

Servitization and supply chain integration: An empirical analysis

Syed Aamir Ali Shah^{a,b}, Muhammad Shakeel Sadiq Jajja^a, Kamran Ali Chatha^c, Sami Farooq^{d,*}

^a Suleman Dawood School of Business, Lahore University of Management Sciences, Lahore, Pakistan

^b Department of Business Administration, Sukkur IBA University, Sukkur, Pakistan

^c College of Business, Abu Dhabi University, P.O. Box 1790, Al Ain, United Arab Emirates

^d Center for Industrial Production, Aalborg University, Fibigerstræde 16, 9220, Aalborg Ø, Denmark

ARTICLE INFO

Keywords:

Servitization

Supply chain integration

Firm performance

Empirical research

International manufacturing strategy survey

ABSTRACT

Supply chain literature highlights the importance of the role of supply chain partners in a manufacturer's journey towards servitization. However, there is scarce empirical research seeking to explain supply chain level factors that enable servitization. Using resource dependence theory, we argue that servitization orientation encourages organizations to enhance supplier, internal, and customer integration (three dimensions of supply chain integration) which in turn enhance servitization (basic and advanced service provision) ultimately affecting firm performance. Covariance-based structural equation modelling is applied to test the hypotheses using data of 307 manufacturing companies obtained from the sixth version of International Manufacturing Strategy Survey. Empirical examination provides evidence that servitization oriented firms enhance internal integration and the integration with key suppliers and customers. However, there is an uneven relationship between firm's integrative practices with suppliers and customers and the provision of basic and advanced services such that enhanced provision of basic services requires more supplier integration while enhanced provision of advanced services requires more customer integration. Also, the performance implications of different types of service provision are found to be unequal. These findings suggest that servitization oriented firms need to improve a specific dimension of supply chain integration to enhance a particular type of service provision. The paper makes an initial attempt to empirically explore the enabling role of supply chain integration in facilitating servitization.

1. Introduction

Traditionally, services have been considered as peripheral to the core business of manufacturing firms. However, in recent times, offering services seem to have emerged as a strategic choice for manufacturers to differentiate their products and simultaneously add an additional revenue stream (Raddats et al., 2016). Manufacturing companies have strong technical and product-centric capabilities (Alghisi and Saccani, 2015) but often lack resources and competencies required for offering goods and services together (Xing et al., 2017). Instead, firms need support from the external environment, especially ensuing from key suppliers and customers to successfully servitize, despite having strong servitization orientation and internal capabilities (Gebauer et al., 2017).

Most of the work on the antecedents of servitization has considered servitization as an outcome of a manufacturing firm's internal factors, including top management commitment (Antico et al., 2008), leadership style (Kim and Toya, 2019), service and manufacturing capabilities (Sousa & da Silveira, 2017), and competitive, demand driven and

revenue-based motivations (Baines et al., 2009; Martinez et al., 2017; Raddats et al., 2016). Another stream of servitization literature has alluded servitization as a practice of mere chance and is dependent on factors beyond the control of a single manufacturing firm such as competitive market environment (Paul et al., 2014; Turunen and Finne, 2014), sectoral innovation intensity (Dachs et al., 2014) and economic context (Neely, 2008; Szász et al., 2017). In other words, the extant empirical work on the antecedents of servitization has either studied micro level (i.e., intra organizational) or macro level (i.e., environmental) enablers of servitization. Despite the recognition and importance of supply chain partners in servitized contexts, the literature provides scant empirical focus on supply chain or meso-level enablers of servitization (Ayala et al., 2019; Marko et al., 2012; Martinez et al., 2017).

Nonetheless, scholars have hinted towards the role of supply chain partners in the manufacturing firms' journey towards servitization, such as the role of strong external relationships with suppliers in the development and deployment of integrated solutions (Ayala et al., 2017,

* Corresponding author.

E-mail address: sami@business.aau.dk (S. Farooq).

<https://doi.org/10.1016/j.ijpe.2020.107765>

Received 20 March 2019; Received in revised form 28 January 2020; Accepted 11 April 2020

Available online 14 April 2020

0925-5273/© 2020 Elsevier B.V. All rights reserved.

2019; Marko et al., 2012; Saccani et al., 2014; Windahl and Lakemond, 2006) and the importance of a close relationship with customers in the provision of integrated offerings (Cenamor et al., 2017; Oliva and Kalenberg, 2003; Wynstra et al., 2015). As most of the research in this stream of literature is either based on anecdotal evidence or qualitative data, study of supply chain level factors in enhancing service provision (servitization) requires empirical examination. Also, prior servitization literature has clearly delineated different types of services and has proposed varying resource and capability requirements for offering each service type (Baines et al., 2017; Benedettini et al., 2015; Li et al., 2018; Sousa & da Silveira, 2017). However, the distinction is least explored empirically in the context of supply chain management level enablers of servitization (Eggert et al., 2014; Sousa & da Silveira, 2019).

In addition, despite the suggested competitive advantage and often celebrated anecdotal evidence of servitization, some empirical studies have raised concerns on the performance implications of servitization, revealing a servitization paradox (Benedettini et al., 2015). Some scholars suggest that servitization has a negative or non-linear impact on profitability of manufacturing companies (Kastalli and Van Looy, 2013; Kohtamäki et al., 2013; Neely, 2008) while others have found positive association between servitization and firm performance (Antioco et al., 2008; Kastalli and Van Looy, 2013; Li et al., 2018). One of the main reasons for the inconsistent results of the link between servitization and performance is related to firm performance measurement (Bustinza et al., 2018). In a recent meta-analysis based study on the servitization-performance link, Weijiao et al. (2018) find that the servitization-performance relationship is influenced by how the performance construct is operationalized and measured.

Considering the above state of literature (see Appendix A for more details), this paper makes an initial attempt to explain the enabling role of supply chain integration (meso-level enabler) in servitization. Drawing on resource dependence theory (RDT) (Pfeffer and Salancik, 2003), we argue that manufacturing firm's servitization orientation requires it to work closely with members of its supply chain to enhance supply chain integration (i.e., supplier, internal and customer integration). In doing so, the paper provides insights into how a manufacturing firm's strategic orientation towards servitization relates with its supply chain practices. We also argue that the three dimensions of supply chain integration (i.e., supplier, internal and customer integration) have positive impact on the two types of services offered by the manufacturing firms (basic/product-related and advanced/customer-related services) which in turn affect growth in the firm's performance. Thus, the paper provides a nuanced understanding of the relationship among servitization orientation, various dimensions of supply chain integration (i.e., supplier, internal, and customer integration) and servitization (i.e., basic and advanced services). In addition, the paper endorses the servitization paradox as suggested in the prior literature (Kastalli and Van Looy, 2013) by operationalizing financial performance in growth terms (Paquette, 2005). Finally, since servitization has become a global phenomenon, it is important to draw on larger samples from various sectors and countries as varying operational environments may impact servitization (Turunen and Finne, 2014). Our data sample from the sixth version of International Manufacturing Strategy Survey comprises firms from six industries and different regions across the globe and allows for analyzing the link between servitization and supply chain integration in different international contexts. In doing so, we respond to the recent calls for contextualizing international business research by testing the relevance of research findings in heterogeneous contexts (Teagarden et al., 2018).

The paper is structured as follows. The next section provides the theoretical background along with the development of hypotheses. The subsequent sections present research methodology and results. The paper then provides the discussion on findings and concludes with theoretical and managerial implications and directions for future research.

2. Theoretical background and hypotheses development

2.1. Servitization orientation

Servitization orientation refers to a manufacturing firm's inclination and capacity building to carry out the design and delivery of the services it aims to offer along with the product offerings (Chen et al., 2009; Sousa & da Silveira, 2017). According to Homburg et al. (2002), manufacturing firm's orientation for services could be conceptualized at two levels, individual and organizational. In the first instance, orientation for services is treated as a personality measure whereby certain people are more service oriented than others while in the second case manufacturing firm's service orientation is depicted in terms of organizational level arrangements and strategic actions (Antioco et al., 2008; Keillor et al., 1999; Paul et al., 2014). A manufacturing firm's investments in new service development, enhancement of skills of employees for service delivery and development of products for enhancing after sales service depict the manufacturing organization's intention and capacity building to offer integrated (i.e., goods and services) offerings. With all its due merits of conceptualizing service orientation at the individual level, researchers and executive managers have shown increasing interest in the concept of an organizational service orientation due to its broader scope (Homburg et al., 2002). Moreover, since the focus of our study is beyond the individual level, the organizational level conceptualization of service orientation is more appropriate for this study.

2.2. Supply chain integration

Supply chain integration is defined as the strategic collaboration with supply chain partners besides aligning intra-organizational practices related to flow and production of products, services, information and joint decision-making in various functional areas inside (internal integration) and outside firm boundaries (supplier and customer integration) (Jajja et al., 2018; Schoenherr and Swink, 2012). The integration may include but may not be limited to product/service development, capability and capacity development, product/service promotion and launch, and product/service delivery, etc. (Flynn et al., 2010; Zhao et al., 2011). Extant literature has suggested various dimensions of supply chain integration that can broadly be classified into three types i.e., internal, supplier and customer integration (Lee et al., 2007; Wiengarten et al., 2016).

Internal integration is the extent to which an organization's key functional departments (procurement, production and sales) collaboratively and coherently work together in a structured way, carrying out their individual roles efficiently and effectively to create a whole that fulfils customer requirements (Chen and Paulraj, 2004). Internal integration serves as the basis for achieving supplier and customer integration successfully (Cheng et al., 2016; Zhao et al., 2011) as it provides the firm a common ground to deal with the issues external to the firm. Supplier integration includes the establishment of long term agreements with the key suppliers such that the day to day information sharing and decision making takes place smoothly (He et al., 2014). A focal firm may also develop the technological and managerial capabilities of its key suppliers enabling them to match the quality standards required by the focal firm in product/service development, production and delivery (Wiengarten et al., 2016). Similarly, customer integration refers to the extent to which an organization considers its customers not just consumers but also partners to work with collaboratively to meet the demand of the customer more efficiently and effectively (He et al., 2014). It involves both, the engagement of the focal firm with the customer to understand the dynamic customer requirements and making customer capable of engaging with the focal firm to better appreciate and participate in the value cocreation (Vargo and Lusch, 2004).

2.3. Resource dependence theory

In this paper, we use RDT to identify the supply chain factors that lead to successful servitization for manufacturing firms. RDT contends that businesses cannot solely opt for their preferred path and attain the desired outcomes on their own (Pfeffer and Salancik, 2003). Instead, organizations are dependent on other entities in their environment to get access of the needed resources for realizing their organizational goals. Thus, the strategic orientation and corresponding actions of the firm along with the interdependence between the firm and its partners collectively shape the subsequent organizational outcomes. RDT suggests that enhanced communication and collaboration within the firm and with external entities result in getting requisite resources by the focal firm with less uncertainty and reduced complexity (Carter and Rogers, 2008).

Prior literature on supply chain management has employed RDT to explain the role of external partners in achievement of various organizational objectives such as product innovation (Jajja et al., 2017), service delivery co-innovation (Tsou et al., 2015), design of organizational structure (Hillman et al., 2009). Similarly, RDT has been used in exploring inter-organizational relationships in different contexts such as the development of buyer-supplier relationship in servitized environment (Marko et al., 2012), formation of service triads (a buyer contracting with a supplier to offer services directly to the buyer's customer) in business services (Wynstra et al., 2015), and governance of international buyer-supplier relationships in international supply management (Ketchen Jr. and Hult, 2007). In all these studies, RDT provides a fundamental theoretical explanation as to why the use of inter-firm behaviors may help firms maintain competitive advantage and achieve their goals. According to RDT, establishing such collaborative relationships (e.g., supply chain integration) constitute a bridging strategy between a specific organizational orientation (e.g., servitization orientation) and the corresponding organizational conduct (e.g., the provision of different types of services) (Tsou et al., 2015). Thus, the current research uses RDT for explaining the dynamics of the association between servitization orientation, supply chain integration and provision of services and the latter's impact on firm performance.

2.4. Servitization orientation and supply chain integration

RDT draws that organizations are embedded in the network of interdependencies for meeting their financial, physical and informational resource requirements. These interdependencies result in complexity and uncertainty for the focal firm as it cannot fully foresee and control the behavior of its partners (Jajja et al., 2017). Servitization orientation of the manufacturing firm further adds to its existing interdependencies (Pfeffer and Salancik, 2003). It is primarily due to the intangible, heterogeneous, inseparable, and perishable nature of services that a different set of resources and capabilities are required as compared to solely offering products (Baines and Lightfoot, 2013; Lightfoot et al., 2013; Pine and Gilmore, 1998). The people, groups, and departments inside the firm will seek to develop coordination, communication and joint-decision making to be able to reduce such complexities and uncertainties, manage environmental dependencies efficiently and help the organization obtain the requisite resources smoothly (Bustinza et al., 2017). Moreover, the recognition of the internal organizational changes in pursuit of servitization is well established in the servitization literature (Baines and Lightfoot, 2013; Gaiardelli et al., 2014; Rabetino et al., 2017). More prominently, Baines and Shi (2015) and Ayala et al. (2019) have unequivocally argued that manufacturing companies heading towards servitization undergo an internal transformation in terms of improved inter-departmental information sharing and joint decision making to overcome distances among procurement, sales and operations and ascertain the smooth flow of resources. Considering this we propose:

H_{1a}. Servitization orientation is positively associated with internal

integration.

One of the central tenets of RDT suggests that organizational goals and organizational dependence are inter-linked such that the more ambitious and innovative organizational goals lead to higher levels of external dependence. (Pfeffer and Salancik, 2003). It is primarily because organizations are not self-sufficient in resources and capabilities in achieving their defined objectives. Servitization orientation, that represents a major strategic goal of manufacturing companies, leads to a major shift in the business model of a traditional manufacturer (Barnett et al., 2013). In fact, manufacturing firm's inclination and capacity building to carry out the design and delivery of the services will lead to changes in enterprise management, contracting, risk, and operations, creating enhanced dependencies on the external environment (Barnett et al., 2013). In order to manage such external dependencies and cope up with the complexities and uncertainties that emanate from inter-dependence, organizations seek to build alliances and collaboration with universities, suppliers, customers, and competitors to get access to knowledge and resources that may support the provision of innovative offerings (Chen et al., 2009).

Firm's servitization orientation will lead to developing strong relationship with key suppliers to leverage on their resources and capabilities for achieving servitization goals. Since services have the characteristic of perishability (Fitzsimmons and Fitzsimmons, 2011), manufacturer's increasing orientation for offering services lead to developing real time resource planning capabilities by either increasing the number of suppliers or dealing more intensely with existing suppliers resulting in more complexity and uncertainty in the supply chain (Marko et al., 2012). In addition, because of inseparability and coproduction inherent in services (Chen et al., 2011), key suppliers at times, may have to be connected directly with the customers of the focal firm for delivery of services, adding more uncertainty and complexity in the supply chain (Finne and Holmström, 2013; Kohtamäki et al., 2013; Wynstra et al., 2015). Thus, servitization oriented firm will enhance integration with key suppliers by developing collaborative relationships and coupling systems to manage supply side uncertainty and complexity in pursuing servitization goals.

Moreover, servitization orientation leads to enhanced system coupling with key customers to assess customer readiness and acquire resources needed for achieving servitization objectives. (Pfeffer and Salancik, 2003). Servitization orientation also encourages firm to gauge customer needs and future requirements more closely to better understand the customer demand for servitized offerings (Homburg et al., 2002). Moreover, in order to develop the viability for offering innovative products, firms need to open up and adapt the offerings based on market requirements and prospects (Chesbrough, 2006). It becomes more imperative for the manufacturing firm to develop a strong relationship with customers, when such innovative offerings involve some of the resources and inputs directly from the customer as in the case of services (Sampson and Spring 2012) where customer participation (be itself customer or customer belongings/information) is a necessary condition for successful service production (Sampson and Froehle, 2006). Furthermore, servitization oriented firm may want to create the demand for its integrated offerings (Sousa & da Silveira, 2017) by sharing information on what to expect and by developing collaborative arrangements with its key customers for risk/revenue sharing and long term agreements. These arguments suggest that servitization orientation may have profound impact on customer integration for reducing uncertainty and enhancing predictability of customer behavior besides getting easy access to customer resources. Thus, we hypothesize:

H_{1b}. Servitization orientation is positively associated with supplier integration.

H_{1c}. Servitization orientation is positively associated with customer integration.

2.5. Servitization

There are a variety of services that a manufacturing firm may offer along with the product. Most of these services are classified as either services related to products (basic services) or services related to the customer (advanced services) (Sousa & da Silveira, 2017, 2019). Advanced or customer-related services may include help desk or customer support, training in using products, consultancy services, product modifications based on customer requirement and lease of products based on customer need (Smith et al., 2014; Szász et al., 2017; Weijiao et al., 2018). Customer-related services are also referred in the literature differently as intricate, professional and use-oriented services (Smith et al., 2014; Weijiao et al., 2018). These services are characterized with high customization and complexity and require closer and direct interaction with the customer (Weijiao et al., 2018). Basic or product-related services, on the other hand, are referred in the literature as elementary and after-sale services and may include maintenance and repair, installation and implementation, and spare-parts (Szász et al., 2017). These services are characterized with low customization and low complexity (Eggert et al., 2011).

Moreover, categorizing servitization into distinct types i.e., basic and advanced, is a common practice in the servitization literature. The primary purpose of the distinction between basic and advanced services is to explore the exclusive enablers and impact of each service offering as resource requirements and competencies for offering different services vary besides their differing impact on firm performance. For example, Sousa and da Silveira (2017), Li et al. (2018), and Sousa and da Silveira (2019) use this distinction of basic and advanced services for similar purpose and operationalize it accordingly using the IMSS VI dataset. Similarly, various other scholars (Eggert et al., 2014; Smith et al., 2014) have defined and categorized servitization using primary data sources. While it is acknowledged that the study of servitization needs to consider different types of service offerings (Baines et al., 2017; Benedettini et al., 2015), few empirical studies have made such distinction. Thus, our study examined the individual mechanisms by which provision of basic and advanced services may be influenced by different dimensions of supply chain integration.

2.6. Supply chain integration and servitization

Servitized offering is different than a singular good or service offering. Thus a servitized firm requires a different mix of resources compared to what a typical pure manufacturing organization might possess. Since products and services are to be delivered jointly and in an integrated fashion, servitization requires an integrated supply chain for real time demand management and resource planning (Brusset and Teller, 2017). Thus, as RDT draws there will be increased reliance on the resources of other supply chain partners in order to offer enhanced provision of basic and advanced services (Pfeffer and Salancik, 2003), we seek to develop the association between supply chain integration and servitization.

A coherent and collaborative working environment among the functional units within a firm can play an important role in bringing innovations in the firm's offerings (Wong et al., 2013) such as servitization (Kastalli and Van Looy, 2013). Since the provision of both basic and advanced services requires a firm level commitment, a higher level of internal integration improves the capability of firms to exploit the internal resources well for servitization (Wong et al., 2013). Servitization encompasses a range of changes within the firm e.g. reconfiguration of organizational resources, capabilities and internal structures and a renewal of organizational goals, practices and values (Kim and Toya, 2019; Weijiao et al., 2018). Thus, all functional departments within a firm need to realize the transition and work collaboratively to assess service demand (which is primarily sales department's work), produce any and all types of services (which is primarily operations/production department's work) and source the needed resources (which is primarily

procurement department's work) timely and efficiently. Thus, we hypothesize:

H₂. Internal integration is positively associated with provision of (a) basic services and (b) advanced services.

RDT suggests that strong relationship and integration with external partners, e.g., key suppliers, is important to achieve organizational objectives, by managing constraints and uncertainty that emanate from the need to acquire resources outside the firm (Pfeffer and Salancik, 2003; Windahl and Lakemond, 2006). Supplier integration provides the risk sharing and management mechanisms to reduce the chances of failure and thus encourage the firm in enhancing the provision of services (Marko et al., 2012). Moreover, integrated suppliers play a critical part in enabling a focal firm to develop and introduce new offerings combining products and services (Fynes et al., 2015). Thus, the increased and open sharing of relevant information between the firm and its key suppliers could lead to offering more services (Wong et al., 2013; Zhang et al., 2017). Also suppliers are more inclined to share ideas with firms that have increased level of joint decision making and collaborative behavior (Jajja et al., 2017). Furthermore, integrated suppliers could jointly design and modify the products or processes of their own and of the focal firm to fully achieve the smooth transition towards servitization. This suggests that increased provision of servitized offerings is a matter of merging activities and aligning the benefits with those of the firm's key suppliers (Marko et al., 2012). We thus hypothesize:

H₃. Supplier integration is positively associated with provision of (a) basic services and (b) advanced services.

RDT suggests that in order to mitigate complexity and uncertainty emerging from the dependence on customers, organizations consider the development of strong relationship with key customers that help in the production of servitized offerings (Pfeffer and Salancik, 2003; Windahl and Lakemond, 2006). This point is also echoed by unified service theory according to which the supply of customer resources (self, information and tangibles) is a necessary condition in service provision (Sampson and Froehle, 2006). Thus, ability of the firm to integrate with its key customers, by ways of developing communication mechanisms and collaborative approaches for smooth flow of resources, helps the firm in getting the required customer resources smoothly for increased service provision (Moeller, 2008). Besides the customer resources, active engagement of customer itself is necessitated in service production. In fact, the service part of the servitized offering is coproduced by the firm and the customer (Chen et al., 2015). Therefore, coordination and information sharing with key customers serve as the precursor for service provision. Moreover, the provision of integrated product and service offerings demands relational, as opposed to transactional exchanges with customers (Oliva and Kallenberg, 2003). A long term commitment and collaboration is required between the firm and its key customers to avoid the opportunistic behavior of the individual entities in the short run (Narayanan et al., 2015). Finally, joint-decision making and system coupling with key customers help in offering services as and when required (Cheng et al., 2016). Therefore, we propose:

H₄. Customer integration is positively associated with provision of (a) basic services and (b) advanced services.

2.7. Servitization orientation and basic service

Manufacturer's inclination and capacity building towards services is required for the provision of basic services (Kindström and Kowalkowski, 2009). Since basic services are low in complexity a manufacturing firm's intention and efforts in augmenting its existing resources and capabilities would enable the firm to provide basic services (Ulaga and Reinartz, 2011). Moreover, the provision of basic services require top management backing in the form of investments for new service

development (Alghisi and Saccani, 2015). It also requires human resource development in the form of workforce training and specialized service skill improvement, and technical expertise development to be able to design products and services jointly (e.g. design for maintenance) (Kindström and Kowalkowski, 2009). Moreover, servitization orientation acts as a key to overcoming any potential obstacles and augmenting a firm's ability to successfully offer new offerings (Kastalli and Van Looy, 2013). Therefore, servitization orientation of the manufacturing firm plays a significant role in the provision of basic services. Thus, we hypothesize:

H₅. Servitization orientation is positively associated with the provision of basic services.

2.8. Basic services and advanced services

We propose that provision of basic services is positively associated with the provision of advanced services. This hypothesis is supported by both the demand-side and supply-side viewpoints as suggested by Sousa and da Silveira (2017). Provision of basic services acts as an entry strategy into the service market. Manufacturers get an opportunity to observe how their products are being used in the field and more closely understand the processes of customers (Ulaga and Reinartz, 2011). Provision of basic services prepares the focal firm of what is required to offer as advanced services i.e., understanding the customer needs and product functionality while the product is in use. Moreover, as customers may get advantages from the higher value proposition in terms of combined product and basic services, they tend to develop confidence on the manufacturer's ability to offer more intricate services that they need (Gebauer et al., 2005). Therefore, we propose:

H₆. Provision of basic services is positively associated with advanced services.

2.9. Firm performance

In a recent meta-analysis of 41 studies on the servitization-performance link, Weijiao et al. (2018) find that 35 studies explore the impact of servitization on financial performance. However, the authors argue that the servitization-performance relationship is influenced by how the performance construct is operationalized and measured. Most of the current literature documenting financial performance implications of servitization use financial performance variable in level terms as opposed to growth terms (Kastalli and Van Looy, 2013; Neely, 2008; Sousa & da Silveira, 2017). However, as the data employed in this research is collected from firms of different sizes in six industrial sectors, measuring financial performance in growth terms allow for better comparisons across firms. For example, small sized firms may relatively have smaller levels of sales and return on sales, but sales and return on sales could be rising at a faster pace than in larger firms (Federal Reserve Bank of Dallas, 2019). In a sense, measuring financial performance in growth terms levels the playing field between smaller and larger firms and firms in different industries (Moreno et al., 2019). Thus, while financial performance in levels provides good information, they are most useful when comparing things similar in size/industry unlike the case in our study. In addition, growth in financial performance has been one of the motivating factors for manufacturing firms to venture into service markets (Gebauer et al., 2005). In fact, firms today are more concerned than ever for sustainability in growth and the pathways to achieve it (Kastalli and Van Looy, 2013). Thus, it is important to consider the effect of servitization on financial performance growth.

Amongst all the indicators of financial performance, sales and profitability have been most frequently used measures in operations management research (Wiengarten, 2019). Moreover, these two indicators of financial performance have frequently been used to assess the effectiveness of different types of diversification strategies including servitization (Tanriverdi et al., 2008; Visnjic et al., 2012; Weijiao et al.,

2018). Paquette (2005) reasons that growth in sales and earnings (profitability) are the most important parameters to judge a company's financial performance. The author writes that many companies now report selected 3, 5, and 10 year growth rates in the financial highlights section of their annual reports besides many popular financial web sites, such as Bloomberg.com and Forbes.com provide summary of measures for sales and earnings (profitability) growth rates. Moreover, Moreno et al. (2019) have argued growth in sales and growth in profitability (return on sales) to be the two most important outcome variables of servitization using the IMSS VI database. Thus, this research uses growth in sales and growth in profitability as indicators of financial performance.

2.10. Servitization and firm performance

Servitization is classified into two types: basic and advanced services, as discussed above. Since these services have fundamental differences they impact firm performance in different ways (Eggert et al., 2011). The provision of basic services caters to the basic product functionality which may lead to increased product life cycle (Kastalli and Van Looy, 2013). These services are more prone to being copied due to the standardization, low complexity, and lack of relational nature of these services (Weijiao et al., 2018). Basic services do not provide a significant differentiation and firms offering basic services may have to compete with two of the major competitor types, the buying firms own internal maintenance units and the specialist service providers in the market who excel in providing services only (Sousa & da Silveira, 2017). Thus, service sales margins will tend to be low or even negative for the provision of basic services given the cost of setting up such services (Suarez et al., 2013). Moreover, extended product life cycle due to the provision of basic services may lead to product substitution effects in favor of basic services. Therefore, the manufacturing firm may experience drop in the product sales compensated by the increase in the sale of basic services. So we hypothesize:

H_{7a}. The provision of basic services has no significant impact on growth in sales.

H_{7b}. The provision of basic services has a negative impact on growth profitability.

On the other hand, provision of advanced services may create unique value for customers which is independent of typical products of manufacturing firms (Sousa & da Silveira, 2017). The specialized and one of a kind nature of the advanced services could reduce the possibility of imitation by the competitors as the provision of advanced services involves customization, high complexity, and relational nature of the contact creating strong customer loyalty (Ulaga and Reinartz, 2011). Moreover, advanced service offerings tend to be less sensitive to the economic cycles and price-based competition, resulting in higher levels of profitability for the manufacturing firm (Weijiao et al., 2018). Thus, the provision of advanced services could lead to profitability for the firm for a longer period of time. Sousa and da Silveira (2017) contend that despite significant investments are required for the provision of advanced services e.g. building a separate service unit, there will be higher net sales margins due to high customer value proposition attached with the provision of advanced services. Thus, advanced services provide better competitive advantage and yield superior financial performance in terms of growth of sales and sales margins for the focal firm. We hypothesize:

H_{8a}. The provision of advanced services has a positive impact on growth in sales.

H_{8b}. The provision of advanced services has a positive impact on growth in profitability.

The direct relationships hypothesized in this paper are represented by the model in Fig. 1.

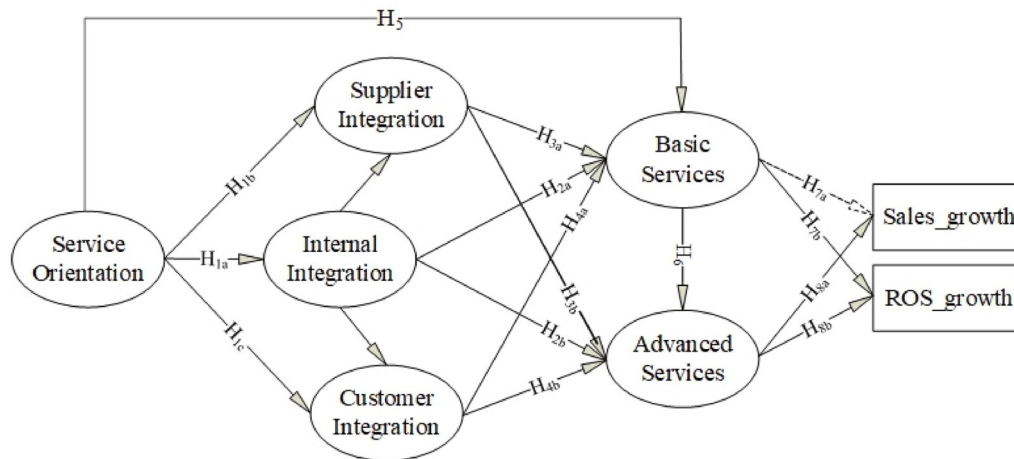


Fig. 1. Hypothesized model (Solid arrows indicate direction of impact. Dashed arrow indicates absence of impact).

2.11. Mediation effects

RDT draws that organizations are embedded in networks of interdependencies for various resources (physical, informational, financial) and mitigate these resource dependences via supply chain or value chain practices (Pfeffer and Salancik, 2003, pp. xi-xii). This indicates that manufacturing firm's servitization orientation would lead to more collaboration within internal and external stakeholders to ease out the resource requirements for enhancing servitization. In other words, servitization orientation encourages firms to widen their organizational structure to enhance integration among internal functional departments and with external supply chain partners (key suppliers and customers) which in turn increases servitization as firm now has access to previously unavailable resources. This relationship draws parallel to the strategy-structure-conduct-performance paradigm (Bain, 1951; Chandler, 1962; Galan and Sanchez-Bueno, 2009; Ralston et al., 2015). It argues that a firm's overall strategy (analogous to servitization orientation), formed in consideration of its goals and competitive environment, pushes the development of organizational processes and structure (analogous to supply chain integration) which in turn result into favorable outcomes (analogous to servitization) affecting performance (analogous to firm performance) (Bain, 1951; Defee and Stank, 2005). The discussion preceding H_1 through H_4 elaborates the role of three types of integration i.e., supplier, internal, and customer integration, as an outcome of servitization orientation and a precursor to servitization. Thus combining the effects of H_1 through H_4 we suggest a mediating role of supplier, internal, and customer integration in the relationship between servitization orientation and servitization. Therefore we hypothesize:

H₉. Internal integration mediates the relationship between firm's servitization orientation and provision of (a) basic services and (b) advanced services.

H₁₀. Supplier integration mediates the relationship between firm's servitization orientation and provision of (a) basic services and (b) advanced services.

H₁₁. Customer integration mediates the relationship between firm's servitization orientation and provision of (a) basic services and (b) advanced services.

3. Research methodology

3.1. Sampling and data collection

We used data from the sixth round of the International

Manufacturing Strategy Survey (IMSS VI) to test the hypotheses. The IMSS is a global network of institutions interested in manufacturing practices and performance of manufacturing companies. The operations management researchers from these institutions collaborate to develop a common survey instrument and protocol and carry out a periodic survey of manufacturers. The IMSS VI was conducted in years 2013–2014 and covers 22 countries from Europe, Asia, and the Americas. Numerous scholars have used the IMSS VI data for operations and supply chain management research (see e.g. Adebajo et al., 2018; Boer and Boer, 2019; Chaudhuri et al., 2018; Chaudhuri and Jayaram, 2019; Cheng et al., 2016; Haleem et al., 2017; Hong et al., 2019; Jajja et al., 2018; Kauppi et al., 2016; Shou, 2018; Sousa & da Silveira, 2017, 2019; Vanpoucke et al., 2014; Wiengarten, 2019; Wiengarten et al., 2014), thus endorsing the usefulness and credibility of the IMSS VI data.

The IMSS VI was designed to collect data from the population of assembly manufacturing plants (ISIC 25–30 classifications) having more than 50 employees. There were three main reasons for the selection of the companies from these six industries: a) financial and competitive strengths, b) sensitivity and ability to adopt a variety of advanced manufacturing practices, and c) being among the first to bring in technological advances. Moreover, selecting companies that perform assembly processes, was to develop comparisons and benchmarking more meaningful among different countries. It resulted in the identification 7167 companies from different countries. Out of the 7167 companies initially contacted by e-mail or phone, a total of 2586 agreed to receive the questionnaire. In total 931 valid (excluding cases with much missing data or any error) responses were received of the 2586 questionnaires distributed across different countries. The response rate, based on the number of companies contacted, was 13% (931/7167), however, it was 36% (931/2586) based on the number of questionnaires distributed. The central coordination team collected data from all participant institutes and then released the combined global data set. Participation of manufacturing companies in the survey was on voluntary basis. Therefore, there is different number of participating companies in various countries.

Non-respondent and late-respondent biases were tested by comparing the size, industry, sales, or proprietorship using publicly available data of the target companies with the received responses. Moreover, survey responses were used to test the differences between early and late responses in cases where the data was not available publicly. No significant evidence of late-response bias and non-response bias was found in the data (Armstrong and Overton, 1977).

IMSS VI survey followed the techniques described by Podsakoff et al. (2003) to minimize common method bias (CMB) proactively. First, items of predictor and criterion variables, that are more susceptible to CMB, were separated from each other in the questionnaire. Second, the survey

used varying anchors/formats to measure potential predictor and predicted variables. Third, the privacy of the respondent and the business unit was assured in the data collection process to avoid the social desirability need of the respondent. Finally, objectivity of the concepts and explanation of the items where required, was taken into account to reduce ambiguity. In addition, the data was tested for common method bias which may be present when a single respondent provides data for multiple variables. The Harman's single factor test was conducted in SPSS using the factor analysis without rotation and fixing the number of factors extracted to one. The percentage of variance explained was 32% which is less than the threshold of 50% (Podsakoff and Organ, 1986) thus providing support that the common method variance was not a significant concern for this study.

The IMSS VI dataset is divided into three sections. Section A asks for *business unit level* questions while sections B and C seek *plant level* data. Thus, the data of constructs from different sections in the questionnaire in a single study should be selected appropriately. This is because data of a particular plant in a business unit may not be relatable with the data at the business unit level as the business unit may have more than one plant. Since the constructs used in this paper come from sections A and C of the IMSS survey, we could only use the 307 data points that are from those businesses that only have one plant (see Table 1 for sample demographics).

Moreover, we inspected all data items for any missing values. There were a relatively low percentage of missing values (between 0 percent and 6 percent). Thus, replacing missing values for each item with the respective series mean was acceptable if these were missing completely at random (MCAR) (Tabachnick et al., 2007, p. 67). To test the MCAR hypothesis, we performed Little's (1988) test with the missing value analysis procedure and expectation-maximization estimation in SPSS (Sousa & da Silveira, 2017). The χ^2 statistic was insignificant ($p = 0.91$), so data could be considered MCAR and thus missing values were imputed with respective series mean.

3.2. Measurement scale

All the constructs in this study were operationalized as first-order reflective constructs containing multiple items (Jarvis et al., 2003) from IMSS VI survey (Vanpoucke et al., 2014). Servitization orientation

Table 1
Sample demographics.

Sample characteristics	Number	%
Firm size (number of employees)		
Small (less than 250)	205	66.78
Medium (251–500)	51	16.61
Large (more than 500)	51	16.61
Industry		
ISIC 25 Manufacture of fabricated metal products, except machinery and equipment	101	32.90
ISIC 26 Manufacture of computer, electronic and optical products	39	12.70
ISIC 27 Manufacture of electrical equipment	47	15.31
ISIC 28 Manufacture of machinery and equipment not elsewhere classified	87	28.34
ISIC 29 Manufacture of motor vehicles, trailers, and semi-trailers	19	6.19
ISIC 30 Manufacture of other transport equipment	14	4.56
Region and Country (country sample size)		
<i>Europe and North America</i>	170	55.37
Belgium (3), Canada (12), Denmark (12), Finland (19), Hungary (24), Italy (14), Netherlands (19), Norway (3), Portugal (7), Romania (22), Slovenia (7), Spain (9), Sweden (3), Switzerland (4), United States of America (12)		
<i>Asia and South America</i>	137	44.63
Brazil (7), China (57), India (43), Japan (24), Malaysia (1), Taiwan (5)		

Total useable sample size = 307, ISIC: International Standard Industrial Classification.

was operationalized at the organization level (Homburg et al., 2002) to capture both the inclination as well as the capacity building for services using Likert scale from 1 (none) to 5 (high) in terms of current level implementation of action programs related to expanding the service offering to customers (by investing in new service development) (SO1), developing the skills needed to improve the service offering (SO2) and designing products so that the after sales service is easier to manage/offer (design for maintenance) (SO3). In a recent study by Sousa and da Silveira (2017), similar items were labelled as service capability that underrepresent the items. The major difference between a firm's *capability* and *orientation* is that the *capability* refers to the ability of the firm to do something "in a reliable and at least minimally satisfactory manner" (Helfat and Winter 2011; Sousa & da Silveira, 2017) while the *orientation* consists of both inclination/openness and capacity of the firm to do something (Bouncken and Koch, 2007; Chen et al., 2009; Sousa & da Silveira, 2017). In other words, servitization orientation refers to a manufacturer's openness/inclination and capacity to carry out the management (design and delivery) of the services it offers besides the product offerings (Bouncken and Koch, 2007; Chen et al., 2009; Sousa & da Silveira, 2017). A manufacturing firm's investments in new service development, enhancement of skills of employees for service delivery and development of products for enhancing after sales service depict both the manufacturing organization's intention and capacity building to offer integrated (i.e., goods and services) offerings. Thus, servitization orientation is more appropriate construction of above three items (SO1, SO2 and SO3).

Internal integration was measured as the current level of implementation of action programs related to cross functional integration among purchasing, operations/manufacturing and sales departments. Information sharing and joint decision making among these departments capture the end-to-end coordination and cooperation inside the firm (Jajja et al., 2018; Zhao et al., 2011). Therefore, the internal integration construct was operationalized using Likert scale from 1 (none) to 5 (high) as information sharing (II1 and II3) and joint decision-making (II2 and II4) between manufacturing and purchasing, and between manufacturing and sales respectively, about sales forecast, production plans, production progress, etc. Similarly, supplier and customer integration were measured through four items each reflecting the current level of implementation of action programs related to information sharing (SI1 and CI1), developing collaborative approaches (SI2 and CI2), joint decision making (SI3 and CI3), and system coupling (SI4 and CI4) with key suppliers and customers respectively based on Likert scale from 1 (none) to 5 (high). Similar items were from IMSS VI were previously used in several other studies to capture these supply chain integration constructs (Cheng et al., 2016; Jajja et al., 2018).

We used the operationalization of servitization as suggested and used by Sousa and da Silveira (2017) and Li et al. (2018) in their work. Both the studies measure basic and advanced services from a list of eight services given in IMSS VI survey questionnaire. These services cover a comprehensive array of services that have typically been associated with servitization in the literature (Gebauer et al., 2005; Neely, 2008; Sousa & da Silveira, 2017). Services whose aim is to set up and maintain basic product functionality are included under basic services and are measured by three items including maintenance and repair of products sold to customers (BS1), installation/implementation services (BS2), and spare-parts/consumables provision for customers (BS3). On the other hand, services that co-create value with the customer considering customers' unique requirements and goes beyond mere basic product functionality are classified as advanced services and are measured by five items including rental/lease of products (with responsibility for maintenance, repair and operation) (AS1), product upgrades (software, product modifications) (AS2), help desk/customer support center (AS3), training in using the products (AS4), and consultancy services (AS5). Respondents were asked to rate the extent that the above services were offered alongside with the products by the business unit on a five-point Likert scale from 1 (none) to 5 (high).

Financial performance of the firm was operationalized by growth in sales and profitability as suggested by Sousa and da Silveira (2017) and Li et al. (2018). Growth in profitability is commonly measured with growth in return on sales (net profits as a percentage of sales) (Suarez et al., 2013). Respondents were asked to indicate sales and return on sales of the business unit in 2012 compared to three year ago on a five point Likert scale from 1 (much lower) and 5 (much higher).

Earlier versions of the IMSS data (IMSS III) used objective measures for sales and profitability, and the respondents were asked to report the exact figures of sales and return on sales. However, it was realized that the companies showed typical unwillingness to share actual performance data. By contrast, the later rounds (IMSS IV, V and VI) used five-point Likert scales to measure sales and profitability. Many scholars have used managers' perception to measure financial performance in the operations management literature: Chen and Tsou (2012); Gebauer and Putz (2007); Hong et al. (2015); Moorman and Rust (1999); Oliva et al. (2012). Moreover, prior research has found a strong correlation between subjective assessments and their objective counterparts (e.g., Dess and Robinson Jr., 1984). Table 2 provides details of measurement items.

Firm size, industry and region are used as control variables as these factors could have an effect on servitization and firm performance (Cheng et al., 2016; Suarez et al., 2013). Since the data we use come from firms in different industries and regions and of all sizes, it is necessary to control for these differences among firms. Firm size was measured in terms of logarithm of total number of employees of a

Table 2
Construct measurement.

Service Orientation (Cronbach's alpha = 0.817, CFI = 1.000)
SO1 – Expanding the service offering to your customers (e.g. by investing in new service development) (FL = 0.822)
SO2 – Developing the skills needed to improve the service offering (FL = 0.903)
SO3 – Designing products so that the after sales service is easier to manage/offer (e.g. design for maintenance) (FL = 0.690)
Supplier Integration (Cronbach's alpha = 0.822, CFI = 0.978)
SI1 – Sharing information with key suppliers (about sales forecast, production plans, order tracking and tracing, delivery status, stock level) (FL = 0.803)
SI2 – Developing collaborative approaches with key suppliers (e.g. supplier development, risk/revenue sharing, long-term agreements) (FL = 0.785)
SI3 – Joint decision making with key suppliers (about product design/modifications, process design/modifications, quality improvement and cost control) (FL = 0.737)
SI4 – System coupling with key suppliers (e.g. vendor managed inventory, just-in-time, Kanban, continuous replenishment) (FL = 0.694)
Internal Integration (Cronbach's alpha = 0.911, CFI = 0.936)
II1 – Sharing information with purchasing department (about sales forecast, production plans, production progress and stock level) (FL = 0.750)
II2 – Joint decision making with purchasing department (about sales forecast, production plans and stock level) (FL = 0.812)
II3 – Sharing information with sales department (about sales forecast, production plans, production progress and stock level) (FL = 0.909)
II4 – Joint decision making with sales department (about sales forecast, production plans and stock level) (FL = 0.906)
Customer Integration (Cronbach's alpha = 0.867, CFI = .997)
CI1 – Sharing information with key customers (about sales forecast, production plans, order tracking and tracing, delivery status, stock level) (FL = 0.825)
CI2 – Developing collaborative approaches with key customers (e.g. risk/revenue sharing, long-term agreements) (FL = 0.855)
CI3 – System coupling with key customers (e.g. vendor managed inventory, just-in-time, Kanban, continuous replenishment) (FL = 0.741)
CI4 – Joint decision making with key customers (about product design/modifications, process design/modifications, quality improvement and cost control) (FL = 0.744)
Basic Services (Cronbach's alpha = 0.786, CFI = 0.956)
BS1 – Maintenance and repair of products sold to customers (FL = 0.793)
BS2 – Installation/implementation services (FL = 0.859)
BS3 – Spare-parts/consumables provision for customers (FL = 0.629)
Advanced Services (Cronbach's alpha = 0.835, CFI = 0.99)
AS1 – Rental/lease of products (with responsibility for maintenance, repair and operation) (FL = 0.460) - Dropped
AS2 – Product upgrades (software, product modifications) (FL = 0.753)
AS3 – Helpdesk/customer support center (FL = 0.750)
AS4 – Training in using the products (FL = 0.803)
AS5 – Consultancy services (FL = 0.715)

CFI: Comparative fit index, FL: Factor loading.

business unit (Jajja et al., 2018; Peng et al., 2013). Industry type is operationalized as a binary variable using ISIC classifications (Wien-garten et al., 2014) with two major types, high-tech (ISIC 26 and 27) (computer, electronic, optical products, and electrical equipment) and low-tech (ISIC 25, 28, 29 and 30) (fabricated, machinery, and transportation products) (Jajja et al., 2018). There are significant differences between the two industry types as each may have varying level of technological and competitive environments, industrial structure and customer demand (Law and Gunasekaran, 2012; Weijiao et al., 2018). Finally, region encompasses many factors including the resource abundance and structure, the stability of economic environment and the presence of regulatory laws and strength of social institutions (Jajja et al., 2018; Weijiao et al., 2018) and is operationalized as a dichotomous variable with two types: Europe and North America versus Asia and South America.

4. Results

4.1. Measurement model

The two step method for structural equation modelling recommended by Anderson and Gerbing (1988) was used to test the hypotheses. AMOS Version 22 modelling software was used for the estimations. As a first step, the measurement model was developed for testing construct validities and reliabilities followed by the second step that tested the structural model. All constructs were subject to confirmatory factor analysis (CFA) which provided overall acceptable model fit ($\chi^2_{188=df} = 440.2$, RMSEA = 0.066, CFI = 0.937, TLI = 0.923, IFI = 0.938, NFI = 0.897). Factor loadings of all items are significant and exceeded the satisfactory limit of 0.60 (Hair et al., 2010) except for one item (AS1). The loading for AS1 is below 0.50 and is dropped to maintain the construct validity. The Cronbach alpha and composite reliability of each construct were above the satisfactory limit of 0.70 (Nunnally, 1978; Raykov, 1997) thus satisfying the construct reliability and internal consistency of the scales. The unidimensionality of the constructs was established by estimating the comparative fit index (CFI) of each construct (Falissard, 1999). For this study the CFI of all constructs have a value greater than 0.90 satisfying the unidimensionality requirements of all the constructs. All the items had sufficient loadings to their respective constructs providing further evidence for unidimensionality (Cheng et al., 2016). Tables 2 and 3 provide the values of factor loadings, Cronbach's alpha, CFI, and composite reliability for all the constructs.

All AVE values are above 0.50 fulfilling the condition of convergent validity (Fornell and Larcker, 1981). (Table 3). Discriminant validity was estimated using chi square difference test. The correlation between each pair of constructs in the CFA model was set equal to 1 to find the chi-square value of constrained model. The constrained model's chi-square value was compared with the chi-square value of unconstrained model. A significant difference (p-value < 0.05) in the values of chi-square for all pairs of constructs provides evidence of discriminant validity (Segars and Grover, 1993). Hence, discriminant validity did not pose any serious issue for this study (Fornell and Larcker, 1981; Li et al., 2007; Segars and Grover, 1993).

Finally, since the responses were sought from various regions with different cultural orientations, we tested for the measurement invariance of all the constructs using the CFA approach (Baumgartner and Steenkamp, 1998; Jajja et al., 2017). For this we segregated the data into two geographically determined groups: Europe and North America; and Asia and South America (Table 1). The unconstrained CFA model in which the items of all the constructs in the two groups were freely estimated in the AMOS model corresponding to each subsample. Values of the fit indices ($\chi^2_{376=df} = 670.281$, RMSEA = 0.051, CFI = 0.927, TLI = 0.911, IFI = 0.929, NFI = 0.852) indicated satisfactory fit. All factor loadings were above 0.60 and significant (p < 0.01) with the exception of one item of servitization orientation (factor loadings: 0.578) and one item of advanced services (factor loading: 0.575) in the Europe and

Table 3
Correlations among latent constructs.

Construct	CR	Basic Services	Servitization Orientation	Supplier Integration	Internal Integration	Customer Integration	Advanced Services
Basic Services	0.808	0.587					
Servitization Orientation	0.850	0.554	0.656				
Supplier Integration	0.842	0.301	0.495	0.571			
Internal Integration	0.910	0.046	0.295	0.561	0.717		
Customer Integration	0.871	0.117	0.402	0.781	0.534	0.629	
Advanced Services	0.842	0.807	0.699	0.435	0.154	0.264	0.571

Diagonal entries are AVE values of the constructs, CR: Composite Reliability.

North America group but still both items were significant ($p < 0.01$). This revealed that all the constructs exhibited reasonable configural invariance across the two subsamples. In addition, the χ^2 test was used to assess the statistical significance of $\Delta\chi^2$ between the constrained and unconstrained multi-group CFA models. For the constrained CFA model, regression weights for all items were fixed between the two groups. This yielded $\chi^2_{398=df.} = 694.319$, thus $\Delta\chi^2$ was insignificant ($\Delta\chi^2_{22= \Delta df.} = 24.038$, $p = 0.345$) and the values of other model fit indices (RMSEA = 0.049, CFI = 0.927, TLI = 0.915, IFI = 0.928, NFI = 0.846) remained satisfactory. As such, there is evidence to suggest full metric invariance and thus support for measurement equivalence across the subsamples (Cheng et al., 2016; Jajja et al., 2017).

4.2. Structural model

Structural equation modelling (SEM) is a recommended approach for hypotheses testing when the research involves complex models seeking to test theory using existing theoretical foundation (Shah and Goldstein, 2006). The full structural model (H₁–H₈) including the control variables (size, industry and region) exhibited good model fit ($\chi^2_{288=df.} = 678.047$, RMSEA = 0.067, CFI = 0.908, TLI = 0.888, IFI = 0.910, NFI = 0.853) (Hu and Bentler, 1999). Table 4 shows path estimates and their significance.

The results provide support for H_{1a}, H_{1b} and H_{1c}, suggesting that servitization orientation has a positive and significant impact on firm's internal integration, supplier integration and customer integration respectively. As far as the relationship between supply chain integration and servitization is concerned, we have interesting results. First, we do not get support for the effect of internal integration on the provision of basic services (H_{2a} not supported) and for the provision of advanced services (H_{2b} not supported). Second, we find that supplier integration has positive significant effect on the provision of basic services (H_{3a} supported) while we do not find evidence for its effect on the provision of advanced services (H_{3b} not supported). Finally, the results suggest that customer integration negatively impacts the provision of basic services (H_{4a} not supported) while it positively and significantly

influences the provision of advanced services (H_{4b} supported). We also get support for H₅ that a firm's orientation towards servitization positively influences the provision of basic services. Results also suggest the provision of basic services positively influences the provision of advanced services and the influence is significant (H₆ supported).

The results provide support for the insignificant effect of the provision of basic services on sales growth (H_{7a} supported) and the negative significant effect of basic service provision on ROS growth (H_{7b} supported). Lastly, the provision of advanced services has significant positive effects on the sales (H_{8a} supported) and ROS growth (H_{8b} supported). Moreover, the control variables region and industry type have insignificant relationships with the dependent variables, while the control variable size has significant and positive relationship with servitization.

The mediation effects hypothesized in H9 through H11 cannot be tested directly in the full structural model because there are three parallel mediators (internal integration, supplier integration, and customer integration) in the relationship between servitization orientation and provision of services. It is recommended to separately estimate each indirect path in case there are multiple parallel mediators in the relationship between two variables (Macho and Ledermann, 2011). Generally, there are three approaches suggested in the extant research to test these specific indirect paths: matrix methods, phantom variable based approach, and user-defined estimand (Bollen, 1989; Cheung, 2007; Kosiba et al., 2018).

Though phantom model approach, compared to matrix method, offers less tedious way for estimating complex structural models over graphical user interface SEM software, it still requires to build a separate phantom model besides the original model (Macho and Ledermann, 2011). However, user-defined estimand approach on the other hand is at the same time more convenient (as no additional model building is required) and powerful (as it enables the bootstrapping of confidence intervals) approach for complex structural model testing (Gaskin, 2016). Since, user-defined estimand approach is based on the bootstrapping technique, it has a higher statistical power, can accommodate multiple mediation hypotheses in a model, is more robust to the assumptions of

Table 4
Hypotheses test results (main effects).

Hypothesis	Standardized Coefficient	Result
H _{1a} : Servitization Orientation → Internal Integration	0.282***	Supported
H _{1b} : Servitization Orientation → Supplier Integration	0.384***	Supported
H _{1c} : Servitization Orientation → Customer Integration	0.295***	Supported
H _{2a} : Internal Integration → Basic Services	−0.139 ^{n.s.}	Rejected
H _{2b} : Internal Integration → Advanced Services	−0.010 ^{n.s.}	Rejected
H _{3a} : Supplier Integration → Basic Services	0.291***	Supported
H _{3b} : Supplier Integration → Advanced Services	0.061 ^{n.s.}	Rejected
H _{4a} : Customer Integration → Basic Services	−0.276***	Rejected
H _{4b} : Customer Integration → Advanced Services	0.165**	Supported
H ₅ : Servitization Orientation → Basic Services	0.658***	Supported
H ₆ : Basic Services → Advanced Services	0.778***	Supported
H _{7a} : Basic Services → Sales Growth	−0.128 ^{n.s.}	Supported
H _{7b} : Basic Services → ROS Growth	−0.386**	Supported
H _{8a} : Advanced Services → Sales Growth	0.279*	Supported
H _{8b} : Advanced Services → ROS Growth	0.515***	Supported

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, n.s. = not significant.

Table 5
Hypotheses test results (mediation effects).

Hypothesis	IV	MV	DV	Effect of IV on MV (a)	Effect of MV on DV (b)	Direct effect (c')	Indirect effect	SE of indirect effect	95% ConI. for mean indirect effect
H _{9a}	SO	II	BS	0.282***	-0.139 ^{n.s.}	0.658***	-0.035 ^{n.s.}	0.027	(-0.089)-(-0.001)
H _{9b}	SO	II	AS	0.282***	-0.010 ^{n.s.}	0.307***	-0.003 ^{n.s.}	0.025	(-0.045)-(-0.037)
H _{10a}	SO	SI	BS	0.384***	0.291***	0.658***	0.100**	0.043	(0.040)-(0.179)
H _{10b}	SO	SI	AS	0.384***	0.061 ^{n.s.}	0.307***	0.028 ^{n.s.}	0.045	(-0.042)-(-0.106)
H _{11a}	SO	CI	BS	0.295***	-0.276***	0.658***	-0.073**	0.036	(-0.148)-(-0.029)
H _{11b}	SO	CI	AS	0.295***	0.165**	0.307***	0.058*	0.034	(0.012)-(0.125)

***p < 0.001, **p < 0.01, *p < 0.05, n.s. = not significant.

IV: Independent variable, MV: Mediating variable, DV: Dependent variable, SE: Standard error, ConI: Confidence Interval, SO: Servitization Orientation, SI: Supplier Integration, II: Internal Integration, CI: Customer Integration, BS: Basic Services, AS: Advanced Services.

normality, and maintains acceptable level of Type 1 error when applied using large sample size (Rungtusanatham et al., 2014). Thus, we used user-defined estimand approach that employs bias-corrected bootstrapping technique generating 5000 resamples to empirically estimate the indirect effects and their significance. The results are presented in Table 5, summarizing the estimated standardized effects and respective 95 percent confidence interval for each hypothesized relationship.

The results of the bootstrapping analysis show that both the indirect effects (i.e. from SO to provision of BS and SO to provision of AS) through internal integration are not significant (p-value > 0.05), thus rejecting H_{9a} and H_{9b}. In addition, the results show that the indirect effects of SO on provision of BS through supplier integration (p-value < 0.01) is positive and significant while through customer integration (p-value < 0.01) is negative and significant. The direct effect of SO on provision of BS is significant in case of both mediators, thus suggesting partially positive and negative mediation effects of supplier and customer integration in the relationship between SO and provision of BS respectively (Zhao et al., 2010), thus supporting H_{10a} and rejecting H_{11a}.

Finally, the results indicate that the indirect effect of SO on provision of advanced services through supplier integration (p-value > 0.05) is insignificant (thus rejecting H_{10b}) and customer integration (p-value < 0.05) is positive and significant. The direct effect of SO on provision of advanced services is also significant, thus suggesting partial mediation effect of customer integration in the relationship between SO and provision of advanced services (Zhao et al., 2010), thus supporting H_{11b}. A summary of mediation hypotheses results is presented in Table 6.

4.3. Contextual analysis

We tested the robustness of the hypothesized model using contextual analysis as performed by Yang et al. (2011) and Paul et al. (2014). Table 7 shows the results of the aggregated data along with the contextual analysis. The sample was segregated into three different sets with two groups in each i.e., small firms (size < 250 employees) versus medium/large firms (size > 250 employees), European & North American firms versus Asian & South-American firms, developed countries versus developing countries. The results indicate that contextual factors such as firm size, regional and economic differences affect the

Table 6
Summary results (mediation effects).

Relationships	Results
H _{9a} : Servitization Orientation → Internal Integration → Basic Services	Rejected
H _{9b} : Servitization Orientation → Internal Integration → Advanced Services	Rejected
H _{10a} : Servitization Orientation → Supplier Integration → Basic Services	Supported
H _{10b} : Servitization Orientation → Supplier Integration → Advanced Services	Rejected
H _{11a} : Servitization Orientation → Customer Integration → Basic Services	Rejected
H _{11b} : Servitization Orientation → Customer Integration → Advanced Services	Supported

implementation level of different dimensions of supply chain integration and different types of service provision, and accordingly the performance outcomes (Hong and Roh, 2009). Below, we highlight some of the important and interesting findings.

The performance outcomes of different types of service provision seem more promising, and aligned with our initially hypothesized model, for medium/large firms, Asian & South American firms and the firms in developing countries, compared to small firms, European and North American firms and firms in the developed countries. Moreover, the association between different dimensions of supply chain integration and service provision types varies based on firm size and geographic and economic regional differences. For example, when it comes to firm size, differences are obvious in terms of the relationships between SI and BS, SI and AS, and CI and AS. Note that in small firms, the effect between CI and AS is non-significant while there is a strong positive effect of CI on AS in large/medium firms as hypothesized initially. Similarly, the relationships between SI and BS, CI and BS, and CI and AS differ for firms in different geographic and economic regions. For example, firms from Europe & North America and from developed countries show negative and significant relationship between CI and AS while this relationship turns positive and higher in significance for firms from Asia & South America and from developing countries. Besides these differences, there are some similarities across firms of all sizes and from varied geographic and economic outlook. For example, relationships between SO→BS, SO→SI, BS→AS, II→AS and BS→S_G are consistent in all firms everywhere.

A possible explanation for variation in the above results can be attributed to the unit of analysis employed in our data, i.e. businesses having only one manufacturing unit/plant. Prior research on servitization suggests that manufacturing firms in more developed economies and advanced geographic regions establish separate business units for offering services as these firms naturally progress after initially offering services in parallel to their manufacturing operations (Oliva and Kaltenberg, 2003; Turunen and Finne, 2014). In their recent study on internationalization of servitization, Vendrell-Herrero et al. (2018) find that more than half of the servitized firms in developed countries have externalized their service function and have started offering services via cross-border strategic alliances or mergers and acquisitions. Moreover, Szász et al. (2017) proposed that the higher the development level of economic context, the more possibilities there are for a firm to organize the provision of services as a separate business unit. Thus, the less significant relationships as discussed above might indicate that manufacturers in more developed and advanced regional contexts offer more and complex services but externalize their service provision at the same time, by establishing a separate business unit. Thus, while our results indicate that manufacturing units in developing and Asian and South American regions have significant results as initially hypothesized, the same might hold true if the service provision of manufacturing companies with multiple units are considered in more advanced regions. Moreover, our results on the outcomes of servitization coincide with the findings of Moreno et al. (2019). Arguing the counter-intuitive results, that the firms from developing countries and the geographic regions of

Table 7
Contextual analysis (main effects).

Hypothesis	Aggregated Sample ^a (n = 307)	Firm Size		Regions (Geographic)		Regions (Economic)	
		Small (n = 205)	Medium/ Large (n = 102)	Europe & North America (n = 170)	Asia & South America (n = 137)	Developed (n = 148)	Developing (n = 159)
H _{1a} : SO → II	0.301***	0.347***	0.149 ^{ns}	0.166 [†]	0.405***	0.237*	0.312***
H _{1b} : SO → SI	0.399***	0.441***	0.336***	0.303**	0.453***	0.296**	0.500***
H _{1c} : SO → CI	0.298***	0.332***	0.234*	0.131 ^{ns}	0.467***	0.199*	0.444***
H _{2a} : II → BS	-0.152 ^{ns}	-0.144 ^{ns}	-0.133 ^{ns}	-0.159 ^{ns}	-0.123 ^{ns}	-0.284*	-0.146 [†]
H _{2b} : II → AS	-0.003 ^{ns}	0.022 ^{ns}	-0.083 ^{ns}	0.066 ^{ns}	-0.024 ^{ns}	0.021 ^{ns}	0.109 ^{ns}
H _{3a} : SI → BS	0.259**	0.215*	0.255 [†]	0.308**	0.264 [†]	0.473**	0.100 ^{ns}
H _{3b} : SI → AS	0.099 ^{ns}	0.189*	-0.007 ^{ns}	0.145 ^{ns}	-0.042 ^{ns}	0.218 ^{ns}	-0.040 ^{ns}
H _{4a} : CI → BS	-0.258***	-0.192*	-0.316*	-0.105 ^{ns}	-0.502***	-0.189 ^{ns}	-0.283**
H _{4b} : CI → AS	0.151*	-0.032 ^{ns}	0.394***	-0.186*	0.400***	-0.186 [†]	0.321***
H ₅ : SO → BS	0.630***	0.636***	0.654***	0.549***	0.811***	0.471***	0.752***
H ₆ : BS → AS	0.769***	0.751***	0.799***	0.762***	0.790***	0.738***	0.760***
H _{7a} : BS → S_G	-0.129 ^{ns}	0.094 ^{ns}	-0.287 ^{ns}	0.172 ^{ns}	-0.155 ^{ns}	0.025 ^{ns}	-0.193 ^{ns}
H _{7b} : BS → ROS_G	-0.358 [†]	-0.236 ^{ns}	-0.411*	-0.424*	-0.286 [†]	-0.323 ^{ns}	-0.423**
H _{8a} : AS → S_G	0.292*	0.065 ^{ns}	0.400*	-0.164 ^{ns}	0.452**	0.069 ^{ns}	0.394**
H _{8b} : AS → ROS_G	0.484***	0.350 [†]	0.547**	0.379 [†]	0.589***	0.338 ^{ns}	0.667***

***p < 0.001, **p < 0.01, *p < 0.05, [†]p < 0.10, ns = not significant.

SO: Servitization Orientation, SI: Supplier Integration, II: Internal Integration, CI: Customer Integration, BS: Basic Services, AS: Advanced Services, S_G: Sales Growth, ROS_G: ROS Growth.

^a This aggregated model was tested without firm size as a control variable.

Asia and South America correspond to a stronger relationship between servitization and firm performance compared to firms from Europe & North America and from developed countries, [Moreno et al. \(2019\)](#) write, “industry plants in developing countries can still harness the benefits of being first-movers, whereas, in developed countries, servitization may have become an order qualifier rather than a factor of differentiation”.

The results of the above preliminary analysis show that context does play a role in the perspective of service orientation, supply chain integration, servitization (advanced and basic services) and performance. However, since, this study is one of the first to empirically explore the association between supply chain integration and servitization, therefore, the focus of the study has been explicitly on highlighting the facilitating role of supply chain integration in servitization. Hence, future research can further in detail explore the role of context in the relationship between supply chain integration and servitization leading to ascertaining any underlying causes of the differences.

5. Discussion

5.1. Servitization orientation and servitization: role of supply chain integration

Based on the RDT, this study provides a comprehensive understanding of partner-led enabling mechanisms in enhancing servitization. The paper extends the RDT ([Pfeffer and Salancik, 1978](#)) to servitization literature, by explaining how servitization orientation impacts different dimensions of supply chain integration that in turn affect different types of service provision. This study provides theoretical and empirical support for the idea that supplier and customer integration act as important enabling mechanisms in the association between servitization orientation and the provision of basic and advanced services thereby adding to the limited research on the supply chain level antecedents of servitization. In fact, our paper builds on the work of [Sousa and da Silveira \(2017\)](#) who note that “it would be important for future research to examine the capabilities at a more detailed level, ... encompassing external, network-based capabilities.” The current paper makes a contribution in this direction.

Our findings lend credence to strategy-structure-conduct-performance relationship framework ([Bain, 1951](#); [Chandler, 1962](#); [Galan and Sanchez-Bueno, 2009](#); [Ralston et al., 2015](#)). Firms having

strategic servitization orientation can achieve the conduct of servitization via structural adaptation in its supply chain relationships (mediation relationship), ultimately affecting firm performance. This implies that structure serves as an important mediating mechanism for moving from strategy to conduct. Our findings suggest that supply chain integration serves as a viable medium for moving from manufacturing firm's servitization orientation to actually offering different types of services, thus providing novel insights in the servitization literature. Prior research has suggested either firm level or environment level antecedents of servitization without explicitly delineating the supply chain level adaptation required for servitization ([Raddats et al., 2016](#); [Sousa & da Silveira, 2017](#); [Szász et al., 2017](#)). Moreover, our findings suggest that the effect of servitization orientation on the provision of basic and advanced services is different for supplier integration and customer integration. In other words, specific structural adjustments are required for achieving specific type of conduct. This paper makes one of the initial contributions on the interface of servitization-supply chain management literature by examining supply chain level enabling mechanism for servitization.

5.2. Servitization orientation and supply chain integration

Drawing from RDT this paper contends that manufacturing firm's strategic move towards servitization enhances the collaboration and communication among key internal functional units (procurement, operations and sales) and with key suppliers and customers, to address the intangible, heterogeneous, inseparable, and perishable nature of services ([Baines and Lightfoot, 2013](#); [Lightfoot et al., 2013](#); [Pfeffer and Salancik, 2003](#)). In doing so, this paper makes an initial attempt in proposing and providing empirical support for the relationship between servitization orientation and supply chain integration. Very few studies have looked at how a manufacturing firm's orientation for services ensues organizational initiatives such as implementation of human and technical lean practices ([Paul et al., 2014](#)) and affects organizational outcomes such as service volume and product sales ([Antico et al., 2008](#)). Similarly, though scholars have studied various antecedents of supply chain integration such as supply chain risk ([Jajja et al., 2018](#)), and market and learning orientation ([Braunscheidel and Suresh, 2009](#)) there is very little research seeking to understand the associations between servitization orientation and supply chain practices. Thus, the theorization and empirical support for the association between service

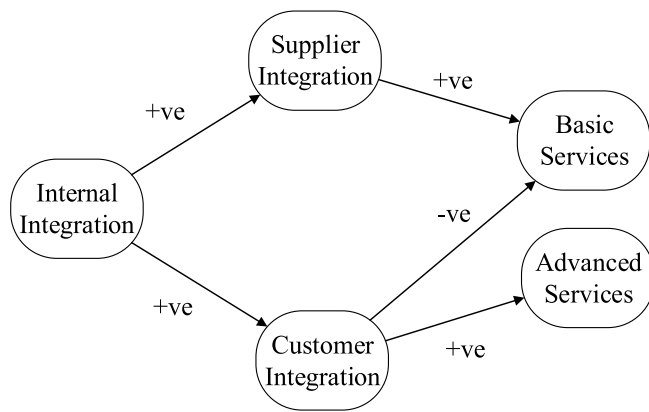


Fig. 2. Significant associations between supply chain integration and servitization.

orientation and supply chain integration in the current research seeks to direct the discussion in the service and supply chain management literature in a relatively less explored domain.

5.3. Supply chain integration and servitization

Our findings suggest that three dimensions of supply chain integration (i.e., supplier, internal, and customer) are differently related to each type of service provision (i.e., basic and advanced). As depicted in Fig. 2, supplier integration is found to be more conducive for the provision of basic services, while customer integration is found to enhance the provision of advanced services. These differences seem to ensue from the differences between basic and advanced services and the different competencies required for each (Smith et al., 2014; Sousa & da Silveira, 2017; Szász et al., 2017; Weijiao et al., 2018). Since basic services are more product related services, provision of such services requires real-time resource planning along with the knowledge of product parts and product design which could be enhanced by the support from key suppliers. Thus, integration with key suppliers in terms of risk sharing, transfer of knowledge and joint-decision making equip the manufacturing firm for enhanced provision of basic services (Kowalkowski et al., 2009). Thus our findings support and complement the work of Sousa and da Silveira (2017) who argue that manufacturing firm's capabilities help in offering the provision of basic services and that integration with key suppliers play an important role in enhancing the capabilities required for the provision of basic services.

The provision of advanced services on the other side requires relatively more service-specific resources and competencies (Kowalkowski et al., 2009). Provision of such services is based on developing increased level of customer interactions and information sharing that help in getting access to the customer's resources. Provision of advanced services requires needed collaboration and joint decision making with the customer (Sampson, 2000). Thus, our findings are consistent with the service literature that emphasizes the importance of customer involvement in advanced services production i.e., coproduction (Chen et al., 2015; Sampson and Spring 2012). Contrary to our hypothesis, we find that increasing customer integration has lowering effect on the provision of basic services. The possible explanation for this apparent inconsistency seems to lie in the fact that since basic services are product related services, these can be offered to customers only initially (Ulaga and Reinartz, 2011). However, when customers are well integrated, they look for advanced services that are more important and value-adding instead of basic services that have relatively lesser benefits for customers (Sousa & da Silveira, 2017). In this manner our findings provide extensive empirical support to the qualitative work of Gebauer et al. (2005) who suggest that as the customer relationship gets stronger, provision of advanced service presents relatively higher value proposition compared to the provision of basic services. Integrated customers

view the provision of advanced services as more rewarding and try to substitute the provision of basic services with more advanced services.

Contrary to our hypothesis, internal integration is found to have lack of impact on servitization. Though surprising, this finding partially parallels with the qualitative assessments of Alghisi and Saccani (2015) who suggest that internal alignment does not last longer in the servitization journey of a manufacturing firm but instead helps the firm to seek external alignment with supply chain partners for enhancing servitization. It is primarily because the internal integration on its own cannot create the needed resources required for service production such as the resources that can come from the customer and the supplier (Sampson and Froehle, 2006). Instead internal integration helps firms in developing stronger relationships with external partners such as suppliers and customers. As already discussed, it is then the focal firm's integration with key suppliers and customers that help in arranging for complementary resources required for servitization. Our findings are consistent with the extant literature providing evidence for the foundational role of internal integration for supplier and customer integration as opposed to having a direct impact on the subsequent objectives (Cheng et al., 2016; Childerhouse and Towill, 2011; Jajja et al., 2018).

To the best of our knowledge, the current study is the first to use large scale empirical data to examine the relationship between supply chain integration and servitization. Earlier empirical research on the antecedents of servitization has either explored intra organizational or environmental level enablers of servitization. However, there is scarce empirical research on supply chain level factors that could play an important role in servitization of manufacturing firms, as involvement and support of key stakeholders in the firm's supply chain is essential for enhancing servitization (Marko et al., 2012). Thus, this study makes one of the initial attempts to study one of the key supply chain level enablers of servitization i.e., supply chain integration.

5.4. Servitization and financial performance

Our findings provide insights on the long-holding performance paradox in the servitization literature which suggests that the quantitative evidence is not conclusive about the positive effects of servitization on firm performance (Bustinza et al., 2018; Weijiao et al., 2018). We find that basic and advanced service provision has varying effect on the growth of financial performance. As hypothesized, provision of basic services is found to have no significant effect on growth of sales but a significant negative effect on growth in profitability. Moreover, the provision of advanced services, instead, is positively associated with the growth in sales and growth in profitability. These results have resembling parallels in the literature. For example, Kastalli and Van Looy (2013) found positive yet non-linear relationship between the scale of service activities of the servitized firm and profitability. Similarly, Sousa and da Silveira (2017) reported negative effects of provision of basic services on return on sales while positive effect of advanced service provision on sales and return on sales. Most of the earlier studies on the link between servitization and performance take into account the financial performance variables in levels. This study using two important growth variables of financial performance builds on evidence for the association between servitization and performance.

5.5. Managerial implications

The study offers novel insights for service operations and supply chain managers in three ways. First, managers who aim to enter into the service business, must acknowledge and appreciate the importance of supplier and customer integration. Clearly, a transformation to service business will often require a significant overhauling in the internal and external supply and demand relationships on the part of manufacturing firms, to ensure the right mix and acquisition of resources needed for servitization. Our findings do provide evidence that supplier, internal and customer integration offer the needed structural elements to achieve

servitization goals. Key suppliers and customers collaborate and play a significant role in realizing focal firm's preferred path, in our case servitization, by coordinated provision of resources. Lack of support from key suppliers or customers may restrain the achievement of servitization goals. Thus, managers should develop integrative practices with key suppliers and customers to enhance servitization.

Second, different type of service provision requires integration with different supply chain partners. Managers may start integration with key suppliers to offer basic services. However, integration with key customers play a significant role to enhance the provision of advanced services that involve direct customer resources and customer participation (Green et al., 2017). Moreover, managers should consider various ways to integrate with key suppliers and customers e.g., sharing information about sales forecast and production plans; developing collaborative approaches in terms of risk/revenue sharing and long-term agreements; and making joint decisions about product design/modifications, process design/modifications, quality improvement and cost control. Integration with suppliers and customers along these dimensions would enhance provision of services.

Third, provision of all service types may not be equally profitable. In terms of aspects which positively affect financial performance, the analysis identified the importance of advanced as opposed to basic services. Managers should aim for offering advanced services in order to get the positive growth in sales and return on sales. The provision of basic services does not have a direct favorable impact on financial performance, but it helps accelerate the provision of advanced services. Thus, managers may not see the direct benefits of the basic service provision but it provides the foundation for offering advanced services that in turn enhance the financial performance. Many manufacturing companies have given away their services either free of charge or at trivial price (Witell, 2013). However, the results suggest that companies should charge services to their customers more actively, strengthening the link between servitization and direct benefits in terms of financial performance. Managers should also be aware that provision of basic services is more prone to service paradox i.e., low service returns in spite of investment in basic service provision. Thus, a firm has to utilize basic service provision as a strategy to open up to the provision of more advanced services which will then provide more financial gains. In other words, provision of basic services should be considered as an investment strategy for enhancing advanced service provision as the former provides the considerable learning opportunities to manufacturing companies to enter into the market for advanced services. Overall, the findings provide guidelines to managers that can be leveraged in a manufacturer's journey towards successful servitization.

6. Conclusion and future research

Servitization orientation encourages a manufacturing firm to enhance supply chain integration to gain access to and coordinate the application of resources for offering services, ultimately affecting firm performance. The empirical examination provides support for the relationship between firm's orientation towards servitization and three forms of supply chain integration (supplier, internal and customer integration). In doing so this paper makes an initial attempt to fill voids in the empirical research by positing and testing whether the manufacturing firm's strategic move (servitization orientation) leads to structural changes in its supply chain (supplier, internal and customer integration). Secondly, the paper offers an empirical investigation of the relationship between supply chain integrative practices and provision of basic and advanced services. The paper lends support for the presence of positive effects of supplier and customer integration on the provision of basic and advanced services respectively. Given the earlier work of Marko et al. (2012) that qualitatively examines post-servitization buyer-supplier relationships across multiple dimensions, our argument and empirical findings provide quantitative and large data based examination of the pre-servitization changes required in the focal firm's

relationship among its key functional departments and with its key suppliers and customers to achieve servitization goals. Moreover, the earlier research on the antecedents of servitization lacks supply chain level factors (Neely, 2008; Raddats et al., 2016). Consequently, this paper is first to explore the effect of supply chain integration, an important supply chain level factor, on servitization.

In addition, this paper uses RDT and supply chain literature to argue for the mediating role of supplier, internal, and customer integration in the relationship between a firm's servitization orientation and provision of basic and advanced services. The empirical examination provides important insight that the manufacturing firm's servitization orientation can lead to enhanced provision of basic and advanced services through supplier and customer integration respectively. The empirical examination did not find support for the mediation effect of internal integration. As a result, this paper makes one of the initial efforts to discuss and use large-scale data to study supply chain integration as a response to servitization orientation for improving provision of basic and advanced services. Finally, the paper provides empirical explanation for the paradox regarding the performance implications of servitization. The paper shows that the provision of basic and advanced services has varying results on firm's financial performance, former having the negative while later having the positive effect thus supporting the earlier studies arguing a non-linear impact of servitization on financial performance.

There are several important future research opportunities ensuing from the findings and limitations of this study. First, the future research may further explore the uneven relationship between different dimensions of supply chain integration and different types of service provision. In this regard, building on the supply chain and servitization literature, future research may examine the association between buyer-supplier relationships and different types of service provision by considering the nature of the relationships e.g., formal versus informal buyer-supplier linkages (Saccani et al., 2014) and transactional versus longitudinal buyer-supplier relationships (Ayala et al., 2019). Second, the uneven association of various dimensions of supply chain integration and servitization (i.e., from no support to strong support) of the direct and mediation hypotheses offer room for future research. Future research may study the specific nature of relationship (formal vs. informal, weak vs. strong, etc.) for the examination of moderation or moderated mediation effects to add to the existing findings. The moderated mediation examination may reveal if supply chain integration has varying relevance under different nature of buyer-supplier linkages in the relationship between servitization orientation and the provision of services. Third, the cross-sectional nature of the data used in this study restricts from the examination of evolving nature of the suggested relationships between supply chain integration and servitization. The use of longitudinal data or case-based research may help study the evolving relationships among different dimensions of supply chain integration, different types of service provision and firm performance overtime. Moreover, the use of more objective measures of financial performance would further bring confidence to the findings of this study. Even though, a contextual analysis was conducted in this study to validate the robustness of the hypothesized relationships. However, future research would benefit greatly by investigating in depth the underlying causes of contextual differences in relation to service orientation, supply chain integration, servitization and financial performance. Finally, the current research employs data mainly from six specific manufacturing industries. Thus, future research may use data from other industrial sectors to examine the generalizability of this research across diverse industries.

Appendix A. Representative servitization, supply chain integration, and financial performance studies in servitization and supply chain management literature

Sr. No.	Author(s)	Year	Journal	Context	Method	Main Focus	Key Pertinent Findings ("→" = lead(s) to)
1	Kim and Toya	2019	JMTM	187 Japanese manufacturers in multiple industries	Survey	Antecedents (micro) of Servitization	- Charismatic leadership style → servitization, number and level of servitization. - Autocratic and autonomous leadership style negatively → servitization, number and level of servitization - Quantitative evidence is not conclusive about the positive effects of servitization on firm performance. - Servitization-performance relationship is subject to different methodological approaches, construct definitions and measurements, and contextual mediators/moderators. - Basic services → marketing performance. - Provision of advanced services → marketing, operational and financial performance. - Organizational characteristics moderate the relationship between provision of advanced services and marketing & financial performance. - Manufacturing capability → basic services. - Manufacturing capability → advanced services. - Service capability → basic services. - Service capability → advanced services. - Basic Services → advanced services. - Basic Services negatively → return on sales. - Advanced Services → sales. - Advanced Services → return on sales. - Service provision → service return. - Economic context negatively → service provision. - Service provision fully mediates the negative impact of economic context on service return. - Economic context moderates the relationship between service provision and service return. - Competitive motivations are most appropriate for producers of non-complex products. - Demand-based motivations appear important for all manufacturers. - Economic motivations appear to be most appropriate for suppliers of complex products and systems. - Supplier integration → cost and innovation performance.
2	Bustinza et al.	2018	IJBE	Literature Review	Literature Review	Consequences of Servitization	- Top management support positively moderates the relationship between SCI and financial performance. - Population density, competing populations, resource dependency, institutional linkages, technology, and political forces affect entry to servitization. - Competitive market environment → strategic customer service orientation. - Strategic customer service orientation → human lean practices. - Strategic customer service orientation → technical lean practices. - Rising degrees of product complexity and lower batch sizes are significantly related to a higher degree of servitization. - Sectoral innovation intensity is associated with rising shares of services. - There is U-shaped relationship between firm size and servitization. - Customer and supplier integration → new product performance. - Supplier integration → manufacturing flexibility → customer integration. - Supplier integration → service capability.
3	Li et al.	2018	HSM	Variety of manufacturing companies from 22 countries in five industries	Survey	- Consequences of Servitization - Antecedents of financial performance	
4	Sousa and da Silveira	2017	IJOPM	Multiple manufacturing industries from multiple countries	Survey	- Antecedents (micro) and consequences of servitization - Antecedents of financial performance	
5	Szász et al.	2017	JMTM	Multiple manufacturing industries from multiple countries	Survey	Antecedents (macro) and consequences of servitization	
6	Raddats et al.	2016	IJOPM	Senior managers in 25 companies in 12 sectors	In-depth interviews	Antecedents (micro) of servitization	
7	Wengarten et al.	2016	IJPE	Multiple manufacturing industries from multiple countries	Survey	Consequences of integration	
8	Zhao et al.	2015	IMM	Manufacturing firms from multiple industries in China	Survey	- Consequences of integration - Consequences of integration - Antecedents of financial performance	
9	Turunen and Finne	2014	EMJ	Conceptual Framework	Framework	Antecedents (macro) of servitization	
10	Paul et al.	2014	JSM	Multiple manufacturing industries from multiple countries	Survey	Antecedents (macro) and consequences of servitization orientation	
11	Dachs et al.	2014	SLJ	Variety of manufacturing companies from ten European countries	Survey	Antecedents (macro) of servitization	
12	He et al.	2014	IJPE	Multiple manufacturing industries in multiple countries	Survey	Consequences of integration	

(continued on next page)

(continued)

Sr. No.	Author(s)	Year	Journal	Context	Method	Main Focus	Key Pertinent Findings ('→' = lead(s) to)
13	Kastalli and Van Looy	2013	JOM	National subsidiaries of a global manufacturing firm turned product-service provider, in the 2001–2007 period	Longitudinal econometric study	• Antecedents (micro) and consequences of servitization • Antecedents of financial performance	• Product sales and service sales complement each other. • Customer proximity of service offerings reinforces the positive feedback from services to product sales. • There exists positive yet non-linear relationship between the scale of service activities and profitability. • There is a non-linear effect of the service offering on sales growth. • Network capabilities positively moderate the effect of the service offering on sales growth. • Supply delivery risk negatively → supplier, internal and customer integration. • Demand variability risk negatively → customer integration. • Supplier integration → customer satisfaction. • Internal and customer integration → competitive performance and customer satisfaction.
14	Kohtamäki et al.	2013	IMM	Manufacturing firms from machine and equipment manufacturing industry in Finland	Survey	• Consequences of Servitization • Antecedents of financial performance	• There is a non-linear effect of the service offering on sales growth. • Network capabilities positively moderate the effect of the service offering on sales growth. • Supply delivery risk negatively → supplier, internal and customer integration. • Demand variability risk negatively → customer integration. • Supplier integration → customer satisfaction. • Internal and customer integration → competitive performance and customer satisfaction.
15	Zhao et al.	2013	SCMIJ	Manufacturing plants in three industries from ten countries	Survey	• Antecedents and consequences of integration	• Demand variability risk negatively → customer integration. • Supplier integration → customer satisfaction. • Internal and customer integration → competitive performance and customer satisfaction.
16	Marko et al.	2012	IJOPM	High-value capital equipment manufacturer for the aerospace, defence and power sector along with two of its suppliers from UK	Case study	• Consequences of servitization	• Adoption of servitization has implications on buyer-supplier relationships across multiple dimensions (information exchange, operational linkages, legal bonds, cooperative norms, buyer and supplier adaptation). • Supplier and customer integration → quality, delivery, flexibility and cost performance. • Internal integration moderates the relationship between external integration strategy and both the delivery and the flexibility performance. • Internal integration does not moderate the relationship between external integration strategy and both the quality and the cost performance. • The provision of services supporting the product → provision of services supporting the clients' actions. • Product innovation activity positively moderate the relationship between the provision of services supporting the product and firm's profit growth. • Product innovation activity negatively moderate the relationship between the provision of services supporting the clients' actions and firm's profit growth. • Market orientation → internal and external integration and external flexibility. • Learning orientation → internal integration. • Internal integration → external integration. • Internal integration, external integration, and external flexibility → SC agility.
17	Schoenherr and Swink	2012	JOM	Broader set of manufacturing industries, as well as distribution and retail firms from many countries	Survey	• Consequences of integration	• Supplier and customer integration → quality, delivery, flexibility and cost performance. • Internal integration moderates the relationship between external integration strategy and both the delivery and the flexibility performance. • Internal integration does not moderate the relationship between external integration strategy and both the quality and the cost performance. • The provision of services supporting the product → provision of services supporting the clients' actions. • Product innovation activity positively moderate the relationship between the provision of services supporting the product and firm's profit growth. • Product innovation activity negatively moderate the relationship between the provision of services supporting the clients' actions and firm's profit growth. • Market orientation → internal and external integration and external flexibility. • Learning orientation → internal integration. • Internal integration → external integration. • Internal integration, external integration, and external flexibility → SC agility.
18	Eggert et al.	2011	IMM	Mechanical engineering industry in Germany	Longitudinal panel surveys	• Consequences of Servitization • Antecedents of financial performance	• The provision of services supporting the product → provision of services supporting the clients' actions. • Product innovation activity positively moderate the relationship between the provision of services supporting the product and firm's profit growth. • Product innovation activity negatively moderate the relationship between the provision of services supporting the clients' actions and firm's profit growth. • Market orientation → internal and external integration and external flexibility. • Learning orientation → internal integration. • Internal integration → external integration. • Internal integration, external integration, and external flexibility → SC agility.
19	Braunscheidel and Suresh	2009	JOM	Manufacturing organizations from the database of Institute of Supply Management	Survey	• Antecedents and consequences of integration	• Demand variability risk negatively → customer integration. • Supplier integration → customer satisfaction. • Internal and customer integration → competitive performance and customer satisfaction.
20	Neely	2008	OMR	Variety of manufacturing organizations from the OSIRIS database	Financial reports and historical records	• Antecedents (macro) and consequences of servitization • Antecedents of financial performance	• Servitization is influenced by local economic circumstances. • Servitization → higher sales revenue. • Servitization → lower profits as % of sale. • Firm size moderates the relationship between servitization and sales revenue & profits as % of sale.

(continued on next page)

(continued)		Key Pertinent Findings ("→" = lead(s) to)			
Sr. No.	Author(s)	Year	Journal	Context	Method
21	Antiooco et al.	2008	JAMS	Manufacturing firms from multiple industries in Belgium, Netherlands and Denmark	Survey
		Main Focus			
		• Antecedents (micro) and consequences of servitization orientation • Antecedents of financial performance			
		• SSC business orientation → relative product sales • SSP business orientation → service volume. • Top management commitment to and visionary leadership of services → SSP business orientation • Service rewards → service business orientations • Service technology → SSP and SSC business orientations • Service technology moderates the relationship between SSP & SSC business orientations and service volume. • Cross-functional communication moderates relationship between SSC business orientation and relative product sales. • Service training moderates the relationship between SSC business orientation and service volume. • Customer treatment → service volume			

SC: Supply chain, SCI: Supply chain integration, SSP: Services in support of the product, SSC: Services in support of the client's actions.

EMJ: European Management Journal, HSM: Human Systems Management, IJBE: International Journal of Business Environment, IJOPM: International Journal of Operations and Production Management, IJPE: International Journal of Production Economics, IMM: Industrial Marketing Management, JAMS: Journal of the Academy of Marketing Science, JMTM: Journal of Manufacturing Technology Management, JOM: Journal of Operations Management, JSM: Journal of Service Management, SCMIJ: Supply Chain Management: An International Journal, OMR: Operations management research, SIJ: Service Industries Journal.

References

- Adebanjo, D., Teh, P.-L., Ahmed, P.K., 2018. The impact of supply chain relationships and integration on innovative capabilities and manufacturing performance: the perspective of rapidly developing countries. *Int. J. Prod. Res.* 56 (4), 1708–1721. <https://doi.org/10.1080/00207543.2017.1366083>.
- Alghisi, A., Sacconi, N., 2015. Internal and external alignment in the servitization journey – overcoming the challenges. *Prod. Plann. Contr.* 26 (14–15), 1219–1232. <https://doi.org/10.1080/09537287.2015.1033496>.
- Anderson, J.C., Gerbing, D.W., 1988. Structural equation modeling in practice: a review and recommended two-step approach. *Psychol. Bull.* 103 (3), 411–423.
- Antiooco, M., Moenaert, R.K., Lindgreen, A., Wetzels, M.G., 2008. Organizational antecedents to and consequences of service business orientations in manufacturing companies. *J. Acad. Market. Sci.* 36 (3), 337–358.
- Armstrong, J.S., Overton, T.S., 1977. Estimating nonresponse bias in mail surveys. *J. Market. Res.* 14 (3), 396–402. <https://doi.org/10.2307/3150783>.
- Ayala, N.F., Gerstlberger, W., Frank, A.G., 2019. Managing servitization in product companies: the moderating role of service suppliers. *Int. J. Oper. Prod. Manag.* 39 (1), 43–74. <https://doi.org/10.1108/IJOPM-08-2017-0484>.
- Ayala, N.F., Paslauskis, C.A., Frank, A.G., Ghezzi, A., 2017. Knowledge sharing dynamics in service suppliers' involvement for servitization of manufacturing companies. [Article]. *Int. J. Prod. Econ.* 193, 538–553. <https://doi.org/10.1016/j.ijpe.2017.08.019>.
- Bain, J.S., 1951. Relation of profit rate to industry concentration: American manufacturing, 1936–1940. *Q. J. Econ.* 65 (3), 293–324. <https://doi.org/10.2307/1882217>.
- Baines, T., Bigdeli, A.Z., Bustinza, O.F., Shi, V.G., Baldwin, J., Ridgway, K., 2017. Servitization: revisiting the state-of-the-art and research priorities. *Int. J. Oper. Prod. Manag.* 37 (2), 256–278. <https://doi.org/10.1108/IJOPM-06-2015-0312>.
- Baines, T., Lightfoot, H., 2013. *Made to Serve: How Manufacturers Can Compete through Servitization and Product Service Systems*. Wiley.
- Baines, T., Shi, V.G., 2015. A Delphi study to explore the adoption of servitization in UK companies. *Prod. Plann. Contr.* 26 (14–15), 1171–1187. <https://doi.org/10.1080/09537287.2015.1033490>.
- Baines, T.S., Lightfoot, H.W., Benedettini, O., Kay, J.M., 2009. The servitization of manufacturing: a review of literature and reflection on future challenges. *J. Manuf. Technol. Manag.* 20 (5), 547–567. <https://doi.org/10.1108/17410380910960984>.
- Barnett, N.J., Parry, G., Saad, M., Newnes, L.B., Goh, Y.M., 2013. Servitization: is a paradigm shift in the business model and service enterprise required? *Strat. Change* 22 (3–4), 145–156. <https://doi.org/10.1002/jsc.1929>.
- Baumgartner, H., Steenkamp, J.-B.E.M., 1998. Assessing measurement invariance in cross-national consumer research. *J. Consum. Res.* 25 (1), 78–90. <https://doi.org/10.1086/209528>.
- Benedettini, O., Neely, A., Swink, M., 2015. Why do servitized firms fail? A risk-based explanation. *Int. J. Oper. Prod. Manag.* 35 (6), 946–979. <https://doi.org/10.1108/IJOPM-02-2014-0052>.
- Boer, H., Boer, H., 2019. Design-for-variety and operational performance. *J. Manuf. Technol. Manag.* 30 (2), 438–461. <https://doi.org/10.1108/jmtm-03-2018-0065>.
- Bollen, K.A., 1989. *Structural Equation with Latent Variables*. Wiley, New York.
- Bouncken, R.B., Koch, M., 2007. The role of innovation orientation: strategic antecedents and innovation consequences of innovation orientation. *Int. J. Technol. Intell. Plann.* 3 (3), 213–232. <https://doi.org/10.1504/ijtpp.2007.015770>.
- Braunscheidel, M.J., Suresh, N.C., 2009. The organizational antecedents of a firm's supply chain agility for risk mitigation and response. *J. Oper. Manag.* 27 (2), 119–140. <https://doi.org/10.1016/j.jom.2008.09.006>.
- Brusset, X., Teller, C., 2017. Supply chain capabilities, risks, and resilience. *Int. J. Prod. Econ.* 184, 59–68. <https://doi.org/10.1016/j.ijpe.2016.09.008>.
- Bustinza, O.F., Vendrell-Herrero, F., Baines, T., 2017. Service implementation in manufacturing: an organisational transformation perspective. *Int. J. Prod. Econ.* 192, 1–8. <https://doi.org/10.1016/j.ijpe.2017.08.017>.
- Bustinza, O.F., Vendrell-Herrero, F., Gomes, E., Lafuente, E., Opazo-Basáez, M., Rabetino, R., Vaillant, Y., 2018. Product-service innovation and performance. *Int. J. Bus. Environ.* 10 (2), 95–111.
- Carter, C.R., Rogers, D.S., 2008. A framework of sustainable supply chain management: moving toward new theory. *Int. J. Phys. Distrib. Logist. Manag.* 38 (5), 360–387. <https://doi.org/10.1108/09600030810882816>.
- Cenamor, J., Rönnerberg Sjödin, D., Parida, V., 2017. Adopting a platform approach in servitization: leveraging the value of digitalization. *Int. J. Prod. Econ.* 192, 54–65. <https://doi.org/10.1016/j.ijpe.2016.12.033>.
- Chandler, A.D., 1962. *Strategy and Structure: Chapters in the History of the Industrial Enterprise*. M.I.T. Press, Oxford, England.
- Chaudhuri, A., Boer, H., Taran, Y., 2018. Supply chain integration, risk management and manufacturing flexibility. *Int. J. Oper. Prod. Manag.* 38 (3), 690–712. <https://doi.org/10.1108/ijopm-08-2015-0508>.
- Chaudhuri, A., Jayaram, J., 2019. A socio-technical view of performance impact of integrated quality and sustainability strategies. *Int. J. Prod. Res.* 57 (5), 1478–1496. <https://doi.org/10.1080/00207543.2018.1492162>.
- Chen, I.J., Paulraj, A., 2004. Understanding supply chain management: critical research and a theoretical framework. *Int. J. Prod. Res.* 42 (1), 131–163.
- Chen, J.-S., Kerr, D., Tsang, S.-S., Sung, Y.C., 2015. Co-production of service innovations through dynamic capability enhancement. *Serv. Ind. J.* 35 (1–2), 96–114. <https://doi.org/10.1080/02642069.2014.979405>.
- Chen, J.-S., Tsou, H.-T., 2012. Performance effects of IT capability, service process innovation, and the mediating role of customer service. *J. Eng. Technol. Manag.* 29 (1), 71–94. <https://doi.org/10.1016/j.jengtecman.2011.09.007>.

- Chen, J.-S., Tsou, H.-T., Ching, R.K.H., 2011. Co-production and its effects on service innovation. *Ind. Market. Manag.* 40 (8), 1331–1346. <https://doi.org/10.1016/j.indmarman.2011.03.001>.
- Chen, J.-S., Tsou, H.T., Huang, A.Y.-H., 2009. Service delivery innovation - antecedents and impact on firm performance. *J. Serv. Res.* 12 (1), 36–55. <https://doi.org/10.1177/1094670509338619>.
- Cheng, Y., Chaudhuri, A., Farooq, S., 2016. Interplant coordination, supply chain integration, and operational performance of a plant in a manufacturing network: a mediation analysis. *Supply Chain Manag.: Int. J.* 21 (5), 550–568.
- Chesbrough, H.W., 2006. *Open Innovation: the New Imperative for Creating and Profiting from Technology*. Harvard Business Press.
- Cheung, M.W., 2007. Comparison of approaches to constructing confidence intervals for mediating effects using structural equation models. *Struct. Equ. Model.: Multidiscipl. J.* 14 (2), 227–246.
- Childerhouse, P., Towill, D.R., 2011. Arcs of supply chain integration. *Int. J. Prod. Res.* 49 (24), 7441–7468. <https://doi.org/10.1080/00207543.2010.524259>.
- Dachs, B., Biege, S., Borowiecki, M., Lay, G., Jäger, A., Scharfing, D., 2014. Servitisation of European manufacturing: evidence from a large scale database. *Serv. Ind. J.* 34 (1), 5–23. <https://doi.org/10.1080/02642069.2013.776543>.
- Defee, C.C., Stank, T.P., 2005. Applying the strategy-structure-performance paradigm to the supply chain environment. *Int. J. Logist. Manag.* 16 (1), 28–50. <https://doi.org/10.1108/09574090510617349>.
- Dess, G.G., Robinson Jr., R.B., 1984. Measuring organizational performance in the absence of objective measures: the case of the privately-held firm and conglomerate business unit. *Strat. Manag. J.* 5 (3), 265–273. <https://doi.org/10.1002/smj.4250050306>.
- Eggert, A., Hogreve, J., Ulaga, W., Muenkhoff, E., 2011. Industrial services, product innovations, and firm profitability: a multiple-group latent growth curve analysis. *Ind. Market. Manag.* 40 (5), 661–670. <https://doi.org/10.1016/j.indmarman.2011.05.007>.
- Eggert, A., Hogreve, J., Ulaga, W., Muenkhoff, E., 2014. Revenue and profit implications of industrial service strategies. *J. Serv. Res.* 17 (1), 23–39. <https://doi.org/10.1177/1094670513485823>.
- Falissard, B., 1999. The unidimensionality of a psychiatric scale: a statistical point of view. *Int. J. Methods Psychiatr. Res.* 8 (3), 162–167.
- Federal Reserve Bank of Dallas, 2019. Growth rates versus levels. DataBasics Retrieved January 31, 2019, 2019, from. <https://www.dallasfed.org/research/basics/growth.aspx>.
- Finne, M., Holmström, J., 2013. A manufacturer moving upstream: triadic collaboration for service delivery. [Article]. *Supply Chain Manag.* 18 (1), 21–33. <https://doi.org/10.1108/13598541311293159>.
- Fitzsimmons, J.A., Fitzsimmons, M.J., 2011. *Service Management: Operations, Strategy, Information Technology*. McGraw-Hill.
- Flynn, B.B., Huo, B., Zhao, X., 2010. The impact of supply chain integration on performance: a contingency and configuration approach. *J. Oper. Manag.* 28 (1), 58–71.
- Fornell, C., Larcker, D.F., 1981. Evaluating structural equation models with unobservable variables and measurement error. *J. Market. Res.* 39–50.
- Fynes, B., Professor Paul Coughlan, P., von Haartman, R., Bengtsson, L., 2015. The impact of global purchasing and supplier integration on product innovation. *Int. J. Oper. Prod. Manag.* 35 (9), 1295–1311.
- Gaiardelli, P., Resta, B., Martinez, V., Pinto, R., Albores, P., 2014. A classification model for product-service offerings. *J. Clean. Prod.* 66, 507–519. <https://doi.org/10.1016/j.jclepro.2013.11.032>.
- Galan, J.I., Sanchez-Bueno, M.J., 2009. The continuing validity of the strategy-structure nexus: new findings, 1993–2003. *Strat. Manag. J.* 30 (11), 1234–1243. <https://doi.org/10.1002/smj.782>.
- Gaskin, J., 2016. MyIndirectEffects Estimand. Gaskin's StatWiki, 2019, from. <http://statwiki.kolobkreations.com>
- Gebauer, H., Fleisch, E., Friedli, T., 2005. Overcoming the service paradox in manufacturing companies. *Eur. Manag. J.* 23 (1), 14–26. <https://doi.org/10.1016/j.emj.2004.12.006>.
- Gebauer, H., Putz, F., 2007. The impact of service offerings on service-related performance outcomes. *Int. J. Serv. Technol. Manag.* 8 (2–3), 123–138. <https://doi.org/10.1504/ijstm.2007.012864>.
- Gebauer, H., Saul, C.J., Haldimann, M., Gustafsson, A., 2017. Organizational capabilities for pay-per-use services in product-oriented companies. *Int. J. Prod. Econ.* 192, 157–168. <https://doi.org/10.1016/j.jipe.2016.12.007>.
- Green, M.H., Davies, P., Ng, I.C.L., 2017. Two strands of servitization: a thematic analysis of traditional and customer co-created servitization and future research directions. *Int. J. Prod. Econ.* 192, 40–53. <https://doi.org/10.1016/j.jipe.2017.01.009>.
- Hair, J.F., Black, B., Babin, B., Anderson, R.E., 2010. *Multivariate Data Analysis*, 7 ed. Pearson Education Prentice Hall, Upper Saddle River, New Jersey.
- Haleem, F., Farooq, S., Wahrens, B.V., 2017. Supplier corporate social responsibility practices and sourcing geography. *J. Clean. Prod.* 153, 92–103. <https://doi.org/10.1016/j.jclepro.2017.03.143>.
- He, Y., Keung Lai, K., Sun, H., Chen, Y., 2014. The impact of supplier integration on customer integration and new product performance: the mediating role of manufacturing flexibility under trust theory. *Int. J. Prod. Econ.* 147, 260–270. <https://doi.org/10.1016/j.jipe.2013.04.044>.
- Helfat, C.E., Winter, S.G., 2011. Untangling dynamic and operational capabilities: strategy for the (N)ever-Changing world. *Strat. Manag. J.* 32 (11), 1243–1250. <https://doi.org/10.1002/smj.955>.
- Hillman, A.J., Withers, M.C., Collins, B.J., 2009. Resource dependence theory: a review. *J. Manag.*
- Homburg, C., Hoyer, W.D., Fassnacht, M., 2002. Service orientation of a retailer's business strategy: dimensions, antecedents, and performance outcomes. *J. Market.* 66 (4), 86–101. <https://doi.org/10.1509/jmk.66.4.86.18511>.
- Hong, P., Jagani, S., Kim, J., Youn, S.H., 2019. Managing sustainability orientation: an empirical investigation of manufacturing firms. *Int. J. Prod. Econ.* 211, 71–81. <https://doi.org/10.1016/j.jipe.2019.01.035>.
- Hong, Y.-P., Kim, Y., Cin, B.C., 2015. Product-service system and firm performance: the mediating role of product and process technological innovation. *Emerg. Mark. Finance Trade* 51 (5), 975–984. <https://doi.org/10.1080/1540496x.2015.1061388>.
- Hong, P., Roh, J., 2009. Implementation of strategic green orientation in supply chain. *Eur. J. Innov. Manag.* 12 (4), 512–532. <https://doi.org/10.1108/14601060910996945>.
- Hu, L.T., Bentler, P.M., 1999. Cutoff criteria for fit indexes in covariance structure analysis: conventional criteria versus new alternatives. *Struct. Equ. Model.: Multidiscipl. J.* 6 (1), 1–55. <https://doi.org/10.1080/10705519909540118>.
- Jajja, M.S.S., Chatha, K.A., Farooq, S., 2018. Impact of supply chain risk on agility performance: mediating role of supply chain integration. *Int. J. Prod. Econ.* 205, 118–138. <https://doi.org/10.1016/j.jipe.2018.08.032>.
- Jajja, M.S.S., Kannan, V.R., Ali, B.S., Zahoor, H.S., 2017. Linkages between firm innovation strategy, suppliers, product innovation, and business performance: insights from resource dependence theory. *Int. J. Oper. Prod. Manag.* 37 (8), 1054–1075. <https://doi.org/10.1108/IJOPM-09-2014-0424>.
- Jarvis, C.B., MacKenzie, S.B., Podsakoff, P.M., 2003. A critical review of construct indicators and measurement model misspecification in marketing and consumer research. *J. Consum. Res.* 30 (2), 199–218. <https://doi.org/10.1086/376806>.
- Kastalli, I.V., Van Looy, B., 2013. Servitization: disentangling the impact of service business model innovation on manufacturing firm performance. *J. Oper. Manag.* 31 (4), 169–180. <https://doi.org/10.1016/j.jom.2013.02.001>.
- Kauppi, K., Longoni, A., Caniato, F., Kuula, M., 2016. Managing country disruption risks and improving operational performance: risk management along integrated supply chains. *Int. J. Prod. Econ.* 182, 484–495. <https://doi.org/10.1016/j.jipe.2016.10.006>.
- Keillor, B.D., Parker, R.S., Pettijohn, C.E., 1999. Sales force performance satisfaction and aspects of relational selling: implications for sales managers. *J. Market. Theor. Pract.* 7 (1), 101–115.
- Ketchen Jr., D.J., Hult, G.T.M., 2007. Bridging organization theory and supply chain management: the case of best value supply chains. *J. Oper. Manag.* 25 (2), 573–580. <https://doi.org/10.1016/j.jom.2006.05.010>.
- Kim, S., Toya, K., 2019. Leadership style required for the transition to servitization in Japan. *J. Manuf. Technol. Manag.* 30 (2), 335–352. <https://doi.org/10.1108/jmtm-02-2018-0034>.
- Kindström, D., Kowalkowski, C., 2009. Development of industrial service offerings: a process framework. *J. Serv. Manag.* 20 (2), 156–172. <https://doi.org/10.1108/09564230910952753>.
- 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. *Ind. Market. Manag.* 42 (8), 1374–1385. <https://doi.org/10.1016/j.indmarman.2013.07.018>.
- Kosiba, J.P.B., Boateng, H., Okoe Amarte, A.F., Boakye, R.O., Hinson, R., 2018. Examining customer engagement and brand loyalty in retail banking: the trustworthiness influence. *Int. J. Retail Distrib. Manag.* 46 (8), 764–779.
- Kowalkowski, C., Brehmer, P.-O., Kindström, D., 2009. Managing industrial service offerings: requirements on content and processes. *Int. J. Serv. Technol. Manag.* 11 (1), 42–63.
- Law, K.M.Y., Gunasekaran, A., 2012. Sustainability development in high-tech manufacturing firms in Hong Kong: motivators and readiness. *Int. J. Prod. Econ.* 137 (1), 116–125. <https://doi.org/10.1016/j.jipe.2012.01.022>.
- Lee, W.C., Kwon, I.W.G., Severance, D., 2007. Relationship between supply chain performance and degree of linkage among supplier, internal integration, and customer. *Supply Chain Manag.: Int. J.* 12 (6), 444–452. <https://doi.org/10.1108/13598540710826371>.
- Li, H., Tian, G., Tian, Y., 2018. Servitization: its preferred organization and impact on firm performance. *Hum. Syst. Manag.* 37 (2), 181–193.
- Li, W., Humphreys, P.K., Yeung, A.C., Cheng, T.E., 2007. The impact of specific supplier development efforts on buyer competitive advantage: an empirical model. *Int. J. Prod. Econ.* 106 (1), 230–247.
- Lightfoot, H., Baines, T., Smart, P., 2013. The servitization of manufacturing: a systematic literature review of interdependent trends. *Int. J. Oper. Prod. Manag.* 33 (11/12), 1408–1434. <https://doi.org/10.1108/IJOPM-07-2010-0196>.
- Macho, S., Ledermann, T., 2011. Estimating, testing, and comparing specific effects in structural equation models: the phantom model approach. *Psychol. Methods* 16 (1), 34–43. <https://doi.org/10.1037/a0021763>.
- Marko, B., Mark, J., Howard, L., Steve, E., 2012. Buyer-supplier relationships in a servitized environment: an examination with Cannon and Perreault's framework. *Int. J. Oper. Prod. Manag.* 32 (6), 650–675. <https://doi.org/10.1108/01443571211230916>.
- Martinez, V., Neely, A., Velu, C., Leinster-Evans, S., Bisessar, D., 2017. Exploring the journey to services. *Int. J. Prod. Econ.* 192, 66–80. <https://doi.org/10.1016/j.jipe.2016.12.030>.
- Moeller, S., 2008. Customer integration—a key to an implementation perspective of service provision. *J. Serv. Res.* 11 (2), 197–210. <https://doi.org/10.1177/1094670508324677>.
- Moorman, C., Rust, R.T., 1999. The role of marketing. *J. Market.* 63 (4 Suppl. 1), 180–197. <https://doi.org/10.1177/002224299906345117>.
- Moreno, R., Marques, L., Arkader, R., 2019. Servitization impact on performance moderated by country development. *Benchmark Int. J.*

- Narayanan, S., Narasimhan, R., Schoenherr, T., 2015. Assessing the contingent effects of collaboration on agility performance in buyer–supplier relationships. *J. Oper. Manag.* 33–34, 140–154. <https://doi.org/10.1016/j.jom.2014.11.004>.
- Neely, A., 2008. Exploring the financial consequences of the servitization of manufacturing. *Oper. Manag. Res.* 1 (2), 103–118.
- Nunnally, J., 1978. *Psychometric Theory*, vol. 2. C. (1978).
- Oliva, R., Gebauer, H., Brann, J.M., 2012. Separate or integrate? Assessing the impact of separation between product and service business on service performance in product manufacturing firms. *J. Bus. Bus. Market.* 19 (4), 309–334. <https://doi.org/10.1080/1051712x.2012.647797>.
- Oliva, R., Kallenberg, R., 2003. Managing the transition from products to services. *Int. J. Serv. Ind. Manag.* 14 (2), 160–172. <https://doi.org/10.1108/09564230310474138>.
- Paquette, L.R., 2005. Growth rates as measures of financial performance. *J. Account. Educ.* 23 (1), 67–78. <https://doi.org/10.1016/j.jaccedu.2005.02.002>.
- Paul, H., Ma, G.Y., David, D.D., 2014. Strategic customer service orientation, lean manufacturing practices and performance outcomes: an empirical study. *J. Serv. Manag.* 25 (5), 699–723. <https://doi.org/10.1108/JOSM-12-2013-0355>.
- Peng, D.X., Verghese, A., Shah, R., Schroeder, R.G., 2013. The relationships between external integration and plant improvement and innovation capabilities: the moderation effect of product clockspeed. *J. Supply Chain Manag.* 49 (3), 3–24.
- Pfeffer, J., Salancik, G.R., 1978. *The External Control of Organizations: A Resource Dependence Perspective*. Harper & Row, New York.
- Pfeffer, J., Salancik, G.R., 2003. *The External Control of Organizations: A Resource Dependence Perspective*. Stanford University Press, Stanford, California.
- Pine, B.J., Gilmore, J.H., 1998. Welcome to the experience economy. *Harv. Bus. Rev.* 76, 97–105.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.-Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: A critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88 (5), 879–903. <https://doi.org/10.1037/0021-9010.88.5.879>.
- Podsakoff, P.M., Organ, D.W., 1986. Self-reports in organizational research: problems and prospects. *J. Manag.* 12 (4), 531–544.
- Rabetino, R., Kohtamäki, M., Gebauer, H., 2017. Strategy map of servitization. *Int. J. Prod. Econ.* 192, 144–156. <https://doi.org/10.1016/j.ijpe.2016.11.004>.
- Raddats, C., Baines, T., Burton, J., Story, V.M., Zolkiewski, J., 2016. Motivations for servitization: the impact of product complexity. *Int. J. Oper. Prod. Manag.* 36 (5), 572–591. <https://doi.org/10.1108/IJOPM-09-2014-0447>.
- Ralston, P.M., Blackhurst, J., Cantor, D.E., Crum, M.R., 2015. A structure–conduct–performance perspective of how strategic supply chain integration affects firm performance. *J. Supply Chain Manag.* 51 (2), 47–64. <https://doi.org/10.1111/jscm.12064>.
- Raykov, T., 1997. Estimation of composite reliability for congeneric measures. *Appl. Psychol. Meas.* 21 (2), 173–184.
- Rungtusanatham, M., Miller, J.W., Boyer, K.K., 2014. Theorizing, testing, and concluding for mediation in SCM research: tutorial and procedural recommendations. *J. Oper. Manag.* 32 (3), 99–113. <https://doi.org/10.1016/j.jom.2014.01.002>.
- Saccani, N., Visintin, F., Rapaccini, M., 2014. Investigating the linkages between service types and supplier relationships in servitized environments. *Int. J. Prod. Econ.* 149, 226–238. <https://doi.org/10.1016/j.ijpe.2013.10.001>.
- Sampson, S.E., 2000. Customer–supplier duality and bidirectional supply chains in service organizations. *Int. J. Serv. Ind. Manag.* 11 (4), 348–364. <https://doi.org/10.1108/09564230010355377>.
- Sampson, S.E., Froehle, C.M., 2006. Foundations and implications of a proposed unified services theory. *Prod. Oper. Manag.* 15 (2), 329–343. <https://doi.org/10.1111/j.1937-5956.2006.tb00248.x>.
- Sampson, S.E., Spring, M., 2012. Customer roles in service supply chains and opportunities for innovation. *J. Supply Chain Manag.* 48 (4), 30–50. <https://doi.org/10.1111/j.1745-493X.2012.03282.x>.
- Schoenherr, T., Swink, M., 2012. Revisiting the arcs of integration: cross-validations and extensions. *J. Oper. Manag.* 30 (1), 99–115. <https://doi.org/10.1016/j.jom.2011.09.001>.
- Segars, A.H., Grover, V., 1993. Re-examining perceived ease of use and usefulness: a confirmatory factor analysis. *MIS Q.* 17 (4), 517–525.
- Shah, R., Goldstein, S.M., 2006. Use of structural equation modeling in operations management research: looking back and forward. *J. Oper. Manag.* 24 (2), 148–169. <https://doi.org/10.1016/j.jom.2005.05.001>.
- Shou, Y., 2018. Risk management and firm performance: the moderating role of supplier integration. *Ind. Manag. Data Syst.* 118 (7), 1327–1344. <https://doi.org/10.1108/imds-09-2017-0427>.
- Smith, L., Maull, R., C.L. Ng, I., 2014. Servitization and operations management: a service dominant–logic approach. *Int. J. Oper. Prod. Manag.* 34 (2), 242–269. <https://doi.org/10.1108/IJOPM-02-2011-0053>.
- Sousa, R., da Silva, G.J.C., 2017. Capability antecedents and performance outcomes of servitization: differences between basic and advanced services. *Int. J. Oper. Prod. Manag.* 37 (4), 444–467. <https://doi.org/10.1108/IJOPM-11-2015-0696>.
- Sousa, R., da Silva, G.J.C., 2019. The relationship between servitization and product customization strategies. *Int. J. Oper. Prod. Manag.* 39 (3), 454–474. <https://doi.org/10.1108/ijopm-03-2018-0177>.
- Suarez, F.F., Cusumano, M.A., Kahl, S.J., 2013. Services and the business models of product firms: an empirical analysis of the software industry. *Manag. Sci.* 59 (2), 420–435. <https://doi.org/10.1287/mnsc.1120.1634>.
- Szász, L., Demeter, K., Boer, H., Cheng, Y., 2017. Servitization of manufacturing: the effect of economic context. *J. Manuf. Technol. Manag.* 28 (8), 1011–1034. <https://doi.org/10.1108/JMTM-11-2016-0166>.
- Tabachnick, B.G., Fidell, L.S., Ullman, J.B., 2007. *Using Multivariate Statistics*, vol. 5. Pearson Boston, MA.
- Tanriverdi, x H., xfc, sey, Lee, C.-H., 2008. Within-industry diversification and firm performance in the presence of network externalities: evidence from the software industry. *Acad. Manag. J.* 51 (2), 381–397. <https://doi.org/10.2307/20159514>.
- Teagarden, M.B., Von Glinow, M.A., Mellahi, K., 2018. Contextualizing international business research: enhancing rigor and relevance. *J. World Bus.* 53 (3), 303–306. <https://doi.org/10.1016/j.jwb.2017.09.001>.
- Tsou, H.-T., Cheng, C.C.J., Hsu, H.-Y., 2015. Selecting business partner for service delivery co-innovation and competitive advantage. [Article]. *Manag. Decis.* 53 (9), 2107–2134. <https://doi.org/10.1108/md-01-2015-0014>.
- Turunen, T., Finne, M., 2014. The organisational environment's impact on the servitization of manufacturers. *Eur. Manag. J.* 32 (4), 603–615. <https://doi.org/10.1016/j.emj.2013.11.002>.
- Uлага, W., Reinartz, W.J., 2011. Hybrid offerings: how manufacturing firms combine goods and services successfully. *J. Market.* 75 (6), 5–23. <https://doi.org/10.1509/jm.09.0395>.
- Vanpoucke, E., Vereecke, A., Wetzels, M., 2014. Developing supplier integration capabilities for sustainable competitive advantage: a dynamic capabilities approach. *J. Oper. Manag.* 32 (7), 446–461. <https://doi.org/10.1016/j.jom.2014.09.004>.
- Vargo, S.L., Lusch, R.F., 2004. Evolving to a new dominant logic for marketing. *J. Market.* 68 (1), 1–17. <https://doi.org/10.1509/jmk.68.1.1.24036>.
- Vendrell-Herrero, F., Gomes, E., Bustinza, O.F., Mellahi, K., 2018. Uncovering the role of cross-border strategic alliances and expertise decision centralization in enhancing product-service innovation in MMNEs. *Int. Bus. Rev.* 27 (4), 814–825. <https://doi.org/10.1016/j.ibusrev.2018.01.005>.
- Visnjic, L., Neely, A., Wiengarten, F., 2012. Another Performance Paradox?: A Refined View on the Performance Impact of Servitization. A Refined View on the Performance Impact of Servitization (July 4, 2012). ESADE Business School Research Paper(231).
- Weijiao, W., Kee-Hung, L., Yongyi, S., 2018. The impact of servitization on firm performance: a meta-analysis. *Int. J. Oper. Prod. Manag.* 38 (7), 1562–1588. <https://doi.org/10.1108/IJOPM-04-2017-0204>.
- Wiengarten, F., 2019. Re-evaluating supply chain integration and firm performance: linking operations strategy to supply chain strategy. *Supply Chain Manag.: Int. J.* 24 (4), 540–559. <https://doi.org/10.1108/scm-05-2018-0189>.
- Wiengarten, F., Humphreys, P., Gimenez, C., McIvor, R., 2016. Risk, risk management practices, and the success of supply chain integration. *Int. J. Prod. Econ.* 171, 361–370. <https://doi.org/10.1016/j.ijpe.2015.03.020>.
- Wiengarten, F., Pagell, M., Ahmed, M.U., Gimenez, C., 2014. Do a country's logistical capabilities moderate the external integration performance relationship? *J. Oper. Manag.* 32 (1), 51–63. <https://doi.org/10.1016/j.jom.2013.07.001>.
- Windahl, C., Lakemond, N., 2006. Developing integrated solutions: the importance of relationships within the network. *Ind. Market. Manag.* 35 (7), 806–818. <https://doi.org/10.1016/j.indmarman.2006.05.010>.
- Witell, L., 2013. From service for free to service for fee: business model innovation in manufacturing firms. *J. Serv. Manag.* 24 (5), 520–533. <https://doi.org/10.1108/josm-04-2013-0103>.
- Wong, C.W.Y., Wong, C.Y., Boon-itt, S., 2013. The combined effects of internal and external supply chain integration on product innovation. *Int. J. Prod. Econ.* 146 (2), 566–574. <https://doi.org/10.1016/j.ijpe.2013.08.004>.
- Wynstra, F., Spring, M., Schoenherr, T., 2015. Service triads: a research agenda for buyer–supplier–customer triads in business services. *J. Oper. Manag.* 35, 1–20. <https://doi.org/10.1016/j.jom.2014.10.002>.
- Xing, Y., Liu, Y., Tarba, S., Cooper, S.C.L., 2017. Servitization in mergers and acquisitions: manufacturing firms venturing from emerging markets into advanced economies. *Int. J. Prod. Econ.* 192, 9–18. <https://doi.org/10.1016/j.ijpe.2016.12.010>.
- Yang, M.G., Hong, P., Modi, S.B., 2011. Impact of lean manufacturing and environmental management on business performance: an empirical study of manufacturing firms. *Int. J. Prod. Econ.* 129 (2), 251–261. <https://doi.org/10.1016/j.ijpe.2010.10.017>.
- Zhao, X., Lynch Jr., J.G., Chen, Q., 2010. Reconsidering Baron and Kenny: Myths and Truths about Mediation analysis. *J. Consum. Res.* 37 (2), 197–206. <https://doi.org/10.1086/651257>.
- Zhao, X., Huo, B., Selen, W., Yeung, J.H.Y., 2011. The impact of internal integration and relationship commitment on external integration. *J. Oper. Manag.* 29 (1), 17–32.
- Zhao, Li, Huo, Baofeng, Sun, Linyan, Zhao, Xiande, 2013. The impact of supply chain risk on supply chain integration and company performance: a global investigation. *Supply Chain Manag.* 18 (2), 115–131. <https://doi.org/10.1108/13598541311318773>.
- Zhao, Gang, Feng, Taiwen, Wang, Dan, 2015. Is more supply chain integration always beneficial to financial performance? *Ind. Market. Manag.* 45, 162–172. <https://doi.org/10.1016/j.indmarman.2015.02.015>.
- Zhang, M., Guo, H., Zhao, X., 2017. Effects of social capital on operational performance: impacts of servitisation. *Int. J. Prod. Res.* 55 (15), 4304–4318. <https://doi.org/10.1080/00207543.2016.1246764>.