

Challenges of servitization: A systematic literature review



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ABSTRACT

The challenges of servitization have gained significant attention from both academics and practitioners, as more firms in the industrial sector are seeking marketing opportunities leading to business growth through the adoption of a service strategy. Although existing research has explored its challenges from multiple perspectives, this is largely fragmented and the studies offer little understanding of the impacts of the challenges on the realisation of servitization benefits and improvements in business performance. This study, therefore, aims to create a formal construct of the challenges and develop a set of hypotheses through a systematic review of the servitization literature to build a theoretical model explaining the underlying relationships. Five challenges are identified: organisational structure, business model, development process, customer management, and risk management. The indicators of each challenge are discussed to support the establishment of hypotheses. This study contributes to the current body of knowledge by reaching a clear conclusion from the fragmented literature and brings together five challenges to explore their impacts on the overall business.

1. Introduction

As the world economy and technologies are progressing, market demand has shifted from manufactured goods to integrated solutions (Davies, 2004; Windahl, Andersson, Berggren, & Nehler, 2004). The ‘Servitization of Manufacturing’ has become a growing trend in the industrial sector, which is defined as the ‘innovation of manufacturers’ capabilities and processes to transform from selling products to selling integrated solutions that deliver value in use for customers’ (Baines, Lightfoot, Benedettini, & Kay, 2009a, p. 555). According to Lightfoot, Baines, and Smart (2013), the studies on servitization have grown from 22 in the period 1991 to 2000 to more than 100 in the period 2001 to 2010, and a wide range of communities have contributed: service marketing, service management, and operations research.

There is a wide consensus in both academia and business, that servitization of manufacturing brings financial, strategic, and marketing benefits (e.g. Kinnunen & Turunen, 2012; Mathieu, 2001) to companies and addresses the challenges of business growth (e.g. Baines, Lightfoot, & Kay, 2009b; Baines et al., 2009a; Brax, 2005; Martinez, Bastl, Kingston, & Evans, 2010). Since the late 1990s, scholars have investigated the challenges of servitization from different angles; however, the findings do not clearly indicate the effects of the challenges on the achievement of its benefits and the improvement in business performance. More importantly, the joint impacts of all the challenges are still under exploration as the existing efforts have been directed at the investigation of individual inhibitors (Nudurupati,

Lascelles, Wright, & Yip, 2016). This is due to the fact that the relevant research on servitization challenges is fragmented and discursive (Baines et al., 2017). It is therefore concluded that servitization research lacks information on how exactly the challenges impact the realisation of expected benefits as well as how to sustain a superior business performance. Kowalkowski, Gebauer, and Oliva (2017) claim that the current research is marginally useful in moving the field forward as most studies examine similar issues rather than discover new knowledge. This deficiency causes the servitization research to be mired in a ‘nascent’ stage, and a clear research focus is needed for the further development of both its theory and practice. Accordingly, an improved systematic literature review (SLR) is adopted for multi-disciplinary studies to perform a solid analysis of the theories and empirical evidence and reach a clear conclusion on ‘what is and is not known’ (Denyer & Tranfield, 2009).

The aim of this study is to identify the challenges of servitization and establish a set of hypotheses to address the connection among servitization challenges, benefits, and business performance. Through the SLR, this study answers two key questions:

1. What are the challenges of servitization?
2. How can they be defined and how do they influence the achievement of servitization benefits (strategic, financial and marketing) leading to the improvement of business performance?

Answers to these questions will enhance the understanding of

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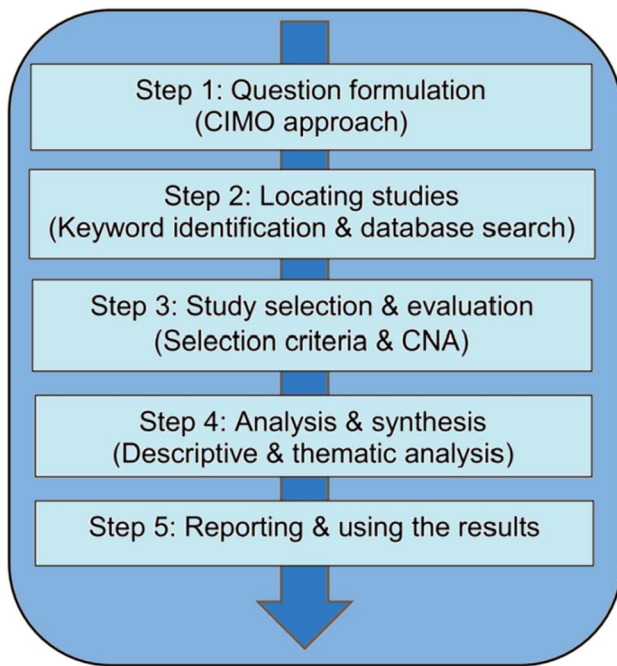


Fig. 1. Improved five-step systematic literature review process (Adapted from Denyer & Tranfield, 2009).

servitization challenges through a more comprehensive picture of underexplored connections to the benefits and the impact on business performance. This paper starts with a detailed description of the SLR method used here. This is followed by a descriptive analysis of the selected studies and a thematic discussion of the emergent themes from the literature, which identifies the constructs of servitization challenges. Through the method of reductionism, this study develops a set of hypotheses connecting the challenges to the realisation of benefits as well as to business performance. To conclude, this paper presents a discussion of the implications and limitations of the study and provides a few avenues to future research.

2. Research methodology

The SLR adopted in this study follows a rigorous process that helps search for all studies that are potentially significant (Cronin, Ryan, & Coughlan, 2008). Fig. 1 demonstrates the improved five-step approach according to Denyer and Tranfield (2009), integrating a citation network analysis (CNA) (Van Eck & Waltman, 2010) to explore the knowledge flow in the servitization research.

2.1. Question formulation

A well-designed research question is important for guiding the

Table 1 Search strings and results.

Search engine	Search strings	Selection criteria	Result
ProQuest (654 initial search)	(servitization* OR servitisation* OR servicing* OR servicing*) AND (challenge* OR difficulty* OR barrier* OR obstacle*)	Search in all fields, full-text available, peer-reviewed, English, 1994–2016 (the earliest available year is 1994), search from all database	230
Scopus (119 initial search)	(servitization* OR servitisation* OR servicing* OR servicing*) AND (challenge* OR difficulty* OR barrier* OR obstacle*)	Article title, abstract & keywords, journal article, English, 1988–2016	46
Science direct (414 initial search)	(servitization* OR servitisation* OR servicing* OR servicing*) AND (challenge* OR difficulty* OR barrier* OR obstacle*)	Search in all fields, article only, 1988–2016, search from all journals	355
Total: (1187 initial search)			631

study. The ‘CIMO’ (context, intervention, mechanism, and outcomes) logic proposed by Denyer, Tranfield, and Van Aken (2008) is used here to help with the question formulation.

Following the CIMO logic, by answering the guiding questions, the challenges of service growth in product-centric companies can be studied. In this context (C), the interventions (I) are the impacts of the challenges in the achievement of servitization benefits as well as the improvement in business performance. This means that the mechanism (M) of interest is the exploration of the main constructs and indicators of the challenges, and the expected outcomes (O) are a set of hypotheses indicating the correlations among servitization challenges, benefits, and business performance. To this end, the research questions were finalised as follows.

1. The overarching research question:

What are the challenges to achieve servitization benefits and improve business performance?

2. Two complementary questions designed to support the above:

- How can the challenges be defined?
- How do they affect the realisation of servitization benefits (strategic, financial, and marketing) leading to the improvement in business performance?

2.2. Locating studies

To locate relevant articles, the search engine and search strings need to be identified in advance (Wong, Skipworth, Godsell, & Achimugu, 2012). Three research engines were used: ProQuest, Scopus, and Science Direct. These databases are widely acknowledged as world-leading sources for servitization research, and they are favourites with leading scholars in the same area (e.g. Baines et al., 2009a; Nudurupati et al., 2016). Thus, it is believed that these databases provide the best coverage in this research field.

The identifying keywords were directly related to the quality of study selection in which a list of more than 20 key terms was created through a brainstorming approach. In order to ensure the validity of the search strings, several pre-tests were run to check the search results. Subsequently, the strings were reduced to eight as shown in Table 1 and resulted in the identification of 1187 scholarly papers for further evaluation.

A citation network (see Fig. 2) was created to quickly identify the papers that contribute the most to theory development in the research area, and extend our search coverage through the ‘snowballing’ approach (exploring references in influential studies) to locate relevant papers not appearing in the selected database.

The network was generated using the software VOSviewer (version 1.6.5) based on the interrelated citations of selected papers from Scopus (Van Eck & Waltman, 2010). The circles represent the publications; the

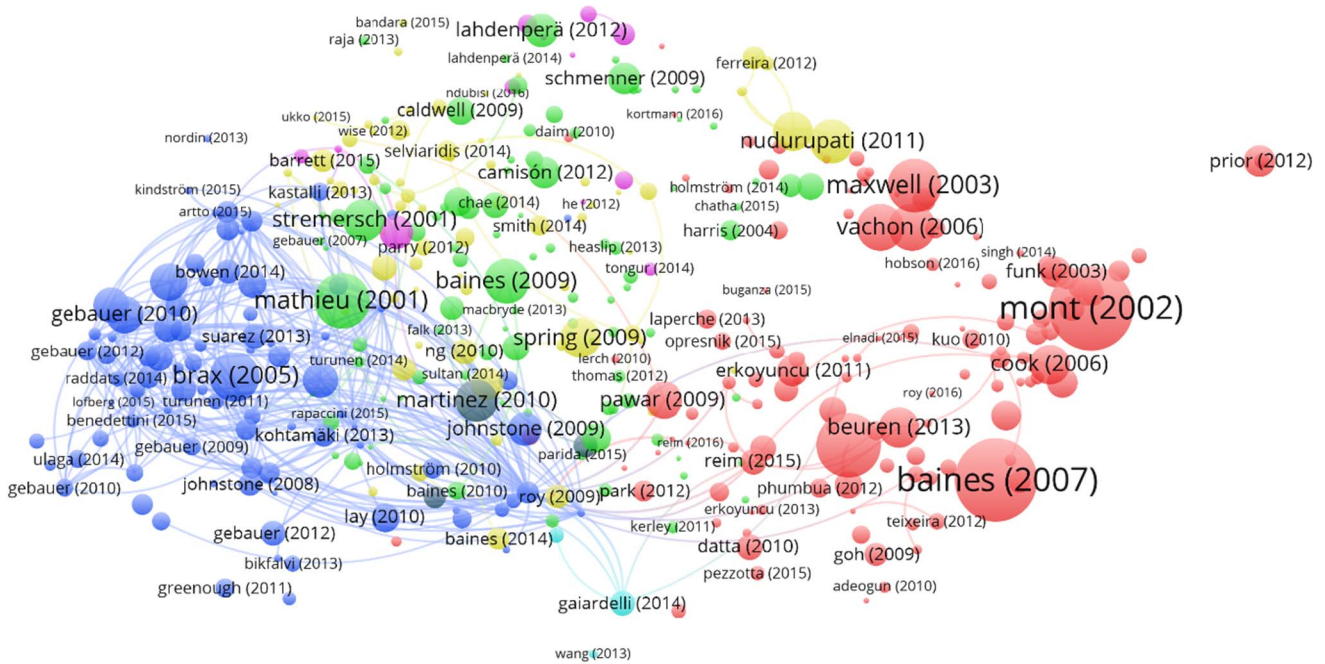


Fig. 2. Citation network (Original in colour).

more important the publication, the larger the circle. This helps to identify the thought leaders in our research area. The line and distance between the circles indicate the strength of the citation links between two studies. The closer the two circles, the stronger the link between two studies. Different colours represent the cluster of studies according to the bibliographic coupling links (multiple items citing the same study), providing a direct view of the connections among the studies.

2.3. Study selection and evaluation

Due to the wide coverage of the results, several criteria were added to identify the highest standard papers. Following Newbert (2007), the following criteria were used in the initial review and the number of potential papers was reduced to 631 (see Table 1):

- Theme — the papers had to be related to the servitization of manufacturing or service provision of product centric companies in a business-to-business (B2B) environment;
- Time range — the papers had to be published in the period 1988–2016;
- Language — the papers had to be written in English;
- Journal type — the papers had to appear in peer-reviewed journals and be available in full-text.

Two sets of robust quality criteria suggested by Wong et al. (2012) were applied in the full-text review: subject matter selection and quality criteria. The subject matter selection criteria in Table 2 helped to categorise the papers according to paper type and research theme. The quality criteria were used to assess the papers based on contribution, theory, methodology, and data analysis (Wong et al., 2012).

Accordingly, the application of the criteria resulted in reducing the

Table 2
Subject matter selection criteria (according to Wong et al., 2012).

Paper type	Must contain
Conceptual/theoretical	Challenges and arguments
Empirical	Challenges and empirical evidence
Methodological	Causal relationship among challenges

number of papers to 48 for final analysis and synthesis.

2.4. Analysis and synthesis

All papers were analysed descriptively and thematically following the predefined standard. The descriptive analysis adopted a deductive approach in which the classification of papers was according to year, methodology, research theme, and country. On the other hand, the thematic analysis was more inductive in nature, and the aim was to identify the constructs of servitization challenges and their relevant indicators. This led to the establishment of hypotheses and theoretical model as the main output of this SLR.

2.5. Reporting and using the results

This paper is a formal presentation of the study results at its earliest accessibility for both an academic and practitioner audience. The remainder of this paper presents the findings of the descriptive and thematic analysis and constructs a theoretical model demonstrating the main conclusions of the study.

3. Descriptive analysis

The selected papers are descriptively analysed in this section with respect to publication year, research method, journal type, and originating country to investigate the trends in servitization research (see Fig. 3).

The interests on servitization challenges began in 1988 when the concept was posited. In the first 10 years, there was no paper on servitization challenges as its conceptualisation developed. The challenges were then presented gradually from 1999 to 2007, with at least one paper every few years. After that, a rising trend began in 2008 and reached its first peak in 2010 with seven papers. However, it sharply declined in the next two years to only two papers per annum. This appears to be because researchers reached a bottleneck period due to the dramatic increase in studies in the previous years; there was a rebound in 2013 and a repetitive trend has continued through 2016. The papers published between 2008 and 2010 represented an early stage in investigating the challenges faced by manufacturers in seeking service

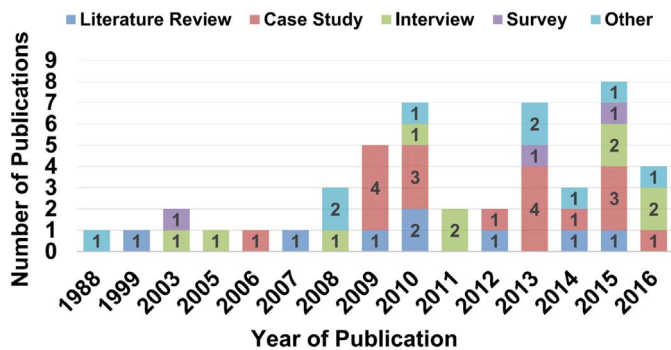


Fig. 3. Analysis of papers based on publication year and research methods ($n = 48$) (Original in colour).

growth. For instance, two most cited works, Baines et al. (2009a) and Martinez et al. (2010), explore the challenges from a broad view through an application of mixed qualitative methods. From 2013 onwards, individual challenges have captured greater attention from both research and management as previous studies had called for future research that looked into various perspectives of servitization challenges.

The main research methods used in the studies were literature reviews (25%) and case studies (38%), accounting for more than half of all the papers. This is because the scholars focus heavily on the conceptualisation development and it potentially reflects that they struggled to promote theory development in the literature. Since then, the application of qualitative studies has been common to boost theory building. However, the dominance of qualitative research has resulted in a lack of theoretical development and validation, which requires more well-designed quantitative studies to move forward the research agendas (Oliva, 2016).

Table 3 shows the categorisation of journal type according to the Association of Business Schools (ABS) ranking. The 48 papers were published in 28 different journals, showing the diversity of research on servitization challenges. Almost half of the publications are in the Operations and Technology Management category, with a clear focus on operations management and technical innovation. However, the publication *Industrial Marketing Management*, under the Marketing category, published the most papers. This is likely because the journal focuses on practical studies in industry markets, which perfectly matches the context of servitization research, particularly in how firms in the industrial sector are competing through servitized offerings to fulfil market needs and increase customer satisfaction (Brax, 2005; Johnstone et al., 2009; Oliva & Kallenberg, 2003; Raddats & Easingwood, 2010).

In terms of the geographical distribution, 48 papers originated from five regions. Indeed, 89% of the papers were from European countries, particularly the UK, suggesting a strong interest in servitization challenges in that region. This appears to be due to the fact that manufacturing companies in developed regions are actively seeking business growth through service offerings, providing local scholars easier access to primary sources in the industry. The total contribution of other regions was less than 15%, including the US, China, and Brazil.

4. Thematic analysis

The SLR has identified five constructs of servitization challenges, and they are discussed in this section with supporting evidence (see Table 4 for a detailed summary).

4.1. Organisational structure (OS)

Organisational structure (OS) refers to the formal allocation of work roles and the adoption of a management mechanism to control internal

activities and support the implementation of business strategy within an organisation (Burgelman & Doz, 2001; Child, 1972).

In servitization research, the focus of organisational literature is on the change of internal structures to support business transformation. Changing culture (OS1), particularly, shifting a cultural mindset from a product-centric to a customer or service-centric organisation, is a key challenge (Fang et al., 2008; Finne et al., 2013; Kowalkowski et al., 2015; Martinez et al., 2010; Oliva & Kallenberg, 2003; Salonen, 2011). This is because the value creation process is changed during servitization, as value is now delivered through a bundle of manufactured goods, service offerings, and service personnel. Thus, an effective communication (OS2) with internal and external customers is necessary to increase awareness of the developing service offerings (Alghisi & Saccani, 2015; Kinnunen & Turunen, 2012). This leads to the development and adoption of ‘new’ language in organisations, which is regarded as a potential obstacle to the effective communication. Baines et al. (2009b) explain that employees in manufacturing companies fully understand the concept of products, but they may lack understanding of service offerings, particularly, when they refer to ‘integrated offerings’ rather than basic services like insurance, overhaul, and repair. Moreover, acquiring and retaining professional service specialists (OS3) is key to service growth in manufacturing companies (Homburg et al., 2003). In general, the performance of service offerings is purely based on the service personnel, with their specialities and professions directly affecting the customer satisfaction of service delivery (Brax, 2005). Intra-organisational synergy (OS4) needs to be fostered to support the development and delivery of integrated offerings (Gebauer, 2008; Isaksson et al., 2009; Johnstone et al., 2009; Neu & Brown, 2008). However, it is difficult to reconfigure the organisational structure, as, in the past, product and service teams may have been managed separately, and these teams then lack knowledge about each other (Brax, 2005).

4.2. Business model (BM)

The business model (BM) is essential in every organisation, as it embodies the core business logic of how a company creates, develops, and delivers value propositions to customers (Shafer, Smith, & Linder, 2005).

In the past few years, modifying the business model (BM1) in servitized organisations has attracted a lot of attention, as many changes are required to integrate service strategy with the production system (Kastalli & Van Looy, 2013; Kindström & Kowalkowski, 2014; Parida et al., 2014; Storbacka, 2011; Tukker, 2015; Wise & Baumgartner, 1999). In such an organisation, the value proposition (BM2) changes from being a unidirectional value delivery to value co-creation. This is not an easy task when internal employees are not thinking from a customer perspective, and may lead to the poor design of value propositions that are not aligned with customer interests (Barnett et al., 2013; Brax, 2005; Pawar et al., 2009; Valtakoski, 2016; Vandermerwe & Rada, 1988). In addition, resource utilization (BM3) faces potential changes during servitization, such as leveraging the workforce and materials across departments (Barquet et al., 2013; Lin et al., 2014) and acquiring new resources to reconfigure the internal structure (Zarpono Neto et al., 2015). Costing (BM4) and pricing (BM5) mechanisms are mainly related to the value created, the prices of servitized offerings are often much higher than the sum of production costs and raise the possibility of disagreements on the customer side (Barquet et al., 2013; Mo, 2012; Nudurupati et al., 2016). In addition, an integrated costing and pricing system needs to be redeveloped for the servitized offerings (Malleret, 2006). Several issues were detected in relation to the supplier collaboration (BM6). First, the shift of mindset is also necessary in the supply chain partners, as supplying physical goods and servitized offerings are different (Martinez et al., 2010; Oliva & Kallenberg, 2003). Second, risk-sharing needs to be agreed on between companies and supply chain partners as the intangibility of services involves many uncertainties (Parida et al., 2014;

Table 3
Analysis of papers according to ABS journal type ($n = 48$).

Journal type	Number of publication	References
Operations and technology management	23	
International journal of operations and production management	5	Benedettini, Neely, and Swink (2015), Durugbo and Erkoyuncu (2016), Johnstone, Dainty, and Wilkinson (2009), Pawar, Beltagui, and Riedel (2009), Reim, Parida, and Örtqvist (2015)
Journal of service theory and practice	2	Brax (2005), Nudurupati et al. (2016)
Proceedings of Institute of mechanical engineers part b: journal of engineering manufacture	2	Baines et al. (2009b), (2007)
Business process management journal	1	Trkman, Mertens, Viaene, and Gemmel (2015)
Journal of manufacturing technology management (formerly “integrated manufacturing systems”)	2	Baines et al. (2009a), Martinez et al. (2010)
Journal of operations management	1	Kastalli and Van Looy (2013)
Production planning and control	1	Alghisi and Saccani (2015)
Supply chain management: an international journal	1	Finne and Holmström, (2013)
Operations management research: advancing practice through theory	1	Neely (2008)
Advances in decision sciences	1	Mo (2012)
CIRP journal of manufacturing science and technology	1	Datta and Roy (2010)
International journal of electronic business management	1	Lin, Chen, Chiou, and Chuang (2014)
Journal of cleaner production	1	Tukker (2015)
Journal of engineering design	1	Isaksson, Larsson, and Rönnbäck (2009)
Research-technology management	1	Parida, Sjödin, Wincent, and Kohtamäki (2014)
The journal of high technology management research	1	Li, Lin, Chen, and Ma (2015)
Marketing	12	
Industrial marketing management	8	Barquet, de Oliveira, Amigo, Cunha, and Rozenfeld (2013), Benedettini, Swink, and Neely (2017), Kowalkowski, Windahl, Kindström, and Gebauer (2015), Matthyssens and Vandenbempt (2008), Raddats and Easingwood (2010), Salonen (2011), Storbacka (2011), Valtakoski (2016)
Journal of business and industrial marketing	2	Kindström and Kowalkowski (2014), Zarpelon Neto, Pereira, and Borchardt (2015)
Journal of business-to-business marketing	1	Homburg, Fassnacht, and Guenther (2003)
Journal of marketing	1	Fang, Palmatier, and Steenkamp (2008)
Sector studies	7	
Journal of service management (formerly IJSIM)	5	Hypko, Tilebein, and Gleich (2010), Matthyssens and Vandenbempt (2010), Ng and Nudurupati (2010), Nordin, Kindström, Kowalkowski, and Rehme (2011), Oliva and Kallenberg (2003)
Service business	1	Finne, Brax, and Holmström (2013)
The international journal of advanced manufacturing technology	1	Meier, Roy, and Seliger (2010)
General management	3	
European management journal	2	Malleret (2006), Vandermerwe and Rada (1988)
Harvard business review	1	Wise and Baumgartner (1999)
International business	2	
Journal of East European management studies	1	Demeter and Szász (2013)
Journal of applied management and entrepreneurship	1	Kinnunen and Turunen (2012)
Strategy	1	
Strategic change	1	Barnett, Parry, Saad, Newnes, and Goh (2013)

The bold number represents the total number of papers in each categorized journal.

Raddats & Easingwood, 2010).

4.3. Development process (DP)

The development process refers to the overall approach that turns an intangible idea into a deliverable (Cooper & Edgett, 2003).

Given that a servitized offering is an integration of services and products, an integrated development process (DP1) for both products and services is necessary for servitized companies. A generic product development involves several stages: idea generation, screening, prototyping, testing, manufacturing, and commercialization (Cooper & Edgett, 2003), which is not suitable for service development because services cannot be stored and practiced before consumption (Meier et al., 2010; Parida et al., 2014). Many scholars, such as Alghisi and Saccani (2015), Baines et al. (2009b), and Kowalkowski et al. (2015), emphasise that reconstructing an innovative development process for a servitized offering is a top priority as the existing processes are not adequate. Additionally, a set of tools, methods, and techniques (DP2) are required to support the development process, but they are still underdeveloped at the initial stage of servitization (Baines et al., 2007; Tukker, 2015; Nudurupati et al., 2016). Since integrated

solutions are priced based on value creation, having performance measurements (DP3) in place is necessary to ensure that the performance of the deliverables meets certain standards throughout the whole process (Mo, 2012). This requires a new set of indicators for the service offerings as the performance measurements in the product-focused company had been designed exclusively for manufactured goods (Baines et al., 2009b; Martinez et al., 2010). Customer engagement (DP4) in the development process is vital to ensure the outputs match their requirements and achieve high standards in practice (Cooper & Edgett, 2003). Given that the notion of a servitized offering was initially new to customers, the suggestion was that the companies, particularly the operations team, work together with clients during the development phase (Brax, 2005). This is because the intangibility of services only allows them to be tested during consumption, which increases the difficulty of receiving instant feedback during the development process (Demeter & Szász, 2013).

4.4. Customer management (CM)

Customer management refers to building and maintaining a close relationship with customers through effective interactions and

Table 4
Constructs and indicators of challenges.

Constructs	Labels	Indicators	References
Organisational structure (OS)	OS1	Culture change	Alghisi and Saccani (2015), Fang et al. (2008), Finne et al. (2013), Oliva and Kallenberg (2003), Kowalkowski et al. (2015), Martinez et al. (2010), Ng and Nudurupati (2010), Nudurupati et al. (2016), Salonen (2011)
	OS2	Communication	Alghisi and Saccani (2015), Baines et al. (2009b), Kinnunen and Turunen (2012)
	OS3	Service expertise	Alghisi and Saccani (2015), Homburg et al. (2003), Lin et al. (2014), Oliva and Kallenberg (2003)
	OS4	Inter-department collaboration	Brax (2005), Isaksson et al. (2009), Johnstone et al. (2009)
Business model (BM)	BM1	Business model modification	Barquet et al. (2013), Kastalli and Van Looy (2013), Kindström and Kowalkowski (2014), Parida et al. (2014), Storbacka (2011), Wise and Baumgartner (1999)
	BM2	Value proposition	Barnett et al. (2013), Brax (2005), Pawar et al. (2009), Valtakoski (2016)
	BM3	Resource utilization	Barquet et al. (2013), Lin et al. (2014), Neely (2008), Zarpelon Neto et al. (2015)
	BM4	Costing mechanism	Barquet et al. (2013), Datta and Roy (2010), Malleret (2006), Ng and Nudurupati (2010), Nudurupati et al. (2016)
	BM5	Pricing mechanism	Barquet et al. (2013), Malleret (2006), Mo (2012)
	BM6	Supplier collaboration	Finne and Holmström (2013), Martinez et al. (2010), Ng and Nudurupati (2010), Parida et al. (2014), Nudurupati et al. (2016), Oliva and Kallenberg (2003)
Development process (DP)	DP1	Integrated development process	Alghisi and Saccani (2015), Baines et al. (2009b), Kowalkowski et al. (2015), Meier et al. (2010), Parida et al. (2014)
	DP2	Tools, methods, and techniques	Baines et al. (2007), Tukker (2015), Nudurupati et al. (2016)
	DP3	Performance measurement	Baines et al. (2009b), Martinez et al. (2010), Mo (2012)
	DP4	Customer engagement	Brax (2005), Demeter and Szász (2013)
Customer management (CM)	CM1	Matching customer needs	Demeter and Szász (2013), Johnstone et al. (2009), Kinnunen and Turunen (2012), Matthyssens and Vandenbempt (2008), Trkman et al. (2015), Valtakoski (2016)
	CM2	Ownership transfer	Baines et al. (2007), Ng and Nudurupati (2010)
	CM3	Long-term relationship building	Barnett et al. (2013), Homburg et al. (2003), Tukker (2015)
	CM4	Value co-creation	Brax (2005), Martinez et al. (2010), Demeter and Szász (2013), Finne and Holmström (2013), Trkman et al. (2015)
	CM5	Information sharing	Matthyssens and Vandenbempt (2008)
Risk management (RM)	RM1	Financial risks	Benedettini et al. (2015), (2017), Gebauer, Fleisch, and Friedli (2005), Matthyssens and Vandenbempt (2010), Neely (2008)
	RM2	Operational risks	Alghisi and Saccani (2015), Baines et al. (2009b), (2007), Barnett et al. (2013), Barquet et al. (2013), Benedettini et al. (2015), Brax (2005), Datta and Roy (2010), Demeter and Szász (2013), Durugbo and Erkoyuncu (2016), Fang et al. (2008), Finne et al. (2013), Homburg et al. (2003), Hypko et al. (2010), Kowalkowski et al. (2015), Li et al. (2015), Lin et al. (2014), Neely (2008), Martinez et al. (2010), Meier et al. (2010), Ng and Nudurupati (2010), Mo (2012), Nordin et al. (2011), Nudurupati et al. (2016), Oliva and Kallenberg (2003), Parida et al. (2014), Pawar et al. (2009), Reim et al. (2015), Tukker (2015), Wise and Baumgartner (1999)
	RM3	External risks	Benedettini et al. (2015), Zarpelon Neto et al. (2015)

communications. Given that the servitization research originated in the industrial sector, business customers in the B2B context are the main focus.

The SLR indicates several challenges related to the management of customer relationships. First, buying ‘solutions’ is a relatively new concept to business customers over the past decades; therefore, the suggestion was that manufacturing companies communicate the idea to customers first and then explore the requirements of the offerings to make sure it matched the customer needs (CM1) (Johnstone et al., 2009). Nevertheless, many scholars (Demeter & Szász, 2013; Kinnunen & Turunen, 2012; Matthyssens & Vandenbempt, 2008; Salonen, 2011; Trkman et al., 2015; Valtakoski, 2016) pinpoint that it is common that the value perceived by the customer is not always the same as that designed by the manufacturer due to a poor understanding of the customer's needs. Second, the customers may reject the non-transferrable ownership (CM2) when purchasing servitized offerings, as they may be concerned with losing control over the whole contract (Baines et al., 2007; Ng & Nudurupati, 2010).

From an operational level, the key success factor is the performance delivered by the integrated solution, which relies heavily on the effectiveness of the operations team. Many researchers (Barnett et al., 2013, Homburg et al., 2003, Tukker, 2015) stressed that the human-based performance involves unstable factors and they can be disadvantageous for a long-term relationship (CM3). In servitized businesses, the value is delivered through co-creation (CM4) with customers and suppliers instead of unidirectional value delivery (Ng & Nudurupati, 2010). This means supplier service personnel often

need to be integrated into a customer's operation system, and this may directly damage the credibility of the suppliers and the maintenance of the relationship if service employees appear to be unprofessional (Brax, 2005; Demeter & Szász, 2013; Finne and Holmström, 2013; Martinez et al., 2010; Trkman et al., 2015). Last, accessing customer operational data sometimes is essential for service operators to do the job properly; however, business customers are likely to reject information sharing (CM5) as information is regarded as commercially confidential (Matthyssens & Vandenbempt, 2008).

4.5. Risk management (RM)

Risks are defined as the probability of uncertainties such as loss, failure, and unexpected consequences (Harland, Brenchley, & Walker, 2003). The SLR shows that risk management has attracted increasing attention in servitization research as researchers have recognised that manufacturers who adopt service strategies are exposed to various types of risks (Benedettini et al., 2015; Gebauer et al., 2005; Mo, 2012; Nordin et al., 2011).

The research on servitization risks first started in the investigation of financial (RM 1) outcomes of servitized businesses by Neely (2008), who concluded that servitized companies face increasing investment needs for business transformation, which easily offset any financial returns at its early stage. Although the adoption of a service strategy can be an option for a manufacturer to grow its business, selling servitized offerings does not always produce the expected returns (Gebauer et al., 2005; Matthyssens & Vandenbempt, 2010; Neely,

2008). More recently, [Benedettini et al. \(2017\)](#) investigated the likelihood of bankruptcy in servitized companies through the analysis of secondary financial data, and concluded that providing services does not necessarily increase the chance of business survival. This is highly related to the operational risks (RM2), as many uncertainties and changes are triggered when companies decide to build and extend their service portfolio to provide value in use for business customers ([Durugbo & Erkoyuncu, 2016](#); [Li et al., 2015](#); [Nordin et al., 2011](#); [Reim et al., 2015](#)). The previous discussions on the challenges ([Sections 4.1, 4.2, 4.3, and 4.4](#)) indicate that all challenges identified here increase the risk of servitization because uncertainties are triggered in different parts of the business ([Hypko et al., 2010](#)).

Apart from financial and operational risks, external risks (RM3) include factors that are outside the organisation and can influence the business landscape ([Sharma & Mahajan, 1980](#); [Sheth & Sisodia, 2005](#)). These risks can be different in nature, such as changes in technology development, regulation, market trends, globalisation, and capital markets ([Benedettini et al., 2015](#)).

5. Theoretical hypotheses

Through the SLR, five constructs and relevant indicators of servitization challenges are identified in [Table 4](#) as a starting point to investigate the relationships among the challenges, benefits, and business performance. This section develops a set of hypotheses in [Tables 5 and 6](#) for exploring the underlying relationships, leading to the development of a theoretical model in [Fig. 4a](#) and [b](#).

5.1. Relationships between servitization challenges and benefits realisation ([Fig. 4a](#))

In servitization research, there is a mutual agreement between scholars and practitioners on the benefits of service growth in a product-centric company. Strategic benefits refer to a company achieving competitive advantage through unique offerings ([Malleret, 2006](#); [Mathieu, 2001](#)). It contributes to the realisation of financial benefits by creating a new and stable source of business income in a market with international competitors having lower expense structure ([Brax & Jonsson, 2009](#); [Oliva & Kallenberg, 2003](#)). Moreover, servitization consolidates the marketing benefits by locking in customers ([Vandermerwe & Rada, 1988](#)), increasing customer satisfaction ([Mathieu, 2001](#)), and thereby strengthening customer loyalty ([Penttinen & Palmer, 2007](#)). The hypotheses in [Table 5](#) describe the impacts of the challenges to strategic benefits (H1a-H5a), financial benefits (H1b-H5b), and marketing benefits (H1c-H5c). The following discussion focuses on the impact of each particular challenge on the achievement of the potential benefits.

Table 5
Hypotheses relating servitization challenges and benefits.

Organisational impact	Hypotheses	
Strategic benefits	H1a	Organisational structure (OS) challenges negatively affect the achievement of strategic benefits (SB)
	H2a	Business model (BM) challenges negatively affect the achievement of strategic benefits (SB)
	H3a	Development process (DP) challenges negatively affect the achievement of strategic benefit (SB)
	H4a	Customer management (CM) challenges negatively affect the achievement of strategic benefits (SB)
	H5a	Risk management (RM) challenges negatively affect the achievement of strategic benefits (SB)
Financial benefits	H1b	Organisational structure (OS) challenges negatively affect the achievement of financial benefits (FB)
	H2b	Business model (BM) challenges negatively affect the achievement of financial benefits (FB)
	H3b	Development process (DP) challenges negatively affect the achievement of financial benefits (FB)
	H4b	Customer management (CM) challenges negatively affect the achievement of financial benefits (FB)
	H5b	Risk management (RM) challenges negatively affect the achievement of financial benefits (FB)
Marketing benefits	H1c	Organisational structure (OS) challenges negatively affect the achievement of marketing benefits (MB)
	H2c	Business model (BM) challenges negatively affect the achievement of marketing benefits (MB)
	H3c	Development process (DP) challenges negatively affect the achievement of marketing benefits (MB)
	H4c	Customer management (CM) challenges negatively affect the achievement of marketing benefits (MB)
	H5c	Risk management (RM) challenges negatively affect the achievement of marketing benefits (MB)

In order to assist service growth in product-centric companies, it is essential to reconstruct the organisational structure to align with business strategy ([Burgelman & Doz, 2001](#); [Child, 1972](#)). As discussed in the previous section, the inhibitors of transforming organisational structure include culture change, internal communication, retaining service expertise, and promoting inter-departmental collaboration to support the transformation from a product-centric to a servitized organisation ([Alghisi & Saccani, 2015](#); [Baines et al., 2007](#)). These changes directly link to the realisation of strategic benefits. From a financial perspective, changing organisational structure increases financial requirements in the initial stages of the servitization journey, such as the development of new functional groups and the recruiting of new human resources ([Neely, 2008](#); [Parida et al., 2014](#)). Hence, there is a likelihood of bankruptcy if expected returns are not attained in the designated period of time ([Benedettini et al., 2017](#)). The key responsibility of the marketing function in manufacturing companies is promoting the manufactured goods. However, since manufacturing companies have pursued service growth in addition to product sales, service marketing is also implemented to address a broader perspective ([Vargo & Lusch, 2004](#)). This is aligned with the change in organisational structure, particularly the shift in the mindset and communicating the new concept to both internal and external stakeholders. This confirms that the challenges to changing organisational structure are negatively correlated to strategic, financial, and marketing benefits, leading to the formulation of hypotheses H1a, H1b, and H1c (see [Table 5](#)).

In addition, modifying the business model helps to redevelop an operational plan to implement the service strategy in companies ([Barquet et al., 2013](#); [Kindström & Kowalkowski, 2014](#); [Parida et al., 2014](#)). The development of the value proposition is difficult as the integrated offerings combine the products and services as a bundle to deliver value in use for customers, which thereby increases the level of difficulty in achieving strategic benefits ([Barnett et al., 2013](#); [Brax, 2005](#); [Pawar et al., 2009](#); [Valtakoski, 2016](#)). Resource allocation is also a challenging part of a strategic plan as it helps to balance resources across organisational boundaries to achieve efficiency in a cost-effective way ([Barquet et al., 2013](#); [Lin et al., 2014](#)). Costing and pricing mechanisms directly link to financial performance, as they mainly capture the financial input and output of developing servitized offerings. The identified challenges, therefore, potentially reduce the expected financial benefits. Supplier collaboration in the business model is the only part that involves third parties, which is directly associated with strategic benefits and finance due to the value co-creation and partial revenue distribution with partners ([Datta & Roy, 2010](#); [Ng & Nudurupati, 2010](#)). Regarding the marketing benefits, the business model assists in the value development and delivery to customers, particularly, in how the value of the offering matches the customer needs and is delivered ([Osterwalder & Pigneur, 2010](#)). These arguments

Table 6
Hypotheses relating servitization benefits to each other and overall business performance.

Organisational impact	Hypotheses	
Impact of strategic benefits	H6a	Strategic benefits (SB) positively influence the financial benefits (FB)
	H6b	Strategic benefits (SB) positively influence the marketing benefits (MB)
Impact of financial benefits	H7a	Financial benefits (FB) positively influence the strategic benefits (SB)
	H7b	Financial benefits (FB) positively influence the marketing benefits (MB)
Impacts of marketing benefits	H8a	Marketing benefits (MB) positively influence the strategic benefits (SB)
	H8b	Marketing benefits (MB) positively influence the financial benefits (FB)
Business performance	H9a	Strategic benefits (SB) positively influence the business performance (BP)
	H9b	Financial benefits (FB) positively influence the business performance (BP)
	H9c	Marketing benefits (MB) positively influence the business performance (BP)

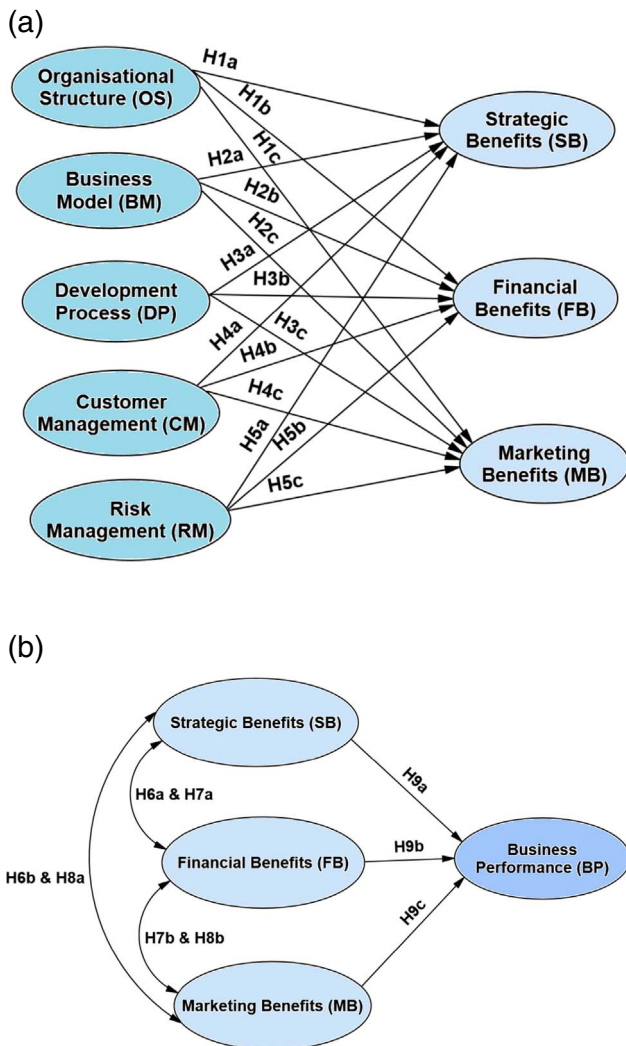


Fig. 4. Theoretical model.
(a) Theoretical model: relationships between servitization challenges and benefit realisation
(b) Theoretical model: interrelationships among servitization benefits and their connections to business performance.

suggest that challenges in the business model are negatively correlated to the realisation of benefits, leading to the formulation of H2a, H2b, and H2c (see Table 5).

The development process facilitates the development of servitized offerings from an idea to a deliverable (Cooper & Edgett, 2003). The SLR highlights that servitized companies found it a challenge to re-engineer the process as product development dominated, while services development was on an ad-hoc basis in the past (Alghisi & Saccani, 2015; Baines et al., 2009b; Kowalkowski et al., 2015). Hence, the

design of the development process is a potential obstacle to strategic benefits. In terms of financial and marketing benefits, the costing and idea generation are part of the development process, having a direct impact on the benefits realisation, particularly, when company strategic goals include reducing operational costs and increasing customer satisfaction. In addition, a selection of tools, methods, techniques, and performance measurements are supplementary to the development process, and therefore, they have indirect impacts. Last, customer engagement in the development process helps companies clarify and test the designs of the offerings, especially, how these match customer expectations (Cooper & Edgett, 2003), which provides strong support to marketing activities. These arguments show that the change in the development process has a direct contribution to the achievement of benefits. On the other hand, failures in managing the change may result in achieving fewer benefits, leading to the formulation of hypotheses H3a, H3b, and H3c (see Table 5).

Given that the delivery of the offering is often through a long-term contract, relationship marketing becomes an important theme in service marketing literature. According to Berry (1995), relationship marketing is not only about attracting and establishing a relationship with customers, but is also about maintaining a relationship and turning new customers into loyal ones. This supports the argument for the need for a positive relationship between customer management and marketing benefits in a servitized business. The relationship marketing strategy is regarded as a part of implementing a service strategy, which would have a positive impact on attaining strategic benefits because strengthening customer loyalty sustains the competitive advantage of a company in the market (Malleret, 2006; Mathieu, 2001). Superior financial performance is one of the key consequences of a sustained competitive advantage since firms with a strong relationship marketing are more likely to enjoy financial benefits (Barney, 1986). These arguments suggest that challenges to customer management are negatively correlated to benefit realisation, leading to the formulation of hypotheses H4a, H4b, and H4c (see Table 5).

Risk management in servitization research refers to the identification and mitigation of internal and external uncertainties in implementing service strategy in product-centric companies. The SLR indicates that a servitized business involves financial (Benedettini et al., 2015; Gebauer et al., 2005; Matthyssens & Vandenbempt, 2010; Neely, 2008) and operational risks (Nordin et al., 2011; Reim et al., 2015) during its transformation, where those risks directly inhibit benefit realisation. Additionally, external risks (Sharma & Mahajan, 1980; Sheth & Sisodia, 2005) can affect the whole company and therefore increase the level of difficulty in achieving expected benefits. These arguments suggest that an increasing level of risk in servitization businesses is negatively correlated to the realisation of benefits, leading to the formulation of hypotheses H5a, H5b, and H5c (see Table 5).

This section discussed linkages between servitization challenges and expected benefits, clarifying theoretical relationships in Fig. 4a. The next section discusses another part (see Fig. 4b) of the theoretical model, focusing on the interrelations among servitization benefits and their connections to the improvement in business performance. This

forms a comprehensive picture of how servitization challenges affect the business performance of the company in the industrial sector.

5.2. Interrelation between servitization benefits and business performance (Fig. 4b)

Based on the SLR, hypotheses about the complex relationships among servitization benefits and business performance are established (see Fig. 4b). The impacts of strategic benefits on financial and marketing benefits are straightforward. When companies achieve strategic benefits, such as the successful adoption of a service strategy inside the organisation by overcoming the challenges discussed in Section 5.1, they are more likely to achieve financial profits and retain customer loyalty. On the other hand, financial and marketing benefits are less likely to be achieved when strategic benefits are not secured, leading to the hypotheses H6a and H6b (see Table 6).

In operations research, financial returns are regarded as a key indicator of business strategy achievement (Neely, 2007a), meaning, higher returns represent the strategic benefits. Servitization literature claims that service growth in product-centric companies creates a new channel for generating sustainable income (Brax & Jonsson, 2009; Gebauer, 2008) and balances the impact of economic cycles (Johnstone et al., 2009), supporting the achievement of business strategy and maintenance of a competitive position in the market. This leads to the formulation of hypothesis H7a (see Table 6). The profits from product sales are often reinvested into research and development (R & D) activities to keep business growing, which contributes to the development of better offerings to match customer needs. This increases the possibility of achieving marketing benefits via competitive offerings, supporting the formulation of hypothesis H7b (see Table 6).

The marketing benefits are mainly associated with customer relationship management in servitized companies. Baines et al. (2009a) claim that servitized offerings are supplied through an integration of products and services and a blend of customer management to support the delivery of value in use for business clients. This shows the importance of relationship management in achieving strategic and financial benefits in servitized businesses (Malleret, 2006; Mathieu, 2001), and implies that achieving marketing effectiveness is positively correlated to the realisation of strategic and financial benefits, leading to the formulation of hypotheses H8a and H8b (see Table 6).

There is always a debate on the relationship between servitization of manufacturing and business performance. A recent study shows that servitization is positively correlated to the marketing performance while the relationship between servitization and the financial performance turns out to be negative (Min, Wang, & Luo, 2015). Given that this study focused on the Chinese manufacturing companies and strategic benefits were not fully discussed, the correlation between servitization and business performance needs to be explored further.

Addressing the measurements of business performance helps us to understand how it can be improved. Neely (2007a) wrote a book on performance measurement in which a collection of viewpoints from different scholars was included. The author suggests that business performance should be measured from three perspectives: accounting (finance) (Otley, 2001), operational (Neely, 2007b), and marketing (Clark, 2007). The financial perspective captures the usual way of quantifying business performance based on financial figures, such as net profits and capital employed, and it offers an easy way to compare figures each year and monitor performance (Otley, 2001). The marketing and operational measurements have been used as non-financial measurements to monitor business performance. As a rule, the cost of marketing activities accounts for between 5% and 20% of business revenues, and this grabs the attention of top management who are keen to know the return on their marketing investment (Eechambadi, 2005). In addition, operations are the cost centre of the company, and inefficient financial performance lead to the poor financial performance such as more employed capital and fewer outputs (Neely, 2007b).

The above discussion highlights key factors of business performance measurement and emphasises that performance needs to be measured from multiple perspectives in order to achieve optimal results (Cox, Blackstone, & Schleier, 2003). The servitization literature stresses that service growth in manufacturing companies contributes to the business performance from three perspectives: strategic, financial, and marketing. The impacts of financial and marketing benefits on business performance are straightforward as they are considered as main indicators in the literature and practice (Clark, 2007; Otley, 2001). The business strategy leads the operational management in most companies as an overarching goal, which implies that attaining operational effectiveness directly contributes to strategic benefits. Given that operational effectiveness is an indicator of business performance (Neely, 2007b), it is clear that strategic benefits are positively correlated to business performance. These arguments suggest that strategic, financial, and market benefits are positively correlated to business performance through close linkages with key performance indicators (financial, operational, and marketing), leading to the formulation of hypotheses H9a, H9b, and H9c (see Table 6).

This section explored the interrelationship among servitization benefits and their connections to the improvement of business performance (see Fig. 4b). The conclusion is that these benefits are positively correlated to one another as well as to the improvement in business performance at servitized companies.

6. Conclusion

This paper investigates the previously uncovered relationships among servitization challenges, benefits, and business performance through an improved SLR. Five constructs for the servitization challenges are identified: organisational structure, business model, development process, customer management, and risk management. The main output of this study is the set of hypotheses that reflect the correlation of servitization challenges and the realisation of benefits. Moreover, complex relationships among the benefits and business performance are investigated to understand the influence of the challenges on the overall business. These hypotheses are grounded in literature and form a theoretical model for application in both research and practice.

The main contribution of this paper is that it gathers theoretical arguments and findings in relation to servitization challenges based on a multi-disciplinary SLR (48 journals cross 28 journals). More importantly, this brings together five challenges in servitization to form a comprehensive viewpoint from existing studies. This contributes to theory development in servitization research as different challenges merge into a new and comprehensive understanding of the topic. Bringing together these servitization challenges opens up new research areas, where several avenues for future research can emerge:

1. Testing hypotheses developed in this paper: it is evident that overcoming servitization challenges will have a negative impact on benefits realisation and business performance in product-centric companies. Future research should test the hypotheses on a large sample of companies that have strong service capabilities, and validate the significance of the relationships.
2. Discovering the relationships among the challenges: this paper explores the connections among the challenges, benefits, and business performance, but their interactions with one another are under-explored here. Future research should explore this area further, as evidence in existing studies are lacking.
3. Investigating the challenges from a risk perspective: the research on the risk management of servitization is largely at an early stage in comparison to other topics. Only a few papers discussed risks of service growth in manufacturing companies, and all of these were mainly theoretical and descriptive.

Even though the SLR is a rigorous and well-established research approach, this paper still contains some limitations. The hypotheses developed here were rarely explicit in the previous studies and thus they lack empirical validation. In addition, there might be other challenges not covered in this study because the perception of an inhibitor may vary by individual, as ‘it can be real, imaginary or psychic’ (Groth, 1994). Finally, the discussion on the interrelationships among the benefits and business performance is brief and requires further exploration.

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