in-depth learning about servitization. Four main criteria were employed in this regard. First, the case company had to be an industrial company that manufactured physical products. Second, the company needed to be dedicated to implementing and fostering a servitization strategy. Third, there needed to be visible and substantial servitization efforts. This led me to look for companies that had grown their revenues from services in recent years. Fourth, the company needed to be willing and able to grant me access for my inquiry. The chosen company, ManCo, can be classified as a mix between a *typical* (i.e., exhibits many of the characteristics associated with servitizing companies) and a *critical* (i.e., the object of study should be particularly clear in the company in the sense of: 'if it doesn't happen here, it likely doesn't happen anywhere') context for investigating servitization at work (Patton, 2002).

As is often the case with qualitative studies, the inquiry did not follow a linear trajectory that emphasized moving from theory-generated hypotheses to sampling, data collection, interpretation and validation. Instead, and because of the emphasis on doubt, the process moved iteratively in interlinked steps (Flick, 2014c; Miles & Huberman, 1994, p. 308). Therefore, not only was the research aim refined in movements between empirics and theory but also the sampling decision was made early in the process, and data collection and analysis were closely interwoven.

Data collection

The project-bound research design emphasized interviews revolving around the thoughts and opinions of practitioners as the main means of data collection. In addition, documents were gathered whenever possible. The data were enhanced by observations I made while working inside the company.

Interviews – round one

In Peirce's understanding, ideas and beliefs are instruments for action in the sense that they go beyond the original experience to influence future events, where they can be used for problem solving (Farjoun, Ansell, & Boin, 2015; Peirce, 1878). In order to investigate the ideas and beliefs in ManCo, the project researchers used expert interviews. These interviews focused on servitization practitioners and their daily work tasks. In our case, experts were defined as personnel who were particularly knowledgeable about servitization work and who had knowledge that was not necessarily accessible to other professionals (Meuser & Nagel, 2009). This meant that we wanted to interview staff with specific professional experience (Flick, 2014b) in the sense that they were deeply involved in servitization as part of their everyday activities. Therefore, the sampling of informants was important (Brinkmann & Kvale, 2015). We received help with this task from our key contact person, who was working in a new service-development unit that was spearheading ManCo's servitization efforts. We viewed this person as an expert, and they, together with their manager, provided us with a list of around 30 potential informants. These informants all worked in ManCo's service arm and were particularly knowledgeable about the company's servitization strategy and its implementation. The informants were very diverse, hailing from all hierarchical levels and ManCo's most important local offices, and they had varying tenures. Their common denominator was that their main work revolved around servitization topics and, typically, engagement with the recently created customer-services division. This variety meant that we would be able to learn about servitization from many different perspectives. As we started conducting the interviews, we quickly realized that this selection of experts provided us with particularly deep insights. When informants were unable to answer questions in as much detail as we would have liked, we asked them to recommend a colleague who might be knowledgeable about that particular question. This technique is known as snowball sampling (Lewis & Ritchie, 2003).

Our interviews were designed to be semi-structured and open-ended (Kvale, 2007). This design was advantageous because it allowed exploring a broad range of topics and provided enough room for informants to indicate the issues that were important for their work. In particular, we aimed to use the interviews to build relationships with the informants by emphasizing a gentle, flexible and non-confrontational form of questioning more akin to a conversation, which Rubin and Rubin (2012) term a *responsive interview*. This was advantageous because questions could be adapted

to informants' answers in order to obtain rich and particularly insightful material. As suggested by Rubin and Rubin (2012), we made use of an interview guide that contained a broad range of main questions as well as follow-up questions on a wide variety of topics (e.g., changes in servitization, pricing, HR implications), which were grouped together thematically, each with a number of carefully worded probes focused on asking for in-depth information about each topic (Rubin & Rubin, 2012). We understood this document as a guide that was helpful for steering the interview, not as an exhaustive list of questions that had to be answered. Parts of this interview guide had been developed before I joined the project, and I added follow-up questions and probes related to my own research interests as the inquiry continued.

However, already after the first two interviews, a strong theme emerged around the need to distinguish services, to find out and articulate what they entailed. This practical consequence of servitization was something that, in the literature, was more discussed in the realm of professional service firms (Jaakkola, 2011) but had only received little attention in the servitization literature. One notable exception is a study by Aarikka-Stenroos and Jaakkola (2012), who, in adopting a service-dominant logic for their study, emphasize the idea of overall value rather than the nature of the servitized offering. But neither of these perspectives were suitable for explaining what these early interviews seemed to indicate. Given this tension, I returned to the literature on market studies and found in Callon et al.'s (2002, p. 209) article on the economy of qualities a quote that summarized what I could not find elsewhere: "Service provision is a machine […] designed to reveal what customers want". This and the overall concept of qualification (Callon et al., 2002) proposed in the article seemed relevant for understanding the practical consequences of servitization in ManCo.

Consequently, the leading project researchers and I agreed that this topic should be explored. We therefore adapted the interview guide and, as the literature was struggling to come to terms with qualifying services (Gadrey, 2000; Hill, 1977; Lovelock & Gummesson, 2004), we ensured that it included questions about service qualification across a broad range of topics, such as how service- level agreements were set up, how new services were designed, how agreements were reached on service prices, and how customers reacted when they were offered services. As the interview data were also collected for the sake of a larger research project, the guide included other questions on topics relevant for other researchers. In order to avoid confusion and not create

an impression that informants needed to prepare for the interviews, we agreed to not share the interview guide with the informants.

As our understanding of qualification developed, the interview guide was adjusted. Questions were rephrased to make them easier to understand and to allow for investigation of the issues that seemed to be particularly pertinent, such as the importance of creating documents in order to control the proliferation of services. Towards the end of this interview round, the guide was seldom used. Consequently, the interviews became more unstructured, which allowed us to keep exploring qualification beyond what the guide covered (Bryman & Bell, 2015). By the end of this interview round, we had achieved data saturation in the sense that we were learning nothing new from informants' answers (Lewis & Ritchie, 2003).

Each interview began with an opening statement about the CBS Servitization Project and the fact that the data would also be used for other academic projects, including my master's thesis. In addition, we explained why we interviewed informants and how we were going to treat the information they provided. Our ambition was to create a welcoming atmosphere and establish rapport in order to make informants feel comfortable (Bryman & Bell, 2015). We always asked for permission to record the interview. Whenever I was leading an interview, I would adopt a calm attitude and maintain eye contact in order to divert the informant's attention away from the recording devices (Brinkmann & Kvale, 2015). The subsequent part of the interview was designed to involve multiple interviewers (Bechhofer, Ellitott, & McCrone, 1984), typically one leading the interview and asking questions, and one who took notes, asked for clarifications and kept the flow going when the conversation seemed to be slowing. In the beginning of this process, other Project researchers took these leading roles, and, in so doing, demonstrating how to ask for what, when to stay silent or when to ask for clarification. During the first few interviews, I was a silent observer, only asking, typically towards the end, my own questions about topics that I felt had not yet been addressed yet. As I gained experience, however, I became more active, acting as the 'secondary' interviewer, having by now developed an intuition for how and when to ask mid-interview, up to the point of taking over the conversation for a short while, when there was an opportune moment. Towards the end of the interviewing process, I was able to lead the interviews, with other researchers only asking supplementary questions. I also interviewed a number of additional informants independently. Exceptions were made for informants from which we could gather that they, for various reasons, would be more comfortable or open to speaking with a senior

researcher (Brinkmann & Kvale, 2015). Here, I was asked to step back and only ask supplementary questions, which had me taking as notes and observing the interview instead. Overall then, the interviews in this first round aimed at understanding the how practitioners went about the servitization process within ManCo.

A total of 38 interviews were conducted (see Table 1), each lasting one to two hours. The interviews were transcribed verbatim, after which I listened to the interviews again to ensure that the transcripts adequately captured not only what was said but also how it was said (e.g., marking sections as ironic or including meaningful pauses, gestures or facial expressions). This resulted in approximately 1,200 pages of written text.

Table 1: Interviews, round one

Position	Location	Duration	Mode	Count
R&D Manager A	Europe	1h 55 min	Face to face	1
R&D Manager B	Europe	1h 11 min	Face to face	2
Vice President A	Europe	57 min	Face to face	3
Vice President B	Europe	1h 1 min	Face to face	4
Head of Department A	Europe	56 min	Face to face	5
Head of Department A	Europe	52 min	Face to face	6
Head of Department B	Europe	1h 23 min	Face to face	7
Head of Department C	Europe	1h 17 min	Face to face	8
Senior Vice President	Europe	1h 1 min	Face to face	9
General Manager A	Europe	1h 6 min	Face to face	10
General Manager B	Europe	1h 4 min	Face to face	11
Sales Manager	Europe	1h 16 min	Face to face	12
Project Manager	Europe	48 min	Face to face	13
General Manager A	South Asia	57 min	Online	14
General Manager B	South Asia	Part 1: 26 min Part 2: 26 min Part 3: 3 min	Online	15
Head of Department	South Asia	1h 11min	Online	16
Local Director	Southern Africa	1h	Online	17
Service Manager	Southern Africa	59 min	Online	18
Local Director	South America	1h 11 min	Online	19
Service Manager A	South America	1h 7 min	Online	20
Service Manager B	South America	1h 16 min	Online	21
Global Manager	Australia	1h 5 min	Face to face	22

Service Manager	Australia	1h 10 min	Online	23
General Manager	Australia	1h 36 min	Online	24
Vice President A	North America	58 min	Face to face	25
Vice President B	North America	57 min	Online	26
Vice President C	North America	1h 21 min	Face to face	27
Vice President D	North America	1h 13 min	Online	28
General Manager A	North America	58 min	Online	29
General Manager B	North America	1h 9 min	Online	30
Sales Manager A	North America	1h 4 min	Online	31
Sales Manager B	North America	1h 42 min	Online	32
Service Manager	North America	1h 19 min	Online	33
Area Sales Manager	Europe	1h 33 min	Face to face	34
General Manager C	Europe	1h 9 min	Face to face	35
Innovation Manager Technical Manager	Europe	1h 8 min	Face to face	36
Vice President Services, Customer Services Innovation Manager Technical Manager	Europe/North America	1h 56 min	Face to face / Online	37
Diverse managers	Europe	No recording; estimated ca. 2h	Face to face	38

Observations

My four-month employment inside one of ManCo's main service-developing units allowed me to observe what practitioners did when they went about in 'doing' servitization. This yielded observational data gathered during naturally occurring situations, which added to the less embedded interview accounts. It also influenced the relationship between myself as a researcher and the field of study (Atkinson & Coffey, 2002). I hesitate to label my observations as *ethnography*, as they do not fit well with two key features of this method, which is "ordinarily conducted over a long period of time" (Wolcott, 1999, p. 49) and requires researcher's presence in the field. However, acknowledging that ethnography means immersion in a field setting and an understanding of those within the setting, Hine (2000) makes a case for ethnographically investigating the internet, thereby challenging what it means to be somewhere 'in person'. Hammersley (2006) points to the fact that ethnography increasingly occurs part-time and in months rather than years. Ethnography enables the researcher to gain deep insider knowledge, which allows for a better understanding of the empirical setting. As such, it aligns well with a pragmatic viewpoint (Visconti, 2010). I was immersed in ManCo, and I learned to understand servitization practitioners and the context in which they were embedded. However, as I was only

in the company for a few months and on a part-time basis, I could not participate in the servitization work of my colleagues. Therefore, it was somewhat easy to maintain my professional distance and a sense of wonder regarding the practitioners' activities (Hammersley, 2006). Nevertheless, while they are best characterized as observations, they were still most useful.

Observations play an important role in exploratory studies (Jorgensen, 2015) and they allow us to gather insights outside of interviews. As I still had relatively little knowledge of ManCo, I used this opportunity to learn as much as possible about the company , keeping a daily log of field notes. Furthermore, my presence in ManCo's service-development unit made it possible to gather valuable insights through a number of spontaneous informal conversations, which flowed much more naturally because they were not being recorded (Van Maanen, 2011). Pragmatism does not understand scholarly work and the work of servitization practitioners as distinct realms (Farjoun et al., 2015). Maintaining such a viewpoint during my employment was difficult – even though we all focused on the goal of making servitization work, the servitization practitioners and I went about this in different ways. In order to overcome this distinction in my mind and to ignite the process of abduction, I had to make peace with Peirce's idea that perceptions and perceptual judgements are vital for the generation of new ideas, "especially when the insight […] arranges phenomena, which we have been puzzling about, in a novel and promising way" (Paavola, 2015, p. 233).

Over time, I became more attuned to the setting. I also tried to remain aware that some things need to be experienced in the field in order to be understood and that theoretical explanations can sometimes prevent researchers from reaching this understanding (Rawls, 2008). Increasingly, I became aware of a disconnect between practitioners' practices and the extant servitization literature. I therefore began to pay attention to the more mundane details of practitioners' servitization work. The idea of qualification (Callon et al., 2002) was very broad and seemed applicable to almost anything. Mobilizing this concept, it appeared as if the service-developing department was a hub for producing and refining ever more qualities for its servitized offerings. I did not know where to draw the line. Qualification work was everywhere – it reached far beyond what I could observe, as I lacked access to, for instance, higher-level stage-gate meetings and customer organizations. I also wondered how I should structure my thinking about the instances of service qualification that I could observe. What did they have to do with market creation? I searched the online databases such as Google Scholar for more detailed explanations of market

creation. In so doing, I came across Callon's (2015) article that treated the marketization processes in greater detail. The processes Callon (2015) described seemed to explain how ManCo went about its servitization work. At the same time, it brushed over some aspects that were important for ManCo, such as making customers interested in an offering and persuading them to pay. I decided to look out for what was not there. The key factor may not have been markets, as I had initially suspected, but customer demand.

Service qualification that aimed at creating customer demand was a more restricted concept to investigate given the time and access I had available. In this regard, I decided to ask about everything that I did not understand or that struck me as odd in relation to customer demand or qualification. I also asked my colleagues to explain their activities in detail and sometimes they would show me an example. Furthermore, I decided to gather whatever material I could, even if it did not seem directly related to qualification work. As I grew more familiar with the way in which practitioners worked, I developed a better understanding of how to ask questions and request examples. This also fed back into how I conducted the more formal interviews. During my employment, I took notes on a total of 81 informal conversations and logged more than 600 received emails. In that process, I also gathered secondary materials – documents, brochures, presentations and calculations – that I understood as 'frozen' testaments of practitioners' work.

Documents – round one

Throughout my time at ManCo, I gathered documents (see Table 2). 'Documents' is an umbrella term for diverse textual and other materials, including photos, emails, brochures and notes (Coffey, 2014). My initial strategy was to gather as much of this secondary material as possible. As I went about gathering documents, I was met with great openness within ManCo. For example, the team emails that I received while at ManCo often contained documents, such as strategic plans, updates from top management meetings held overseas and summaries of the service- developing unit's performance. Over time, I developed an understanding of which materials were more sensitive and I began to sense that some items should not be used for my inquiry. Given my responsibility to not expose my informants or to disclose anything that could render them vulnerable, I chose to change my strategy. The documents I was interested in were chiefly created for everyday purposes as outputs of servitization work (Flick, 2014a). I therefore focused on documents that would help me answer my research question and areas that the experts suggested I should consider. I therefore ended up disregarding some of the gathered material, even though

it was relevant for my research question, in order to protect the informants. Moreover, I began emphasizing publicly available material, such as ManCo's official service brochures and catalogues.

Over time, I amassed an array of materials from ManCo's intranet, PowerPoint presentations, service business plans, photographs of service displays, posters and other items accessible to me during my employment. I also gathered service brochures, leaflets and other documents used to communicate or develop services. The documents are summarised in Table 2.

Table 2: Overview of documents

Document	Description	Company	Count
Field notes on observed practices	Log of daily field notes capturing observed servitization practices	ManCo	• 74 informal conversations
Emails	Email communication within ManCo to organize and coordinate service delivery as well as correspondence with customers to coordinate service delivery	Customer sites, ManCo	• More than 600 formal and informal emails
Photographs	Photos of my workplace at ManCo and of servitization materials, such as prototypes, replicas, and marketing or service coordination materials (e.g., flowcharts, project plans)	ManCo	• 42 high-resolution photographs
Service brochures, manuals, checklists, etc.	Marketing and other informational material to communicate service offerings – often used in conversations with customer personnel on site	ManCo	• 2 service booklets • 18 service brochures • 8 service leaflets • 2 service manuals • 1 service checklist
Service sales and business plans	Multi-tabbed Excel documents that provided different scenarios of providing one service	ManCo	• 4 service business plans • 1 service sale plan
Corporate intranet	Miscellaneous internal information on ManCo's service provision and its coordination	ManCo	• 22 screenshots • 12 documents

Analysis: An iterative process

The analysis was organized around the structure of template analysis (Brooks, Mccluskey, Turley, & King, 2015; King, 2012) and was enhanced by a parallel reading of the literature and the writing of texts (see Table 3). Template analysis involves the creation of a coding template – a list that

organizes the different labels, or themes, emerging from theory and the data. Different themes are aggregated into codes (Brooks et al., 2015). Codes and themes are captured in an overall list, or template, which is applied to increasing amounts of empirical material and continuously adapted until it adequately reflects the empirical material (King, 2012).

While 'template analysis' is sometimes used interchangeably with 'thematic analysis' (Braun & Clarke, 2006), this characterisation is inaccurate. Brooks et al. (2015) summarize the relationship between template and thematic analysis as follows: template analysis is one form of thematic analysis, but it provides more freedom than other forms of thematic analysis, as it requires neither a pre-determined structure in terms of the levels or positioning of themes nor explicit distinctions between themes in advance. In particular, it deviates from thematic analysis as described by Braun and Clarke (2006) in that it allows for production of initial versions of the template from subsets of the data, thereby prompting researchers to establish theme definitions early on, and it typically has fewer sub-themes in the coding (Brooks et al., 2015; King, 2012). Overall, these authors conclude that template analysis is useful across a broad range of philosophical stances and provides the flexibility to adapt to researcher's needs. I selected it over Braun and Clarke's version of thematic analysis because of this flexibility, although I included more levels of sub-codes in order to try out different theoretical views and compare their nuances. An alternative analysis method was grounded theory (Corbin & Strauss, 2008), which calls for certain steps and primarily demands inductive reasoning (Charmaz, 2009, 2014). As such, it is less permissive of an inquiry fuelled by doubt in which data collection, analysis and theory inform each other. Some of the precepts of grounded theory, such as repeatedly revisiting data or defamiliarizing oneself from it, have been argued to usefully inform abductive analyses (Timmermans & Tavory, 2012). However, revisiting data naturally occurs in template analyses when, for example, template adjustments call for the re-coding of the data. Moreover, template analysis allows for defamiliarization through reading, trying out alternative theoretical approaches and experimenting with the links between different themes. New insights can also come from themes or codes that are initially assumed to be of importance but are later excluded from the final template. For example, I initially had a code relating to 'care' – engineers diligently going about their work and working hard to ensure good service delivery. However, it became apparent that such care was not part of the puzzle and that elements of caring, such as measuring results and ensuring their correctness, were better explained by the concept of qualification (Callon et al., 2002).

Importantly, following the steps of template analysis in order is not a strict requirement but rather a suggestion (King, 2012), which makes it possible to go back and forth iteratively. Therefore, I started the analysis for article 1 by asking *how* questions. As my understanding developed, I was able to ask more *why* questions (Silverman, 2006) for article 2.

Table 3: Overview of the analysis process

Template analysis as suggested by Brooks et al. (2015)		**Reading of the literature**	**Empirical inquiry**	**Production of texts**	
Step	*Aim*				*Count*
1	Becoming familiar with the material	Throughout	Throughout	Writing (and discussing) PowerPoint summaries	• 27
2	Preliminary and tentative coding, whereby a priori themes are acceptable			Writing emails to the research team, and engaging with other researchers at CBS and abroad; expressing thoughts about the links between data and theory, suggesting other literature, and drawing relations on whiteboards for easier visualization and discussion	• Around 400
3	Organizing themes into codes and specifying inter- and intra-code relationships			Exploring relationships within and between codes in different versions of conference article drafts, abstracts, presentations and posters; refining and adjusting whiteboard drawings	• Around 150 draft versions of articles • 3 abstracts • 1 poster
4	Specification of an initial coding template				
5	Application of the template to an increasingly amount of data – modifying as necessary				• 7 evolving drawings
6	Finalization of the template and application to the entirety of the material			Crafting of a feedback report and presentation for ManCo	• 1 report • 1 slide deck
				Writing articles for this dissertation	• 2 articles

To analyse the material collected in round one, we began by familiarizing ourselves with the transcripts as soon as they became available (Step1). We divided the transcripts among ourselves, read them multiple times, and took notes whenever we had an idea, saw an association or suspected an emerging pattern. We met a total of six times to present our findings to each other, discuss what we felt was important and try to establish an overall understanding of what was going on in the company. Overall topics and issues were gathered at the end of each meeting and transferred as tentative inductive themes into the NVivo coding software (Step 2). At the same time, while reading the literature, I derived a number of deductive themes that summarized items that I was expecting to find and included them in NVivo. As the data analysis and theory reading progressed, themes and codes accumulated, and we refined our understanding of their interrelations during our meetings. As the data-collection process was still underway, emerging ideas could be discussed with practitioners in interviews, or I could raise them in conversations at my ManCo workplace or at the project's servitization practitioner events.

After each of the analysis meetings, I adjusted the coding structure in NVivo to reflect our current understanding (Step 3). Over time, we developed a template that contained all of the themes and codes (Step 4). I coded the accumulated empirical material against this template, creating new themes and codes and modifying existing ones when necessary in order to best capture the empirical material (Step 5). Saldaña (2009, p. 297) calls this *provisional coding* – a list of researcher-generated codes is continually revised, modified and expanded in order to include new insights. However, our researcher-generated codes combined both inductive codes emanating from the material and deductive codes emanating from the servitization literature. Notably, this coding occurred on a relatively general level. Although we were beginning to break the material down into more meaningful categories, it could still be considered a first level of coding (Coffey & Atkinson, 1996, p. 36)

As we approached what might have been a final run according to template analysis (Brooks et al., 2015), I discussed the relations between the codes as well as the material with another researcher who was similarly embedded in ManCo and who was, for a duration of a few months, also coding the data. Together, we finalized the list of codes (Step 6). I then applied that template to all of the material that had been collected by that time. I examined this material from my desk at CBS, which provided enough distance from my workplace at ManCo to find patterns. This is also known as 'pattern coding' (Saldaña, 2009, p. 296), a second-level process in which major themes

are developed from the entire corpus of data, and themes and codes are re-organized in a search for a theoretical construct. In this regard, I asked: *How do practitioners do servitization work?* Going beyond the inductive processes that Saldaña (2009) describes, I started reading different streams of literature that covered such concepts as qualification (Callon et al., 2002) and marketization (Callon, 2015) in order to develop an understanding of what I saw across the data. Organizing the material into categories around marketization did not yield any new insights. Therefore, this notion was discarded. After re-reading some of the richest transcripts (Step 1), I recognized that ManCo was not trying to create markets as much as it was trying to create customer demand for its servitized offerings. A parallel reading of the literature on qualification and the writing of various texts (e.g., emails, conference submissions) led to a new concept – tradability (Geiger & Finch, 2016). Subsequently, I repeated the process of pattern coding (Step 6). The findings of this work are presented in article 1.

We realized that the qualification work evident in the data could be conceptualized in other ways. In conversations with my co-authors, a new understanding emerged that there was more to this qualification work and the way in which it was achieved. We reconsidered what was in the data and tried out other concepts, such as inscription (Latour & Woolgar, 1986) and modularity in servitization (Wang et al., 2011), which lead to new revisions of the coding template (Step 4) and a new round of re-coding a number of select transcripts (Step 5) and, later, all of the material (Step 6). At this point, the empirical inquiry was basically complete, and the resulting distance from the field made it to easier to group and re-group codes. However, something did not add up.

At that point, a co-author highlighted the need to work with the same register (Callon, 1986) across all materials, which meant paying closer attention to non-human things. Our questions changed to: *Why* is this work done this way? *Who or what* is at work here? Based on our collective brainstorming and parallel theory reading, I created another list of new codes in NVivo (Step 4) and applied that list to what we considered to be the richest and most informative interview transcripts (Step 5), paying particular attention to the qualities of all materials employed. Again, new codes emerged and older codes became obsolete – the product became more important and the vast array of services I had initially coded for became less relevant. I kept talking with my co-authors about emerging patterns and changing the structure until we had a list that I applied to the entire material (Step 6). Ultimately, what stood out were three instances in which practitioners

experimented with inscriptions of service qualities. These experiments could only go so far, because the product struck back. These results are presented in article 2.

These insights made me realize that there was more to the product than the extant literature suggested. If the product could be an entity that struck back at service provision, could it also be more actively involved in other aspects of servitization work? Returning to the servitization literature, I noticed that products involved in servitization are generally assumed to play a relatively minor role in the sense that they are treated as "largely stable entities" (Spring & Araujo, 2017, p. 128). The extant literature assumed that the product was an unchanging canvas that provided opportunities for additional revenues through the addition of services. However, our findings led me to doubt this assumption. Therefore, I devised a new study to investigate the product.

I continued with a study focused on the product

Existing academic forays into the product focused on its instability over time, as it moved across different owners, was repurposed and, ultimately, recycled (Kopytoff, 1986; Thomas, 1991; Spring & Araujo, 2017). However, these authors hone in on the product as considered *across* different exchanges, gifting and stealing. From this point of view, the machines that ManCo serviced should have been relatively stable: They were built for one customer, whom they typically served until the end of their useful life and subsequent demolition. In what may be considered its only biographical episode (Appadurai, 1986), it did the same work and was commonly not repurposed. And yet, such a product also managed to strike back at servitization implementation, from which I surmised that there was more to it than initially expected.

How (not) to learn about the product

I started out by re-visiting the previously collected interview material. However, products hardly featured in that material. Moreover, when informants did speak about them, they chiefly did so in terms of products as an installed base that was willing and ready to be serviced, which was aligned with the argument made in the literature (Baines et al., 2009a; Huikkola et al., 2016; Neely, 2008; Visnjic Kastalli & Van Looy, 2013). I found this notion of a readily serviceable installed base at odds with a product that, as per article 2, was able to strike back. As Czarniawska (2014, p. 30) states, "interviews do not stand for anything else; they merely represent an interaction that is recorded or transcribed". Therefore, when a product featured in the interview material, it was the product as produced by the practitioner's talk. I realized that something about the product was

difficult to express in talk–and hence hadn't yet featured in the literature. This led to the next problem: the need to inquire about the product in a way that was not just talking *about* it.

Attending to the product in such a way meant that I needed to conduct a new inquiry. At first, this seemed difficult to achieve for travels to ManCo's globally distributed machinery was prohibitively expensive and required a type of access that was out of my reach. Discussions with colleagues led me to re-visit ANT. As it is more than a collection of words making up an infralanguage, I felt that it could provide a helpful methodology for pursuing my question (Latour, 1996). Some of the seminal accounts by Callon (1986) and Latour (1999) present non-human entities in a way that goes beyond how people talk. This is because a central part of the ANT methodology is the insistence on keeping things *flat* (Latour, 2005). Using the metaphor of cartography, Latour (2005) explains that instead of taking a landscape as a given, researchers should investigate how mountains and valleys came to be three-dimensional in the first place. He further suggests analysing *how* things came to be connected with each other rather than assuming that they have *always been* connected or starting an investigation with pre-existing ideas on how they *should* be connected. From this perspective, products were not a priori bound to distant customer sites. Furthermore, the second article had already shown that the product could affect the organization of service provision and that this affect occurred away from customers' sites. What happened with the product as it was serviced remained unclear.

A focus on the product is well aligned with the ANT methodology and its key tenet that non-human entities possess agency (Latour, 2005). Important is not what something means but what the actor does (Justesen, 2017). Czarniawska (2014, p. 58) thus summarizes that "social scientists spend too little time studying objects and too much time studying humans, misled by the fact that humans can talk and can therefore be spokespersons, even for networks primarily comprising non-humans". Despite the fact that service involves a combination of man and product (Gadrey, 2000), much research favours the human aspect. In turn, *methods* to help flatten out the relations among different things, such as servitization and the product, "on a table with the back of our hand until they become legible and usable again" (Latour, 2005, p. 172). The literature advises that we do this by "following the actors" (Latour, 2005, p. 227) – shadowing a person or a thing as a way of conducting a 'mobile ethnology' (Czarniawska, 2013). However, the product I was interested in did not physically move from place to place. Moreover, as the extant literature on product

instability was mostly conceptual (Kopytoff, 1986; Spring & Araujo, 2017; Thomas, 1991), it offered little practical advice for designing an empirical inquiry into the product.

Nevertheless, it was clear what *not* to do: focus on experience, favour humans and have preconceived notions of the world. Therefore, the second part of my inquiry (which informed article 3) sought to do the opposite. It asked how servitization and the product relate to one another. More specifically, my aim was to examine *how the product is servitized* and what that entails.

Conducting a flat study of practices

With this vague idea from the literature, I embarked on a second round of gathering empirical material. Having scrutinized the material emanating from the first inquiry round, in particular reverting back to my log of observations and the gathered documents, there was indeed something about the product, which appeared to differ across different instances and I could grasp that location was important. I conducted an initial interview in order to see how I might establish flatness but I struggled with how to ask practitioners about the product in a way that would not result in mere speech acts. This first interview provided little insight into how to handle the inquiry. While there was evidence of qualification (Callon et al., 2002), there seemed to be more to servitizing a product. Inscriptions (Latour & Woolgar, 1986) appeared to play a part as well, but this term did not seem to adequately capture the elements of unsteadiness and uncertainty.

In light of my struggles to find a conceptualization that made room for unsteadiness around the servitized product, my PhD supervisor suggested the term *multiplicity*. Coined by Annemarie Mol, this notion pertains to the more recent ANT literature and was first used to describe the "array of lived medical realities" (Mol, 1998, p. 278) that Mol found emanating from medical practice. Mol (1999) argues for reality as enacted by practices. For her, this means that the product is not one thing – it is possible to enact it differently by doing something with or to or about it. In her book on the body multiple, Mol (2002) addresses this issue in greater detail. In describing doctors' practices of diagnosing and treating atherosclerosis, she shows how the disease and the ways of tending to it are interlinked, thereby making the point that healthcare practices enact different diseases, all of which go by the same name (see Chapter 2). According to Mol (2002), multiplicity contains the practices of qualifying and inscribing. Importantly, in focusing her attention on practices, Mol (2002) presents a way to tend to the body that keeps the world flat and goes beyond

practitioner's speech acts. I found there to be some important parallels: My product appeared to be similar to the 'body' that, when treated with healthcare services, became multiple. Servitization appeared to operate similarly to the atherosclerosis that Mol sought to study. But instead of paying attention to nouns, as I had done before (qualification, inscription), I could now see how I could solve my dilemma by looking for servitization *practices* instead of asking for opinions. The new research question thus became: How do servitization practices enact the product*?*

Mol (2002) also adopts a different methodological approach. Instead of presenting the story of one or two patients that she followed, she provides an assortment of data snippets – different episodes of practices that take place across the different hospital wards. Instead of outlining a clear beginning, she starts her investigation in the middle of things, in a consultation room. This led to the insight that if I similarly understood servitization as something that is practically achieved, I could also start in the middle, which was what I had done by re-considering the existing data and conducting a first interview. One problem remained. Mol (2002) conducts what she calls a *praxiography*, for which she undertakes in-depth ethnographic inquiry. Here, Mol's access in terms of scale and time were far beyond what I could negotiate with ManCo. In searching through the literature, I came across an article by Heuts and Mol (2013) on the good tomato. In this article, the authors investigate the practices of people as varied as consumers, chefs, growers and supermarket staff in making or obtaining what they think is a good tomato. Similarly, I planned to meet with a variety of practitioners who were involved in different servitization practices, and who would be willing to explain their work and let me watch as they did that work.

In short, this meant that I needed to gather material on how servitization was done and how this related to the product. In order to keep the world flat, I decided to obey three tenets that I adapted from the ANT methodology:

- **Taking nothing for granted or as a given**. Moving from collecting speech acts to documenting practices meant asking people about what they do, not what they think (Mol, 2002). That also meant that if I came across practices that were difficult to understand, I could approach the situation along the same lines as Latour and Woolgar (1986). In other words, I did not necessarily have to understand the mathematical, chemical or engineering details. Instead, I needed to record the doing – what was written down, how something was inscribed, how it was qualified and how that enacted the product. If I had trouble

understanding, I had to ask for an example, probe for elaborations, and ensure that I understood how the practices, documents and machines related to one another.

- **Dissolving the differentiation between global and local** (Latour, 2005). Instead of hunting for a pre-defined product, I decided to tend to it by going where the servitization practices took place. While ManCo's machines, at least in their physical form installed at customer's various global locations, were far away for me, a focus on servitization practices, wherever they occurred, dissolved any such perceived distance.
- **Minding the non-humans**. ANT views agency as distributed across human and non-human materials (Callon, 1999; Law, 1992). This means that the servitization practices that I was after were not entirely human-made. Instead of gathering documents and other materials as a means to supplement interview materials, I now understood those materials as enacting servitization in their own right.

Following such an ANT outline allowed me to move beyond the viewpoint of the first two articles by stating that reality is not experienced or interpreted but *enacted* (practices make multiple objects) (Mol, 2002). What we might think of as given phenomena, such as servitization, are better understood as *outcomes* that are worthwhile to investigate in terms of how they are achieved. From this point of view, ontologically, there is not one reality but multiple realities. As ANT interweaves methodology and ontology, what we can know about the world multiple (epistemologically) comes from the practices that make it.

Documents – round two

I started looking for the product by re-considering ManCo's publicly available service documents. Although I had been collecting documents throughout the study, the role I attributed to them changed. I initially understood them as secondary materials because they had been made for purposes other than my line of inquiry (Easterby-Smith et al., 2013), and I chose to include them in the study when they supplemented practitioners' statements, such as when they provided additional information or summarized a discussion topic. However, I now understood them as non-human materials, without which hardly any practice could exist (Law, 1992). While the understanding with which I gathered and considered them changed, the information contained in these materials remained the same. Different from the interviews, I found that the product featured very prominently in materials such as ManCo's service brochures or corporate websites detailing its service offerings.

Typically, documents are viewed as additions to interview or survey data, and central questions revolve around how far documents can guarantee openness in the research process (Flick, 2014a). In particular, certain problems are associated with the use of documents, such as how documents are selected and the need consider the context in which they were produced and for what purpose (Flick, 2014a, pp. 300–301). However, according to Latour (2005), everything is data. Therefore, my general rule was to gather all of the documents that treated servitization and that related to the product in some way (see Table 4**)**. I made exceptions to this by excluding materials when I considered them too sensitive.

Table 4: Overview of documents – round two

Document	Description	Company	Count
Service videos	Promotional videos explaining service provision in theory and at customer sites	ManCo	• 36 videos (around 200 minutes in total)
Patents	Detailing new materials, parts or techniques	ManCo	• 37 service-related patents
Corporate web presence	Webpages detailing service provision and corporate purchasing	ManCo, ChinCo	• 1 calculation tool • 5 customer-service case studies • 1 supplier guideline
Corporate newsletter	Detailing noteworthy occurrences and overall corporate strategy	ChinCo	• 11 newsletters
Other documents	Strategy document detailing supplier management and supplier e-platform usage manual	ChinCo	• 1 internal brochure

When I did not have access to the company, I tried to find material on the internet. ManCo had a large online presence that went well beyond its detailed website. The company made use of social-media platforms, such as YouTube and, to a lesser degree, Instagram. While the latter platform provided little more than background information, ManCo's YouTube channel was a rich source of information on service provision at customers' sites and in ManCo's back-offices. A number of these videos mentioned trademarked procedures and parts. In following this trail, I searched all of ManCo's entries at the United Stated Patent and Trademark Office (USPTO) and made copies of all entries that detailed new materials, parts or techniques. Furthermore, I investigated ChinCo, one of ManCo's customers, and subscribed to ChinCo's investor relations newsletter as well as a more general newsletter from a leading industry association.

In terms of the context and purpose of these documents, I treated the statements made in them in the same way as I treated statements made during an interview. Atkinson and Coffey (2011) warn that documents do not provide an accurate portrayal of the social world but "construct their own kinds of reality" (p. 90). As my interest was in the enactment of servitization practices, I followed Goffmann (1981) by distinguishing between two ways of reading documents: *propositional* and *contextual*. A propositional reading can be understood as focusing on the "literal" or "standard" meaning of a sentence (Goffmann, 1981, p. 56), while a contextual reading tries to take into consideration that which is implied but not necessarily explicitly stated (p. 57). Czarniawska (1998) makes a similar distinction. She also points out that an understanding of the context of the text is required in order to make sense of it. In that sense, the documents I investigated were all anchored in the context of servitization and many were particularly concerned with selling services. This is how these documents were entangled in the practice of servitization. My reading of the text, while acknowledging this context, sought out the propositional. For instance, when a service brochure talked about how different replacement parts made up a machine and together became the "components of success", I was less interested in how this might be an argument to advertise services (contextual) and more interested in what this statement told me about the product (i.e., that it was made up of parts – propositional). Similarly, when I looked at images, I did not view them as persuasive or more or less successful in terms of reaching a certain (contextual) goal. Instead, I tried to discern what I could learn from them about the product. Furthermore, I tried to maintain an active awareness about when these products became pertinent and why.

In this way, the documents I gathered had the ability to reveal more than their authors realized (Loizos, 2000) – yet another aspect that made them valuable for this inquiry. Based on Mol (Heuts & Mol, 2013; Mol, 1999, 2002), I expected differing and sometimes opposing enactments of the product. This meant that all potential enactments were of interest. My aim was not to say which enactment was most accurate or sincere, but to understand the different enactments as well as when and why they clashed, and how such clashes were resolved.

The organization of this material was fluid and emerged over time. Different types of equipment featured in ManCo's videos, newsletters, brochures and webpages. Often, I would watch a service video in one tab of my browser and have a website that detailed the service procedure open on

another tab while searching through piles of service brochures and checklists on my desk. Ultimately, I could see that the information could be usefully structured into two rudimentary categories – some enactments appeared to be more pertinent on ManCo's premises, while others were more pertinent to customers' premises. This was where my understanding ended. I needed to make sense of this material together with the interview data.

Observing Interviews – round two

I conducted the second round of interviews independent from the Project, chiefly in the autumn of 2018. While I first envisioned these interviews to be similar to the semi-structured design I had used as part of my research with the Project, the nature of my interest made it difficult for informants to tell without showing. While I had created a new interview guide, I opted not use it (as explained in detail in the previous section). Already in the first interview would informants draw out brochures, use their feet and hands to indicate dimensions or movements, or even prompt me to touch or knock on the table in order to make a point about material compositions.

Inspired by Czarniawska (2014), I changed my setup to one of *observing interviews*. One research strategy emanating from ethnography is to let interviews flow in parallel with observations (Hammersely & Atkinson, 1983), The idea is that visualizations add richness to the understanding that researchers create during the interview process (Czarniawska, 2014). My aim was to achieve interactions similar to those that Mol (2002) describes when she explains how she talks with her informants while simultaneously observing what they do. Therefore, I started each interview by asking introductory questions about the interviewee's position and how he or she came to work for the company (Brinkmann & Kvale, 2015). Then, as recommended by Czarniawska (2014), I shifted the topic towards the interviewee's working days and asked them to describe in detail what they had done so far that day (or the day before). I would then probe into how this doing related to the machines, prompting the interviewee for examples. Like Mol (2002) in the hospital, I was then looking, together with informant at brochures or, using their (or my) smartphone, at other publicly available material, on which they showed me what it means to do servitization work. Sometimes informants would allow me into their offices, where I could look over their shoulder (Czarniawska, 2014) as they showed and explained to me such things as how they dealt with customer emails and brochures; what led customers to opt for fewer service options on order forms; and why certain photos were chosen for PowerPoint presentations. Whenever possible, I tried to obtain those documents. When that was not possible, I took notes immediately after the meeting in order to capture what I had seen and learned in as much detail as possible.

Also important was the question of how I could investigate *practice* when what was collected in the interviews was *talk*. Firstly, this interview round differed from the first in that I did not ask about informants' opinions or ideas, but about what it was that they did. In that sense is talk an

important part of doing service work (Orr, 1996). Secondly, I tried to observe as much of the goings-on as I could, even beyond what my informants showed me, for servitization work was occurring all around me: Informants liaising with colleagues from different departments while queuing for coffee, video screens announcing travel warnings and reporting on days without accidents or marketing material being passed out that announced ManCo's vision to become a full-service provider.

The interviews with informants from ChinCo were conducted over the phone. It was in this company that someone asked for my interview guide in advance of the conversation, which nobody had done before. Fearing that they might decline otherwise, I provided it. In the ChinCo interviews, it was then also more difficult to be shown things. However, one informant then turned out to be particularly forthcoming and first explained how they worked with and ultimately emailed me an important internal document which is used internally in order to organize ChinCo's purchasing process.

In total, I conducted 11 interviews in this round (see Table 5), which lasted an average of 50 minutes. The interview transcripts totalled around 400 pages. The interviews were again transcribed verbatim with annotations that I found helpful, such as when an informant smiled or was being ironic (Brinkmann & Kvale, 2015).

Table 5: Interviews – round two

Company	Position	Practices	Duration	Mode	Count
ManCo	Service Manager	Service delivery coordination and systematic delivery of services	1h 24 min	Face to face	1
ManCo	Senior Project Manager	Development of new service offerings	1h 9 min	Face to face	2
ManCo	Team Leader Service Maintenance	Coordination and sales of maintenance services	56 min	Face to face	3
ManCo	Team Leader Service Maintenance	Coordination and sales of maintenance services	30 min	Face to face	4
ManCo	Mechanical Engineer	Development of new service offerings	49 min	Face to face	5
ManCo	Development Manager	Coordination of service development	42 min	Face to face	6
ManCo	Mechanical Engineer, Senior Project Manager	Group interview about service development and provision	1h 4min	Face to face	7
ManCo	Mechanical Engineer, Mechanical Engineer	Group interview about service provision at clients' sites	45 min	Face to face	8
ChinCo	Head of Demand Management	Assessing and planning demand for service consumption	60 min	Phone	9
ChinCo	Purchasing Regional Level	Tender and purchasing process for services	58min	Phone	10
ChinCo	Head of Supplier Management	Digitalizing purchasing process and new purchasing strategies	1h 15 min	Phone	11

Analysis

The analysis for the third article began with reading the documents and it accelerated during the transcription process, which made me familiar with the interview data. As in round one, I used template analysis to identify patterns in the material, and to relate and compare different patterns (Brooks et al., 2015). In an effort to avoid becoming overwhelmed by the material, I started transcribing and analysing immediately after each interview, and I maintained this analytical process throughout the data-collection and writing processes (Czarniawska, 2014). This had the advantage that my understanding evolved along with the investigation, allowing me to direct upcoming inquiries toward topics that seemed interesting.

Since ANT warns about forcing pre-established analytical ideas on the empirical material and suggests maintaining registers when moving from the technical to the social (Callon, 1986), I tried to ensure flatness in the analysis by not privileging the interview data over the other materials. In other words, I tried to reach an understanding across all of the materials rather than understanding the brochures and documents as supplementary to the interviews. In so doing, I noticed that

although, in theory, servitization means that products and services are sold together (Oliva & Kallenberg, 2003; Vandermerwe & Chadwick, 1989), servitization in ManCo's case was chiefly about servicing already sold equipment. I therefore focused on this servicing, and tried to understand how it enacted the product and in the ways in which such enactments might differ.

I first ordered the different materials by type. I saved interview transcripts in one folder (and later moved them to the NVivo software), service emails in Outlook, my observations from the first inquiry in an Excel file, photographs on my camera, videos in my YouTube account, and printed material in a cabinet near my desk. This system provided an initial overview of the material and what it was about. In my first few readings of the material, I only paid attention to what was being *done* to the product. I marked the relevant passages in the material and took notes in my notebook.

I then re-visited all of the instances of doing, asking: How is this enacting the product? What is the product here? The common logic in the servitization literature is that there first has to be a product in order to service it. However, my analysis turned that logic around: I had evidence of servitization practices and I now examined what they made of the product. Once again, I used template analysis (Brooks et al., 2015; King, 2012) and coded all material in NVivo. This led me to distinguish between practices occurring within ManCo and practices taking place at customers' sites. However, NVivo, while practical, forces codes into a hierarchical order. As the analysis progressed, this became increasingly bothersome: practices (and products) were poorly represented in such a top-down system. The relations I found were much more fluid and difficult to rank. I therefore decided to relate codes to one another using mind-mapping software, which allowed them to sit next to each other. This coding method resulted in a list of practices coded as 'on customers' premises' and 'at ManCo'. The mind-mapping codes increasingly allowed for visual flatness in the coding and let me experiment with how codes related to one another *laterally* (see Figure 3).

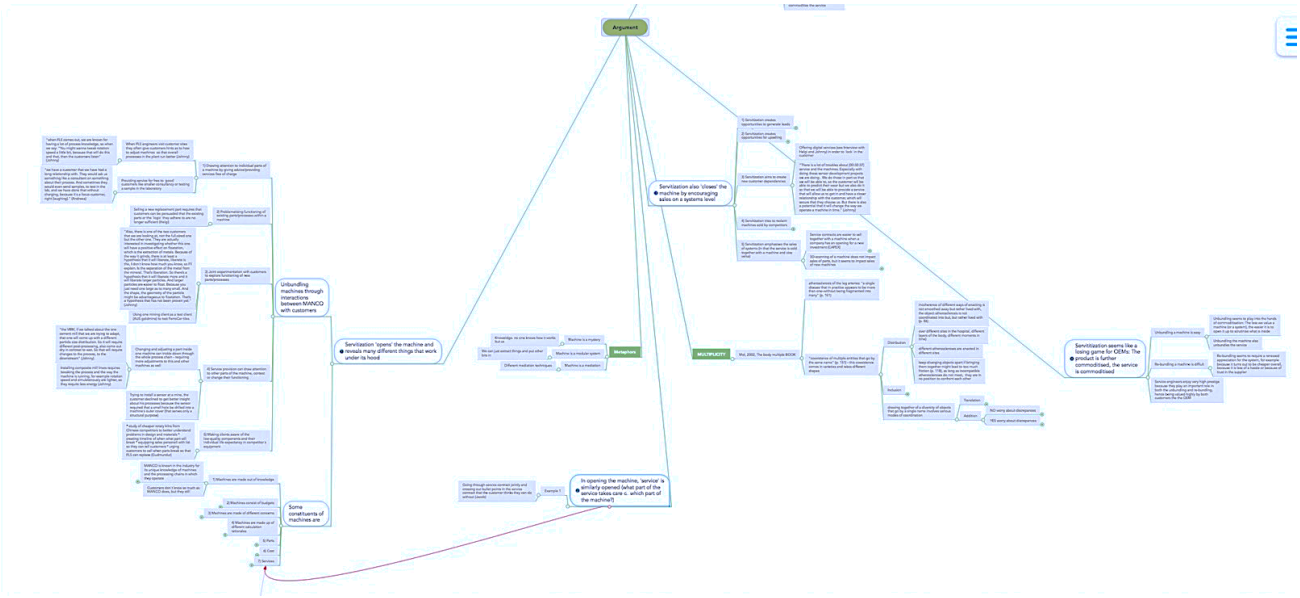

Figure 3: Laterally approaching codes for the third article

This lateral organization of codes allowed to see that enactments were not alone distinguished by location. Over time, the codes 'on customers' premises' and 'at ManCo' became obsolete. I began to move similar enactments together and opposed them to those that seemed different. Experimenting with the mind-mapped codes, I began to further aggregate the material, writing stories (based on these codes) of how servitization practices differed across locations and product types: parts of finely engineered high-tech machinery leaving ManCo's foundries, easy-to-copy pieces of equipment at customers' sites, problematic machines that refused to work in one country and machines that had functioned just fine for the last 30 years in a different country.

I developed a table to gather the essence of these little stories (see Figure 4). I subsequently used the terms of 'part(s)', 'calculation', 'function' and 'engineering knowledge' as codes in order to refer to the different enactments.

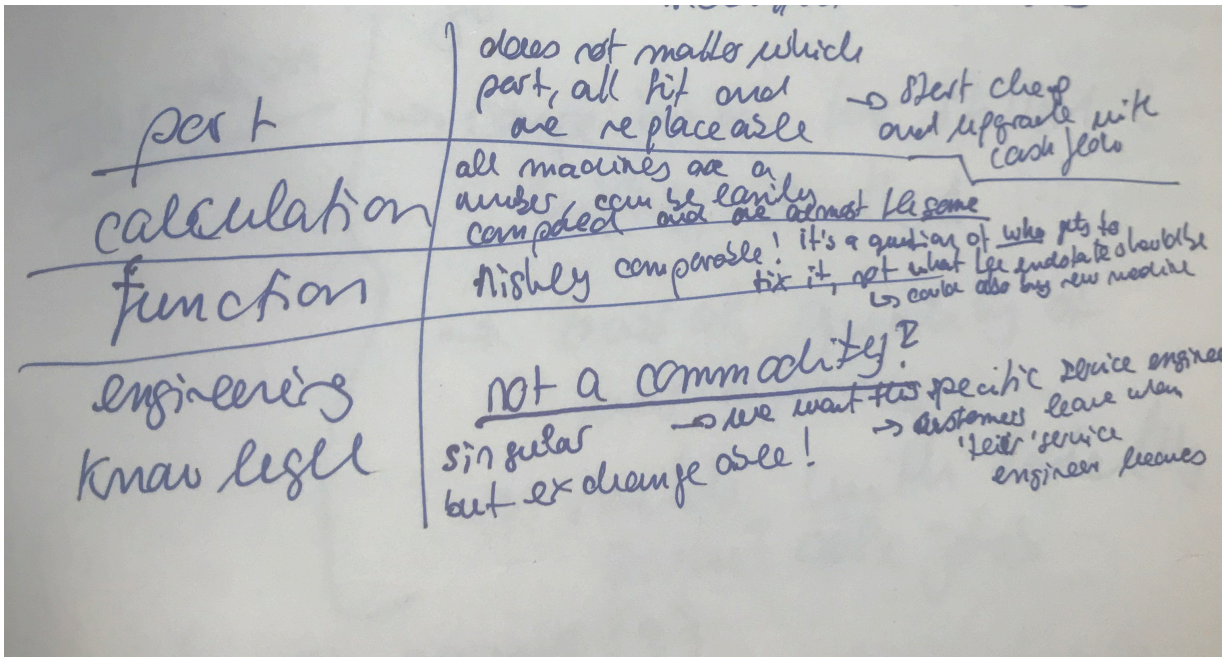

Figure 4: Excerpt from my notebook, dated 18 February 2019

As I kept adding material, however, I could see that the machines grouped under the 'function' code similarly contained practices that had to do with calculating. Re-reading the material pertaining to both codes, it became apparent that the 'calculation' code was more appropriately re-named into 'business case'. However, this left open how such machine enactments clashed and how clashes were resolved.

Mol (2002) speaks about coordination work that leads to a single diagnosis and treatment plan for the patient. However, such coordination work is not always successful (Stensrud, 2016). I read through the material again, trying to discern how any service could be delivered to all of the different machines. When looking at the codes side-by-side on the mind map, I realized that there was a temporal succession. This temporal aspect differs from the biographical approach adopted by Spring and Araujo (2017) in that the product in question is still within one biographical episode and it is enacted as many different things. I subsequently began to adjust my codes for the mind map. I also changed the stories in my notebook, experimenting with the temporal dimension by writing about which product was what, when and where. The results of this inquiry are presented in article 3 (Chapter 4).

Quality in qualitative research

The above discussion of my methods leads to the issue of quality assessment in qualitative research. Latour (1988) writes that the results give merit to the methodology – not the other way

around. Others point out that great results have much to do with serendipitous circumstances in the empirical world that are beyond the control of the researcher (Czarniawska, 2014; Merton & Barber, 2004).

This makes the assessment of qualitative research difficult. What may generally be considered to be classic criteria for good research – validity and reliability – are emphasized in quantitative research (Kirk & Miller, 1986, Chapter 2). *Validity* seeks to assess the extent to which the applied measures and the resulting findings accurately measure and depict what they claim to do, while *reliability* seeks to assess whether the methods will produce the same or similar results each time they are used (Easterby-Smith et al., 2013, pp. 48; 347). This is often problematic for qualitative research because it is difficult, if not impossible, to measure social realities. Moreover, the methods used to learn about them will likely produce different results in different circumstances. Therefore, some researchers have tried to adapt these criteria in order to render them more appropriate for qualitative inquiry (Brinkmann & Kvale, 2015, pp. 281–294; LeCompte & Goetz, 1982). Others have offered their own conceptualizations, such as Guba (1981), who argues for establishing the trustworthiness of qualitative inquiry. However, in his later works, Guba joined others in arguing that such quantitative assessments are generally unfit for qualitative inquiry and that achieving compatibility between them is a difficult task given that the two realms vary too greatly in terms of how they define truth (Lincoln & Guba, 2000; Smith & Heshusius, 1986). Tracy (2010) suggests a catalogue of eight judgement criteria, including *worthy topic* and *credibility*. Such criteria remain debatable, as ideas about worthy topics differ greatly and as the type of credibility outlined by Tracy may not always be desirable or feasible given that the thick descriptions and triangulation that are emphasised are not necessarily in sync with every qualitative research method. In general, there is a great deal of debate around assessing qualitative research, especially when the assessment criteria associated with quantitative work are involved.

Mol (2008) offers different criteria:

> "Good case studies inspire theory, shape ideas and shift conceptions. They do not lead to conclusions that are universally valid, but neither do they claim to do so. Instead, the lessons learned are quite specific. If one immerses oneself long enough in a case, one may get a sense of what is acceptable, desirable or called for in a particular setting. This does not mean that it is possible to predict what happens elsewhere or in new situations." (2008, p. 9).

As Mol explains, there is value in learning new lessons precisely because they are *specific*. Specific cases allow us to learn specific things. Specificity allows for comparison to other instances. By immersing ourselves in a case, we gain a sense of it that we can then compare to the sense we have gained elsewhere. This means that there is power in a specific account. Similarly, Flyvbjerg (2006) points to the value of the practical and context-dependent knowledge provided by case studies, especially as the social sciences generally lack predictive and context-independent theory. He stresses the importance of the researcher's "strategic choice" (2006, p. 226) of a case. This means that for articles 1 and 2, the choice of the company and the selection of informants provide important indications of quality. In particular, article 1 (and article 2 to some extent) presents people's opinions and beliefs. This is why we interviewed experts and used a conversation-style interview form that is argued to foster knowledge transfer. For the third article, different considerations were called for because *practices*, rather than opinions, were the object of study. In this regard, Mol explains: "Examining a practice is not a matter of collecting suitable examples, but of learning new lessons" (2008, p. 9).

This suggests that using a priori criteria to sample materials or informants would have been less of a strength and, perhaps, even an impairment in this instance. In order to learn about practices, I had to accept that certain things were difficult to plan or anticipate and that my inquiry needed to go where the practices were. In so doing, there were some unexpected turns, such as interviewing a customer organization, which was not pre-planned but emerged from the inquiry in order to better understand servitization practices beyond ManCo's gates. There are also other aspects of good research apart from leaving room for the inquiry to evolve. One evaluation approach is offered by Pratt (2008), who presents a summary of criteria based on the practices of published authors:

- Ensure that the methods are well-written and complete,
- Write interestingly and clearly express thoughts, and
- Link the research to existing and new theories.

These three practical criteria summarize the practices used by 133 survey participants to persuade the reviewers of top-tier Northern American journals that their qualitative work was good enough for publication. This is what I tried to do throughout the study. By providing an exhaustive and

understandable description of this study's methods, I shed light on what I have done and how. By writing clearly, I provide transparency, and illuminate my research and analysis processes. Because I mobilize pragmatism and problematize taken-for granted assumptions in the literature in order to link different theories around servitization and multiplicity, I am able to generate new theories, gain novel insights and push the envelope of relevant research (Alvesson & Sandberg, 2013a). Another important aspect of good social science research is that it does not harm those involved in the research. I therefore detail the ethical considerations of my research in the next section.

Ethics: Lie, cheat and steal

Regardless of my different approaches to studying servitization at work, I maintained the same ethical considerations regarding:

- Confidentiality (disclosing others),
- Transparency (disclosing myself) and
- Representation.

In particular, I was aware of ethical concerns regarding lying, cheating and stealing.

Lie

I could have lied in two broad ways: lying to my informants and lying in the account provided here. As a rule, I was upfront with informants. I fully disclosed the facts that I was a researcher, that I was collecting material for my academic work and that I would keep their information confidential (i.e., not disclose their names and ensure that they could not be recognized from the data). That said, I did not disclose everything I did. For example, I did not reveal to ManCo that I was speaking with ChinCo or vice versa. Also, I took great care to not disclose anything I learned from one company to the other, including the very fact that I was knowledgeable about them.

Much information was also provided in an aggregated format that is not possible to trace back to an individual. Sometimes, informants mistook me for a student or an intern, especially in the earlier stages of the inquiry. I benefitted from these misunderstandings, which often resulted in particularly patient and easily understandable explanations. However, when I suspected that this was the case, I would gently remind informants of my role as a researcher, which I felt led to more in-depth discussions.

I acknowledge that my concern for the anonymity of my informants has affected not only the selection of information that I present in this dissertation but also how I present it. Many of the quotes included in the articles have been anonymized, shortened and made more concise. However, I always indicate where and how a quote has been altered. Furthermore, I do not disclose specific details about the company, such as its name, or revealing information about its operations or precise locations. Moreover, such details would not significantly contribute to my argumentation.

These are the standards that I have applied in order to present an accurate account. In order to decide whether I should write about something, I asked myself the following question: How would it help my argument? In so doing, my aim has been to provide an account filled not with *all* of the information I gained but with most of the information relevant to my inquiry.

Cheat

Cheating can be understood as not adhering to a set of rules in order to gain an unfair advantage. For this research, there were different sets of rules, including CBS's rules on ethical research and the rules listed in the confidentiality agreements. Most of these rules concerned lying. However, cheating also entails a betrayal of trust. My being warmly welcomed into the company meant that informants shared sensitive information with me. Some of that material was highly relevant for my research. However, after spending time inside the company and interviewing a number of employees, I developed a sense of what informants considered confidential. No matter how much I might have tried to anonymize such information, it was not shared with me to be put out into the world. Therefore, I decided that it would be wrong to include it.

Lastly, cheating can be understood as way to deliberately present material in a way that is misleading. This is why I wrote at length about my methodology and the material that I excluded.

Steal

Stealing means taking something that belongs to others. As I clearly state, some of the research presented here was conducted as part of a larger research initiative. Two of the articles that emerged from this collaborative work are included here. These articles were co-authored with other researchers. As I do not wish to claim the work of others as my own, I have detailed my own involvement, and acknowledged the efforts and help of the project's leading researchers as

well as my co-authors. In addition, to avoid stealing, I always asked for permission before taking a brochure or a photo. Moreover, any time an informant indicated that certain information was not to be shared, I did not include it in my analysis. These relatively clear lines were more difficult to draw online, where I searched for documents and other material. Some platforms on the internet share information where the integrity of the material or of those who provide it is questionable. I therefore took care to avoid using material that was unrightfully distributed. Fortunately, there was a wealth of high-quality material from official corporate channels as well as industry information aggregated by reputable sources, such as patent data, that I could use in good faith.

I was also very aware of informants' time and the fact that an hour of their time had a monetary value. Therefore, I kept the interviews to the promised length. In the later research stages, I offered to meet my informants during their lunch breaks to avoid taking up their work time. Lastly, I was most graciously invited to lunches. This was due to the setup of the corporate cafeteria and informants insisted that this was not a problem. I repaid the favour by bringing in cake on my last day.

This concludes my chapter on methodology in which I explain how I moved between the worlds of servitization practitioners and the books. Detailing my abductive movements in this way shows how my approach to the inquiry grew with my emerging understanding of the focal phenomenon. As I learned more, I made my inquiries in a different way. Such movements would not have been possible without the personal interactions with practitioners and academics that helped me see the connections between the two worlds. In particular, my informants went above and beyond what I expected of them, and protecting their anonymity became an important task. Emphasizing the practice rather than the individual person is also in line with the ANT understanding. In the next chapter, I present the articles that emanated from this inquiry and detail my findings about servitization at work.

Chapter 4: Servitization at work: The case of ManCo

In this chapter, I introduce the case company, ManCo, an industrial manufacturer that implemented servitization in order to remain competitive after a severe downturn affected its industries. In particular, I show that ManCo is more than a trope stylized by servitization research. In so doing, I highlight how the company tries to grapple with three servitization issues that have

thus far rarely been discussed in the literature: ManCo presents a case where it is difficult to know about the installed base, where, there are no clear-cut lines between service and servitization, and where service provision spread knowledge out beyond the product. These servitization issues have implications beyond the management problems that are commonly described in the literature (Bustinza et al., 2015; Reim et al., 2018; Tuominen, Rajala, & Möller, 2004).

First, I introduce the case company, ManCo, and explain its industrial operations. Then I describe the steep decline that ManCo experienced in its traditional businesses and how the company adjusted by emphasizing service provision through servitization. As I show next, that service provision had implications beyond the product in terms of how it spread and how it created knowledge. This makes ManCo both a typical and a unique case setting for the investigation of servitization at work.

ManCo: A western engineering company

ManCo is a global industrial firm that specializes in delivering engineering technologies for heavy industries. It is a large company that developed its business over more than a century. In this time, ManCo expanded from a small enterprise specialized in building materials to the sprawling cooperation it is today, having grown both organically and through extensive rounds of mergers and acquisitions. ManCo employs several thousand workers and accrues substantial, albeit cyclically fluctuating, revenues. The company manufactures, sells and delivers large-scale industrial machines, projects (e.g., devising and setting up entire production facilities), and services. This line of work is knowledge-intensive and human capital plays an important role (Muller & Doloreux, 2009).

Given the technical nature of the work, the employees typically have engineering backgrounds, and most are trained as mechanical, chemical or electrical engineers. Many have doctoral degrees in their respective fields. Employees typically stay with ManCo for many years. In fact, many employees start at ManCo in a student job and work their way up to take on different assignments across departments and countries. The company is highly diverse in terms of nationalities and cultural backgrounds, a result of its globally distributed and highly decentralized business. In order to support its employees in their work, ManCo provides them with the freedom to engage in entrepreneurial activities and experimentation.

ManCo's equipment and project execution are used in many different industries, such as those involved in the production of fertilizers, paper, construction, infrastructure and metallic elements (e.g., gold, iron ore and copper). These industries provide key materials for society: construction materials for building walls, roofs and plumbing; metals for electrical wiring, lighting, heating and computer chips; and fertilizers for use in agriculture. The nature of these industries has demanded that ManCo maintain a global reach since its foundation. Raw materials are sourced from where they occur naturally and for most of ManCo's industries, that is where they are found in the ground. Such geological deposits are often situated in remote locations. As their transportation is expensive and does not add to the value of the final product, such materials are typically processed in a nearby facility. However, travel to such production sites is often a complex undertaking because doing so can require, for instance, adapting to high altitudes or entering zones with dangerous geological activity, social unrest, extreme poverty or terrorist threats. ManCo's employees often trade stories of their most dangerous deployments, which may involve anything from specialized insurance to the use of bulletproof vests or bodyguards. In one extreme case, a personal doctor accompanied a service engineer throughout an entire trip.

Apart from their global spread, these industries are highly diverse in terms of players, production processes, and governing regulations. As such, they require their respective workforces to have different skillsets. They are also influenced by a variety of factors, although they all tend to be affected by fluctuations in energy and commodity prices, levels of private and public investment, and environmental regulation and deregulation as well as new tariffs arising from international trade wars. ManCo's clients – the industrial companies operating within one or several of these industries – typically have operations characterized by large-scale facilities and mass production of materials. However, since the value of the end product varies significantly, the cost of a stoppage at a production site can range from around several hundred thousand USD to one or two million USD per day. The production processes tend to require a number of steps. The raw materials are usually crushed and subsequently treated with different chemicals and extreme heat in order change their chemical compositions and to extract impurities. For example, in copper production, mining endeavours are typically financially viable when the copper content in the soil is at least 2% (Copper Development Association, n.d.). although steady advancements in production equipment, such as the equipment sold by ManCo, are making it increasingly feasible to extract copper out of mined ore with even lower copper content. In comparison, paper

production requires the removal of the tree's bark, after which the wood is cut up and shredded. The resulting pulp is then thermomechanically refined and bleached before it is fed into paper-forming equipment. Of these two examples, copper mining by far outweighs paper production in terms of the scale of operations, the environmental impact of production and the price of the end product. This also means that requirements for products, projects and services across industries differ greatly. ManCo is active in more than a dozen of such greatly differing industries.

A customized and global installed base

ManCo's establishment of production facilities for customers and the fact that it also provided the equipment needed to run them resulted in a large, global installed base. Generally, products (or goods) are considered to be material or immaterial things that exist independently of their owners and that can be traded (Hill, 1999), while projects are time-bound sets of activities that produce unique deliverables (Harvard Business Essentials, 2004). However, the difference between projects and products in ManCo is much more fluid, especially given the large scale of the machinery. More specifically, ManCo sells the industrial equipment that is used to break down, transport and transform raw materials that are dug out from the ground. After processing, these materials are used for purposes as diverse as the production of paper or fertilizers, construction, or infrastructure development. Machines of this calibre can be as big as a four-storey house. Often, machines are sold together as a bundle in the form of an entire production line. Such 'product' deliveries require careful planning, sourcing, manufacturing and commissioning, and they have little in common with boxed products sold off a shelf. In fact, sales of these products can become projects in their own right.

This means that ManCo's products in the form of functioning and operating equipment chiefly exist on customers' sites. This is because typically, these machines are not manufactured and moved as a whole. Instead, they come in parts that are individually transported to the customer's local site, where they are assembled, installed and commissioned. At the site, they typically remain attached to the ground until the end of their useful life when they are scrapped. Re-selling or re-purposing is highly unusual. However, as this machinery is manufactured to last a long time, it often remains in use for at least several decades. One of ManCo's oldest machines has been in operation since the 1940s. Its ability to produce such durable machinery sets ManCo apart from its competitors. Over time, this factor has created a strong brand and a perception of ManCo as a

premium provider. But it also comes at a cost: ManCo's equipment is relatively expensive, rendering it a particularly large capital expenditure (CAPEX) for customers. Informants often referred to the "good old days" when ManCo had a monopoly, such that it did not have to "sell" anything – at the time, there was an understanding that customers were "allowed to buy" production lines and entire facilities.

Historically, it was these offerings that grew the company. In ManCo's early days, a series of trademarked innovations made the company's technology the best available. In addition, its premium equipment was (and often still is) usually customized. Informants stressed that customization was important for satisfying the needs of one customer in one industry at one location. For instance, machines located within the Russian tundra need to be able to withstand different temperature ranges than those being used in India. Local regulations, such as those governing environmental pollution and CO_2 emissions vary, requiring locally adapted setups. Different materials mean different mining and refinement processes. Even what one might think of as 'one' material, such as iron ore, can have greatly varying chemical compositions from one place to the next, requiring different attunement of the machine in order to achieve maximum output. Therefore, ManCo rarely manufactures any two machines in the same way.

In recent years, ManCo acquired a number of companies, a manoeuvre that helped strengthen its position in existing industries and enabled it to enter new, adjacent industries. One of its main ambitions was to re-deploy its unique ability to provide entire production lines, which it developed in the building-material industry, also in other industries. Consequently, ManCo tried to acquire not only new technical competencies but also new products. Today, the company offers a vast catalogue of machines and as a result, there is a highly diverse installed base that is spread across the world.

Nevertheless, it is difficult to know about this base. While records on the company's sold and installed machines exist, they are scattered. Data ranges from computerized entries found in modern databases to old and sometimes outdated references on microfilm, some of which informants insisted were "somewhere in the basement". Many entries are kept locally and are not shared across geographies. Moreover, each machine is composed of hundreds of individual parts and often one part has more than one part number. Importantly, especially given their long lifespans, the machines are constantly being altered. It is therefore difficult to know whether

equipment that is listed in the records is still in operation or has been replaced. Even if the machine still exists, it is hard to know how well it is functioning because customers tend to tinker with their equipment. Sometimes, such tinkering is undertaken by knowledgeable in-house mechanics to, for example, enhance performance. At other times, customers' employees fail to maintain the machines as ManCo suggests. Third-party service providers may also be brought in to make changes in the way the machines function, the outcomes of which can vary greatly. Over time, parts wear out and need to be replaced, and not all customers buy original parts from ManCo. Smaller, local competitors can supply replacement parts relatively quickly and cheaply, and sometimes these are non-licensed copies of an original part. Customers might also make do by welding a piece of metal into a roughly appropriate shape themselves. Therefore, even if ManCo knows where a machine is installed, it has no way of knowing exactly how it has been treated in the past or how it is performing today.

Weathering a global downturn by emphasizing service provision

In 2015, a global industrial downturn occurred as commodity prices, one of the prime economic drivers in all of ManCo's industries, experienced a sudden and steep decline (Hutt, 2015). While there were multiple reasons for this downturn, it was rooted in the changing expectations of global investors, a slowdown in China's growing economy, and fears of dampened demand for mined and processed materials, such as those produced by ManCo's customers (Irwin, 2018). As production rates for these materials remained high, hedge funds began betting *against* commodity prices (Sanderson, Raval, & Sheppard, 2015). This negatively affected ManCo's customers. Commodity prices fell to the point that the exchange value for a tonne of material hardly covered the cost of production (Latimer, 2015). Consequently, production sites were losing money just by remaining in operation. ManCo's customers suffered significant losses, which forced them to radically change how they operated and invested. In turn, orders for new equipment and production sites came to a halt, and customers began hunting for efficiencies and cost reductions wherever possible. As a result, ManCo found itself struggling to sell even a fourth of the volumes it had once achieved.

Moreover, new market entrants claimed much of the demand for machinery and products that remained. Mounting cost pressures meant that customers who required new equipment made different calculations, which often led them to prefer a competitor's offering. From these

customers' perspectives, cheaper, radically standardized machines with shorter payback cycles could still perform reasonably well for up to ten years, even if they were not as reliable or durable as ManCo's products. This strategy tied up less money for shorter periods of time, thereby decreasing the investment risk. At the same time, it radically de-emphasized the high quality that ManCo offered. As such, ManCo found itself in the peculiar position that the qualities that had once rendered its offerings "the best in the market" had become a liability.

While ManCo's leaders were unsure whether they were facing a particularly severe downturn or a "new normal", they agreed that the best way to ensure survival and stay afloat was to emphasize services. Throughout its history, ManCo had "always offered services", although offerings like transportation, consulting or repairs were originally viewed as secondary to delivering high-quality machinery. However, ManCo now understood these offerings as an important way to generate revenue. Therefore, it established a new service division in order to aggregate the previously scattered service activities. Furthermore, instead of having service employees "actively waiting for the phone to ring", as in the past, a new management directive emphasized a focus on closeness to customers. This meant that employees began to travel to customers' local sites as often as possible. In fact, they travelled almost "full-time", accruing at least 180 travel days per year. Furthermore, informants agreed that "customer intimacy" required face-to-face interactions and the building of relationships with key personnel on site, such as maintenance, operations and site managers. Service needs are best discovered while walking around production sites, looking at machinery, wearing the typical uniform of hard hats and high-visibility vests, talking while smoking a cigarette with them.

Notably, ManCo grew its service business in a way that differs from the common description in the literature. For instance, it was difficult for ManCo to sell combined bundles of products and services (Vandermerwe & Rada, 1988) owing to the low demand for its products. However, even when ManCo managed to close a product sale, there was rarely an opportunity to turn it into a 'bundled', servitized offering for two reasons. First, economic circumstances had made customers particularly suspicious of ManCo's pricing. According to some informants, this meant that combinations of products and services would likely provide new grounds for clients to try to remove the service component in order to negotiate even lower prices. Second, even though a service division had been established, information about sales and services did not always travel

smoothly between that division and the product division, making it difficult to sell a product and a service contract as a bundle.

Instead of starting with 'lower-level' or 'basic' service offerings and then advancing its service portfolio (Kowalkowski et al., 2015; Sousa & da Silveira, 2018a), ManCo developed a broad range of service offerings, including commissioning, repairs and maintenance as well the more sophisticated services of remote monitoring, process consulting and employee training. Given its extensive expertise, ManCo was also able to build and run entire facilities for its clients, which is considered to be one of the most sophisticated servitization offerings. Servitizing for ManCo meant that, while it tried to combine equipment sales with service contracts, it found servicing its installed base to be more lucrative and easier to achieve.

In so doing, ManCo tried to reposition itself as a full-service provider. It highlighted the experience and engineering ingenuity many still associated with its strong brand as a way to promote and sell services. Within a few years, services contributed a significant share of ManCo's overall revenues. Its most lucrative services centred around the product-centric provision of spare parts – a service that is described as 'basic' in the literature (Gebauer et al., 2010). At ManCo, however, this is anything but basic: Much time and energy is spent on improving and re-engineering designs, creating innovative compound materials for lighter and more durable parts, which, in turn, require fewer shutdowns and reduce fuel consumption. ManCo also experiments with combining parts with sensors in order to offer even more accurate replacement services and predictive maintenance. Consequently, in ManCo's case, there is no clear line between offering services and servitization – most of its services aim to have some effect on a machine. This works so well that the company has begun to service competitors' equipment, an activity that it frowned upon in the past. But as service provision was turning out to be a viable business, a new understanding emerged that such equipment, being of lesser durability and manufactured in less diligent ways, also provided many opportunities to be enhanced by service provision.

In this sense, servitization is a fluid phenomenon in ManCo. It is not necessarily mapped out along different implementation trajectories. Instead, it leads ManCo to explore new sales opportunities. As it is difficult to know about state of the installed base overall, such fluid servitization comes with practices that are both achievable and lucrative for ManCo.

Servitization: spreading knowledge beyond the product

While ManCo's services revolve around certain products and are sometimes even sold as a bundle with those products, they are not necessarily confined to them. This means that servitization, particularly in the shape of 'product-based' services (Gebauer et al., 2010), such as repairs or spare parts, actually spreads ManCo's expertise and deep engineering knowledge *beyond* its products. This occurs, for instance, when ManCo services competitors' equipment. ManCo is increasingly targeting such customers through marketing initiatives focused on making them aware of the early signs of machine failure and reminding them to call their local ManCo representative to set up an appointment as soon as they notice any suspicious signs, such as cracking or bent parts. ManCo has been able to adapt its parts and services in order to attend to the increasingly standardized machinery that is flooding its industries. To the contrary, informants were adamant that the plants and machinery produced by competitors were actually *easier* to service, as engineers needed little time to learn about the setup – they knew that they could expect "even the toilets" to be situated in the same spot.

In order to foster servitization, ManCo also established service hubs in addition to its regional offices. Smaller, local service providers were acquired in order to increase ManCo's flexibility and ability to quickly deploy service workers whenever customers might need them. When acquisitions were not feasible, regional offices entered into partnerships with external, local service providers in order to improve their service coverage. When demand for services peaked, regional offices would sometimes temporarily hire "arms and legs" – comparatively untrained workers who would "blend in" with experienced ManCo engineers and be let go again when demand subsided. In addition, ManCo set up a number of strategically placed 'super' service hubs, complete with on-site laboratories, repair and training facilities, and enough room to keep consignment stock. These hubs operate across regions and are located in proximity of clustered customer activities. They make it possible to provide in-depth and highly technical engineering knowledge that often surpasses what local providers and regional offices can provide.

While servitization spreads the reach of ManCo's expertise, it also expands the content of that expertise. Experimentation with new materials and sensors for spare parts, acquisitions of laboratories that can provide detailed chemical analyses of the materials at each production stage, and acquisitions of service providers enhance ManCo's technical service abilities. However,

servitization also led the company to be more innovative and strategic with its marketing. Although marketing had previously been viewed as "propaganda" that typically emanated from the central marketing department, effective marketing skills quickly became desirable when they became key for selling services. Employees who could persuade customers that they needed a service – those who were good at identifying, bundling and communicating desirable service qualities – were deliberately promoted to leadership positions so that they could share their techniques with others. Notably, these employees were engineers who worked across the local offices. According to informants, central marketing was "too slow" and "too traditional" in its approaches, and engineers who were in regular contact with customers found that they had a much better sense of how to overcome customers' reluctance to buying services. For example, more thought was put into the design of service brochures, which clearly communicated offerings, used customer testimonials and featured the faces of service engineers.

Servitization also extends ManCo's knowledge into customers' organizations, thereby not only enhancing but also replacing customers' knowledge. Informants expressed an expectation that clients could be "locked" into service contracts with increasingly longer durations that offered better conditions on follow-up purchases. At a first glance, this strengthens ManCo's competitiveness by giving it a competitive advantage. However, such contracts also relieve customers of the need to hire their own maintenance crews and simultaneously remove those knowledgeable enough to directly control ManCo's results or able to bargain on factors other than price, output or time. In addition, new technologies make it possible and lucrative to provide 'smart' services, such as the remote monitoring or condition-based maintenance of equipment. Machines can, with increasing ease, be retrofitted with sensors and chips that gather information at all stages of the production process. This allows for the collection and evaluation of detailed information on customers' equipment usage, maintenance behaviour and adjustments of a machine's standard settings. While ManCo finds it difficult to obtain ownership of such data, just being able to analyse it might already be enough in order to gain detailed intel on its customers, which could be used for even more targeted service provision but also to improve ManCo's own bargaining position vis-à-vis clients.

In conclusion, ManCo presents both a typical and a unique case setting for an investigation of servitization at work. It fulfils the characteristics for servitizing companies often outlined in the

extant literature (Baines et al., 2009a). At the same time, servitization is a fluid phenomenon here, it is more than 'just' providing services, even though ManCo combines its service components often with previously sold rather than newly manufactured equipment. This has also to do with ManCo's globally installed base, which is subject to change at the hands of customers. As ManCo tries to take over an increasing proportion of customers' and competitors' tinkering, its proprietary knowledge circulates outside company boundaries and even beyond its products.

Chapter 5: The articles

Article 1: When demand is not a default: Exploring the tradability of servitized offerings

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and
the 34th annual IMP Conference 2018

Introduction

Western industrial companies increasingly seek to secure their continued existence by selling services, creating new offerings by combining their products with services. This phenomenon has been termed servitization (Vandermerwe & Rada, 1988). Although we have witnessed an ever-burgeoning literature on servitization, demand for these industrial services and servitized offerings is often an implicit presumption (Oliva & Kallenberg, 2003) or assumed to arise automatically (Berry et al., 2006). These notions of default demand have led to research on servitization that takes customer demand for granted. But how can such demand be a default when customers do not always know themselves what they want–or need (Normann, 2000)? Assuming default demand is problematic because we know that companies implementing servitization may not always be successful (Neely, 2008). Rather than selling them, services are often still often provided free of charge, as a gift, to many a manager's despair (Ulaga & Loveland, 2014; Ottosson

& Kindström, 2016; Perks et al., 2017). We argue that there is a need to better understand how customers come to want–and pay for–services in the first place

In this paper, we investigate the phenomenon of servitization by mobilizing a more goods-centric approach. In so doing, we lean onto work that understands products, services and servitized offerings as fluid and malleable entities, requiring special efforts from market participants such as suppliers and customers in order to delineate and control their attributes (Callon et al., 2002; Callon & Muniesa, 2005; Kjellberg & Helgesson, 2006). This school of thought provides a different way to understand the marketing of industrial offerings (Araujo & Spring, 2006; Azimont & Araujo, 2007; Finch & Geiger, 2011; Mason, Friesl & Ford, 2017) and its nuanced take on transactions and the work that enables them can provide valuable insights into the efforts necessary in order to sell industrial services.

We employ this approach to the empirical case of a global manufacturing firm, where it allows creating an understanding of how offerings are sold and demand is stimulated (Araujo, Kjellberg & Spencer, 2008). In so doing, we investigate the following research questions:

RQ: How does demand for servitized offerings arise? How are they traded?

With this study, we aim to contribute to the literature on servitization by detailing the efforts that the case company makes in order to create demand for and sell its industrial services. These efforts have largely been neglected in the extant literature and understanding them as an important part of servitization work allows for new insights into the complexities servitization entails.

The remainder of the paper is structured as follows: next, we provide the theoretical background to the study. In this, we discuss the broader servitization literature and the inherent practical and theoretical challenges around servitization, before considering how tradability for industrial services may be achieved. The subsequent sections provide the research methodology and empirical case background, followed by the research findings emanating from the study. We finish by discussing our findings and presenting some concluding remarks.

LITERATURE REVIEW

The context of servitization

The term servitization implies a change within industrial manufacturing organizations towards offering services and product-service combinations, in order to create closer relational bonds with its customers (Vandermerwe & Rada, 1988; Tuli, Kohli & Bharadwaj, 2007; Raja et al., 2013; Kowalkowski et al., 2017). Servitization is also widely recognized as a competitive strategy that focuses on addressing increasingly complex customer needs in order to protect the company from competitors (Luoto, Brax & Kohtamäki, 2017). And yet, for servitization to be successful, companies need to do more than 'just' adding services to the portfolio of their offerings. Selling servitized offerings might be best facilitated by agreeing on a pre-determined set of services that follow a certain strategic intention, whereby the service design process should be formalized (Gebauer, Fischer & Fleisch, 2010). Furthermore, research suggests that services and products should be developed in an integrated development process (Zhang & Banerji, 2017).

Increasingly, research begins to highlight the inherent complexity in implementing a servitization strategy and the managerial dilemmas with which organizations have to contend (Valtakoski, 2017; Raja, Frandsen & Mouritsen, 2017; Fliess & Lexutt, 2019). Yet, there still remains a tendency to assume that customers want to buy servitized offerings from the outset (Vandermerwe & Rada, 1988; Berry et al., 2006; Oliva & Kallenberg, 2003; Davies, Brady & Hobday, 2007; Baines et al., 2009). This, however, is problematic. Firstly, mounting evidence suggests that such a priori demand does not exist to the propagated extent, if at all (cf. Neely, 2008; Benedettini et al., 2015; Valtakowski, 2017). Secondly, it obscures the efforts companies put forth in order to still achieve service sales. If customer demand is, at best, uncertain, what services are then traded and how?

A part of the answer may be connected to gaining customer-related knowledge, which could be imperative for successful servitization (Valtakowski, 2017). Yet customers themselves are not necessarily always aware of, or able to specify, their actual needs (Normann, 2000; Hendry, 2002). This is likely aggravated when such customer needs increase in complexity, which is precisely what servitization aims at. How do companies then trade services with their customers, in particular when it is not clear what, if anything, they might need exactly?

This problem around comprehending and specifying customer needs cannot be easily answered with servitization because there is a related challenge of defining services. A growing understanding of services is leading to reject the popular service characteristics of intangibility, heterogeneity, inseparability and perishability (IHIP) (Lovelock & Gummesson, 2004). Instead, there has been the realization that services, especially those that revolve around products, are particularly complex to define (Gadrey, 2000), not at last because the products that they aim at

have themselves evolving biographies (Spring & Araujo, 2017). This challenge around defining services then suggests a need to also trade them differently from products (Hill, 1977). But how might that be?

With our article, we wish to contribute to this more nuanced stream of research on industrial services by exploring how servitized offerings become tradable–without assuming customers to be pre-configured as knowledgeable about their own needs or demanding services from the outset. To provide such an account, we turn towards the literature on qualification and tradability, on which we next elaborate.

What makes servitized offerings tradable: the role of qualification

Callon and Muniesa (2005) posit that, in order to become tradable, services firstly need to become things. This, they argue, is achieved by defining the properties of services in order to stabilize, at least temporarily, the different meanings attached to them, an activity they term *qualification*. This, however, is easier said than done. Qualities in general and for services in particular are seldom obvious and it tends to require significant effort and investments in order to determine them (Callon, Méadel, & Rabeharisoa, 2002; Çalışkan & Callon, 2010). A service can therefore be any thing, as long as its qualities have been determined and, at least for a certain period, fixed in such a way that the service-thing is graspable as such. Consequently, what makes a service or a product is unlikely to be determined by any pre-determined characteristics such as IHIP, but rather lies in the configuration of product-user interactions (Araujo & Spring, 2006). One way to steer such interactions and to facilitate service qualification is by using objects and other things in order to enable market activities (Muniesa, 2008, p. 291). Such objects are also relevant for service qualification because they can help to tame the many ambiguities around services (Callon, 2002; Araujo & Spring, 2006). Consequently, they also play a role in establishing tradability when they are used in relation that extend beyond the supplying firm (Geiger & Finch, 2016). *Tradability* then implies an at least temporarily stabilized combination of qualities (Callon et al., 2002) that makes it possible for the offering in question to transfer from the supplier into the ownership of the customer. But in order to secure a customer's *actual* willingness to buy, the offering's qualities must be composed in such a way that it fits exactly with the customer's needs (Callon, 2016). Or, in other words, offerings require persuasive value propositions (Storbacka, 2011; Storbacka & Pennanen, 2014). Such value propositions may be persuasive because servitized offerings can be made quite unique, fitting to customers, and competitors cannot easily provide something similar (Rabetino et al., 2015).

Understanding servitization in relations to other offerings may be helpful in order to understand tradability and demand. For example, Callon (2016) explains that firms may wish to create demand that cannot be affected by the influence of other firms, in the sense that it is "related to a product which has been designed to be different from all other imaginable products" (p. 11). A different word for this is *singularization* (Callon et al., 2002). While the concepts of qualification, tradability and singularization are interlinked (see Table 6), it remains unclear how qualified or singular a service needs to be in order to become tradable. However, the way in which services and servitized offerings are qualified should play an important role for their tradability. Instead of assuming that such service qualities are readily available at the outset, it might be more likely that they are established in interactions between suppliers and customers, to which we turn next.

Table 6: Key concepts

Concept	Meaning	Example of studies
Qualification	Defining the properties of a thing in order to stabilize the different meanings attached to it (Callon et al., 2002)	Azimont & Araujo, 2007; Lindberg & Nordin, 2008; Finch & Geiger, 2011; Doganova & Karnøe, 2015; Onyas & Ryan, 2015
Tradability	Tradability requires an at least temporarily stabilized constellation of qualities (Callon et al, 2002)	Araujo & Spring, 2006; Geiger & Finch, 2016; Mason et al., 2017
Singularization	Combining different qualities in such a way that it renders the offering in question unique from other offerings, including those of the same category (Suchmann, 2005; Karpik, 2010)	Finch & Geiger, 2011; Spring & Araujo, 2017

1.3 Establishing tradability in interactions

Particularly when offerings and (or) the terms of their exchange lack specification, we may expect many organizing efforts occurring between suppliers and buyers (Kjellberg & Helgesson, 2007). Qualification, should it lead to tradability, then needs to be considered as achieved in a process of interactions between these parties. The extant literature offers two diametrically opposed conceptualizations of the role of such interactions.

One is the service-dominant (SD) or service logic, which was introduced as a more accurate and holistic perspective in order to understand how things are traded (Vargo & Lusch, 2004). Its most central position entails, instead of making everything a *thing*, considering anything as a *service*, including tangible goods. These goods are seen only as means to achieve a desired effect from their usage and, in so doing, creating value (Vargo & Lusch, 2008). A second hallmark of SD-logic is its emphasis on the role of the customer, understanding only those using a product or receiving a service as able to create, estimate and evaluate the resultant value, whereby the notion of value here is not without contestation (Grönroos, 2011a). Providers are therefore left to co-create value together with their customers, which is only possible during direct interactions with them (Grönroos, 2011b; Aarikka-Stenroos & Jaakkola, 2012). Here, interactions with customers are seen as the only way in which providers may influence value production. While service logic presents a thriving research domain (Pohlmann & Kaartemo, 2017), it remains open how co-creation then exactly establishes a tradable service. Furthermore, apart from our main critique of assuming readily equipped and interested customers from the outset, we would like to add that customers themselves may not always be able–or willing to–reveal what they might need. Resultantly, they may struggle to comprehend and evaluate the potential 'value' of a service and could thus chose to not engage in any co-creation.

Moving away from service logic's opaque notion of 'value', we return to an approach that emphasizes relations and interaction between entities. For example, Callon (2016) outlines how interactions between buyers and sellers aim to establish qualities and achieve a trade. While customers can play a part in the qualification process, they are not by default understood to be willing to buy or to necessarily be at the center of any ensuing interactions. Instead, other players, such as suppliers, products or other objects may also be at work when a trade is established. Honing in on suppliers and buyers of business services, Gadrey (2000) presents three demand rationales for interactions to characterize how services are exchanged, namely (1) request for intervention, (2) access to technical capacities and (3) live performance. While this article has been important for servitization research, it remains vague as to how customers come to be willing to buy anything in the first place. Investigating incremental innovation as a business service,

Geiger and Finch (2016) find zones of interaction, or trading zones, between suppliers and customers, whereby, in their case, not all qualities of the exchange object had to resolved for it to be tradable. Importantly, they also find that qualifying the trade itself had implications for the tradability of the offering in question. This then begs the question as to how the stimulation of customer interest might factor into establishing service tradability.

We want to explore this further by taking the supplier as a starting point for such interactions. If we think of demand and, subsequently, the willingness to buy not as a default, the burden might sit with suppliers in order to establish the tradability and, ultimately, a sale of their offerings. When customers do not always know what they need, we suspect it is then suppliers who need to persuade customers to engage with them. What then do suppliers do in interactions with their customers in order to create demand and sell servitized offerings?

RESEARCH METHODOLOGY

Given the exploratory nature of the research, we deemed a single qualitative case study approach appropriate. Case studies provide a local and context-specific understanding (Järvensivu & Törnroos, 2010), which matches our aim of investigating how servitized offerings become tradable. Focusing on a single case allows for greater proximity to reality and for particularly deep insights (Dyer & Wilkins, 1991; Flyvbjerg, 2011), which is useful since the issue at hand has so far received little attention. A single case is valuable to explore in detail how such tradability is established in a complex environment–such as that posed by a company implementing servitization–whereby the case selection becomes critical (Siggelkow, 2007). Therefore, this research adopted a purposeful sampling approach (Patton, 2002) in that we employed four guiding criteria in order to select a case firm. First, it needed to be an industrial product company, preferably one with deep manufacturing competency. Second, the company needed to be on its way to implementing a servitization strategy. Third, this service business needs to be sufficiently successful, ideally accruing a significant portion of the company's overall revenues. Fourth, the company needed to grant the research team with the necessary access to its service units.

To this end, the case company, ManCo (a pseudonym), was chosen and a longitudinal study was undertaken over a period of in excess of three years, during which researchers were immersed inside. ManCo is a European firm, which leads in the worldwide provision of plants and capital equipment in the heavy industries. In order to examine how service tradability unfolded in this case, we paid special attention to dynamically arising tensions and how they were resolved over

time (Langley, Smallman, Tsoukas, & Van de Ven, 2013). The case firm is outlined in greater detail in the next section.

Case firm

ManCo is a global industrial organization that primarily operates in the heavy processing industries, to which it has been providing complete plants, complex equipment and other technology projects for over a century. Due to the technical nature of the work, ManCo's employees are highly trained, typically hailing from an engineering background. The company is renowned for a strong brand and its offerings are associated with high quality and deep underlying expertise. This is ManCo's main differentiator, and its capital goods are often tailored exactly to customer needs. Such high-end equipment is then not only durable but also expensive and labour-intensive in its conception and manufacture.

ManCo's reputational capital is considered increasingly important as the company seeks to transition towards becoming a full-service provider. While ManCo has always offered some form of service, in more recent years this business has become a strategic priority, due to a particularly grave economic downturn, stymied industry growth, and ManCo's traditional plant and equipment offerings coming under severe pressure from new competitors. After an extended period of consolidation in its markets, the company now suffers from a reduced customer base and also faces strong competition from overseas providers who are able to deliver increasingly better equipment at a quicker pace than ManCo.

With equipment sales shrinking, services now make up more than half of ManCo's revenues, whereby the lion's share pertains to spare part sales for the upkeep of machines sold in the past. A broken part is likely to cause a shutdown of the overall machine, which, in turn, affects the whole process chain inside a plant. The resulting cost of lost production quickly amounts to several hundreds of thousands of US dollars a day. Speedy repair and maintenance services are therefore important for ManCo's customers. This requires ManCo to employ new capabilities, such as the quick and efficient deployment of service workers with the correct skillset and appropriate certifications for specific industries, equipment and localities.

Apart from selling parts, ManCo tries to mobilize its ability to service the whole process chain in a plant or a mine, a distinctive feat that sets it apart from other suppliers in its industries. This process knowledge then allows ManCo to offer anything from repair and maintenance, shutdown overhauls and remote monitoring of plants on performance-based contracting models. Since most of ManCo's customers operate in remote settings, which are often marked by extreme

climate conditions, lack of infrastructure and varying socio-political conditions, many services are tailored and developed locally to meet the specific needs of customers–and their equipment. The industry's overall inclination towards services is then a direct result of the overall economic downturn. Customers more than ever try to cut costs and particularly services that maintain and repair machines take precedence over the sales of new equipment.

Nevertheless, apart from repairing obviously broken equipment, ManCo often still finds it difficult to sell services, particularly to customer employees who are typically evaluated on tight quarterly performance objectives and thus have little incentive to proactively invest their limited budgets. Customer employees in higher management positions tend to be less constrained by such factors but are also extremely difficult to get hold of and rarely have time to listen to a sales pitch.

Data collection

This study investigates the qualification work ManCo undertakes in order to create demand and establish its servitized offerings as tradable, specifically focusing on the interactions that company employees engage in. In order to do so, multiple data collection methods were employed (see Table 7). Extensive rounds of interviews were conducted with employees throughout ManCo's various global operations and management levels. Informants included vice presidents and general managers, as well as service and sales employees, all of which were deemed particularly knowledgeable about customers, service strategies, development and delivery. We applied a snowballing approach for identifying additional informants in order to obtain the accounts from all those involved in the service qualification process. Resultantly, we recorded a total of 40 interviews, which were conducted with informants from across all five of ManCo's main geographic market areas, each interview lasting between 60 and 120 minutes. Each interview was transcribed verbatim, resulting in approximately 1200 pages of text.

In addition, a researcher was embedded within a services developing and coordinating unit located at ManCo's offices for a duration of four months, where they observed the daily qualification work, resulting in a log of detailed field notes, but also internal email communication and access to internal documentation such as service business plans, development schemes, material available on the company intranet, PowerPoint presentations and minutes from management meetings.

In addition to this internal material, we also collected publicly available documents on service qualification, such as annual reports, service marketing brochures as well as industry reports and industry association newsletters. Two feedback sessions were held over the research

period, which provided the opportunity to discuss our emerging perceptions, a measure that is known to enhance the trustworthiness of research (Yin, 2003). Combining all this diverse material allowed us to develop a particularly nuanced understanding of the matter at hand. Furthermore, as ManCo operates in a highly technical environment, we performed regular member checks, for example during the interviews, while being embedded at the company and in the feedback sessions, a measure which is also understood to foster credible research (Lincoln & Guba, 1985).

Table 7: Data sources

Empirical material	*Geographic location*	*Position in company*	*Function: front office /back office*	*Count*
Interviews	**Europe**			
		Project, Launch and Global Product Line Managers	Front and backoffice	7
		Sales Managers	Frontoffice	4
		Vice presidents	Backoffice	3
		Department heads, General Managers	Front- and backoffice	4
		Business developers, Innovation engineers	Backoffice	2
	North America			
		Vice presidents	Backoffice	4
		Sales managers	Frontoffice	3
		General managers	Front- and backoffice	2
	South America			
		Service managers	Frontoffice	3
	Australia			
		Global and general managers	Front- and backoffice	2
		Service managers	Frontoffice	1
	Africa			
		Directors	Front- and backoffice	1
		Service managers	Frontoffice	1
	India			
		General managers	Front- and backoffice	2
		Service managers	Frontoffice	1
Group interviews	**Europe**			
		Vice presidents	Backoffice	1
		Global product line, technical managers	Front- and backoffice	
		Innovation and technical managers	Front- and backoffice	1
Workshops	**Europe**			
		Vice presidents	Backoffice	1
		Service and technical managers	Front- and backoffice	
Documentation				
	Field notes		Backoffice	
	Emails		Backoffice	

Internal documents / intranet		Backoffice
Industry reports/ newspaper articles		N/A
Corporate newsletters / company websites		Frontoffice

Data analysis

Our understanding of ManCo was formed using an abductive approach (Dubois & Gadde, 2002). In so doing, our data analysis was undertaken over the duration of the study, by iteratively switching back and forth between data collection and theory reading. Doubting the literature's assumption of default demand lead us to inquire into how such demand arises for ManCo's offerings. Comparing our emerging insights with the extant literature, we came to find the notion of 'qualification' to be relevant for our case. As our understanding of ManCo evolved, however, we noticed that ManCo's service qualifications differed greatly and began to comprehend the importance of the work in which such qualification was achieved. Returning to the literature then lead us to the notion of *interactions*, which we found helpful to capture the relational aspect of the practices the embedded researchers observed and informants tried to explain. In so doing, the analysis shaped our understanding of the research problem and the subsequent interviews and conversations with employees could be directed towards new and surprising discoveries. In two instances, informants were contacted to follow up on a remark they made.

Given the technical nature of ManCo's work, we utilized secondary materials such as brochures and internal documents in order to familiarize ourselves with the equipment used in heavy processing industries and how ManCo's services relate to this. Industry reports and newsletters, newspaper articles and company websites provided additional context to explanations and remarks on customers.

All empirical material, including transcripts, field notes and photographs taken on site, were coded using the QSR NVivo software. As our understanding evolved, we adapted our interview template to include specific questions on service qualification and, in consequence, we adapted our coding structure to reflect the differentiated qualification practices we encountered.

FINDINGS

ManCo establishes the tradability of its servitized offerings in a number of interactions, which occur within ManCo's supplier sphere, in the customer's sphere and across these two. We find the process around establishing tradability to be tripartite, involving the qualification of the customer, the servitized offering and the underlying transaction (see Table 8). We present this first in a structured manner, but in reality, this is very much intertwined, which we address at the end of this section.

Table 8: Establishing tradability entails three different qualification processes

	Interaction within customer sphere	**Alternating between spheres**	**Interaction within supplier sphere**
Qualifying customer	• Enquiring into the customer and their equipment • Identify potential or existing needs	• Establishing interfaces (being close to customers) • Establish and articulate customer need	• Cross-unit cooperation • (Re-)writing information documents • Create customer representations
Qualifying offering	• Presenting service ideas • Discussing potential service parameters	• Service co-creation: o Matching customer needs with service parameters • Refining service parameters	• Creating service *business case* • Sparring with customer advocates • Render offering tangible
Qualifying transaction	• Delivering service • (potential corrections if necessary)	• Selling the servitized offering o Negotiating service and transaction parameters o Agreeing on price	• Organizing and coordinating service delivery • Accommodating for changes in transaction parameters

Qualifying customer

Given the economic situation at the time of inquiry, customers were generally more interested in obtaining services than investing in new capital equipment. Nonetheless, customers remained reluctant to purchase services, often trying to obtain them free of charge. This ambiguous demand is met with another challenge: It is difficult to know what customers actually need, in particular given their heterogeneity and large global spread. Therefore, ManCo aims at being 'close to customers', and, in so doing, employees seek to qualify their customers, which occurs in the customer and the provider sphere, as well as in movements across the two.

Interactions within customer sphere

All informants stressed the importance of *enquiring into the customer*. Particularly, ManCo uses the long lifetime of its equipment as a reason for repeated visits to customer's sites. Top management emphasizes that, once being on site, employees need to mobilize their deep process knowledge and engage in informal conversations, asking 'open-ended questions' as well as being inquisitive about the site itself:

> "*It's important that a technician […] has some ideas about the other equipment that's on the job site as well. So we get the opportunity to assist the customers on things they maybe didn't even know that they needed help with.*"
>
> [Vice President A, backoffice]

It is during those proactive visits and conversations in situ that ManCo's employees may *identify potential customer needs*. Yet, this is difficult given that customers often restrict access to their processes and equipment. Such secrecy is due to a fear that specific data on throughput or uptime could travel to competitors or, worse still, be used to affect share prices. Since customers often tend to be unaware of the 'root causes' for their 'pains' their employees are not always interested in showing visitors around. ManCo's employees, in turn, aim at establishing friendly interactions with customer employees, engaging in small talk, sometimes 'having a cigarette', which provides valuable opportunities to enquire more specifically into work processes and equipment issues.

Alternating between spheres

By *establishing interfaces,* ManCo's employees seek to bridge the customer sphere with their supplier sphere, allowing for transporting customer qualities inside. These interfaces have different forms, for example the service R&D department, which connects travelling sales and service personnel with relevant service developing back-office employees. In addition, new functions, such as that of 'global product line manager' (GPLM) are established in order to enable product experts to travel out into customer's spheres for scouting for new opportunities:

> *"We are trying to set up a formalized lead generation program so that […] if they spot something that could generate a sale […] that [that] is being reported back to the salesperson responsible."*
>
> [General Manager, front and backoffice]

In order to *establish and articulate the customer need*, ManCo deliberately enlists its engineers, sales employees and GLPs to both investigate customer and equipment qualities on site as well as

to interpret and make sense of such qualities. This is then somewhat different from "diagnosing needs" as described by Aarikka-Stenroos and Jaakkola (2012) in that ManCo focuses on the qualities of customers and their equipment first, in order to establish a new need around such qualities secondly, a process that plays out across the two spheres.

Interactions within supplier sphere

Cross-unit cooperation is crucial in order to transport insights on the qualified customer need within the customer sphere. Informants stressed both the difficulty in staying abreast of the requirements of all the different regions, especially with the many on-going changes inside the company, and the need to, despite those changes, continue to share information. Interestingly, most communication flows within ManCo's deeply rooted relationship networks, which employees have developed over time with their long tenures at ManCo and with job rotations in different global localities. Countless informal gatherings such as breakfast meetings, or enabling back office employees to fly to other local offices allows employees to work together closely in order to corroborate and evaluate customer needs.

Furthermore, we could observe ManCo's heightened attentiveness to collect and arrange detailed customer information in primarily digital formats such as databases, spreadsheets or online share points provided by the company's intranet. *(Re-)writing information documents* is necessary to keep entries up-to-date and reflecting ManCo's changing understanding of their customers, not unlike to the service manuals described by Callon (2002).

In differentiating between which information is worthwhile to write down and which terms to choose in order to describe a customer need, employees *create customer representations,* reducing customers in their complexity: No longer the whole organization is of interest; rather, it is a few specific details for example on the equipment, the location and employees, that, when presented next to one another, allow to reconfigure the customer around a new service need, as one informant explained:

> *"… the TCO models that we are building go back to very first principles, where […]the CAPEX information of course is what our sales would be […and] the OPEX is generated from the maintenance tasks associated with that equipment…"*
>
> [Global Manager, backoffice]

The process of creating such customer representations, as one informant explained, then 'allow[s] us to communicate' and establish a new 'vocabulary' around ManCo's customers and their needs.

Qualifying offering

Once ManCo has an at least temporarily stabilized understanding of a customer and their current needs, it is possible to qualify a service offering to match. This work can be tedious since changed customer qualities often dictate adjustments to the service in question. Here again requires qualification interactions with as well as across provider and customer spheres.

Interactions within customer sphere

Frequent trips to customers allow for discussing previously established customer needs, verifying that they are important enough to merit further efforts, and *presenting new service ideas* that might match the customer's need.

Moreover, this then presents ManCo's customer-facing employees with opportunities for *discussing potential service parameters* with customers. For example, on informant explained that:

> *"I don't sell service. I sell solutions. […] You must understand your area to the highest level to be able to understand how to correct, to be able to get to root cause analysis and […] then create corrective actions in a very timely manner and a very, you know, inexpensive manner because our customer is always the cheapest people in the world."*
>
> [General Manager 2, front and backoffice]

This quote indicates that for customers, amongst others, a service being 'inexpensive' is an important quality, which is certainly not true for ManCo. Service qualification therefore needs to produce other parameters that can compete with price, such as finding out and addressing the 'root cause' of a problem instead of merely treating its symptoms. Ultimately, however, the true service qualities, if at all, are only revealed much later, typically during or after service delivery (to which we turn later).

Alternating between spheres

If no use for the potential service parameters could be found, all efforts would stop here and employees would need to update their customer files accordingly. Nonetheless, if customers can be interested in them seeks ManCo to engage them in a process of *service co-creation*. Given the restricted access to customer's spheres, *matching customer needs with service parameters* does not often occur ad hoc on a customer's site. Instead, new information on customer needs is, via established interfaces, transported into the supplier's sphere. Any resulting service ideas can then oscillate between customers and ManCo in a joint effort to qualify a viable solution. Here,

customers contribute to the process by keeping ManCo up-to-date with more detailed insights into their equipment, processes and requirements:

> Interviewer: *And how did you decide what services would be bundled into the initial [service contract]?*
>
> Service Manager (front office): *Through a couple [of] meetings with the plant manager, you know. We sat down […] and we talked and I made my recommendations for where I think the plant needed help. And then she also added to that, areas where she wants, internally, things to be improved. So we came up with a combined list.*

The above excerpt also serves to illustrate that *refining service parameters*, even if it is as simple as creating a list of desired services that can be aggregated into a single service contract, requires more than one visit and different conversations with plant managers. Service co-creation is therefore heavily influenced by the types of customer employees involved and their existing relationship with ManCo. With some select customers, ManCo may even install new parts and provide innovative services for on-site testing purposes, and later utilize their feedback for further improvement of the offering.

Interactions within supplier sphere

In *creating a service business case*, ManCo seeks to verify also in its supplier sphere that the potential service offering is worthwhile. By comparing across a number of customer representations, service R&D workers seek to establish how a service idea might become a new offering that can yield an economic benefit:

> *"…we ask the people who are in touch with the customers what they think we can sell if we succeed in delivering such a project or a product? Or a service for that matter. What that could contribute to the business."*
>
> [Project Manager, backoffice]

Apart from this, many other service parameters need to be defined, for example, what type of equipment this service is relevant for, what engineering skill levels are required or in which regions such a service may be relevant.

Sparring with customer advocates, such as sales employees, helps to ensure that assumptions of service parameters are best possibly based on the current understanding of the regarding customers. This then also serves as a measure of control: When sales employees do not think a certain service could be sold, it will not be developed. Only when sales personnel is willing to 'take a vow on the assumptions' that the service is sellable will the service idea realized.

The aim is then to *render the offering tangible*, turning it from a rough outline of qualities into a fully grasp-able offering with proposed uses. Our informants further stressed the need to understand a servitized offering, before it may be presented as an offering in the customer's sphere, firstly in the supplier's sphere. Different objects enhance this internal tangibility, for example spreadsheets dictate the rules for calculating contribution margins, archived construction plans capture the history of plants, stage gate development models force engineers to communicate service development in writing. This is therefore dissimilar to "visualizing the value" as described by Kindström, Ottosson and Carlborg (2018), whereby an offering is made understandable for customers.

Qualifying transaction

Only when a service offering could be qualified around a stabilized customer need does the process continue. Then ManCo engages in interactions within and across customer and supplier spheres in order qualify the transaction around the service, which, ideally, results in a sale.

Interactions within customer sphere

When service engineers are *delivering the service* at customer's premises, the offering's true qualities are revealed. In these 'moments of truth' (Norman, 2000), ManCo employees face both the customer and the underlying equipment on site and, in doing this service work, play a great role in realizing the prognosed and promised service qualities. This, however, is very intricately intertwined with qualifying ManCo's part of the service transaction, which we also found to be complexly intertwined with the service itself: Qualifying the transaction then not only involves the end result (for example achieving a desired change in the condition of a machine) but also the way in which this result was achieved (for example, if it the requested service engineer presented on site at the correct time) as well as continued access to ManCo's engineering expertise after the service had been delivered. This is because, despite ManCo's best abilities, the transaction is always open to unexpected interference. This can happen if the conditions of the machine or, in extension, the customer, changed significantly since they were last qualified or if ManCo for some other reasons cannot fully achieve the desired qualities. This then results in interactions around *potential corrections*. For example in rare cases, the service itself is not delivered up to ManCo's own standards and informants insisted that it is imperative that such mistakes are rectified as soon as possible:

"*…we had to redo it and that was done free of charge. 'Cause the problem is, if you don't – you know, the thing about a service is […] if you don't do that […], then you will never get a job again, right?*"

[R&D Manager, front and backoffice]

Given its positioning as a premium brand, ManCo cannot afford to leave customers dissatisfied and it will often go out of its way to ensure that it delivers on its own part of the transaction, even if it will result in a financial loss. Informants were adamant that the promise of repeat business was worth the potential losses from an individual transaction.

Alternating between spheres

Before a transaction can culminate in service delivery, however, ManCo engages in numerous interactions around *selling the servitized offering*, which typically play out across the customer's and provider's spheres. In the background, these interactions are entangled with evaluations of and adjustments to service qualities, yet, in the foreground, they revolve around *negotiating service and transaction parameters*, capturing what kind of service is to be delivered when and how and for how much. It is not only the offering that must be made to fit the customer so well that they are willing to pay for it, but importantly, also the underlying terms and conditions must be composed in such a way that a transaction can occur:

"*The bottom line is... we're selling uptime. We're selling confidence. We're selling the ability for someone to go home to her family on a Friday night. We're not selling toothbrushes*."

[Sales Manager, front office]

Still, this selling process is also fragile in that a host of unanticipated factors may turn the carefully composed qualities upside down. For example, geopolitical changes may require the deployment of service with or without certain nationalities, sudden changes in tariffs require different sourcing strategies for spare parts or customer's fluctuating share prices may alter their service budgets.

Particularly *agreeing on a price* often gives rise to extensive deliberations, since customers perceive ManCo's offerings as a premium and attempt to lower the prices they are presented with. To this end, giving discounts plays such an important role for customer's demand that a certain leeway is already included in the prices:

"*...we set our pricing so that there's always room for discounts because everybody has to have a discount, right?*"

[General Manager, front and backoffice]

Nevertheless, ManCo is not willing to accept any price and informants explained that sometimes, they decide to forgo transactions if it becomes apparent such a transaction would ultimately result in a loss for ManCo. Only if all parameters fall into place will then a service contact be signed.

Interactions within supplier sphere

Since service sales increasingly sustain the company, employees in the supplier sphere work hard to establish and maintain the qualities revolving around the transaction itself. Unsurprisingly then do many interactions then revolve around organizing and coordinating service delivery, which are deliberately kept away from the customer's gaze in order to preserve ManCo's trade secrets:

"*We don't really want to tell our customer where it* [the part] *is sourced from, or we don't want them to identify. Well, they will know it's from Spain for example, but not which workshop because next time they probably go directly to the workshop*."

[Sales Manager, front office]

Given the current economic climate, many interactions centre around *accommodating for changes in transaction parameters*. Interestingly, while ManCo tries to avoid entering into agreements that are unprofitable from the outset, this changes once a contract has been signed. Rather than delivering 'poor service' that could harm its reputation, ManCo's willingness to do 'everything it takes' for little or no additional charge indicates its rationale of qualifying sold transactions differently, shifting attention from the single (unprofitable) transaction towards a chain of future business that is anticipated to be profitable.

Tradability arises in the interrelationships between customer, service and transaction qualities

While we have presented the different qualification processes and their regarding interactions above in an orderly fashion, these are in reality very much intertwined (see Figure 5). For example, qualifying the customer can reveal qualities that also have implications for how the transaction needs to be qualified. If customers have a history of delaying payments, ManCo will be more adamant to ensure timely payment in new contracts. Qualifying the transaction in a certain way

can then also bring about new service qualities, for example services may need to be delivered in such a way that they have a visible impact before a bill is sent out. This then also implies that demand for and tradability of servitized offerings are very much intertwined. It is not enough that an offering is qualified so that it could *potentially* be traded. Its qualities also need to be in harmony with the customer and the overall transaction qualities for it to be demanded, so that the offering in question can *actually* be traded.

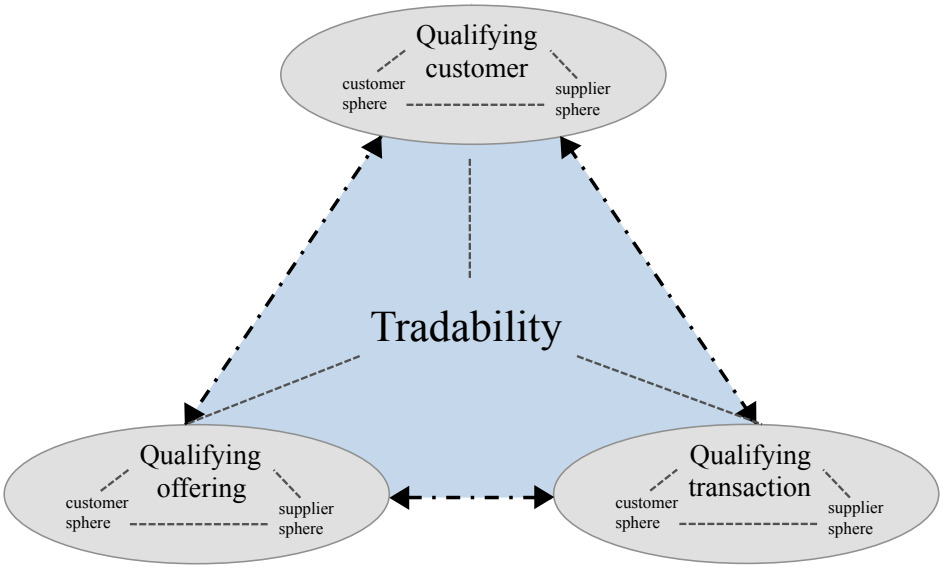

Figure 5: Customer, offering and transaction qualities establish tradability

However, this construct is also fragile. At any given point, interferences such as changes in customer's strategy and workforce, local political quibbles or ManCo's own reorganization may topple over previous work. In these cases, ManCo needs to revert to the drawing board to construct new customer, service and transaction qualities.

DISCUSSION AND CONCLUSION

The purpose of this study was to provide a better understanding of how servitized offerings become tradable. The empirical background to our investigation provided a global manufacturing and projects company that aspires to become a full-service provider. The case study we reported above shows that, contrary to much literature on servitization (Vandermerwe & Rada, 1988; Berry et al., 2006; Oliva & Kallenberg, 2003; Davies et al., 2007; Baines et al., 2009), demand and need for servitized offerings is not an a priori condition. Moreover, our study reveals the efforts

necessary in order to format a servitized offering so that it can *actually*, not only hypothetically, be traded.

Theoretical contribution

Following from our analysis, we propose three main contributions: (1) the tradability of a servitized offering is established alongside a customer's demand for it; (2) the tradability of servitized offerings is established from qualification interactions in the customer and supplier sphere and across the two; (3) establishing tradability can be a long, difficult and costly endeavour that may well fail, which presents an added layer of complexity to implementing servitization.

First, *the tradability of a servitized offering is established alongside with customer's demand for it*. Creating demand for and, ultimately, selling servitized offerings requires ManCo to involve its customers throughout the qualification process, up to a point where new offerings are, to a certain degree, tailor-made to match specific customer needs. This, in turn, creates a qualification process that not just invites, but actively *pulls* customers in. Customers have no choice but to reveal at least some of their preferences when they are confronted with new service ideas or documents representing services. In so doing is service provision truly a machine that seeks to reveal and satisfy customer demands (Callon et al., 2002). Contrary then to what Gebauer et al. (2010) report, ManCo's servitized offerings are not necessarily created with a certain strategic intention but rather follow and flow with the customer's rationale. Rather than propagating an integrated development process for servitization (Zhang & Banerji; 2017), our case indicates how services can be qualified around already sold equipment. While most existing literature focuses on the offering in question, we find tradability to be tripartite, made up of customer, offering and transaction qualities. The 'description of the offering' that Storbacka and Pennanen (2014) find to be essential, is, in our case, not static or a 'given', but rather continuously shaped and reshaped even after it is sold.

Second, *tradability of servitized offerings is established from qualification interactions in the customer and supplier sphere and across the two*. This is because customers are not necessarily able to specify their own needs (Normann, 2000; Hendry, 2002) and services are difficult to qualify (Gadrey, 2000), particularly since products have evolving biographies (Spring & Araujo, 2017). To this, agreeing with Geiger and Finch (2016), we would like to add that the underlying transaction also requires qualification. ManCo solves this problem by constantly seeking interactions with customers hoping to coax them into progressively revealing their preferences for certain qualities (Callon, 2002). Such preferences are difficult to reveal

otherwise, as they only become articulable during 'on the spot' (Geiger & Finch, 2009) encounters. Tradability, we find, implies that customer, offering and transaction qualities are adjusted at least at one point in time so that the offering can actually, not just hypothetically, be traded. Interestingly, we find that singularity (cf. Callon et al., 2002; Karpik, 2010) was difficult to track down in our case. The deep process knowledge that ManCo employs in order to qualify customers, their equipment and their needs is quite unique in its markets. At the same time, however, we could find no indication that services were qualified vis-à-vis a competitor's service offering. Singularity most prominently rested in the process of being able to do this qualification work in the first place, which was facilitated by ManCo's status as a premium brand. Consequently, service qualities may not always have to result in a singular offering, as long as the way in which these qualities are determined and adjusted is singular.

Third, *establishing tradability can be a long, difficult and costly endeavour that may well fail, which presents an added layer of complexity to implementing servitization*. Previous literature on services and servitization has already shed light on tradability (Gadrey, 2000; Araujo & Spring, 2006) to which we add by explaining where customer demand results from. While we also touch on how documents and other objects may support such a process, it is particularly the maintained qualification efforts we wish to highlight. Servitization is difficult and costly for companies to implement because of these above described efforts to establish service tradability.

Managerial implications

This research indicates how industrial companies may go about in configuring tradable servitized offerings. Companies are not subject to some demand 'out there'; they actively work to create it in order to achieve sales. Services are rendered tradable in interactions within and between the supplier and customer spheres. In order to foster this process, managers may wish to consider assessing and fostering the interfaces they have with their customers and the documents and other objects that employees utilize for service qualification. Furthermore, this study indicated the need for information sharing across employee groups and departments. Such practices can be enhanced, for example by providing spaces for informal meetings, granting opportunities to travel in order to meet abroad colleagues face-to-face as well as facilitating dialogues digitally such as by providing detailed information on company intranets.

Limitations and further research

This study has sought to go beyond the notion of a default demand for servitized offerings by exploring how demand and tradability for such offerings can arise from qualification processes. Further research is needed in order to establish how other companies, in different sectors, qualify their offerings and with what ramifications on a larger, network level such efforts may occur. Another avenue for future research could be to examine demand creation for servitization with quantitative research. Importantly, this would serve to verify our exploratory endeavour presented in this study.

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Article 2: The product strikes back: The 'new industrial revolution' and the qualification of services

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Abstract:

The 'new economy' is said to require a move towards services. This process of servitization, however, has been shown to be deeply challenging for many companies. The focus of this paper is the challenges of qualification, which is not just how to define and stabilize a service as a definitive set of qualities, but how to do so in a way that can both be customized to meet the needs of various customers and produced with economies of scale. Considering this challenge in various experimental locales throughout a large multinational firm shows that service qualities are deeply and variably related to product qualities, whether emerging from those latter qualities or at their boundaries. As a result, this research shows that the ability to define service qualities, which are customizable and yet scalable, very much depends on the stabilization and acceptance of the product qualities to which they pertain and on which they rely.

> Whether one talks about the new economy, the information economy, the knowledge economy or even, more directly, of the service economy, one is expressing the possibility of a profound transformation of the rules by which markets function, a transformation that is thought to be related essentially to radical changes in the characteristics of the goods traded. (Callon et al., 1992, p. 196)

Introduction

Modern competition is said to entail a move towards services (Çalışkan & Callon, 2010; Callon, 1992), which has increasingly been said to provide a source of growth in new economies (Callon, 2002). This phenomenon has particularly affected industrial manufacturing companies, which increasingly seek to combine product and service elements as a means of competitiveness: a movement commonly referred to as "servitization" (Vandermerwe & Rada, 1988; Wise & Baumgartner, 1999).

Servitization is often advanced with rather normative prescriptions. Rolls Royce's 'power by the hour' service offering, for instance, in which it earns revenue from engine usage rather than the sale, is an often-cited example of the relative ease and benefits of servitization. However, as Callon and colleagues have highlighted, a complex set of activities are required to define the qualities that constitute the service and stabilize them in relation to competitors and customers in a way that is competitive (Callon et al., 2002; Callon & Muniesa, 2005; Callon, 2016). This work of "qualification" involves the development and arrangement of heterogeneous judgment devices, capabilities, experts, etc. into a network that often reaches far beyond the organization (Cochoy, 2008; Lezaun & Schneider, 2012; Callon et al., 2002).

In principle, the qualification of services might be relatively straightforward; existing primarily on paper, there are many possibilities for constructing services in ways that are relevant to the customer. Indicatively, the literature emphasizes the central role of the customer (Callon et al., 2002; Sampson & Spring, 2012; Davies et al., 2007) and the need for co-creation of new service offerings (Vargo & Lusch, 2004). Such approaches toward selling services, however, encourage a proliferation of service qualities; they suggest that it might be possible (even easy) to make a new set of service qualities for each customer. This possibility, however, overlooks the organizational necessity to achieve economies of scale and scope from service provision, and to construct qualities from the existing installed base and capabilities of the organization, particularly in a manufacturing environment. These hitherto largely overlooked organizational/strategic challenges illuminate a central tension in the process of service qualification and singularization: the tension is one of both producing customer-relevant qualities (as the current literature emphasizes) and doing so in a way that it is scalable (made from a parsimonious number of standardized 'parts') and related to the existing installed base (e.g. does not require additional capital investments).

Interestingly for our purposes, this challenge of how to produce highly customized product offerings with a limited number of standardized and therefore scalable components has long been highlighted within the literature on modularity and modular design (Schilling, 2000; Baldwin & Clark, 1997; 2000). This literature has attended almost exclusively to a product manufacturing context and has tended to conceptualize modularity as planned process of design rules which specify how any offering should be built, so that it consists of ideal modules, platforms, and platform architectures (e.g. Baldwin & Clark, 1997; 2000). Recently, however, modularity has been considered within a service context (Garud et al., 2008; Baldwin & Clark, 1997; 2000), and researchers have begun to conceptualize modularity as a problematic and continually emergent process closely related with the ongoing question of what their core components consist of (cf. Garud et al., 2008; Tuertscher et al., 2014; Davies et al., 2007).

Building on this literature, this research investigates the struggles of a global and traditionally manufacturing-focused engineering firm to qualify the services that make up servitized offerings. We conceptualize these struggles as experiments to ask: *how do experiments on service qualities produce modular servitized offerings?*

Such an enquiry illuminates several key tensions at the heart of service qualification: between scope and simplicity, global scale and local presence, and the harmonization of products, services and projects. These tensions highlight particular ways in which, in the qualification of services, the product strikes back. Building on Spring and Araujo (2017), we show distinctive ways in which "the intimate entangling of products and services" (p. 127) has a central significance for the process of service qualification. These tensions also illuminate overlooked aspects of the processes of qualification more generally. They show, in particular, that the organizational challenge of qualification is not one of establishing ever more relations between the product and the consumer, but to manage the proliferation of relations by organizing and even limiting them in ways that produce economies of scale and build on existing assets and installed bases.

The paper is structured as follows: the next section provides the conceptual background, focusing service qualification and modularization. Following this, we outline our method and the role of experimentation as well as our research setting and approach to data collection and analysis. The findings of our empirical study are subsequently presented, followed by a discussion and tentative conclusions.

Conceptual background

The complexities of service qualification

The literature increasingly highlights that the turn towards services for industrial organizations is an important phenomenon (Vandermerwe & Rada, 1988; Bowen et al., 1989; Davies & Brady, 2000; Davies, 2004); optimists have even argued that servitization is part of a "new industrial revolution" (Zhou, 2016). Central to this movement is the definition and stabilization of the characteristics and parameters of the services themselves. Indeed, as Chamberlain (1947) pointed out long ago, the properties of products and services do not exist a priori. Instead, Callon and colleagues (Callon et al., 2002; Callon & Muniesa, 2005; Callon, 2016; Cochoy, 2009; Spring & Araujo, 2009; 2017) have highlighted, they need to be constituted and stabilized through the mobilization of a heterogeneous set of elements which exist within and extend beyond the organization: measurement devices, standards, prices, contracts, relationships, expertise, etc. (Callon, 2016). The constitution of this extended socio-material network requires significant work and investments (Callon et al., 2002), and it is only at the end of this work of "qualification" that the service is able to exist as an economic entity that can be bought and sold and that can form the basis of competition (Çalışkan & Callon, 2010). Think, for instance, of extraordinary network that must be crafted and aligned to constitute 'music streaming' as an economic entity; this will include the expectations of the consumer, telephone applications, property rights, broadband access, legal terms, even the wishes of the music artists, and so on.

This challenge of service qualification (and its solution) is primarily presented as a matter of invention and innovation: of continual qualification and requalification through the forging of new links between the organization and its customers. Thus, researchers illuminate the role of branding specialists (Beckert & Aspers, 2011), focus groups (Miller & Rose, 1997; Lezaun, 2007), metrological standards (Aspers, 2013), judgment devices (Karpik, 2010), even shopping carts (Cochoy, 2008), in constituting new and stable links between consumers and the things that are bought and sold. All of these investments make ever new qualifications possible.

We agree that qualification is central to servitization, however, we suggest that the organizational challenge is not only to invent and stabilize qualities, but importantly also to limit and control the

number of qualities and how they are related. This is based on two observations: firstly, the provision of servitized offerings is, by definition, intricately intertwined with products, being both the company's own and those in competitor's portfolios (Spring & Araujo, 2009). Given that industrial equipment may be in operation for several decades, services must also be compatible with equipment that is no longer manufactured. In consequence, services might require mobilizing many differing qualities in order to cater to a broad range of product offerings. Secondly, servitized offerings are known to require some degree of tailoring to customer's specific needs (Tuli et al., 2007; Davies et al., 2007). This also creates the temptation to custom-qualify service offerings to each individual instance of service delivery. While such tailored offerings may facilitate the sales process (Callon, 2015), they may easily give rise to a proliferation of service qualities, which ultimately renders the overall assessment of the servitized offering difficult (Callon & Law, 2005). Therefore, finding the right balance between too few and too many service qualities adds to the complexities of service qualification. The service entity, in other words, must be rendered *customizable enough for sale, but standardized enough for scale.*

We argue that in order to understand the specification of service qualities, we need to attend to the dynamic that governs those questions of how many qualities to have and how to manage them efficiently. In order to help us conceptualize this dynamic, we next turn to the literature on modularity and modular design.

Modularity and service qualities

This tension has been addressed for some time within the literature on modularity and modular design. This literature looks at how organizations are able to produce complex products and services "from smaller subsystems that can be designed independently yet function together as a whole" (Baldwin & Clark, 1997, p. 84). The finding is that scale and customization can be simultaneously delivered by both or in conjunction 1) reducing the number of components in a system, and 2) reworking the way that the components interact (Simon, 1962). Modularity specifies that the means of doing this is to constitute products and services through the making of modules, defined as "components of a system whose elements are powerfully connected among themselves and relatively weakly connected to elements in other [components]" (Baldwin & Clark, 2000, p. 63), which can be recombined through standardized interfaces. Reducing the dependencies between modules in this way enables the mixing and matching of modules within

an architecture[3]. This idea, originally developed in the product manufacturing setting, has more recently been shown to be applicable in various service settings, including healthcare (de Blok et al., 2014; Vähätalo & Kallio, 2015) logistics (Bask et al., 2011) and industrial services (Carlborg & Kindström, 2014; Hellström, 2014).

In order to achieve benefits from service modularity, the way in which modularity principles are implemented is important. Given the emergent nature of product and service qualities, it might be helpful to understand modular design as both a process and an outcome, allowing for 'incompleteness' during the process (Garud et al., 2008). It has been suggested that design propositions should be tested in experiments, emphasizing participation and communication (Romme, 2003). Such experimenting might not only be helpful in investigating the design proposition, but also to understanding emerging modularity implementation. This is consistent with recent works on modularity (e.g. Garud et al., 2008; D'Adderio & Pollock, 2014), which sees it as an emergent and dispersed phenomenon. Consequently, we move away from the idea of 'design' as an *a priori* deliberate activity and instead emphasize it as an on-going process of experimentation.

To return to our research objective: we mobilize the concept of modularity to consider the way in which organizations seek to qualify their service offerings. As we have previously highlighted, the challenge of service qualification is to manage a tension between the production, on the one hand, of enough qualities to sell the service, and on the other hand, of not so many qualities that complexity will proliferate and economies of scale will not be possible (this is referred to above as the tension between customization and standardization). The modularity literature reminds us that organizations are constantly involved in experimental activities to manage this tension by seeking to reduce the number of qualities (without reducing sales) and to better specify the interface of its parts to increase customizability. In the multinational setting, this brings up issues of communication, standardization and control: modularity requires the application and homogenization of design rules to as much of the organization as possible, in order to allow the development of highly independent modules.

[3] In addition to offering variety with limited complexity a key benefit of a modular architecture is that it enables modular experimentation. In this regard, the thin crossing points between modules (Baldwin, 2008) enable transactions and thereby experimentation to occur in an eco-system of organizations.

Methods

To explore our research question, we investigate various settings across a multinational organization, where experiments are being undertaken to qualify services and to address the tension between having too many and too few qualities.

In this research, we mobilize the idea of experimentation. This is because, as highlighted above, modularization is not something that is designed a priori, but is instead continually negotiated from various locales. In some locales, actors are involved in first-order "in-vivo" experiments to determine, face to face with the customer if certain qualities of services can be sustained and sold. In other locales, such as in the central office, actors are involved principally in second-order "in-vitro" experiments to determine, often through management controls, how far those services qualities can extend. Like scientists in other settings (cf. Callon, 2009), those in ours are seeking to engage complexity and reduce it to a set of inscriptions that are complex enough to be believable locally yet parsimonious enough to travel far beyond (Latour & Woolgar, 1986; Callon et al., 2002; Reijonen & Tryggestad, 2012). It is only when these first and second order experiments are undertaken successfully that one can talk of a modularized set of service qualities: of a set of service qualities that are simultaneously customizable enough for sale, but standardized enough for scale.

Research setting

The research is undertaken with a provider of industrial equipment and services for the global cement and minerals industries. EngCo (a pseudonym) has a long history, dating over a hundred years, of providing high quality engineering equipment and plants for various industries. EngCo has developed reputational capital for high quality with customers, and claims to have 'invented the industry' with early patents for cement production equipment. Typically, the equipment is provided for the customer as part of a complete plant, which is customized to specific needs and regional conditions, such as temperature, altitude or the ore's unique composition. Customization of plants and equipment to customers has, however, created added complexity for EngCo when providing parts, upgrades and services, especially given the long life of the heavy equipment.

Given that cement is a commodity in higher demand in developing countries and, by their nature, minerals are located in specific locations, EngCo is highly dispersed across the globe with local

offices in the USA, South Africa, Chile, India and Australia, amongst others. As a consequence, it has a highly-decentralized structure with a European headquarters.

Due to the nature of EngCo's business, the company is exposed to global macroeconomic fluctuations. With the downturn in the cement and, more recently, the minerals industries, customers are reluctant to invest in new plants, which have, to date, been EngCo's "bread and butter". In response, EngCo now considers service provision to be an important part of its business strategy to generate growth and prevent the commoditization of its traditional offerings. Indeed, the service business generates the greatest profits and provides a strong and secure financial position for EngCo. Centralized activities include the development and sale of spare parts, repair and maintenance activities and the establishment and coordination of strategically located large-scale Supercenters, along with an array of miscellaneous services. Service sales are mainly achieved through local units. Service provision generates more stable, albeit lower revenues, which are important for the business. The 'new' service strategy emphasizes becoming a *'trusted partner'* and *'full service provider'* to customers. Here, service conception and delivery is fashioned in the traditional EngCo maxim of customization by finding out the particular qualities of the equipment installed on-site and tailoring service qualities exactly to local needs, culminating in a large, unstructured service portfolio. Unsurprisingly, the meaning of 'service provision' differs throughout EngCo and is tightly bound to regional or country-specific contexts.

Data collection

Given the exploratory nature of our inquiry, we deemed a qualitative approach appropriate. To this end, we undertook an in-depth exploratory case study within a large industrial engineering organization operating globally. In particular, we study how the service part of the organization continuously experiments with service qualities, constantly tries to balance standardization with customization efforts and how product qualities might influence the geographical travelling area of the service offering. This study was undertaken over a two-year period, during which the research team were actively immersed at EngCo's offices. Extensive data collection was undertaken with individuals from across different operational sites during this time, in order to understand the efforts being made to create, qualify and sell services.

We began by reviewing the extant literature, from which we devised an interview template. During the study, 40 semi-structured interviews were conducted with a range of informants at

both strategic and operational levels. The interviews were of a duration of between one and two hours and followed the rationale of an *analytical* interview (Kreiner & Mouritsen, 2005), in order to facilitate joint knowledge construction between both interviewers and interviewees. All interviews were recorded and transcribed verbatim and the resulting transcripts formed the main part of our data pool. As the interviews progressed, the template was adjusted to reflect new insights which emerged and in order for us to investigate and probe those developing issues further. For example, it became apparent very early in the interviewing process that, internally at EngCo, there were many different understandings on service qualities. Interviewees were asked to describe and reflect upon what they understood 'good service' entailed, to describe the qualities of specific services provided by EngCo and how services were being developed and delivered both centrally and locally to customers. Our approach permitted us then to explore specific instances of how and why services which were developed and delivered in one locality or industry would travel (or not) to other places.

The interview data was complemented with the six-month employment of individuals from the research team within EngCo's research and development (R&D) unit, which was responsible for services. This employment entailed open access to company buildings, personal workspaces inside the R&D unit, complete with own telephones and company computer including personalized company email accounts. The employment provided ample opportunity for informal conversations with company employees on a daily basis (van Maanen, 2011). Over time, the researchers became fully immersed and trusted inside the organization (Spradley, 1980). Being employed by EngCo allowed for observations to be made of how the service development process was unfolding, which included negotiations by EngCo's managers of many situated struggles across different, geographically-dispersed offices. It also allowed for other individuals of interest to be identified for interviewing (Miles & Huberman, 1994) at specific sites, which could provide an operational account of local experimentations and service qualification. All observations were captured in detailed daily field notes. In addition, we drew on numerous informal conversations, attendance at service strategy meetings and feedback workshops.

Finally, further insights into EngCo were gleaned by accessing the company's intranet. The intranet played a pivotal role for EngCo, given its size and geographic spread and provided an online meeting place for all employees, enabling communication and sharing of documentation. The research team were provided with full access to this portal, enabling us to reach out to

employees in further locations, such as Australia and Chile. Company databases also provided valuable access to documentation, such as protocols for service sales and delivery, product specification sheets, Excel planning files, work safety drills, slide decks containing background information on each of the different divisions, internal news and email correspondence, which included attachments with service business plans, PowerPoint presentations and other working documents. We also draw on publicly available material, such as product and service brochures, the company's official website and financial reports in the business press.

Data analysis

The data were coded and analysed by the research team. This is best described as an iterative process, involving pragmatic movement back and forth between the empirical data and the extant literature (cf. Locke et al., 2008; Strauss & Corbin, 1990). The data collection was conducted predominately by three of the researchers, which allowed the fourth researcher to challenge and question the explanations arising from the analysis process. The analysis process was supported by researchers being embedded with EngCo's offices, allowing for further exploration and clarification on the emergent explanations.

Findings

Three experiments with service qualities

In this section, we explore three experiments with service qualities: audits, full flow sheet, and frame agreements. For each experiment, we describe: the qualities of services and the devices which bring them about; the efforts to enrol the largest possible network of allies; and the relation between the service qualities and the products and installed base. We will show that this latter relationship is centrally important.

Audits

Audits are high-level assessments of equipment designed to determine their current efficiency levels and necessary improvement potential. It is a process that begins with an inspection, which typically requires the service engineer to be present at a customer's site. This inspection entails measurement and assessment undertaken both with analytical equipment and the auditor's five senses. Informants emphasized the latter, stating the importance of visual clues such as cracks in

equipment mantles as well as sound, highlighting that different types of humming sounds may be indicative of equipment defects. The findings from the inspection are compiled into a written report, giving the audit a formal character and providing customers with a comprehensive performance evaluation of process and production methods, quality and pollution control procedures and visual inspection of equipment.

Audits require specialized engineering knowledge not only about the functioning of a single piece of equipment, but also the age, history and location of the equipment in the process chain of cement or ore production. This is proprietary knowledge of EngCo engineers and might be a service quality that could be communicated clearly.

In recent years, however, there has been increasing pressure on the stability and applicability of the audit as a universal service quality. Informants mentioned that cost-cutting in customer organizations has emphasized equipment upkeep, which, in turn, has impacted the importance of audits in supporting preventative and predicative maintenance. Many of the informants in EngCo did not consider audits to be a service in their own right. Instead, they described audits as an opportunity to be on customer's sites, and to engage in discussions with customers about future product sales. The audit, as a service quality, was becoming merely a free quality of the products which were sold. As one manager explained:

> I'm basically funding out of my budget some quarterly visits to some of these clients to do some kind of surface level audits, again, to identify opportunities for both parties. Opportunities for them for improvement and also opportunities for us to identify sales and make it a win-win situation for both parties where we've not had the strongest presence. So, I'm trying to initiate that as well to get that intimacy, basically secure and lock down that business and potentially set up a model that we could then sell to other customers for that same type of service. But at that point, having the customers pay for it rather than us. (Sales Service Manager)

This then created a debate, in other words, about whether the audit was a 'door opener' for product sales or a quality of a service to be bought and sold.

In order to ensure a more coordinated and efficient delivery of audits, EngCo began a concerted second order experiment to stabilize and expand the universality of the audit as a service quality. One initiative entailed the creation of a standardized checklist (see Figure 6 below), which support auditors in structuring the way in which they conduct inspections, ensuring consistency. A second

initiative related to the format in which the audit report is delivered. A standardized template is used, which auditors can complete in simple steps, and then a PDF report is delivered to customers. The report was created with the customers' needs in mind, including a simplified structure and a clear list of recommendations. This is illustrated in the following:

> It's a PDF-file in a new way and you can just go up and search, and when you read the conclusion it refers to a page and you can go in and search to that number. And then you have the recommendation and so on. (Sales Service Manager)

The third initiative entailed devising a policy to ensure that auditor knowledge obtained on-site is transferred to employees in the customer service department through EngCo's customer relationship management system (CRM), which then allows for a more purposeful approach to selling:

> …he [the customer] can tell his management: "I already had the service specialist here." But he forgets that there is a lot of recommendations to follow up, there is a lot of spare parts he has to follow up, so that's our job in cooperation with our service people to remind them. So we prepare a proposal for these recommended spare parts, and then we are trying to push for them to buy it during the next overhaul. (Sales Service Manager)

EngCo, in summary, sought to stabilize one approach to audit delivery, which resulted in a more standardized audit offering, delivered in a standardized fashion throughout EngCo. Doing so would stabilize a service quality in a way that was parsimonious and would allow economies of scale.

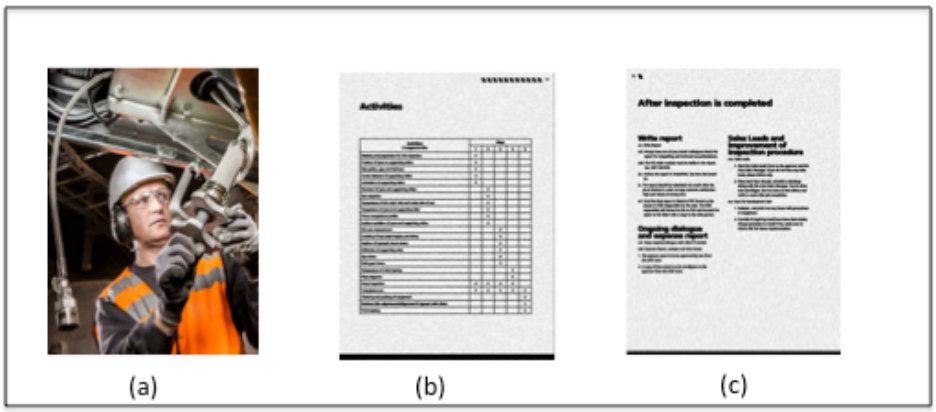

Figure 6: (a) official image from a service brochure showing an actual service engineer at work; (b) internal task checklist for inspections; (c) internal document showing report and recommendations compiled from audit

In seeking to specify a standard service quality, however, the existing products at EngCo struck back with a significant force. Standardized audits were found to depend heavily on the engineers;

it is the auditor's experience and specialized product knowledge that allows for a diagnosis of the equipment's health to be made. However, the engineers were deeply concerned with the products and the extraordinary degree of customization of which those products had been delivered and installed. Despite the existence of standardized templates and representations, they argued that the equipment customization made, to varying degrees, audit customization necessary. While there are variations in the types of audits, all are typically very thorough, which allows for conclusions to be drawn about how equipment is used, how well it is maintained and, in consequence, allows for recommendations about the types of parts, training, maintenance or optimization the customer might require:

> …an observational audit opportunity for us [is] to go out and talk to the operator, to observe operating conditions, observe maintenance practices, safety practices, help them with some of the optimization exercises that I just mentioned to make sure that they're getting the most of out of the equipment. (Service Sales Manager)

While audits are typically delivered in a systematic manner, they may also be delivered as part of a customized mix of different service types. This is illustrated in the following:

Interviewer:	You say audit services, field and training and optimization. So, are there different types of bundles in terms of what the customer asks for, you're willing to put together … I mean, how do you go about bundling the different offerings together?
Sales Service Manager:	It really is site-specific. It's what they need, what they're looking for. This particular customer, […] we're also looking at just generic, off-the-shelf. [But] the program on-site is going to be very customized, very specific to their equipment, to their operation, to their work and safety standards.

From the above, it can be discerned that audit services do not exist independently from the product, which is itself highly customized. To engage that product as one service quality, was therefore, seen to be impossible. The qualities resulting from multiple customized products could not be contained by the same one service quality, according to the engineers. This was compounded by the number of different IT systems that were the result of numerous mergers and acquisitions (M&As) over time. The inconsistent IT arrangements impaired the audit reports from reaching all locations that require detailed customer and equipment usage information.

The 'full flow sheet'

The full flow sheet is a concept that aides service provision and qualification. The idea behind it is that EngCo can provide services not just on individual pieces of equipment, but on the 'full process chain' of production at a site, identifying and eliminating bottlenecks and adjusting the overall process setup in order to increase efficiencies. The full flow sheet involves a full assay of a site (including production and storage) by EngCo's highly specialized engineers. In this process, they identify problems on all pieces of equipment, which pervade the whole process chain and typically also affect equipment in subsequent production steps. Service engineers subsequently speak with plant managers in their offices, where they often draw on the office's whiteboard and simultaneously tell a narrative:

> I typically do this drawing when I'm up against local competitors … [Informant draws a line with different intersections on the whiteboard, imitating how he would talk to a customer on-site] … A bottleneck over here, I think you have potential issues in your roll mill because the way you burn your clinker indicates you're running the roll mill wrongly. [Directed to interviewer] See you don't probably understand a lot of this but this is about linking our full flow sheet capabilities to some of our single services simply to make a value proposition that my local competitor, he cannot talk about this. (Head of Department, drawing depicted in Figure 7 below)

Full flow sheets have always been constructed by EngCo engineers, but in a non-standardized and haphazard fashion. The challenge for EngCo engineers has been one of obtaining the time and attention of plant managers to speak to them about the interdependencies in the operation. Service engineers, as a result, would often undertake quick, impromptu flow assessments and present their findings in various ways.

Only recently, however, have various EngCo employees begun to understand that their engineering experience and competencies of the cement production as a whole process chain sets them apart from their competitors. As a result, they have begun to undertake second order experiments with the full flow sheet as a standardized service quality. To do this, whiteboard drawings were transformed into a professionally-rendered graphical visualization with EngCo's corporate colours and branding. This visualization in turn has come to inform the thinking process in departments across EngCo; for example, those in the R&D team utilize elements of the full flow sheet in order to generate new ideas (see Figure 7 below). The experiment was one of determining how much of the organization could be made to accept such a standardized service quality. A recent acquisition in minerals was the impetus for widening its scope.

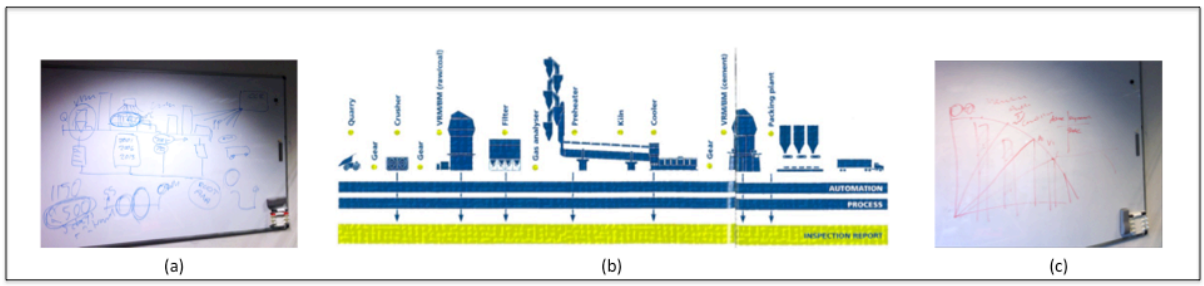

Figure 7: (a) The full flow sheet drawn on a whiteboard to explain how service managers mobilize this device on customer sites; (b) scan of the full flow sheet from a service brochure; (c) mobilizing the full flow sheet to modularize service offerings according

The response to this experiment, however, was again strongly shaped by the existing product. Although the full flow sheet became a standardized service offering within cement operations, its entry into the minerals business has been problematic. As one informant commented, the minerals process is more heterogeneous than that of cement:

> …the trouble is when you really break it down, you think well, what does that mean? Is that a copper plant? Is that a gold plant? Is that a zinc, lead, you know, iron ore and coal? They're all as different to one another as cement. You know, cement is an industry, minerals is not an industry because it's made up of, you know, the whole bunch of different industries. So, to answer that question, I think what [EngCo] is trying to do is identify key industries, and that's what they've identified and have told the market, which is copper, gold, iron ore, coal and fertilisers, then they're developing flowsheet, full flowsheet capabilities, in all of those areas. (Country Manager)

The challenge for the service quality was creating different full flow sheets for each industry. Such efforts are currently still unfolding. What has travelled is the word 'full flow sheet', and the concept of 'owning it', which now builds a common narrative inside EngCo. In addition, EngCo has strategically established regional Supercenters in both cement and minerals industry strongholds. The Supercenters draw from EngCo's global capabilities and offer proximity advantages, and in them resides the competency to deliver training programs and to service customer equipment, as well as technologies, such as laboratories.

Frame agreements

Frame agreements are documents that state the price and obligations of EngCo for providing continuing services to its products. Such agreements have always been an essential part of EngCo's business. Whenever EngCo delivers a capital product, it must go through the long and often tedious process of specifying and agreeing with all relevant parties on the obligations and prices of future engagements.

Apart from a tendency to re-invent frame agreement and contracts over and over across different locales, there has also been quite a lot of cutting and pasting of contracts and frame agreements throughout the years, which occurred in an uncoordinated way, and with minimal amounts of purposive standardization. However, it has become increasingly clear that the frame agreements have value adding service qualities than can be standardized. Indeed, because EngCo's equipment is very expensive, customers are willing to pay a premium price, in part due to the expectation that EngCo will provide technical expertise about the equipment over its long life. Effectively and precisely communicating and agreeing the terms of engagement is therefore a quality of EngCo's service.

Two experiments were on this basis undertaken to standardize and scale this quality in Pakistan and the USA. The frame agreement in Pakistan specified different bundles of service agreements, which was possible due to the co-location of plants. The frame agreement in the USA established pre-paid, pre-determined services that were sold in advance. Although emerging independently of each other, the experiments both came about from a close engagement with a long-term customer, and offered the potential for value adding services to be specified. As one of the USA informants stated:

> I started talking to customers who we had good relationships with, about selling them services in advance. So, something that had not really ever been done before. But I sat down with a couple product managers, and ones that I know would benefit and find value in what we provide. And ... I started creating what I coined to be Service Partnership Agreement. (Service Sales Manager B, USA)

However, the outcome of the experiment differed between the USA and Pakistan, again because of some relation to the existing product.

In the process of creating the frame agreement for the Pakistani customer, there were internal issues with EngCo's legal department:

> I went through Legal and I said, "Can we make a service agreement contract?" then Legal came back with ... Let's just say it was very text heavy, and I said, "No, we want to do something simple. Something where you can flip up on the first page and then head of procurement, he can say, "Okay, if I don't do it, then it's going to cost me this. If I do it, it's going to cost me this. (Head of Department)

The contracts prepared by the central legal department was constructed for the extensive coverage which EngCo typically requires for its project and large equipment sales. This was not, however, compatible or conducive to the needs of a customer who requires an easily comprehensible document in order to agree to the frame agreement swiftly. In consequence, several rounds of re-drafting the contract followed until it could be presented to the customer. The aim was that the customer could comprehend it alone, without any advice or legal counsel. The savings from the efficiencies created by the bundling of service visits resulted in mutual benefit for both the customer and EngCo, yet it was never replicated with other customers elsewhere.

In the USA, however, the underlying contract was drawn up by the sales manager himself and was never reviewed by EngCo's legal department as basic legal training was provided:

> …I wrote it to look like a legal document almost… you know. Some of those verbs I learned in Legal Boot Camp. But ultimately, by signing the agreement, you know, on page 12 or 13 where the customer acknowledges and signs the agreement, what he is signing and acknowledging is that he's making an agreement to the scope provided, at the rates provided, and to make payments on time. And all of our services fall, and include our terms and conditions. (Service Sales Manager)

This allowed for a contract to be crafted that was easily comprehensible and did not require a lengthy back-and-forth between the customer's and EngCo's legal departments. The contract stated how many 'service days' the customer would acquire from each service type and is billed quarterly. This way, the customer has direct, yet limited influence on the contract and, due to recurring billing, is not surprised with any sudden raises in spending that individual service visits may cause. This offering may be easily transferred to other customers and is beginning to spread throughout the USA.

Tensions in the qualification of services

EngCo's strategy is to be a "full-service provider" with key service offerings mainly targeting the full flow sheet. Due to its long history, growth through acquisitions, the focus on different industries, operations in different countries and complex organizational setups, implementing a servitization strategy is found to be especially difficult to manage and coordinate in a standardized way. There is a tension between the ability to offer services in a multiplicity of ways, whilst at the same time simplifying the service offerings. Whereas the customization of projects and equipment appears to be accepted as necessary, the level of customization of service offerings towards

individual, local customers is increasingly a concern. There are fears that inefficiencies resulting from excess customization detract from the full profit potential of offering services.

> But I'm fairly convinced that at the end of the day, you need to get to a point where you have a service ladder where you can, you know, scale up and down. Dependable on customer needs and preferences. And by scaling up and down I mean it's a fixed ladder. So, your offerings are fixed. So, you can step up and down, and wherever the customer feels comfortable, you can offer that. But that also needs to be, a very standardized approach, a modularized approach, otherwise you're going to make it very difficult for yourself. (General Manager)

Becoming a full-service provider without simplifying the service offerings consequently seems to imply a risk of an overly complex service delivery system. This fixing of service offering essentially involves determining the qualities of services to offer to which customers and communicating these in a simple, concise and coherent way.

However, a second and important element in the development of a modularized approach to service offerings involves simplification of services to render them applicable in such domains and be clearly communicable. In effect, the process of modularization is one in which service qualities are modified, or even reduced, more than it is a process of adding service qualities. Consequently, it is also a process involving the tension between the ambitions of increasing the scope of service offerings, while maintaining an emphasis on simplifying the complexity of the service offerings in totality. Essentially, it is a process which requires investment in abstraction in order to define an architecture containing the building blocks necessary to meet the customization needs with only the necessary properties. As one informant explains the product architecture with reference to Lego bricks, it involves having just the right amount and types of bricks to meet the needs that customers value:

> Imagine five piles of Lego bricks. And that's all your parts. To get to a modular approach, it's basically how many of those bricks do you put together and put on the shelf. So every time you have to build this piece of equipment you take, number one in the first pile, you take number eight in the second, and you know, put those together. And that will then basically give you the combinations that you have in your offering… . We have way too many of them, and they're way too big. And by that, I mean, we have way too many different parts, so you can say the (...) most parts are project specific. So, there's not a lot of reuse. And if you don't get to a point where you can start re-using parts and modularizing them, I think we're going to lose. So that's a path we are taking. And we believe that's going to help us be more competitive. (General Manager)

While, on the surface, this may seem to be a simple undertaking, it actually reveals complex relationships between first order and second order experimentation. Based on the three experimental settings presented, we find that there are a number of dimensions which are particularly relevant to address in understanding the tensions inherent in service qualification, including (i) scope and simplicity, (ii) global scope with local presence, and (iii) harmonizing products, services and projects. Each is discussed in turn.

Scope and simplicity

The tension between scope and simplicity involves a desire to increase the breadth of offerings while limiting their complexity. Traditionally, the case organization has predominantly been addressing customer requests for customization by means of tailoring projects. Project engineers have had significant degree of freedom to make necessary modifications in order to meet customer requirements for the individual projects. As a consequence, each installation of equipment is relatively unique and although different projects share the same configuration in terms of the combination of equipment, they are in practice very different. This increases the complexity of the installed base of products and present significant difficulties in terms of servicing. In particular, the research shows that, rather than narrowing the scope of products to be serviced, the firm is widening the scope of its service offerings to also include products installed by other providers. For audits this increases the scope by including procedures for auditing the equipment of others, in addition to the existing practice of auditing with regard to the interrelationship between different pieces of equipment, i.e. the interoperability of equipment. For the full flow sheet, the scope is expanding internally as the narrative travels within the company. As highlighted above, the notion of the full flow sheet is finding application not only within the cement market but is increasingly being mobilized in arguing for the engineering competencies also within minerals industries. With regard to the frame agreements the expanding scope involves the reuse of contracts negotiated with specific customers to also find application with other customers.

Global scale with local presence

While the tension between scope and simplicity is one related to the definition of offerings, the tension between global scale and local presence is critically related to the competencies involved in developing and delivering services. Specifically, there is a tension between the knowledge

residing locally with regard to individual customer needs and potential new services to meet these and the capabilities within headquarters. We find that first order experimenting typically occur locally by customer facing parts of the organization, very often in direct collaboration with customers. Second order experimentation involves making the first order experimentations applicable in multiple contexts and hence rely on knowledge of these, as well as the ability of, and interest in, performing second order experiments. Consequently, the tension we find related to the global scale with local presence involves a lack of incentive locally to invest in second order experimentation (i.e. making experimentations applicable elsewhere), while it globally involves a lack of knowledge of local contexts. Second order experimentation involves abstracting from the contextual specificity to render services applicable across a wider context as well as to develop the capabilities to deliver these in an efficient manner, such as through the development of Supercenters. Consequently, we find the interplay between the global scale and the local presence is a key tension in pursuing second order experimentation.

Harmonizing products, services and projects

The third tension between first and second order experimentation relates to the need for harmonizing products, services and projects. Group functions such as legal, marketing, R&D and the corporate training institute each have developed capabilities over time with regard to their respective areas. However, they are typically based on the requirements needed for supporting larger projects and product launches. For example, legal aspects of the project-based business involve defining extensive contracts with the inherent risk of complex litigation processes with trusted customers. Similarly, our findings suggest that marketing has a predominant interest in developing materials to support product launches, which attract more attention within the organization. This has implications for the scope of second order experimentation with regard to service. For audits, R&D are used to dealing with technical development of products with an emphasis on predictable development process more than on quickly trying out new services as a result of first order experimentation. For the full flow sheet, the focus of the marketing group is supporting new complex and innovative products (i.e. equipment), more than on simplifying an abstract idea such as the full flow sheet which has difficulty in receiving the attention of marketing group at headquarters. Finally, for frame agreements the difference in nature from the complex project related contracts resulted in difficulties in scaling these up, given that they are primarily devices that are part of interactions with customers more than a simple, typical legal agreement. Consequently, we find that the harmonization of products, services and projects is formed by the

traditional focus of the company and involves tensions as service related experimentation of first and second order bring about clashes of mentality and technicality within the organization.

The product strikes back

All of these tensions allude to what Spring and Araujo (2017) have described the "intimate entangling of products and services" (p. 127). Indeed, they show that each service quality is linked to the product in a way that is both enabling and limiting. It is the intimate and detailed local knowledge about the product that makes all of the service qualities possible and compelling. At the same time, however, it is differences in the understanding of the product that limit the scalability of each of the service qualities. In the case of the audit, for instance, the same detailed engineering knowledge which makes the audit valuable also stops the audit from becoming standardized and transcending relatively isolated locations or locales. In order to diagnose problems in a distinctive way, engineers needed to maintain the products as fundamentally different. The product thus cannot be considered simply an installed base upon which services are constructed (Potts, 1988; Wise & Baumgartner, 1999; Oliva and Kallenberg, 2003; Davies, 2004); the product is at the same time a strong and stable network which constitutes the boundaries for the construction of the network necessary to constitute stable and scalable service qualities.

Discussion and conclusions

What does understanding service qualification as a matter of modular experimentation add? Firstly, this research challenges the underlying assumption within much organizational literature that creating and specifying more customer-centric qualities will make a service offering more desirable in the marketplace, leading to higher sales (Callon et al., 2002; Callon & Muniesa, 2005, Callon, 2016). Such a strategy, this research highlights, is at odds with the observation that industrial companies struggle to achieve economies of scale with their services, which, as we argue, fosters the so-called service paradox (Gebauer et al., 2005; Fang et al., 2008; Kastalli & Van Looy, 2013), where investments in a service business cannot be offset with the revenues it incurs (Neely, 2008; Benedettini et al., 2015). The central organizational challenge of qualification, therefore, is shown to be one not of constructing ever more relations between the customer and a product or service, but rather of limiting these relations to ones that are achievable at scale.

Secondly, this research sheds light on some of the dynamics which govern this kind of (modular) challenge of qualification. One dynamic pertains to its experimental nature. This research shows that modular qualification requires two kinds of experimentation: on the one hand, it is essential for actors to intimately engage customers in localized settings to determine qualities that might be valuable; on the other hand, it is essential for actors to engage the entire global organization in order to specify globally those qualities as standardized parts for the construction of any kind of service offering. Another dynamic pertains to the tensions inherent in these different kinds of experimental activities. This research shows that between the first order in-vivo experimental setting (of face to face interactions with the customer) and the second order in-vitro experimental setting (of attempts to impose management controls), there are inherent tensions between scope and simplicity, global scale and local presence, and the harmonization of products, services and projects. It is the management of these tensions, rather than the construction of stable networks alone, which are at the heart of service qualification.

Thirdly, this research contributes to a growing stream of literature which underscores the complex relation between the product and servitization (Spring & Araujo, 2017). Each of the tensions above are shown to relate directly, but in different ways, to the network in which existing products are constituted. Our findings suggest that service qualities are very much dependent on the qualities of the product at which they aim. In consequence, service platforms arise through experiments; in places where there is an overall agreement on a certain set of product qualities, services may draw upon them and their qualities can be re-combined within this area without any proliferation of additional qualities. This geographical relevance of services is determined by the overall agreement in the network on product qualities. The ideal setting for service modularity would therefore imply reaching as much agreement on the product as possible within the network and to then work with as few service qualities as possible.

Focusing on product qualities may be helpful for limiting and managing service qualities for servitized offerings. While they are still subject to change over their lifetime (Spring & Araujo, 2017), products might still provide a more reliable foundation to anchor service qualities. While we do not see customer input in service design as obsolete, we argue that customer involvement in determining service qualities may likely result in a proliferation of those qualities, as involved parties have an incentive to demand qualities that fit their own purposes (Callon & Law, 2005). Customer involvement, while proclaimed to be at the heart of a market, also makes it difficult to

create economies of scale from servitized offerings. One solution might be the modularization of the underlying service component. Instead of devising a modular design *a priori* (Baldwin & Clark, 2000), our findings lead us to agree with Garud et al. (2008) in that modularization is an emergent and dispersed phenomenon. We find that service modularity must not always be purposefully designed, but can emerge through experimentation in different locations. The dense socio-material networks in which products, services and customers are intertwined makes it problematic to forecast platform architectures and applicability of components. Understanding service qualification as a series of experiments for service platform creation thus allows for a more flexible approach to modularity. While some service platforms might be globally applicable, others might only be relevant in certain locations.

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Article 3: Servitization and the product multiple: Exploring commoditization and differentiation

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Abstract
Servitization is often described as a way for industrial companies to survive in saturated and highly competitive markets. In particular, servitization is understood as helpful for differentiating otherwise commoditized product offerings. However, previous research has shown that servitization is difficult to implement and that companies struggle to reap its anticipated benefits. One reason for this finding is that the product is not as stable as it is assumed to be, especially when it is used and abused by the customer. This article investigates how product differentiation is achieved through servitization under such conditions. It presents qualitative case-study research focused on a company struggling with product commoditization that implements servitization. The findings show that servitization practices enact multiple products – some differentiated and some commoditized – and that coordination work can enact a product that is actionable. The article contributes to the extant servitization literature by revealing a thus far unrecognized role of products in servitization and by highlighting the ways in which servitization practices achieve product differentiation or commoditization.

Introduction

Servitization is defined as the combination of products and services in order to form new, integrated offerings (Vandermerwe & Rada, 1988). Much servitization research is motivated by the commoditization of products (Böhm et al., 2017; Coyne, 1989; Gebauer, 2008; Gebauer & Fleisch, 2007; Huikkola et al., 2016), which is typically characterized by a decline in a product's differentiation from other offerings in the market (Matthyssens & Vandenbempt, 2008). Research suggests that this is the result of such developments as products reaching maturity (Kowalkowski et al., 2017), and increasing competitiveness and the resulting price pressure (Cova & Salle, 2007; Vandermerwe & Rada, 1988; Visnjic Kastalli & Van Looy, 2013). Under these conditions, companies find it difficult to differentiate based on product innovation alone (Baines et al., 2009). As a countermeasure, the literature is almost unanimous in suggesting that companies should servitize their offerings, which allows them to grow even in saturated markets. A servitization

strategy helps companies differentiate their product offerings even in tougher market environments, such as commodity markets (Gebauer & Fleisch, 2007; Robinson et al., 2002).

However, there is mounting evidence that servitization is a difficult strategy to implement and maintain (Benedettini, Swink, & Neely, 2017; Gebauer, Ren, Valtakoski, & Reynoso, 2012). Among product-centric manufacturers, servitization demands far-reaching organizational and cultural change (Davies et al., 2006; Mathieu, 2001a). Its implementation is often difficult, as there are different servitization trajectories (Matthyssens & Vandenbempt, 2010) and their implementation depends on the company's manufacturing strategy (Sousa & da Silveira, 2018b). This gives rise to a host of complexities. Moreover, companies sometimes opt to de-servitize by closing their service businesses (Kowalkowski, Gebauer, Kamp, et al., 2017; Kowalkowski, Gebauer, & Oliva, 2017; Valtakoski, 2017).

Most of the studies investigating these difficulties pertain to research that emphasises the service component. For example, our current understanding and classification of servitized offerings is based on the sophistication of the service (Oliva & Kallenberg, 2003). A company's servitization journey is commonly judged in terms of how many service offerings it has in its portfolio (Neely, 2008). Success in servitization is largely associated with financial gains from service sales (Lexutt, 2019). At the same time, the extant literature treats the product as if it is a stable or predictable underlying entity that can simply be differentiated through the addition of a service component. However, recent research leads us to question this assumption of product stability (Spring & Araujo, 2017). Products might be better understood as being subject to change when, for example, they are used, sold or re-purposed (Kopytoff, 1986). Product instability presents a common empirically observed servitization challenge – customers are known to use and abuse their products (Reim et al., 2018), sometimes in unintended or haphazard ways, which renders the task of servicing them difficult, costly and unpredictable (Orr, 1996). Instead of treating the product as a stable background object, it might be more adequate to think of it as a difficult to predict, unstable entity. Consequently, it becomes a managerial problem to coordinate servitization practices so that they match such instable products and generate service sales while at the same time differentiating it from competitor's offerings in order to defend the supplier's installed base. Importantly, under these circumstances, it remains open as to how servitization practices differentiate such a product-in-use. The aim of this article is therefore to explore the following:

RQ: How do servitization practices achieve differentiation if the underlying product is unstable?

This article argues that when servitization practices interfere with unstable products, so far unrecognized challenges arise, which put the commoditization and differentiation of the product at stake. The notion of multiplicity (Mol, 1999, 2002) is adopted in order to understand practices as achieving or enacting multiple ontological objects. This article deviates from other servitization research by exploring not *what* servitization practices are but rather what they actually *do* to the product. This approach provides more nuanced insights into both product instability and the differentiation of products through servitization.

As such, the contribution of this study is twofold. First, by focusing on the product, the article adds to a new stream of research that more critically engages with the underlying product in servitization (Sousa & da Silveira, 2018b; Spring & Araujo, 2017). Second, it addresses the general tendency to assume that the "addition" of services helps to combat product commoditization (S. Brax, 2005; Kowalkowski, Gebauer, & Oliva, 2017; Vandermerwe & Rada, 1988) by showing how differentiation is (or is not) achieved.

The remainder of this article is structured as follows. First, a brief overview on servitization is provided in order to position the article. That overview is followed by a more detailed presentation of servitization's ability to differentiate products, the difficulties associated with servitization and the literature's current stance on products. Thereafter, an alternative way in which servitization might be understood is discussed, after which the methods are presented, including a description of the case company. The findings are then detailed and, lastly, a discussion of those findings is presented.

Theoretical background

Servitization as a means to resist product commoditization

The extant servitization literature tends to assume that the addition of services (Parry & Tasker, 2014; Vandermerwe & Rada, 1988) to a stable, underlying product (Salonen et al., 2017) yields differentiation. In particular, servitization research adopting an industrial marketing perspective tends to emphasize the exploitation of unused product potential and proprietary client knowledge.

For example, Kowalkowski and colleagues (2017) see the true litmus test of servitization in that services need to primarily aim at 'defending' the provider's product business, for which they are willing to tolerate product cannibalization. Importantly, services aid differentiation because they better satisfy customer needs (Oliva & Kallenberg, 2003). Such needs typically revolve around the industrial equipment customers use to produce their wares. For example, digital services based on analyses of product data, such as remote monitoring, might be a key differentiator that can set suppliers apart (Sklyar et al., 2019). In this sense, services help firms effectively exploit unused potential connected with the product.

Servitization also provides new ways for companies to interact with their clients (Mathieu, 2001b; Mont, 2002b; Oliva & Kallenberg, 2003; Shepherd & Ahmed, 2000). In selling services, providers can engage their clients in new kinds of interactions; establish and build relationships with them (Tuli et al., 2007); negotiate how to offer, value and exchange services (Geiger & Finch, 2016); and, in so doing, keep competitors out (Baines et al., 2009). Over time, the sale and provision of services enable providers to develop a particularly deep understanding of their customers and their respective business processes and technologies, which can create advantages relative to competitors that lack such information (Cohen et al., 2006). Furthermore, service providers can achieve differentiation by communicating the distinct strengths that allow them to provide high-end services and then linking those strengths to their existing brands and products (Davis et al., 2008; Reim et al., 2015). In this sense, servitization practices are depicted more as a way to obtain and capitalize on knowledge on clients, build relationships with them, demonstrate supplier capabilities and, thereby, outmanoeuvre the competition.

Much of this research has been conducted at the firm level, where it has focused on operational, strategic or marketing topics (Kohtamäki et al., 2018a). However, the research question presented here focuses on servitization challenges at the product level – at the intersection of products and services (Lee et al., 2016).

Servitization at the product level

Empirical evidence suggests that companies find it challenging to implement servitization (Benedettini et al., 2015, 2017) and that they may even abandon their service businesses (Finne et al., 2013; Kowalkowski, Gebauer, Kamp, et al., 2017; Valtakoski, 2017). This can be traced back to challenges emerging on the product level.

For example, the literature provides evidence of a "service paradox" (Gebauer et al., 2005) – firms struggle to achieve the expected revenue growth from their investments in their service businesses. Even if they increase their revenues, servitized companies may lag behind their non-servitized peers in terms of profits (Neely, 2008). Adding to this is the fact that providers sometimes tend to pay little attention to the immediate profitability of the servitized offering because they hope to use free service provision as a means to stimulate future product sales (Kujala et al., 2013). This indicates that servitization can have unintended consequences in terms of how product and service combinations play out over time (Spring & Araujo, 2009).

Understanding servitization as playing out over time and tending to customers' product-related needs presents an important challenge (Nudurupati et al., 2016; Zhang & Banerji, 2017). With services, suppliers try to tend to dynamically unfolding series of such needs. It has, however, been well documented that manufacturers can have a poor grasp of what such customer needs might entail (Johnstone et al., 2009; Trkman et al., 2015). Consequently, suppliers need new insights into their customers' operations if they wish to become more involved in the processes related to their products (Martinez et al., 2010). However, customers may be reluctant to share information about their product usage with their suppliers, especially when they consider such data commercially sensitive (Matthyssens & Vandenbempt, 2008).

Servitization also implies that it becomes the supplier's responsibility to ensure that customer processes run without interruption. When customers use, wear out or damage equipment, there is an opportunity for service sales, such as repairs or training (Barnett, Parry, Saad, Newnes, & Goh, 2013). Nevertheless, tending to damaged products also means that those damages become the provider's responsibility (Barquet et al., 2013). In this regard, servitization has suppliers tending to product malfunctions and answering for defects that are not of their own making, even though product ownership and operation remain with the customer. This indicates a different kind of servitization challenge – the need to tend to products that are used (and sometimes abused) in ways that can be difficult to know for the supplier. The product, it appears, merits a closer look.

Servitization in industrial marketing assumes stable products

Industrial marketing research appears to have largely fallen in line with its recommendations to practitioners in that it has mainly directed its attention to services (see Tan et al., 2019). While points such as emphasizing a service culture (Nuutinen & Lappalainen, 2012), shifting management and operations towards servitization (Barnett et al., 2013), and measuring servitization success in terms of service revenue or the number of services offered (Wang, Lai, & Shou, 2018) help servitization gain traction in product-centric companies, this emphasis has left the product in a somewhat "offside" position, and not well understood. Consequently, products are treated as "largely stable entities" (Spring & Araujo, 2017, p. 128), that are "simultaneously taken for granted and never really present" (ibid., 2017, p. 128). In other words, the product has not been ignored completely, but it is assumed to be unchanging – it is viewed as a background or object that, if serviced, offers an opportunity for additional revenue. However, from empirical observations, we know that this is not necessarily the case. In his ethnography of field service technicians, Orr (1996) describes machines that are not stable – they might have been fiddled with by inexperienced users. Some of these machines produce mysterious error codes or require short-term fixes to temporarily stabilize them until an appropriate replacement part can be delivered. This shows that products are not stable. As the products are in use, servitization demands interactions not only with the customer but also with the machine.

Only recently has minding the product garnered a small number of interesting research contributions. Sousa and da Silveira (2018), for example, found that manufacturers producing standard products, which are generally believed to benefit the most from servitization, were less servitized than companies following a product-customization strategy. This, they argue, could indicate that customized and, arguably, already differentiated products are particularly compatible with services. Products also play a central role in advanced service settings. Moreover, trying to achieve scalability across different customer needs may require new approaches to the product that affect, for instance, its sophistication (Raja, Frandsen, & Mouritsen, 2017). Spring and Araujo (2017) build on Kopytoff's (1986) notion of product biographies to show that products can be usefully understood as physically and institutionally unstable entities. In contrast to the product lifecycle, the biography approach does not assume that all products move through the same sequential and inevitable life stages over time. Instead, a product's characteristics change as it is conceived, manufactured, used, exposed to wear and tear, sold, used again, and has its parts disassembled and recycled. In this process, products may switch between being commoditized and differentiated objects.

All in all, a new understanding of the product is emerging, which also suggests that there are under-researched implications for how companies servitize. This leads to the question of how companies 'do' servitization in the first place, which is discussed in the next section.

Theoretical positioning: Servitization is achieved through servitization practices

This section first provides a brief overview of how 'doing' servitization is understood in the industrial marketing domain. Thereafter, an alternative way of theorizing servitization practices and their outcomes is presented.

Servitization is a practical undertaking (Vandermerwe & Rada, 1988), even when this is not always explicitly stated (Kowalkowski, Gebauer, Kamp, et al., 2017). Practices are routinized behaviours that link thoughts to actions (Mason & Spring, 2011). Most of the investigations into servitization have therefore been concerned with what companies do. 'Doing' servitization, as we now know, is not achieved by a smooth unilateral transition (Kowalkowski et al., 2015). Rather, it entails diagnosing customer needs and responding to them by designing and producing solutions (Aarikka-Stenroos & Jaakkola, 2012). It also involves employees working "silly hours" and turning one-off experiments into established routines (Spring & Araujo, 2013), as well as the establishment, coordination and incentivising of networks of third-party service providers (Raja & Frandsen, 2017).

Recently, researchers have called for more explicit examinations of servitization practices (Kohtamäki et al., 2018a), which has given rise to a small but growing stream of literature. Some of this research is characterized by a more normative interest in practices, such as trying to identify practices that might lead to successful servitization (Baines & Lightfoot, 2013; Storbacka, 2011). In this vein, Rabetino, Kohtamäki and Gebauer (2017) suggest that mapping servitization practices might allow for a better understanding of the strategic logics employed. One answer to this call is provided by Palo, Åkesson and Löfberg (2018), who focus on the *doing* that makes servitization. They find that servitization involves parallel and contradictory practices. This approach focuses on the doing and presents a different way to show *how* nouns (e.g., strategy, servitization) are achieved in practice. However, this lens is less attuned to the materials used to achieve this doing and, importantly, it does not investigate *what* these practices may actually

achieve. The question therefore remains: How do servitization practices achieve differentiation if the underlying product is unstable?

Servitization practices enact product multiplicity

Another way to attend to servitization practices is provided by Mol with her work on multiplicity (Mol, 1999, 2002). Her accounts, which are based on social science research undertaken at a Dutch hospital, detail how different practices of talking about, diagnosing and treating symptoms produce different versions of atherosclerosis, which we might otherwise think of as 'one' disease. She explains how practices enact *multiple* versions of the disease:

> Talking about reality as multiple depends on another set of metaphors. Not those of perspective and construction, but rather those of intervention and performance. These suggest a reality that is done and enacted rather than observed. Rather than being seen by a diversity of watching eyes while itself remaining untouched in the centre, reality is manipulated by means of various tools in the course of a diversity of practices. (Mol, 2002, p. 77)

Instead of accepting the object as a given (i.e., that there is one product that can be serviced), Mol's approach turns the issue on its head and draws out what practices make of such objects (i.e., what do servitization practices make of the product?). If we regard products in this way, we do not make a priori assumptions about what products really are. Instead, we investigate how practices enact products and what those products then become. In the context of servitization, such practices may be as varied as selling services, maintaining machines, refining service business plans or talking with customers.

Mol (2002) conducts what she calls a "praxiography" in order to investigate how the multiple enacted diseases are coordinated to form what ultimately appears to be one disease. It is important to note that these are not people's projections or personal opinions of a disease. For example, in the hospital's pathology department, atherosclerosis is enacted under the microscope by finding and looking at a thickening of the vessel wall in the artery. In the outpatient clinic, atherosclerosis is enacted as the patient's intermittent pain upon walking. Participating in these enactments are other things, such a microscopes, scalpels or patient files, and immaterial objects, such as ultrasounds and measurement techniques. Some authors find that multiple enactments can also

exist in friction with one another (e.g., Brives, 2013). In other cases, they can be made to co-exist peacefully. In particular, Mol (2002) shows how different atheroscleroses are coordinated, balanced, added up or subtracted. In order to be able to make a diagnosis and arrive at a single plan of treatment, different diseases are made comparable, weighted, prioritized, combined or explained away.

This conceptualization of practices lends itself to the study of domains beyond medicine, such as industrial marketing. In this domain, multiplicity is helpful for understanding the development of a market in an industrial setting, the practices of sustainable waste management or market-shaping in general (Finch & Acha, 2008; Finch, Horan, & Reid, 2015; Kjellberg & Helgesson, 2006). This article employs the notion of multiplicity in order to investigate the product and to provide new insights into how servitization practices may come to enact it.

The practices of diagnosing atherosclerosis produce multiple versions of the disease. Similarly, servitization practices may have a bearing not only on how but *what* a machine is. From this point of view, service provision is likely to create multiple, and possibly different, enactments of the machine. This could lead to important insights about how products can simultaneously be differentiated *and* commoditized (see Figure 8).

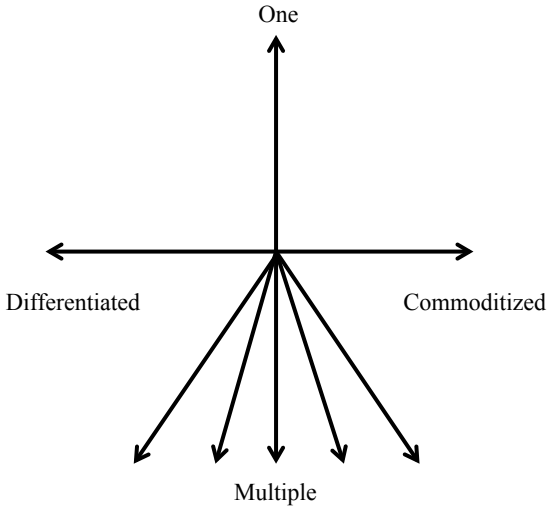

Figure 8: Differentiation and commoditization of the product as one and as multiple things

This article provides a different and more nuanced understanding of the product, not as something that simply switches between being differentiated and commoditized but as something that is

practically achieved, whereby its multiple enacted versions can play out on a spectrum of commoditization and differentiation.

Few studies to date have addressed how multiplicity fares with the differentiation/commoditization dualism. One such study is provided by Stensrud (2016), who shows how practices enact multiple versions of water in southern Peru and how political decisions aimed at singularizing water lead to practices that produce new entities and, in that process, more multiplicity. In differentiating real-estate projects in Chile, real-estate market professionals enact new, and multiple, meanings of social class (Ariztía, 2014). In undertaking "analyst work", equity analysts enact their profession in multiple ways, each of which has distinct implications for the commoditization and differentiation of shares (Blomberg, 2016). Similarly, buying and selling can enact multiple versions of second-hand oilfields, some of which are more differentiated and others that are more commoditized (Finch & Acha, 2008).

The servitization literature tells us that service provision differentiates the product but it fails to address how such differentiation might occur. From Mol (2002) we can surmise that servitization practices, because they differ, enact multiple products (further showing that products are not stable). This then gives rise to the question of how such servitization practices can be empirically investigated, which is discussed in the next section.

3. Research method and data analysis

Research approach

This article investigates servitization practices and their implications for the product using an exploratory case-study approach. A case study is suitable given the lack of pre-existing information on the focal phenomenon. The use of a single case allows for particularly deep insights (Dyer & Wilkins, 1991) into practices and their implications for the product. This renders the selection of the case company important (Siggelkow, 2007).

In order to provide a meaningful account, a purposeful sampling approach was adopted (Patton, 2015) and five guiding criteria were used to select a relevant research site. Firstly, it needed to be what may be considered as the 'classic' environment for servitization: a western company operating chiefly in industrial manufacturing. Second, the industry and the machinery it typically

used needed to be facing serious commoditization pressure. Third, the company needed to be on a dedicated servitization path and possess competencies in service provision to ensure that there would be servitization practices to investigate. Fourth, the company needed to be interested in at least maintaining or possibly even enhancing its servitization efforts. Therefore, the company needed to accrue a significant portion of its revenues from services. Lastly, the company needed to provide relevant access to the researcher.

Given these criteria, ManCo and one of its main customers, ChinCo, were selected for the case study, and relevant access was secured. ManCo is a large European firm that is a global leader in the manufacture and provision of industrial capital equipment for heavy industries. ChinCo, a global market leader the production of heavy industry materials, obtains many of its plants, equipment and services from ManCo.

3.2 Data collection

In order to provide an account of multiplicity based on servitization practices, the primary empirical material for this article was gathered through interviews and from documents related to servitization. This material was supported by observations undertaken in the case company.

Moreover, ManCo took part in a larger, longitudinal research project. The findings reported here draw on that work to the extent that I was immersed in a service-development unit inside ManCo as part of the project. Over four months, I visited the company as often as possible (at least four times per week), where I had my own desk and computer as well as access to team emails and the company's intranet. Therefore, it was possible to directly observe some of the ongoing servitization practices at ManCo's offices. These observations, emails and informal conversations were captured in daily field notes, and provided me with an overall understanding of what it means to *do* servitization at ManCo. This understanding served as the background for this article.

Building on this understanding, and separate from other investigations into ManCo, I undertook an independent effort to examine how servitization practices might enact the product and with what results. I paid particular attention to how the product was treated when it was being servitized, asking: What aspects about the product become important? The aim of the data collection was to determine how the product was repaired, maintained or audited; how it was

measured, evaluated, calculated and planned; and how it was talked about in the course of such practices.

Informed by my observations and the literature, an interview guide was created and ManCo informants working on servitization were found using a snowball technique. In total, eight semi-structured interviews were conducted with members of ManCo's operational and managerial staff. This allowed informants involved with servitization to discuss their daily practices and what they did in relation to servitization in great detail (Czarniawska, 2014). Whenever possible, informants were asked to show (and later provide) the documents that they used when doing servitization work and to explain how those documents were used. Close attention was paid to what the product *became* in those instances.

Through the interviews, it was possible to transcend ManCo's local offices and to explore interactions that informants had with the equipment and customers at different sites, including, but not limited to, ChinCo. It became clear that ManCo's customers played an important part in these practices. Consequently, access to one of ManCo's main customers, ChinCo, was arranged and three additional interviews were conducted with managerial staff from ChinCo's procurement and IT departments.

Table 9 depicts the interviews conducted, while Table 10 provides an overview of the collected materials. The interviews had an average duration of about 50 minutes. They were recorded using a digital recording device and later transcribed verbatim, resulting in more than 400 pages of text.

Table 9: Interviews conducted

Nr.	Company	Name	Position	Practices	Duration
1	ManCo	Joshua	Service Manager	Service delivery coordination and systematic delivery of services	1h 24 min
2	ManCo	Abigail	Senior Project Manager	Development of new service offerings	1h 09 min
3	ManCo	Peter	Team Leader Service Maintenance	Coordination and sales of maintenance services	56 min (first interview)

4	ManCo	Peter	Team Leader Service Maintenance	Coordination and sales of maintenance services	30 min (second interview)
5	ManCo	Hunter	Mechanical Engineer	Development of new service offerings	49 min
6	ManCo	Jenny	Development Manager	Coordination of service development	42 min
7	ManCo	Hunter and Abigail	Mechanical Engineer, Senior Project Manager	Group interview about service development and provision	1h 04 min
8	ManCo	Hunter and Jack	Mechanical Engineer, Mechanical Engineer	Group interview about service provision at clients' sites	45 min
9	ChinCo	Jeffrey	Head of Demand Management	Assessment of demand for services	60 min
10	ChinCo	Janet	Purchasing Regional level	Tender and purchasing process for services	58 min
11	ChinCo	Michael	Head of Supplier Management	Digitalization of purchasing processes and new purchasing strategies	1h 15 min

Table 10: Materials collected

Document/file	Description	Place/ companies	Count
Field notes on observed practices	Log of daily field notes capturing observed servitization practices	ManCo	74 informal conversations
Emails	Email communication within ManCo on organizing and coordinating service delivery as well as correspondence with customers on coordinating service delivery	Customer sites, ManCo	Over 600 formal and informal emails
Service brochures, manuals, checklists, etc.	Marketing and other informational material designed to communicate service offerings (often used in conversations with customers' personnel on site)	ManCo	2 service booklets 18 service brochures 8 service leaflets 2 service manuals 1 service checklist
Service sales and business plans	Multi-tabbed Excel documents covering different scenarios of providing one service	ManCo	4 service business plans 1 service sale plan

Corporate intranet	Miscellaneous internal information on ManCo, service provision and its coordination	ManCo	22 screenshots 12 documents
Service videos	Promotional videos explaining service provision in theory and at customer sites	ManCo	36 videos
Patents	Details on new materials, parts or techniques	ManCo	37 service-related patents
Corporate web presence	Webpages detailing service provision and corporate purchasing	ManCo, ChinCo	1 calculation tool 5 customer-service case studies 1 supplier guideline
Corporate newsletter	Details on noteworthy occurrences and overall corporate strategy	ChinCo	11 newsletters
Other documents	Strategy document detailing supplier management e-platform	ChinCo	1 internal brochure

Data analysis

Throughout the data-collection process, the empirical material was analysed using template analysis – a type of thematic analysis that is an adaptable and flexible way to identify patterns in qualitative data and to relate them to each other (Brooks et al., 2015). The identification of themes in empirical material is called coding. In template analysis, a coding template is developed that captures and organizes the different themes emerging from the coding process. The coding template is first generated from a subset of the empirical material and, as it is applied to increasingly more material, it is continually revised and refined until it adequately reflects the themes in the material (King, 2012). In this article, I use template analysis as a way to "unravel the surface of 'reality'" (Braun & Clarke, 2006, p. 81) in the sense that the coding process first tried to identify how servitization was "done" and then what that such 'doing' made of the product.

The coding process followed abductive reasoning (Burks, 1946; Locke et al., 2008). Prior observations in ManCo led to the inclusion of the product (inductive), while an examination of the extant servitization literature led to the inclusion of commoditization and singularization (deductive) as a priori themes. They were captured in the coding template using the NVivo software. All interview transcripts were saved in NVivo as they became available, as was other textual and pictorial material. All written material was read multiple times (while listening to the original audio files when possible). In so doing, the first inductive patterns were identified (e.g., unanticipated consequences from servicing machines). In coding increasingly more material, the

analysis progressed through a number of iterations that moved between the extant literature and new empirical insights. Conversations with colleagues helped me to "conceptually leap" (Klag & Langley, 2013) from understanding services as singularizing one machine towards appreciating servitization as a phenomenon that could create multiple machines. The literature on multiplicity helped to guide the exploration towards finding out what these machines could be, where and when (deductive). As my understanding of ManCo's machines developed, it became clear that in order to better grasp how multiple machines were coordinated, I needed to interview a customer organization. The continual adaptation of the coding template guided my evolving understanding and assessment of the research problem. In three instances, informants were contacted again in order to follow up on a remark made during an interview.

After the data collection was concluded, I applied the template to all of the material. I then went through all coded pieces of material and compared them with other material categorised under the same code as well as material grouped under other codes. In so doing, patterns were identified and the coding structure was continuously refined. Thereafter, the relationships between the different codes were examined using such questions as: How do they relate to one another across time and space? Consequently, the coding template was revised to reflect how servitization practices, products and their relationships across time and space played out at ManCo and ChinCo.

Servitization practices against product commoditization in ManCo

ManCo is an industrial manufacturer of heavy equipment, which it supplies to the global heavy industries. As it has been active in its markets for a very long time, it has a reputation for high-quality offerings and unique engineering expertise. For most of ManCo's history, its high-end equipment was the best available and customers were willing to pay a premium for it. This changed in the aftermath of the recent financial crisis and what, in hindsight, turned out to be a large-scale downturn across its industries. Moreover, new competitors from, for instance, China entered its markets and began selling equipment at a fraction of ManCo's prices.

The low competitor prices created a challenge for ManCo. Pressure to produce materials as cheaply as possible and the uncertainty of running production sites as investment objects radically changed how customers understood their equipment. What mattered now was that processing equipment and plants could be delivered quickly and cheaply. Overall quality, reliability and

dependability were no longer differentiators. This transformed ManCo's equipment from sought-after investment objects into necessary evils on which customers tried to spend as little as possible, as they were more interested in short-term returns than longevity or maintainability. Consequently, ManCo and other companies were forced into a price competition, which ManCo could only lose.

As a means to defend itself against the eroding differentiation of its equipment and to avoid competing on price, ManCo decided to make the revival and growth of its service business a strategic priority. Although ManCo has always offered basic services, such as the transportation, installation or commissioning of its equipment, the new aim was to engage with clients on a more personal level and to reap the benefits of ManCo's large installed base. Visits to customer sites and inquiries about their equipment and overall production processes became a management directive. Today, most of ManCo's personnel is highly mobile with its most popular service engineers travelling at least 200 days per year. The aim is to offer customers something more than machinery in order to build relationships and to become a "trusted advisor" to which customers can turn. This strategy has been successful. Customers increasingly began experiencing new and unexpected difficulties in production processes that involved cheaply sourced machinery. In turn, ManCo's engineering knowledge, sold in the form of replacement parts, maintenance, repair, process training or audits, became a profitable business. Today, services contribute more than half of the company's revenues and were viewed as an effective way to demonstrate superior product quality and, thereby, persuade customers to make follow-up purchases with ManCo.

With services at the forefront, most of ManCo's revenues pertains to spare-part sales. As customers try to cut costs, services focused on maintaining and repairing machines take precedence over sales of new equipment. Furthermore, a broken part is likely to lead to a shutdown of the overall machine, which then affects the whole process chain within the plant. The cost of lost production often amounts to several hundreds of thousands of US dollars a day. Speedy repair, maintenance services and spare-part provision are therefore important for ManCo's customers. Apart from selling parts, ManCo tries to mobilize its ability to service the whole process chain in a plant or mine –a feature that sets it apart from other suppliers in its industries. ManCo's process knowledge allows it to offer everything from repair and maintenance to shutdown overhauls and remote monitoring of plants.

ManCo's customers are often larger organizations. One of its main customers is ChinCo, which has around 60,000 employees and operates in 60 countries. ChinCo has a number of regional production sites at which different forms of mineral resources are extracted from the ground and processed until they have been transformed into usable products that can be sold to other industrial companies. Many of ChinCo's sites use ManCo's equipment and ChinCo makes ample use of ManCo's services.

Implications of servitization practices for unstable products

> Abigail (Senior Project Manager): *We had a new type of sensor that we are developing, and we wanted to test it. And the site required that we drilled a hole in the cover of the machine. But they wouldn't let us do that. It has no structural purposes, just covering the machine up. But [the client said] 'No, no! Don't drill a hole in our machine! Do it without drilling.'*
>
> KB: *So the sensor itself was fine, but you couldn't...*
>
> Abigail: *Yeah! We were not doing it, 'cause we didn't have a solution for not drilling a hole! Now we are working on something else. Just drilling a simple hole that had no effects, and nobody was willing to take that chance.*

At a first glance, the above interview excerpt presents a seemingly mundane challenge that ManCo's employees encounter when testing a new service offering – a client, for unknown reasons, will not allow a hole to be drilled into a machine. However, a closer look reveals something quite interesting – the client had agreed to a sensor test, which is the basis for a service that is contested in ManCo's industries. Typically, clients are unwilling to share any data related to their product usage or production volumes out of concern that such information may find its way to competitors, their own clients or thieves. Consequently, services based on sensor-generated data are difficult to sell. The fact that this client allowed testing of a sensor-based service in the first place is indicative of its good relationship with ManCo. However, the test never occurred because there was no way to bypass the machine's cover without drilling. It appears that the drill and the engineer about to drill into the cover did something that months of persuading the client and many hours of planning, devising and explaining the service failed to do. A part that only served a structural purpose suddenly and unexpectedly became the determining feature of the machine. Servitization practices affect the machine, even if the service itself does not occur.

This section presents the findings of this article in three parts. First, I show that servitization enacts multiple machines. Next, I discuss what is at stake with the machines and how they, in turn,

become singularized and commoditized. Lastly, I provide examples of "typical" service provision in order to show how these multiple machines are made to co-exist.

Servitization enacts multiple machines

This section details how servitization practices enact machines as four different things: parts, function, engineering knowledge and a business case.

Parts

When ManCo started focusing on services as a means to grow and remain competitive, an important step was emphasising the provision and sales of parts. Parts can be sold at high margins, making their trade a lucrative business. There are three general types of parts. Structural parts mainly keep machines together or cover them. Spare parts are interchangeable parts that, depending on their criticality for a machine's operation, are kept in storage. Wear parts are a subtype of spare parts that, after a period of continued operation, wear out and need to be replaced. With a focus on spare parts and wear parts, ManCo created new offices, budgets and positions in order to allow engineers to spend more time on research and development for new and innovative materials and designs. Parts made of lighter materials are easier to move and, therefore, consume less fuel. Parts that are more durable allow for longer stretches between maintenance stoppages.

For parts to be relevant in the market and to justify the often significant R&D costs, they need to fit both ManCo's and competitor's equipment, allowing for maximum sales. Servitizing by engineering and selling parts that are compatible across a number of manufacturers requires machines in which wear spare and structural parts interface and interact with each other. I often observed engineers hovering together over a laptop, comparing different drawings of parts, 'figuring out what is up and down', and calculating measurements, weights and angles of new parts. These practices enact a machine that is made up of interchangeable parts.

But this parts-machine is not exclusive to engineer's computers. Service brochures also enact this machine when, for example, they make statements like 'avoid downtime by being smart about spare parts' or 'trust our wear parts to keep your operations running reliably'. In fact, some service brochures depict entire machines as composed of different parts (see Figure 9).

Figure 9: Excerpt of a service brochure: "The components of success"

At customers' sites, engineers enact the parts-machine by, for instance, identifying underperforming parts and replacing them with ManCo's own parts, as one informant explained:

> *"We are using [ManCo] parts on competitor's equipment. So if this kiln, if that would be a Chinese kiln, then we would very much like to inspect it, the kiln, identify that something needs to be replaced, hopefully, and then also replace it"* (Peter, Team Leader Service Maintenance)

From the above quote, we can glean that for the parts-machine, the ability to replace is important in its enactment. Sometimes, the replacement of a part requires a lot of service work, especially for older machines that have been customized to fit customer requirements. In these cases, measurements need to be taken on site to ensure that a new part will fit with the other parts. In other cases, replacement parts fit right away:

> *"The Chinese just copy. We can, on some of the kilns we have just replaced with our equipment, we didn't need to change the foundation or anything. Because it just fitted. All holes and everything was in the same place."* (Jack, Mechanical Engineer)

Ironically, such a fit is not necessarily to be expected given that ManCo customizes many of its machines. However, competitors copy ManCo's standard models. In these copied machines, holes that need to hold screws and align with bolts fit perfectly with replacement parts. Interestingly, the competition around machinery now also extends to replacement parts. In some cases, drawings that ManCo has provided to cooperating foundries in the past appear to have found their way to competitors. In other cases, the customers themselves weld metal scraps into shape in order to, at least temporarily, replace a broken part. While ManCo tries to continually improve its replacement

parts by fashioning them out of innovative materials in order to improve their durability or, ironically, rendering them increasingly easier to install and replace, its competitors do so now, too. This has created a situation where parts no longer differentiate a machine. Instead, the competition now centres around which provider can install the largest number of components at clients' sites.

These practices enact the machine as an assembly of different parts. This parts-machine is dominant within ManCo, up to the point that:

> *"Services are regarded mostly as something that generates potential for sales of parts. "*
> (Joshua, Service Manager)

Servitization practices such as designing, selling and replacing parts enact the machine as parts.

Function

There are other machines apart from the parts-machine. Before a parts-machine can exist, there is the function-machine – a machine that simply serves a function. Its sole purpose is to transform inputs into outputs. On ManCo's own premises, machines no longer have such a function because their production sites were sold long ago. Function machines are enacted at customers' local sites, where parts-machines have been assembled, are in use, and need to run predictably. The function-machine becomes most salient when its function is at stake.

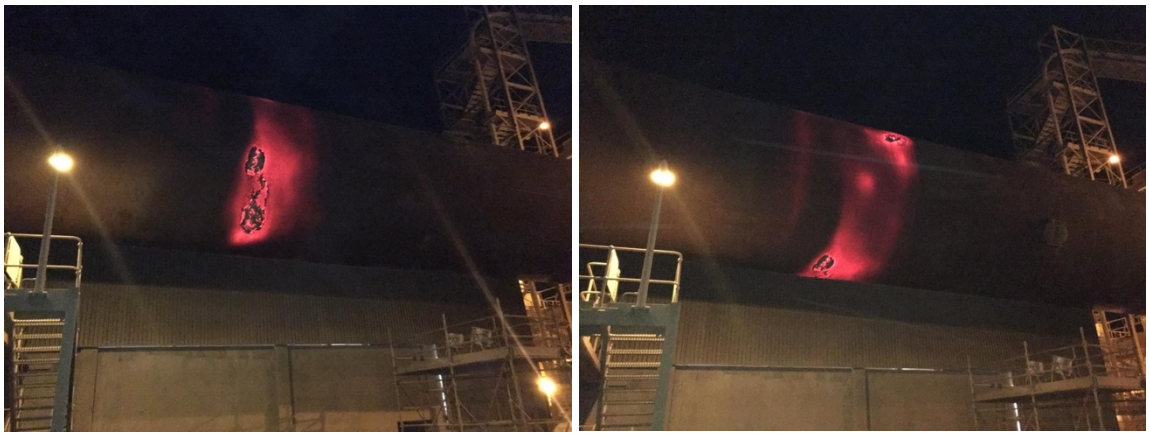

Figure 10: A rotating kiln with a hotspot

This can happen in different ways. Sometimes, the machine draws attention to its function all by itself. Figure 10 shows a kiln from one of ManCo's customers. The machine is rotating, with each side showing a glowing hotspot. While the kiln is working (it turns and heats after all!), it still

appears that something might not be *functioning* properly. Where does servitization's enactment of the machine enter in this case? The photos were taken by a concerned employee, who e-mailed them to ManCo's global service support team with a request for an inspection. In this instance, the request for service enacted the machine as a function. Had the employee acted differently, the machine might have become something else – a heap of burning metal or, possibly, an insurance claim. When the photos were taken, there was not much else the machine could be – certainly not a part, for it was not clear which component of the machine could be responsible for the hotspot. Moreover, the customer's employee could not simply call ManCo and request a replacement machine because such machines are prohibitively expensive and take several months to manufacture, transport and assemble. The employee's doing enacted the machine as a function – one that is no longer ensured.

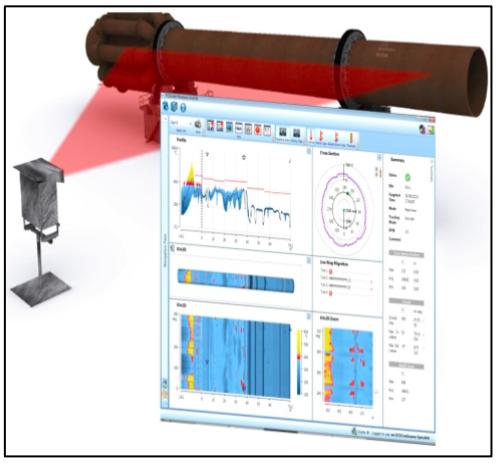

Figure 11: Screenshot from ManCo's intranet showing the data resulting from a scan of a kiln

Service engineers further enact the machine as a function by traveling to the customer's site to take various measurements (see Figure 11). In this example, they might ask questions such as: How hot are the hotspots? How is the kiln's ovality? What is the exact degree of its inclination? How much load is on its bearings? Relevant measurements are taken and compared against standard values. Sometimes this can happen on site and sometimes it is necessary to run more detailed analyses at ManCo's local laboratories or at its headquarters (e.g., to determine the chemical composition of a machine's outputs). Using measurements to determine how a machine is functioning is also prevalent in day-to-day operations:

> *"I don't think anyone is running at what [production levels] we say they should run. They always put more through [...] we can see it where you have an inspection report, where we send, for example, plant service and maintenance to site, to measure the kilns, go through*

> *them, and do a report. You have like a designer value and then you have current value for tons per day and most of them [the current values] are higher."* (Hunter, Mechanical Engineer)

A divergence between actual and suggested, or 'designer' values allows ManCo's engineers to problematize how the machine functions. Overproduction as described in the above quote has a direct impact on the machine. It may still work (in that it is still running), but there will be increases in wear and the strain on materials designed for lower throughput values, giving way to more unanticipated damages. Enacting the machine as a function then means taking measurements of how the machine is run, finding out the strain of overloading machines by taking measurements from their bearings, inlays, outlets or chutes. Such strains are compared to standards, the deviation articulated and documented in inspection reports and, importantly, communicated as being problematic to clients. Customers are informed of the implications of these divergences for the machine and, in turn, the overall plant, typically in terms of US dollars per day of stoppage.

Enacting the function-machine is more difficult when customers have purchased cheaper, lower-quality equipment, such as equipment from certain Chinese competitors. These machines are often exact copies of ManCo's designs (sometimes they even have ManCo's logo). Such equipment will, at least temporarily, work as if it was as durable and reliable as the original. In order to enact function in such cases, one informant explained that it was important to make customers aware of likely future problems. This informant explained a plan that his department was working on:

> *"It's a strategic plan where you go in and then you talk to the customers and then you inform them: 'We know this because you have a Chinese one [machine]: This fails, this fails, this fails, this fails.' And then we have to make a time line, you know. What is failing after how long time, based on ... well, that is pretty hard but we try. But we know which parts are failing but sometimes they fail after two, sometimes after six months, it depends on how they run."* (Jack, Mechanical Engineer)

Correctly predicting failures in seemingly well-performing machines impresses customers. Urging customers to contact ManCo as soon as a failure occurs prompts them to keep enacting the machine as a function, to be mindful of its values and to watch for any deviance. However, once a function-machine is enacted, it can give way to a parts-machine because only with the right parts at the right time can the machine be made to function correctly again. In other words, in every function-machine rests an opportunity to sell replacement parts and services.

This becomes particularly clear when ManCo tries to problematize high-quality and well-run equipment. In one instance, ManCo wanted to sell a newly developed wear part, a lining made of an innovative and particularly long-lasting material. However, ManCo found that it was impossible to enact a parts-machine: customers did not want replacements of their existing linings. ManCo's engineers spent long hours estimating and calculating the part's underlying parameters in order to make a good case for the parts-machine. They found that stopping a customer's machines in order to exchange worn linings, even for an hour, would mean lost production worth up to USD 250,000. The longer-lasting wear part would reduce the need for stoppages and, hence, save money. One informant stated that this part was so good that it was 'a no brainer' and that any customer would be 'crazy' not to buy it. However, customers remained reluctant to deviate from their tried and trusted weld-on lining:

> *"Someone in my department did an analysis on past deals. Why are we not selling this? And basically, what came up was this mismatch [between…] how we want to sell it and how the customer wants to buy it. That's not aligned. We want to sell it as a product, the customer wants to buy it as a service."* (Abigail, Senior Project Manager)

The above quote indicates that selling the part as a replacement part, like a product, was not what customers wanted. They wanted to buy it as a service that rectified a wrong. But, to the customer, there was no wrong to rectify. Consequently, the parts-machine could not be enacted in this case because the function-machine was not at stake. In response, ManCo launched a multi-media problematisation campaign to draw attention to the function-machine. The campaign included an online calculation tool into which customers could input their current values for material and capacity as well as their current liner's wear life. In return, they obtained an indication of how much money they could save by using ManCo's new wear part. The campaign also included brochures with select use cases and testimonials highlighting that the new wear parts 'drastically' outperformed other solutions. The company also produced videos explaining how the 'frequent shutdowns' to exchange wear parts created bottlenecks in production as well as other documents that depicted the original parts as failing to keep up with rising industry demands in terms of wear life.

Engineering knowledge

If enacting a function-machine involves finding and expressing a deviation in the machine's measurements from the norm, then enacting the engineering knowledge machine is to explain

such deviations and to provide recommendations. Engineering knowledge is the essence of the machine, without which nothing would function and which, ultimately, makes the different parts fit together. Such engineering knowledge is proprietary to ManCo. Some informants called this knowledge 'the greatest competitive advantage that we have in the company'. This engineering-knowledge machine is enacted by service engineers and sales employees.

The engineering-knowledge machine comes about when engineers interact with the machine, as they know what to measure as well as when and where, and they are able to tell customers what those findings mean in terms of availability, uptime or lost production. This differs from the function-machine – although quite a few people might be able to use an infrared thermometer to measure a kiln's temperature, interpreting that result (apart from its deviation from the average) and drawing conclusions about what it means for the machine is a skill that few have. These specialists can, for instance, understand the importance of the shape of a burner's nozzle for creating an optimal flame. They also know when it would make sense to use a special high-temperature camera instead of an infrared thermometer. When primary fuels, such as gas or coal, are to be substituted with alternative fuels, such as old tires or local waste, these engineers understand how to mitigate the variance in the alternative fuel's humidity and density levels.

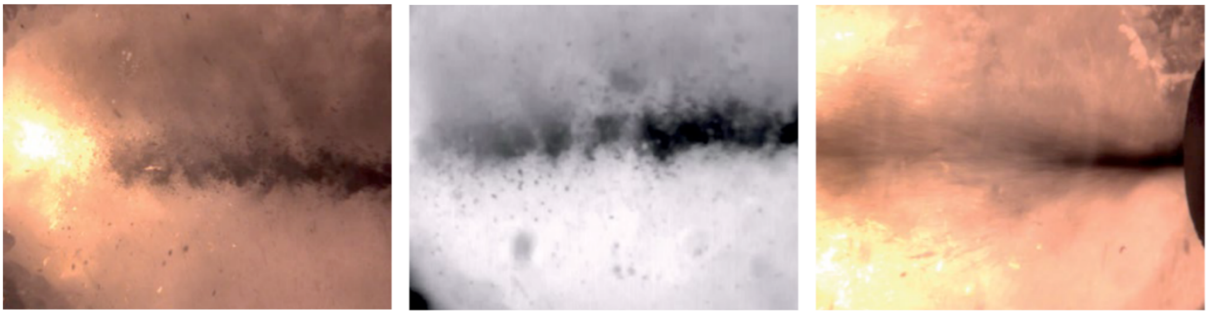

Figure 12: Burner-flame footage, left and right on the visual spectrum, middle on the infrared spectrum

In Figure 12, the left and middle images show how a burner burns a mixture of primary and alternative fuels, both on the spectrum visible to the human eye and on the infrared spectrum. The lighter the colours are, the hotter is the flame. Dark spots indicate cold, unignited fuel. Service engineers understand that the dark spots demarcate the solid alternative fuels, which are poorly suspended and, therefore, drop out of the flame. Engineers can mobilize this knowledge together with the camera evidence to make a strong case for replacing the focal burner. In the actual case

involving the above photos, the customer agreed to let ManCo install a new burner in order to better burn alternative fuels. The new burner was an innovation developed through an extensive research and development project that ManCo had undertaken in cooperation with a local university. 'Our knowledge base […] provides the basis for future improvements', a ManCo R&D engineer explains. The flame footage of the resulting burner on the right shows a much hotter flame and hardly any spots of unburned fuel. Important however, is that executing this engineering knowledge enacts this machine. Experienced and trained engineers decide which parts need repair, which parts need to be replaced and which parts can be retained.

But how to verbalize, how to sell this machine to customers? Sales employees typically lack this deep engineering knowledge, so rather than demonstrating, they enact the engineering knowledge machine by talking about it:

> *"We know our products best because we developed, manufactured and commissioned them. This means we should be able to recognise weaknesses before they become a problem."* (ManCo Service brochure)

> *"Instead of simply treating the symptoms, we identify and treat the actual root causes."* (ManCo Service brochure)

The above statements enact the engineering knowledge machine by emphasizing service engineers' knowledge. The notion of a root cause indicates that the symptoms are brought about by something else – a chain of causes that originate from the same root. In this regard, machines are enacted as complex but logical in that they obey the laws of cause and effect as well as the laws of physics, electronics and chemistry. This is no longer about a function or about parts.

Therefore, sales employees try to use service engineers when selling services. When it comes to closing service deals, sales employees coordinate meetings with customers in such a way that they can be joined by an engineer. While sales employees may be able to talk about parts and functions, only engineers can most credibly talk about a machine as engineering knowledge:

> *"The sales managers, operational managers, they are just noise. The actual value is the specialist who knows about the machinery."* (Jacob, Team Leader Plant Service Sales)

Informants agreed that service engineers are very persuasive because they wish to remain objective and have little to no intent to sell. Moreover, they do not have to engage in sales. As

their deep knowledge makes them easily hireable elsewhere, ManCo largely refrains from imposing sales targets on them. That makes engineers even more credible machine enactors:

> *"We are known for having a lot of process knowledge, so when we say: "You might wanna tweak rotation speed a little bit, because that will do this and that, then the customers listen."* (Abigail, Senior Project Manager)

By knowing and explaining how different parts relate to one another and suggesting how to improve on current situations, engineering knowledge machines are enacted. Even when a part needs to be replaced, some engineers will refuse to recommend ManCo parts 'because doing so would be biased'. Therefore, their recommendations do not necessarily aim to enact the parts-machine because part sales are of comparably little interest to service engineers. Their job entails more than replacing parts – it involves finding the right part that is made of the right materials and ensuring that it enhances the machine in the right way at the right time.

Business case

There are instances in which servitization practices enact the machine as a business case. When testing potential services, ManCo employees typically use calculative tools to derive likely outcomes. For example, they use net present value (NPV) in order to render future payments comparable. This is particularly important when new parts are developed, as one informant explained:

> *"It comes down to where we do things on calculation. We do net present value calculations [...] based on that business case, and estimate of the project cost, [so] you can project backwards from the future earnings back to what is that in current value. And then you compare that to the actual cost or the estimated cost. That's not the only thing we look at, but it's one of the important numbers. How much does it cost? What is the NPV5? And how long does it take to implement? 6 months? 12 months? 18 months?"* (Abigail, Senior Project Manager)

However, a business case for a service cannot work if the focal machine is not taken into consideration. ManCo's business cases, which are typically created as Excel files, feature the machine in terms of its basic features (see Figure 13). However, the machine is not simply transformed into static numbers. Instead, its core values, such as production hours per day, are *variable*, so that different numbers can be inserted into those fields. This version of the machine is very different from the function-machine. Instead of measured values or values representing the engineered ideal, it is possible to insert different *hypothetical* values and to calculate how the machine might fare with a new service offering under different conditions. This variability sets

the business case machine apart from mere efforts to render servitization commensurable. Although many values are ultimately expressed in monetary terms, these statements about value are neither final nor viewed as ultimate truths. Instead, they allow for testing of different scenarios and assumptions about the properties of new service offerings in order to get a feel for what works.

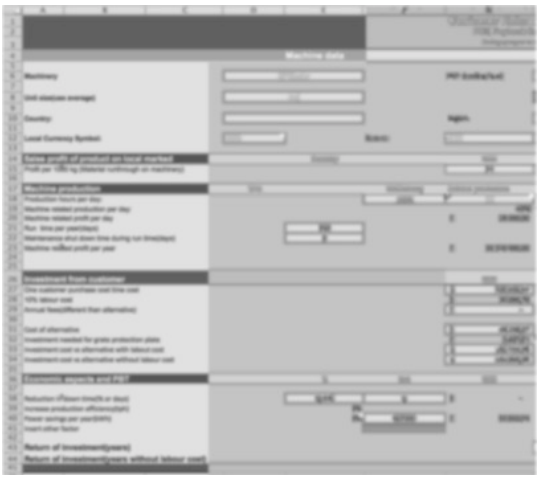

Figure 13: Screenshot of a machine's value-input page in a service business plan

The business case machine allows ManCo to get a better understanding of, for instance, the risk of offering a longer guarantee on a replacement part or the return on investment that customers could realize if they implemented ManCo's suggestions. In this format, the business case machine is able to travel to the customer's sites, for example via email into the offices of the plant management in order to persuade them to invest in service.

But the business case machine can also be enacted in other shapes, such as a budget. Local sites typically have funds at their disposal to cover some of their service needs. These "smaller" operating expenses (OPEX) are typically in the range of USD 10,000 to USD 60,000 and can be approved by the site's management without the involvement of the customer's central headquarters. Without having seen these budgets themselves, for customers giving up such information loose bargaining power, ManCo's employees nevertheless emphasized the need to understand how and when they become open for planning and detailed how they act upon such opportunities:

> Peter (Team Leader Service Maintenance): "*You can never go into a client and say: 'Please, buy this service contract', because he can never get it approved. Because as an individual product or solution it is simply not with a focus on budget."*

KB: "*So, what do you do instead?"*

Peter: *"If you replace [a machine], the client will ask what CAPEX investment he would be around, and let's say it would be a one million Euro investment. He will ask his manager for 1.2, because the project manager, he will always try to have a buffer, right? [smiling] That leaves the door open for eating some of that buffer that he has. So we tell the client: "Ok, we can actually push the guarantee for these parts up to five years, but against a service contract that enables us to go down there every year and monitor the actual operation of the [machine], to make sure the balance is correct and that you run it ok. You don't have to pay for the service contract now, you can pay it through the maintenance budget year after year."*

The way of 'doing' servitization detailed above enacts the machine as a business case. 'Buffer' budget, originally designated to purchase the machine as a form of capital expenditure (CAPEX), is transformed into a service budget (OPEX) , which, in turn, affects the calculation of the machine's cost by means of longer guarantees and ensuring correct utilization. Put differently, the budget may determine which machine can be bought, but servitization practices determined what kind of business case the machine could be and how and when it should come about. Again, manipulated here are hypothetical, ideational values. Customers have little incentive to reveal their actual CAPEX budgets and ManCo's sales employees rely on their experience to estimate the size of the buffer that can be used on services.

In a difference instance, the business case machine is enacted by servitization practices needed for insurance: ManCo's customers, as is common in these industries, are insured against the losses emanating from lost production. Insurance companies themselves calculate the premium they need to charge for their different contracts, amongst other factors, also based on which supplier delivers crucial inspection and maintenance services. Importantly, insurance companies do not trust cheaper and, typically, less-qualified service suppliers to optimally tend to machines. Consequently, if customers choose to obtain their yearly inspections from anyone but the leading suppliers, such as ManCo, they are likely to be charged a higher premium. According to several informants, the difference between the two premiums is greater than the price of the actual service. In these cases, customers do not opt for ManCo's services purely because they believe them to be better, but because they fear that insurers will punish them if they choose another supplier. This was mirrored in one of ManCo's marketing displays, which read:

"It's more than maintenance; it's protecting my customer's investment" (A service Engineer quote displayed on a ManCo Service Banner)

Notably, it is not necessarily the customer who cares too much about this investment, but rather the insurance companies that will have to pay if this investment is impaired. In this regard, hypothetical values are also at play. While insurers' exact calculations remain opaque, the hypothetical risks they assign to a machine that is not subject to the best inspections can make it expensive to insure. The higher premium is difficult to offset, even if the cheapest service supplier is selected. ManCo's services enact a business case machine that implies a lower risk for the insurance company and, as such, requires a smaller premium. In turn, ManCo's servitization practices render the business case machine cheaper for its customers.

Multiple machines can be singularized and commoditized

The above outlined how there are different machines, each enacted by different servitization practices. This section shows how, for each of them, something different is at stake. Furthermore, the practices that bring these machines to life also put them in a relation with other machines. In so 'doing' servitization, ManCo and its customers also enact the machines as singular or as common. This is summarized in Table 11.

The parts-machine. For the parts-machine, replaceability is at stake. Different components must fit with each other, regardless of their make. Over time, the parts-machine has been so widely perpetuated that customers now buy Chinese machines, knowing that they will be able to replace their cheaper insides with higher-quality ManCo parts, which tend to fit well. As parts-machines become increasingly similar and replaceable, they also become less differentiated and more commoditized.

The function-machine. Finding and problematizing a deviation of the machine's actual measurements from averaged standard values puts at stake the machine's general ability to reliably transform inputs into outputs. The function-machine may not be as immediately replaceable as the parts-machine. Nevertheless, the days in which ManCo provided the only equipment able to reliably handle this job are over. Today, a broad range of machines can more or less reliably transform inputs into outputs, and properly functioning machines are common, at least in the short run. However, drawing attention to the function-machine establishes this machine as unique by problematizing its deviation from all other machines. Acts of monitoring and announcing deviations (and possible impairments) enact a differentiated machine.

The engineering-knowledge machine. When engineers know what to measure and determine what the results could mean, ManCo's premium brand is at stake. ManCo's extensive expertise and process understanding are unique in the market and are chiefly enacted by its service engineers. These engineers have a strong tendency to resist corporate demands for upselling. Moreover, their advice is taken seriously and highly valued by customers, and often engineers and customers form professional friendships over time. This makes it difficult for competitors to gain a foothold. It is in such enactments of the engineering machine that it becomes singular.

The business case machine. Servitization expresses the machine in variable and hypothetical numbers in order to make it easier to manage. In this regard, money is at stake. Alternative scenarios provide greater insight into how a service might affect a machine and enable better estimates of how its economic viability could change. In so doing, the machine becomes one composed of numerical values used to estimate its unique business potential. In turn, the machine becomes somewhat easier to compare but remains different from other machines.

The implication of this is that all of these machines are very different from each other. How can we still speak of and mean one machine? In order to answer this question, the next section considers how these multiple machines are organized into a machine multiple.

Table 11: Multiple machines

Machine is…	Enacted by…	Singularization/ commoditization	Quote
Parts	• Detecting and pointing out broken or underperforming parts • Persuading customers of the usefulness of new parts • Replacing parts to improve overall operation	*Commoditization:* Almost all components of the machine are replaceable; machines provide a platform for selling new parts to customers	"… some customers buy cheap. And then when they start to get cash flow, they go in and then they start there and we just take all that out and replace it with ManCo." (Jack, Mechanical Engineer)
Engineering knowledge	• Understanding why the machine's functioning and values deviate from the norm • Explaining how deviations occur • Demonstrating the meaning of deviations and repairs from technical and economic standpoints • Demonstrating that the essence of a machine is the understanding of how it's different parts work together and the consequences • A deep understanding of the machine allows for treatment of its parts in novel or different ways	*Singularization:* Engineering knowledge is unique in the market and proprietary to ManCo	Abigail: Some of the serious development we are doing [is] an alloy, we are doing it in a sneaky way. So you can't reverse engineer it. KB: What does that mean? How do you... Abigail: It means that we are putting in so little of some things that you cannot really measure, but it has an effect. And also, the second part is how we treat it when we manufacture it. You can't see that in the piece you are trying to … you need to be there. (Abigail, Senior Project Manager)
Function	• Taking measurements and comparing them to standard values to determine current functioning • Problematizing the way in which the machine is functioning in terms of deviations between current and standard states • Suggesting solutions involving additional services/part sales	*Singularization:* The machine's functioning is different from the norm	"The main findings [of the service report] the customer finds out [on site]. And, you know, it's a matter of perspective on how you put that. Because you can say: "Oh, we see that this equipment has this much air and you should pay attention to it in the future because it might break down … or, you could say that: "Yes, I see this and then you should pay attention to it and if you're interested, we can follow up with a call and then see what kind of support you need from us." (Joshua, Service Manager)
Business case	• Calculating hypothetical numbers reflecting a potential change in a machine resulting from a service • Comparing standard/current values of a machine to the hypothetical values • Evaluating the machine and making decisions on services based on calculations	*Commoditization:* Numbers and calculations allow for direct comparisons	"So we tell the client: 'Ok, we can actually push the guarantee for these parts up to five years, but against a service contract that enables us to go down there every year and monitor the actual operation of the kiln to make sure the balance is correct and that you run the equipment ok. You don't have to pay for the service contract now, you can pay it through the maintenance budget year after year.'" (Peter, Team Leader Service Maintenance)

From multiple machines to the machine multiple

This section details how clashes among the different machines are avoided through separation. It also demonstrates how machines are coordinated when separation is not possible.

Avoiding clashes by separating machines

Given the long lifespan of equipment and the fact that different engineers with different backgrounds see to it and pay attention to different issues, we can view industrial service provision as episodic. In other words, it plays out in many smaller events distributed across time and space as opposed to being one singular event. These practices do not occur within a vacuum – they are linked to occurrences in the past and the future.

Table 12 presents such episodes as “snippets”, each of which occurred on its own and all of which make up what it means to ‘do’ servitization. This arrangement of episodes shows how different machines are situated and how they become separated or intertwined along the service-provision path.

Table 12: Multiple machines are enacted episodically at different times in different places

Place	Enacting parts	Enacting function	Enacting engineering knowledge	Enacting business case
Customer site	(2008 continued) A closer look reveals multiple cracks and a broken tooth in the pinion of the gearbox. ManCo's engineer suggests replacing the damaged pinion as soon as possible. He explains ManCo's new concept for such parts – a modular approach that makes replacements relatively easy. However, it takes an average of 20 months to produce and deliver such parts. In 2011, the replacement parts finally arrive. While the machine is standing still for two weeks in order to replace the broken pinion, other non-broken parts are replaced as well.	A piece of ManCo equipment is installed in 1977. In 1997, a visual inspection confirms that it is still in "very good" working condition. In 2008, an unforeseen event in the production process affects the machine. An inspection by a ManCo engineer reveals problems within the machine's gears.	(2008 continued) ManCo's engineer recommends buying not one new pinion but, given the equipment's age and way it runs, an entire set of parts in order to "secure" the continued operation of the site so that if another breakdown occurs, the customer will not have to wait another year for important parts to arrive.	(2008 continued) Plant management weighs the cost of lost production due to a likely machine breakdown against the cost of ordering new parts. New parts will have to be ordered. ManCo promises an installation time of about two weeks, which is deemed acceptable. The customer places an order with ManCo.
Customer's central purchasing				The central purchasing department's main task is to help local sites order the parts that make the most sense commercially. Purchasing employees know what to look for when, for example, ordering expensive replacement parts. Suppliers

				are evaluated using different calculations that weigh and compare key parameters, such as price, lead time, time required for installation and necessary security measures. The best solution may not always be the cheapest but the one that is viable "overall".
ManCo	2017-2019: While ManCo has somewhat detailed information about its installed base, most of that information is on a general, machine-level. Now that services, and spare parts are contributing an increasing proportion of the company's revenue, there is a new effort to keep track of not only the machinery sold but also the parts used in those machines and when they are replaced. The aim is to provide customers with better spare-part services in the future		Autumn 2018: " we have a customer that we have had a long relationship with. They would ask us something like a consultant on something about their process. And sometimes they would even send samples, to test in the lab, and we have done that without charging, because it's a focus customer, right [laughing]. But, I think that because we are a premium supplier, they kind of expect that." (Joshua, Service Manager)	Spring 2016: A service R&D employee at ManCo's headquarters works on an elaborate spreadsheet, calculating different scenarios for efficiency gains yielded by a new replacement part. The subsequent part development must occur in such a way that its purchasing cost can be offset with efficiency gains within six months.

The practices detailed in Table 12 enact the four machines, which seem to co-exist with hardly any conflict. This is no accident – it is achieved through spatial, functional and temporal separation. Different machines can co-exist because they are separated by time, place or function. Moreover, different machines are enacted in different spaces. While machines can be enacted in many different ways at customers' sites and ManCo's premises, at the central purchasing department it can only be a business case. This is due to purchasing's dedication to providing comparability and commercial rational. Its main task is to keep away the function, parts and engineering-knowledge machines. How is it then possible that multiple machines can co-exist in other places?

Potential clashes from spatial co-existence can be avoided through, for example, functional separation. In this regard: different machines can come about from practices that are generally associated with different functional units. In ManCo, for instance, engineers are generally understood as the sole authorities who have the expertise required to fully comprehend, build and service machines. However, various practices across functions can move a machine into the engineering domain, such as when customers ask for expert advice. Whenever ManCo's sales employees mobilize engineers during sales pitches or administrative staff direct customer questions to engineers, they all enact the machine as engineering knowledge. In contrast, ManCo's sales employees organize service encounters, set up new service offerings (typically revolving around new part sales), and calculate their viability in coordination with local sites and customers' central purchasing departments. These practices overlap in enacting the parts-machine and business case machine. In this situation, the different machines are formally separated in that different sales employees tend to have different authorities based on their experience (e.g., sourcing new parts or devising new service agreements). However, such functional separation may not always be intentional or desirable. I observed the frustration of several ManCo employees when they learned that an auditing service had been delivered without a follow-up from a different department to remind the customer to adhere to the recommended timeline of pre-ordering wear parts and scheduling service visits. In fact, I wrote in my field notes: "Many little silos make it hard to coordinate service delivery across departments under certain conditions".

Sometimes employees cross the functional divides, typically when there is reason to believe that doing so best serves the customer. In one instance, a new technology for separating materials was developed, but it was too expensive for the line of business for which it was originally developed.

Given the green light from management, Abigail started networking to find resources and a team in a different business line that would further develop this technology. She was subsequently named the project manager for this new initiative:

> *"[…] we work closely together. Because we do share resources and stuff like that, there is specific things that then that's... then we can borrow resources for eight weeks and then we're done. But this is... yeah. I think it's obvious, right? They have something that is a core product in [business line A], core knowledge, and [business line B] has the market that is open to trying it out. So we have to build a bridge"* Abigail (Senior Project Manager)

This appears to be stricter at customers' sites, where different functions may enact the machine in different ways, as evident in this quote:

> *"…the pain of the maintenance manager is different from the pains of an operation manager or procurement manager. Procurement is price and lead time, most often, right? [For the] Maintenance manager it's of course quality, speed of delivery, such things. Whereas the operations manager is more [about] capacity, cost, like energy cost, and the quality of the [industry] product."* Peter (Team Leader Service Maintenance)

Also here there are different functions that enact the machine as different things. Again have employees both differing and overlapping authorities when it comes to enacting different machines.

As servitization occurs over time, temporal separation made it possible for different machines to be enacted within the same year (e.g., 2008; see Table 12). In order to enact the function-machine, the impairment of its output had to be noticed and deemed problematic. Further probing revealed a specific problem within a gear's parts, which, together with the suggestion of how and when to replace it, directed attention to the machine's parts. In recommending that a whole set of parts be ordered, the service engineer used his knowledge to suggest the best course of action given the parts, the age of the machine and its operation. These suggestions were subsequently inserted into the business case that collected data on the machine's expected lifespan, estimates of production impairments and the impact on the budget. That business case compared various options, such as replacing the entire machine or letting it run until it failed. Not until after such calculations were made could the new spare parts be ordered and installed.

This demonstrates that multiple machines can comfortably co-exist because they are separated across space, functions and time. However, we can also speak about the machine as one when, for example, its multiple versions are sequenced in time. This raises a question about what happens

when it is impossible to separate the different machines from each other. How do we still arrive at one machine? This is addressed in the next section.

Coordinating multiple machines

When separation is not possible, clashes are managed by prioritizing one machine over the other or by incorporating different machines into one. Within a single space, such as ManCo, most conflicts are solved through personal networks. Most of ManCo's employees have been with the company for many years, during which they have developed their own contacts with whom they can negotiate and exchange favours. Therefore, the prioritization of one machine over another is negotiated on a case-by-case basis. For example, one ManCo sales employee detailed how he overstepped his functional authority by making a personal call to the procurement team. He asked them to disregard company policies and source from a specific supplier in order to obtain a particularly well-made part for a client regardless of the additional cost. In this instance, the parts-machine was prioritized over the business- case machine.

In customers' purchasing departments, clashes between machines are resolved by translating the engineering-knowledge, parts and function-machines in a way that allows them to become part of the business case machine. This is practically achieved when employees in the purchasing department try to take the wishes and suggestions of the local sites into account. For example, if local sites prefer a certain supplier, purchasing employees will ensure that this supplier is alerted of a new tender and that its offer is included as an option in the initial selection round. When different offers are evaluated, purchasing's calculations do not allow for allocation of bonus points to suppliers with experienced service engineers or friendly hotline staff. However, ChinCo's purchasing employees were adamant that price, while important, is not everything. Therefore, they were sometimes willing to change the way in which they compared and evaluated offerings. In fact, at times, ChinCo accepts a more expensive offer when, for example, local technical experts convince it to assign more weight to such parameters as speedy delivery (incorporating the function-machine) or to take additional factors into account, such as the technical prowess of the supplier (incorporating the engineering-knowledge machine).

Different machines can also clash at customers' sites. This occurs, for instance, when maintenance, operations and procurement managers disagree about the best course of action for a machine. In such cases, the site manager typically makes the final decision. Depending on the

situation, the site manager might prioritize one machine over others or try to find a compromise by incorporating different machines within one budget. The management of clashes between different machines is an outcome of case-by-case negotiations.

However, coordination work is not the only factor that can help us think about the machines as one. Sometimes the machines can be peacefully presented side by side, as depicted in Figure 14.

Figure 14: Extract from a ManCo service brochure enacting multiple machines

The service brochure shown in Figure 14 explains how machine parts follow a "plug and play" logic, making any exchanges easy and quick (parts-machine). It also details how the service "protects" the machine against failures and ensures its availability (function-machine). The brochure explains that this is possible thanks to ManCo's core competencies and its "state-of-the-art" technologies (engineering-knowledge machine). Lastly, it explains that the services are an attractive investment with a short payback time (business case machine).

Interestingly, multiple machines are also found next to each other in other documents that are not necessarily aimed at customers. For example, ManCo's patents for its equipment and service

techniques present different machines comfortably beside each other. For example, a certain technique patent may be described as improving the functioning of a machine, with a second paragraph providing an exemplary calculation detailing how overall productivity and useful lifespan are affected.

At least when communicating what it means to 'do' servitization, differences between multiple machines seem acceptable. This might, at least in part, be due to the fact that nothing important is at stake. Service brochures and patents speak to a broad audience and more machines seem not only acceptable but helpful in terms of persuading the target audience. However, when it comes to the actual 'doing', servitization practices can have larger implications, which means that the different machines are more likely to clash. As such, they require more active management through, for instance, separation, sequencing, domination or incorporation, as discussed above.

The need to manage multiple machines also has implications for what it means for a machine to be singular or commoditized. First, a singularized machine may not always be desirable or useful. For ManCo, the commoditized parts-machine is the main source of service revenue. At the same time, the function and engineering-knowledge machines are important enactments, as they can, for example, tip the scales in ManCo's favour during a tender process. 'Doing' servitization means both enacting and coordinating multiple machines and, in so doing, rendering them commoditized at times (when enacting the parts-machine) and singularized at others (when enacting the function, engineering-knowledge or business case machines).

Discussion and conclusion

Theoretical contributions

The aim of this article was to explore how differentiation is achieved through servitization given that the underlying product is unstable. The extant literature suggests that servitization can create differentiation and counter the effects of product commoditization (Huikkola et al., 2016a; Matthyssens & Vandenbempt, 2010; Rangan & Bowman, 1992; Robinson et al., 2002; Visnjic Kastalli & Van Looy, 2013). However, servitization is difficult to implement (Benedettini et al., 2015, 2017; Finne et al., 2013; Kowalkowski, Gebauer, Kamp, et al., 2017). One reason for this difficulty might be that we have come think about the product as a stable entity, ignoring research that would suggest otherwise (Kopytoff, 1986; Spring & Araujo, 2017). In order to explore this

from a practical perspective, this article adopted Mol's (2002) notion of multiplicity, which allowed me to investigate servitization practitioners' daily activities. The findings indicate that servitization enacts multiple products. The answer to the research question is therefore the following: servitization practices enact both differentiated and commoditized product multiples, and management faces a challenge of coordinating differentiated and commoditized product multiples in order to achieve one actionable product. Furthermore, the terms 'differentiation' and 'commoditization' carry no value judgements in this regard, as both are necessary for servitization.

Given this answer, the article makes three important contributions to the extant literature. First, servitization is difficult because services enact multiple products. Lee et al. (2016) claim that products and services can be understood as inseparable. The findings presented here demonstrate how such inseparability is practically achieved. This also extends our limited understanding of product instability (Orr, 1996; Spring & Araujo, 2017). In particular, this article shows that products are also unstable within a single biographic episode, where the stability of the product has thus far been relatively uncontested (Kopytoff, 1986). This indicates that products may be even more unstable than first anticipated, revealing more complexity than is currently acknowledged in the literature, which tends to talk about adding services (Baines, Lightfoot, Benedettini, & Kay, 2009d; Spring & Araujo, 2013; Vandermerwe & Rada, 1988) to an underlying product (Davies, 2004; Salonen et al., 2017).

Second, servitization does not exclusively differentiate products and such differentiation is not always desirable. Although differentiation through servitization is prevalent, it is not necessarily achieved in the ways that extant literature suggests. While the literature argues that differentiation is achieved by suppliers using services to forge customer relationships (Tuli et al., 2007), thereby gaining deep customer knowledge (Cohen et al., 2006) and highlighting their distinctive strengths (Davis et al., 2008; Reim et al., 2015), it does not consider the implications of *servicing*. Servicing creates its own differentiation by reducing the product to a limited number of unique features (e.g., a delta between current and desired values, or a deep understanding of how different parts interact) upon which the service acts (e.g., through a repair or a process audit). However, the findings also show that services can commoditize the product when, for example, enacting it as parts. Contrary to what the literature implies (D'Aveni, 2010), such commoditization is not necessarily detrimental. Given the ensuing sales potential, products enacted as commodities

represent important and lucrative business opportunities. Therefore, servitization is less about escaping commoditization (Huikkola et al., 2016a; Visnjic Kastalli & Van Looy, 2013) and more about negotiating across the differentiated and commoditized enactments, and finding compromises when they collide.

Third, the findings demonstrate the coordination work necessary to manage colliding products. When the stakes are low, multiple products can be on the same page. However, when something specific is at stake or when a decision must be made, coordination work is necessary. This coordination work pertains to the thus far under-researched micro-practices of servitization (Kohtamäki et al., 2018a), and it differs from specifying and characterizing the product (Spring & Araujo, 2017), or coping with two opposing business models (Palo et al., 2018). Coordination work pertains to 'doing' servitization but it is easily overlooked in favour of more immediately visible practices, such as service sales. However, it can take up considerable time and energy, and it involves employees on both the customer and supplier side. Coordination is difficult because it is not always possible to reach an agreement. This results in difficult trade-offs with opaque implications – one product must be prioritized over the other in order to arrive at one actionable machine. As servitization research is becoming more interested in practices (Kohtamäki et al., 2018a), the coordination work described here contributes a more nuanced understanding of what it means to 'do' servitization and why it is difficult.

Conclusion

A key understanding in the literature is that servitization protects companies from product commoditization. The research presented here shows that services both differentiate and commoditize products, each of which is important for servitization in its own right. Furthermore, it highlights the importance of product instability for servitization. In this regard, product instability refers to product multiplicity, which, at times, requires coordination and demands often unseen but important work on both the customer and supplier sides.

The findings reported here support previous research indicating that servitization consists of parallel and contradictory practices (Palo et al., 2018). Instead of suggesting that servitization practices should be mapped out (Rabetino et al., 2017), the findings of this article indicate that such mapping might be difficult because 'doing' servitization involves many spatially, functionally and temporally distributed practices that nonetheless go under one name. Future

research could map out the *enactments* of such practices in, for example, industries other than manufacturing and in contexts beyond the customer-supplier dyad. In so doing, it can enhance our understanding of the product as well as provide an alternative conceptualization of servitization and the challenges it involves.

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Chapter 6: Concluding discussion

With this dissertation, I have explored servitization at work. My ambition was to challenge three assumptions found in the servitization literature, which I characterized as problematic (Alvesson & Sandberg, 2011, 2013a). In order to explore the basis for these assumptions, I made use of the infralanguage and methodology provided by ANT. In particular, I employed the ideas regarding qualification (Çalışkan & Callon, 2010; Callon, 2016; Callon et al., 2002; Callon & Muniesa, 2005), inscription (Latour & Woolgar, 1986) and multiplicity (Mol, 2002). In so doing, I developed an understanding that differs from that currently posited by the extant literature and I provided a dynamic account of servitization. This account goes beyond the common view of servitization as concerned with companies' resources (Eloranta & Turunen, 2015; Fang et al., 2008; Gebauer et al., 2005; Ulaga & Loveland, 2014) or capabilities (Paiola et al., 2013; Rönnberg Sjödin et al., 2016; Sousa & da Silveira, 2018a; Storbacka, 2011), and instead highlights not only the materiality involved in creating this phenomenon but also its fluidity.

What I did

I mobilized Peirce's pragmatic notion of abduction (Campbell, 2005; Peirce, 1878), which allowed me to consider theories beyond those typically employed in the servitization domain. In particular, it allowed me to move between theory and empirics throughout the course of the study in order to explore concepts that might help explain the puzzling notions I encountered in the literature and in the empirical world.

I started with the servitization literature and, as I learned, I moved between the literature and the empirical world. In so doing, I discovered the usefulness of the ANT infralanguage (Latour, 2005), which I employed in the three articles. My evolving understanding resulted in two separate inquiries into ManCo, a global manufacturing company. The first inquiry, which lead to articles 1 and 2, was focused on servitization as expressed in practitioners' speech and opinions. The second inquiry looked into servitization practices without a priori distinguishing between human and non-human actors (hence, trying to keep the world flat; Czarniawska, 2014; Latour, 2005). In so doing, I have gathered empirical material from time spent inside the company for observations, conducted two different rounds of interviews, and also inquired inside one of ManCo's major customer organizations, ChinCo. The findings presented in the three articles chronicle my move from practitioners' speech acts to servitization practices. The co-authored articles 1 and 2 are more

functional. They begin with an understanding of what servitization is and then juxtapose that understanding with ideas regarding qualification and inscription. These papers focus on how servitization at work emanates from different individuals and local work groups that collaborate globally to devise and sell services. In contrast, article 3 tries to avoid making assumptions regarding what servitization means or entails, and investigates servitization practices in relation to the product.

The aim of this chapter

In this chapter, I discuss the insights emerging from these articles, and provide a concluding discussion on servitization at work as well as its proliferation and containment. The chapter is structured as follows. First, I highlight the contributions that this dissertation makes to the extant servitization literature. Second, I discuss the broader implications of the findings. I conclude by highlighting potential pathways for future research.

Contributions to the servitization domain

In exploring servitization at work, this dissertation contributes to the servitization domain by doubting (see Locke, Golden-Biddle, & Feldman, 2008) and problematizing (see Alvesson & Sandberg, 2011) the assumptions of (1) customer demand from the outset, (2) servitization being a definite thing and (3) products being stable entities. In particular, I detail how the phenomena behind these assumptions do not occur by default but, rather, are an outcome of the coordinated efforts that take place across human and non-human entities.

There is no default demand

Challenging the notion of default demand, the dissertation shows how customers come to demand servitized offerings. A common argument in the literature is that customers demand such offerings because their own needs are becoming increasingly complex (Baines et al., 2009a; Oliva & Kallenberg, 2003b; Vandermerwe & Chadwick, 1989). This dissertation shows that even though customers may have complex needs, those needs are not necessarily obvious or well-understood. Instead, they need to be discovered and qualified (Callon et al., 2002) through measurements, articulation and evaluation. In addition, customers need to be persuaded that these needs are relevant. So doing requires, as article 1 shows, time- and cost-intensive work taking place largely hidden from customer's view. Some researchers argue that a deep understanding of customers helps to build long-lasting relationships with them (Tuli et al., 2007), which disadvantages

competitors that lack such insights (Cohen et al., 2006). However, as was the case in the focal firm, there are also instances in which customer's price concerns become greater than their interest in sourcing from trusted parties. Consequently, for the focal firm, servitization meant not only keeping competitors out but, as shown in article 3, benefiting from the weaknesses of competitors' sub-par equipment and mobilizing those weaknesses as a platform for service provision.

Servitization is also discussed as providing an opportunity to engage with clients in a more relational manner, thereby creating customer centricity and directing the company to pay attention 'where it counts' (Geiger & Finch, 2016; Kastalli et al., 2013; Shepherd & Ahmed, 2000). However, the customer interactions during or after service provision are not the only thing that counts. Crucially, as article 1 shows, interactions are necessary for gaining first-hand access to customers' operations, finding opportunities for casual interactions with blue-collar staff and winning the trust of the local site's management. These thus far unrecognized efforts add to the already known difficulties of setting up a financially viable service business (Brax, 2005; Gebauer et al., 2005a). Moreover, understanding customer demand as an achievement rather than a given helps explain why companies might opt to exit the service business altogether (Finne et al., 2013; Kowalkowski, Gebauer, Kamp, et al., 2017; Valtakoski, 2017).

Servitization is fluid

There is a prevailing assumption in the literature that servitization can be implemented using strategic and linear approaches, for example from offering few to many services (Davies et al., 2007; Oliva & Kallenberg, 2003; Vandermerwe & Rada, 1988) or by following a number of different strategic trajectories (Kowalkowski et al., 2015; Matthyssens & Vandenbempt, 2010; Paiola et al., 2013). More recently, an understanding has emerged that such implementation can be difficult (Brax, 2005; Jacob & Ulaga, 2008; Raja, Frandsen, & Mouritsen, 2017), but there is nonetheless an expectation that companies evolve or somehow develop 'upwards' on their servitization path (Davies et al., 2006; Penttinen & Palmer, 2007).

Article 2 adds to the stream of research that challenges this notion (Finne et al., 2013; Fundin et al., 2012). The article argues that servitization implementation is not necessarily easily plannable or linear in the sense that companies strive to increasingly implement more or less services. Together with article 1, article 2 shows that servitization can be fluid in the sense that its implementation leads companies to manage the way in which they qualify their servitized

offerings. Such qualifications need to take a host of changing requirements into account. Moreover, rather than developing them along a static trajectory, we found that the focal company experimented with service inscriptions (Latour & Woolgar, 1986). Article 1 indicates that there were grounds for proliferating service qualities, while article 2 shows that the focal company tried to manage that proliferation in a centralized and modular manner: While customers will likely demand highly customized combinations of service qualities in order to agree to a purchase, these combinations may not always be feasible to deliver at a higher scale. However, trying to solve this problem by modularizing service qualities underestimates the fluidity of servitization. Creating service modules renders them stiff and fitting such stiff modules together was found to require adaptation, for example because the 'underlying` product struck back at such modularized services.

The influence of products on servitization implementation has thus far been discussed rather statically (e.g., Matthyssens & Vandenbempt, 2010). However, article 2 shows that products are not a reliable basis for service qualities and that this unexpectedly affected the way in which the focal company implemented servitization. This provides further evidence that servitization is not as smooth or submissive to managers' organizing as suggested in the literature – the process is much more bumpy and ad hoc.

Servitization changes the product's boundaries

With few notable exceptions (Kopytoff, 1986; Spring & Araujo, 2017; Thomas, 1991), there is a prevailing but seldom-articulated tendency in the extant literature to think of products as stable entities. This becomes evident, for example, when researchers suggest that services can be "added" to an underlying product (Parry & Tasker, 2014; Salonen et al., 2017; Vandermerwe & Rada, 1988). Products are depicted as providing a stable basis that is compatible with almost any service offering. While Spring and Araujo (2017) show that products are unstable entities, they do so by arguing that product instability arises *across* a product's biography when it is sold, repurposed or recycled.

However, article 3 shows that products can also be unstable *within* a biographical episode even if they are installed at customers' sites, not moving and in continued operation, as in ManCo's case. Mol's (2002) notion of multiplicity helped demonstrate how servitization practices across focal and customer companies enact multiple products. In order to arrive at one that is manageable as

well as serviceable, practitioners engage in coordination work. Furthermore, article 3 shows how the boundaries of the product change and become looser. The product is enacted not only at customers' sites, where it is in operation, but also, for instance, in customers' central purchasing departments, company offices and service brochures. Therefore, the product is more than a physical entity – it becomes unbundled into such things as knowledge and rationalizations. This leads to a new question: Where does servitization start and the product end? In fact, unbundling can even occur with a small spare part, which can be simultaneously understood as a part of the machine and part of the service. However, the point is not that the machine is replaced with service over time, but that it becomes increasingly difficult to say what the machine is when it is servitized.

Articles 1 and 2 point to the under-researched but important role of the product. In this regard, the infralanguage of ANT (Callon, 1986; Latour, 2005; Law, 1992) has proven to be a useful tool for exploring the otherwise hidden efforts to make something appear like a matter of course. Interestingly, as article 3 shows, not all of the multiple products that servitization practices enact are differentiated. Some have to be commoditized in order to move between the focal company and its customer. In so doing, article 3 provides evidence against the common argument that servitization is a sure-fire way to differentiate products (Bustinza et al., 2015; Mudambi et al., 1997; Oliva & Kallenberg, 2003; Porter & Ketels, 2003). This also leads to the question of whether our understanding of product differentiation as inherently desirable is adequate. While product commoditization is generally described as a serious concern (Böhm et al., 2017; Coyne, 1989; Gebauer, 2008; Gebauer & Fleisch, 2007), in the case of ManCo, differentiation and commoditization are both outcomes of servitization practices, and neither is to be understood as better or worse than the other.

These are some of this dissertation's more immediate contributions to the extant literature. However, the findings presented here do more than just suggest a need to replace one set of assumptions with their opposites. This is discussed in the next subsection.

Servitization at work: proliferation and containment

In exploring servitization at work from a non-positivist angle, this dissertation also set out to provide an alternative understanding of the phenomenon of servitization. In so doing, it makes another set of contributions that add to how we might talk about and investigate servitization.

Seeing things differently

The approach adapted here differs from the approach seen in much of the extant servitization literature. Most researchers focus on managers (Chakkol, Karatzas, Johnson, & Godsell, 2018; Martinez et al., 2010; Matthyssens & Vandenbempt, 2010; Selviaridis & Norrman, 2014; Ulaga & Loveland, 2014) and they do so with an a priori understanding of what servitization is or should be. With few exceptions (Spring & Araujo, 2017), such research assumes that the non-human entities involved in servitization are stable and predictable. This has resulted in the widely-accepted notion that servitization entails a move away from focusing on products and towards focusing on customers and their needs (Kohtamäki et al., 2018a; Martinez et al., 2010; Neely et al., 2013; Trkman et al., 2015).

The research presented here sees things differently. First, it tries to view human and non-human entities as equal contributors to servitization. Second, especially in the third article, an effort has been made to keep the world flat (Latour, 2005) by avoiding pre-established assumptions of what servitization is, entails or should be. The results indicate that non-human entities play essential and largely under-researched roles in servitization. They do not always behave in anticipated ways. In this regard, inscriptions involve the transformation and loss of thing-ness (Latour & Woolgar, 1986). When managers act upon them, they do not take the entirety of the world into account. This acting at a distance from the world has consequences that are sometimes difficult to anticipate, as shown in article 2, where non-human entities interfered with the company's servitization efforts. This shows that objects play an important role even if managers' speech acts might suggest otherwise. A focus on practices, rather than speech, helps to shed light on this matter. In this way, the approach adopted here lends itself to a more general discussion of what servitization is.

Servitization at work

Servitization is often characterized as a strategy (Baines, Lightfoot, Benedettini, & Kay, 2009b; Kowalkowski, Gebauer, & Oliva, 2017; Lee, Yoo, & Kim, 2016), journey (Baines, Lightfoot, & Kay, 2009; Brax & Visintin, 2017; Martinez et al., 2010) or change process (Baines & Lightfoot, 2013; Barnett, Parry, Saad, Newnes, & Goh, 2013; Martinez, Bastl, Kingston, & Evans, 2010).

This implies an expectation of somewhat linear relationships, and that sustainable and profitable servitization can be achieved if companies manage to identify the necessary conditions to do it "right". This point of view has led to the suggestion that servitization implementation can be measured (Falk & Peng, 2013), for example considering firm value (Fang et al., 2008), the number of service offerings (Partanen, Kohtamäki, Parida, & Wincent, 2017) or the level of service revenue (Forkmann, Henneberg, Witell, & Kindström, 2017). Furthermore, some suggest that servitization can be evaluated in terms of its success and that such success can be influenced by adjusting the company's available resources and capabilities (Fliess & Lexutt, 2019; Rönnberg Sjödin et al., 2016). Such thinking separates servitization from its outputs (i.e., the servitized offerings), as explicitly mentioned by Kohtamäki et al. (2018b).

The servitization described in the three articles presented here is different. In those articles, servitization is understood as a dynamically unfolding re-organization of a heterogeneous network. This has a number of implications. First, it implies that servitization is more than a strategy or a change process. Some of the things that it produces – servitized offerings, customers, service inscriptions – re-organize the network by becoming part of it. This does not mean that measuring servitization is useless. Instead, it implies that measuring servitization has different implications. In order to measure servitization, factors such as customers, machines, sales, and engineers need to be stable. In that sense, measures might be less about correctly capturing an outcome and better understood as one of the many enactments of servitization. Similarly, the guidelines suggested in the literature, from more general frameworks for aiding servitization (Barquet et al., 2013; Tan et al., 2019; Trkman et al., 2015) to more specific pieces of advice (Fliess & Lexutt, 2019; Lexutt, 2019), are not ready-made solutions for achieving linearity between input and expected success. For example, Fliess and Lexut's (2019, p. 71) suggestion to "[e]nsure that your customers value your service offering and are willing to cooperate with you closely" is not a solution but rather an outline of one problem managers are likely to face. One difficulty with servitization, as this dissertation shows, is arranging for such desired combinations of service qualities while simultaneously coping with the difficult-to-foresee reverberations of creating these combinations.

Second, it implies that these networked elements are connected in a fluid and dynamic manner. This means that what counts as a resource or a capability that can further a company's interests is conditional. The large, installed base of competitors' equipment became a resource for ManCo

when it decided to qualify that equipment in a way that gave rise to additional service sales. In that sense, it is useful to think of servitization as servitization *at work*: a fluid and dynamic re-organization of an existing network.

Servitization at work – between proliferation and containment

Characterizing servitization as being at work is also useful because it implies that servitization does not have a center. There is, contrary to what literature might suggest (Ekman et al., 2016; Kowalkowski et al., 2013), not 'one' servitization neatly contained in a company or a supply network. Instead, as the articles show, there are many ways to enact servitization: qualifying service offerings, compiling a business case, and persuading service engineers to watch for and report new service opportunities to sales staff. Moreover, servitization is not confined to a specific space – it takes place wherever it is practiced or discussed. Similarly, many different people and things are involved. All of these elements are loosely coupled in multiple ways. In principle, each combination can be enacted as a new relationship. However, not all enactments may be possible to achieve, as article 2 shows, and not all enactments may be always able to co-exist, as article 3 highlights.

As this dissertation demonstrates, this centre-less aspect of servitization at work is characterized by two opposing forces: proliferation and containment. There is proliferation of service qualities (articles 1 and 2); products (article 3); customers, who become buyers, users, investors or employers; and the focal company itself, which becomes a service provider, a place of experimentation, and a repository of process knowledge. However, such proliferation is met with practices of containment in which attempts are made to modularize service qualities (article 2), coordinate different product enactments (article 3), and reach, at least temporarily, compromises on who the customers and the focal firm are in order to devise contracts, and sell and deliver servitized offerings. As the articles suggest, the tensions between these two forces give rise to dynamically unfolding effects.

This then also implies that working solutions from one place may not necessarily be implementable elsewhere, as places, people, offerings and practices differ–and hence how proliferation and containment play out. Consequently, the methods of implementing servitization suggested in the literature (Kowalkowski et al., 2015; Matthyssens & Vandenbempt, 2010; Paiola

et al., 2013) have merit in terms of offering inspiration, but they cannot be expected to be applicable without any adaptations. In this sense, servitization at work is conditional.

What might come next

This dissertation has looked into servitization at work. However, as with any piece of research, there are areas left open, unattended to and unexplored. In this section, I discuss three ways in which future research might further the insights presented here.

First, I highlight the importance of paying attention to things and practices. The literature's focus on manager's speech acts has obfuscated the role of non-human entities in servitization at work. It is possible to take their roles into consideration by focusing on practices. Further research could benefit from such a practice-centric approach in terms of discovering the role of other, thus far under-researched elements of servitization at work. Such practices differ from the resource-oriented understanding of capabilities (Eloranta & Turunen, 2015; Huikkola, Kohtamäki, & Rabetino, 2016b) – capabilities describe potential for action, while practices are everything that involves action. Such practices could be explored beyond the focal company, especially across customer and supplier organizations or, perhaps more interestingly, across a focal company and lesser-researched entities that are involved in servitization, such as insurance providers, local or global regulators, and third-party service providers.

Second, the qualification work outlined in the articles indicates that customers do not necessarily want to buy many of the services offered by the focal company, at least initially. While there is a tendency in the literature to talk about customer needs (Agrawal & Bellos, 2017; Davies, 2004; Davies et al., 2007; Kindström, 2010), those needs may not be as prevalent as assumed. The extensive work documented in article 1 on qualifying service offerings points towards the focal company's attempts to create and persuade customers of new *wants* rather than responding to existing customer needs. As such, servitization at work also means cultivating aspects that make customers want something. How such cultivation might be undertaken has been documented here. However, the ways in which such efforts affect changes in customer organizations was beyond the scope of the dissertation. This might be an interesting endeavour for future research.

Lastly, researchers might find it useful to reverse the common servitization narrative. This could occur by, for example, focusing on customer organizations or service suppliers and, "following the actors"' (Latour, 2005, p. 227), tracing how they took on those roles. Servitization implies an outsourcing decision for customers. How the networks of two companies do–or do not–become intertwined could reveal more about the challenges of servitization at work. Furthermore, it could be interesting to trace how companies de-servitize (Finne et al., 2013; Valtakoski, 2017) and to examine the ways in which entanglements with customers can – or cannot – be dissolved, especially if such efforts only concern service sales. How do de-servitization practices enact products, customers or the company? Such analyses could provide additional insights into how the loosely coupled elements that characterise servitization come together as one thing and can then drift apart again.

Driven by doubt and a focus on switching between the empirical and theoretical worlds, this research was inspired by the works of others. while also seeking to interest future endeavours to consider similar pathways in servitization at work. This concludes my dissertation.

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