Exploring the Root Causes of Servitization Challenges: An Organisational Boundary Perspective

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ABSTRACT

Purpose – This paper explains how servitization disrupts long-established internal and external boundaries of product-focused manufacturers and investigates the root causes of servitization challenges.

Design/methodology/approach – We draw from the collective experiences of 20 senior executives from ten multinational manufacturers involved in servitization, using a multiple case study approach, and employ a codebook thematic analysis technique.

Findings – We develop an integrative framework based on the theoretical notions of power, competency and identity boundaries to offer insights into the root causes of various servitization-related challenges.

Research limitation/implication – Although the extant literature discusses servitization challenges, it does not examine the underlying root causes that create them in the first place. This study contributes to the extant research by establishing rational links between organisational boundaries (internal and external) and servitization challenges in the interest of building a coherent and systematically integrated body of theory that can be successfully applied and built upon by future research.

Practical implications – This study provides a foundation for managers to recognise, anticipate and systematically manage various boundary-related challenges triggered by servitization.

Originality/value – It is one of the first studies to employ the concept of organisational boundary to understand the challenges created by servitization and to account for both internal (between different functions of the same organisation) and external boundaries (between an organisation and its external stakeholders) to establish a holistic understanding of the impacts of servitization on manufacturers.

Keywords – Servitization, Organisational Boundary, Servitization Challenges.

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1. INTRODUCTION

The manufacturing sector is transforming towards new business models, where services fulfil an essential and arguably dominant role. Such strategic transformation is commonly referred to as servitization (Baines et al., 2009), which entails the fundamental re-orientation of a manufacturer's strategy (Josephson et al., 2016), value creation and capture (Sjödin et al., 2020), organisational structure (Bustinza et al., 2015), and culture (Jorritsma and Wilderom, 2012). Numerous research and case descriptions indicate that servitization is fraught with challenges and difficulties (see Martinez et al., 2010, Baines and Shi, 2015, Zhang and Banerji, 2017, Reim et al., 2019, Dmitrijeva et al., 2020, Kapoor et al., 2021). While these contributions highlight that servitization creates a considerable range of challenges for manufacturers, they largely describe the symptoms of such challenges (what they are) and do not systematically explore the underlying root causes (why they were created). The handful of studies (e.g., Gebauer et al., 2005, Hou and Neely, 2018) that examine the underlying root causes largely pursue a firm-centric approach to understand servitization challenges, for example, by examining the shortcomings in leadership, communications, and financial risk management within organisations or by exploring the failures in managing collaborations. In this study, we take a more holistic view and shift the focus of analysis to inherently relational challenges that servitization creates and attend to the role of organisational boundaries that provide distinctions shaping a collective scope and activities.

Boundaries are social, symbolic or material demarcations and provide distinctions that shape a collective's scope and activities (Langley et al., 2019). They apply to both the internal and external context of organisations, highlighting demarcations between departments/functions, or between the organisation and its customers or partners. In the wider business and management literature, the boundary concept represents a well-established focal point to explain the underlying root causes of organisational and strategic challenges (Carlile, 2004, Kellogg et al., 2006, Zuzul, 2018). This is, however, an underexplored theme within the servitization literature (Valtakoski, 2017, Kohtamäki et al., 2019), and the opportunity such a concept offers to explain the root causes of servitization challenges has not received much attention.

So far, authors have implicitly referred to boundary disruptions when discussing servitization challenges; for instance, how product- and service-related activities (e.g., development, sales and delivery) become indistinct, leading to wider organisational challenges (Kindström et al., 2013, Eggert et al., 2015), or how objections to changes in roles and responsibilities impede

the transformation effort towards services (Sklyar et al., 2019, Hullova et al., 2019), or even lead an organisation to abandon servitization (Valtakoski, 2017). Although these studies demonstrate that servitization has a disruptive impact on the established social, symbolic and material demarcations that separate various stakeholders, groups or entities of product-focused manufacturers (Huikkola et al., 2020), a detailed and systematic understanding of this impact, and the ways in which it creates the servitization challenges, has not yet been established. Therefore, the present study focuses on the following research question: *How does servitization affect manufacturers' internal and external boundaries?*

In order to answer the research question and conceptualise the diverse implications of servitization on manufacturers, this study draws on an integrative framework on organisational boundaries by Santos and Eisenhardt (2005). This framework distinguishes between power, competency and identity boundaries, and provides a comprehensive understanding of the different underlying boundary conceptions. Adopting this perspective in understanding the servitization challenges substantially shifts the foci of analysis from the focal actors/companies to the relationships that surround servitization. Central to the boundary perspective is the recognition that relations are critical in understanding the challenges. Instead of seeing competence in isolation and from the focal firm perspective, it sees competence relationally across collectives, instead of seeding identity independently and from a focal firm perspective it sees it relational to customers, suppliers, and collaborators, and finally, instead of seeing power as something possessed by the focal firm or a group of actors it suggests that power should be seen in the relational context. We draw from the collective experiences of 20 senior executives from ten multinational manufacturers involved in servitization, using a multiple case study approach. The study takes into account both internal and external boundaries to better understand the root causes of servitization challenges and establish a holistic understanding of boundary implications.

The paper contributes to the servitization research in several distinct ways. First, by drawing on Santos and Eisenhardt's (2005) boundary conceptions, this study proposes an integrative framework that identifies servitization-specific boundary dimensions, consolidating the findings from previous research. Our proposed framework demonstrates how servitization disrupts long-established internal and external boundaries of product-focused manufacturers building on the theoretical notions of power, competency, and identity boundaries; it offers insights into the root causes of servitization challenges, and the management interventions needed to address them. Second, by focusing on the boundary disruption, we contribute to the

emerging body of research on servitization and organisational boundaries (e.g., Huikkola et al., 2020, Chakkol et al., 2018) and extend the view from boundary changes to the boundary implications that may lead to these changes.

From a practical perspective, this research provides a foundation for managers to systematically recognise, anticipate and manage the challenges created by servitization. Without such an understanding, we risk creating an isolated understanding of the root causes of servitization challenges, which could then lead to isolated/non-coordinated management efforts being made, or delayed decisions taken to tackle these challenges.

The remainder of the paper is structured as follows. Section 2 reviews the literature on servitization challenges and then discusses the notion of organisational boundary in a servitization context. Section 3 outlines the methodological approach of the research, followed by the analysis and description of the key findings in Section 4. The theoretical framework developed through the research is presented and discussed in Section 5. Finally, Section 6 presents the key contributions towards research and practice and offers directions for future research based on the limitations of this study.

2. THEORETICAL BACKGROUND

2.1 Framing Servitization Challenges

It is widely accepted that servitization is fraught with strategic and operational challenges since services require structure, resources, and processes that are new to product-focused manufacturers (Oliva et al., 2012). A number of authors have taken a broad view and showed how these challenges extend beyond the manufacturers' internal effort into their external context. (Zhang and Banerji, 2017), for instance, distinguish between challenges at the level of the organisation (internal) and those at the level of customer/ecosystem (external). Within the first group, the contributions emphasise the internal challenges that manufacturers face; for instance, in effectively transitioning towards a service culture (Homburg et al., 2003), creating a new service organisation that is responsible for service-related activities (Bustinza et al., 2015), and developing the required service capabilities and methods (Story et al., 2017). The customer/ecosystem-oriented contributions tend to emphasise the external challenges that manufacturers face; for instance, in effectively selling or delivering their service-based offerings to different market segments (Reinartz and Ulaga, 2008, Ulaga and Reinartz, 2011), building long-term relationships with customers, suppliers and other key players (Helander and

Möller, 2007, Penttinen and Palmer, 2007), and aligning key activities with the wider value network (Matthyssens and Vandenbempt, 2008, Martin et al., 2019).

In addition to pointing to the different loci (internal and external), a number of researchers have taken a more specific view towards servitization challenges, which can be largely categorised into organisational structure and leadership, resources and capabilities, and cultural and mind-set (see, for example, Zhang and Banerji, 2017, Kamal et al., 2020, Dmitrijeva et al., 2020).

In particular, evidence in the literature points to challenges that relate to the disruption of the established structure and arrangement of organisations. Manufacturers are required to make certain changes to their organisational structures that enable the use of their conventional product-oriented resources to support their transformation towards services (Bustinza et al., 2015). Such restructuring triggers resistance, as it affects the resource dependency between the service and other business functions. Researchers also suggest that servitization can disrupt existing roles of manufacturers and the wider ecosystem in which they are operating. (Rabetino and Kohtamäki, 2018) demonstrate that manufacturers need bargaining power in the ecosystem to develop and deliver integrated product-service offerings, and (Turunen and Finne, 2014) show how servitization makes manufacturers increasingly dependent on third-party organisations for accessing resources needed to develop and deliver services. Such dependencies could potentially pose issues for manufacturers, as they increase commercial risks in service-related contracts (Hou and Neely, 2018).

From the resources and capabilities perspective, servitization research has shown that, in the development and delivery of service offerings, manufacturers are required to leverage unique resources and build distinctive capabilities and competencies (Kowalkowski et al., 2013). Existing research also indicates that manufacturers lack the required resources within manufacturing organisations. This requires changes in the position of the manufacturers in the wider ecosystem, not only to leverage the use of existing resources and core capabilities but also to acquire capabilities they do not currently possess (Rabetino and Kohtamäki, 2013). For instance, (Coreynen et al., 2017) explain how servitizing manufacturers are required to collaborate with external firms to either develop or acquire the new knowledge and competencies that allow them to customise their service offerings. Such service-related competencies may interact with the competencies of other actors (customers, suppliers, etc.), ultimately changing the competency configuration of the servitization-based ecosystem (Gebauer and Binz, 2019).

Furthermore, evidence in the existing literature suggests that servitization triggers cultural and mind-set challenges in traditionally product-focused environments (Tronvoll et al., 2020). Servitization requires relationship-based value creation, and this increases the number of employees who interact with customers directly. Such reorientation in roles is one of the principal challenges of servitization (Martinez et al., 2010). The extant literature also suggests that servitization affects the role and identity of manufacturers in the wider ecosystem (Martin et al., 2019), largely due to the innovative value creation and capture processes. The transformation towards a service- and customer-centric logic requires a new thinking towards the traditional product-view of value creation and an improved understanding of how customers experience value (Brady et al., 2005). Such redirection, therefore, determines how external players (suppliers, partners, customers, etc.) perceive the identity and role of servitizing manufacturers (Kohtamäki *et al.*, 2019).

It is evident that the servitization literature has identified and examined a considerable number of challenges that manufacturers confront while servitizing. Though, they principally express the symptoms of such challenges without providing comprehensive explanations of the underlying root causes that create them. Such explanations are vital for manufacturers to better prepare for the wider implications servitization may create, particularly with regard to the power dynamics, competency gaps, and identity differences. This study, therefore, focuses on the concept of organisational boundary as a theoretical perspective that integrates and explains the root causes of the internal and external challenges that servitizing manufacturers face.

2.2 Boundaries within and across organisations

The above review of the servitization challenges suggests that servitization disrupts the status quo in manufacturers as it demands changes in their structure, their existing resources and competencies, and the prevalent mind-set and culture inside and outside of its boundaries. At their core, these challenges reveal how servitization disrupts the relationships between various stakeholders (internal employees and external firms) and how those relationships change in the course of the servitization.

Organisational Boundaries are critical in understanding how employees perceive, regulate and manage their relationships with others in organisations and wider ecosystems. They capture the relational properties of social processes and have, therefore, become central to various branches of social sciences and organisational studies (Lamont and Molnár, 2002, Emirbayer, 1997). Boundaries create divisions by separating areas of information and knowledge

(Lawrence and Lorsch, 1967), identities and cultures (Lave and Wenger, 1991, Brown and Duguid, 2001), and even political interests (Carlile, 2002). They also create a sense of belonging and certainty for employees that reside within them, and determine their membership in a group or organisation by showing who is 'in' and who is 'out' (Aldrich and Herker, 1977).

Organisations often deal with a multitude of boundaries. External organisational boundaries, mostly visibly, demarcate organisations from their operating environments and are essential in understanding what constitutes the organisation. How employees understand, respond to, and interact with their environment is largely shaped by these external organisational boundaries (Aldrich and Herker, 1977, Simon, 1997). In particular, external boundaries protect an organisation from their environment by buffering their employees from the potential uncertainties that the environment may create for them. In addition, organisations have internal boundaries – between various groups, teams, departments and specialties. The common language and shared practices and interests within these boundaries mean that employees enjoy shared spaces in which they can comfortably communicate, interact and exchange knowledge. Internal boundaries often demarcate across departments, different knowledge domains and practices, and vested professional interests (Carlile, 2002, Carlile, 2004, Bechky, 2003).

In an attempt to consolidate diverse views towards organisational boundaries, Santos and Eisenhardt (2005) drew on multiple theoretical perspectives to arrive at their integrative boundary framework. Drawing on the transaction cost theoretical perspective (Williamson, 1989), they introduced the boundary of efficiency which demarcates the legal and economical boundary of the firm. Building on the resource dependence view (Pfeffer and Salancik, 2003), they introduced the notion of the power boundary which forms around power dependencies amongst actors, such as employees and external firms (Santos and Eisenhardt, 2005, Bäck and Kohtamäki, 2015), and demarcates realms of influence. Building on the resource-based view (Penrose, 1959), they introduced competency boundaries which are determined by resources that a firm possesses and demarcate areas of expertise. Drawing on the organisational identity perspective (Albert and Whetten, 2004), they introduced identity boundaries which relate to how employees define their organisations holistically and demarcate membership domains.

In this study, we draw on Santos and Eisenhardt's (2005) framework to advance the understanding of servitization challenges. Their framework is widely adopted by management scholars (see Navis and Glynn, 2011, Zott and Amit, 2008) and is well-aligned with the servitization challenges that we identified above: structures, resources, and culture. In view of

this backdrop, our main focus will be on power, competency, and identity boundaries identified by Santos and Eisenhardt (2005).

We leave the boundary of efficiency out of this study, mainly because the range of servitization challenges identified in the extant literature seem to lack an explicit focus on the legal implications of servitization. In addition, the legal boundaries are defined contractually leaving very little room for the negotiations and conflicts that may be experienced in other boundaries. While power, competency, and identity boundaries may be constantly disrupted during servitization journeys, once settled, legal boundaries will remain for longer periods. Therefore, they fall outside the scope of the current research which seeks to understand how servitization unsettles the different boundaries.

3. METHODOLOGY

3.1 Research method and case selection

This study adopts a multiple case study approach to address the research question (Miles et al., 1994). Hence, to understand how the manufacturer's internal and external boundaries are affected by servitization, the study sought to draw on the experiences of a number of servitizing manufacturers. In order to ensure reproducibility and generalisability of our research and findings (Lee and Baskerville, 2003, Yin, 2003), a number of case selection criteria were established to clearly and consistently identify a representative target group for our research (literal replication logic). These criteria focused on identifying (a) well-established multinational manufacturers, that (b) are grounding their competitive advantage on intermediate and/or advanced service offerings, and (c) cover a variety of industry sectors to ensure the outcomes of this study are applicable to wide-range of industries engaged in servitization (Mastrogiacomo et al., 2019). A range of techniques was used to establish a shortlist of manufacturers, including: (i) monitoring and contacting attendees at field service and servitization networking events, (ii) participating in forums and networking on LinkedIn, (iii) reviewing articles in professional periodicals and magazines, and (iv) web searches for manufacturers that have associations with servitization.

After confirming their eligibility to be included in the study and their interest to participate, we focused on 10 case companies (see Table 1) in line with the well-accepted recommendation of four to ten cases for case-study research (Eisenhardt, 1989). This approach also allows the development of a more robust theory as the foundations are deeply rooted in varied empirical evidence (Eisenhardt, 1989). Servitization in these 10 case companies is driven by both internal

and external forces of change. While external forces are mostly technology-driven and based on service-focused customer preferences and competitor moves, the internal forces pivot around organisational moves to diversify with services as a potential revenue source.

Table 1: Profiles of case companies

Case companies	Staff / revenue	Industry/ business focus	Type(s) of service offering	Interviewees
Case A	> 6,000/ ~ £2B	Heating equipment manufacturer	Intermediate services (e.g., Connected solutions; Protection plans)	Manager for Customer Services and Vision; Manager for Innovation Distribution
Case B	< 3,000/ ~ £125M	Printing equipment manufacturer	Intermediate services (e.g., Remote monitoring and cloud capability; Extended maintenance)	Director of Service Development; Director of Product Development and Delivery
Case C	>14,000/ ~ £3B	Powered industrial equipment manufacturer	Intermediate services (e.g., Condition monitoring; Extended maintenance)	Director of Product-Service Research; Service Relationship Manager
Case D	> 3,000/ ~ £600M	Packaging equipment manufacturer	Intermediate services (e.g., Remote performance monitoring and performance advisory)	Service Business Manager; Director of Service Design
Case E	> 2,000/ ~ £3B	Industrial extraction equipment manufacturer	Intermediate services (e.g., Remote support for air filtration units)	Vice President for Service Development; Relationship Manager
Case F	> 70,000/ ~ £40B	Networking and tele-communications	Intermediate services (e.g., Digitised customer experience and performance advisory)	Senior Manager for Personnel Development; Director for Service Design and Development
Case G	> 100,000/ ~ £45B	Construction equipment manufacturer	Intermediate services (e.g., Leasing, renting & extended warranty; remote monitoring) Advanced services (e.g., Guaranteed performance contracts)	Head of Services; Service Design Manager
Case H	> 30,000/ ~ £600M	Commercial heavy vehicle manufacturer	Intermediate services (e.g., Remote monitoring services to support customers in fuel management) Advanced services (e.g., Predictive maintenance and overhaul)	Director of After Sales; Head of Service Management

Case I	> 70,000/ ~ £12B	Commercial tire manufacturer	Intermediate services (e.g., Sensor-enabled monitoring of tires for the road haulage companies)	Principal Innovation Officer; Director of Solutions
			Advanced services (e.g., Guaranteed uptime contracts)	
Case J	> 30,000 ~ /£7B	Transportation equipment manufacturer	Intermediate services (e.g., Remote monitoring services)	Director of Services; Senior Manager for Product Design
			Advanced services (e.g., Outcome-based performance contracts)	

3.2 Data collection

We used interviews to gather data on the internal and external impacts that servitization creates for the selected manufacturers. The specific research focus warranted access to interviewees who have responsibility and insights on both strategic decision-making and operational aspects of service development and delivery. Therefore, data was collected in the form of expert interviews (Bogner and Menz, 2009). This approach helps explore complex phenomena that can only be explained by individuals with extensive insights on the topic (Meuser and Nagel, 2009).

We, therefore, concentrated on employees who were: (a) decision-makers involved with devising key servitization strategies; (b) directly involved in development and delivery of service offerings, and (c) experienced in key service-supporting functions (such as marketing, sales, etc.). Across the manufacturers, only a selected number of representatives met these criteria, which not only limited the pool of respondents for the study, but also revealed that only members of senior management had comprehensive, yet similar insights on the topic. Therefore, we limited our sample size to two interviewees per case company, which is consistent with other studies that have used expert interviews with limited number of interviewees (Schroeder et al., 2020, Herterich et al., 2016, Long et al., 2016, Matthyssens and Vandenbempt, 2008).

Data collection was carried out using semi-structured interviews with questions focusing on: (a) the manufacturer's business focus and motivations for servitization; (b) the extent of the servitization efforts so far; (c) servitization challenges and their implications, internal and external to the manufacturer, and (d) management actions to address these challenges (the guiding interview questions are provided in Appendix 1). Interviewees were ensured confidentiality to improve the accuracy of their accounts. The interviews were conducted by

two researchers, which maintained clarity and consistency in the interview process, and confirmed the dependability of the research (Guba and Lincoln, 1994). Overall, 20 interviews were conducted, each lasting 45–60 minutes, resulting in over 950 minutes of recorded material.

We mitigated respondent bias in multiple ways. For instance, we guided interviewees to focus on chronologies of objective events (Davis and Eisenhardt, 2011) of the firm's servitization journey, and encouraged them to focus on facts and behaviours of employees, partners and customers. We also gathered extensive secondary data from sources, such as websites and internal company information (business plans and internal reports), to collate additional insights on manufacturers' service offerings (Table 1). These sources corroborated interview data (data triangulation) on the servitization objectives of the case companies (Yin, 2009), and enhanced the depth of data available for analysis.

In addition, we pursued 'member checking' to ensure the reliability of the findings and that the results resonate with the interviewee experiences (Birt et al., 2016). This technique allows interviewees to witness their experiences across the study's results, which increases the reliability of the analysis and makes the findings more transferable to the wider community (Birt et al., 2016). The synthesised data was returned to all 20 interviewees, in which 12 (from six case companies) agreed to take part in the member checking process. In line with the accepted guidelines in research for member checking (Candela, 2019), the respondents were interviewed again; this resulted in a further 6.5 hours of interview data. In the interview they were encouraged to check the accuracy of the findings and analysis, and provide alternate interpretations, if deemed necessary. The questions were mainly directed at (a) completeness of the findings, (b) accuracy of the codes segregating the servitization challenges and the root causes, and (c) fair and realistic representation of the analysis.

3.3 Data analysis

Thematic analysis was employed to analyse the data (Aronson, 1995, Vaismoradi et al., 2013). This approach has been successfully used by previous servitization-based studies (Lightfoot et al., 2011, Raddats et al., 2016, Story et al., 2017, Zhang and Banerji, 2017). For our study, two researchers followed a hybrid coding process to identify theory- and data-driven codes (Fereday and Muir-Cochrane, 2006). While the theory-driven coding focused on identifying servitization challenges, data-driven coding focused on identifying the root causes of these

challenges. As a part of data-driven coding, we were also able to identify some actions (management interventions) aimed at managing the servitization challenges.

The development of theory-driven codes was undertaken using a 'codebook' containing information on the codes, the means to identify those codes, and the examples for each code (Boyatzis, 1998, Braun et al., 2018). The codebook was based on the three boundaries of power, competency and identity. Two researchers went through the interview transcripts to understand, apply and refine the data to identify and categorise servitization challenges against the three boundaries. It is worth noting that not all challenges reported by the case companies were shortlisted for analysis. For instance, Case A considers expansion of service offerings as a major servitization challenge (because not all their products can be delivered in the form of product-service bundles), which creates planning, costing and management challenges. Since this challenge is not directly related to their power, competency or identity boundaries, it was deemed irrelevant for this study, and thus discarded. At this stage, it was also possible to group the challenges into *internal power/identity/competency boundaries* to reflect the dynamics playing out internally in a case company (e.g., between the service function and the wider organisation), and *external power/identity/competency boundaries* to reflect the dynamics playing out externally to the case company (e.g., between the manufacturer and external stakeholders, such as customers, technology partners and so on).

The aim of subsequent data-driven coding was to identify the root causes of the servitization challenges. For this purpose, we first grouped similar servitization challenges to derive meaning-based observations (Braun and Clarke, 2006). For instance, four separate challenges (but with common traits) of *uncertainty about servitization implications, confused professional identity, doubts over employment with the manufacturer*, and *employee dissatisfaction resulting in decisions to quit* were all grouped together into *employees fail to apprehend service concepts, and review association with the firm*. Thereafter, we analysed the collective challenge by consolidating the possible, yet credible, causes from each of the case companies to arrive at the root cause, which in this example is the *perceived threat posed by service identity outside of the service function.* In addition, as part of the analysis, we consolidated the steps undertaken by the case companies to address the servitization challenges that have emerged from the unsettled internal and external power, competency and identity boundaries, and presented them as 'management interventions' in the findings.

It should be noted that in undertaking data-driven coding, the two researchers also explored the opportunity to categorise the servitization challenges based on different types of service offerings, i.e., intermediate and advanced services. However, since all of the 10 shortlisted case firms offered some form of intermediate services (only four case firms also offered advanced services), our analysis did not suggest a direct correlation between the type of service offering (intermediate and/or advanced services) and the servitization-related challenges.

4. FINDINGS

4.1 Power boundaries

The analysis identified four servitization challenges (Table 2) emerging from control and dependency conflicts, both internal (between the service function and other business functions), and external to the manufacturer (between the firm, and their partners and customers).

Table 2: Power Boundaries

INTERNAL POWER BOUNDARIES		
Servitization Challenges	**Root Causes of Servitization Challenges**	**Management Interventions**
Difficulties in approving changes to service designs **Cases A & J:** lengthy processes of service design change approvals **Case H:** conflicts between product and service functions over service designs	**Internal misalignment of design authority:** most changes in service design require amendments in product designs. Yet, product functions tend to lead such changes without service function consultation, causing prolonged revisions of service designs.	**Aligning authorities and decisions for service design** Formalise product-related roles within the service function, and vice versa. Establish internal ratification processes to share decision-making of product and service function.
Customers' disapproval of service charges **Case D & E:** customers are reluctant to pay a premium for services, and expect services to be included in the product price, as a complementary offering	**Internal misalignment of service promotion and sales authority:** marketing and sales functions do not involve service function in service promotion and market positioning decisions; due to their lack of service experience, the true value of services to justify the pricing is not well communicated to the customers.	**Aligning authorities and decisions for sales and marketing** Integrating decision-making structures between service and marketing/sales functions. Consult service technicians, who receive most of the services-related feedback from customers.

		Formalise internal mechanisms for marketing/sales function to share customer feedback on service offerings with the service function.
EXTERNAL POWER BOUNDARIES		
Servitization Challenges	**Root Causes of Servitization Challenges**	**Management Interventions**
Difficulties in building direct manufacturer-customer relationships **Case E:** complexities in demonstrating potential of service offerings directly to the customers **Case F:** problems in accessing product use data from customer sites **Case I:** complications in involving customers in service pilots	**Manufacturer's limited control over customer relationship:** traditional product-focused business models relied on distributors/dealers/resellers as first point of contact for customer interactions; this reliance obstructs the development of the direct manufacturer-customer relationship required for the services context.	**Creating ownership for customer relationships** Establish direct interactions between manufacturer and customers (e.g., conference, training, customer visits). Develop service-related customer relationship management capabilities through acquisition of specialist companies.
Difficulties in building and controlling external partner collaborations **Case G:** IP issues and strategic concerns are straining partner relationships **Case H:** conflict of interests between manufacturers and dealer-networks in managing delivery of service offerings	**Manufacturer's lack of control over service delivery:** lack of service capacity and/or manufacturers' decision of not to invest in building service capacity internally requires manufacturers to outsource. This increases their dependency on external partners, which would result in those partners controlling some aspects of service design and delivery instead of the manufacturer.	**Developing ownership for service delivery** Conduct external stakeholder analysis to identify key partners and evaluate relationship risks. Ensure alignment of firm focus and goals with those of the involved partners.

Internal power boundaries

The analysis of the manufacturers' servitization efforts revealed *difficulties in approving changes to service designs* as an internal power boundary challenge. The root cause for this challenge was emerged as the misalignment of the design authority; that is the service function's lack of control over product designs, which ultimately creates significant challenges for the development of service offerings. Insights from Case A show the implications of the lack of such power:

If we [service function in the UK] did product development, we'd be in control, but as it is developed in Holland [product function], we are always a step behind. We feedback changes to the product function in Holland, they feedback to software guys, also in Holland, who then send back updates to the product function, before they finally come to us. When there are issues, communication is complex, and it is hard to resolve quickly. (Case A. Manager for Customer Services and Vision)

In addition, the data shows that *customers' disapproval of service charges* is another internal power boundary challenge. Lack of service function's input towards activities, such as service promotion and sales, is evident as the underlying root cause in this case, as it leads to ineffective market messaging that leaves customers unconvinced about the price they have to pay for services. For instance, Case D's service function does not have the power to engage in service sales, and their sales function, who are inexperienced in services, struggle to attractively package services to enable income generation from them. Case E experienced a similar challenge and discussed that:

We don't have the authority to communicate the usefulness of our services, but if done correctly, it can attract many more customers. (Case E, Vice President for Services)

External power boundaries

The analysis also identified a number of instances where servitization disrupts the preformed locus of control between manufacturers and their external partners and customers. The data revealed *difficulties in building direct manufacturer-customer relationships* as an external power boundary challenge. The root cause stems from the unsettled external power boundary where the manufacturer's control over customer relationship is limited due to the reliance on the distributors, dealers and sellers to deal with customers. In this regards, Case F reports:

The business model relies on partners to be the resellers of our offerings, resulting in those partners managing the customer relationships. (Case F, Senior Manager for Personnel Development)

Further probing into the data revealed *difficulties in building and controlling external partner collaborations* as another power-related challenge. Servitization requires new infrastructure, and manufacturers rely on external providers for critical aspects (technology, data analysis, etc.) of service provision. This externalises control of those aspects and this could be

considered as the root cause that complicates the effective management of the partner networks. Case G reports one such complication:

> *We wanted to keep a lot of the intellectual property, and they (software partners) wanted to commercialise it. We wanted them to do this for us, and not go ahead and sell our solutions to the rest of the market.* (Case G, Head of Services)

Management interventions

Servitization puts substantial strains on the preformed power boundaries of a product-focused manufacturer, which can significantly alter dependencies between the manufacturers' internal and external actors (e.g., employees, third party firms etc.). In addressing these challenges, the managerial actions undertaken by the case companies were aimed at: (a) formalising communication and decision-making structures to align and empower the service function with defined authority over service-related decisions across different business functions; (b) internalising control over customer relationships; and (c) understanding the service delivery network and power dependencies to strengthen the firm's leadership position, and maintain satisfactory control over network partners.

4.2 Competency boundaries

The analysis then identified four servitization challenges emerging from conflicts in comprehending the services concept, and the organisational readiness towards the provision of services (Table 3). Interestingly, our case companies showed that the competency-related challenges only affect manufacturers' external boundaries.

Table 3: Competency Boundaries

EXTERNAL COMPETENCE BOUNDARIES		
Servitization Challenges	**Root Causes of Servitization Challenges**	**Management Interventions**
Difficulties in formulating effective approaches for operating in the services market **Case B:** complexities in developing new service-led business models **Case E & G:** ineffective service marketing strategies and poorly	**Manufacturer's lack of knowledge on service industry practices:** manufacturers are unfamiliar with the service industry standards and best practices. Also, their inability to understand the customers' marketplace prevents them from exploiting the full potential of their service offerings, which hinders their ability to effectively	**Acquiring service industry knowledge from external sources** Collaborate with partners, who have the service expertise and working knowledge of the service industry dynamics. Seek assistance from research-based organisations for accessing

defined processes for introducing services	position services in the right consumer market.	market data and statistics to better understand the services market. Undertake the customer segmentation activity to identify potential markets for selling services
Limited range of service offerings, circumscribed to existing clientele **Case B & E:** inability to develop service offerings that can address the needs of an entire customer segment **Case H& I:** mismatch between the service offerings and the customers' requirements	**Manufacturer's lack of knowledge of customer's service requirements:** manufacturers struggle to identify the needs of the wider market for services as their offerings are designed to cater to the service needs of prominent product customers. Moreover, they fail to engage in quality conversations with the customers to understand customers' pain points that manufacturers can then use to develop the service offerings that customers most seek. This restricts the firm's service outreach and ability to build their service business.	**Develop competency to understand customer needs** Commit to advance internal service awareness and employ external expertise: develop internal skills to raise awareness of customers' (that the firm intends to target) business; employ personnel with experience in customer business and the service industry. Conduct workshops at customer sites for assessing their pains and gains to clearly define their service needs, and propose novel services aimed at maximising value for those customers.
Low-quality services with basic features and limited usefulness **Cases B & F:** restricted development of services using the few internal competencies derived from underdeveloped service-focused knowledge structures	**Manufacturer's lack of willingness to use external service competencies:** production culture is not receptive to external expertise ('not invented here mindset') and rejects the use of external resources/competencies. Internal evolution of service competencies is a slow process, hindering manufacturers' ability to develop high-quality advanced services.	**Develop competency to improve service quality** Undertake projects with external partners to then internally demonstrate the value of positive outputs from such collaborations. Employ service experts permanently to establish internal expertise, in line with the organisational culture. Project the need for a future service capability and already invest in its development and/or sourcing plans.
Inability to support service operations internally **Case A:** Inadequate service marketing and sales expertise	**Manufacturer's lack of service competencies due to excessive outsourcing:** some manufacturers fail to internally invest in service capacity as they scale up, and rely	**Systematically plan service capabilities**

prevents firm from directly selling to the customer **Case E & G:** lack of internal proficiency for supporting a crucial custom-built (outsourced) software	excessively on outsourced service-specific know-how, which not only limits their ability to develop such competencies internally, but also puts them in a vulnerable position due to increased dependency on external parties.	Identify missing competencies and access them via alliances, partnerships or acquisitions. Reassess strategic decisions to explore the potential of building resources internally and employ service-competent personnel to reduce dependency on external partners.

External competency boundaries

A review of the interview data showed that many manufacturers faced *difficulties in formulating effective approaches for operating in the services market*. Although dedicated service industries (e.g., consulting, legal) have developed best practices, such as those related to contracting, pricing, and valuation, manufacturers' lack of such expertise becomes the root cause of various hurdles in the context of service delivery. For instance, Case B reports:

> *Industry knowledge is crucial. We are a printing company. Servitization is a really new horizon. It requires us to understand how the industry works outside of just printing, so that's a huge challenge.* (Case B, Director of Product Development and Delivery)

Furthermore, evidence from the case companies suggests, manufacturers' *limited range of service offerings circumscribed to existing clientele* is representative of another challenge. In this case, the lack of expert knowledge on requirements of the service market emerges as the root cause, which hinders manufacturers' ability to effectively create services of value for a wider customer-base. For instance, Cases B and H report:

> *We need to understand the customer better, so the development is in customers' interests.* (Case B, Director of Product Development and Delivery)

> *Most of our service offerings failed to gain traction because customer challenges and needs were not understood by the development team.* (Case H, Director of After-Sales)

We also found that manufacturers developing *low-quality services with basic features and limited usefulness* posed an added competency-related challenge. Plans to outsource competencies too often tend to clash with manufacturers' product-centric organisational culture, which can compromise the overall quality of the firm's service outputs. For instance, Case B reports:

> *We do everything internally; outsourcing is not our strong point, and sometimes we'll push and develop something with our limited knowledge, instead of reaching out for the best to help us.* (Case B, Director of Product Development and Delivery)

On the other hand, if manufacturers extensively draw from external providers to make up for their limited service competencies, it can create another challenge related to the manufacturers' *inability to support service operations internally*. Dependency on external providers and excessive outsourcing are considered as the root cause that reduces the manufacturers' own learning/knowledge of the outsourced competencies, and also exposes them to significant risks if external providers fail to provide future support, as with Case E:

> *At first, it looked like the partners understood our requirements. But after a while, we found they don't have the industrial experience. Now we are exploring other options to continue supporting the software.* (Case E, Vice President for Business Development)

Management interventions

Servitization clarifies the distinction between product- and service-specific competencies and stresses the unavailability of the latter within manufacturers. In accessing these service-specific competencies, the case companies aimed their actions at: (a) increasing their grasp of service industry dynamics by systematically identifying the capabilities required for the development and delivery of services; (b) improving processes for capturing customer requirements; (c) enhancing internal capacity for developing/supporting service competencies by creating internal competencies in-house or via new hires; and (d) engaging in partnerships to develop the competencies missing within the firm.

4.3 Identity boundaries

Lastly, the analysis identified four servitization challenges emerging from sense-making conflicts between the manufacturers and their internal and external actors (e.g., employees, partners and customers) (Table 4).

Table 4: Identity Boundaries

INTERNAL IDENTITY BOUNDARIES		
Servitization Challenges	**Root Causes of Servitization Challenges**	**Management Interventions**

Difficulties in accepting and portraying the potential of services internally **Cases A, C & G:** disagreements across various functions over service-related opportunities resulting in non-cooperative silos **Cases B, D & E:** product mindset causing difficulties in achieving internal service buy-in	**Rejection of service identity outside service function:** servitization strategy is not unequivocally accepted throughout the manufacturer, because services are not recognised as a viable revenue stream. Support for service initiatives is withheld by some employees, impeding the overall progress of servitization within the firm.	**Repositioning the corporate identity towards services** Formalise processes to frequently disseminate service-related success stories within the firm (importantly, manage employee expectations by communicating realistic outcomes from services). Demonstrate the availability of capabilities for developing and selling services to reassure employees about the firm's service-readiness. Institutionalise service-oriented internal dialogues and devise mechanisms to incentivise/reward service sales.
Employees fail to apprehend service concepts and review association with the firm **Case A:** misconceptions leading employees to believe that services will replace them and cause job losses **Case B**: frustrated employees, as they struggle to understand services, which unlike products are intangible and tougher to measure	**Perceived threat posed by service identity outside of service function:** employees feel threatened by service changes that directly impact their longstanding product-dominant professional status. Uncertainty about what such changes entail fuels employee frustration; some even decide to leave, as their personal goals no longer align with those of the firm.	**Realigning professional identities with services** Clarify the importance of service goals for the business and arrange briefings from the top management to build employee confidence in services and explain how services help unleash the full potential of products offerings. Ensure that the line management and supervisors fully accept the firm reorientation towards a product-service world. Implement necessary training programmes to help employees develop service skills.
EXTERNAL IDENTITY BOUNDARIES		
Servitization Challenges	**Root Causes of Servitization Challenges**	**Management Interventions**
Difficulties in communicating the value of service offerings to external partners and customers **Case B:** lack of effective communication tools and	**Manufacturer's service identity not trusted by the partners and customers:** manufacturers' reputation as successful and reliable product businesses does not transfer to their service	**Demonstrate service identity to partners and customers** Establish and communicate manufacturers' motives to sell services.

framework to convey the value of services, which negatively affecting service sales **Case D**: Meagre service revenues causing difficulties in explaining true value of services to partners and customers	business. External partners and customers, doubt manufacturers' service abilities, given their lack of service experience.	Communicate to the customers that the firm has significantly invested in acquiring/accessing skills and competencies necessary for the development of high-quality services. Establish collaboration with a set of partners with a credible service reputation and experience in the service industry.
Difficulties in establishing a credible service reputation **Case D & H:** customers are suspicious about the manufacturer's ability to manage different aspects related to services	**Manufacturer's over-dependency on external partner's service reputation:** manufacturers' service credibility is heavily reliant on their partners' service ethos. Their partners' service reputations directly reinforce manufacturers' reputations as reliable service providers. Also, the manufacturers are apprehensive about talking to the customers, as they believe their lack of service knowledge could be perceived as their weakness by the customer.	**Developing service identity-consistent collaborations** Work towards building an independent service reputation by establishing a well-balanced profile of superior service competencies internally and creating a history of only partnering with organisations whose customers trust and vouch for their service capabilities. Build a trusting relationship with the customers to learn about their business to then demonstrate the value of the service offering in line with their needs and requirements.

Internal identity boundaries

Most case companies reported *difficulties in accepting and portraying the potential of services internally*, which can be understood to be an identity-related challenge. The root cause here is the unsettled internal identity boundary - the product-centric functions are used to produce demonstrable results, which are difficult to achieve with services, and this leads to differing opinions of the service potential across different business functions. Case A, for instance, expresses following concerns:

> *We started talking about services two years ago, and it's taking quite a lot of process to get something tangible. We have overpromised and under-delivered, and lost some engagement internally.* (Case A, their Manager for Customer Services and Vision)

Furthermore, a shift in organisational priority towards services creates a mindset challenge, where *employees fail to apprehend service concepts and review association with the firm*. Poor understanding of such priority shift is considered to be the underlying reason that heightens career-related anxiety amongst employees, making employee-retention a problem for the manufacturers. For instance, Case A explains:

> *Our engineers are worried that if we have smart technology then there's less jobs, less engineers. They see it as a risk, rather than looking at it as – you'll fix things faster, sell more boilers, have more work.* (Case A, Manager for Innovation Distribution)

External identity boundaries

Interviewees also reported *difficulties in communicating the value of service offerings to external partners and customers* as an identity-related challenge. The root cause lies in the fact that manufacturers are judged by their product quality, and partners/customers have less confidence in their abilities as service providers. For instance, Case B describes their experience:

> *We recognise some efficiency benefits with services and wanted to share them with the customers by lowering costs, but customers don't trust us as service providers, and lower costs did not translate correctly or improve service sales.* (Case B, Director of Service Development)

Another external identity challenge arises with the *difficulties in establishing a credible service reputation.* As manufacturers often engage in long-term partnerships to support their service development and delivery, affiliations dictate how (positive/negative) the service identity of the manufacturers is being perceived by their partners and customers. For instance, Case D explains:

> *The company you choose to partner with carries weight. The company we are looking at protects huge portion of the world's banking transactions. We are relying on their credible image to up the stakeholders' trust in us.* (Case D, Service Business Manager)

Management interventions

Servitization triggers a transition from a product-centric identity to a product-service-centric identity, creating several challenges. In managing these, the case companies took actions aimed at: (a) projecting servitization as a goal that is complementary to the organisation's product-

centric goals by using effective internal communication; and (b) strengthening external communication to build partner and customer trust in manufacturers' service-readiness and ability to deliver reliable and viable services.

5. DISCUSSIONS

The present study has adopted the concept of organisational boundary to explain how servitization affects manufacturers and creates a wide range of challenges. Such a perspective has led us to develop an integrative conceptual framework (illustrated in Figure 1), which offers insights into the root causes of various servitization-related challenges. Based on the theoretical notions of power, competency, and identity boundaries, the theoretical framework proposes that the transformation from a product to a service-led business model (servitization) disrupts the manufacturer's established product-focused boundaries. Such disruptions create a variety of servitization challenges, which ultimately demand management interventions to bridge the gaps between the established product- and prospective service-focused boundaries.
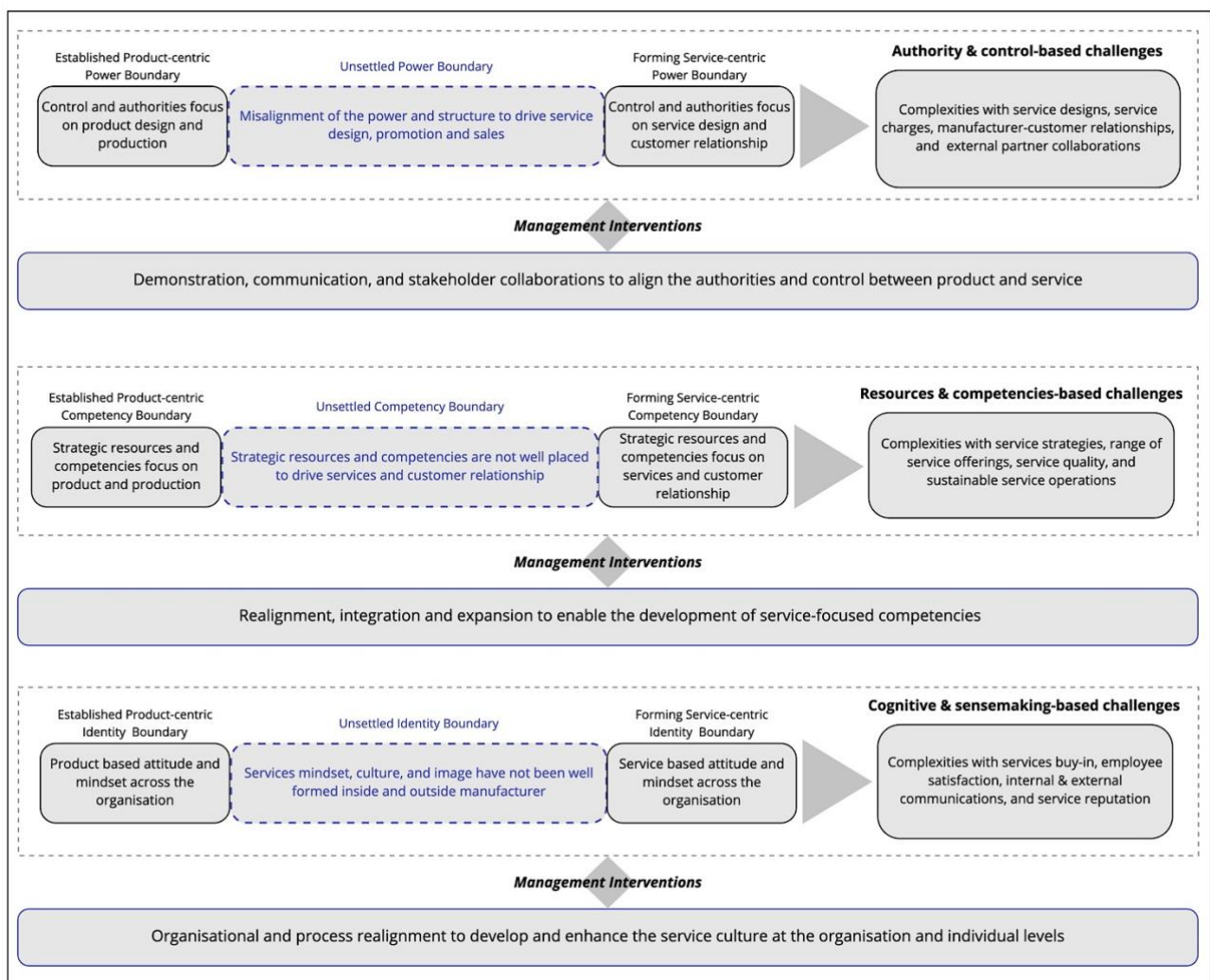
5.1 Power boundary

Our findings explain how servitization disrupts and unsettles the internal and external power boundaries which were formed to support the manufacturers' product-focused strategy. However, such boundaries are ineffective in accommodating the distinct requirements of a service-focused strategy (design, promotion, sales, etc.), creating a range of authority and control-based challenges. Although such challenges have been described by the extant literature (Brashear et al., 2012, Fischer et al., 2010), our focus on the unsettled power boundary as the root cause of these challenges provides a rich basis to theorise on the power implications of servitization.

Power boundaries, with their foundation in the resource dependence view (Pfeffer and Salancik, 2003), demarcate both power imbalances and mutual dependencies in an organisational context (Casciaro and Piskorski, 2005). The understanding that servitization creates power imbalances by increasing the power of the service function within the manufacturer (Alghisi and Saccani, 2015), and by increasing the power of the manufacturer within its ecosystem (Bustinza et al., 2015) has been established in the literature. Our study extends these discussions by demonstrating that servitization not only affects the power balances, but also the mutual dependence of product and service functions.

The range of identified root causes highlights authority and control requirements (e.g., misalignment of power, lack of control), yet the range of management interventions point to a wider scope of initiatives addressing power balances and mutual dependences (e.g., communication and stakeholder collaborations). The management interventions targeting internal power boundaries aim to expand collaboration and decision making in order to align and accommodate the growing mutual dependence between the service and product functions. Yet, the management interventions targeting the external power boundaries aim to formalise the manufacturer's ownership of its customer relationship and service delivery network. As organisations often seek to consolidate power in the early stages of a strategic reorientation (to increase flexibility) (Baines et al., 2020), it may be that at a later stage the manufacturers will seek to emphasise the mutual dependence in the range of management interventions.

Additionally, there are some interdependencies in the management interventions for tackling internal and external power boundary challenges. For instance, the sales function/service

technicians can be expected to be more forthcoming with the service function in sharing service-focused customer feedback (internal boundary) when the manufacturer demonstrates strategic realignment to now gain ownership for both customer relationships and service delivery processes (external boundary).

5.2 Competency boundary

Our findings also reveal the different ways servitization unsettles the manufacturers' competency boundaries, creating a range of resources and competency-based challenges. Notably, competency-focused servitization challenges and root causes were only identified with regards to the external boundaries and not internal ones. In fact, internal challenges that included competency aspects, for instance, difficulties in approving changes to service designs, were explicitly framed by the interviewees as power-related challenges as they were used as arguments for sharing decision-making authority instead of internal knowledge exchange.

Servitization requires the manufacturer to expand the scope of their external competency boundary and develop better knowledge of the needs of their customers, service practices, and new technologies (Story et al., 2017, Kapoor et al., 2021). The identified effects of servitization on the external competency boundary highlight a paradoxical concurrence of a need for external competencies, but also a rejection and overreliance on such competencies. Although prior studies have already identified the need for external service competencies among servitizing manufacturers (see Paiola et al., 2013, Coreynen et al., 2020), it is only through the identification of the other effects that the dilemma of the external competency boundary becomes clear: the unwillingness to draw on external service competencies likely exacerbates the lack of internal service competencies, leading to further service outsourcing which, in turn, limits the development of the manufacturer's own service competency.

The effect servitization has on the external competency boundary can be interpreted through the resource-based view (Penrose, 1959): for a product-focused manufacturer, service competencies are of limited strategic value; they are likely of limited complexity, and of limited importance for the core business and, therefore, prime candidates to be outsourced (Lacity et al., 2010). However, for a servitized manufacturer that competes through services, the service-related competencies increase in complexity and importance for the core business. Hence, the resource-based view suggests that the manufacturer's service competence becomes a strategic resource in a servitization context which requires its control and careful development to further ensure that it can become the manufacturer's long-term source of competitive advantage.

5.3 Identity boundary

The analysis sheds further light on the different ways servitization unsettles the manufacturer's established internal and external identity boundaries. It specifically demonstrates how the unsettling of the internal service/product demarcation causes cognitive and sensemaking-based challenges among product-focused employees, hereby confirming other studies that described how the rejection of service-identities represent a major servitization challenge (Ulaga and Loveland, 2014, Lenka et al., 2018). In addition, our analysis identifies how servitization unsettles the manufacturer's external identity boundary, which has received less attention in the literature. It shows how servitization creates a misalignment between the product-centric image these manufacturers have established and the service-focused identity they require to match their service-focused strategy.

The external identity boundary becomes particularly important as the manufacturers draw on communication-based management interventions to address the unsettled identity boundaries: a well-developed service identity provides the manufacturers with legitimacy in the market, and their ability to communicate initial market success provides the momentum to support the development of their internal service identity. In the context of identity boundaries, it is important to consider the interdependence of internal and external boundaries, as they create a self-enforcing dynamic which may lead organisations into "protracted period of identity ambiguity" (Tripsas, 2009: 452). Arguably, in a servitization context the risk of extended periods of identity ambiguity is particularly high as manufacturers normally not just pivot to a service model, but often seek to maintain their product-and service businesses in parallel.

6. CONTRIBUTIONS, LIMITATIONS AND FUTURE RESEARCH

6.1 Theoretical contributions

Our research findings and the development of the boundary conception of servitization provide multiple theoretical implications to both servitization and organisation boundary literatures. First, our study highlights how servitization unsettles the existing internal and external power-, competency- and identity-boundaries of product-focused manufacturers. These insights not only advance our understanding of the substantial disruption servitization creates (Baines et al., 2017), but also directly address calls for researchers to investigate the implications of servitization from a more holistic perspective (Calabrese et al., 2019, Paschou et al., 2020).

Second, by showing how servitization unsettles the established boundaries, the study contributes to the emerging body of research that examines how servitization shapes the

manufacturers' boundaries (e.g., Huikkola et al., 2020, Chakkol et al., 2018); it expands the research scope from a focus on the recognisable boundary changes servitization creates to a focus on the implications of such changes (which may or may not lead to actual boundary changes). Our study further contributes to servitization research by integrating considerations of the manufacturer's internal (Gebauer et al., 2009, Raddats and Burton, 2011) and external boundaries (Huikkola et al., 2020). This integration creates opportunities to theorise on the commonalities (see Section 5.1, power boundary discussion) and interdependencies (see Section 5.3, identity boundary discussion) between manufacturers' internal and external boundaries in a servitization context.

Third, our study provides an integrative framework that creates an opportunity to consolidate the boundary-related root causes of various servitization challenges and ground them in the related theory base i.e., resource-based view (Penrose, 1959), resource dependence view (Pfeffer and Salancik, 2003), and organisational identity perspective (Albert and Whetten, 2004). Although others have already drawn on the resource-based view to interpret servitization-related competence challenges (see Raddats et al., 2019), our study further characterises these challenges as emerging boundary issues by theorising on the availability of the missing competences - outside the boundary; a reinterpretation that shifts the focus from resource creation (e.g., Raddats et al., 2017) to resource access (e.g. collaboration, alliance, acquisition). This reinterpretation not only emphasises the range of options that are available to address these competence challenges (create vs. integrate vs. utilise), but also imposes a more careful consideration of the critical nature of these competences and the strategic implications these options create, internally and externally.

Our research also highlights how servitization challenges established dependencies and helps to understand how these unsettle the manufacturer's internal and external boundaries. It integrates previously separated discussions on the internal (Wagstaff et al., 2020) and external (Ziaee Bigdeli et al., 2017) power implications servitization creates and highlights a link between internal power and competency boundaries. Similarly, our focus on the unsettling of the internal and external identity integrates previously independent consideration of internal (Kohtamäki et al., 2018) and external (Huikkola et al., 2020) identity challenges and provides a basis to consider their dynamic and ambiguous interdependence.

Our study also contributes to the established boundary literature in two distinct ways. While boundary studies generally focus either on the organisations' internal (Majchrzak et al., 2012,

Edmondson and Harvey, 2018) or external boundaries (Rosenkopf and Nerkar, 2001, Santos and Eisenhardt, 2009), we see value in integrating the analysis of these two boundary types to enable theorisation on their commonalities. In addition, within the current context of out/in-sourcing, and mergers and acquisitions, the distinction between internal and external boundaries is of an increasingly temporary nature and a matter of perspective (Baldwin, 2008, Ferraro and O'Mahony, 2012). As the underlying theories are applied within and across organisations, we established substantial opportunities to study both types together.

Further, we contribute to the understanding of organisational boundaries by showing how they are disrupted by an organisation-wide change initiative, such as servitization. The wider literature often conceptualises boundaries as firmly set and stable demarcations which interrupt information flows and limit shared understanding (Langley et al., 2019), with corresponding studies focusing on boundary bridging (e.g. boundary spanning) (Birkinshaw et al., 2017, Kaplan et al., 2017) instead of boundary adjustment (Langley et al., 2019). We demonstrate how a strategic initiative affects these boundaries and turns them from settled demarcations which actors interact and collaborate across, into unsettled contended areas, which call for managerial interventions to adjust them.

6.2 Managerial contributions

By drawing on the experiences of a diverse range of manufacturers, this study not only provides a framework to identify and assess how servitization affects the manufacturer's boundaries, but also offers concrete recommendations for dealing with these effects. Through highlighting the diverse range of boundary implications, our proposed boundary conception of servitization helps decision makers in anticipating the range of possible implications their servitization efforts may create and rationalise the range of servitization challenges they may have to manage.

Of particular interest are the identity-related challenges and management interventions that the study identified. While business executives involved in servitization could relatively quickly recognise the emerging identity challenges between product and services functions, they may not swiftly notice the challenge of developing an external service identity, which usually surface as the market shows no interest or rejects the service offerings. Arguably, balancing an external identity is as critical as the internal one. It therefore becomes important for servitizing manufacturers to systematically engage with these efforts by developing the careful

communicating approaches, and also engage in the strategic partnerships that can help with the development of the external service identity.

With regards to the power boundary, our findings demonstrate that the internal power boundary is of particular interest for business leaders. While manufacturers will likely anticipate the external power implications of servitization and will have considered ways to accommodate their network partners, they may not necessarily anticipate the power implications servitization creates internally which can have a potentially debilitating effect. For manufacturers, it would be important to focus early on strengthening the collaboration and formalising the new relationship between the service and product functions to ensure these boundary implications are effectively managed to avoid escalation.

In addition, the competence boundary implications should be considered by business leaders engaging in servitization. Although the analysis only identified competence issues with regard to the external boundary, it is clear that the range of choices (creation, collaboration, alliance, acquisition) may have critical strategic implications as they can create dependencies that can affect the service business in the long run.

By showcasing the diverse efforts that manufacturers perform to overcome the internal and external boundary implications, this paper provides a toolbox of concrete management interventions to lower boundaries (e.g., shared decision making), expand boundaries (e.g., learning about services), or assert boundaries (e.g., taking ownerships of customer relationships). A manufacturer's transformation from a product- to a service-focused business model will necessarily involve internal and external boundary changes, which require careful considerations and targeted management interventions.

6.3 Limitations and future research

This research, despite a range of theoretical and practical contributions, has certain limitations. First, the selection of case studies has a significant impact on the research outcome. The study specifically captured scenarios from large and multinational manufacturers, which needs to be taken into consideration when translating the findings to the context of small–medium-size manufacturers. Second, the choice of method has inherent limitations. Although the study relied on a diversity of interviewees to provide a balanced and rich perspective, more interviews could have further expanded the findings. Third, in employing the codebook technique, we follow thematic analysis as explained by Braun and Clark (2006). However, defining the point of saturation in interpreting the data and developing the codebook is subjective to the

researchers involved in the coding process (Ando et al., 2014). Hence, while the data was analysed in a team context, and significant time was spent in consolidating the interpretations of the data, other researchers might have drawn additional conclusions.

Based on the findings and limitations of this study, there are several opportunities for future research. Although we have selected our case companies that offer intermediate and/or advanced services (i.e., on different stages of transformation), our analysis did not identify a significant link between the type of service offering and the related boundary challenges that servitization creates. Though, it would be valuable for the future research to also explore a process view of servitization and apply a narrower or theoretical replication logic that differentiates between manufacturers at different transformation stages in order to investigate how organisational boundaries are impacted or disrupted at different stages of the servitization journey (Baines et al., 2020). Such insights would help manufacturers to be more targeted in anticipating and managing the challenges and would help inform the emerging processual view on servitization (see Palo et al., 2019, Sjödin et al., 2020). In addition, our study mainly identifies management interventions, but does not account for how effective these interventions are in managing the servitization challenges. Future research could look into the effectiveness of these management interventions to help formalise these actions as relevant strategies.

Our adoption of the boundary perspective focused on the power, competence and identity boundaries, but did not focus on the efficiency boundary as these legal and contractual boundaries are largely defined at the final stages of servitization transformation, leaving very little room for negotiations and conflicts that may be experienced in other boundaries. However, as the manufacturers progress through the transformation, future research should explicitly examine the efficiency boundaries and analyse how the underlying transaction cost economics (Williamson, 1989) can explain servitization challenges and management interventions.

Finally, although our study targets diverse range of boundaries individually, the discussion and interpretation of the findings highlight possible interdependencies across the different types of boundaries and between the internal and external perspectives. Future research should specifically focus on further exploring the interdependencies and interactions as well as potential patterns of prevalence or dominance of any single boundary type (power, competence and identity) to develop a systems-view of servitization boundaries. Our proposed framework provides a solid basis for this and the other future research opportunities.

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