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Unpacking the relationship between digital capabilities, services capabilities, and firm financial performance: A moderated mediation model

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ABSTRACT

Extant research exploring the relationship between servitization, digitalization, and firm financial and market performance provides valuable insights, but yields inconsistent and inconclusive results. This study argues that these inconsistencies arise from the ambiguous nature of servitization. Prior research have operationalized servitization as a business model (service type) or a set of service capabilities, treating these distinct constructs interchangeably. This study, therefore, advanced the proposition that both service capabilities and service type need to be incorporated into an integrated framework. To test this, the research develops and empirically validates a moderated-mediation model for the relationship between digitalization, service type (moderator), service capabilities (mediator) and firm financial and market performance using data from 204 manufacturing firms. The results indicate that service capabilities positively mediate the relationship between digitalization and firm financial and market performance. The moderating effect of the service type on service capabilities and firm financial and market performance are more pronounced for services supporting customers than services supporting products. The findings underline the imperative for manufacturers to develop their digital capabilities to enhance their service capabilities, irrespective of the type of services they offered. The findings contribute by enriching our understanding of the relationship between servitization, digitalization and firm performance.

1. Introduction

Servitization reflects the strategic transition from selling products to selling services (Baines, Lightfoot, Benedettini, & Kay, 2009). Benefits associated with pursuing a servitization strategy include customer lock-in (Visnjic et al., 2017), more profitable longitudinal revenue streams (Neely, 2008), and sustained competitive advantage (Bustinza et al., 2015). Whilst these benefits have been well discussed, empirical research suggested the existence of a 'servitization paradox' whereby manufacturers do not receive the expected returns from the investment made in servitization (Brax, 2005; Gebauer et al., 2005). However, recent studies have consistently suggested a positive, yet not always linear, relationship between servitization and firm performance (Fang et al., 2008; Eggert et al., 2011; Visnjic Kastalli and Van Looy, 2013; Visnjic et al., 2016; Kohtamäki et al., 2013). Wang et al. (2018) meta-analysis confirms this trend, finding a general positive relationship between servitization and firm performance. More recently, servitization

scholars have become interested in digital technologies and what benefits they afford servitized manufacturers, leading to a stream of research labelled 'digital servitization' (Vendrell-Herrero et al., 2017). The benefits of growing data availability, analytical techniques and other digital tools include improved customisation of service offerings for individual customers (Cenamor et al., 2017), more proactive maintenance (Grubic, 2014) and improved centralised decision making (Sklyar, Kowalkowski, Sörhammar, & Tronvoll, 2019). In addition to studies on what digital technology affords servitized manufacturers, interest has increased in the relationship between servitization, digitalization and firm performance. Despite research attention, the nature of the relationship between servitization, digitalization and firm performance remains contested and incomplete.

Studies investigating the relationship between servitization, digitalization and firm performance have provided insightful, but often conflicting or incomplete results. Focussing on quantitative studies, Kohtamäki et al. (2020) analyse the moderating effect of servitization on

the relationship between digitalization and firm performance, finding that high levels of servitization and digitalization positively affect firm performance, helping firms capture value from investments in digital technologies. Martín-Peña et al. (2020) find that digitalization has a positive mediating effect on the relationship between servitization and firm performance. Abou-foul et al., 2020 find that servitization partially mediates the relationship between digitalization and firm performance. These results suggest there is a positive relationship between servitization, digitalization and firm performance. Finally, Yang et al. (2023) conceptualised servitization as base and advanced services and find servitization partially mediates the relationship between digitalization and firm performance. The conflicting results with respect to the interactions between variables and the type and direction of relationships means the nature of this relationship remains contested and requires further exploration (Abou-foul et al., 2020).

To unpack the relationship between servitization, digitalization and firm performance, our study adopts the resource-based view (RBV), developing and empirically validating a theoretical model using conditional process analysis and survey data from 204 manufacturing firms from the UK and Germany. In the model, servitization is characterised using two constructs from existing research, service capabilities and service types. Service capabilities reflect the resources required to design and deliver services (Ayala et al., 2019; Sousa & da Silveira, 2017). Service types reflect the business model of the organisation and the services they provide their customer (i.e., services supporting products and services supporting customers) (Oliva & Kallenberg, 2003; Visnjic Kastalli & Van Looy, 2013). The distinction is based on the separation of strategic (business model) and operational (design and delivery) components of servitization (Baines, Lightfoot, Peppard, et al., 2009; Barnett et al., 2013), which require alignment for manufacturers to obtain positive outcomes from servitization (Baines, Lightfoot, Peppard, et al., 2009; Brax, 2005). Our hypothesis is that service capabilities mediate the relationship between digital capabilities and firm financial and market performance, whilst service types moderate this mediation relationship, being more intense for services supporting customers than services supporting products.

The paper is structured as follows. The next section provides the theoretical background, hypothesis, and theoretical model. The subsequent sections present the research methodology and results. The paper then provides a discussion of the findings, with particular emphasis on the theoretical and managerial implications of the research. The paper concludes with a summary and a set of future research directions.

2. Research hypothesis and framework

2.1. Servitization

Servitization reflects the strategic transition from selling product to selling services and is defined as "*the innovation of an organisations capabilities and processes to better create mutual value through a shift from selling product to selling PSS*" (Baines, Lightfoot, Benedettini, & Kay, 2009; pp. 555). By integrating products and services, servitization has enabled manufacturers to obtain both strategic and economic benefits (Neely, 2008). For example, servitization allows manufacturers to receive more profitable longitudinal revenue streams (Wang et al., 2018), lock-in their customers (Visnjic et al., 2017) and differentiate themselves from pure product manufacturers, thereby avoiding the "commoditization trap" (Baines, Lightfoot, Benedettini, & Kay, 2009; Bustinza et al., 2013). Servitization is therefore an effective strategic change to improve manufacturers financial and market performance, generate competitive advantage and improve customer satisfaction (Baines et al., 2017; Kindström & Kowalkowski, 2014). Examples of successful servitization in industry, with a focus on advanced services, include Rolls Royce "Power by the Hour", Alstom's availability contract with Avanti Trains on the East Coast Main Line in the United Kingdom, Xerox Managed Print Services, and MAN Truck & Bus's performance-based contracts. Whilst these examples generally reflect services supporting customers, servitization is often seen as a continuum stretching from services supporting products (SSP) to services supporting customers[1] (SSC) (Oliva & Kallenberg, 2003; Visnjic et al., 2016). Along this continuum, it is accepted that SSCs provide the most benefit strategically and economically for manufacturers, with SSP often considered a platform for manufacturers on their path toward SSC (Sousa & da Silveira, 2017; Suarez et al., 2013; Visnjic Kastalli & Van Looy, 2013). However, simply moving along the continuum toward SSC with respect to a change in the business model is not enough to receive the strategic and economic benefits of SSC. To be successful in servitization, the research community has identified the need to develop both service-orientated resources and capabilities and digital capabilities aligned to the service type offered (Gebauer et al., 2021; Hullova et al., 2019; Marcon et al., 2022; Münch et al., 2022; Sousa & da Silveira, 2017). However, there is a lack of empirical work that considers both the firms digital and service capabilities and the service type offered in an integrated model (Münch et al., 2022). Based on the RBV, this research develops a theoretical model to understand and test the relationship between service capabilities, digital capabilities, service type and firm financial and market performance. Fig. 1 presents our theoretical model.

2.2. Service capabilities

This study draws on the RBV of the firm and conforms to the view that competitive advantage is achieved through a firm's ability to utilise its capabilities, which are considered bundles of resources at the firm's disposal, to perform productive activities in a consistent, reliable and at least satisfactory manner (Jacobides & Winter, 2012; Story et al., 2016). Consistent with the broader service operations management literature that services are processes (e.g., Sampson & Froehle, 2006; Ponsignon et al., 2011), we subscribe to Sousa and da Silveira (2019) view that servitization capabilities are associated with a manufacturers' ability to design and deliver services consistently and dependably for their customers. Therefore, whilst dynamic capabilities are required for servitized manufacturers to respond to market changes and seize these opportunities, this study focusses on operational capabilities with respect to service design and delivery that allow manufacturers to operate in the present day (Jovanovic et al., 2019; Raddats et al., 2017).

Within the literature, different types of capabilities have been discussed with respect to service design and delivery. For example, Ulaga and Reinartz (2011) highlight four service-related capabilities required by manufacturers for servitization, including risk mitigation and design to service. Tuli, Kohli, & Bharadwaj (2007) highlight the need for joint design and delivery of products and services. Ostrom et al., (2010) and Baines, Lightfoot, Benedettini, and Kay (2009) note that service orientated culture is different from a manufacturing culture. Raddats et al. (2015) describe the requirement for skilled service personnel, with Visnjic Kastalli and Van Looy (2013) identifying their skills and how the close proximity of service personnel to customers can help sales and customer relationships. Ayala et al. (2019) highlight the need for change across three dimensions for servitized manufacturers: the resource base, activity (delivery) system and the service offering. Finally, Sousa and da Silveira (2017) find empirical evidence that shows both base (SSP) and advanced (SSC) require service specific capabilities, where service capabilities are measured as a firms' ability to effectively design and deliver their specified services for their customer. Overall, there is a consensus within the literature that whilst SSP generally rely on existing manufacturing capabilities such as product and production knowledge, both SSP and SSC require varying degrees of service-related capabilities

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[1] Services supporting products and services supporting customers are considered analogous to Baines and Lightfoot (2014) base, intermediate and advanced services within our study. The latter, advanced services, is considered SSC whilst base and intermediate are SSP.
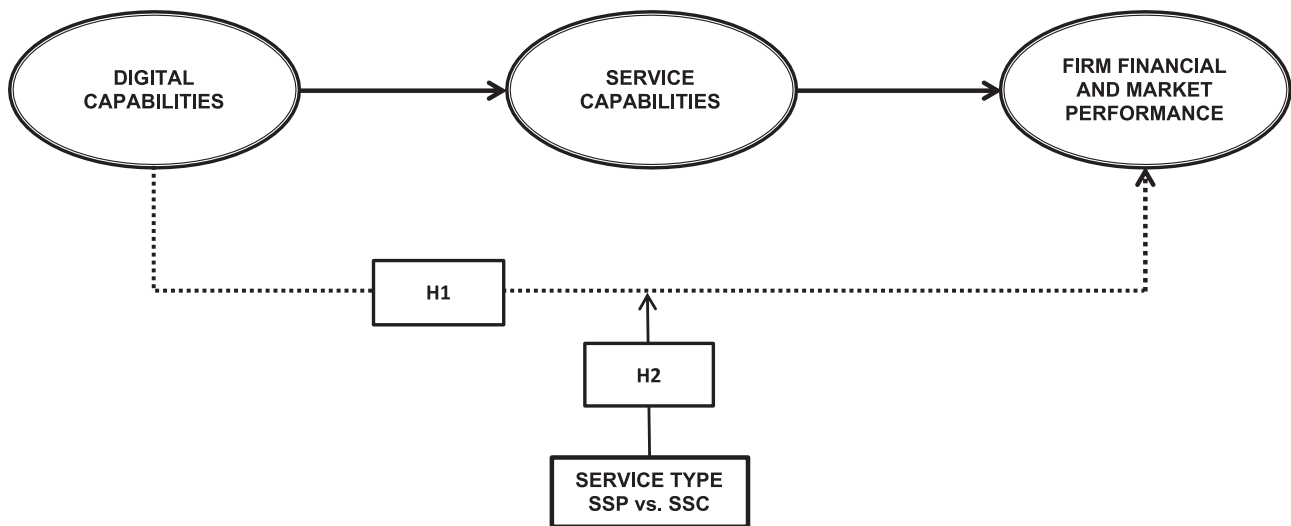
Fig. 1. Theoretical model.

if a firm is to capture the financial and market benefits of servitization.

2.3. Digital capabilities

Digital capabilities arise from an integrative programme of digital transformation. We adopt the perspective of Volberda et al. (2021) who proposed that digital transformation is the use of novel digital technologies (technology assets for digital transformation) that facilitate comprehensive organizational change (organizational capabilities for digital transformation). This entails reframing a firms cognitive management models through envisioning innovative digitally enabled business models. Our study therefore considers digital capabilities developed internally within a firm, and examines the dual transformation: organizational capabilities and technological assets required to develop digital capabilities. Following the rational of this dual transformation, previous studies has showed how digital capabilities are responsible of achieveing competitice advantage (Mikalef et al., 2020) and increased resource orchestration capability that ultimately improves firm performance (Kristoffersen et al., 2021).

Recently, a new stream of servitization research has developed known as 'digital servitization' (Vendrell-Herrero et al., 2017). Interest in digital servitization increased researchers found that digitalization improved centralised decision making (Sklyar, Kowalkowski, Tronvoll, & Sörhammar, 2019), improved front-office and back-office coordination (Cenamor et al., 2017), supported the provision of customised solutions at scale (Davies et al., 2021), that integrated customer data supported efficiency in the automation of support processes (Sklyar, Kowalkowski, Sörhammar, & Tronvoll, 2019), and digitalization improved product and service process optimisation within servitized firms (Frank et al., 2019). For Schroeder and Kotlarsky (2014), digital resources are valuable to servitized manufacturers as digital technologies such as IoT offer manufacturers the opportunity to develop digital capabilities and provide more complex, advanced services with more profitable revenue streams. Paschou et al. (2020) claim that digital technologies such as IoT are pre-conditions for developing digital services, and are often associated with more advanced services such as performance contracts and availability contracts (Green et al., 2017). This is because digitalization enables the collection and transmission of data from product use back to the OEM for analysis, monitoring and decision-making (Schroeder et al., 2019). Ulaga and Reinartz (2011) postulate that service-orientated data analytics are a core capability for servitizing manufacturers. Capabilities in data analytics are beneficial for both differentiation (e.g., customisation) and cost leadership advantage (e.g., efficiency) (Iansiti & Lakhani, 2020). Finally, Marcon

et al. (2022) find that across the entire continuum of service types, each type of service (i.e., SSP or SSC) requires some form of digital capability to deliver service for their customers. For instance, whilst most of the literature has focussed on digital capabilities for advanced services, within their review they find SSPs (base services) require a range of digital capabilities, including remote diagnostics, internal integration of product use and customer data, and service-orientated support services.

The consistent thesis throughout these studies is that digital capabilities enable and enhance a manufacturer's ability to deliver both SSP and SSC. This suggests a relationship between digital capabilities and service capabilities and aligns to the thesis that digital technologies, and with them the digital capabilities firms create, are enablers of servitization. Notably, Sjödin et al. (2020) clearly state the enabling role of digital technologies for service delivery in their definition of digital servitization, which is "*as the transformation in processes, capabilities, and offerings within industrial firms and their associate ecosystems to progressively create, deliver, and capture increased service value arising from a broad range of* **enabling** *digital technologies such as the Internet of Things (IoT), big data, artificial intelligence (AI), and cloud computing*" (pp. 478). Therefore, whilst articles that offer a combined view of digital capabilities and service capabilities are rare (Münch et al., 2022), our review highlights a clear relationship between digital capabilities and service capabilities. Specifically, digital capabilities are identified as enablers of servitization, enhancing an organisation's service capabilities and allowing them to capture more value.

Based on the above review, we posit the following hypothesis:

H1. Service capabilities mediate the relationship between digital capabilities and firm financial and market performance.

2.4. Service types

There is a significant body of empirical work investigating the relationship between servitization and firm performance. This literature predominantly analyses relationships according to their type (i.e., SSP or SSC), therefore operationalising servitization from the perspective of the service offering or business model rather than service capabilities. Within the literature, servitization manufacturers, and in particular SSCs, are shown to have more profitable longitudinal revenue streams, economic stability and have competitive advantage over those competing on the basis of manufacturing alone (Baines, Lightfoot, Benedettini, & Kay, 2009; Oliva & Kallenberg, 2003; Visnjic et al., 2016). Furthermore, studies typically found a positive, yet non-linear relationship between servitization and firm performance for SSCs. For

instance, Fang et al. (2008), Kohtamäki et al. (2013) and Suarez et al. (2013) identify a U-shaped relationship between servitization and firm performance, where revenues and profitability initially fall following the introduction of services, then increase again once a critical mass of service offerings are achieved. Visnjic Kastalli and Van Looy (2013) find servitized firms can expect an initial surge in profitability, but reach a profitability plateau, with profit growth stalling before increasing again, creating an S-shape relationship between servitization and firm performance. The authors find the profitability growth returns when firms can achieve economies of scale through their service offers. Visnjic et al. (2016) study the interplay of product innovation and service business model innovation and whilst their results reveal initial negative implications for firm performance, the interplay between the two leads to better long-term performance than when service business model innovation and product innovation develop in isolation. Finally, whilst not all firms are successful in servitization (see Benedettini et al., 2015; Neely, 2008), Wang et al. (2018) meta-analysis of servitization literature finds a general significant and positive relationship between servitization and firm performance, and proposes that conflicting reports in the literature may be associated with how scholars operationalise certain constructs and/or the control variables they use.

Whilst the literature is consistent in showing a positive relationship between servitization and firm performance, this is generally for SSC. It is argued SSP are a necessary pre-condition when developing SSC (Sousa & da Silveira, 2017), which have a negative impact on firm performance (Shah, Jajja, Chatha, & Farooq, 2020). For instance, Visnjic Kastalli and Van Looy (2013) highlight how SSP may enhance product life cycles due to improvements in the products performance and through-life condition which can lead a drop in long-term product sales and can contribute to the substitution effect (Sousa & da Silveira, 2017). Furthermore, as SSP are considered low in complexity and just require product knowledge, external service providers are able to offer these services, leading to greater competition for original equipment manufacturers (OEM) in the SSP market (Shah et al., 2020). Whilst SSP may not be as profitable as SSC, and indeed can lead to negative outcomes, costs can be managed as SSPs can rely on existing manufacturing capabilities and do not require the significant investments in service capabilities of SSCs (Sousa & da Silveira, 2017; Shah et al., 2020). Furthermore, as digital technologies become pervasive and firms develop digital capabilities, firms are likely to benefit from efficiency gains that digital technologies provide (Vendrell-Herrero et al., 2021). We therefore expect servitized firms to benefit from productivity gains for both SSP and SSC when they adopt digital technologies (Kharlamov & Parry, 2021). Efficiency gains may allow OEMs to compete with external service providers in cost effective provision of SSP, leading to marginal improvements from the provision of digital SSP. The digital capabilities for SSP presented by Marcon et al. (2022) suggest efficiency gains could be made from improved integration of customer data, efficient integration with existing customer processes and the installed base, new processes for support services and improved diagnosis skills. However, even whilst digital capabilities may result in more efficient and viable provision of SSPs, digital servitization literature recognises that SSCs are the most profitable and strategically beneficial form of service to provide (Kohtamäki et al., 2020; Paschou et al., 2020). Therefore, whilst SSP and SSC require both digital and service capabilities, our review suggests the need for them, and intensity of, varies according to the type of service offered.

Based on the above review, we propose the following hypothesis:

H2. Service type moderates the effect of service capabilities on the relationship between digital capabilities and firm financial and market performance – specifically, the positive mediation effect of service capabilities is stronger for services supporting customers as opposed to services supporting products.

3. Methods

3.1. Sample and data collection

A sample of 273 survey responses were collected in 2021 by Qualtrics on behalf of the research team based for this study. 25 were initially collected for a pilot study to ensure the survey was robust, with a further 248 collected for the final study. 44 incomplete responses were received and removed from the final study sample, leaving 204 usable responses for the final sample. The data was collected based on the following criteria.

First, firms must be situated in Germany or the UK who, according to the Digital Economy and Society Index,[2] are two of the most digitised countries. Further, according to the EU commission,[3] they have the largest manufacturing sectors in Europe with a large proportion of medium and large enterprises. Given the focus of our study is on digitalization and manufacturing firms, it was deemed appropriate to target these two countries. Second, we excluded companies that had <100 employees. Following previous studies, this is justified as micro and smaller enterprises are unlikely to offer manufacturing-based services, and in particular services supporting customers (Kohtamäki et al., 2013; Sjödin et al., 2020). Third, following Visnjic et al. (2016), only firms with Standard Industrial Classification (SIC) codes between 10 and 39 were included in the dataset. Finally, the study focusses on the internal business unit so to remain consistent with our model responses from managers within service business units or equivalent (Sousa & da Silveira, 2017). Based on these criteria, the final dataset includes a total of 204 manufacturing firms, with 100 German firms and 104 UK firms – population 16,692 firms, confidence level 95% (Z = 1.96), margin of error 5%, minimum sample size $n = 194$[4]; no statistical difference between the sub-samples found within our research. Descriptive statistics indicate that the data encompasses a wide range of firm types in terms of annual sales revenue, with 5% of the sample having less than £50 million in revenue and 33% falling within the £250–£1000 million range. Similarly, there is variation in the number of employees, with 5% of the sample consisting of firms with employee counts between 5000 and 9999, and 39% having between 500 and 999 employees. The sample includes firms from the entire set of SIC manufacturing codes, ensuring coverage across various industry sectors.

3.2. Tests for non-response and common method bias

We test non-response bias (NRB) by comparing early and late respondents for the independent, dependents and moderator variables (Armstrong & Overton, 1977). This standard procedure is a *t*-test that showed no statistically significant differences between the aforementioned respondents, even at the 10% level (*p*-value >0.1). Additionally, the number of employees was used as a control variable to assess the importance of NRB by comparing responding and non-responding firms and their data collected by the survey firm. Again, no statistically significant differences between responding and non-responding firms was found at the aforementioned level (p-value >0.1). The results suggest NRB is not an issue for this sample.

For Common Method Bias (CMB) we followed two ex-ante precautions. This bias appears when the same respondent/method is used to measure multiple variables, a possible generator of spurious correlations. In the first stage the specifications of the moderating effects on the

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[4] Here, $n = \frac{N*Z^2*p*(1-p)}{(N-1)*e^2+Z^2*p*(1-p)}$, where n is the target sample size, N is the population ($N = 16,692$), $Z = 1.96$ (confidence level of 95%), e is the margin of error ($e = 5\%$), and p is a realistic estimate of the desired probability ($p = 0.15$) based on previous studies (Kohtamäki et al., 2020; Sousa & da Silveira, 2017).

survey go beyond a respondent's cognitive map, facilitating visualization of interactions and, therefore reducing CMB (Chang et al., 2010). This is because including the type of services associated with products as a moderating variable enabled respondents to easily visualize the objective of the survey, therefore reducing CMB. In the second stage we sought to ensure that respondents were familiar with the topics under study following a pilot test that incorporated academics, industry experts and firms belonging to the sample population (Forza, 2002; MacKenzie & Podsakoff, 2012). We continued assessing CMB by using a standard validity statistical procedure, the Unmeasured Latent Method Factor (ULMF). ULMF is an ex-post CMB test providing confirmatory factor analysis (CFA) by incorporating all the variables used in the study (independent, dependents, and moderator variable in our case) that are loaded onto a common method factor (Johnson, Rosen, & Djurdjevic, 2011). Checking the poor fit of the model (CFI = 0.756 and TLI = 0.638, both expected to be higher than the threshold acceptance range > 0.900; and RMSEA = 0.098, with a threshold acceptance range 0.050–0.080), we are assured that NRB and CMB do not present an issue in this research.

3.3. Variables

Dependent variables: *Service capabilities* is a previously validated scale (Ayala et al., 2019; Zhou et al., 2020) and reflects the dimensions of servitization practices embedded in firms: the resource base required to servitize; and activity system, which is the set of activities required to design and deliver services (Ayala et al., 2019). This variable is expected to play a mediation role in the relationship between digital capabilities and the other dependent variable, *firm financial and market performance*. The latter is a reliable scale to measure performance in similar research (Fullerton et al., 2014; Sila, 2007; Zhou et al., 2020). Five indicators measure market share, profit, return on total assets, overall competitive position, and successful new product/service introductions (see Appendix). For both variables we employ a five-point Likert scale (1-strongly disagree to 5- strongly agree).

Independent variables: Digital capabilities involves acquiring and developing hardware, software, and organizational capabilities in relation to their use. Therefore, it is measured using items in two dimensions: organizational capabilities and technology assets (see Appendix 1). This variable was also operationalized using a five-point Likert scale (1- strongly disagree to 5- strongly agree) showing the extent of respondent agreement, reflecting their current expectations. We used the linear prediction of the Principal Component Analysis for all latent variables, as explained below (*service capabilities* and *firm financial and market performance*), to operationalise these variables into continuous variables that are valid enough to be incorporated into the Conditional Process Analysis (CPA). CPA is an approach allowing analysis of moderation and mediation in a single integrated model. Introduced by Hayes (2013), it is considered useful to analyse moderated direct and indirect effects with more rigor as it includes method interpretation, statistical inference, and model estimation (Bolin, 2014).

3.4. Conditional process analysis vs SEM analysis

Conditional process analysis, a statistical approach that combines mediation and moderation analysis, is undertaken with ordinary least squares regression-based path analysis by the PROCESS macro for SPSS and SAS. We undertook the analysis in SPSS hypothesising *digital capabilities* is a predictor of *firm financial and market performance, service capabilities* is a mediator of this relationship, and *service type (SSP vs. SSC)* moderates this mediation. *Service type* (Bustinza et al., 2019; Visnjic Kastalli & Van Looy, 2013) is a categorical variable with two categories taking values 0 and 1 respectively: services supporting products (SSP), and services supporting customers (SSC). We selected only these service categories as previous studies showed that these two types of service require different capabilities thus have different

performance impacts (Marcon et al., 2022; Sousa & da Silveira, 2017). The choice of using PROCESS vs SEM for analysing moderated mediation models depends upon an endogeneity test as both methods report largely identical results (Hayes et al., 2017). Therefore, we proceeded to test endogeneity to select the most appropriated method to estimate the moderated mediation model.

Following suggestions from previous studies on servitization (Neely, 2008; Sousa & da Silveira, 2017, and Zhang & Zhang, 2014), four set of covariates are introduced in the model as control variables to test endogeneity. Organisation size, Sales, and Industry variables were three of the variables selected. Additionally, and based on Sousa and da Silveira (2017) recommendations to add a control variable associated with the variables of the model, the last covariate selected was variable *Modularity* (Vickery et al., 2016), previously found to be related to both explanatory variables Digitalization (Hsuan, Jovanovic, & Clemente, 2021), and Servitization (Johnson et al., 2021; Davies et al., 2021). First, we provide descriptive analysis, Table 1, of the means, standard deviations (SD), and correlation between the variables.

To test for endogeneity problems, we followed the IV/2SLS procedure (Angrist & Pischke, 2008) that addresses self-selection concerns and other endogeneity threats. This method requires at least two instruments per endogenous variable. Therefore, we chose the four aforementioned control variables. Diagnostic information for the IV/2SLS model reports three useful statistics (Anderson, 2018): 1) Wald Chi-sq, which is a test of the joint validity of instruments for identifying Weak Instruments selection. It needs to be significant to indicate that the instrument variables are valid (Chi-sq 182.79, df = 2, $p < 0.001$ for digital capabilities, and Chi-sq 145.66, df = 2, p < 0.001 for service capabilities); 2) Model Chi-sq test of over-identifying restrictions (Sargan test). It needs to be not significant (Chi-sq model vs saturate 7.82, df = 6, $p = 0.358$); and 3) Chi-sq Difference or Hausman Test of the consistency of parameter estimates across models, which is an endogeneity test (constraining *digital capabilities* ~ ~ *service capabilities* = 0 Chi-sq 8.91 $p = 0.002(<0.01)$; constraining *service capabilities* ~ ~ *firm financial and market performance* = 0 Chi-sq 24.58 $p = 0.000(<0.01)$; and constraining *digital capabilities* ~ ~ *firm financial and market performance* = 0 Chi-sq 1.13 $p = 0.2871(>0.01)$. Hausman tests are statistically significant for the relationships *digital capabilities* ~ ~*service capabilities* and *service capabilities* ~ ~*firm financial and market performance*, but statistically significant for the *digital capabilities* and firm financial and market performance relationship. Therefore, this test indicates that an OLS approach is more consistent than a SEM approach to test the relationship between these two variables. Finally, the IV/2SLS procedure shows that the parameters for the relationship between *digital capabilities* ~ ~*service capabilities* ~ ~firm financial and market performance are significant, demonstrating that *service capabilities* is a mediator of the relationship between *digital capabilities* and *performance*.

4. Results

The CPA predictions in the current study were from Model 7 of the PROCESS macro (Hayes, 2013) that breaks down into two regressions models of the path coefficient estimation: a) a single regression with *digital capabilities* predicting *service capabilities*; and b) a multiple regression with *digital capabilities* and *service capabilities* predicting *firm*

Table 1
Descriptive analysis and correlations between the variables.

| Variables	1	2	3	4
1. *Digital capabilities*	1			
2. *Firm financial and market performance*	0.651**	1		
3. *Service capabilities*	0.695**	0.673**	1	
4. *Service type*	−0.058	−0.065	−0.110	1
Mean	4.158	4.223	4.141	1.471
Standard deviation	0.668	0.633	0.581	0.500

Note: ** p < 0.01, * p < 0.05.

financial and market performance. The default setting for confidence intervals is 95% and the number of bootstrap samples 5000. For Hypothesis 1, direct and indirect effects need to be estimated. As for direct effect, parameter estimation shows a positive and statistically significant value ($\beta_{DE} = 0.218$, s.e. 0.051, $p < 0.001$), with the estimation for the indirect effect ($\beta_{IE} = 0.221$, s.e. 0.041, p < 0.001), resulting in a total net effect positive that is statistically significant ($\beta_1 = 0.439$, s.e. 0.043, p < 0.001), supporting Hypothesis 1. This means that more than half of the effect that *digital capabilities* has on *performance* is due to *service capabilities* (0.221/0.439 = 50.34%).

Firstly, to support Hypothesis 2 that argues that *service type* is a moderating variable on the mediation relationship between *digital capabilities, service capabilities* and *firm financial and market performance*, the indirect effect of the mediation needs to be tested by a bootstrapping procedure. This nonparametric procedure postulates a null hypothesis where the population indirect effect is zero, whereas the alternative is that the population indirect effect is non-zero. Therefore, and following bootstrap standard errors and confidence interval analysis, if zero falls outside of the interval from a lower and upper confidence levels then you reject the null hypothesis (Hayes & Scharkow, 2013). Results for β_{IE} = 0.221 shows that zero falls outside of the confidence interval (BootLLCI = 0.148 and BootULCI = 0.305), demonstrating that service capabilities is a significant mediator of the *digital capabilities*-firm financial and market performance relationship. Secondly, the PROCESS macro also tests the moderating role of the variable *service type*. In doing so, a traditional "pick-a-point" approach is followed to probe interactions. Results show that the intercept between *services capabilities* and *service type* as a predictor of firm financial and market performance is statistically significant (Int = 0.180, $p < 0.05$) taking increasing positive values for the simple slopes at a "low" (-1SD), and "high" (+1SD) value on the moderator. The slopes become more positive as we move from low (services supporting products-SSP, $\beta_{SSP} = 0.174$, s.e. 0.067, p < 0.001) to high (services supporting customers-SSC, $\beta_{SSC} = 0.283$, s.e. 0.074, $p < 0.01$) *service types*. We undertake an omnibus test of the conditional indirect effect (Preacher et al., 2007) that follows the same logic of the null hypothesis. It analyses if *service types* is a moderator of the model or

just of the relationship between *service capabilities* and firm financial and market performance. Results for the index of moderated mediation (Index 0.108, BootSE 0.050) shows in this case that zero falls outside of the confidence interval (BootLLCI = 0.015 and BootULCI = 0.212), therefore showing that *service type* is a significant moderator of the *services capabilities*-firm financial and market performance relationship and a moderator of the mediation model, therefore supporting Hypothesis 2. In other words, the indirect effect of *digital capabilities* on firm financial and market performance varies as a function of service type, being greater for services supporting customers than for services supporting products. Fig. 2 shows the model and hypothesis estimations and table 2 shows the mediation and moderation analysis and bootstrap results.

Table 2
Mediation and moderated mediation analysis and bootstrap results.

Variables	Beta	se	t	p
Hypothesis 1 Direct Effect: *Digital Capabilities➔ Performance*	0.218	0.051	4.131	<0.001
Hypothesis 1 Indirect Effect: *DigCap ➔ ServCap x ServCap ➔ Perf*	0.221	0.041	3.401	<0.001
Hypothesis 1 Total Effect: *DigCap ➔ ServCap ➔ Performance*	0.439	0.043	3.971	<0.001
	Bootstrap result for indirect effect			
	I. Effect	Se	LL 95% CI	UL 95% CI
Hypothesis 1: *Mediation*	0.221	0.041	0.148	0.305
	Bootstrap result for index of moderated mediation			
	Index		LL 95% CI	UL 95% CI
Hypothesis 2: *Moderated mediation*	0.108		0.015	0.212
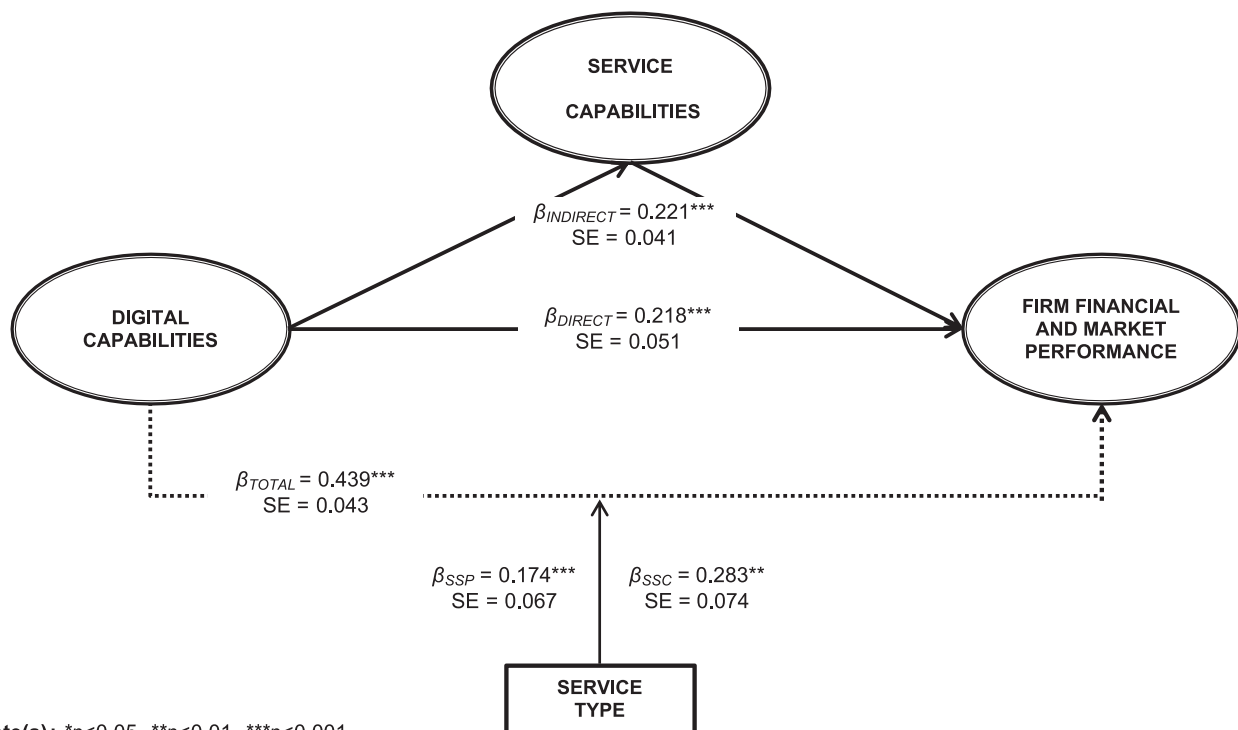
Note(s): *p<0.05, **p<0.01, ***p<0.001

Fig. 2. Parameter estimation.

5. Discussion

5.1. Theoretical implications

Taking a RBV, this study set out to examine the relationship between servitization, digitalization and firm performance. The results support the proposed hypothesis, showing a moderated mediation model where service capabilities positively mediate the relationship between digital capabilities and firm financial and market performance, whilst service type moderates the relationship between service capabilities and performance. The effect of the moderation is greater for services supporting customers than that of services supporting products. By analysing the relationship between digitalization, servitization and firm performance, our study addresses the calls made by Kohtamäki et al. (2020) and Abou-foul et al. (2020) to investigate the connection between servitization, digitalization, and firm performance. Additionally, our research aligns with Münch et al. (2022) who emphasize that studies integrating service and digital capabilities are infrequent. Furthermore, our research is consistent with previous developments regarding the intricate relationships among digital capabilities, resource orchestration, and firm performance (Kristoffersen et al., 2021; Mikalef et al., 2020). Our findings contribute to the research in two primary ways.

First, by identifying the role of both service capabilities and service type in capturing value from digitalization, this study goes beyond more simplistic narratives within the literature (e.g., Abou-foul et al., 2020; Kharlamov & Parry, 2021; Kohtamäki et al., 2020) to explain the relationship between digitalization, servitization and firm performance. Expanding upon these existing narratives, our theoretical model focusses on the focal firm, paying specific attention to the firms' internal service capabilities and the type of services provided (i.e., SSP and SSC) as the key explanatory factors determining a firm's ability to capture value from their digital capabilities. Consistent with most other studies that analyse the relationship between servitization, digitalization and firm performance, our study finds that service business model innovation (i.e., the provision of SSP or SSC) plays a significant role in capturing value from digitalization, particularly for SSC. By drawing on the RBV of the firm, we operationalized servitization across two dimensions, service capabilities and service type, to provide richer insight into the nature of the relationship between digitalization, servitization and firm performance. In analysing a more complex model, our results extend the findings of Kohtamäki et al. (2020) and Kharlamov and Parry (2021) who operationalise servitization as a business model change only. We highlight that it is not just the provision of services that enables greater value capture from digitalization, but also the development of the organisations service capabilities plays a significant role in capturing value from digitalization and the provision of manufacturing services, in particular SSCs. Therefore, our results indicate that the interplay between digitalization and servitization is more complicated than previously analysed in existing quantitative studies.

Second, by deconstructing servitization across service type (strategic) and service capabilities (operations), our findings provide support for wider literature that suggests providing more SSCs does not guarantee superior firm performance. For instance, Brax (2005), Baines, Lightfoot, Benedettini, & Kay, 2009, Baines, Lightfoot, Peppard, et al. (2009) and Kowalkowski et al. (2017) all find that organisations need to invest in the development of their resource base and service capabilities to align them with their proposed service provision (i.e., to SSP or SSC from pure product provision). In particular, Brax (2005) highlighted that misalignment between the organisations capabilities and the service type results in an increased risk of failure. Therefore, our findings provide empirical support for these qualitative studies. The research also adds to literature on digital servitization by finding digitalization has a positive effect on firm performance, with this effect largely explained by the role of service capabilities. Our research finds support for claims that digitalization has a positive effect on performance (Marcon et al., 2022; Vendrell-Herrero et al., 2017) that varies as a function of the service type

offered, being more effective for those firms that develop SSC (Paschou, Rapaccini, Adrodegari and Saccani, 2020; Abou-foul et al., 2020). Our results extend Kohtamäki et al. (2020) proposal for the need for effective interplay between digitalization and servitization to support investment in digital capabilities and achieve firm performance by showing the mediating role of service capabilities and finding the effect varies as a function of the service type. Understanding that the impact of digitalization increases as firms move to offer more complex services may help servitized firms to overcome the digitalization paradox, whilst also showing both SSP and SSC require some level of digitalisation. Therefore, our findings suggest digital technology development should occur concurrently with service development, rather than one occurring before the other.

5.2. Managerial implications

The empirical findings of our study have managerial implications for industrial business-to-business (B2B) firms implementing digital servitization. First, our study unpacks the relationship between digitalization, servitization and firm performance, providing insights that can inform strategy formulation and investment decisions for digital servitization. Our research highlights that digital capabilities play an enabling role in developing service capabilities for the delivery of both SSP and SSC, but that they play an increasingly important role in the provision of SSC, which require a greater degree of both digital and service capabilities. The findings show that managers need to pay attention to the synergies between service capabilities, digital capabilities and service type (business model), which should not be developed in isolation if they are to deliver positive effects on firm performance. Delivering positive outcomes for firm financial and market performance will require ambidextrous innovation capabilities (Kohtamäki et al., 2019) and a high-risk tolerance (Yang et al., 2023). Our empirical findings show a variation in performance effects for two different types of services. Both SSP and SSC have positive effects on firm performance, with SSC having a larger effect than SSP. The finding that SSC provide the best financial performance is consistent with existing literature (Visnjic et al., 2016). However, our findings that show SSPs can deliver positive returns subject to strategic investment in digital capabilities is counter to much of the existing research (e.g., Sousa & da Silveira, 2017; Shah et al., 2020). Our finding is evidence that investments in digital capabilities can improve the financial performance of SSPs such that they may provide marginal positive benefits for the organisation as opposed to negative or negligible returns. The finding is important for managers in B2B environments as it may encourage them to initiate a transition to service provision in the knowledge that during digital servitization, SSPs may not, as previously reported negatively affect their financial and market performance. Further, for B2B organisations who are deservitizing from SSC, our findings may alleviate concerns that offering SSPs may negatively affect firm performance.

6. Limitations, and future research

Our study can be extended in several ways. First, the study does not differentiate between the different capabilities required for SSC and SSP. Whilst this research provides important clarification on the relationship between digitalization, servitization and firm financial and market performance, future research should investigate more granular views of digital and service capabilities required for SSP and SSC. This will provide a more detailed, nuanced understanding of the relationship between the variables within our model. This is important as the literature notes SSPs require fewer digital capabilities than SSCs, which has implications for complexity in implementation of services and ultimately, firm performance (Marcon et al., 2022).

Another limitation of our study is that it primarily focuses on the analysis of digital capabilities developed internally within the firm, exploring the dual transformation of organizational capabilities and

technological assets. Our measures capture the organizational capabilities developed within the firm. However, the manner in which technological assets are obtained presents an intriguing question to be explored in future research. Moreover, existing research has demonstrated that market-oriented firms tend to exhibit better financial and market performance (Kohli & Jaworski, 1990; Narver & Slater, 1990; Ruekert, 1992). In the case of manufacturing firms, which often have a strong internal focus, it would be interesting to examine whether the effects of service capabilities on firm performance differ between market-oriented and non-market-oriented firms. Future research can explore the role of market orientation as a moderator of the relationship between service capabilities and firm performance, which would contribute significantly to the existing body of knowledge.

Scholars could usefully conduct longitudinal studies that seek to understand how organisations simultaneously develop both digital and service capabilities that align with the service type provided. Further insight through a longitudinal study would potentially provide insight into how organisations make strategic decisions in their investments in service and digital capabilities, which would shed light on how organisations manage and overcome both the digital and service paradox. Secondly, our study only considers mature markets. The model proposed should be employed in the context of developing markets. Further samples from different countries would help to determine cross-country heterogeneity in digitalization and service capability outcomes. Thirdly, it would be insightful to investigate the roles played by various existing digital technologies, such as Big Data Analytics, in the context of servitization and their ultimate influence on performance. Finally, our research only considered an organisation's internal resources. Inter-firm relationships and multi actor capabilities influence servitization (e.g., Ayala et al., 2019; Raddats et al., 2017; Story et al., 2016). Further explanatory variables from the wider supply network or ecosystem may increase the explanatory power of our model. For instance, Marcon et al. (2022), in their systematic literature review, identify several capabilities required by the provider, the intermediary and the customer for the provision of SSPs and SSCs.

Data availability

Data will be made available on request.

Appendix 1. Appendix

1. Digital capabilities scale

Organizational capabilities for digital transformation (adapted from Eller et al., 2020; Gurbaxani & Dunkle, 2019; Kane et al., 2015).

OC1. There is a clearly defined vision mapped to an understanding of digital needs.

OC2. Senior executive team has a clear understanding of digital technology importance and how they will support business objectives.

OC3. There is availability of digital expertise.

OC4. Technical talent for digitalization is already available in the company.

OC5. There is no problem with lack of budget/resources assigned to digital transformation.

Technological assets for digital transformation (adapted from Dogan & Birant, 2021; Kohtamäki et al., 2020; Scuotto et al., 2017; Vadana et al., 2019).

TA1. We use software to improve customer understanding (e.g.,

Customer Relationship Management systems).

TA2. We use software to improve supplier interactions (e.g., Supply Chain Management systems).

TA3. We have and use technology based on Data Mining and Predictive Analytics.

TA4. We use internet hardware infrastructure and web and mobile software technologies.

TA5. We have and use technology based on cloud Computing.

2. Service capabilities scale

Resource base dimension (adapted from Ayala et al., 2019).

RB1. To develop our services, we frequently develop new competences inside our company.

RB2. The human capital (individual expertise) of my company is a source of competitive advantage.

RB3. The internal knowledge owned by my company is considered a source of competitive advantage.

RB4. Our company is very flexible to market changes, being able to adapt quickly.

Activity system dimension (adapted from Ayala et al., 2019).

AS1. Our services and products are developed together and simultaneously

AS2. The service area has an active role in taking strategic decisions about new products and markets

AS3. Our different functional areas often work together in the development of new products and solutions

AS4. Our customers have an active participation in the development of our new products and services

AS5. Other business units of our company are very active in new product and service development

3. Firm financial and market performance (adapted from Sila, 2007 and Zhou et al., 2020).

FP1. Our market share grew faster than our competitors in the three years after we adopted a digital servitization strategy.

FP2. Our profit grew faster than our competitors in the three years after we adopted a digital servitization strategy.

FP3. Our return on total assets grew faster than our competitors in the three years after we adopted a digital servitization strategy.

FP4. Our overall competitive position grew faster than our competitors in the three years after we adopted a digital servitization strategy.

FP5. Our number of successful new product/service introductions grew faster than our competitors in the three years after we adopted a digital servitization strategy.

References

Abou-foul, M., Ruiz-Alba, J. L., & Soares, A. (2020). The impact of digitalization and servitization on the financial performance of a firm: An empirical analysis. *Production Planning and Control, 32*(12), 1–15.

Anderson, B. S. (2018). Endogeneity and entrepreneurship research. In *Open science framework*. Available at: https://osf.io/75tn8.

Angrist, J., & Pischke, J. S. (2008). *Mostly harmless econometrics: An Empiricist's companion*. NJ, Princeton University Press: Princeton.

Armstrong, J. S., & Overton, T. S. (1977). Estimating nonresponse bias in mail surveys. *Journal of Marketing Research, 14*(3), 396–402.

Ayala, N. F., Gerstlberger, W., & Frank, A. G. (2019). Managing servitization in product companies: The moderating role of service suppliers. *International Journal of Operations & Production Management, 39*(1), 43–74.

Baines, T., & Lightfoot, H. (2014). *Made to serve. What it takes for a manufacturer to compete*. NJ: John Wiley & Sons.

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

Baines, T., Ziaee Bigdeli, A., Bustinza, O. F., Shi, V. G., Baldwin, J., & Ridgway, K. (2017). Servitization: Revisiting the state-of-the-art and research priorities. *International Journal of Operations & Production Management, 37*(2), 256–278.

Baines, T. S., Lightfoot, H. W., Benedettini, O., & Kay, J. M. (2009). The servitization of manufacturing: A review of literature and reflection on future challenges. *Journal of Manufacturing Technology Management, 20*(5), 547–567.

Barnett, N. J., Parry, G., Saad, M., Newnes, L. B., & Goh, Y. M. (2013). Servitization: Is a paradigm shift in the business model and service enterprise required? *Strategic Change, 22*(3), 145–156.

Benedettini, O., Neely, A., & Swink, M. (2015). Why do servitized firms fail? A risk-based explanation. *International Journal of Operations & Production Management, 35*(6), 946–979.

Bolin, J. H. (2014). Book review: Hayes, Andrew F. (2013). Introduction to mediation, moderation, and conditional process analysis: A regression-based approach. *Journal of Educational Measurement, 51*(3), 335–337.

Brax, S. (2005). A manufacturer becoming service provider: Challenges and a paradox. *Managing Service Quality, 15*(2), 142–155.

Bustinza, O. F., Bigdeli, A. Z., Baines, T., & Elliot, C. (2015). Servitization and competitive advantage: The importance of organizational structure and value chain position. *Research-Technology Management, 58*, 53–60.

Bustinza, O. F., Lafuente, E., Rabetino, R., Vaillant, Y., & Vendrell-Herrero, F. (2019). Make-or-buy configurational approaches in product-service ecosystems and performance. *Journal of Business Research, 104*, 393–401.

Bustinza, O. F., Parry, G., & Vendrell-Herrero, F. (2013). Supply and demand chain management: The effect of adding services to product offerings. *Supply Chain Management: An International Journal, 18*, 618–629.

Cenamor, J., Rönnberg Sjödin, D., & Parida, V. (2017). Adopting a platform approach in servitization: Leveraging the value of digitalization. *International Journal of Production Economics, 192*, 54–65.

Chang, S. J., Van Witteloostuijn, A., & Eden, L. (2010). From the editors: Common method variance in international business research. *Journal of International Business Studies, 41*, 171–184.

Davies, P., Parry, G., Phillips, L. A., & Ng, I. C. L. (2021). Boundary negotiations: A paradox theoretical approach for efficient and flexible modular systems. *International Journal of Operations & Production Management, 41*(5), 574–597.

Dogan, A., & Birant, D. (2021). Machine learning and data mining in manufacturing. *Expert Systems with Applications, 166*, 114060.

Eggert, A., Hogreve, J., Ulaga, W., & Muenkhoff, E. (2011). Industrial services, product innovations, and firm profitability: A multiple-group latent growth curve analysis. *Industrial Marketing Management, 40*(5), 661–670.

Eller, R., Alford, P., Kallmünzer, A., & Peters, M. (2020). Antecedents, consequences, and challenges of small and medium-sized enterprise digitalization. *Journal of Business Research, 112*, 119–127.

Fang, E., Palmatier, R. W., & Steenkamp, J. B. E. M. (2008). Effect of service transition strategies on firm value. *Journal of Marketing, 72*(5), 1–14.

Forza, C. (2002). Survey research in operations management: A process-based perspective. *International Journal of Operations & Production Management, 22*(2), 152–194.

Frank, A. G., Mendes, G. H. S., Ayala, N. F., & Ghezzi, A. (2019). Servitization and industry 4.0 convergence in the digital transformation of product firms: A business model innovation perspective. *Technological Forecasting and Social Change, 141*, 341–351.

Fullerton, R. R., Kennedy, F. A., & Widener, S. K. (2014). Lean manufacturing and firm financial performance: The incremental contribution of lean management accounting practices. *Journal of Operations Management, 32*(7–8), 414–428.

Gebauer, H., Fleisch, E., & Friedli, T. (2005). Overcoming the service paradox in manufacturing companies. *European Management Journal, 23*(1), 14–26.

Gebauer, H., Paiola, M., Saccani, N., & Rapaccini, M. (2021). Digital servitization: Crossing the perspectives of digitization and servitization. *Industrial Marketing Management, 93*, 382–388.

Green, M. H., Davies, P., & Ng, I. C. L. (2017). Two strands of servitization: A thematic analysis of traditional and customer co-created servitization and future research directions. *International Journal of Production Economics, 192*, 40–53.

Grubic, T. (2014). Servitization and remote monitoring technology: A literature review and research agenda. *Journal of Manufacturing Technology Management, 25*(1), 100–124.

Gurbaxani, V., & Dunkle, D. (2019). Gearing up for successful digital transformation. *MIS Quarterly Executive, 18*(3), 209–220.

Hayes, A. F. (2013). *Introduction to mediation, moderation, and conditional process analysis: A regression-based approach*. New York, NY: The Guilford Press.

Hayes, A. F., Montoya, A. K., & Rockwood, N. J. (2017). The analysis of mechanisms and their contingencies: PROCESS versus structural equation modelling. *Australasian Marketing Journal; AMJ, 25*(1), 76–81.

Hayes, A. F., & Scharkow, M. (2013). The relative trustworthiness of inferential tests of the indirect effect in statistical mediation analysis. *Psychological Science, 24*(10), 1918–1927.

Hsuan, J., Jovanovic, M., & Clemente, D. H. (2021). Exploring digital servitization trajectories within product–service–software space. *International Journal of Operations and Production Management, 41*(5), 598–621.

Hullova, D., Laczko, P., & Frishammar, J. (2019). Independent distributors in servitization: An assessment of key internal and ecosystem-related problems. *Journal of Business Research, 104*(October), 422–437.

Iansiti, M., & Lakhani, K. R. (2020). *Competing in the age of AI: Strategy and Leadership When Algorithms and Networks Run the World*. Boston: Massachusetts: Harvard Business Review Press.

Jacobides, M., & Winter, S. (2012). Capabilities: Structure, agency, and evolution. *Organization Science, 23*(5), 1365–1381.

Johnson, R. E., Rosen, C. C., & Djurdjevic, E. (2011). Assessing the impact of common method variance on higher order multidimensional constructs. *Journal of Applied Psychology, 96*, 744–761.

Jovanovic, M., Raja, J. Z., Visnjic, I., & Wiengarten, F. (2019). Paths to service capability development for servitization: Examining an internal service ecosystem. *Journal of Business Research, 104*, 472–485.

Kane, G. C., Palmer, D., Phillips, A. N., Kiron, D., & Buckley, N. (2015). Strategy, not technology, drives digital transformation. *MIT Sloan Management Review and Deloitte University Press, 14*, 1–25.

Kharlamov, A. A., & Parry, G. (2021). The impact of servitization and digitization on productivity and profitability of the firm: A systematic approach. *Production Planning and Control, 32*(3), 185–197.

Kindström, D., & Kowalkowski, C. (2014). Service innovation in product-centric firms: A multidimensional business model perspective. *The Journal of Business and Industrial Marketing, 29*(2), 96–111.

Kohli, A. K., & Jaworski, B. J. (1990). Market orientation: The construct, research propositions, and managerial implications. *Journal of Marketing, 54*(2), 1–18.

Kohtamäki, M., Parida, V., Oghazi, P., Gebauer, H., & Baines, T. (2019). Digital servitization business models in ecosystems: A theory of the firm. *Journal of Business Research, 104*, 380–392.

Kohtamäki, M., Parida, V., Patel, P. C., & Gebauer, H. (2020). The relationship between digitalization and servitization: The role of servitization in capturing the financial potential of digitalization. *Technological Forecasting and Social Change, 151*, 119804.

Kohtamäki, M., Partanen, J., Parida, V., & Wincent, J. (2013). Non-linear relationship between industrial service offering and sales growth: The moderating role of network capabilities. *Industrial Marketing Management, 42*(8), 1374–1385.

Kowalkowski, C., Gebauer, H., & Oliva, R. (2017). Service growth in product firms: Past, present, and future. *Industrial Marketing Management, 60*, 82–88.

Kristoffersen, E., Mikalef, P., Blomsma, F., & Li, J. (2021). The effects of business analytics capability on circular economy implementation, resource orchestration capability, and firm performance. *International Journal of Production Economics, 239*, 108205.

MacKenzie, S. B., & Podsakoff, P. M. (2012). Common method bias in marketing: Causes, mechanisms, and procedural remedies. *Journal of Retailing, 88*(4), 542–555.

Marcon, E., Marcon, A., Ayala, N. F., Frank, A. G., Story, V., Burton, J., … Zolkiewski, J. (2022). Capabilities supporting digital servitization: A multi-actor perspective. *Industrial Marketing Management, 103*, 97–116.

Martín-Peña, M. L., Sánchez-López, J. M., & Díaz-Garrido, E. (2020). Servitization and digitalization in manufacturing: The influence on firm financial performance. *The Journal of Business and Industrial Marketing, 35*(3), 564–574.

Mikalef, P., Krogstie, J., Pappas, I. O., & Pavlou, P. (2020). Exploring the relationship between big data analytics capability and competitive performance: the mediating roles of dynamic and operational capabilities. *Information & Management, 57*(2), 103169.

Münch, C., Marx, E., Benz, L., Hartmann, E., & Matzner, M. (2022). Capabilities of digital servitization: Evidence from the sociotechnical systems theory. *Technological Forecasting and Social Change, 17*, 121361.

Narver, J. C., & Slater, S. F. (1990). The effect of a market orientation on business profitability. *Journal of Marketing, 54*(4), 20–34.

Neely, A. (2008). Exploring the financial consequences of the servitization of manufacturing. *Operations Management Research, 1*(2), 103–118.

Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management, 14*(2), 160–172.

Ostrom, A. L., Bitner, M. J., Brown, S. W., Burkhard, K. A., Goul, M., Smith-Daniels, V., … Rabinovich, E. (2010). Moving forward and making a difference: research priorities for the science of service. *Journal of Service Research, 13*(1), 4–36.

Paschou, T., Rapaccini, M., Adrodegari, F., & Saccani, N. (2020). Digital servitization in manufacturing: A systematic literature review and research agenda. *Industrial Marketing Management, 89*, 278–292.

Ponsignon, F., Smart, P. A., & Maull, R. S. (2011). Service delivery system design: Characteristics and contingencies. *International Journal of Operations & Production Management, 31*(3), 324–349.

Preacher, K. J., Rucker, D. D., & Hayes, A. F. (2007). Addressing moderated mediation hypotheses: Theory, methods, and prescriptions. *Multivariate Behavioral Research, 42*(1), 185–227.

Raddats, C., Burton, J., & Ashman, R. (2015). Resource configurations for services success in manufacturing companies. *Journal of Service Management, 26*(1), 97–116.

Raddats, C., Zolkiewski, J., Story, V. M., Burton, J., Baines, T., & Ziaee Bigdeli, A. (2017). Interactively developed capabilities: Evidence from dyadic servitization relationships. *International Journal of Operations & Production Management, 37*(3), 382–400.

Ruekert, R. W. (1992). Developing a market orientation: An organizational strategy perspective. *International Journal of Research in Marketing, 9*(3), 225–245.

Sampson, S., & Froehle, C. (2006). Foundations and implications of a proposed unified services theory. *Production and Operations Management, 15*(2), 329–343.

Schroeder, A., & Kotlarsky, J. (2014). Digital resources and their role in advanced service provision: A VRIN analysis. In T. Baines, & D. K. Harrison (Eds.), *Servitization: The theory and impact*. UK: Aston University.

Schroeder, A., Ziaee Bigdeli, A., Galera Zarco, C., & Baines, T. (2019). Capturing the benefits of industry 4.0: A business network perspective. *Production Planning and Control, 30*(16), 1305–1321.

Scuotto, V., Caputo, F., Villasalero, M., & Del Giudice, M. (2017). A multiple buyer–supplier relationship in the context of SMEs' digital supply chain management. *Production Planning and Control, 28*(16), 1378–1388.

Shah, S. A. A., Jajja, M. S. S., Chatha, K. A., & Farooq, S. (2020). Servitization and supply chain integration: an empirical analysis. *International Journal of Production Economics, 229*, Article 107765.

Sila, I. (2007). Examining the effects of contextual factors on TQM and performance through the lens of organizational theories: An empirical study. *Journal of Operations Management, 25*(1), 83–109.

Sjödin, D., Parida, V., Kohtamäki, M., & Wincent, J. (2020). An agile co-creation process for digital servitization: A micro-service innovation approach. *Journal of Business Research, 112*, 478–491.

Sklyar, A., Kowalkowski, C., Sörhammar, D., & Tronvoll, B. (2019). Resource integration through digitalization: A service ecosystem perspective. *Journal of Marketing Management, 35*(11–12), 974–991.

Sklyar, A., Kowalkowski, C., Tronvoll, B., & Sörhammar, D. (2019). Organizing for digital servitization: A service ecosystem perspective. *Journal of Business Research, 104*, 450–460.

Sousa, R., & da Silveira, G. J. (2019). The relationship between servitization and product customization strategies. *International Journal of Operations & Production Management, 39*(3), 454–474.

Sousa, R., & da Silveira, G. J. C. (2017). Capability antecedents and performance outcomes of servitization: Differences between basic and advanced services. *International Journal of Operations & Production Management, 37*(4), 444–467.

Story, V. M., Raddats, C., Burton, J., Zolkiewski, J., & Baines, T. (2016). Capabilities for advanced services: A multi-actor perspective. *Industrial Marketing Management, 60* (January), 54–68.

Suarez, F., Cusumano, M., & Kahl, S. (2013). Services and the business models of product firms: An empirical analysis of the software industry. *Management Science, 59*(2), 420–435.

Tuli, K. R., Kohli, A. K., & Bharadwaj, S. G. (2007). Rethinking customer solutions: from product bundles to relational processes. *Journal of Marketing, 71*, 1–17.

Ulaga, W., & Reinartz, W. J. (2011). Hybrid offerings: How manufacturing firms combine goods and services successfully. *Journal of Marketing, 75*(6), 5–23.

Vadana, I. I., Torkkeli, L., Kuivalainen, O., & Saarenketo, S. (2019). Digitalization of companies in international entrepreneurship and marketing. *International Marketing Review, 37*(3), 471–492.

Vendrell-Herrero, F., Bustinza, O. F., Parry, G., & Georgantzis, N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management, 60*, 69–81.

Vendrell-Herrero, F., Bustinza, O. F., & Vaillant, Y. (2021). Adoption and optimal configuration of smart products: The role of firm internationalization and offer hybridization. *Industrial Marketing Management, 95*, 41–53.

Vickery, S. K., Koufteros, X., Dröge, C., & Calantone, R. (2016). Product modularity, process modularity, and new product introduction performance: Does complexity matter? *Production and Operations Management, 25*(4), 751–770.

Visnjic, I., Jovanovic, M., Neely, A., & Engwall, M. (2017). What brings the value to outcome-based contract providers? Value drivers in outcome business models. *International Journal of Production Economics, 192*, 169–181.

Visnjic, I., Wiengarten, F., & Neely, A. (2016). Only the brave: Product innovation, service business model innovation, and their impact on performance. *Journal of Product Innovation Management, 33*(1), 36–52.

Visnjic Kastalli, I., & Van Looy, B. (2013). Servitization: Disentangling the impact of service business model innovation on manufacturing firm financial performance. *Journal of Operations Management, 31*(4), 169–180.

Volberda, H. W., Khanagha, S., Baden-Fuller, C., Mihalache, O. R., & Birkinshaw, J. (2021). Strategizing in a digital world: Overcoming cognitive barriers, reconfiguring routines and introducing new organizational forms. *Long Range Planning, 54*(5), 102110.

Wang, W., Lai, K. H., & Shou, Y. (2018). The impact of servitization on firm financial performance: A meta-analysis. *International Journal of Operations & Production Management, 38*(7), 1562–1588.

Yang, Z., Zhang, Y., & Zhang, T. (2023). Leveraging digitalization and servitization to improve financial performance. *Production Planning and Control*. https://doi.org/10.1080/09537287.2023.2229263 (available online).

Zhang, Y., & Zhang, L. (2014). Organizing complex engineering operations throughout the lifecycle. *Journal of Service Management, 25*(5), 580–602.

Zhou, D., Yan, T., Zhao, L., & Guo, J. (2020). Performance implications of servitization: Does a Manufacturer's service supply network matter? *International Journal of Production Economics, 219*, 31–42.