

A maturity model for the servitization of product-centric companies

Servitization

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Abstract

Purpose – The purpose of this paper is to contribute to the understanding of the servitization phenomenon of product-centric companies, by identifying the resources, capabilities and organizational aspects needed to successfully deploy a servitized business model (BM).

Design/methodology/approach – By adopting a literature-based approach, this paper develops a servitization maturity model (SeMM) aimed at assessing and positioning companies in the servitization journey. The paper also illustrates the model application to two small and medium-sized enterprises (SMEs), a machinery and a forklift truck company.

Findings – The SeMM identifies a set of 85 critical requirements that are used to evaluate the servitization level of product-centric companies, through a specific five-stage measurement scale. The requirements are categorized into: five maturity dimensions (organizational approach, process management, performance management, tools, capabilities) and nine BM Canvas components. The empirical application exemplifies how the SeMM can support managers in identifying and bridging the gaps in their servitization journey.

Originality/value – The SeMM adopts an original bi-dimensional approach and provides an operationalization of the servitization process through the identification of specific critical requirements framed on established BM and maturity dimensions taken from the literature. Moreover, the model responds to a call for research to develop practitioner-oriented tools and guidelines to support the servitization process, in particular for SMEs, and to the need to go beyond to measures of servitization based on indicators about number of services offered or their turnover.

Keywords Servitization, Case studies, Service operations, SMEs, Maturity model

Paper type Research paper

1. Introduction

To increase revenues and build sustainable competitive advantage, product-centric companies are increasingly undergoing servitization (Neely, 2008; Baines *et al.*, 2009). To be successful in this transformation, they should redesign their business model (BM) (Forkmann *et al.*, 2017; Kowalkowski *et al.*, 2017; Raddats *et al.*, 2019). However, product-centric companies undertaking servitization face several challenges (Alghisi and Saccani, 2015; Zhang and Banerji, 2017), and this transition remains a complex matter (Reim *et al.*, 2015; Martinez *et al.*, 2017), especially for small and medium-sized enterprises (SMEs) (Kowalkowski *et al.*, 2013). In fact, servitization research has devoted limited attention to comprehensively analyzing the elements that support this BM reconfiguration (Adrodegari and Saccani, 2017; Forkmann *et al.*, 2017). Moreover, empirical evidence mainly concerns large multinational companies, while SMEs attempts to servitize are not much investigated (Adrodegari *et al.*, 2018; de Jesus Pacheco *et al.*, 2019). Despite the considerable amount of literature on servitization, moreover, a lack of studies has been pointed out about describing and prescribing how to servitize a product-centric firm



(Baines *et al.*, 2017). This paper adopts the maturity model (MM) approach as a mean to fill this gap. More specifically, it develops a servitization MM (SeMM) that characterizes servitization maturity levels, assessing and positioning companies undergoing the transformation. The SeMM is built on established BM and maturity dimensions, operationalized through specific items (critical requirements). Moreover, based on two case studies, the paper shows how the SeMM can be used in practice to support assessment and change actions in SMEs.

The paper is structured as follows. The next section provides a literature background, Section 3 describes the research methodology, Section 4 describes the SeMM and Section 5, the empirical application. Finally, Section 6 draws some concluding remarks.

2. Theoretical background

2.1 *The servitization of product-centric companies*

An increasing number of product-centric companies are shifting from selling products to providing solutions to gain competitive advantage, increase revenues, margins, customer satisfaction and retention (Oliva and Kallenberg, 2003; Neely, 2008). Such transition, named servitization, can be conceptualized as “a change process whereby a manufacturing company deliberately or in an emergent fashion introduces service elements in its BM” (Brax and Visintin, 2017 p. 18). The BM perspective is, therefore, central to characterizing servitization (Adrodegari and Saccani, 2017; Baines *et al.*, 2017; Forkmann *et al.*, 2017; Suppatvech *et al.*, 2019; Raddats *et al.*, 2019), as it describes how value is created, delivered and captured (Teece, 2010). Several product-centric companies are, therefore, innovating their BM either by adding advanced services to their product offerings or delivering products “as services,” selling their usage or performance (Baines and Lightfoot, 2013; Ayala *et al.*, 2017; Martinez *et al.*, 2017; Suppatvech *et al.*, 2019).

However, this transformation requires fundamental changes in the firm’s structure, culture and competencies, in the way value is delivered and relationships with customers and stakeholders are managed (Martinez *et al.*, 2010; Martinez, 2017). Therefore, servitizing companies may incur the so-called “service paradox” and not reach the expected benefits (Gebauer *et al.*, 2005) while they are exposed to greater internal and environmental risks that may prevent achieving the financial and economic outcomes posited by the servitization literature (Neely, 2008; Benedettini *et al.*, 2015).

The service transition, thus, remains a complex matter for both scholars and practitioners, in particular from SMEs (Tukker, 2015; Kowalkowski *et al.*, 2017). In fact, it is acknowledged that undertaking a servitization path is less common in SMEs than in large firms (Neely, 2008), and that SMEs usually do not possess the resources or the experience to successfully undertake the servitization journey (Kowalkowski *et al.*, 2013; Clegg *et al.*, 2017). However, only few prior studies address servitization in SMEs (e.g. Coreynen *et al.*, 2017; Valtakoski and Witell, 2018). Research has, therefore, been called to provide models and guidelines aimed to describe and prescribe how to servitize a product-centric firm (Adrodegari *et al.*, 2017; Baines *et al.*, 2017).

MMs appear as suitable tools to fill this gap, as they allow assessing the current maturity of a company in servitization and identifying the main actions needed to successfully deploy a servitized BM, and their descriptive and diagnostic role can be particularly useful to SMEs.

2.2 *Maturity models*

The seminal capability MM (CMM), “a framework representing a path of improvements recommended for software organizations that want to increase their software process capability” (Paulk *et al.*, 1993 p. 27), was developed for the information systems sector by the Software Engineering Institute. MMs have then been developed for several other domains such as business process management (Roglinger *et al.*, 2012), inventory

management (Niemi *et al.*, 2009), supply chain management (Lockamy and McCormack, 2004), new product development (Fraser *et al.*, 2002), R&D projects (Berg *et al.*, 2002), project management (Cooke-Davies and Arzymano, 2003), quality management (Yoo *et al.*, 2006), sustainability (Pigosso and McAloone, 2016; Machado *et al.*, 2017; Correia *et al.*, 2017), service innovation (Rapaccini *et al.*, 2013) and service management (Neff *et al.*, 2014; Alvarez *et al.*, 2015).

MMs represent theories about how organizations evolve in a stage-by-stage manner along an anticipated, desired or logical path (Röglinger *et al.*, 2012). MMs are, therefore, adequate for complex topics because the sequence of levels and their requirements, tracing multiple objectives and practices, can gradually lead the company through an improvement process (Wendler, 2012; Van Looy *et al.*, 2014; Machado *et al.*, 2017). In particular, MMs may have three different purposes (de Bruin *et al.*, 2005): *descriptive* (diagnostic tools to assess the current capabilities of a company), *prescriptive* (identify desirable maturity levels and provide guidelines and improvement measures) and *comparative* (internal or external benchmarking).

Given their limited resources and experience, SMEs would particularly benefit from an assessment of their current situation and emergent gaps that can be provided by MMs (Mittal *et al.*, 2018). Therefore, the MM approach appears suitable to address both the gaps about the lack of studies describing and prescribing how to servitize a product-centric firm (Baines *et al.*, 2017) and the limited attention to the issues faced by SMEs in the servitization journey.

2.3 Maturity models for the service domain in product-centric contexts

Despite the fact that seminal works suggest that product-centric firms gradually shift along a product-service continuum (Oliva and Kallenberg, 2003; Martinez *et al.*, 2010; Baines and Lightfoot, 2013), a structured effort toward a detailed characterization of servitization stages has not been carried out until recently (Lütjen *et al.*, 2017). It is not surprising, therefore, that few MMs concerning the service business in product-centric companies are found in the literature. They are summarized in Table I.

Wikström *et al.* (2009) analyze the changes in project-based firms as they move from pure equipment-suppliers to being also service providers. Rapaccini *et al.* (2013) propose a service development (NSD) MM for product-centric firms built upon the following dimensions: the management of processes and projects; the use of specific resources, skills and tools; the involvement of customers, suppliers and other stakeholders; and the adoption of performance management systems. Jin *et al.* (2014), similarly, define a set of NSD success factors and group them into dimensions, namely: strategy management, process formalization, knowledge management and customer involvement. The four-stage product-centric service MM by Li *et al.* (2014) considers four dimensions: sales profit source, service business composition, service process quality and service infrastructure. Neff *et al.* (2014) developed a MM for the heavy equipment manufacturing industry to assess the information systems support to the product service system (PSS). Their MM, therefore, focuses on information technology as an enabler of servitization and evaluates the following key dimensions: performance measurement of industrial service, installed base management, mobile support for the service workforce, integration of service and product data and data quality assurance. Pigosso and McAloone (2016) applied the five-level Ecodesign MM to support companies in the development of sustainable PSSs. Finally, Alvarez *et al.* (2015) see servitization as an evolutionary process based on the relationships among players in the value chain. Their MM analyzes four key dimensions: market, network, customer and internal. Only the last two papers mentioned are close to the objective of this study, i.e. to assess the servitization maturity of a company. However, Pigosso and McAloone (2016) focus solely on the environmental sustainability aspect, while the MM by Alvarez *et al.* (2015) does not support the identification of the main weaknesses and actions to be deployed so that little prescriptive value could be obtained from the model. Moreover, it does not adopt a BM perspective.

Author	Topic	Dimensions evaluated	Maturity levels	Empirical application
Wikström et al. (2009)	Service provision	Value creation, mental process, organization, key process, culture, customer, priority, main offering, approach to personnel, sales bias	Goods dominant logic, customer-centric logic, business-dominant logic	Yes
Rapaccini et al. (2013)	New service development	Organizational approach, resources, customers, suppliers and other stakeholders, performance management	Initial stage, repeatable, defined, managed, optimized	Yes
Li et al. (2014)	Service management	Sales profit sources, service business composition, service process quality, service infrastructure	Basic services, initial stage for value-added services, the growth stage for value-added services, the maturity stage for value-added services	Yes
Jin et al. (2014)	New service development	Strategy management, process formalization, knowledge management, customer involvement	Five maturity level for each dimension	No
Neff et al. (2014)	Information system for PSS	Performance measurement of industrial service, installed base management, mobile support for the service workforce, integration of service and product data, data quality assurance	Rudimentary spare parts service, reactive maintenance service, predictive maintenance service, performance contracting service, managing the customer's operations	Yes
Alvarez et al. (2015)	Servitization	Market, network, customer, internal	Prospection, initiation, consolidation, specialization	Yes
Pigozzo and McAlloone (2016)	Sustainable PSS	A list of 62 Ecodesign management practices for PSS development	Limited, start-up, experienced, expansion, incorporation	No

Table I.
Review of maturity models in the literature addressing the service domain.

3. Research process and method

To fill the gaps emerged from the previous analysis, we adopt a three-step research process. First, we carried out a literature review of MMs relevant for this research. We searched the Scopus database for papers published in scientific journals (conferences were excluded), using keywords such as “maturity model,” “capability model,” “process improvement model,” “assessment model,” “maturity grid” in combination with “servitization,” “solutions” and “PSS.” Among the 69 papers identified, 18 were selected and analyzed after reading the title and the abstract. Only seven of them propose a structured MM related to services in product-centric companies: they have been discussed in [section 2.3](#). We then developed the SeMM, described in [section 4](#). It is built on BM and maturity dimensions found in the literature and operationalized through specific “critical requirements” ([Alvarez et al., 2015](#)) that characterize servitized BMs. Besides the MMs analyzed in [section 2.3](#) and the literature on MMs mentioned in [section 2.2](#), to develop the 85 critical requirements in our model, we considered the relevant literature on servitization. In particular, we resorted to the reference framework proposed by ([Adrodegari et al., 2017](#)) that identified key aspects for the different

BM components. To point out the requirements, we analyzed (and enriched) the set of literature analyzed in that paper. In the third step of the research, the model was applied to two companies undertaking the servitization journey, as described in section 5, to ascertain the exhaustiveness and practical applicability of the SeMM.

To enhance the reliability of the data collection and elaboration (Voss *et al.*, 2002), we designed a research protocol where the SeMM requirements represent the list of aspects to be investigated. The application started with a full-day meeting with the top managers belonging to different business functions such as after-sales service, sales and marketing, research and development (R&D) and information systems. During the workshop, after identifying the business line object of the study and investigating the company BM and servitization journey, we investigated each critical requirement following the research protocol. A second half-day workshop was then carried out in each firm to discuss the results of the SeMM application, point out the relevant gaps and identify the most appropriate improvement actions.

4. The servitization maturity model (SeMM)

4.1 Overview

The SeMM evaluates the servitization maturity level of product-centric companies through the assessment of a set of critical requirements. As shown in Figure 1, the model adopts a multi-dimensional approach (Pöppelbuß and Röglinger, 2011): we follow a bi-dimensional approach similar to Kindström and Kowalowski (2014) who addressed service innovation and crossed a BM dimension with a capabilities and resources one. In our work, we cross BM components with maturity dimensions. The five maturity dimensions are derived from the review of relevant MMs in literature and are: organizational approach (e.g. Wikström *et al.*, 2009; Rapaccini *et al.*, 2013), management of processes (e.g.: Van Looy, 2014; Tarhan *et al.*, 2016), performance management systems (e.g.: Alvarez *et al.*, 2015), tools (e.g.: Rapaccini *et al.*, 2013; Neff *et al.*, 2014), capabilities (e.g.: Paulk *et al.*, 1993 and others CMM models). For the BM components, instead, we resort to the nine building blocks of the BM Canvas model (Osterwalder and Pigneur, 2010).

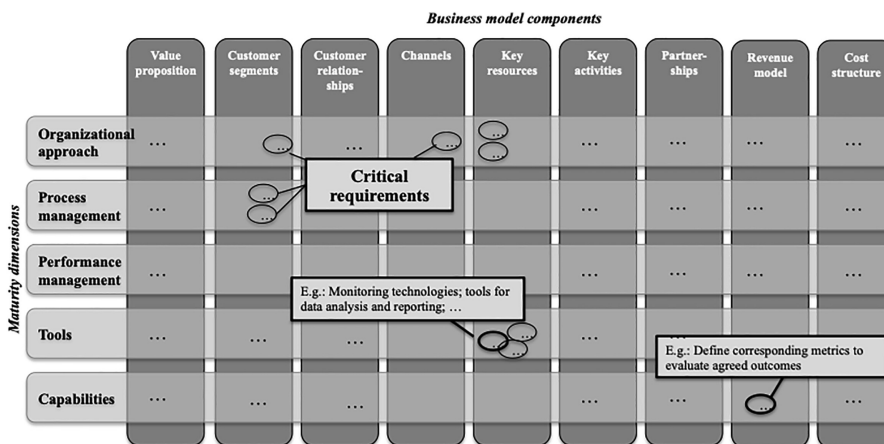


Figure 1. SeMM structure

4.2 Critical requirements

Table II reports the 85 critical requirements identified from the literature. In the following, they are described (they appear in *italic*), grouped according to the nine BM components (Osterwalder and Pigneur, 2010).

4.2.1 Value proposition. In servitized BMs, it becomes crucial to understand the nature of the value that can be generated and delivered to customers. Specific capabilities are needed to this end, such as *design-specific value propositions to meet customers' products and service needs* (Barquet *et al.*, 2013) and *develop new service offerings that create value for the customer* (Kindström and Kowalkowski, 2014), which entails extending, repackaging, improving and introducing new lines of service in accordance with market opportunities (Kindström and Kowalkowski, 2009). *Specific tools and methods for service value proposition* design should be used, such as visualization tools for the co-creation, representation and prototyping of customer-centered services (Kindström, 2010; Keränen and Jalkala, 2013). In particular, new tools and procedures are needed to *ease the determination of the value* of the new offering. In addition, *service portfolio management procedures* should be in place (Saul and Gebauer, 2018). Therefore, providing solutions requires a more *customer-centric organization* (Saul and Gebauer, 2018) and a *service logic translation capability* to move away from a product-centric culture (Kindström and Kowalkowski, 2014).

4.2.2 Customer relationships. Customer relationships are critical for servitized BMs (e.g. Gebauer *et al.*, 2005; Davies *et al.*, 2007). Therefore, *relational skills* should be developed in both the sales and after-sales personnel (Kindström *et al.*, 2015). Another important aspect concerns interactions with customers throughout the product lifecycle. It implies the definition of the extent of information sharing. For instance, *procedures and practices for managing customer feedbacks on product/service experience* need to be implemented to enable the product/service improvement and closer customer relationships (Meier *et al.*, 2010; Kindström and Kowalkowski, 2014). Similarly, *information and communications technology (ICT) systems/applications that support the automatization of relationships and collaboration between customers and providers*, such as Web-based information tools become fundamental (Reim *et al.*, 2015).

4.2.3 Customer segments. Understanding customer needs is critical to define value propositions that respond to different customer segments (Reim *et al.*, 2015; Storbacka *et al.*, 2013). In this process, required capabilities are *understanding the customer's problem and interpret its real needs* (Ulaga and Reinartz, 2011) and *managing customer's production processes data* to gain intimate customer knowledge (Kindström, 2010; Storbacka, 2011). These capabilities represent the basis for providing the most appropriate offer to each customer. Therefore, *procedures and practices for assessing customer preferences and needs on product and process-related information* but also on *service-related information* should be established (Kindström, 2010; Storbacka, 2011; Kindström and Kowalkowski, 2014).

4.2.4 Key activities. Servitization often requires developing new activities or redesigning the current ones. Marketing and sales activities, fleet maintenance planning, product retrofit, revamping, disposal and reverse logistic processes (Barquet *et al.*, 2013; Liu *et al.*, 2014) may be (re-)designed. Moreover, companies need the *capability to communicate and make tangible the value for the customer* of new offerings (Kindström and Kowalkowski, 2009; Reim *et al.*, 2015). To this end, companies should also develop *specific sales tools or methods*, such as a total cost of ownership model (Meier *et al.*, 2010; Ulaga and Reinartz, 2011; Storbacka *et al.*, 2013). To meet new product and service design requirements, special emphasis should be placed on aligning physical product characteristics with service (Reim *et al.*, 2015): the R&D function, therefore, should *design modular products and components* (Mont *et al.*, 2006), in which critical elements are *easy to access and to repair* (Azarenko *et al.*, 2009), taking into account also the *need for disassembly/recycling* (Tukker, 2004). Likewise, *dedicated teams and roles for new service development* should be established (Kindström, 2010; Storbacka, 2011;

BM component	MM dimension	Critical requirement
Value proposition	Capabilities	Capability to design specific value propositions to meet actual customer needs Capability to develop new service offerings that create new value for the customer Service logic translation capability
	Process management	Procedure and practices to define and formalize the key value sources for specific value propositions Procedure and practices to ease the determination of the value for the customer (e.g. total cost of ownership)
	Tools	Procedure and practices to manage service portfolio Specific tools and methods for service value proposition design Tools to ease the determination of the value of the new offering Establishment of a customer-centric organization
	Organizational approach	Relational skills of sales and marketing personnel Relational skills of service personnel Procedures and practices for managing customer feedbacks on product/service experience
Customer relationships	Capabilities	ICT systems/applications that support the automatization of relationships and collaboration between customers and providers Capability to understand the customer's problem and interpret their real needs Capability to manage customer production processes data Capability to manage customer portfolio and identify customer segments Procedures and practices for assessing customer preferences and needs on product and process-related information (e.g. technical and technological, etc.) Procedures and practices for assessing customer preferences and needs on service-related information (e.g. services, financial aspects, risks, etc.)
	Process management	Establishment of an after-sales teams for different service categories Establishment of a field service organization
Customer segments	Tools	Establishment of sales teams/key account managers to direct interface with important customers Capability to select and evaluate suppliers'/partners' performances over time and their achievement of targets/expectations Procedures and practices for drawing-up business deals/agreement with key partner/suppliers
	Capabilities	Procedures and practices for drawing-up business deals/agreement with key partner/suppliers
Channels	Organizational approach	ICT systems/applications that support supply chain management and collaboration activities with suppliers
	Process management	
Partnerships	Capabilities	
	Tools	

(continued)

Table II.
SeMM – critical requirements list

BM component	MM dimension	Critical requirement
Key activities	Organizational approach	<p>Establishment of dedicated team/roles/persons for new service development</p> <p>Establishment of a distinct service function with profit-and-loss accounting and responsibility for strategic service development</p>
	Performance management	<p>Metrics to measure service-related activities operational performances (e.g. response time, quality, etc.)</p> <p>Metrics to measure product state and product-process performances</p>
	Process management	<p>Procedures and practices for development of new services</p> <p>Procedures and practices for total cost of ownership evaluation and assessment</p> <p>Procedures and practices for internal service-related processes (e.g. helpdesk) standardization</p> <p>Procedures for managing service delivery processes (e.g. technical assistance intervention)</p> <p>Procedures and practices for managing the integration between product and service development processes</p> <p>Procedures and practices for managing the involvement of different business functions in the product design and improvement</p> <p>Procedures and practices for aligning incentive and rewards systems of sales and marketing personnel to strategic service objectives</p>
Key activities	Capabilities	<p>Capability of technical office to design modular products and components (product-design phase)</p> <p>Capability of technical office to design reliable products anticipating potential causes of failure during the product-design phase</p> <p>Capability of technical office to design products in which components are easy to access/replace during technical assistance (design for serviceability)</p> <p>Capability of technical office to design products taking into account the need for disassembly/recovery/disposal/recycling at the end of the product lifecycle and the environmental impact (design for end-of-life)</p> <p>Capability of technical office to design products taking into account the economical impact of the product during the whole product lifecycle</p> <p>Capability of the deputed roles to design modular services (service-design phase)</p> <p>Capability to formalize and standardize services/new service offerings</p> <p>Capability to communicate and make tangible the service value to the customer (sales and marketing personnel)</p> <p>Capability to organize and manage the after-sales activities</p> <p>Capability to internally coordinate sales and field service organizations</p> <p>Tools for supporting the product design accordingly to new service design requirements</p> <p>Tools for supporting the development of new services</p> <p>Tools for total cost of ownership evaluation and assessment</p> <p>Tools for supporting sales and marketing personnel (e.g. payroll simulation tools)</p> <p>Tools for planning and managing maintenance activities (e.g. scheduling routine maintenance)</p> <p>Tools for supporting the development and delivery of maintenance activities</p>

(continued)

BM component	MM dimension	Critical requirement
Key resources	Organizational approach	Service business attractiveness and mind-set Top management commitment: drive change and establish a service culture Open access to customers' installed base data (data availability)
	Capabilities	Capability to analyze data collected from the installed base for improving fleet management Capability to collect product and process-related data (e.g. usage, performance, health state) Capability to collect service-related data (e.g. reliability, failure) Capability to interpret product and process-related data Capability to interpret service-related data
	Process management	Capability to elaborate business plans and documents to acquire new financial resources Procedures and practices for data collection, interpretation and processing of product and process-related data Procedures and practices for data collection, interpretation and analysis of service-related activities Procedures to manage financial resources allocation
Key resources	Tools	Monitoring technologies on product/systems that support collection of service-related data (e.g. Maintenance activities) Monitoring technologies on product/systems that support collection of product and process related data (e.g. Product usage, performance, . . . stems/applications that support the collection of service-related data (e.g. Maintenance activities information)) Ict systems/applications that support collection on product and process-related data (e.g. Product usage, performance, etc.) ICT systems/applications that support interpretation, analysis and reporting on product and process-related data ICT systems/applications that support interpretation, analysis and reporting on service-related data
	Capabilities	Product-service solution pricing capabilities Capability to define reliable outcome expectations with the customer and define the corresponding metrics/parameters to evaluate the agreed outcome
Cost structure	Capabilities	Capability to evaluate operating and financial risks and manage uncertainty Capability to distribute risk to other network of partners Capability to design and implement safeguarding mechanisms (e.g. For financial and operating risks)
	Process management	Procedures and practices for financial risk evaluation Procedures and practices for operating risk evaluation
	Tools	Tools to support cost evaluation of the product-service solution Tools for reporting and cost accounting of service-related activities
Performance management	Performance management	Metrics to evaluate service-related activities costs Metrics to evaluate service-related activities costs Metrics to measure financial performances Metrics to evaluate fleet financial costs

Table II.

Rapaccini *et al.*, 2013), together with *procedures for the development of new services* (Ulaga and Reinartz, 2011; Storbacka *et al.*, 2013) and *service engineering practices* for the systematic design and development of services (Meier *et al.*, 2010; Rapaccini *et al.*, 2013). Also, a company needs to *formalize and standardize services* for a more effective service delivery (Kindström and Kowalkowski, 2014).

The service delivery planning and execution processes are crucial in servitized BMs (Kindström and Kowalkowski, 2009). They should evolve from an uncontrolled and random reaction to a controlled and structured set of actions: to this end, *procedures and practices for internal service-related processes standardization* along with *procedures for managing service delivery processes* are required (Storbacka, 2011; Kindström and Kowalkowski, 2014). This evolution may entail also important organizational changes, such as the *establishment of a separate service business unit* (Oliva and Kallenberg, 2003) and a clear *separation between front-office* (e.g. technical assistance) and *back-office* (e.g. help desk) activities. In fact, a dedicated back-office infrastructure enables cost-efficient operations (Kindström and Kowalkowski, 2014). Companies should also implement specific *tools to support the service planning, delivery and execution* to avoid or minimize troubleshooting processes and also create a knowledge base to further improve service processes (Meier *et al.*, 2010; Kindström and Kowalkowski, 2014).

Since different functions should synergistically operate in service development, planning and execution, the level of interaction and integration among different company functions plays an important role (Nordin and Kowalkowski, 2010; Gebauer and Kowalkowski, 2012). Thus, the *inter-functional coordination capability* should lead, for example, to increased involvement of the service organization in the sales process (Kowalkowski, 2011). Consequently, *procedures and practices for managing these integrations* should be implemented.

4.2.5 Key resources. A new *corporate culture* and *top management commitment* to the service business) to enhance the service orientation of employees (Barquet *et al.* (2013); Ulaga and Reinartz, 2011). Other critical resource in servitized BMs is the installed base, as it provides critical insights about product operations and valuable customer knowledge (Ulaga and Reinartz, 2011), and the related *monitoring technologies* (Ardolino *et al.*, 2018). Therefore, the company should implement *procedures and practices for collection, interpretation and processing of product, process- and service-related data* (Ulaga and Reinartz, 2011). Similarly, traditional information technologies should be integrated with *new ones* (such as internet-of-things), enabling data collection, interpretation and reporting (Neff *et al.*, 2014). Consequently, companies need to acquire or develop the *capability to collect product-, process-, service-related data and interpret them*, and in particular, *to analyze data collected from the installed base* (Ulaga and Reinartz, 2011).

As the availability of financial resources is a prerequisite for servitized BM (Tukker, 2004), a company needs to *elaborate business plans* to acquire financial resources (Azarenko *et al.*, 2009; Ng *et al.*, 2013) and, at the same time, *procedures to manage financial resources allocation* (Mont, 2006; Barquet *et al.*, 2013).

4.2.6 Partnerships. Companies may decide to outsource activities or acquire external resources to deliver services (Gebauer *et al.*, 2013). *Selecting partners* is, therefore, essential to develop a network that delivers services effectively, as it is consequently the *capability to measure their performances over time* (Kindström, 2010; Storbacka, 2011; Kindström and Kowalkowski, 2014). As in a servitized environment, relationships with partners are crucial, (Saccani *et al.*, 2014) *procedures and practices for drawing-up agreements with key partner/suppliers* are needed to formalize and specify contractually the responsibilities and obligations of all parties (Ng *et al.*, 2013). Another crucial aspect is the sharing of data with partners, to build trust and strengthen relationships (Gebauer *et al.*, 2013), relying on *information systems and tools for information sharing* with the network (Storbacka, 2011; Kindström and Kowalkowski, 2014).

4.2.7 Channels. Companies need to rethink how they create customer awareness (Kindström *et al.*, 2015) and deliver offerings. A company should establish *sales teams/key account managers* to interact with key customers and create a “service-savvy” *sales force* (Uлага and Loveland, 2014). This may lead to the reconfiguration of the sales channel through internalization or externalization (Kindström *et al.*, 2015).

A similar development path has to be followed for after-sales service channels, where the *establishment of a field service network* allows venturing into more complex offerings (Uлага and Reinartz, 2011). In fact, in addition to selling and delivering services, the after-sales channel collects critical information about customers, service operations and the market (Gebauer and Kowalkowski, 2012).

4.2.8 Cost structure. Companies need to assess the cost of servitized offerings (Datta and Roy, 2010). To this end, *specific metrics* have to be defined (e.g. to evaluate service-related activities costs, financial performances, fleet financial costs, etc.) using, for example, data collected from the installed base (Storbacka, 2011; Barquet *et al.*, 2013). Moreover, traditional cost assessment procedures are no longer suitable in the new setting, and *tools for reporting and cost accounting* of product-service solutions are required (Datta and Roy, 2010). The evaluation of how risks are shared among the company, its suppliers/partners and the customer is critical in servitized BMs. To this end, companies should develop the capabilities to *evaluate operating and financial risks and manage uncertainty, to distribute risks to other network partners and to design and implement safeguarding mechanisms* (Nordin *et al.*, 2011; Kindström and Kowalkowski, 2014). Moreover, procedures have to be implemented to *formalize and manage financial and operating risks* (Tukker, 2004; Nordin *et al.*, 2011). Finally, *mechanisms to reduce customers’ liability risks and enhance control* over production uncertainties should be arranged (Azarenko *et al.*, 2009).

4.2.9 Revenue model. Several revenue generation mechanisms can be developed in servitized BMs, which require new *pricing capabilities* (Bonnemeier *et al.*, 2010; Rapaccini, 2015). As payments may be based on the availability of the product and/or service, on the usage intensity, or on the results achieved (Barquet *et al.*, 2013), the *capability to define reliable outcome expectations with the customer and define the corresponding metrics/parameters* to evaluate the agreed outcome are required (Meier *et al.*, 2010; Storbacka, 2011; Uлага and Reinartz, 2011).

4.3 SeMM operationalization

In the MM literature, a common design principle is to represent maturity as a number of cumulative stages (generally five) with a logical progression (de Bruin *et al.*, 2005). The SeMM, thus, operationalizes the maturity concept with five-stage scales to measure the service orientation of each requirement (Table III). We mostly adopt standard scales based on the literature (one for each dimension), but also develop *ad hoc* ones when needed to take into account the peculiarities of some requirement.

Based on the evidence collected at the companies, we assign a maturity score to each requirement, ranging from 1 (no service orientation) to 5 (highest servitization maturity). By aggregating the scores of the requirements according to the BM component and/or maturity dimension they belong, the SeMM provides a maturity level for each dimension and for each BM component. By averaging out such scores, an average servitization maturity score for the company is obtained. Figure 2 provides examples of radar charts visualizing the maturity of BM components and maturity dimensions and of their disaggregation into the constituting requirements.

5. Empirical application

The SeMM has been applied to two companies undertaking a servitization journey, HSM and FORK. HSM is a medium Italian company that manufactures high-speed milling systems,

Table III.
Standard scales
adopted in the SeMM

Dimension	Key references	Level 1	Level 2	Level 3	Level 4	Level 5
Organization	Adapted from Rapaccini <i>et al.</i> (2013)	No formal or informal roles	Project-based team, extemporaneous, <i>ad hoc</i> identification of participant (e.g. for specific problem)	Project-based recognized team	Project-based recognized team Formal role responsible of specific service category	Project-based recognized team Formal role responsible of specific service category Roles dedicated also to strategic planning based on service portfolio analysis
Process management	Adapted from UNI EN ISO 9004:2009;	There are absolutely no evidence of any activities supporting the process	No formal procedures, chaotic and non-systematic approach: only some policy statements have been made and no documented objectives or plans Processes are planned and managed in an informal, <i>ad hoc</i> way: there are <i>ad hoc</i> activities present, but not aware of how they relate to each other within a single process	There is systematic approach: the company is aware of the process, but some activities are still incomplete or inconsistent	There is a systematic approach with formal procedures shared inside the company: procedures encompass and set also targets for quality Tasks, responsibilities and authorizations are well defined and communicated Comprehensive management reports are produced and discussed In addition to L3, specific KPIs for service performance considering financial aspect (cost, savings, interests, profit, revenue)	In addition to Level 4, the procedures are integrated with other company's key processes and lead to a continuous improvement: quality management and continuous improvement activities are formalized in the procedure Process planning is integrated with strategy deployment Balanced measures for services performance, considering internal, external, customer and financial. KPIs are integrated and aligned to the whole company business
Performance management	Adapted from Rapaccini <i>et al.</i> (2013)	No measures in place	Few and <i>ad hoc</i> measures, mainly related to costs, to point out cost-savings opportunities	Standard key performance indicators (KPIs) dashboard. Productivity, quality and time measures are mainly considered		

(continued)

Dimension	Key references	Level 1	Level 2	Level 3	Level 4	Level 5
Capabilities	Likert scale	No awareness of the skill required	Low	Medium	High	The specific skill is consolidated within the company. There are formal training activities on this specific skill that is also assessed periodically. Moreover recruitment can focus on this skill
Tools	Adapted from Rapaccini <i>et al.</i> (2013); Neff <i>et al.</i> (2014)	No methods and tools	No standard methodology: only <i>ad hoc</i> /project-defined initiative (with a general-purpose tool)	Some tools implemented, derived from other purpose	Self-made/ <i>ad hoc</i> tools are implemented and their use is formalized	Specific tools are implemented and used in a structured way Development process formalized specific supporting tools and “best-of-breed” tools Continuous improvement of methods (customization/declination of existing methodologies to specific company needs)

Table III.

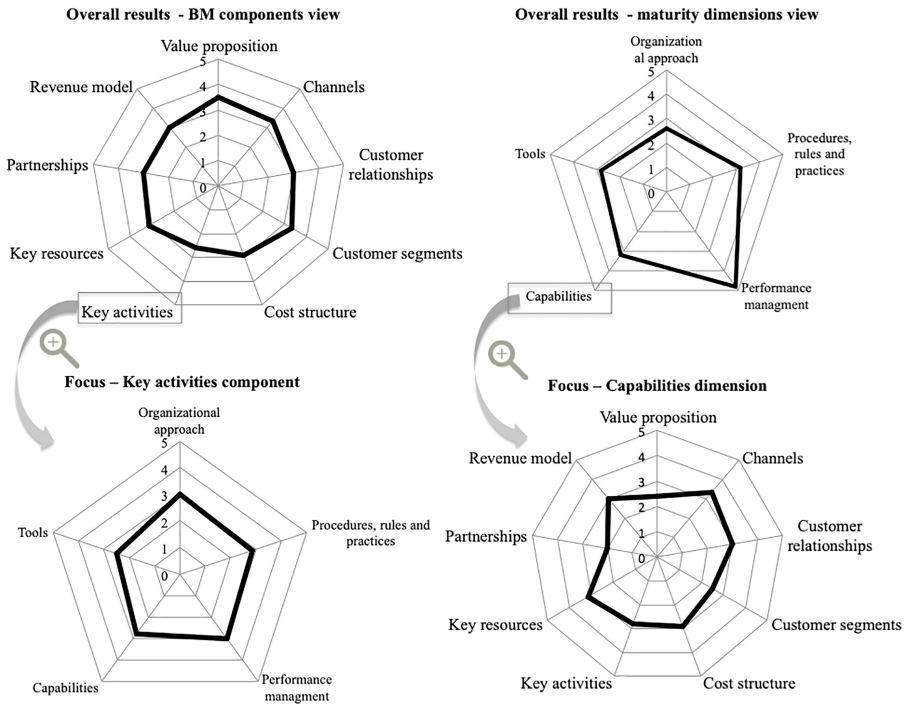


Figure 2. SeMM structure

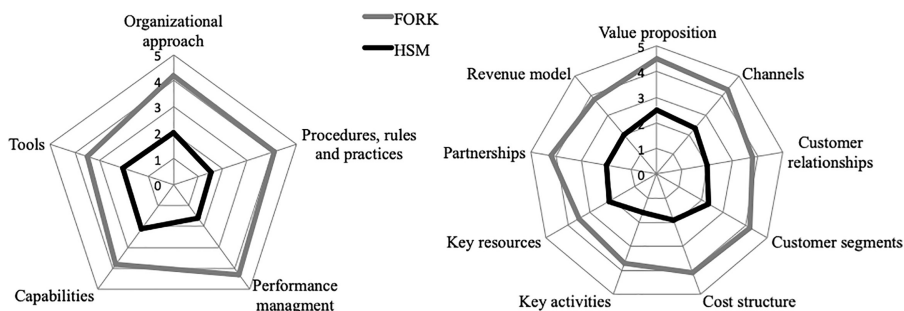
characterized by a high customization and flexibility. Machine sales represent the greatest part of the turnover (more than 75 percent), while after-sales services were traditionally considered a “necessary evil,” and only recently, the company has started focusing on the development of the service business. The service portfolio is still mainly made of base services, such as technical assistance, training and spare parts provision. FORK is a medium Spanish firm operating in the forklift truck sector. Its business evolved in the past ten years from a reseller to being mainly a forklift rental company. Today, FORK has a fleet of over 2,000 forklift trucks on long-term rental and a related business of financial and after-sales services.

5.1 Servitization maturity assessment

The assessment of the servitization maturity leads to two very different pictures. Figure 3 shows that, both in the maturity dimensions and BM components, FORK is consistently positioned slightly below or above Level 4, while HSM generally stands around Level 2[1]. In the following, the results of the SeMM application are briefly presented, grouped by key components.

Key activities – HSM has no explicit strategy for both existing and new services. FORK, instead, has structured processes and responsibilities for the development of new services, adopts service engineering methods and specific workflows to guide the service design phase, ensuring the participation of different business functions. On the contrary, HSM has no procedures and practices for managing the integration between product and service development. Similarly, while FORK adopts clearly defined procedures for service delivery (e.g. technical support, help desk, etc.), in HSM, these are still missing. In addition, FORK has a service business unit with profit and loss responsibility.

Figure 3. SeMM structure



Revenue and costs – HSM has no specific metrics to measure service-related operational performances (e.g. response time, quality, etc.) and costs, and the management acknowledges that this may be critical when new services related to a newly developed remote monitoring system will be launched. FORK, on the other hand, has detailed indicators to monitor services performance, encompassing internal, external, customer and financial aspects. Moreover, FORK has also developed the capability to design safeguarding mechanisms and to evaluate operational and financial risks. As the latter aspect is critical also to determine how to price services, FORK is able to charge its rental fleet with periodic fees that also include periodic maintenance. On the opposite, HSM adopts a traditional one-off transactional revenue model.

Key resources – In HSM, the technical know-how (mechanical and software) represents the core competence. However, the low level of service orientation in the organization could hinder the development of servitized offerings requiring to move some key employees from purely technical roles to service-related ones. On the other hand, FORK has moved from emphasizing only technical product features to a service delivery logic, and specific roles are set in the organizational chart to promote services and to be a unique touch point for the customer. Both companies are rather immature in terms of ICT tools and monitoring technologies: a common critical aspect is the data collection from the installed base. However, they have recently implemented sensors and tools for data collection and product health management, which will enable the collection and elaboration of data about equipment and customer operations, allowing to strengthen customer relationships.

Channels and partnerships – Besides the common involvement of partners in the technological development of remote monitoring systems, great differences emerge. In fact, while FORK has designed a field service network made both by internal personnel and external service partners, HSM has not yet structured its channels to provide field services effectively. FORK, moreover, has a formalized set of criteria for partner selection and has improved the communication and information sharing with its sales and service network to secure transparency and visibility.

Customer segmentations and relationships – While FORK adopts *ad hoc* tools to ease the information exchange with customers, HSM instead still collects few data from customers, using spreadsheets not integrated with the enterprise resource system (ERP) system (e.g. technical and fault reports). Consequently, no formal procedures for managing customer feedbacks are present in HSM, while FORK has implemented workflows to collect and manage feedbacks on product/service experience. This also allows FORK to better understand customer preferences and needs: thanks to the data collected, FORK has developed customer segmentation criteria. HSM, instead currently lacks the capability to design customer-specific value propositions.

5.2 SeMM usage and improvement actions

HSM has recently introduced a new smart spindle in the machines and aims to develop preventive and predictive maintenance services, thanks to this technological innovation and to a condition-based monitoring tool (designed by a partner). Instead, FORK aims to develop a new short-term rental business (i.e. rentals ranging from few days to two months), to increasingly exploit its fleet. This offering will include a novel full-service contract to customers and a daily rental fee based on the actual forklift usage (pay-x-use). The short-term rental will rely on a novel field management system that allows FORK to monitor and analyze the signals collected from the forklift (e.g. working hours, battery level, engine temperature, etc.).

Based on the maturity assessment previously illustrated and the innovations and objectives described above, FORK and HSM identified a set of actions to improve their servitization maturity and sustain the development of the new offering. The actions are listed in [Table IV](#).

6. Conclusion

6.1 Theoretical contribution

A need for studies aimed at describing and prescribing how to servitize a product-centric firm has been observed ([Baines et al., 2017](#)). The MM developed in this paper contributes to fill this gap and to accumulate knowledge on the service transformation of product-centric companies. The model has an original bi-dimensional structure, combining five maturity dimensions with the BM Canvas components. Through the identification of 85 detailed critical requirements, it provides a comprehensive understanding of the service transition phenomenon. In particular, it helps addressing some among the most acknowledged challenges of servitization, the cultural readiness and the top management commitment ([Oliva and Kallenberg, 2003](#); [Gebauer et al., 2005](#), [Martinez et al., 2010](#)). In fact, the SeMM generates awareness about the critical aspects to be controlled, contributing to the creation of a company culture about the many elements, both inward and customer-facing, to be considered and aligned when undertaking a servitization journey. In addition, as several challenges hinder the achievement of the expected strategic, financial and marketing benefits of servitization ([Zhang and Banerji, 2017](#)), the choice of using BM components as one of the axis of our SeMM helps reading servitization in the light of the BM transformations needed, on each component and at each maturity stage. The identification of gaps in single requirements or in their aggregation (e.g. BM components) supports the definition and prioritization of the actions and transformations required to servitize, as shown by the case studies.

Another specific contribution of this paper stands in the operationalization of the servitization concept, thanks to the definition of critical requirements and their measurement scales, that address another research gap observed in the literature. In fact, it has been pointed out that servitization measures are varied and inconsistent across studies ([Calabrese et al., 2019](#)) and mostly based on one single indicator, such as the number of services (or service types) offered or the share of revenue made from services. Servitization being a largely intra- and inter-organizational multidisciplinary matter, linking its measure simply to an output indicator cannot capture the complexity of the phenomenon ([Lütjen et al., 2017](#)). The adoption of a multidimensional and comprehensive perspective on the organization and its relationships, instead, appears as more appropriate way to deal with the measure of servitization.

Finally, because SMEs often do not possess the resources or the experience to successfully servitize ([Kowalkowski et al., 2013](#)), this research contributes to the development of guidelines and tools that SMEs can apply for pointing out the capabilities, resources and organizational changes needed that are advocated in the literature ([Adrodegari et al., 2017](#); [Baines et al.,](#)

BM component	HSM	FORK
Value proposition	<ol style="list-style-type: none"> (1) Develop a new service culture and attitude (2) Include the new predictive maintenance service in the traditional portfolio (3) Design the new offerings: software and related services 	<ol style="list-style-type: none"> (1) Design the lifecycle cost models of the new short-term rental model (2) Define the value of the new offering compared to long-term rental
Customer relationships	<ol style="list-style-type: none"> (1) Implementation of specific ICT tools to ease the relationships with customers (e.g. customer relationship management (CRM), trouble ticketing, etc.) (2) Formalize specific procedures to manage customer feedbacks (3) Develop relational capabilities both in the sales and after-sales personnel 	<ol style="list-style-type: none"> (1) Implement a Web portal for short-term rental customers: ticketing, renting and automatic configuration of the forklift (2) Improve the existing internal procedure for managing customer feedback to use these feedbacks for product/service improvement and strengthen customer relationships
Customer segments	<ol style="list-style-type: none"> (1) Design a periodic survey to assess customer satisfaction and needs (2) Develop new customer segmentation criteria and accordingly manage the customer portfolio (3) Develop the capability to customize value proposition to meet actual customer needs 	<ol style="list-style-type: none"> (1) Adapt the existing customer advisory procedure to better define the new short-term rental value to each customer segment
Key activities	<ol style="list-style-type: none"> (1) Establishment of service business unit (2) Formalization of workflow for the service design phase (3) Formalization of workflow for the service planning and delivery phase (4) Implementation of tools for managing service-related activities and enable predictive maintenance (5) Identification of relevant KPIs, especially related to the service function (6) Design specific marketing initiative for new full-service contracts (7) Define procedure that formalize and standardize the data collection, interpretation and processing (from product and service activities) 	<ol style="list-style-type: none"> (1) Create a dedicated team for the analysis and interpretation of new signals collected from the forklift (2) Improve the current procedure for forklifts refurbishment (i.e. initial diagnosis, disassembly, painting and repair, assembly and final quality tests) (3) Improve logistics and reverse logistics processes (4) Develop specific marketing initiative to promote the short-term rental model aiming to clarify the new values for the customers
Key resources	<ol style="list-style-type: none"> (1) Define new service roles in the organization chart (2) Define new job profiles to acquire specific capabilities needed (3) Develop a project management and planning attitude (4) Integration/migration of the data manually collected into the ERP (5) Exploit the functionalities of the new condition-based monitoring tool (6) Use new techniques for product design accordingly to the service requirements (e.g. implementation of new diagnostic sensor on the machines; adoption of design-for-X techniques) 	<ol style="list-style-type: none"> (1) Exploit the functionalities of the new fleet management and health management systems (2) Implement additional devices for the connectivity of the forklift (3) Implement new additional sensors on the battery (i.e. monitoring the electric energy consumption will help to understand the real usage of the battery and when it needs to be regenerated) (4) Implement geo-localization of the forklift to ease their quick (re)-allocation in the short-term rental business

(continued)

Table IV. Main actions to support the development of the new servitized offerings in the two companies, grouped by BM component

BM component	HSM	FORK
Partnerships	(1) Develop new external partnerships to provide maintenance in countries where HSM is not present with a direct subsidiary (2) Define procedures that help to formalize and specify contractually the responsibilities and obligations of all parties	(1) Develop new partnerships with local logistics providers and financial service providers (2) Design specific indicators to monitor partners' performances in the short-term rental business
Channels	(1) Design a new after-sales channel, structuring a field service network (2) Define a new unique touching point (e.g. "sales support and customer service profile") (3) Periodic inter-firms meeting to ease the interaction among sales and after-sales channels	(1) Manage the coexistence of short- and long-term rental models
Cost structure	(1) Formalize procedures for financial risk assessment and evaluation (2) Formalize procedures for operational risk assessment and evaluation	(1) Develop a total cost of ownership tool for the short-term rental (2) Adapt the existing procedure for financial risk assessment to short-term rental
Revenue model	(1) Develop new pricing capabilities (2) Definition of new reliable outcome expectations with the customer for the new predictive service (3) Formalize the reward system and explicitly indicate that it is oriented to something different than new product sale	(1) Align incentive and rewards systems to new strategic short-term rental objectives (2) Develop a new capability to elaborate business plans to quantify to customers the new value of the short-term rental business

Table IV.

2017). For instance, a critical aspect for SMEs concerns the sales and service channels, which are often intermediated (Gebauer *et al.*, 2010): consequently, partnerships have a key role in providing SMEs access to the end-customer base and/or the additional capabilities needed to develop and sell service offerings (Kowalkowski *et al.*, 2013; Paiola *et al.*, 2013). Those aspects are explicitly assessed in the SeMM, showing how the critical requirements structure proposed can guide SMEs in identifying the key aspects for their servitization journey and the improvement actions to be undertaken.

6.2 Managerial implications

From a managerial perspective, the SeMM responds to the call for application-oriented research (Baines *et al.*, 2017). The model provides a way to assess the servitization maturity of the five dimensions and nine BM components, also in a visual fashion (Figures 2 and 3), suggesting priority action areas for the company management. Therefore, managers can use the proposed model to identify and bridge the (internal and external) gaps to successfully deploy the new BM, selecting specific actions to overcome them, as it has been shown through the case application in section 5.

In particular, the model can be particularly useful to SMEs, supporting practitioners in the servitization journey through a rigorous yet practical tool, helping them bridging the distance with large companies. In fact, the SeMM supports managers, to successfully leverage, coordinate and align the transformations needed to servitize.

Moreover, the cases show how the model can be applied in product-centric companies coming from both a pure manufacturing background – having traditionally conceived services as a “necessary evil” – and from a reseller/distributor one – seeking to create value for the customer through additional services and new revenue models.

6.3 Limitations and research opportunities

This study comes with some limitations, suggesting avenues for future research. First, the empirical application relies on two case studies only, and it should be extended to additional companies and sectors to verify its reliability and consistency.

Second, although the SeMM lists 85 critical requirements, some crossings between BM components and maturity dimensions are not described by any item. Future research could focus on these crossings, to identify critical requirements to be added to the current set.

Third, further studies may investigate the relationships among the critical requirements identified, leading to the definition of archetypal configurations of servitized BMs (i.e. configurations of the requirements for specific value propositions, such as “pay-per-use”).

Finally, as companies may adopt different BMs simultaneously (e.g. to address different markets or customer segments), future research may investigate how the SeMM can support companies in defining the configuration of resources and capabilities in a multiple BM perspective.

Note

1. A detailed evaluation of the requirements for each company can be provided upon request.

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