

Ruiz-Martín, Agustín; Díaz-Garrido, Eloísa

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A Review of Servitization Theoretical Foundations

Agustín Ruiz-Martín , Eloísa Díaz-Garrido 

Rey Juan Carlos University (Spain)

agustin.ruiz@urjc.es, eloisa.diaz@urjc.es

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Abstract:

Purpose: This study seeks to analyse how the servitization topic has been addressed through different theoretical approaches. More specifically, the aim is to answer two key questions: What theoretical approaches have been used to study the phenomenon of servitization? What specific aspects of the servitization process have been analysed through each theoretical approach?

Design/methodology/approach: This paper adopts a systematic literature review. The first step involves a descriptive analysis, which is then followed by a thematic one.

Findings: The results show that the topic of servitization has been analysed according to the main boundary of the firm theories (Resource-based view, Game theory, and Transaction cost economics) and to organizational boundaries (Contingency theory and Resource dependence theory), among others. From the perspective of these theoretical frameworks, the following topics have received the most scholarly attention: Performance, Capabilities, Supply Chain Management, Business Model, Strategy, and Sustainability.

Originality/value: Observations are made on the relevance that diverse theories have on the development of research into servitization. The most suitable theoretical lenses are recommended for future research.

Keywords: servitization, organisational boundary theory, boundary of the firm theory, systematic literature review

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1. Introduction

The last twenty years have witnessed major technological advances that together with the freeing up of global trade have led to increased competition in the manufacturing sector. This sharp increase in competition has prompted the relocation, or even closure, of many western industrial firms due to the lower labour costs in other countries (mainly in Asia). Faced with this increase in competition, manufacturing firms have now been forced to reinvent themselves, and many have seized the business opportunity involved in launching the process of marketing services alongside their products (Johnson, Herrmann & Bauer, 1999).

Vandermerwe and Rada (1988) have referred to this process as servitization, which may be understood as a process for increasing value by adding services to products. It is a way of creating value-added capabilities that are

distinctive and sustainable regarding competitors (Baines, Lightfoot, Benedettini & Kay, 2009a), whereby instead of simply providing products, a firm begins marketing product-service systems (PSS) (Visnjic & Van Looy, 2013). In short, servitization is when manufacturing firms provide their customers with a comprehensive range of products and services in order to increase the latter's user value and experience.

The literature has analysed the servitization process from different angles (Forkmann, Henneberg, Witell & Kindström, 2017). It is a complex, contingent and even paradoxical issue that involves myriad organizational, operational, strategic, relational and even ecosystemic issues. Given this complexity and the considerable increase in the number of publications on this transition process, recent studies have focused on the need to strengthen the theories related to the servitization process (Rabetino, Harmsen, Kohtamäki & Sihvonen, 2018; Raddats, Kowalkowski, Benedettini, Burton & Gebauer, 2019).

Gioia and Pitre (1990), for example, have defined theory-building as “any coherent description or explanation of observed or experienced phenomena”. Bacharach (1989) considers a theory to be “a statement of relations among concepts within a set of boundary assumptions and constraints. It is no more than a linguistic device used to organize a complex empirical world”. Theories help researchers to make sense of the world around us. Over and above a mere description, theories allow predicting the nature of relationships between phenomena. In turn, phenomena of interest uncover topics of practical significance. Theories sometimes arise from a new idea or a metaphor that leads to the development of a conceptual model that then helps to reconsider theoretical approaches, being referred to as “theory building” (Colquitt & Zapata-Phelan, 2007). On other occasions, previously established theories are applied within a new context to help to understand a topic, which is known as “theory testing”.

Within the field of servitization, there is a need for more studies on both theory building and theory testing. Rabetino et al. (2018) and Eloranta and Turunen (2015) consider the need to extend and develop this research topic using well-established theories and theoretical frameworks from different disciplines. Li, Kumar, Claes and Found (2020) have expressed the need to study social and organizational theories, calling for the increased use of well-established ones from mature fields and borrowing ideas to stimulate knowledge accumulation.

The purpose of this research is to study how the topic of servitization has been analysed through different theoretical approaches. The specific aim is to answer two key questions: (1) What theoretical approaches have been used to study the phenomenon of servitization? (2) What specific aspects of the servitization process have been analysed by each theoretical approach?

We shall be using a systematic review of the literature to answer these two questions. The first step will involve using a descriptive analysis to find all those articles published on servitization that are related to one or more of the theoretical approaches, and the second step will consist of a thematic analysis of the main topics studied in the selected articles.

This review helps to identify the theoretical lens that best explains the phenomenon of servitization, revealing its strategic importance and the need for an organizational aspects-servitization-performance fit. In addition, it also highlights the two main challenges that industrial firms must face: digitalization and the natural environment.

The paper is organised into three clearly differentiated sections. The first one describes the methodology, specifically identifying the keywords used in the search and the criteria applied for the systematic literature review, as well as the papers that comprise the sample and their subsequent screening. The following section will involve studying the results based on the papers obtained in two clearly differentiated analyses: one descriptive and the other thematic. Finally, the third section summarises the conclusions, outlining this study's contributions and limitations.

2. Methodology

Answering our two questions has involved conducting a systematic two-stage review of the literature, beginning with a descriptive analysis based on activity indicators and then proceeding with a thematic analysis (Tranfield, Denyer & Smart, 2003).

The review's first step requires identifying and selecting the data to be used. Again according to Ramos-Rodríguez and Ruiz-Navarro (2004), the data sources are papers published in scientific journals, as their content is deemed to be "certified knowledge" (this term is commonly used to describe those papers that have successfully undergone a critical peer review).

In particular, Elsevier's Scopus database has been used to find the papers because it is the most comprehensive electronic database for citations and abstracts (it provides 20% more coverage than Web of Science) and has more consistent results (Falagas, Pitsouni, Malietzis & Pappas, 2008). Moreover, Scopus is considered as an effective tool for electronic literature search, which has been evidenced by Tukker (2015) or Li et al. (2020) in their revisions. The decision to choose scientific papers rather than other documentary sources, such as books, PhD theses or congress proceedings, is based on their consideration as certified knowledge, being understood as research that has been submitted to peer review and successfully passed their critical evaluation (Callon, Courtial & Penan, 1993).

The identification of the pertinent papers for conducting our research has involved the use of a search string consisting of terms related to the servitization process and each one of the theoretical approaches to be studied. The keywords have been chosen according to the study by Rabetino et al. (2018), involving some of the primary search terms used in their research. The timeframe for the search has extended from 1988, the publication year of the paper by Vandermerwe and Rada (1988), which first referred to the transformation process under study here as servitization, through to December 2020. Table 1 lists the terms used, the search conditions established, and the papers found.

This initial search produced 117 papers. This was followed by an analysis of these papers' abstracts and keywords to discover whether they were sufficiently relevant to PSS. Three papers were discarded from Scientific management theory because they had not been published in journals, but in conference proceedings instead. A further 24 papers were discarded for not being considered relevant, more specifically because they did not relate to industrial companies although they did relate to services. Out of these latter papers, four corresponded to Game theory, one to Industrial organization, eleven to Linear programming, two to Resource-based, three to Organizational behavior, and three to Scientific management. After screening, there were 93 papers in the final sample. The list of papers analysed is provided in Appendix A. Figure 1 illustrates the review process we have conducted.

	Search tips and limits
Servitization	serviti* OR servicing OR "product-service systems" OR "integration of products and services" OR "service growth" OR "service transition" OR "service science" OR "integrated solution" OR "solution offering" OR "service infusion"... Limit: Article title, Abstract, Keywords Published between 1998 and 2020 Document type: paper Search conducted between January and December 2020 (final check on 15/12/2020)
Servitization + theory	Search strings and results
Agency theory	... AND "agency theory" Three papers found
Bureaucracy theory	... AND "bureaucracy theory" No papers found
Contingency theory	... AND "contingency theory" Ten papers found
Elements administration	AND "elements administration" No papers found

Servitization + theory	Search strings and results
Ecological theory	... AND "ecological theory" One paper found
Administrative behavior	... AND "Fatalism" No papers found
Game theory	... AND "game theory" Twenty papers found
Human relations theory	... AND "human relations theory" No papers found
Industrial organization	... AND "industrial organization" Five papers found
Institutional theory	... AND "institutional theory" Three papers found
Linear programming	... AND "Linear programming" Fourteen papers found
Organizational behavior	... AND "organizational behavior" Six papers found
Resource-based theory	... AND "resource-based" Thirty one papers found
Resource dependence theory	... AND "resource dependence" Four papers found
Scientific management	... AND "scientific management" Five papers found
Social practice theory	... AND "social practice theory" Four papers found
Transaction cost	... AND "transaction cost" Eleven papers found

Table 1. Selection criteria and keywords

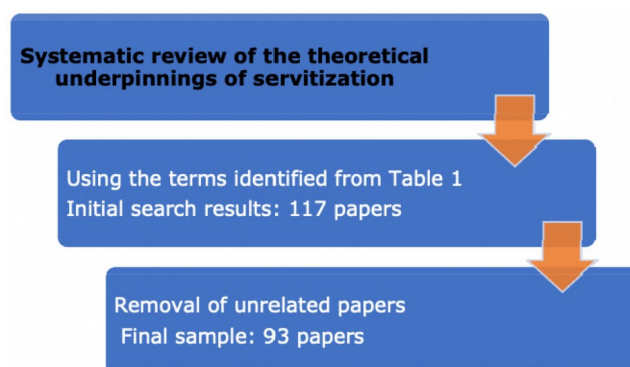


Figure 1. The review process

3. Findings

The sample's 93 papers have been used to conduct a descriptive analysis of the following indicators of size: the journals in which they were published and their authors.

The 93 papers have been published in 58 different journals. As an overview, Table 2 below lists those journals that have published three or more papers.

Journal	No. papers	Theory	Frequency
<i>Industrial Marketing Management</i>	6	Agency	1
		Resource-based	3
		Industrial organization	1
		Institutional	1
<i>Journal of Business and Industrial Marketing</i>	5	Resource-based	4
		Transaction cost	1
<i>Journal of Cleaner Production</i>	5	Transaction cost	2
		Institutional	1
		Social practice	2
<i>International Journal of Production Economics</i>	5	Game	1
		Contingency	1
		Resource-based	3
<i>International Journal of Production Research</i>	3	Game	1
		Ecological	1
		Linear programming	1
<i>International Journal of Operations and Production Management</i>	3	Contingency	2
		Organizational behavior	1

Table 2. Journals with three or more publications (author's own work)

Among these six journals, *International Journal of Production Economics*, *International Journal of Operations and Production Management* and *International Journal of Production Research* publish papers related to the topics of engineering, production and management. In turn, the papers published in *Journal of Business and Industrial Marketing* and *Industrial Marketing Management* are more closely related to industrial marketing and management. Finally, *Journal of Cleaner Production* is an interdisciplinary publication that focuses on Cleaner Production.

The six journals featured in Table 2 are ranked in percentile 1 in CiteScore 2019, with the exception of one of the topics (Business, Management and Accounting-Marketing) in *Journal of Business and Industrial Marketing*, which is ranked in percentile 2.

As is the case with the journals, there is a broad range of authorship for the papers in the sample. Specifically, only nine scholars have published two or more of the papers (Table 3).

As regards the authors publishing the most on the topic under study here, first place corresponds to Asian scholars, and this is due to the sharp increase in publications that have been written in China on the subject of servitization, which stands to reason because that country today records the world's highest industrial output. On the other hand, the table features scholars such as Baines, Gebauer, Parida and Kohtamäki, who are leading authorities in servitization-based research. These results are consistent with those reported by Martín-Peña, Pinillos and Reyes (2017) and Rabetino et al. (2018).

Authors	Frequency
Chang, C-Y	3
Cheng, T.C.E	2
Chang, F.	2
Baines, T.	2
Chicksand, D.	2
Gebauer, H.	2
Kohtamäki, M.	2
Parida, V.	2
Lin, L.	2

Table 3. Authors with two or more publications

This descriptive analysis concludes with Figure 2, which lists the year of issue of the papers analysed.

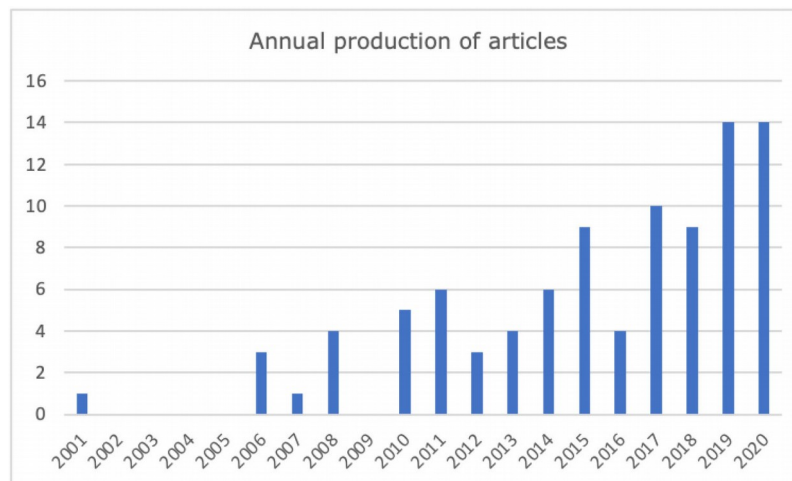


Figure 2. Annual production of articles

Most of the papers on servitization, together with the different theoretical frameworks underpinning them, have been published in the past 20 years. These results are consistent with those reported in prior studies, such as those by Díaz-Garrido, Pinillos, Soriano-Pinar and García-Magro (2018), Rabetino et al. (2018), and Li et al. (2020), which reveal an exponential increase in the number of publications dealing with servitization.

4. Discussion of Results

The review of the papers analysed reveals that the following theories have underpinned the subject of servitization over the past 32 years: Resource-based theory, Game theory, Transaction cost theory, Contingency theory, Resource dependence, Social practice theory, Linear programming, Organizational behavior, Agency theory, Scientific management, Industrial organization, and Ecological theory. Table 4 details the number of papers that have been analysed for each one of these theoretical approaches. By contrast, the topic of servitization has not been addressed through other theoretical approaches, such as Bureaucracy theory, Elements administration, Administrative behavior, and Human relations theory. There are some papers in which aspects of servitization have been addressed by two or more theories, such as those by Ceci and Prencipe (2008), Ceci and Masini (2011), Yan, Li and Cheng (2020) (Contingency theory and Resource-based theory); Chang, Zhou, Zhang, Xiao and Wang (2019) (Resource dependence and Game theory) or Kohtamäki, Parida, Oghazi, Gebauer and Baines (2019), Zhang, Wang, Gao and Li (2019) (Transaction cost and Resource-based theory).

All these theoretical approaches may be divided into two main groups: boundary of the firm and organizational boundary theories, on the basis that economics is dedicated to the study of the way in which players may choose to use their scarce resources with different applications. It may therefore be stated that economics (seen from a classical viewpoint, and originating in British marginalism through Jevons, the Austrian school by the hand of Menger, and Walras for the development of general equilibrium theory) is the source of the different approaches that make up boundary of the firm theories, and which seeks to explain why firms exist and the nature of their relationship with the market. On the other hand, organizational boundary theories provide the foundations for the organizational design of any kind of institution (public or private, for-profit and not-for-profit) (Table 4). To answer the first question initially posed, the results show that servitization has basically been underpinned by the following four theoretical approaches: Resource based, Game theory, Transaction cost, and Contingency theory, as these account for around 71% of the papers studied (Table 4).

THEORETICAL APPROACHES	No. Papers found	No. Papers analysed	Frequency %
Resource-based	31	29	31.18
Game	20	16	17.20
Transaction cost	11	11	11.83
Contingency	10	10	10.75
Industrial organization	5	4	4.30
Social practice	4	4	4.30
Linear programming	14	3	3.23
Organizational behavior	6	3	3.23
Resource dependence	4	4	4.30
Institutional	3	3	3.23
Agency	3	3	3.23
Scientific management	5	2	2.15
Ecological	1	1	1.08

Table 4. Theoretical Approaches and servitization

Resource-based theory argues that differences between firms are primarily the result of firm heterogeneity regarding their bundles of resource and capability endowments (Barney, 1991; Rumelt, 1984; Wernerfelt, 1984). This theory contends that firms are capable of creating and upholding competitive advantages through the development and integration of a series of valuable, rare and inimitable resources. This theory has provided the theoretical underpinnings for a large number of the papers analysed (31.18%). This is in keeping with other prior studies in which this theory serves as a platform for many literature discussions focusing on service infusion (Oliva & Kallenberg, 2003).

The subject of servitization analysed through Resource-based theory refers to assets that are valuable, rare, inimitable, or organised (VRIO) (Eloranta & Turunen, 2015). As regards the resources and capabilities related to servitization, the literature has identified three main resources and potentially capabilities: installed base (e.g., Oliva & Kallenberg, 2003; Ulaga & Reinartz, 2011; Wise & Baumgartner, 1999), unique and complex ranges (e.g., Ulaga & Reinartz, 2011; Gremyr, Löfberg & Witell, 2010), and improved services-relationships (e.g., Tuli, Kohli & Bharadwaj, 2007). Furthermore, the services added to the product range may be considered a resource, providing financial value (Kohtamäki, Partanen, Parida & Wincent, 2013) and driving innovation (Wallin, Parida & Isaksson, 2015). As regards capabilities, the unique ones related to servitization have also been singled out (e.g., Gebauer & Fleisch, 2007; Storbacka, 2011), as has the role played by complex combinations of resources and capabilities in

avoiding imitation (Oliveira & Roth, 2012). Kanninen, Penttinen, Tinnilä and Kaario (2017) have analysed the type of capabilities firms in industry require as servitization spreads.

Resource-based theory has provided the reference framework for studies that analyse servitization through digitalization (Coreynen, Matthyssens & Van Bockhaven, 2017), as well as for deciding the service strategy and growth options that may be most appropriate and successful, considering the resources required in each case (Raddats, Burton, & Ashman, 2015; Raddats & Easingwood, 2010).

Game theory has been used in 17.20% of the papers analysed. This is a discipline that was launched by Von Neumann, Morgenstern & Kuhn (1944) based on the transcription of a situation into abstract formulations based on logics and rules assuming rational behavior. Generally speaking, it can be classified into non-cooperative and cooperative game approaches (Song & Panayides, 2002).

This theoretical approach is used to analyse the return on the servitization strategy (Lee; Yoo & Kim, 2016). Zhong (2014) adopts Game theory for conducting a quantitative analysis of coordination mechanisms for integrating products and services through the creation of mathematical models. It is also an ideal theoretical model for analysing the relationships between consumers and service providers (Hsieh & Yeh, 2018). Hezarkhani (2017) uses Game theory to manage these relationships, seeking to coordinate the parties' efforts to optimise the gains made by the entire system, instead of focusing on the decision-making problems they face. Gómez & Heredero (2013) consider that gamification leads to an improvement in users' experience, pursuing the aim of motivating, achieving, promoting and upholding greater engagement with the features of the products and services that firms offer them. This renders it expedient to consider that Game theory is a useful framework for analysing consumers' behavior in the provision of services and the impact of the co-creation of value between businesses and consumers. Lee et al. (2016) use Game theory to identify the situations in which a servitization strategy is more profitable (depending both on the degree of dependence between the service being provided and the tangible assets and on the operation of the retail channel).

The origin of **Transaction cost theory**, which is a feature of 11.83% of the papers analysed, has been attributed to Coase (1937), who reported that the existence of firms lies in the fact that markets operate with certain costs, as well as being imperfect. These so-called transaction costs reflect the market's operating costs. According to this neoclassical approach, prices in a perfectly competitive market contain all the information to ensure the exchange can take place. According to Transaction cost theory, the pricing system is costly, which explains the existence of organizations; in turn, the coexistence of markets and organizations is explained by the characteristics associated with the different types of transaction, which refer to the information and nature of the goods being exchanged (Williamson, 1977).

Transaction cost theory has acted as a yardstick for analysing new business models when applying servitization processes in general (Mont, Dalhammar & Jacobsson, 2006) or new business models involving territorial servitization (Bellandi & Santini, 2019). It has also provided the basis for sundry studies related to digital servitization. Nevertheless, Kohtamäki et al. (2019) consider that transaction costs can be significant in the provision of product-service-software systems because of the sale and delivery of highly complex, bespoke smart solutions. Delivering smart solutions also incurs significant transaction costs because of upstream interactions with the service supply chain, in addition to product supply. Likewise, an analysis has been conducted from a transaction cost perspective to understand how supply chains are organised regarding relations involving suppliers, manufacturers, and providers in the field of servitization (Boehmer, Shukla, Kapletia & Tiwari, 2020; Wiig, 2001). All the factors commonly associated with influencing transaction costs (asset specificity, uncertainty and frequency) are significantly higher for firms with more fully implemented supply chain management, making a more integrated solution advantageous (Lietke & Boslau, 2007).

Contingency theory has been used in 10.75% of the papers. Walker, Chicksand, Radnor and Watson (2015) consider it a suitable theory for explaining the topic of servitization. This theory postulates a link between the environment, organizational structure and performance (Drazin & Van de Ven, 1985; Duncan, 1972; Venkatraman, 1989). According to this theoretical approach, it is argued that a strategy is successful only when there is a fit (i.e., a degree of internal consistency) between existing capabilities and external environmental contingencies

(Venkatraman, 1989). This interpretation of fit may be used to obtain the configurations of different contingencies, each one with distinctive implications for organizational design (Child, 1975). A direct implication of the contingent approach for the study of servitization is that, as such, there is no better strategy when addressing a servitization process in an industrial firm.

Yan et al. (2020) merge Contingency theory with Resource-based theory to analyse the success of servitization in companies based on two factors of organizational design: a service-focused organizational structure and a service-focused organizational culture. Ceci & Prencipe (2008) investigate the way in which the environmental context and companies' organizational structure influence their strategic choice and lead to different configurations of capabilities. In a similar vein, Ceci and Masini (2011) apply these same theories to analyse how the differences in fit between environmental variables and strategic choices partially account for performance differences among integrated solution providers.

The results show that the topic of servitization has not been addressed through other theoretical approaches, such as Bureaucracy theory, Elements administration, Administrative behavior, and Human relations theory. These are classic theoretical approaches within Organizational boundary theories, with a clear pragmatic orientation focused on worker analysis: job design, productivity, behavior, ...

To answer the second question and identify those specific aspects of the servitization process that have been analysed through each one of these theoretical approaches, this research has been informed by research topics identified in the study by Li et al. (2020): Organizational aspects, Value co-creation, Consumer behavior, Business models, Resources and capabilities, Innovation, Performance, Sustainability, Supply chain management. A few more have been added, such as the following: digitalization, Industry 4.0, Circular economy, Human resource management, and CRM. The data on the frequency with which each topic has been addressed are contained in the following table (Table 5).

Research topics	Total	Organizational theories	Theories of the firm	Frequency	Aggregate frequency
Performance	20	6	14	21.51	21.51
Capabilities	15	3	12	16.13	37.63
Business models	10	1	9	10.75	48.39
Supply chain management	8	3	5	8.60	56.99
Strategy	6	2	4	6.45	63.44
Sustainability	6	2	4	6.45	69.89
Consumer behavior	5	1	4	5.38	75.27
Value co-creation	4	3	1	4.30	79.57
Organizational aspects	3	2	1	3.23	82.80
Innovation	3	0	3	3.23	86.02
Flexibility	3	1	2	3.23	89.25
Digitization	3	2	1	3.23	92.47
Circular economy	2	2	0	2.15	94.62
Human resources	2	1	1	2.15	96.77
Industry 4.0	2	0	2	2.15	98.92
Customer relationship management	1	0	1	1.08	100.00
	93				

Table 5. Research topics in the theoretical underpinnings of servitization

The research topic that most frequently appears in the papers analysed involves **performance** (21.51%), which is studied from the perspective of different theories, such as Contingency theory (Ceci & Masini, 2011), Linear programming (Geng, Chu, Xue & Zhang, 2011), Resource dependence theory (Shah, Jajja, Chatha & Farooq, 2020;

Chang et al., 2019), Agency theory (Datta, 2020), Game theory (Arabi, Mansour & Shokouhyar, 2018; Gómez & Heredero, 2013; Hezarkhani, 2017; Lee et al., 2016) and Resource-based theory (Fang, Palmatier & Steenkamp, 2008; Yan et al., 2020; Zhang et al., 2019), These results are consistent with those reported by Wang, Lai, and Shou (2018), identifying numerous studies that analyse the impact that servitization has on performance.

The literature has traditionally analysed a service-based strategy as a source of competitive advantage in goods manufacturing firms (Wise & Baumgartner, 1999), and which furthermore enable those firms defining it to enhance their performances (Neu & Brown, 2005). Nevertheless, servitization does not always have positive outcomes, which leads to the consideration of what is referred to as the “service paradox” (Gebauer & Friedli, 2005). The theoretical analysis developed here enables us to explain the difference in outcomes because there are organizational factors that may moderate the relationship between servitization and outcomes (Yan et al., 2020). In addition, the different ways of measuring results may give rise to variations in the analysis of the relationship between servitization and performance (Shah et al., 2020). Zhang et al. (2019), for example, identify a non-linear relationship between servitization and financial performance, while Fang et al. (2008) conclude that an industrial firm’s decision to provide services may have both positive and negative effects. Specifically, the effects that servitization has on firm performance may be positive only when the level of service sales attains critical mass (around 20% to 30% of the firm’s overall turnover), ensuring that the services provided are strongly related to the firm’s core manufacturing business.

The second most common research topic in the papers studied here involves **capabilities** (16.13%). This subject has specifically been analysed mostly through theoretical approaches such as Resource-based theory (Coreynen et al., 2017; Hasselblatt, Huikkola, Kohtamäki & Nickell, 2018; Huikkola & Kohtamäki, 2017; Ulaga & Reinartz, 2011), Contingency theory (Ceci & Masini, 2011; Ceci & Prencipe, 2008), and Resource dependence theory (Li, Zhu, Lin, Ma, & Huang, 2015).

Studies such as those conducted by Ceci and Masini (2011) analyse the operational and dynamic capabilities required for servitization, calling upon manufacturers and customers to work together to create capabilities to enable service offerings and optimise service performance. Known examples of such capabilities in the context of servitization are ‘hybrid offering sales’, ‘hybrid offering deployment’ and ‘service-related data processing and interpretation capabilities’ (Ulaga & Reinartz, 2011). Coreynen et al. (2017) and Kohtamäki et al. (2019) have focused on the capabilities required for developing digital servitization.

Third place corresponds to **Business models**, an approach that specifically features in 10.75% of the papers in our sample. This topic has been analysed mainly through boundary of the firm theories, such as Game theory (Nishino, Wang, Tsuji, Kageyama & Ueda, 2012), Industrial organization theory (Kohtamäki et al., 2019), Resource-based theory (Kessler & Stephan, 2013; Kohtamäki et al., 2019; Lütjen, Tietze & Schultz, 2017), and Transaction cost theory (Bellandi & Santini, 2019; Mont et al., 2006).

The servitization of the manufacturing sector involves the emergence of a new business model that is modifying the structure of many industries that opt for the provision of holistic solutions (Ceci & Masini, 2011). In their approach to a successful servitization process, companies need to redesign their business model (Baines et al., 2009a). This literature review has identified different studies that analyse this aspect from different perspectives. For example, Nishino et al., (2012) define a ‘platform-type product service system’ as a comprehensive business model with a common platform on which service providers, consumers, and manufacturers mutually interact. Parida, Sjödin and Reim (2019) describe the impact that the digitalization undertaken by manufacturing firms has on their service business model (digital servitization). Kohtamäki et al. (2019) consider that business models in digital servitization should be viewed from an ecosystem perspective.

Fourth place corresponds to **Supply Chain Management (SCM)**, which has been analysed through, among others, Contingency theory (Engelseth & Jafari, 2018); Resource dependence theory (Shah et al., 2020), and Transaction cost theory (Boehmer et al., 2020; Lietke & Boslau, 2007; Wiig, 2001).

SCM encompasses the efforts involved in delivering and producing products and services in the value chain (Vendrell-Herrero, Bustinza, Parry & Georgantzis, 2017). Shah et al. (2020) contend that the focus on servitization encourages organizations to enhance internal, supplier, and customer integration, which in turn enhance

servitization (basic and advanced service provision), specifically positing that servitization-oriented firms need to improve a specific dimension of their supply chain integration to reinforce a particular type of service provision.

Finally, there are two research topics that have appeared in 6.45% of the papers, namely **Strategy** and **Sustainability**.

Strategy has been analysed mainly through Resource dependence theory (Chang et al., 2019; Li et al., 2015); Contingency theory (Pleshko & Heiens, 2011; Pleshko, Heiens & Peev, 2014) and Game theory (Chang et al., 2019; Hsieh & Yeh, 2018; Li, Ji, Chen & Jiao, 2017; Wang, Zheng, Zhao & Tian, 2019; Zhong, 2014).

Baines, Lightfoot, Peppard, Johnson, Tiwari, Shehab et al. (2009b) for example, have already highlighted the strategic importance of servitizing the manufacturing sector, analysing industrial firms' internal production and support operations to ensure the effective and efficient delivery of products and their closely associated services. Service-oriented manufacturing and integrated solutions have therefore emerged as a new strategy in corporate practice (Li et al., 2015). The theoretical underpinnings analysed show that there are scholars that consider servitization to be a competitive-level strategy (Lee et al., 2016), in the sense that traditional manufacturing firms launch services to supplement their products as a market differentiation strategy (Raddats & Easingwood, 2010). By contrast, other firms view it as a functional-level strategy; for example, Fang et al. (2008) evaluate the effectiveness of service transition strategies as a marketing approach. Zhong (2014) contends that product-service integration enables a firm to improve its overall turnover, whereby it should adopt appropriate income distribution strategies to promote its product-service integration.

Sustainability has been addressed through sundry approaches, such as Institutional theory (Stål & Corvellec, 2018); Social practice theory (Retamal & Schandl, 2018; Sousa-Zomer & Miguel, 2016); Game theory (Arabi et al., 2018; Chang et al., 2019; Hezarkhani, 2017), and Resource-based theory (Leismann, Schmitt, Rohn & Baedeker, 2013).

The importance of the launch of services by manufacturing firms may also be analysed from the perspective of environmental sustainability, which highlights the need to manage a product's lifecycle through the provision of different kinds of services. These theoretical approaches reveal that servitization is a suitable approach for achieving sustainability because of the potential PSS have to simultaneously deliver social well-being and economic prosperity (Sousa-Zomer & Miguel, 2016). What's more, PSS provides a combination of products and services that may fulfil customers' expectations, offering an alternative to the purchase of an existing product or a new one (Leismann et al., 2013). Retamal and Schandl (2018) and Stål and Corvellec (2018) have analysed PSS (or servitization systems) as circular business models.

5. Conclusions

With a view to shedding some light on the increase in the number of publications on servitization, and faced with the need to improve the theories related to the servitization process itself, our findings provide an alternative theoretical lens by combining different approaches to account for the success of firms' transformation in this field.

We propose using a double theoretical lens by combining different theories to analyse different research topics, which include the following:

- There is no doubt about the importance of servitization in the manufacturing sector, although it remains to be seen whether it should be considered a strategy at competitive level or, by contrast, at functional level in the field of production and operations, as well as in terms of marketing. Resource dependence, Contingency, and Game theories may provide the appropriate frameworks for identifying different generic configurations of servitization strategies. There is a need for a further exploration of the strategic approach to servitization to discover whether or not it may be considered a functional strategy within a firm; for example, for the field of production and operations, or even for marketing.
- Resource-based and Contingency theories may also be applied to the analysis of the relationship between organizational aspects, servitization and performance. This is consistent with other prior studies, such as those conducted by Yan et al. (2020) and Ceci and Masini (2011). It would be expedient to propose models of fit between environmental and organizational variables, capabilities, and resources in order to identify

the more profitable type of servitization model. This would help to explain how capabilities in servitization generate competitive advantage and the types of configurations of resources and processes they require. These theories might constitute the theoretical lens that best explains the service paradox.

- It would be expedient to analyse the earnings and costs linked to different levels of servitization from the perspective of Transaction cost and Resource-based theories (Zhang et al., 2019) to ensure industrial firms make the right decision when launching a servitization process. These analyses could be supplemented by the study of value co-creation.
- Different industries are now facing the major challenge of digitalization. The Internet of Things (IoT), smart data-based products and services, and technologies are forcing organizations to create wholly new business models focused on products and service-based approaches. Specifically, advances in information technology and digitalization are prompting new business models involving digital servitization. It would be convenient to identify the dynamic capabilities that need to be deployed in industries that are intensive in technology and R&D, which would also lead to improvements in performance. These studies should be conducted within the theoretical framework of Resource-based and Resource dependence theories.
- In turn, concern for the environment and sustainability are topics that merit greater analysis, in the sense that servitization may feasibly be considered an enabler of sustainability. This finding is consistent with prior studies, such as the one by Díaz-Garrido et al. (2018). Nevertheless, sustainability will not be achieved solely through innovations in terms of the provision of services, as there is a need for additional research that considers sustainable consumption and demand with a view to introducing sustainable PPS that are profitable from an economic, environmental and social perspective. This may be readily argued through Social practice, Game and Resource-based theories.
- Dealings with customers and suppliers within SCM in industrial firms will require a far-reaching review of the internal and external supply and demand of goods and services to ensure the combination and acquisition of the resources and capabilities required for servitization, in line with the findings reported by Shah et al. (2020). These analyses should be framed within the lens of theoretical approaches such as Contingency theory, Resource dependence theory, and Transaction cost theory.

Our study makes a significant contribution to the state-of-the-art on the theory of servitization, specifically helping to analyse the theoretical lens that can better explain the subject of servitization in general, and its associated research topics in particular.

This study has several implications for the servitization literature. First, identifying the theoretical foundations that demonstrate a great degree of scientific maturity of servitization-related research. Second, not only the thematic areas that may be of interest for future research have been identified, but also the theoretical foundations under which such research could be developed have been indicated.

The present study has several practical implications for managers who are engaged in servitization. It is expected that servitization can help industrial companies in undertaking the digital transformation of their businesses and in improving environmental sustainability.

Notwithstanding this contribution, our paper has certain limitations. Firstly, we have used only one database (SCOPUS) and the peer-reviewed papers featured in it. Some publications may therefore have been overlooked. Secondly, we have only considered papers written in English, whereby there may be other publications drafted in other languages, such as Chinese, Italian, French or German, for example.

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References

- Arabi, M., Mansour, S., & Shokouhyar, S. (2018). Optimizing a warranty-based sustainable product service system using game theory. *International Journal of Sustainable Engineering*, 11(5), 330-341. <https://doi.org/10.1080/19397038.2017.1387187>
- Bacharach, S.B. (1989). Organizational Theories: Some Criteria for Evaluation. *Academy of Management Review*, 14(4), 496-515. <https://doi.org/10.5465/amr.1989.4308374>
- Baines, T.S., Lightfoot, H.W., Benedettini, O., & Kay, J.M. (2009a). The servitization of manufacturing: A review of literature and reflection on future challenges. *Journal of Manufacturing Technology Management*, 20(5), 547-567. <https://doi.org/10.1108/17410380910960984>
- Baines, T.S., Lightfoot, H.W., Peppard, J., Johnson, M., Tiwari, A., Shehab, E. et al. (2009b). Towards an operations strategy for product-centric servitization. *International Journal of Operations and Production Management*, 29(5), 494-519. <https://doi.org/10.1108/01443570910953603>
- Barney, J.B. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99-120. <https://doi.org/10.1177/014920639101700108>
- Bellandi, M., & Santini, E. (2019). Territorial servitization and new local productive configurations: the case of the textile industrial district of Prato. *Regional Studies*, 53(3), 356-365. <https://doi.org/10.1080/00343404.2018.1474193>
- Boehmer, J.H., Shukla, M., Kapletia, D., & Tiwari, M.K. (2020). The impact of the Internet of Things (IoT) on servitization: an exploration of changing supply relationships. *Production Planning and Control*, 31(2-3), 203-219. <https://doi.org/10.1080/09537287.2019.1631465>
- Callon, M., Courtial, J.P., & Penan, H. (1993). *Cienciometría. La medición de la actividad científica: de la bibliometría a la vigilancia tecnológica*. Gijón: Trea, Ed.
- Ceci, F., & Masini, A. (2011). Balancing specialized and generic capabilities in the provision of integrated solutions. *Industrial and Corporate Change*, 20(1), 91-131. <https://doi.org/10.1093/icc/dtq069>
- Ceci, F., & Prencipe, A. (2008). Configuring capabilities for integrated solutions: Evidence from the IT sector. *Industry and Innovation*, 15(3), 277-296. <https://doi.org/10.1080/13662710802040879>
- Chang, F., Zhou, G., Zhang, C., Xiao, Z., & Wang, C. (2019). A service-oriented dynamic multi-level maintenance grouping strategy based on prediction information of multi-component systems. *Journal of Manufacturing Systems*, 53, 49-61. <https://doi.org/10.1016/j.jmsy.2019.09.005>
- Child, J. (1975). Managerial and organizational factors associated with company performance-PartII. A contingency analysis. *Journal of Management Studies*, 12(1-2), 12-27. <https://doi.org/10.1111/j.1467-6486.1975.tb00884.x>
- Coase, R.H. (1937). The Nature of the Firm. *Economica*, 4(16), 386-405. <https://doi.org/10.1111/j.1468-0335.1937.tb00002.x>
- Colquitt, J.A., & Zapata-Phelan, C.P. (2007). Trends in theory building and theory testing: A five-decade study of the Academy of Management Journal. *Academy of Management Journal*, 50(6), 1281-1303. <https://doi.org/10.5465/AMJ.2007.28165855>
- Coreynen, W., Matthyssens, P., & Van Bockhaven, W. (2017). Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers. *Industrial Marketing Management*, 60, 42-53. <https://doi.org/10.1016/j.indmarman.2016.04.012>
- Datta, P.P. (2020). Hidden costs in different stages of advanced services – A multi-actor perspective of performance based contracts. *Journal of Business Research*. <https://doi.org/10.1016/j.jbusres.2020.03.036>
- Díaz-Garrido, E., Pinillos, M.J., Soriano-Pinar, I., & García-Magro, C. (2018). Changes in the intellectual basis of servitization research: A dynamic analysis. *Journal of Engineering and Technology Management*, (June 2017), 1-14. <https://doi.org/10.1016/j.jengtecman.2018.01.005>
- Drazin, R., & Van de Ven, A.H. (1985). Alternative Forms of Fit in Contingency Theory. *Administrative Science Quarterly*, 30(4), 514. <https://doi.org/10.2307/2392695>

- Duncan, R.B. (1972). Characteristics of Organizational Environments and Perceived Environmental Uncertainty. *Administrative Science Quarterly*, 17(3), 313. <https://doi.org/10.2307/2392145>
- Eloranta, V., & Turunen, T. (2015). Seeking competitive advantage with service infusion: A systematic literature review. *Journal of Service Management*, 26(3), 394-425. <https://doi.org/10.1108/JOSM-12-2013-0359>
- Engelseth, P., & Jafari, H. (2018). Marketing complex product designs in the contemporary value chain. *International Journal of Value Chain Management*, 9(4), 311-329. <https://doi.org/10.1504/IJVCM.2018.095259>
- Falagas, M.E., Pitsouni, E.I., Malietzis, G.A., & Pappas, G. (2008). Comparison of PubMed, Scopus, Web of Science, and Google Scholar: strengths and weaknesses. *The FASEB Journal*, 22(2), 338-342. <https://doi.org/10.1096/fj.07-9492lsf>
- 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. <https://doi.org/10.1509/jmkg.72.5.001>
- Forkmann, S., Henneberg, S.C., Witell, L., & Kindström, D. (2017). Driver Configurations for Successful Service Infusion. *Journal of Service Research*, 20(3), 275-291. <https://doi.org/10.1177/1094670517706160>
- Gebauer, H., & Fleisch, E. (2007). An investigation of the relationship between behavioral processes, motivation, investments in the service business and service revenue. *Industrial Marketing Management*, 36(3), 337-348. <https://doi.org/10.1016/j.indmarman.2005.09.005>
- Gebauer, H., & Friedli, T. (2005). Behavioral implications of the transition process from products to services. *Journal of Business and Industrial Marketing*, 20(2), 70-78. <https://doi.org/10.1108/08858620510583669>
- Geng, X., Chu, X., Xue, D., & Zhang, Z. (2011). A systematic decision-making approach for the optimal product-service system planning. *Expert Systems with Applications*, 38(9), 11849-11858. <https://doi.org/10.1016/j.eswa.2011.03.075>
- Gioia, D.A., & Pitre, E. (1990). Multiparadigm perspectives on theory building. *Academy of Management Review*, 15, 584-602. <https://doi.org/10.5465/amr.1990.4310758>
- Gómez, C.G., & Heredero, C.D.P. (2013). La gamificación y el enriquecimiento de las prácticas de innovación en la empresa: Un análisis de experiencias. *Intangible Capital*, 9(3), 800-822. <https://doi.org/10.3926/ic.377>
- Gremyr, I., Löfberg, N., & Witell, L. (2010). Service innovations in manufacturing firms. *Managing Service Quality*, 20(2), 161-175. <https://doi.org/10.1108/09604521011027589>
- Hasselblatt, M., Huikkola, T., Kohtamäki, M., & Nickell, D. (2018). Modeling manufacturer's capabilities for the Internet of Things. *Journal of Business and Industrial Marketing*, 33(6), 822-836. <https://doi.org/10.1108/JBIM-11-2015-0225>
- Hezarkhani, B. (2017). Optimal design of uptime-guarantee contracts under IGFR valuations and convex costs. *European Journal of Operational Research*, 256(2), 556-566. <https://doi.org/10.1016/j.ejor.2016.06.032>
- Hsieh, Y.H., & Yeh, S.Y. (2018). Modeling dynamic service recovery strategies: a signaling game approach. *Kybernetes*, 47(5), 888-919. <https://doi.org/10.1108/K-05-2017-0171>
- Huikkola, T., & Kohtamäki, M. (2017). Solution providers' strategic capabilities. *Journal of Business and Industrial Marketing*, 32(5), 752-770. <https://doi.org/10.1108/JBIM-11-2015-0213>
- Johnson, M.D., Herrmann, A., & Bauer, H.H. (1999). The effects of price bundling on consumer evaluations of product offerings. *International Journal of Research in Marketing*, 16(2), 129-142. [https://doi.org/10.1016/s0167-8116\(99\)00004-x](https://doi.org/10.1016/s0167-8116(99)00004-x)
- Kanninen, T., Penttinen, E., Tinnilä, M., & Kaario, K. (2017). Exploring the dynamic capabilities required for servitization: The case process industry. *Business Process Management Journal*, 23(2), 226-247. <https://doi.org/10.1108/BPMJ-03-2015-0036>
- Kessler, T., & Stephan, M. (2013). Service transition in the automotive industry. *International Journal of Automotive Technology and Management*, 13(3), 237-256. <https://doi.org/10.1504/IJATM.2013.054919>

- Kohtamäki, M., Parida, V., Oghazi, P., Gebauer, H., & Baines, T.S. (2019). Digital servitization business models in ecosystems: A theory of the firm. *Journal of Business Research*, 104, 380-392. <https://doi.org/10.1016/j.jbusres.2019.06.027>
- 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. <https://doi.org/10.1016/j.indmarman.2013.07.018>
- Lee, S., Yoo, S., & Kim, D. (2016). When is servitization a profitable competitive strategy? *International Journal of Production Economics*, 173, 43-53. <https://doi.org/10.1016/j.ijpe.2015.12.003>
- Leismann, K., Schmitt, M., Rohn, H., & Baedeker, C. (2013). Collaborative consumption: Towards a resource-saving consumption culture. *Resources*, 2(3), 184-203. <https://doi.org/10.3390/resources2030184>
- Li, A.Q., Kumar, M., Claes, B., & Found, P. (2020). The state-of-the-art of the theory on Product-Service Systems. *International Journal of Production Economics*, 222(September 2019). <https://doi.org/10.1016/j.ijpe.2019.09.012>
- Li, H., Ji, Y., Chen, L., & Jiao, R.J. (2017). Bi-Level Coordinated Configuration Optimization for Product-Service System Modular Design. *IEEE Transactions on Systems, Man, and Cybernetics: Systems*, 47(3), 537-554. <https://doi.org/10.1109/TSMC.2015.2507407>
- Li, J.H., Zhu, W.J., Lin, L., Ma, L.Y., & Huang, Q.B. (2015). Manufacturer-user dependence, relationship learning and manufacturer servitisation in China. *International Journal of Technology, Policy and Management*, 15(4), 311-312. <https://doi.org/10.1504/IJTPM.2015.072792>
- Lietke, B., & Boslau, M. (2007). Exploring the transaction dimensions of supply chain management. *International Journal of Networking and Virtual Organisations*, 4(2), 163-179. <https://doi.org/10.1504/IJNVO.2007.013541>
- Lütjen, H., Tietze, F., & Schultz, C. (2017). Service transitions of product-centric firms: An explorative study of service transition stages and barriers in Germany's energy market. *International Journal of Production Economics*, 192, 106-119. <https://doi.org/10.1016/j.ijpe.2017.03.021>
- Martín-Peña, M.L., Pinillos, M.J., & Reyes, L.E. (2017). The intellectual basis of servitization: A bibliometric analysis. *Journal of Engineering and Technology Management - JET-M*, 43, 83-97. <https://doi.org/10.1016/j.jengtecman.2017.01.005>
- Mont, O., Dalhammar, C., & Jacobsson, N. (2006). A new business model for baby prams based on leasing and product remanufacturing. *Journal of Cleaner Production*, 14(17), 1509-1518. <https://doi.org/10.1016/j.jclepro.2006.01.024>
- Neu, W., & Brown, S. (2005). Forming successful business-to-business services in goods-dominant firms. *Journal of Service Research*, 8(1), 3-17. <https://doi.org/10.1177/1094670505276619>
- Nishino, N., Wang, S., Tsuji, N., Kageyama, K., & Ueda, K. (2012). Categorization and mechanism of platform-type product-service systems in manufacturing. *CIRP Annals - Manufacturing Technology*, 61(1), 391-394. <https://doi.org/10.1016/j.cirp.2012.03.053>
- Oliva, R., & Kallenberg, R. (2003). Managing the transition from products to services. *International Journal of Service Industry Management*, 14(2), 160-172. <https://doi.org/10.1108/09564230310474138>
- Oliveira, P., & Roth, A.V. (2012, February). Service orientation: The derivation of underlying constructs and measures. *International Journal of Operations and Production Management*, 32, 156-190. <https://doi.org/10.1108/01443571211208614>
- Parida, V., Sjödin, D., & Reim, W. (2019, January 14). Reviewing literature on digitalization, business model innovation, and sustainable industry: Past achievements and future promises. *Sustainability (Switzerland)*, 11, 391. <https://doi.org/10.3390/su11020391>
- Pleshko, L.P., & Heiens, R.A. (2011). A contingency theory approach to market orientation and related marketing strategy concepts: Does fit relate to share performance? *Academy of Banking Studies Journal*, 10(1), 119-133.
- Pleshko, L.P., Heiens, R.A., & Peev, P. (2014). The impact of strategic consistency on market share and ROA. *International Journal of Bank Marketing*, 32(3), 176-193. <https://doi.org/10.1108/IJBM-06-2013-0057>

- Rabetino, R., Harmsen, W., Kohtamäki, M., & Sihvonen, J. (2018). Structuring servitization-related research. *International Journal of Operations and Production Management*, 38, 350-371. <https://doi.org/10.1108/IJOPM-03-2017-0175>
- Raddats, C., Burton, J., & Ashman, R. (2015). Resource configurations for services success in manufacturing companies. *Journal of Service Management*, 26(1), 97-116. <https://doi.org/10.1108/JOSM-12-2012-0278>
- Raddats, C., & Easingwood, C. (2010). Services growth options for B2B product-centric businesses. *Industrial Marketing Management*, 39(8), 1334-1345. <https://doi.org/10.1016/j.indmarman.2010.03.002>
- Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J., & Gebauer, H. (2019). Servitization: A contemporary thematic review of four major research streams. *Industrial Marketing Management*, 83, 207-223. <https://doi.org/10.1016/j.indmarman.2019.03.015>
- Ramos-Rodríguez, A.R., & Ruiz-Navarro, J. (2004). Changes in the intellectual structure of strategic management research: a bibliometric study of the Strategic Management Journal, 1980-2000. *Strategic Management Journal*, 25(10), 981-1004. <https://doi.org/10.1002/smj.397>
- Retamal, M., & Schandl, H. (2018). Dirty Laundry in Manila: Comparing Resource Consumption Practices for Individual and Shared Laundering. *Journal of Industrial Ecology*, 22(6), 1389-1401. <https://doi.org/10.1111/jiec.12696>
- Rumelt, R.P. (1984). Towards a strategic theory of the firm. *Competitive Strategic Management*, 26(3), 556-570.
- 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. <https://doi.org/10.1016/j.ijpe.2020.107765>
- Song, D.W., & Panayides, P.M. (2002). A conceptual application of cooperative game theory to liner shipping strategic alliances. *Maritime Policy and Management*, 29(3), 285-301. <https://doi.org/10.1080/03088830210132632>
- Sousa-Zomer, T.T., & Miguel, P.A.C. (2016). Exploring the consumption side of sustainable product-service systems (PSS): An empirical study and insights for PSS sustainable design. *CIRP Journal of Manufacturing Science and Technology*, 15, 74-81. <https://doi.org/10.1016/j.cirpj.2016.04.004>
- Stål, H.I., & Corvellec, H. (2018). A decoupling perspective on circular business model implementation: Illustrations from Swedish apparel. *Journal of Cleaner Production*, 171, 630-643. <https://doi.org/10.1016/j.jclepro.2017.09.249>
- Storbacka, K. (2011). A solution business model: Capabilities and management practices for integrated solutions. *Industrial Marketing Management*, 40(5), 699-711. <https://doi.org/10.1016/j.indmarman.2011.05.003>
- Tranfield, D., Denyer, D., & Smart, P. (2003). Towards a methodology for developing evidence-informed management knowledge by means of systematic review. *British Journal of Management*, 14(3), 207-222. <https://doi.org/10.1111/1467-8551.00375>
- Tukker, A. (2015, June 15). Product services for a resource-efficient and circular economy - A review. *Journal of Cleaner Production*, 97, 76-91. <https://doi.org/10.1016/j.jclepro.2013.11.049>
- Tuli, K.R., Kohli, A.K., & Bharadwaj, S.G. (2007). Rethinking Customer Solutions: From Product Bundles to Relational Processes. *Journal of Marketing*, 71(3), 1-17. <https://doi.org/10.1509/jmkg.71.3.001>
- Ulaga, W., & Reinartz, W.J. (2011). Hybrid offerings: How manufacturing firms combine goods and services successfully. *Journal of Marketing*, 75(6), 5-23. <https://doi.org/10.1509/jm.09.0395>
- Vandermerwe, S., & Rada, J. (1988). Servitization of business: adding value by adding service. In: *European Management Journal*, 6(4), 314-320. [https://doi.org/10.1016/0263-2373\(88\)90033-3](https://doi.org/10.1016/0263-2373(88)90033-3)
- Vendrell-Herrero, F., Bustinza, O.F., Parry, G., & Georgantzis, N. (2017). Servitization, digitization and supply chain interdependency. *Industrial Marketing Management*, 60, 69-81. <https://doi.org/10.1016/j.indmarman.2016.06.013>
- Venkatraman, N. (1989). The Concept of Fit in Strategy Research: Toward Verbal and Statistical Correspondence. *Academy of Management Review*, 14(3), 423-444. <https://doi.org/10.5465/amr.1989.4279078>
- Visnjic, I., & Van Looy, B. (2013). Successfully Implementing a Service Business Model in a Manufacturing Firm. In *Cambridge Service Alliance*. Available at: www.cambridgeservicealliance.org

- Von Neumann, J., Morgenstern, O., & Kuhn, H.W. (1944). *Theory of Games and Economic Behavior*. Princeton, NJ: Princeton University Press.
- Walker, H., Chicksand, D., Radnor, Z., & Watson, G. (2015). Theoretical perspectives in operations management: An analysis of the literature. *International Journal of Operations and Production Management*, 35(8), 1182-1206. <https://doi.org/10.1108/IJOPM-02-2014-0089>
- Wallin, J., Parida, V., & Isaksson, O. (2015). Understanding product-service system innovation capabilities development for manufacturing companies. *Journal of Manufacturing Technology Management*, 26(5), 763-787. <https://doi.org/10.1108/JMTM-05-2013-0055>
- Wang, W., Lai, K.H., & Shou, Y. (2018). The impact of servitization on firm performance: a meta-analysis. *International Journal of Operations and Production Management*, 38, 1562-1588. <https://doi.org/10.1108/IJOPM-04-2017-0204>
- Wang, Z., Zheng, L., Zhao, T., & Tian, J. (2019). Mitigation strategies for overuse of Chinese bikesharing systems based on game theory analyses of three generations worldwide. *Journal of Cleaner Production*, 227, 447-456. <https://doi.org/10.1016/j.jclepro.2019.04.100>
- Wernerfelt, B. (1984). A resource-Based View of the firm. *Strategic Management Journal*, 5(2), 171-178. <https://doi.org/10.1002/smj.4250050207>
- Wiig, A. (2001). Supply chain management in the oil industry: The Angolan case. *Working Paper - Cbr. Michelsen Institute*, 6, 1-37. Retrieved from www.cmi.no
- Williamson, O.E. (1977). Markets and hierarchies. *Challenge*, 20. Available at: <https://books.google.es/books?hl=es&lr=&id=pg-wGL12BjUC&oi=fnd&pg=PA106&dq=williamson+transaction+1975&ots=vVWvgzz7ej&sig=muPQgzfZMi6I5EqxGLvL4JvpvY>
- Wise, R., & Baumgartner, P. (1999). Go Downstream: The New Profit Imperative in Manufacturing. *Harvard Business Review*, 77(5), 133-141.
- Yan, K., Li, G., & Cheng, T.C.E. (2020). The impact of service-oriented organizational design factors on firm performance: The moderating role of service-oriented corporate culture. *International Journal of Production Economics*, 228, 107745. <https://doi.org/10.1016/j.ijpe.2020.107745>
- Zhang, Y., Wang, L., Gao, J., & Li, X. (2019). Servitization and business performance: the moderating effects of environmental uncertainty. *Journal of Business and Industrial Marketing*, 35(5), 803-815. <https://doi.org/10.1108/JBIM-03-2019-0123>
- Zhong, H. (2014). Game analysis of product-service integration. *Journal of Industrial Engineering and Management*, 7(5), 1447-1467. <https://doi.org/10.3926/jiem.1221>

Appendix A. Papers analysed.

PAPERS	YEAR	AUTHORS	KEYWORDS	METHODOLOGY	RESEARCH THEME
ORGANIZATIONAL BOUNDARY THEORY					
Bureaucracy theory					
Contingency theory (10)					
Balancing specialized and generic capabilities in the provision of integrated solutions	2011	Ceci, F. Masini, A	Firm size, industrial performance, industrial structure, information technology, model test	Survey	Capabilities, organizational aspects, performance
Theoretical perspectives in operations management: An analysis of the literature	2015	Walker, H., Chicksand, D., Radnor, Z., Watson, G.	Operations management, Literature review, Theory	Conceptual, literature review	Theories
Configuring capabilities for integrated solutions: Evidence from the IT sector	2008	Ceci, F. Prencipe, A.	Capabilities, integrated solutions, IT sector, contingency theory, resource-based view	Interview, literature review	Capabilities, organizational aspects
The impact of strategic consistency on market share and ROA	2014	Pleshko, L.P., Heiens, R.A., Peev, P.	Marketing strategy, Strategic fit, Firm performance, Credit unions, Miles and Snow typology, Porter typology	Survey	Strategy
A contingency theory approach to market orientation and related marketing strategy concepts: Does fit relate to share performance?	2011	Pleshko, L.P., Heiens, R.A.	Marketing strategy, Strategic fit, Firm performance, Credit unions, Miles and Snow typology, Porter typology	Survey	Strategy
Service delivery system design for risk management in sharing-based product service systems: a customer-oriented approach	2020	Hazée, S., Van Vaerenbergh, Y., Delcourt, C., Kabadayi, S	Product-service systems (PSS), Risk management, Service delivery system design, Servitization, Sharing economy, Trust	Survey	Value co-creation, business models
Specialised capabilities in integrated solutions: The role of fit	2013	Ceci, F. Masini, A.	Contingency theory; integrated solutions; IT sector; capabilities	Survey	Organizational aspects, business models
Successful business models for service centres: an empirical analysis	2020	Gaiardelli, P., Songini, L.	Business model, Medium-heavy commercial vehicle industry, Service centres, Servitization, Top performer	Case study	Business models, performance
The impact of service-oriented organizational design factors on firm performance: The moderating role of service-oriented corporate culture	2020	Yan, K. Li, G., Cheng, T.C.E	Servitization, Organizational change, Organizational design factors, Culture, Firm performance	Survey	Organizational aspects, performance, hr
Marketing complex product designs in the contemporary value chain	2018	Engelseth, P., Jafari, H.	Postponement, customer value, supply timing, Alderson, transvection, servitisation	Case study	SCM
Elements administration					
Ecological theory (1)					
Ecosystem evolution mechanism of manufacturing service system driven by service providers	2017	Zhang, W., Shi, Y., Yang, M. Tang, R., Pan, X.	Manufacturing service system; service providers; producer services; ecological evolution; predatorprey model	Case study	Ecological evolution
Fatalism					
Humans relations theory					
Institutional theory (3)					
A decoupling perspective on circular business model implementation: Illustrations from Swedish apparel	2018	Stål, H.I. Corvellec, H.	Circular business models, circular economy, decoupling, sustainable business models, institutional theory, product-service-systems	Case study	Circular economy, business models, flexibility
Management accounting change and the implementation of gfmis: A Jordanian case study	2017	Alsharari, N.M., ElAziz Youssef, M.A.	Institutional theory, Government Financial Management Information Systems, Management accounting change	Case study	Accounting, SIG
How institutional pressures and systems characteristics shape customer acceptance of smart product-service systems	2020	Kropp, E., Totzek, D.	Adoption of innovations, Business-to-business marketing, Digitization, Institutional theory, Internet of things, Product-service systems	Survey	Digitalization, consumer behavior
Linear programming (14)					
Optimization of a Distributed Cogeneration System with solar district heating	2014				SCM, Strategy, performance
Capturing dynamics in integrated supply chain management	2008	Puigjaner, L., Laínez, J.M.	Supply chain management; Predictive control; Stochastic programming	Case study	(creation value)
An exact algorithm for the integrated planning of berth allocation and quay crane assignment	2013				

A systematic decision-making approach for the optimal product-service system planning	2011	Geng, X. Chu, X., Xue, D. Zhang, Z.	Product-service system (PSS), Engineering characteristics (EC), Fuzzy pairwise comparison, Kano model, Non-linear programming	Case study	Performance
A utility-driven approach to supplier evaluation and selection: Empirical validation of an integrated solution framework	2016				
Aircraft maintenance, routing, and crew scheduling planning for airlines with a single fleet and a single maintenance and crew base	2014				
Integrated stochastic optimization approaches for tactical scheduling of trains and railway infrastructure maintenance	2019				
Air traffic optimization models for aircraft delay and travel time minimization in terminal control areas	2015				
Module configuration approach for product service system design driven by customer requirements	2016	Geng, X. Xu, S. Ye, C.	Customer requirements, Quality function deployment, Product service system	Conceptual, Theoretical analysis	Consumer behavior. PSS, Quality
A specialized column generation approach for a vehicle routing problem with demand allocation	2013				
Application driven inverse type constraint satisfaction problems	2017				
An initial load-based green software defined network	2017				
Centralized visual based navigation and control of a swarm of satellites for on-orbit servicing	2020				
Sustainable water supply systems for the islands: The integration with the energy problem	2020				
Organizational behavior (6)					
Theoretical perspectives in operations management: An analysis of the literature	2015	Walker, H., Chicksand, D., Radnor, Z., Watson, G.	Operations management, theory, literature review	Conceptual, literature review	Theories
Towards a model of governance in complex (product-service) inter-organizational systems	2010	Roehrich, J.K., Lewis, M.A.	Product-Service Systems, Inter-organizational Governance, Contracts, Trust, Complexity	Conceptual	Organizational aspects, strategy
An empirical study on the influences on the acquisition of enterprise software decisions: A practitioner's perspective	2010	Palanisamy, R., Verville, J., Bernadas, C., Taskin, N.	Decision making, Organizational behavior	Survey	Digitalization
Transforming cross-cultural conflict into collaboration: The integration of western and eastern values	2018				
Computerized Immediate Feedback Increases Product Recall Efficiency Due to Interlocking Contingencies in Food Manufacturing	2017				
The effect of organizational citizenship behaviors on the success of enterprise resource planning (ERP) information systems	2014				
Resource dependence (4)					
A service-oriented dynamic multi-level maintenance grouping strategy based on prediction information of multi-component systems	2019	Chang, F. Zhou, G. Zhang, C., Xiao, Z, Wang, C.	Product-service-system, Service-oriented maintenance, Maintenance strategy, Grouping maintenance, Predictive maintenance, Dynamic rolling horizon	Conceptual, case study	Strategy (maintenance)
Manufacturer-user dependence, relationship learning and manufacturer servitisation in China	2015	Li, J.H., Zhu, W.J., Lin, L., Ma, L.Y., Huang, Q.B.	Joint dependence, dependence advantage, relationship learning, manufacturer servitisation, resource dependence theory, service-oriented manufacturing, manufacturer-user dependence, China, cooperation, communication, value creation, joint action	Survey	Strategy, capabilities
Servitization and supply chain integration: An empirical analysis	2020	Shah, S.A.A. Jajja, M.S.S. Chatha, K.A., Farooq, S.	Firm performance, Empirical research, International manufacturing strategy survey	Survey	Performance

Construct Outsourcing Vendor Selection Criteria for Business Intelligence	2019	Chang, C.-Y., Yang, J.-W. Wu, M.-C.	Business intelligence, outsourcing vendor, selection criteria, modified Delphi method, analytic hierarchy process	Método Delphi (13 experts)	SCM, Performance
Scientific management (5)					
Toward a ubiquitous personalized daily-life activity recommendation service with contextual information: A services science perspective	2010	Wang, C.-Y., Wu, Y.-H., Chou, S.-C.T.	Service innovation, service productivity, service design	Case study	Flexibility, quality Strategy, Value co-creation
Services science to be taught at NC state	2006	Allen, S. G., Mugge, P.	Service design, management, business strategy	Conceptual	Value co-creation
System convergence in the crafting and execution of a services directed strategy: A technology perspective	2015				
Services management in highly competitive contexts of tumultuous change	2015				
Toward a ubiquitous personalized daily-life activity recommendation service with contextual information: A services science perspective	2008				
Social practice theory (4)					
The role of values in collaborative consumption: Insights from a product-service system for lending and borrowing in the UK	2015	Piscicelli, L., Cooper, T., Fisher, T.	Collaborative consumption, Pro-environmental behavior change, Product-service systems, Social practice theory, Social psychology, Values	Case study	Value co-creation
Collaborative consumption practices in Southeast Asian cities: Prospects for growth and sustainability	2019	Retamal, M.	Sharing economy, Social practice theory, Product-service systems, Emerging economies	Survey	Value co-creation
Dirty Laundry in Manila: Comparing Resource Consumption Practices for Individual and Shared Laundering	2018	Retamal, M., Schandl, H.	Developing countries, households, industrial ecology, product-service system (PSS), social practices, sustainable consumption	Case study	Sustainability
Exploring the consumption side of sustainable productservice systems (PSS): An empirical study and insights for PSS sustainable design	2016	Sousa-Zomer, T.T., Miguel, P.A.C.	Sustainable product-service systems, Sustainability, Consumption, Practice theory, Sustainable design	Case study	Sustainability
BOUNDARY OF THE FIRM THEORY					
Agency theory (3)					
Multitask agency, modular architecture, and task disaggregation in SaaS	2010	Susarla, A., Barua, A., Whinston, A.B.	Endogenous matching, information technology, modularity, multitask agency, outsourcing, service science, services	Survey	Consumer behavior
Mitigating adverse customer behaviour for productservice system provision: An agency theory perspective	2018	Reim, W., Sjödin, D., Parida, V.	Product-service systems (PSS), Agency theory, Trust, Adverse behavior, Agency mechanisms, Servitization	Case study	Consumer behavior
Hidden costs in different stages of advanced services – A multi-actor perspective of performance based contracts	2020	Datta, P.P.	Hidden costs, Performance based contracts, Case based research, Servitization, Multi actor systems, Engagement, S-D logic, Agency theory	Case study	Performance (hidden cost)
Game theory (20)					
A module-based service model for mass customization: Service family design	2011	Moon, S.K., Shu, J., Simpson, T.W., Kumara, S.R.T.	Coalitional game, mass customization, module-based service model, service family and platform design	Case study	Business models, innovation Strategy, performance
When is servitization a profitable competitive strategy?	2016	Lee, S. Yoo, S., Kim, D.	Servitization, Channel competition, Game theory	Conceptual	performance
Bi-Level Coordinated Configuration Optimization for Product-Service System Modular Design	2017	Li, H., Ji, Y., Chen, L., Jiao, R.J.	Bi-level programming, configuration design optimization, genetic programming, modular design, product-service systems (PSSs)	Case study, conceptual	Business models
Categorization and mechanism of platform-type product-service systems in manufacturing	2012	Nishino, N., Wang, S., Tsuji, N., Kageyama, K., Ueda, K.	Service, Decision making, Business model	Conceptual, Theoretical analysis	Business models

Costing-based coordination between mt-IPSS customer and providers for job shop production using game theory	2017	Mu, H., Jiang, P., Leng, J.	Product service systems; operational research; job shop scheduling; Stackelberg game; coordination decision	Case study	CRM
The gamification and the enrichment of innovation practices in the firm: An analysis of experiences	2013	Gómez, C.G., Heredero, C.P.	Gamification, Business strategy, Innovation 2.0, Gameplay, Value co-creation, Games theory, Servitization	Conceptual	Value co-creation, performance
Optimal design of uptime-guarantee contracts under IGFR valuations and convex costs	2017	Hezarkhani, B.	Revenue management, Pricing, Game theory, Maintenance, Contracts, Servitization	Conceptual	Performance, sustainability
Optimizing a warranty-based sustainable product service system using game theory	2018	Arabi, M., Mansour, S.	End of life management; game theory; stackelberg; sustainability; warranty	Case study	Performance, sustainability
Game analysis about incentive of information sharing in product servitization supply chain	2014	He, Z., Chen, J., Yao, S.	Servitization, Supply Chain, Game theory	Case study	Strategy, SCM
A service-oriented multi-player maintenance grouping strategy for complex multi-component system based on game theory	2019	Chang, F., Zhou, G., Cheng, W., Zhang, C., Tian, C.	Smart product service system, Maintenance grouping strategy, Performance-based maintenance, Proactive services, Stackelberg-Nash game	Case study	Strategy, performance, sustainability
Mitigation strategies for overuse of Chinese bikesharing systems based on game theory analyses of three generations worldwide	2019	Wang, Z., Zheng, L., Zhao, T., Tian, J.	Chinese bikesharing programs, Overuse, Game theory, Management modes	Conceptual	Strategy, maintenance
Manufacturing service order allocation in the context of social manufacturing based on Stackelberg game	2019	Guo, W., Jiang, P.	Strategy, Service failure, Service recovery, Game theory, Signalling game	Case study	Strategy, consumer behavior
Modeling dynamic service recovery strategies: a signaling game approach	2018	Hsieh, Y.-H., Yeh, S.-Y.	Game theory, product-service integration, shapley value, servitization	Conceptual	Strategy, organizational aspects
Game analysis of product-service integration	2014	Zhong, H.	Service engineering, multi-agent simulation, lifestyle, equilibrium analysis, service ecosystem	Survey	Performance, hr, consumer behavior
Analysis of membership-type service in manufacturing using integrating approach with economic experiments and multi-agent simulation	2014	Nishino, N., Okida, K.			
A Bayesian network approach for cybersecurity risk assessment implementing and extending the FAIR model	2020				
A systematical analysis on the dynamic pricing strategies and optimization methods for energy trading in smart grids	2020				
Execution quality and chargeback penalties in retail supply chains	2020				
A scheme design of cloud + end technology in demand side management	2015				
Research on the strategy of manufacturing enterprise carrying out service in full life cycle based on game theory	2012	Jia, Y.-F., Miao, R. Cao, J.-T. Wang, L.-Y. Jiang, Z.-B.	Product service systems; Game theory, Product life cycle	Others (simulation)	Consumer behavior
Industrial organization (5)					
Digital servitization business models in ecosystems: A theory of the firm	2019	Kohtamäki, M., Parida, V., Ozhazi, P., Gebauer, H., Baines, T.	Digitalization, Industry 4.0, Ecosystems, Digital servitization, Product-service systems (PSS), Firm boundaries, Business model innovation, Platforms and sustainability	Conceptual	Business models, strategy, industry 4.0
Treatment of olive oil waste waters	1986				
A knowledge graph-Aided concept-Knowledge approach for evolutionary smart product-Service systemdevelopment	2020	Li, X., Chen, C., Zheng, P., Wang, Z., Jiang, Z., Jiang, Z.	Concept generation, Conceptual design, Concept-knowledge model, Creativity, Knowledge evolution, Knowledge graph, Smart product-service system	Case study	Performance, flexibility
CO2 reduction through digital transformation in longhaul transportation: Institutional entrepreneurship to unlock product-service system innovation	2020	Haftor, D.M., Climent, R.C	Digital technology value, Digital transformation, Ecological sustainability, Industrial entrepreneurship, Institutional entrepreneurship, Servitization	Case study	Circular economy, ecological evolution

Identification the intangibles arising from investments in prevention of occupational risks and their perception in smes. Implications in the service sector and the servitization	2014	Cortés, M., Gragera, E., Rodríguez, A.	Intangibles, prevención, valoración, rentabilidad, servitización	Survey	Capabilities, performance
Resource-based (31)					
Hybrid offerings: How manufacturing firms combine goods and services successfully	2011	Ulaga, W., Reinartz, W.J.	Hybrid offerings, service transition strategies, resource-based view, business-to-business services, service classification, positional advantage	Case study, survey	Capabilities, strategy
Effect of service transition strategies on firm value	2008	Fang, E., Palmatier, R.W., Steenkamp, J.-B.E.M.	Service ratio, solution selling, service transition strategies, Tobin's q, resource-based view, firm value	Survey	Performance, strategy Capabilities, strategy, performance
Services growth options for B2B product-centric businesses	2010	Raddats, C., Easingwood, C.	Product-centric, services, product-attached, operations, servitization	Survey	Digitalization, capabilities
Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers	2017	Coreynen, W., Matthyssens, P., Van Bockhaven, W.	Servitization, Digitization, Value innovation, Manufacturing companies, SME	Case study	Digitalization, capabilities
Collaborative consumption: Towards a resource-saving consumption culture	2013	Leismann, K., Schmitt, M., Rohn, H., Baedeker, C.	Collaborative consumption; resource efficiency; resource saving potential; rebound effects; product sharing; service; product service systems; ownership-substituting; services; sustainable consumption patterns	Case study	Sustainability, flexibility
Transitioning from product to service-led growth in manufacturing firms: Emergent challenges in selecting and managing the industrial sales force	2014	Ulaga, W., Loveland, J.M.	Service transition strategies, Resource-based view, Business-to-business services, Goods-centric sales force, Services sales force	Survey	Business models
Seeking competitive advantage with service infusion: A systematic literature review	2015	Eloranta, V., Turunen, T.	Servitization, Dynamic capabilities, Competitive advantage, Resource-based view, Relational view, Service infusion	Conceptual, Theoretical analysis	Theories Capabilities, organizational aspects, performance
Balancing specialized and generic capabilities in the provision of integrated solutions	2011	Ceci, F. Masini, A.	Firm size, industrial performance, industrial structure, information technology, model test	Survey	Innovation
Service innovation and new product performance: The influence of market-linking capabilities and market turbulence	2016	Chen, K.-H., Wang, C.-H., Huang, S.-Z., Shen, G.C.	Market-linking capability, Market turbulence, New product performance, Servitization service innovation	Survey	Capabilities, manufacturer, resource configuration, service infusion, servitization
Resource configurations for services success in manufacturing companies	2015	Raddats, C., Burton, J., Ashman, R.	Operations management, theory, literature review	Survey	Conceptual, literature review
Theoretical perspectives in operations management: An analysis of the literature	2015	Walker, H., Chicksand, D., Radnor, Z., Watson, G.	Capability, Aerospace industry, Process view, Product-service systems, Routines	Case study	Capabilities, innovation
Configuring capabilities for integrated solutions: Evidence from the IT sector	2008	Ceci, F. Prencipe, A.	Product-Service Systems, Digitization, Customer, Maritime industry	Action research	Capabilities
Understanding product-service system innovation capabilities development for manufacturing companies	2015	Wallin, J. Parida, V., Isaksson, O.	Solution business, solutions, strategic capability, resource-based view, servitization	Survey	Performance, capabilities
Are my symptoms serious Dr Google? A resourcebased typology of value co-destruction in online self-diagnosis	2014		Service transition; servitization; service innovation; barriers; energy utilities	Case study, Survey	Business models, capabilities
Assessing transformational change from institutionalising digital capabilities on implementation and development of ProductService Systems: Learnings from the maritime industry	2017	Pagoropoulos, A., Maier, A., McAlloone, T.C.	Internet of Things, Industrial Internet, servitization, resource-based view, Business Intelligence, digitalization	Case study, Survey	4.0, Capabilities

Innovative product development in hotel operations	2006	Frehse, J.	Product development, innovation, hotel industry, hotel operations, resource-based view	Conceptual	Business models, capabilities
Digital servitization business models in ecosystems: A theory of the firm	2019	Kohtamäki, M., Parida, V., Ozhazi, P., Gebauer, H., Baines, T.	Digitalization, Industry 4.0, Ecosystems, Digital servitization, Product-service systems (PSS), Firm boundaries, Business model innovation, Platforms and sustainability service transition, automotive industry, mechanical engineering, diversification, customer integration, technological change	Conceptual, Theoretical analysis	Business models, theories, digitalization
Service transition in the automotive industry	2013	Kessler, T., Stephan, M.	Service science, service quality, productivity, digital connections, enterprise engineering, cyber-infrastructure, production function, scaling, extended enterprises, service cycle times, transaction costs	Case study	Business models
Exploring the dynamic capabilities required for servitization: The case process industry	2017	Kanninen, T., Penttinen, E., Tinnilä, M., Kaario, K.	Servitization, Resource-based view, Capabilities, Process industry	Case study, conceptual	Business models
Contemporary perspectives on the strategic role of information in internet of things-driven industrial services	2018	Turunen, T., Eloranta, V., Hakanen, E.	Servitization, Strategy, Resource-based view, Industrial services, IoT, Service infusion	Case study, survey	Organizational aspects, Flexibility
Allocation of composite mode on-orbit service resource based on improved DQN	2020				
Servitization and business performance: the moderating effects of environmental uncertainty	2019	Zhang, Y. Wang, L., Gao, J., Li, X.	Business performance, servitization, environmental uncertainty, adjustment cost, coordination cost	Survey	Performance
Combat resource two-stage virtualization method in cloud cooperation	2018	Sun, H. Zhang, A., Gao, F.	Case study, China, resource-based theory, resource management, servitisation	Case study	Capabilities
The transformation mechanism of servitisation in China: A resource-based perspective	2017	Li, J. Lin, L. Ma, L.	Social manufacturing, Resource configuration, Dynamic community, Multi-level Optimization	Case study	Organizational aspects
An optimal configuration method of multi-level manufacturing resources based on community evolution for social manufacturing	2020	Zhang, Y., Zhang, D. Wang, Z., Qian, C.	Case study, Human resource, Profit model, Resource-based view, Servitisation, Technology resource	Case study	Capabilities, Flexibility
Exploring the prot model of servitising manufacturers: A resource-based perspective	2020	Li, J., Lin, L., Zhang, T.	Servitization, Organizational change, Organizational design factors, Culture, Firm performance	Survey	Organizational aspects, performance
The impact of service-oriented organizational design factors on firm performance: The moderating role of service-oriented corporate culture	2020	Yan, K. Li, G., Cheng, T.C.E	Business intelligence, outsourcing vendor, selection criteria, modified Delphi method, analytic hierarchy process	Delphy	Performance
Construct Outsourcing Vendor Selection Criteria for Business Intelligence	2019	Chang, C.-Y., Yang, J.-W. Wu, M.-C.	Product-service systems; Leasing; Remanufacturing; Prams; Durable products; Eco-design	Conceptual	Business models
Transaction cost (11)					
A new business model for baby prams based on leasing and product remanufacturing	2006	Mont, O., Dalhammar, C., Jacobsson, N.	Vertical integration, Supply chain integration, Downstream integration, Building materials, Retailing, Merchanting, Vertical marketing, Sweden	Case study	Organizational aspects, SCM
Vertical integration in supply chains: Driving forces and consequences for a manufacturer's downstream integration	2012	Guan, W. Rehme, J.	Service science, service quality, productivity, digital connections, enterprise engineering, cyber-infrastructure, production function, scaling, extended enterprises, service cycle times, transaction costs	Conceptual	Digitalization, Value co-creation
Improving service quality and productivity: Exploring the digital connections scaling model	2009	Cheng, Hsu., Spohrer, J.C.	Digitalization, Industry 4.0, Ecosystems, Digital servitization, Product-service systems (PSS), Firm boundaries, Business model innovation, Platforms and sustainability	Conceptual, Theoretical analysis	Business models, theories, digitalization
Digital servitization business models in ecosystems: A theory of the firm	2019	Kohtamäki, M., Parida, V., Ozhazi, P., Gebauer, H., Baines, T.			

Territorial servitization and new local productive configurations: the case of the textile industrial district of Prato	2019	Bellandi, M., Santini, E.	Industrial district, new manufacturing, knowledge-intensive business services (KIBS), territorial servitization, local productive configuration	Mix	Business models
Transition to circular economy on firm level: Barrier identification and prioritization along the value chain	2020	Werning, J.P., Spinler, S.	Circular economy, Barriers, Organizational change, CE-Matrix, Sets of barriers, Firm-level	Case study	Organizational aspects
Servitization and business performance: the moderating effects of environmental uncertainty	2019	Zhang, Y., Wang, L., Gao, J., Li, X.	Business performance, servitization, environmental uncertainty, adjustment cost, coordination cost	Survey	Performance
Exploring the transaction dimensions of supply chain management	2007	Lietke, B. Boslau, M.	supply chain management, SCM networks, hybrid governance, survey, transaction costs, transaction dimensions, asset specificity, uncertainty	Survey	SCM
The impact of the Internet of Things (IoT) on servitization: an exploration of changing supply relationships Construct Outsourcing Vendor Selection Criteria for Business Intelligence	2020 2019	Boehmer, J.H. Shukla, M. Kapletia, D., Tiwari, M.K. Chang, C.-Y., Yang, J.-W., Wu, M.-C.	Servitization, IoT, buyer-supplier relationships, manufacturing, services	Case study	SCM
Supply chain management in the oil industry: The Angolan case	2001	Wiig, A.	Oil industry, Supply chain, Rrm, Property rights, Economic theory, Angola	Conceptual	SCM

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