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Servitizing manufacturers: The impact of service complexity and contractual and relational capabilities

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Abstract

Servitization drives manufacturing firms to develop service offerings characterised by increasing levels of complexity. This has also been termed service ladder or transformation staircase. Manufacturing companies need to adapt their organisational processes to the different stages of the service ladder to provide value to their customers. In particular, this paper focuses on contractual and relational capabilities for services of different complexities. Based on two case studies within the European Healthcare sector, we found that in a highly regulated business context, contractual capabilities only marginally differ depending on service complexity. In contrast, the importance of relational capability increases with higher levels of service complexity. Developing relational capabilities can function as a competitive advantage for manufactures moving into product-service system offerings.

Keywords: servitization, service complexity, product-service system, contract and relational capabilities, multiple case studies

1. Introduction

In order to stay competitive globally, manufacturing companies have increasingly bundled their products and services to add value to their core offerings (Spring and Araujo, 2009). This change is associated with a shift in focus from individual products or services to the provision of product-service systems (PSSs) (Mont, 2000). PSSs are integrated offerings that consist of a bundle of products, services and information, seamlessly combined to provide and address clients' needs in order to provide more value than the parts alone (Baines et al., 2009). Selling and purchasing PSSs confronts organisations with the challenge of developing and implementing new PSS strategies and associated organisational structures and capabilities. In particular, manufacturers have to develop and implement contractual and relational capabilities.

Servitization is connected to increasing levels of service complexity as different service

offerings can have different levels of complexity depending on the company's strategy and capabilities (Neely et al., 2011). For instance, offering support services such as maintenance incorporates a lower level of service complexity connected to the operational processes and delivery system than offering outcome-based contracts such as the delivery of product capability. These different levels have been described as a service ladder (Neely et al., 2011) or transformation staircase (House of Commons Defence Committee, 2009). However, the current literature offers limited insights into the issue of service complexity and relationship management in terms of contractual and relational capabilities for PSS providers and customers. In particular, the following two issues are still not well understood. First, limited research explores a dyadic perspective between service provider and customer as many current studies adopt a purely seller perspective. As the value of PSS offerings emerges during their use, it is the dyadic relationship that plays a key role in determining the benefit. Second, prior studies do mainly not distinguish between different levels of service complexity (except Neely et al., 2011) and their impact on contractual and relational capabilities.

We address the above limitations by answering the following two research questions (RQs): (i) To what extent do different levels of service complexity impact on contractual capabilities when providing and buying PSSs?; (ii) To what extent do different levels of service complexity impact on relational capabilities when providing and buying PSSs? We investigate the RQs by presenting two case studies of one PSS provider and its customers. The studied provider operates in the European healthcare sector and has traditionally been a manufacturer of complex engineering products and has made deliberate steps to introduce servitization strategies based on PSSs. The presented case studies offered an in-depth understanding of contractual and relational capabilities in an organisational context to compare the influence of service complexity. Thus, we contribute to the literature in the field in two ways. First, the investigation of both PSS provider and customer offers insights into the service relationship from a dyadic perspective which helps to draw a more comprehensive picture of the PSS and relationship management. Second, we offer a theoretically-grounded and empirically-tested framework of service complexity in the context of servitization and its influence on contractual and relational capabilities. This will form a guideline for industry to strategically plan and develop their service offerings and the necessary contractual and relational capabilities.

2. Theoretical background

2.1 Service complexity and servitization

The typical offerings described in the servitization literature are Product Service Systems (PSS). PSSs are integrated, seamless combinations of products, services and information (Baines et al., 2009). They are often described as integrated solutions (Davies et al., 2006) that create value by improving operating efficiency, increasing asset effectiveness, enabling market expansion, and mitigating risk (Cornet et al., 2000). The shift towards providing and receiving PSSs is typically undertaken gradually (Smith et al., 2012). In other words, manufacturing companies provide support services with different degrees of orientation around the product. These offerings include different levels of service complexity (Batista et al., 2008). Complexity in the context of services can have varying definitions depending on their focus (Neely et al., 2011). Reviewing the literature in the field, Benedettini and Neely (2011; 2012) found that service complexity can be differentiated into complicatedness and difficulty. Complicatedness refers to the high number of components and their interrelation within the service provision. Difficulty is defined as the high amount of resources that are needed to achieve the intended outcome. In other words, a complicated service offers many

different functions while a difficult service delivers sophisticated functions (Benedettini and Neely, 2012). However, this does not seem to be a distinct differentiation as a service that delivers sophisticated functions often also delivers many different functions. As such, complexity can be connected to the engineering system necessary to fulfill the requirements (Ng et al., 2011) and the interaction between the service stakeholders (Tien, 2008). Complexity can further arise from the dynamic nature of services due to the ‘open’ nature of services, i.e. the constant adaptation to context and conditions (Badinelli et al., 2012).

In this paper, we use a definition of complexity associated with the characteristic of the services. As such, we do not relate our understanding of service complexity to the amount and interaction of the people involved in the production and consumption of a service (Tien, 2008) or the dynamic change of the service to adapt to new situations and conditions (Badinelli et al., 2012). We agree that these are important aspects that can create complexity and need to be considered in a coherent understanding of this topic. However, the purpose of this paper is to draw the connection between service complexity and contractual and relational capabilities and thus we use a more static characterisation of service complexity. This was captured in Shostack’s definition which says that complexity is “*the number and intricacy of the steps required to perform it*” (1987: 35). This definition relates to the service system used in the literature (Ng et al., 2011) and seems to also incorporate both categories of service complexity presented by Benedettini and Neely (2011; 2012). It further highlights the activity-centered process of services (Araujo and Spring, 2006).

The assumption is that the path towards offering PSSs is connected to an increasing level of service complexity. The shift towards providing and receiving PSSs means that the activities and processes of provider and customer become increasingly integrated which has also been described as a service ladder (Neely et al., 2011) or transformation staircase (House of Commons Defence Committee, 2009). Processes relate to information sharing, planning and undertaking of the activities to deliver the availability of a range of products (Tukker, 2004; Neely et al., 2011). The higher the level of integration, the more activities and processes are necessary to provide and receive the PSS, i.e. the higher the service complexity. This is the assumption underlying the research presented in this paper and is depicted in **Figure 1**.

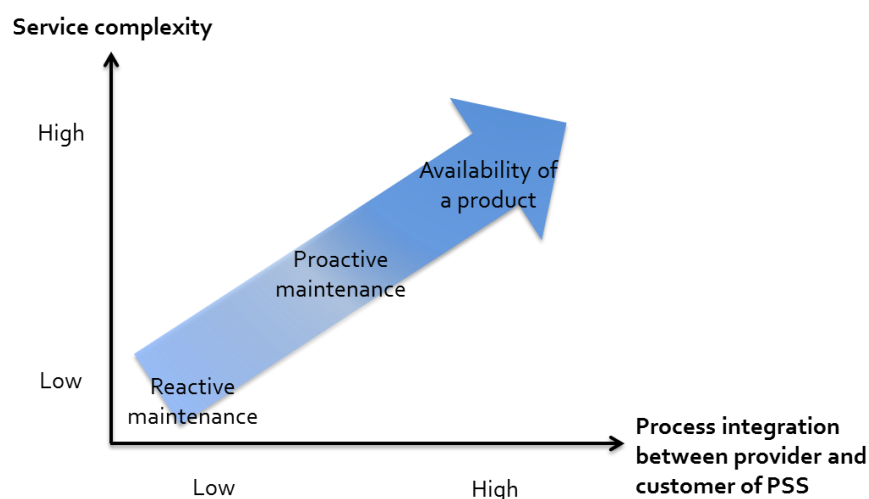


Figure 1. Relationship between service complexity and process integration between provider and customer of PSS

2.2 Capability development for PSS delivery

The extant body of literature on capabilities has emphasised how organisations must possess the relevant resources, knowledge and skills to create or adapt to new market and technological opportunities (Teece et al., 1997). A capability is the ability of the organisation to perform coordinated activities utilising resources to achieve a goal and to purposefully create, extend or modify its resource base (Helfat and Peteraf, 2003). Zollo and Winter (2002) claim that capability development is often initiated by an external stimuli or feedback such as a need to transition towards PSS offerings. The heterogeneity of capabilities across organisations then is a reflection of different investments of time, efforts and resources in these learning activities (Zollo and Winter, 2002). To provide PSS arrangements, organisations need to restructure their product-service delivery by establishing new contractual and relational capabilities. With regards to relationship management to deliver PSS offerings, the following sections review two discrete, yet inter-related, types capabilities: contractual and relational.

2.2.1 Contractual capabilities

Contractual capabilities refer to the recognition of the contingencies associated with PSS offerings and their implications for the efficiency and effectiveness of the service delivery, encompassing capabilities to write, negotiate, monitor and enforce contracts (Mayer and Argyres, 2004). Contractual safeguards and rules are established to minimise cost and performance losses from relationship hazards (Joskow, 1988). In other words, PSS suppliers and buyers structure complex contracts to protect themselves from opportunistic behaviour, to reduce uncertainties and to specify roles and responsibilities of partnering organisations by relying upon legal rules, standards and remedies (Achrol and Gundlach, 1999). The study by Deakin et al. (1997) draws out the importance of contracts as a planning and incentivisation tool in long-term business relationships. According to TCE logic, the most efficient legal safeguard represents a trade-off between different instruments of formal control, depending on the degree of asset specificity, uncertainty and transaction frequency (Williamson, 1985). Complete contracts reduce uncertainty, risk of opportunism and provide a safeguard against ex post performance problems (Williamson, 1985).

Bijlsma-Frankema and Costa (2005) argue that formal control through contracts depends on three underlining conditions – codification, monitoring and safeguards - which are seldom fulfilled in an inter-organisational relationship. In practice it is rarely possible or practical to draft complete contracts owing to the complex nature of product-service offerings, asymmetric information situations and associated costs and time efforts (Lyons and Mehta, 1997). Inter-organisational relationships are mostly governed by incomplete contracts with an element of uncertainty that makes them unenforceable in their entirety (Roehrich and Lewis, 2010). Gaps in the existing contract are filled when contingencies arise, allowing some degree of flexibility to deal with unforeseen contingencies (Klein Woolthuis et al., 2005).

2.2.2 Relational capability

Relational capabilities are an organisation's ability to benefit from its inter-organisational relationships (Bititci et al., 2003). In other words, relationally capable organisations invest in relationship-specific assets and effectively create, exchange and exploit knowledge and skills through the application of socially complex routines. Thus, relational capabilities refer to socially complex routines, procedures and policies in inter-organisational relationships which are vital to establish and maintain through inter-personal and inter-organisational trust (Zaheer et al., 1998). Partnering companies invest in relationship-specific assets and create

exchange knowledge and effectively govern their relationship through relational routines and behaviour (Dyer and Singh, 1998). Contractual capabilities are complemented by relational capabilities to prevent conflicts and adversarial behaviour and to promote problem-solving and information exchange (Carey et al., 2011).

The concept of relational capabilities draws on related concepts such as learning (Zollo and Winter, 2002), alliance competence (Gemünden and Ritter, 1997), interaction capability (Capaldo, 2007), relational capital and administrative mechanisms providing institutional support (Sivadas and Dwyer, 2000). Although relational dynamic capabilities are a significant trend in the future of strategic research, their foundations are still in their infancy and their investigation is fragmented. A few recent contributions have used empirical approaches and moved beyond abstract concepts to focus on practices, functions, tools and controls (Roehrich and Lewis, 2010). Prior research on relational capability development explored the concepts in alliances and supply chain processes in long-term relationships (Dyer and Singh, 1998).

2.3 Positioning an initial conceptual framework

Relating the development of contractual and relational capabilities in PSS relationships to the issue of service complexity, we position an initial conceptual framework as depicted in Figure 2. We expect that higher levels of service complexity will need to be supported by a higher amount of contractual and relational capabilities in order to coordinate between the PSS provider and its customers.

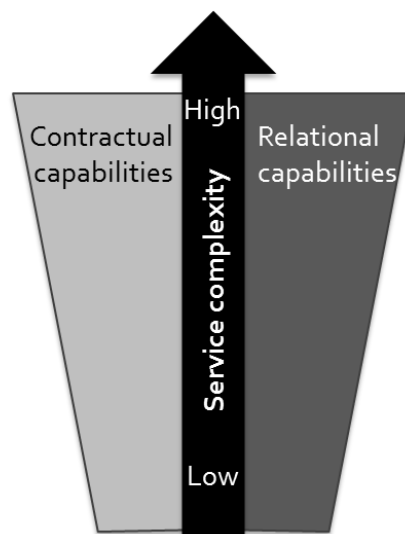


Figure 2. Initial conceptual framework

3. Methodology

3.1 Research approach and case selection

To investigate the research questions: (i) To what extent do different levels of service complexity impact on contractual capabilities when providing and buying PSSs?; (ii) To what extent do different levels of service complexity impact on relational capabilities when providing and buying PSSs?, we present two case studies of different levels of service complexity within one company to gather an in-depth understanding of the issue (Stake, 1995; Yin, 2009). Our case company, which we label 'PSS provider', operates within the European healthcare industry and offers support services for their equipment. The company's service

offers can be categorised into three levels which differed mainly in their level of service complexity. These three levels are described in Table 1. For this study, we selected an agreement from level 1 (case A) and from level 3 (case B) to compare and contrast the impact of service complexity on the development of contractual and relational capabilities.

Table 1. Service offerings of PSS provider

Service level	Complexity	Description
1	Low	Proactive preventative maintenance by the supplier to ensure safe and efficient operation of the products. This includes documented inspections, quality assurance, security inspections and software inspections for viruses or similar.
2	Medium	All the activities included in level 1 plus labour rates for corrective maintenance activities, telephone support and regular updates of the equipment.
3	High	The availability of the product is guaranteed by delivering maintenance (both preventative and corrective maintenance activities), delivery of spare parts, regular updates of the software systems to enhance productivity and availability

3.2 Data collection and analysis

Our unit of analysis is the PSS, encompassing contractual and relational capability developments within two service agreements between the case company and two of their customers. The customers were hospitals providing different health services to private patients. In 2013, we conducted 23 semi-structured interviews with 19 interviewees both on the provider and customer sides to obtain insights from ‘both sides of the story’ (some of the interviewees from the PSS provider side were interviewed for both cases). The interviews addressed retrospective and current activities of the service agreements. Respondents were drawn from multiple functions, such as service managers, account managers, service engineers, strategic buyers and physicians who were involved in the service agreement and stood in direct relationship with the customer or PSS provider. We asked questions about the rationale for moving to PSS offerings, changes in the organisational strategy and structure, the development of the dyadic relationship and the importance and development of contractual and relational capabilities. Interviews lasted between 45 and 120 minutes and were tape-recorded and sub-sequently transcribed. Data collection stopped when we experienced conceptual saturation. We triangulated data to overcome common method bias and improve internal and external validity and case study rigour (Lewis and Grimes, 1999). This included the service contracts, information on the tendering process, marketing material and other publicly available information such as announcements on webpages.

We analysed the interview transcripts and the additional material, adopting ‘systematic combining’ to inform our analysis of the data (Dubois and Gadde, 2002). In other words, we drew on existing theory and aimed to generate justified research questions, analysis and implications with regards to causal drivers for PSS and capability developments and changes. We systematically coded our data into major thematic categories connected to PSS, relational and contractual capabilities (Strauss and Corbin, 1990). Some categories were derived from our theoretical framing while others emerged based on our empirical data analysis. Data were subsequently summarised and written up as case reports to be presented to the case companies

for verification. Data were coded, summarised and displayed in an iterative fashion – travelling back and forth between data analysis, data collection and pertinent literature – and facilitated theory building (Miles and Huberman, 1994).

4. Findings

Both contracts were based on a long-standing relationship between the PSS provider and two customers. However, the interviews highlighted that this relationship changed driven by the change of the business context. We describe the context for the PSS relationship before highlighting findings with regards to contractual and relational capabilities.

4.1 Contextual setting

The business conditions and contextual setting of the European healthcare sector have changed dramatically over recent decades. The process of acquiring new equipment and new service agreements has been formalised with the introduction of a formal European-wide tendering process. This means that the customer have to publish their requirements with detailed descriptions of the required service complexity and requested service activities. This process also means that communication between the customer and the competing PSS providers (i.e. bidders) is also formalised. For instance, questions regarding the service requirements or contractual arrangements can be asked but tend to be communicated to all competing PSS providers. Informal communications or exchange are constraint by these tendering regulations. All of the submitted bids are evaluated objectively based on predefined and published criteria. These criteria are usually price bid (including the price of the equipment, education of the customer's staff and the Total Cost of Ownership), degree of fulfilment of the requirements, performance and workflow.). The service manager (both cases) expressed his evaluation of the changing business context as follows;

“They have changed a lot. If you look at the sales for instance, in the old days it was the relationship between one customer and one sale engineer. That was the most important part from the sales. Right now you have the tender business that means that everybody from the EU can go in and make an offer when they announce the tenders. We are all evaluated objectively. That means the relations are not there at all on the paper. But of course in the real world, there are of course some relations that are still working. But not as it used to be.” (Service Manager, PSS provider)

One implication of this formalisation of the tendering and negotiating process is that the acquisition process has become longer and more complex. Simple requirements and acquisition of equipment cannot be solved within this “relationship between one customer and one sale engineer” (Service manager, PSS provider, both cases). In contrast, a formal list of requirements has to be compiled for each acquisition which needs to follow rigid European legal guidelines and laws. This means that the acquisition process has changed from agreements between two companies or even between a sales engineer and his/her customer to a more substantial process with legal implications. One of the physicists of case B explains: *“It tends to be quite substantive. The work load and so on. You almost need to have a legal department nowadays to handle these things”* (Physicist 2, customer, case B).

This means that the tenders now mainly aggregate service offerings into larger contracts. “If you win, you win a lot. If you lose, you lose a lot. It is important to win because you can actually lose a whole region just in one tender” (Account manager, PSS provider, case B). This has put a lot of pressure on the PSS provider to win the tenders when they are

announced. In particular, the PSS providers had to adapt to the changes as the tendering process had become more strenuous and more complex. These organisational adaptations happened abruptly through the introduction of the tendering process and were long lasting with effects still visible to date. For the first tender, the PSS provider had to prepare a service agreement for 20 products in addition to bids for three other product ranges. The Service Manager explained:

“Four offers at once in a big pile. Nobody had summer vacation that year; everybody worked 24 h a day until we could deliver our offers. And you could say ‘That was tough.’ But it created that burning platform for us that meant, in fact, that we made some things that we are still using today. So that was kind of a shift we made through that one (tender).” (Service Manager, PSS provider, both cases)

In addition, the PSS provider expressed concerns that their customers had become increasingly demanding with regards to the service offerings. As such, customers demand new business models that do not only include the product but also the maintenance and servicing of these products over extended lifecycles. For instance, the Service Manager of the PSS provider (both case) mentioned that: *“The customer asked for higher uptime of the equipment use and then you could not live with the fact that the equipment can be down for 1, 2 or 3 days. That could happen quite often if you do not do proper maintenance and if you do not learn from the past and use this experience to develop solutions that would avoid downtime.”* As such, the service components have become vital for the survival of European manufacturers in the healthcare industry. This means that the PSS providers have changed their offerings in accordance with the customer demand to secure additional revenue and secure customers.

4.2 Contractual capabilities

Our assumption of the initial framework was that service agreements of higher complexity will show higher levels of contractual capabilities. One reasons for this assumption was that the additional contractual capabilities would be needed to deal with the additional uncertainties introduced through the additional activities and their interdependencies of services with higher complexity. However, for both cases, only marginal differences in the contractual capabilities were detected. Both contracts consisted of three pages with the following content: (i) a title page that listed the serviced product(s) with its specifications such as product type and model number; (ii) one page describing the service activities. This was done using a modular approach where a table showed the different activities for each of the three levels of service complexity and the ones included in the specific contract were clearly marked.; and (iii) one page of contract specific information such as agreed response time, telephone numbers in case telephone support was part of the agreement, the contract date and the signatures of contractual partners.

In addition, the contract covering the higher level service complexity offering included two additional pages, stating general terms and conditions of the PSS provider. Thus, our assumption of higher levels of contractual capabilities for services of higher levels of complexity was not empirically supported across our investigated cases. One reason for this could be the high level of regulations within the European healthcare sector. As such, there were tight regulations within the sector that had legal implications by themselves as it prohibits specific opportunistic behaviour . This was explained by the Account Manager (PSS provider) of case B as follows: *“We can’t talk together. I can’t call the other company [a competitor] and say ‘Well, we don’t like this one going out in the summer. Why don’t we all*

just ignore it?’ That’s illegal so not possible.” In other words, the legality of possible opportunistic behaviours both on the PSS provider and the customer side is mitigated by European regulations. This means that rules to mitigate opportunistic behaviour do not have to be included in every contract, thus contract complexity has rather been reduced.

The agreement of contract-specific performance indicators was clearly stated from the outset of the tendering process. The Service Manager from the PSS provider (both cases) stated: *“As a result of the tender they [customers] have defined all the service levels. I do not have to tell them what those services are because they decided themselves.”* However, the customer’s specifications in the tender documents may not completely relate to the service offerings by the PSS provider. Thus, the Service Manager went on to highlight that: *“I then translate their service levels 1, 2, 3, 4, 5, 6 and so on into our service level understanding of [levels 1, 2 and 3]. That is important as I do not want the transparency to be too big. If they, for instance, have a [competitor’s] scanner I can directly compare and if it is not the same I put in more modules to match and exceed their [competitor’s] service offering.”* This statement highlights that despite the high level of regulations in the sector, strategic evaluations and contractual arrangements with the specific PSS providers are still important.

An example of contract-specific indicators was the response time to failures of repair requests from the customer. This was found to be also related to the level of service complexity across the investigated case studies. As such, the contract characterised by a high level of service complexity included a shorter response time in the contract than the contract with low service complexity. The Service Engineer, PSS provider in case A (low complexity) mentioned that: *“We [supplier] are on call so they [buyer] can call us within working hours and we need to address that within 4 hours. We have to take some actions. That has been the purpose of the contract.”* In contrast, in case B the PSS provider had to react within one hour of the customer request. The Service Engineer, PSS provider, case B explained: *“The usual procedure will be that if I am just sitting at my office I will go to the customer side, but if I am busy with something else, I will connect remotely and see if I can diagnose the problem.”* In summary, the contract with the higher level of service complexity included performance indicators of higher service quality such as response time within the contractual arrangement.

These findings illustrate that even though the contractual capabilities were not a distinguishing feature with regards to different levels of service complexity across the investigated case studies, they were still essential to ensure a high level of service quality to be delivered throughout the contract period. Contractual capabilities ensured that occurring problems were addressed in a timely manner to avoid any escalation within the PSS provider-customer relationship.

4.3 Relational capabilities

Despite the high level of regulation within the healthcare sector, we found that relational capabilities were important across both case studies. The customer in case B expressed this as follows: *“Personally, I think it’s important that when you go out and you buy a new system, you are not allowed to take into consideration your previous experience. But of course somewhere, you always have that in the back of your head.”* (Physicist 2, customer, case B). This highlights that the customer’s experience with PSS providers is an important influence on their decision during subsequent tendering processes. This importance was also highlighted by the PSS provider: *“For the service, relations are very important. (...) And these relations are built up over years by brilliant work of all the technicians. So it is very important that we have a good foundation from the customer services”* (Service Manager,

PSS provider, both cases).

Our assumption of the initial framework was that more relational capability is needed for services characterised by higher complexity. This assumption was confirmed across both case studies. Case A (low service complexity) was characterised by four annual visits for preventative maintenance activities where the system was inspected and recommendations made. For these visits, appointments are agreed with the customer. *“Then we go on site. And we have a protocol that we have to fill out. And we go step-by-step and perform all the things that need to be done”* (Service Engineer, PSS provider, case A). This protocol is sent to the customer with a list of faults or recommendations for repairs and/or upgrades. *“There is a common field that we could fill out. ‘We will recommend you do this and that.’ Or we can say ‘The system has this fault which we have to find a solution to’ because like here they have to pay for the spare parts. So it might be that they want to leave this fault and if it is not security or safety, then they can live with that”* (Service Engineer, PSS provider, case A).

In contrast, case B (high complexity) was characterised by a much closer relationship between the service engineers and the customer. When the engineers are on site for the preventative maintenance inspections, they also consider whether there are additional issues they could solve during their visit. Service Engineer 2 in case B explained *“Before getting started, I will ask if they [customer] have any problems that they didn’t report to us. Sometimes they have a small problem that they think is not important. They write it in a notebook and they ask me.”* In addition, the customer receives much closer attention even if they do not have any issues with the product. This was highlighted as follows: *“But sometimes I am just going to the customer site and have a chat. To see if they have any problems or just to follow up on how it goes”* (Service Engineer 2, PSS provider, case B). This point was also supported by Service Engineer 1 from case B. This engineer had worked with the customer for 36 years and thus knew the site very well and had a very close relationship with them.

“It is always nice to go there. Always when I go there, there are almost all the time some questions that I can look at. Maybe it is not my equipment but also something else, like a PC is not working or something else. It is like I am working in the hospital.(...) Many of them I know personally. Not privately but I have been so many time times they know me and I have 5 km to the hospital. So they just call me. They call me directly” (Service Engineer 2, PSS provider, case B).

This high level of relational interaction between PSS provider and customer was confirmed by the customer of case B. One of the interviewed physicist explained *“I would say that our relationship with this technician is informal and it works fine for us. (...) I think it worked well if we have a problem we can call (PSS provider) and have a fast and efficient reaction”* (Physicist 1, customer, case B). The second interviewed physician confirmed this: *“The most important thing when you call them they react reasonably quick. They’re typically here within an hour; so that is the main thing. And when they come here they solve the problem really fast”* (Physicist 2, customer, case B). This highlights that the customer perceived the relational capabilities in terms of providing high levels of service quality. They did not comment on the fact that the service engineers of the PSS provider would sometimes be on site without being called in, but they focused mainly on their perception that when they did have a problem, it would be solved quickly and effectively. This suggests that high relational capability was translated by the customer into perceived service quality.

This seemed to also add to the competitiveness of the PSS provider as the service quality, as

perceived by the customer, gave them an advantage over competing PSS providers. The fact that local support was available, that the PSS provider had a high level of relational capability already built up, gave the PSS provider a competitive to other PSS providers within the European community. This was highlighted by one of the physicists:

“Some of the other manufacturers rely on support from [other European countries] and I think that might be a bit too far away in some cases, when you need to get things up and running quickly. And also the communication might not flow as easily. But that is a good thing with [the PSS provider], they’ve got quite a huge, local department (...). That is an advantage” (Physicist 2, customer, case B).

This development of high levels of relational capabilities was part of the operational strategy of the PSS provider. Building a close working relationship between the service engineers and the customer was emphasised as an important aspect that was crucial when, for example, selling additional services in the future.

“When we have that [good relations], of course, it is much easier for me to approach the customer because they know our good service. And I do not have to present our organisation, I do not have to present our concept because they know it. In fact, a lot of the service agreements we finalise by mail. I do not visit the customer anymore, we just send an email and they come back to me” (Service Manager, PSS provider, both cases).

Including the relational capability in the operational and sales strategy of the PSS provider was particularly important for the contract with a high level of service quality. One of the physicists of case B highlighted:

“It’s nice to know that he’s not on the clock. So when he’s here, we can actually discuss things and maybe have a cup of coffee. If that wasn’t the case, we’d have to stand beside him and watch ‘is he working now and is he doing this fast?’ It’s more relaxed the other way. And then we get the time to discuss other things. (...) I mean if we want to start something new, we can discuss it without worrying about spending [this money]” (Physicist 2, Customer, Case B).

Thus, our case findings suggest that relational capabilities are influenced by service complexity: The contract with low level of service complexity (case A) showed lower levels of relational capability development than the contract with a high level of service complexity (case B). The following section summarises the results of both cases, reflecting on our initial framework.

5. Discussion

5.1 Contractual and relational capabilities for PSS relationships

Table 2 summarises the results of both cases with reference to the initial framework. Our initial assumptions were only partly confirmed through the investigated cases. Both cases illustrated that contractual capabilities did not differ to a high degree between the two levels of service complexity. One possible reason for this could be the high level of regulation in the industrial sector, as the European healthcare sector is governed by international legal agreements. These regulations include possible opportunistic behaviours of PSS providers and customers. Contractual capabilities are often used to control for these possible opportunistic

behaviours, and thus having a high level of regulations means that contractual capabilities can be kept at a low level. Extant literature suggests that the development of contractual capability is particularly important for service agreements as possible opportunistic behaviour can be mitigated, long-term relationships can be established, operational outcomes at agreed performance levels can be guaranteed and competitive advantage can be achieved. However, we showed that in highly regulated business contexts such as the European healthcare industry, high levels of contractual capabilities are not necessary as the regulations deal with these types of uncertainties and possible sources of opportunistic behaviour.

Table 2. Summary of findings of contractual and relational capabilities for contracts of different service complexities

	Low level of service complexity	High level of service complexity
Description	Proactive preventative maintenance by the supplier to ensure safe and efficient operation of the products. This includes documented inspections, quality assurance, security inspections and software inspections for viruses or similar.	The availability of the product is guaranteed by delivering maintenance (both preventative and corrective maintenance activities), delivery of spare parts, regular updates of the software systems to enhance productivity and availability.
Contractual capability	Contractual arrangement on three pages including: <ul style="list-style-type: none"> Title page with equipment specifications, Service activities included in the agreement, Contract specific information including date and signatures. 	Contractual arrangement on five pages including: <ul style="list-style-type: none"> Title page with equipment specifications, Service activities included in the agreement, Contract specific information including date and signatures. Two pages of terms and conditions form Service provider.
Relational capability	Importance of relational capability in the service agreement, Low levels of relational capability as every activity and visit needs to be recorded and charged to customer, Formalised information exchange through service protocols	Importance of relational capability in the service agreement, High level of relational capability with regular visits outside of scheduled or requested inspections and repairs, Informal information exchange between PSS provider and customer, Long standing relationship between service engineer and customer, High level of relational capability used for sales strategy

In contrast, relational capabilities were found to be an important mechanism and distinguishing feature even in the existence of high level of regulations. We found that it could influence perceived service quality and future sales. We further found that relational capabilities were dependent on the level of service complexity. For the contract with a high level of service complexity, we detected a high level of relational capability development that was characterised by a close relationship between the service engineer and the customer. In addition, this relationship was characterised by frequent unscheduled visits by the service engineer to the customer site to see whether any additional help could be provided. In contrast, the contract with a low level of service complexity was characterised by a close relationship between service engineers and the customer only for the activities explicitly included in the contract. No additional visits were undertaken and any activities beyond the service agreement were communicated to the customer as recommendations.

Prior studies further suggested that relational capabilities are a governance mechanism to

create relational routines (Dyer and Singh, 1998), prevent conflicts and solve problems as well as exchange information (Carey et al., 2011). These insights were confirmed through our case studies as services with high relational capability were characterised by strong relational routines and a high level of information exchange between PSS provider and customer. In addition, we showed that a high level of relational capability can also be a tool to create competitive advantage as it creates a high level of perceived service quality for the customer through short response times and effective problem solving (Grönroos, 1984; Parasuraman et al., 1988). This was further found to influence the possibility of future sales both of the product and of future service agreements in the context of competitive bidding (Kreye et al., forthcoming).

We showed that the development of relational capabilities was particularly influenced by the level of service complexity as higher complexity leads to higher relational capabilities. However, due to the high level of industrial regulation within the investigated research context of the European healthcare sector, we did not confirm our assumption of higher contractual capabilities for levels of high service complexity. We acknowledge that this is a limitation of the presented research and suggest that future research needs to address this issue in less regulated business contexts.

5.2 Positioning a revised conceptual framework

Based on these findings, we position a revised conceptual framework, depicted in Figure 3. The existence of sector-wide regulations meant that the development of contractual capabilities was not dependent on the level of service complexity, while relational capability increased with the level of service complexity. The investigated cases particularly illustrated that the development of relational capabilities influenced the customer's perceived level of service quality, the customer's attitude towards purchasing new equipment and further services from the provider and the PSS provider's competitive advantage when bidding for new service agreements.

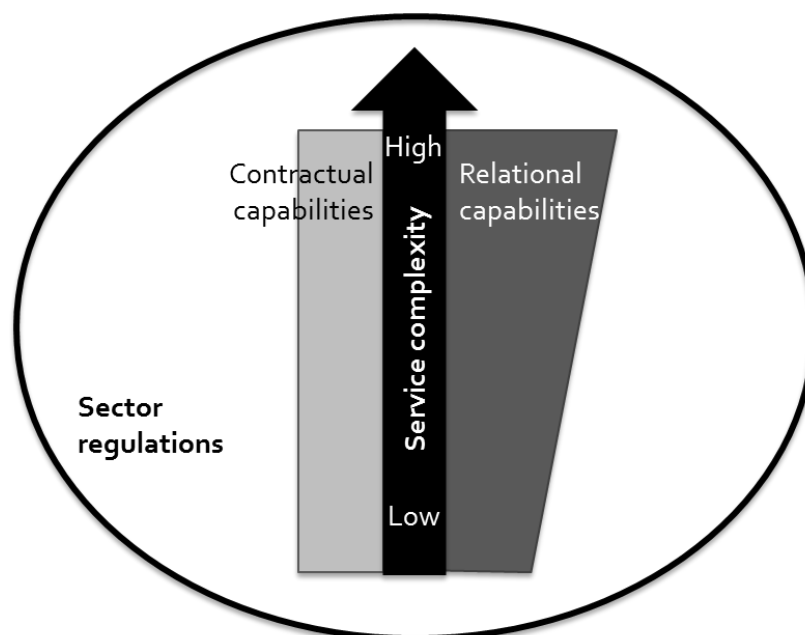


Figure 3. Revised conceptual framework

Our study paves the way for future research which should investigate whether contractual capabilities are of similar importance as relational capabilities in less regulated business

environments. As our findings focus on a highly regulated business sector, we did not find any impact of service complexity on contractual capabilities. Further research should refine our revised conceptual framework by offering further insights into the processes and organisational changes that manufacturers need to address to become successful providers of PSS and add value to their core offerings. In addition, further research also needs to establish whether a company's level of relational (and contractual) capabilities can be used as a tool to judge its readiness to move to the next step along the service ladder in servitization. In other words, a company's capabilities can be used as a basis for the managerial and strategic decision-making process to deliver service offerings of higher levels of complexity.

6. Conclusions and Implications

This paper described the relationship between service complexity and the development of contractual and relational capabilities within the buyer-supplier relationship for product-service system provision. We presented two industrial cases of one PSS provider and two of their customers, which differed in the level of service complexity. Our empirical study offers two distinct, but inter-related, contributions: (i) service complexity did not impact on contractual capabilities due to the high level regulation within the studied industrial sector; and (ii) increasing levels of service complexity increase the level relational capability development of PSS provider and customer. Developing and maintaining relational capabilities can be considered a vital distinguishing feature for PSS relationships. Thus, we contribute to extant literature by extending previous findings to the concept of service complexity and investigating the dyadic PSS relationship. This is important as manufacturing companies tend to increase the level of service complexity of their offerings when shifting to being a provider of PSSs. Our findings suggest that when realising a servitization shift, manufacturing companies need to improve particularly their relational capabilities such as establishing relational routines and behaviour, exchanging knowledge and information and building up inter-personal and inter-organisational trust. While developing contractual capabilities is important, it is the development of relational capabilities that can function as a distinguishing feature in PSS relationships.

The research results have multiple implications for management practice. First, manufacturers in highly regulated industry sectors should focus mainly on the development of relational rather than contractual capabilities as a distinguishing feature. The reason for this is that contractual capabilities are typically covered by the sector regulations as legal punishment for opportunistic behaviour is established across company and national borders. Second, EU regulations to standardise operations and processes within the industrial sector may be a useful tool to increase the global competitiveness of Europe's manufacturers. A high level of industrial regulations means that manufacturers can focus their efforts on developing relational capabilities that improve perceived service quality by the customer and improve the strategic position of manufacturers in the tendering process for new service contracts. Third, these relational capabilities can be developed step-by-step by the manufacturers as they engage in servitization and undergo the service ladder and increase the service complexity of their offering. This means that the relational capability may be a useful tool to judge a company's "readiness" to engage in the next step of servitization.

References:

- Achrol, R. V. and Gundlach, G. T. (1999). "Legal and social safeguards against opportunism in exchange." *Journal of Retailing* 75(1): 107-124.
- Araujo, L. and Spring, M. (2006). "Services, Products, and the Institutional Structure of

Production." *Industrial Marketing Management* 35(7): 797-805.

Badinelli, R., Barile, S., Ng, I., Polese, F., Saviano, M. and Nauta, P. D. (2012). "Viable service systems and decision making in service management." *Journal of Service Management* 23(4): 498-526.

Baines, T., Lightfoot, H., Peppard, J., Johnson, M., Tiwari, A., Shehab, E. and Swink, M. (2009). "Towards an operations strategy for product-centric servitization." *International Journal of Operations & Production Management* 29(5): 494-519.

Batista, L., Smart, A. and Maull, R. (2008). "The systematic perspective of service processes: Underlying theory, architecture and approach." *Production Planning & Control* 19(5): 535-544.

Benedettini, O. and Neely, A. (2011). "Complexity in services: an interpretative framework". POMS 23rd Annual Conference Chicago, Illinois, USA, 20-23 April.

Benedettini, O. and Neely, A. (2012). "Factors influencing service complexity: the perspective of servitized manufacturers ". EurOMA, Amsterdam, The Netherlands, 1-5 July.

Bijlsma-Frankema, K. and Costa, A. C. (2005). "Understanding the trust-control nexus." *International Sociology* 20(3): 259-282.

Bititci, U. S., Martinez, V., Albores, P. and Mendibil, K. (2003). "Creating and sustaining competitive advantage in collaborative systems: The what and the how." *Production Planning & Control* 14(5): 410-425.

Capaldo, A. (2007). "Network structure and innovation: The leveraging of a dual network as a distinctive relational capability." *Strategic Management Journal* 28(6): 585-608.

Carey, S., Lawson, B. and Krause, D. R. (2011). "Social capital configuration, legal bonds and performance in buyer-supplier relationships." *Journal of Operations Management* 29: 277-288.

Davies, A., Brady, T. and Hobday, M. (2006). "Charting a Path Toward Integrated Solutions." *MIT Sloan Management Review* 47(3): 39-48.

Deakin, S., Lane, C. and Wilkinson, F. (1997). "Contract law, trust relations, and incentives for co-operation: A comparative study". in S. Deakin and J. Michie, *Contracts, Cooperation and Competition*. Oxford University Press, Oxford, UK, 105-139.

Dubois, A. and Gadde, L. E. (2002). "Systematic combining: An abductive approach to case research." *Journal of Business Research* 55(7): 553-560.

Dyer, J. H. and Singh, H. (1998). "The Relational View: Cooperative Strategy and Sources of Interorganizational Competitive Advantage." *The Academy of Management Review* 23(4): 660-679.

Gemünden, H. G. and Ritter, T. (1997). "Managing technological networks: the concept of network competence". in H. G. Gemünden, T. Ritter and A. Walter, *Relationships and networks in international markets*. Pergamon/Elsevier, Oxford, UK, 294-304.

Grönroos, C. (1984). "A Service Quality Model and its Marketing Implications." *European Journal of Marketing* 18(4): 36-44.

Helfat, C. M. and Peteraf, M. A. (2003). "The Dynamic Resource-Based View: Capability Lifecycles." *Strategic Management Journal* 24: 997-1010.

House of Commons Defence Committee, U. (2009, 21 July). "Helicopter capability - Defence Committee: Memorandum from the Ministry of Defence." Retrieved 08 May 2012, from <http://www.publications.parliament.uk/pa/cm200809/cmselect/cmdfence/434/434we10.htm>.

Joskow, P. (1988). "Asset specificity and the structure of vertical relationships: Empirical evidence." *Journal of Law, Economics, and Organization* 4(1): 95-118.

Klein Woolthuis, R. K., Hillebrand, B. and Nooteboom, B. (2005). "Trust, contract and relationship development." *Organization Studies* 26(6): 813-840.

Kreye, M. E., Newnes, L. B. and Goh, Y. M. (forthcoming). Uncertainty in Competitive Bidding – A Framework for Product-Service Systems. *Production Planning & Control*: 1-16.

- Lewis, M. W. and Grimes, A. J. (1999). "Metatriangulation: Building Theory from Multiple Paradigms." *The Academy of Management Review* 24(4): 672-690.
- Lyons, B. and Mehta, J. (1997). "Contracts, opportunism and trust: Self-interest and social orientation." *Cambridge Journal of Economics* 21(2): 239-257.
- Mayer, K. J. and Argyres, N. S. (2004). "Learning to Contract: Evidence from the Personal Computer Industry." *Organization Science* 15(4): 394-410.
- Miles, B. M. and Huberman, M. (1994). *Qualitative Data Analysis: An Expanded Sourcebook*. Sage Publications, Thousand Oaks.
- Mont, O. K. (2000). Product service-systems. Lund, Sweden, Lund University.
- Neely, A., McFarlane, D. and Visnjic, I. (2011). "Complex Service Systems – Identifying Drivers, Characteristics and Success Factors". 18th European Operations Management Association Conference, Cambridge, UK, July.
- Ng, I. C. L., Parry, G., Maull, R. and McFarlane, D. (2011). "Complex engineering service systems: a grand challenge". in I. C. L. Ng, G. Parry, P. Wild, D. McFarlane and P. Tasker, *Complex Engineering Service Systems*. Springer, New York, NY, USA.
- Parasuraman, A., Zeithaml, V. A. and Berry, L. (1988). "SERVQUAL: A Multiple Item Scale for Measuring Consumer Perceptions of Service Quality." *Journal of Retailing* 64(1): 12-40.
- Roehrich, J. K. and Lewis, M. A. (2010). "Towards a model of governance in complex (product-service) inter-organisational systems." *Construction Management and Economics* 28(11): 1155-1164.
- Shostack, G. L. (1987). "Service Positioning Through Structural Change." *Journal of Marketing* 51(1): 34-43.
- Sivadas, E. and Dwyer, F. R. (2000). "An examination of organizational factors influencing new product success in internal and alliance-based processes." *Journal of Marketing* 64(1): 31-49.
- Smith, L., Ng, I. and Maull, R. (2012). "The three value proposition cycles of equipment-based service." *Production Planning & Control* 23(7): 553-570.
- Spring, M. and Araujo, L. (2009). "Service, services and products: rethinking operations strategy." *International Journal of Operations & Production Management* 29(5): 444-467.
- Stake, R. E. (1995). *The Art of Case Study Research*. Sage, London, UK.
- Strauss, A. L. and Corbin, J. (1990). *Basics of Qualitative research: Grounded Theory Procedures and Techniques*. Sage Publications, Newbury Park, CA, USA.
- Teece, D. J., Pisano, G. and Shuen, A. (1997). "Dynamic capabilities and strategic management." *Strategic Management Journal* 18(7): 509-533.
- Tien, J. M. (2008). "On integration and adaptation in complex service systems." *Journal of Systems Science and Systems Engineering* 17(4): 385-415.
- Tukker, A. (2004). "Eight types of Product-Service System; eight ways to sustainability? Experiences from SUSPRONET." *Business Strategy and the Environment* 13: 246-260.
- Williamson, O. E. (1985). *The Economic Institutions of Capitalism*. Free Press, New York, NY, USA.
- Yin, R. K. (2009). *Case study research: design and methods*. SAGE Publications, Los Angeles, CA, USA.
- Zaheer, A., McEvily, B. and Perrone, V. (1998). "Does Trust Matter? Exploring the Effects of Interorganizational and Interpersonal Trust on Performance." *Organization Science* 9(2): 141-159.
- Zollo, M. and Winter, S. (2002). "Deliberate learning and the evolution of dynamic capabilities." *Organisational Science* 13(3): 339-351.
- Zollo, M. and Winter, S. G. (2002). "Deliberate Learning and the Evolution of Dynamic Capabilities." *Organization Science* 13(3): 339-351.