

ORIGINAL RESEARCH

Overcoming the knowledge gaps in early-stage servitization journey: A guide for small and medium enterprises

Mario Rapaccini¹ | Federico Adrodegari²  | Giuditta Pezzotta³ | Nicola Saccani²

¹Department of Industrial Engineering, University of Florence, Florence, Italy

²Department of Mechanical and Industrial Engineering, University of Brescia, Brescia, Italy

³Department of Management, Information and Industrial Engineering, University of Bergamo, Dalmine, Italy

Correspondence

Federico Adrodegari, Department of Mechanical and Industrial Engineering, University of Brescia, Via Branze 38, 25123, Brescia, Italy.
Email: federico.adrodegari@unibs.it

Funding information

National Recovery and Resilience Plan; Italian Ministry of University and Research funded by the European Union; NextGenerationEU, Grant/Award Number: PE00000004; Italian Ministry of University and Research, Grant/Award Number: CUP F13C22001230001

Abstract

Although the move to more service-oriented business can be beneficial even to smaller firms, servitization in SMEs remains a largely unexplored topic. The authors contribute to fill this gap exploring how SMEs can overcome the knowledge gaps of servitization faced by companies in the early-stages of this journey. By combining systematic literature review and expert panel methodology, the authors identify three knowledge gaps that hinder servitization initiatives in SMEs and propose a set of managerial recommendations to tackle with these gaps. In particular, the authors suggest a structured plan of recommendations, and point out how each stakeholder can contribute to fill the mentioned gaps. The proposed actions are specifically suggested for SMEs and focus on greater engagement of internal and external stakeholders. In addition to contributing to the domain scientific research on servitization, the authors therefore respond to the call for application-oriented research.

KEYWORDS

customer services, manufacturing industries, small-to-medium enterprises

1 | INTRODUCTION

Servitization is defined as a strategic transformation of manufacturing companies that shift their business orientation from being product-centric to becoming more focused on services as mechanisms for value co-creation [1]. When correctly implemented, this move brings remarkable benefits such as strategic differentiation, revenue growth, and higher profitability to mention a few [2–4]. However, this transformation is risky [5–7], particularly in the case of Small and Medium Enterprises (SMEs) [8, 9]. In fact, SMEs are more vulnerable to market pressures and have limited budgets for product innovation [10–12]. Although the move to more service-oriented business can be beneficial even to smaller firms [13, 14], servitization in SMEs remains a largely unexplored topic [15]. As known, SMEs are rarely mainstream of scientific research [16], and servitization research makes no exception [17–19]. This paper contributes to filling this gap. In

particular, we explore how SMEs can overcome the challenges of servitization in the very early stages. These challenges mostly pertain to becoming aware of pros and cons from introducing services in product-centric businesses [20, 21]. This research adopts a hybrid methodology that combines a literature review with empirical research. We have first scanned the literature on servitization challenges, with a focus on knowledge gaps faced by SMEs in their preliminary servitization stages. Then, we organized a workshop in which we have asked the managers of different companies to discuss and suggest solutions to tackle with these challenges. The remaining of this paper is organised as follows: Section 2 summarises the findings of previous studies. It specifically identifies three knowledge gaps that are typical of early stages of servitization in SMEs. Section 3 presents the research methodology of this paper, explaining how we used a panel of experts to collect insights around the paper objectives. Section 4 presents the findings from the application of the expert

This is an open access article under the terms of the [Creative Commons Attribution-NonCommercial-NoDerivs](https://creativecommons.org/licenses/by-nc-nd/4.0/) License, which permits use and distribution in any medium, provided the original work is properly cited, the use is non-commercial and no modifications or adaptations are made.

© 2024 The Authors. *IET Collaborative Intelligent Manufacturing* published by John Wiley & Sons Ltd on behalf of The Institution of Engineering and Technology.

panel methodology, and Section 5 elaborates these findings into a structured plan of managerial recommendations. Last, Section 6 draws up some concluding remarks and suggests avenues of future research on this topic.

2 | KNOWLEDGE GAPS AND CHALLENGES OF SERVICITIZATION IN SMEs

Research on this topic suggests that SMEs, just like large manufacturing companies, can obtain financial benefits and remarkable competitive advantages by moving to service-oriented businesses [6, 15, 22]. These benefits can be achieved in various industrial sectors [23] using different approaches to formulate and implement these strategies [24]. Just like larger firms, servitization in SMEs can be an attempt for mitigating the competitive pressures for counteracting product commoditisation and for differentiating the company's offering [8]. Lastly, servitization can be a way to enhance profitability, capturing new opportunities and stimulating business growth [13]. It has also been found that servitization is a risky and not linear transformation, which therefore requires tackling with numerous challenges [7, 25, 26]. In fact, managers encounter several complex and ill-structured problems [27, 28]. For instance, Alghisi and Sacconi [20] claim that developing a service strategy poses cultural and strategic challenges, and therefore several questions should be addressed, such as *what does creating and capturing value with services mean?* and *how can we compete through services in product-dominated markets?* They suggest that these questions should be clearly answered before introducing any other organisational actions. This is in line with other studies that show that firms have to go through some preliminary stages before implementing and scaling up their service strategy [21]. In particular, at the beginning of this transformation, there is the need for exploring and experimenting new service-based value propositions and business models. Exploration is also characterised by finding out the implications for the actual business of competing through a service-based offering. Experimentation concerns, convincing the organisation until the potential of competing through services, are widely accepted. It is also known that when moving through the early stages of servitization, numerous organisational tensions originate [29]. These are induced by two contradictory needs: on one hand, the need of exploiting well established capabilities as a product manufacturer, and on the other, that of developing new knowledge around the service business [30]. The root causes of these challenges are mostly related to cognitive aspects, and addressing these knowledge gaps is required first [31].

In sum, past research identifies various challenges and knowledge gaps that manufacturing companies confront in the early stages of servitization [21]. This is particularly true in the case of SMEs that have limited resources to close these gaps [19, 22]. Also empirical evidences suggest that servitization concerns so far large multinational companies, whereas most industrial SMEs appear to be anchored to product-centric competition [18, 32]. Doubts that servitization efforts of

smaller firms could be aggravated by the greater effort required in the early stages are, therefore, legitimate.

To identify the gaps in early stages of SMEs servitization, we have reviewed past research. Following the methodology suggested by Thomé et al. [33], we have retrieved papers dealing with this topic from scholarly databases such as Scopus and WoS. In this search, we employed multiple keywords—such as “servitization”, “service innovation”, “service strategy”, “service infusion”, and “product-service systems (PSS)” —in combination with terms that characterise the firm's size (e.g. “SMEs”, “small business”, and “small and medium sized firms”). After removing duplicates, we have read abstracts and excluded articles with little or no relevance to the paper's objective. Table 1 shows the exclusion criteria that we have used in this paper.

At the end, we constituted a base of 23 papers focusing on servitization of SMEs that were carefully scanned in order to scrutinise problems of different kinds, related to cultural aspects, know-how and capabilities, practices and technologies. We aggregated similar arguments, paying attention to harmonising the terminologies. This brought us to identifying three specific challenges of early stage servitization in SMEs. Overall, this review confirmed the scant literature dealing with this subject. The following subsections discuss the three knowledge gaps that emerged from this literature review.

1. Unearthing the business opportunities of servitization

The decision to move to a servitized business model can be triggered by different factors. In smaller firms, this decision could be less deliberate than in larger companies [34]. As said, competing with services cannot be taken for granted in SMEs, as the smaller the company size, the greater the gaps to be fulfilled [35]. These gaps can be related to identifying which know-how and capabilities are required to compete with services [13]. In addition, product companies usually put lower emphasis on service culture and customer orientation [36]. The leaders of the company play a crucial role to transform this culture and demonstrate that servitization is possible [18]. It takes however time to change the existing mindset and infuse a service culture among the employees [37]. The first challenge is therefore becoming aware of the pros and cons of the shift to the service business, that is, what benefits and opportunities this move can disclose, what investments and resources are required, and what are the risks. This knowledge is not easily

TABLE 1 Exclusion criteria.

Criteria	Explanation
Not relevant (NR)	NR-1: Papers not written in English, no research articles;
	NR-2: The abbreviation SME is not related to small and medium-sized enterprises;
	NR-3: Papers not dealing with manufacturing firms.
Poorly relevant (PR)	PR-1: Paper focusing on servitization, but with little or no focus on SMEs;
	PR-2: Paper focusing on servitization but in which the considerations around SMEs pertain mostly to future or possible avenues of research, not actual findings.

available in SMEs that unlike larger business cannot recruit managers with previous experience. In certain cases, becoming aware of these opportunities can be epiphanic [38], in others even upsetting [34].

2. Exploring customers' needs

Product-companies have poor reputation as service providers, and customers are reluctant to buy their product-service solutions, as they have little fit with their actual needs [8]. Manufacturers have in fact limited knowledge about the pain points of their end customers. This gap is greater in smaller enterprises that allocate limited resources to market research and needs exploration [13]. In addition, smaller businesses have less sophisticated information systems, such as Customer Relationship Management (CRM) and Enterprise Resource Planning (ERP) systems, to support customers profiling and segmentation [39]. A great help could come from the Internet of Things (IoT) revolution. The collection of field data could facilitate the comprehension of customers' behaviors [40]. However, it has also been found that customers are reluctant to connect their installed base and share sensitive data because of cybersecurity issues [41]. Based in these considerations, we identify a second challenge that pertains to the fact that SMEs find hard to gain insights about customers' needs in respect to product-service offerings.

3. Introducing new technologies to support the service delivery and business

Shifting to a service business requires capabilities that differ from those of product-centric business [18, 24]. For instance, designing and engineering services are different than designing and engineering products [8, 42]. The same is true for organising and managing service operations across global networks [2]. This complexity can be faced with new tools and information systems that servitizing firms must adopt as their new practices [24]. The choice of the proper information systems and digital technologies is thus crucial [41]. This is in line with the literature that shows the challenges faced by SMEs when introducing digital technologies. In fact,

digitalisation can add further complexity for SMEs, as it requires additional competencies [40, 43–45]. In particular, SMEs have difficulties in finding the necessary resources [46, 47] and have limited know-how regarding the technological infrastructure that is needed for business development [48]. For the mentioned reasons, we have identified a third gap that characterises the early stages of servitization in SMEs. This pertains to understanding (i.e. knowing, exploring, and experimenting) which digital technologies and ICTs can support the practices of the service business.

Table 2 summarises the knowledge gaps identified, the roles of the firm that would be more impacted by these gaps, along with questions to ponder. These questions have been formulated to avoid any ambiguity and to ensure that these statements can coherently summarise the relevant concepts through concise sentences, as required for expert panels and Delphi methods [49].

It is worth mentioning that the challenges described in Table 2 reflect those identified by mainstream research, focused on large manufacturers [50]. Our review suggests that facing these challenges could be notably more critical in SMEs, and this could finally hinder the service transformation in these situations. As explained in the next Section, we have used expert panel methodology to collect insights on how these gaps could be overcome. Section 3 provides details about the research methodology.

3 | RESEARCH METHODOLOGY

To provide answers to the given questions (i.e. how knowledge gaps that hinder SMEs servitization in early stages can be overcome), we adopted the *expert panel method* [51, 52] that is based on the established approach of Delphi studies [53] and further expands it to enable individuals to *'apply their expertise while simultaneously providing a platform for discussion and integration of the insights created'* [54]. Indeed, individuals participating in the panel can leverage their expertise around a given topic and share insights from their experience. They can also fine-tune their ideas, integrating their own views with those provided by other experts. For these reasons, this

TABLE 2 Knowledge gaps of early stages servitization of SMEs.

Gaps	Domain	Roles involved	Guiding questions	Key references
Unearthing pros and cons of servitization	Pertain to formulating the service strategy, discussing the cultural barriers, making financial and cost analysis	Senior executives, shareholders, top managers, board of directors	How, when and why SMEs decide to formulate and implement a service strategy.	[13, 18, 35–37].
Exploring customers' needs	Pertain to tools, practices and methods that can be used for service market research	General managers, service operations managers, consultants, sales managers, innovation managers.	How SMEs explore current and prospective needs of their end customers, in order to develop marketable service solutions?	[8, 13]
Introducing new technologies for the service business	Pertain to tools, practices and methods that can be used for managing the service factory	IT department, service managers, innovation managers consultants, technological partners	How SMEs select and introduce new technologies to enable the development of the practices and capabilities necessary for competing with services	[40, 41, 45]

method is suited to collect opinions with respect to unstructured and complex problems, which allows to move from individual reflection to engagement of the panel [55]. At the end, the solution to the given problem emerges from previous knowledge in the form of collective discussion, consensus and agreement. In this way, we were able to derive a set of practical recommendations to close knowledge gaps of early stage servitization that transcend a specific dimension of change (e.g. organisation, skills, systems, processes, etc.), overcoming the limitation of a traditional approach such as maturity models. In fact, although maturity models in the servitization domain have been analysed to collect insights for our study (e.g. [19, 56]), this approach tends to focus only on one or a few dimensions of the transformation, providing prescriptive actions related to a specific dimension (e.g. develop specific capabilities). Moreover, the majority of existing maturity models in literature emphasize the transition towards a more advanced service without discussing the early stages of the servitization transformation.

In this paper, following previous research [57], we adopted an online/real-time variation of the expert panel method that greatly encouraged the dialogue between the academic and industrial counterparts. This method is in fact considered effective in transforming subjective opinions into collective interpretations of complex issues, thanks to the rigor coming from the academic approach [58]. In order to ensure validity and reliability to this research, the methodology was previously discussed among the paper's authors and then shaped into the staged approach as shown in Figure 1. The findings of the first two stages, respectively, are as follows: (a) *Identification of knowledge gaps from the literature*, and (b) *Formulation of statements for evaluation* have been presented in the previous section. The results coming from the remaining stages are described in the following paragraphs.

3.1 | Composition of the expert panel

The expert panel of this research included 30 participants, all having experience and interest in servitization of manufacturing companies. Participants were purposively selected among service directors and managers of the firms affiliated to the ASAP Service Management Forum (www.asapmf.org), as an interuniversity research centre and a community where scholars and managers collaborate in developing and sharing knowledge and experiences on servitization of industrial companies, active since 2003. The experts were selected on the basis of the following criteria: (a) they should be in executive roles (e.g. managing directors, service directors, and service managers) and responsibilities in firms operating in different industries in order to facilitate sector-independent discussions; (b) they should have been acknowledged for their expertise in servitization; (c) there should be at least a given amount of participants with the previous or current work experience in smaller firms to obtain solutions in line with the paper's objectives; and (d) they should have an interest in contributing to scientific research and a predisposition to collaborate with their peers and academic researchers. At the end, after few rounds of selection and invitation, we defined the panel presented in Table 3 and then organised the virtual workshop and invited the experts to attend. This is further explained in the next subsection.

3.2 | Execution of virtual workshop

The virtual workshop was based on three rounds carried out synchronously. First, in a plenary virtual session, set up with MS Teams[®], we presented the workshop agenda and objectives, as well as the rules for the following dialogic interactions. We then

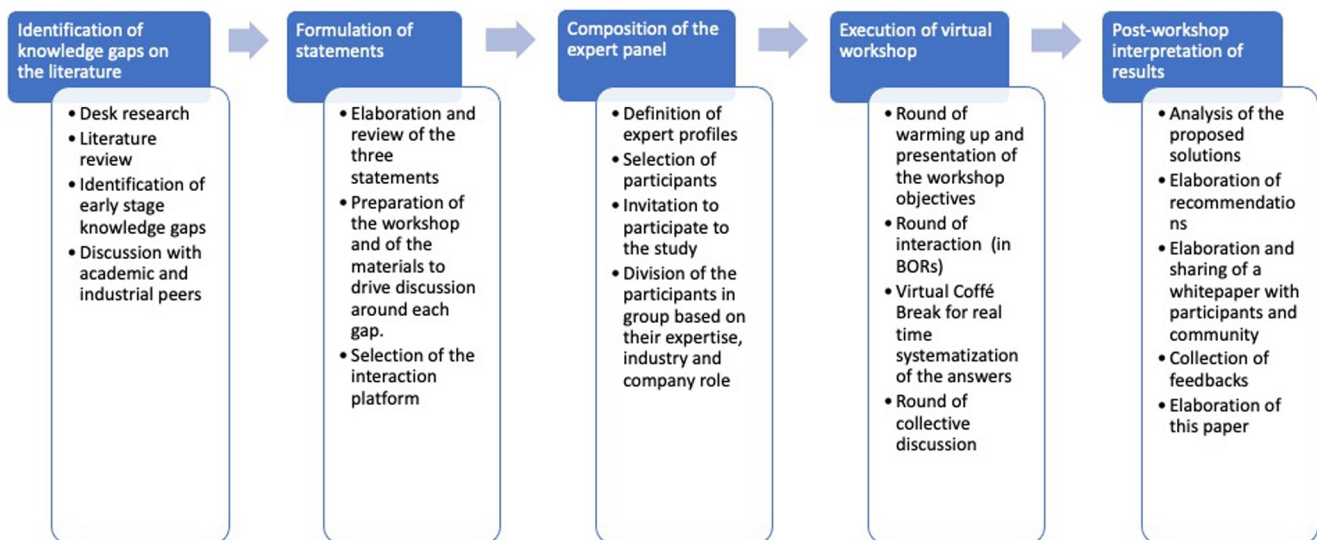


FIGURE 1 Research methodology of this paper adapted from [57].

TABLE 3 Composition of the expert panel.

	Role/Position	Industry/Sector/Manufacturer of	Size
#1	Service manager	Testing solutions for automotive and aerospace industries	Medium
#2	Service manager	Industrial process heating equipment	Medium
#3	Service manager	Air conditioning and refrigeration	Medium
#4	Sales and marketing manager	Air conditioning and refrigeration	Medium
#5	Global field operations manager	Air conditioning and refrigeration	Medium
#6	Managing director	Laundry equipment (services)	Small
#7	Service director	Household and professional appliance	Large
#8	Customer care manager	Household and professional appliance	Large
#9	Service director	Household and professional appliance	Large
#10	Head of consumer services	Kitchen hoods	Large
#11	Service and quality analyst	Kitchen hoods	Large
#12	Sales manager	Energy and facility services	Large
#13	Aftersales executive	Gable top packaging equipment	Small
#14	Managing director	Hot dip galvanising plants	Medium
#15	Service director	Air compressor systems, pumps, material handling systems	Large
#16	Managing director	Domestic appliance (service provider)	Small
#17	Operations and cust. Service director	Printing and document management solutions	Large
#18	Customer support and service solutions	Material handling solutions	Large
#19	Business analyst leader	Lens cutting equipment	Small
#20	Account manager	Information systems for service management	Small
#21	Reg. Director of professional markets	Household and professional appliance	Large
#22	Head of service professional	Household and professional appliance	Large
#23	Service and control systems manager	Electric and cooling systems	Large
#24	After sales director	Small domestic appliances	Medium
#25	Managing director	Logistics solutions provider	Medium
#26	Logistic and reverse manager	Printing and document management solutions	Large
#27	Service director	Printing and document management solutions	Large
#28	Head of management accounting	Trucks (service provider)	Small
#29	Marketing	Information systems for service management	Large
#30	CEO	Information systems for service management	Small
#31	Data analyst	Logistics solutions (national service provider)	Large
#32	Head of customer care	Logistics solutions (national provider)	Large

illustrated to the panel the three knowledge gaps in the form of challenges to be solved. This stage lasted about 30 min.

Then, using the Break-Out Room (BOR) functions of MS Teams, we divided the experts in three groups, challenging each to collectively provide solutions to one gap. In this round, we also used Mural[®] as a collaborative digital workspace. The discussion in each BOR was guided by a facilitator that was selected among the research team on the basis of their knowledge of the phenomena being explored, of the industries, and of the direct relationship to the experts of their group.

This greatly facilitated the categorisation of the solutions proposed by each group and, as a result, their integration for discussion and validation in the plenary session. This second round lasted about 45 min. Review and integration by the facilitators were carried out during a coffee break (around 15 min) (see Figure 2). Then, the audience was requested to get back to the plenary session, listen to the presentations by the facilitators and provide feedbacks, consensus or disagreement. This increased the efficacy of the outcomes produced to a large extent [59, 60].



FIGURE 2 Ideas proposed by the experts on the Mural[®] interactive whiteboards as they were reviewed, classified and aggregated by the facilitators during the coffee break.

3.3 | Post-workshop interpretation

After the workshop, we systematised the solutions proposed by the expert panel into a set of recommendations that were arranged on the basis of the focal stakeholder (e.g. customers, employees, consultants, etc.) to whom each action pertains. We then included these recommendations in a whitepaper that was shared with the participants. Again, we received valuable feedbacks, appreciation and validation. Section 4 shows the solutions collected in the three BORs, then harmonised in real time with the aid of the three facilitators, and then discussed and validated by the experts during the third round of the virtual workshop. Section 5 illustrates the managerial recommendations that originate from rearranging these solutions on the basis of the focal stakeholders.

4 | FINDINGS: HOW TO OVERCOME THE KNOWLEDGE GAPS OF SERVICITIZATION IN SMEs

As explained in Section 3, the experts generated over 50 ideas to overcome the three knowledge gaps. This is higher than the number of ideas that could be generated by the most creative expert, acting in isolation, in a similar amount of time. This is a proof of how productive a community can be when

collaboratively discussing solutions to managerial issues. Ideas were instantaneously classified and aggregated by the facilitators in relation to some emerging similarities (for instance, what type of knowledge was discovered? what are the entities involved, and what the methods used?). This facilitated the following discussion among experts, bringing further understanding, clarification, and validation of the produced contents. After the workshop, the researchers finalised the criteria used for this aggregation. Tables 4–6 show the solutions proposed to, respectively, the three knowledge gaps. These have been aggregated based on their focus (i.e. what is the subject of the exploration). The same tables also show which information, resources and methods are important to the corresponding knowledge generation processes.

As said, while producing the whitepaper (post-workshop), we found that there were commonalities between some of the proposed solutions. This could concern the use of the same methodology, or the same information sources. For example, the experts proposed to conduct a survey on specific market segments to both explore the customer needs (i.e. challenge 2) as well as to investigate what kind of technologies could be adopted (i.e. challenge 3). This was expected as some of the proposed actions ended up being quite “common sense”. Therefore, we rearranged the solutions of Tables 4–6 in the form of a structured plan for strategic actions/recommendations, as discussed in the next section.

TABLE 4 Unearthing pros and cons of servitization.

Focus of exploration	Key resources	Description of the proposed solution
Financial and strategic benefits of servitization	ERP's data	Develop spreadsheets and tools that use the company's data available (e.g. revenues from sales of basic services, actual cost of service delivery, extent of the installed base, etc.), eventually integrated with secondary sources (e.g. databank, literature). Using this data, run what-if analysis and evaluate the economic benefits of selling maintenance contracts in combination to each new unit sold and to the previously installed base.
	Customers' feedbacks	Create a database of the various positive and negative feedbacks given by customers towards products and services; analyse the influence of good and bad product and service quality over opportunities (taken or missed) for up- and cross-selling
	Community of professionals	Take part in events with presentations of industry-specific business cases that show the benefits of servitization in terms of business growth, revenues stabilisation, increase of margins, customer satisfaction, and competitive advantages.
	Consultants	Engage consultants to assess the economic benefits and the return on investment of selling advanced services such as equipment as a service or outcome-based contracts.
Business models and organisational barriers.	Company managers	Organise internal workshops and use the business model canvas methodology to identify the opportunity and organisational impacts of business servitization with respect to the current business model and organisation.
		Create a team with key figures from each company department, ask the team to discuss internally and present to the CEO any critical issues they can foresee that could stem from servitization, in terms of organisational assets, responsibilities and roles.
Service culture	Customers' feedbacks	Organise all the feedbacks received from customers through phone calls, social media, emails, letters, and voices. Identify, extract and analyse any piece of information that can be useful to infer what customers think about the company's culture and service orientation, mindset, attitude to solving problems, focus on customer needs etc.
Benefits for customers	Demo and simulators	Develop tools and demo to show the benefits of the offered services to prospect customers so that they can understand how the service will be delivered and which benefits it will generate.
Practices and capabilities	Other SMEs	Create partnerships with other SMEs to share ideas, resources, practices and competences for service development and delivery.
	Top customers	Survey top clients to understand how they value the company's service offer.
	Global suppliers and big vendors	Observe the firm's global suppliers or technology big vendors to discover what customer services they offer, and how they offer them.
	Rivals	Make competitive benchmarking analysis to discover the product-service offer of competitors

These recommendations have been inductively derived by differentiating between the operand from the operand resources, finding that four categories of actors were explicitly or implicitly emerging: (a) consultants, (b) customers, (c) employees, and (d) other partners/stakeholders (suppliers, competitors, and technology vendors). The rationalisation and formalisation of the evidence collected, therefore, represent an important contribution for SMEs approaching servitization.

5 | STRATEGIES TO ADDRESS KNOWLEDGE GAPS IN SERVITIZATION OF SMEs

In the following, we illustrate the plan and discuss how each recommendation addresses a particular knowledge gap.

5.1 | Action #1: Hire consultants

SMEs may not be able to address the knowledge gaps of servitization using their own/internal resources [19, 22]. Receiving support by qualified consultants can be helpful. The expert panel expects that the number of professionals with experience in servitization is likely to increase, in response to the growing market demand, and guided by professional certifications such as 'servitization manager' issued by leading certification bodies, such as Bureau Veritas. Experts expect also a steadily growth of the amount of public fundings that SMEs can access to for contributing to the cost of qualified managers for servitization and innovation projects. As a result, the knowledge gaps of the early stages of servitization in SMEs can be addressed with the help of external consultants. In particular,

TABLE 5 Exploring customer needs.

Focus of exploration	Key resources	Description of the proposed solution
Specific market segments	Prototypes of product-service solutions, created by the service department	Prototype minimum viable product-service solutions (MVPSS) using agile/lean approaches, identifying specific market segment, go out with pilots proposals, measure the market response, infer how the proposals fit with the customer's needs and willingness to pay for the offered services.
	Marketing and sales department	Train employees of marketing and sales department, teach how to perform market analysis, and ask them to use their knowledge and experience to identify and elaborate the needs of the customers you intend to serve.
	Consultants and industry experts	Hire use of consultants/trainers with long experience in the business/industry you want to serve.
One selected/prime customer	Pilot project with a maintenance contract	Assign resources and budget to develop a specific pilot project concerning a relevant product line of business (LoB), offer free of charge to one selected customer a maintenance contract for this product offering; use the feedback from this pilot to collect information about critical customer's pain points, replicate and scale up to the whole business after improvements.
Actual or prospective customers that are early adopters of services	Customer day event	Organise a "customer day" event, inviting actual and prospective customers that could have a particular interest in receiving services. Establish the meeting agenda in order to have time for discussing with those managers about their problems.
	Co-design of services	Involve customers in the design phase (co-design) of the service.
Under-served customers	Communication technologies	For under-served customers, increase touchpoints to gather information
	Customer loyalty programme	Attract customer with free services and new loyalty programmes that require them to register and enter a range of information. Use this data to profile market segments that show higher opportunities for the development of the service business.
Emerging markets	Open innovation and business ecosystem	Analyse how demand is evolving, identify emerging business opportunities and determine the barriers that hinder the business growth. Address questions such as: Which issues originate from limitations in firm size and resources? Which can be tackled with open innovation strategies? Develop new relationships with industrial and technological partners, adopt ecosystem perspective and try to scale up the service business, in particular, finding ways for complementing the company expertise and know-how with those of partners.

- Gap #1: Consultants can support the elaboration of cost-benefit analyses of service innovation projects. Consultants can help the company's directors in developing the business plans for servitization, estimating service revenues and costs on the basis of their experience and available data. Consultants can also be involved in innovation workshops with company managers to support the elaboration of a servitization roadmap. Using simple tools such as the business model canvas, a consultant could raise the awareness of the company owners and directors about the implications of shifting to the service business.
- Gap #2: Industry experts can be hired to acquire knowledge about market trends and customer needs. In this case, we are

referring to senior consultants who in their previous career have worked as professionals for leading companies of the customer markets. These figures can be of great values, in particular, if they still have a relationship with their companies. In addition to bringing new knowledge about customer needs and pain points, they can also leverage their seniority and suggest some good prospects. Last, senior consultants can investigate the service offerings from competitors and unveil how they have started this journey, how the service offering is communicated, and why the customers consider these services attractive.

- Gap #3: In certain cases, the hired consultants can be also technology geeks. This is the case, for instance, of those

TABLE 6 Introducing new technologies for the service business.

Focus of exploration	Key resources	Description of the proposed solution
Technological frontiers of industry domains	Internal field force and service network	Exploit the knowledge gained from the field force, both internal and external (branches, retailers, agents, distributors), in particular, from those most in direct contact with customers in the sectors of greatest interest to the company's business, or those considered to be on the frontier of innovation, to systematically acquire information on technologies and systems adopted and being adopted
	Ecosystems of technological research and innovation	Connect with organisations operating in the field of technological innovations, such as university research centres, industry and trade associations, innovative clusters, participate in open days, events, demos and pilots, seminars and courses, fairs and exhibitions.
Requirements of operational processes.	Internal field force and service network	Leverage the knowledge of the field force to identify opportunities for technological innovations that deliver process efficiency and resource/time savings.
	Managers and employees	Define the functional requirements of internal and external processes, select technologies on the basis of their fit, their utility and ease of use.
State-of-the-art technologies	Scientific and grey literature	From whitepapers, reports and scientific publications, identify state-of-the-art technologies for each sector and assess how these technologies can be applied in your context.
	Survey about pilot projects	Conduct surveys to evaluate the state of the art of technologies on the basis of pilot projects in each sector of interest.
Technology scouting and adoption	Company networks	Establish/participate to alliances of companies with similar needs, with the aim of carrying out pilot project to acquire knowledge with little costs and investments, to understand which technologies can be adopted and how they should be introduced.
	Technology vendors	Develop partnerships with technology vendors to avoid built-in-house strategies.

senior professionals who had previously worked for a technology vendor in roles such as project manager or project engineer.

5.2 | Action #2: Involve employees

Experts suggest that employees from sales and service departments, who certainly possess valuable knowledge, could be actively involved in servitization projects. For instance,

- **Gap #1:** The business opportunities of servitization could emerge from open discussions among key figures of business units such as marketing and sales, R&D, services, and financial departments. The company's director should organise specific meetings to debate these opportunities, inviting her/his collaborators. Managers can also discover the pros and cons of servitization through the participation to webinars and short training programmes. This can also facilitate the alignment of different departments towards a common vision.
- **Gap #2:** A preliminary analysis of untapped market needs could be done on the basis of the information collected by the company's frontline, such as sales people and field technicians. Marketing and R&D departments can collaborate with sales and field-force staff to develop 'proofs of concept' of the most promising solutions to address customers' needs.

- **Gap #3:** Front-line employees and field technicians could provide information about the technologies that market leaders are using in their own business processes.

5.3 | Action #3: Increase customer engagement

Customers, when engaged effectively, can provide valuable contributions to the debate around servitization. The experts have suggested the following actions:

- **Gap #1:** SMEs can discover the implications of the service business by analysing what customers think about the basic service offering, if any. This can be done through the analysis of customers' related data, such as emails, phone calls, customer complaints, and social media. Every channel can be used to evaluate the sentiment towards the company services. Additionally, the customer touchpoints that are already in place can be leveraged to gather more information. Once collected, these data points can be transformed into valuable insights on new business opportunities.
- **Gap #2:** Few customers that are representative of the relevant markets in which the company operates could be asked to take part in focus groups, to be interviewed or surveyed.
- **Gap #3:** The firm can start some pilot projects with a prime customer to co-develop, implement and test a new service

offer. Pilots are powerful ways for generating knowledge about servitization and understanding how technologies can be used.

5.4 | Action #4: Partnering

Participating in communities and consortia, establishing networks and alliances with either other SMEs or large firms, can help in addressing the complexity of the services journey. Moreover, as SMEs generally have a more direct relationship with (long-standing) customers, they can benefit from favourable conditions for experimenting with new servitized offerings with selected customers. Partnering also with suppliers and even competitors can be a good move. Technology vendors are also potential partners from which the firm can absorb knowledge. Existing communities of professionals, industrial associations, chambers of commerce, technology clusters, and research centres: all these organizations can provide contributions to service innovation. This is in line with the literature that highlights the benefits that SMEs can gain if they participate in alliances, consortia and collaborative networks [61]. Indeed, from collaborating with partners, product and service innovation capabilities are enhanced [62], and the possibilities of seizing new business opportunities are enhanced [63]. In particular, our research shows that, through a partnership strategy, smaller firms can:

- Gap #1: Participate in working groups about servitization in order to explore potential benefits and costs, compare practices and capabilities, and evaluate internal competency gaps. Important contributions to this epiphany also originate from participating in events and training programmes. To this aim, the firm leaders should invest time to establish new connections and create opportunities for knowledge absorption.
- Gap #2: Knowledge about the needs of industrial sectors in which the firm operates can be gathered from partners and professional communities. This could be particularly relevant in situations in which these needs are induced by changes in the competitive context, modification to environmental regulations, and emergence of new industrial standards or production technologies. Partners can be beneficial for needs exploration particularly in those situations in which the firm has no direct connection with the end-customers due to the use of intermediaries, dealers and distributors. Independent channels are generally reluctant to share information about markets and customer needs. Larger partner networks can also be the context in which product-dominated firms can find complementary resources, capabilities and technologies to develop advanced service offerings.
- Gap #3: Carrying out pilots with partners can also be an effective way to test new/advanced service technologies. Making joint investments through strategic alliances reduces the risk and effort of technology-driven service innovation to a great extent. Last, entering into a cluster of similar

companies can increase the purchasing power of the firm when dealing with technology vendors, thus allowing them to receive more tailored proposals for testing and introducing new technologies.

6 | CONCLUDING REMARKS

This paper suggests a set of recommendations to close knowledge gaps of early stage servitization by integrating a literature review with an expert panel. The proposed actions are specifically suggested for SMEs and focus on greater engagement of internal (e.g. employees) and external (e.g. consulting firms, customers, other partner firms) stakeholders. To a large extent, they can be carried out with minimal additional investments; therefore, they are pertinent for smaller businesses. As the review shows, there is scant literature that addresses the gaps that hinder servitization of SMEs. In line with previous studies [21, 29], we identify three gaps that should be addressed before undertaking further initiatives. The paper suggests a structured plan of recommendations and points out how each stakeholder can contribute to fill the mentioned gaps. Thanks to the contribution of experienced managers, working in firms from various industrial sectors, the results produced have a broad managerial value. This paper also gives contribution to scientific research. There are indeed previous studies that explore challenges and barriers to servitization. Unfortunately, this literature does not cover smaller businesses [64], even if they constitute the backbone of the world economy [65]. To the best of the authors' knowledge, this is the first paper that discusses the challenges of servitization with respect to the small-sized firms, identifying that they are mostly of cognitive nature (i.e. knowledge gaps). For this reason, the paper can serve as a basis for future studies on this topic. In this line, we suggest that more research studies should focus on investigating the hurdles of servitization in SMEs, in particular, the challenges connected to the implementation of advanced service strategies. Future research could also aim at integrating our findings with the ones proposed by the adoption of maturity models in servitization [19, 56]. Maturity models, in fact, are suitable tools for mapping the current state and developing future vision [66]. Thus, they could be used both by researchers and managers as a basis to assess whether the proposed actions can help SMEs in moving towards a higher service orientation. Last, the recommendations of Section 5 can be, to a certain extent, taken as alternatives. Therefore, another promising avenue is related to exploring the most effective actions and approaches. Moreover, future studies about the recommendations presented in this article may also foster further specialisation of these actions with reference to the distinctive characteristics of SMEs opposed to large companies. This can be done through, for instance, participatory research, case studies, and also quantitative survey-based research. Such empirical research studies, conducted in sectors other than those involved in this study, may also enrich the discussion on the generalisability of our findings.

AUTHOR CONTRIBUTIONS

Mario Rapaccini: Conceptualisation; data curation; investigation; supervision; writing – original draft. **Federico Adrodegari:** Conceptualisation; investigation; methodology; writing – original draft. **Giuditta Pezzotta:** Methodology; writing – original draft. **Nicola Saccani:** Conceptualisation; supervision; validation.

ACKNOWLEDGEMENTS

This research is inspired by the Research Centre on Innovation and Service Management in Industrial Firms (ASAP), an inter-university centre involving four Italian universities (www.asapmf.org). Funder: Project funded under the National Recovery and Resilience Plan (NRRP), Mission 4 Component 2 Investment 1.3—Call for tender No. 341 of 15/03/2022 of Italian Ministry of University and Research funded by the European Union—NextGenerationEU. Award Number: PE00000004, Concession Decree No. 1551 of 11/10/2022 adopted by the Italian Ministry of University and Research, CUP F13C22001230001, MICS (Made in Italy - Circular and Sustainable).

CONFLICT OF INTEREST STATEMENT

No conflict of interest to disclose.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

ORCID

Federico Adrodegari  <https://orcid.org/0000-0001-7939-4150>

REFERENCES

- Kowalkowski, C., et al.: Servitization and deservitization: overview, concepts, and definitions. *Ind. Market. Manag.* 60, 4–10 (2017). <https://doi.org/10.1016/j.indmarman.2016.12.007>
- Baines, T.S., et al.: The servitization of manufacturing: a review of literature and reflection on future challenges. *J. Manuf. Technol. Manag.* 20(5), 547–567 (2009). <https://doi.org/10.1108/17410380910960984>
- Rabetino, R., et al.: The tribes in the field of servitization: discovering latent streams across 30 years of research. *Ind. Market. Manag.* 95, 70–84 (2021). <https://doi.org/10.1016/j.indmarman.2021.04.005>
- Shen, L., Sun, W., Parida, V.: Consolidating digital servitization research: a systematic review, integrative framework, and future research directions. *Technol. Forecast. Soc. Change* 191, 122478 (2023). <https://doi.org/10.1016/j.techfore.2023.122478>
- Gebauer, H., Fleisch, E., Friedli, T.: Overcoming the service paradox in manufacturing companies. *Eur. Manag. J.* 23(1), 14–26 (2005). <https://doi.org/10.1016/j.emj.2004.12.006>
- Adrodegari, F., Saccani, N.: Business models for the service transformation of industrial firms. *Serv. Ind. J.* 37(1), 57–83 (2017). <https://doi.org/10.1080/02642069.2017.1289514>
- Chávez, C.A.G., et al.: Analyzing the risks of digital servitization in the machine tool industry. *Robot. Comput. Integrated Manuf.* 82, 102520 (2023). <https://doi.org/10.1016/j.rcim.2022.102520>
- Confente, I., Buratti, A., Russo, I.: The role of servitization for small firms: drivers versus barriers. *Int. J. Enterpren. Small Bus.* 26(3), 312–331 (2015). <https://doi.org/10.1504/ijesb.2015.072394>
- Pezzotta, G., et al.: The digital servitization of manufacturing sector: evidence from a worldwide digital servitization survey. In: IFIP International Conference on Advances in Production Management Systems, pp. 165–180. Springer Nature Switzerland, Cham (2023)
- Man, T.W.Y., Lau, T., Chan, K.F.: The competitiveness of small and medium enterprises: a conceptualization with focus on entrepreneurial competencies. *J. Bus. Ventur.* 17(2), 123–142 (2002). [https://doi.org/10.1016/s0883-9026\(00\)00058-6](https://doi.org/10.1016/s0883-9026(00)00058-6)
- Madrid-Guijarro, A., García, D., Van Auken, H.: Barriers to innovation among Spanish manufacturing SMEs. *J. Small Bus. Manag.* 47(4), 465–488 (2009). <https://doi.org/10.1111/j.1540-627x.2009.00279.x>
- Lucherini, F., Rapaccini, M.: Exploring the impact of Lean manufacturing on flexibility in SMEs. *J. Ind. Eng. Manag.* 10(5), 919–945 (2017). <https://doi.org/10.3926/jiem.2119>
- Michalik, A., Besenfelder, C., Henke, M.: Servitization of small- and medium-sized manufacturing enterprises: facing barriers through the Dortmund management model. *IFAC-PapersOnLine* 52(13), 2326–2331 (2019). <https://doi.org/10.1016/j.ifacol.2019.11.553>
- Kolagar, M., et al.: Digital servitization strategies for SME internationalization: the interplay between digital service maturity and ecosystem involvement. *J. Serv. Manag.* 33(1), 143–162 (2021). <https://doi.org/10.1108/josm-11-2020-0428>
- Le-Dain, M.A., et al.: Barriers and opportunities of digital servitization for SMEs: the effect of smart Product-Service System business models. *Serv. Bus.* 17(1), 359–393 (2023). <https://doi.org/10.1007/s11628-023-00520-4>
- Brunswick, S., Vanhaverbeke, W.: Open innovation in small and medium-sized enterprises (SMEs): external knowledge sourcing strategies and internal organizational facilitators. *J. Small Bus. Manag.* 53(4), 1241–1263 (2015). <https://doi.org/10.1111/jsbm.12120>
- Uden, L., Naaranoja, M.: Service innovation by SME. *Int. J. Web Eng. Technol.* 5(3), 268–294 (2009). <https://doi.org/10.1504/ijwet.2009.031010>
- de Jesus Pacheco, D.A., et al.: Overcoming barriers towards sustainable product-service systems in small and medium-sized enterprises: state of the art and a novel decision matrix. *J. Clean. Prod.* 222, 903–921 (2019). <https://doi.org/10.1016/j.jclepro.2019.01.152>
- Adrodegari, F., Saccani, N.: A maturity model for the servitization of product-centric companies. *J. Manuf. Technol. Manag.* 31(4), 775–797 (2020). <https://doi.org/10.1108/jmtm-07-2019-0255>
- Alghisi, A., Saccani, N.: Internal and external alignment in the servitization journey—overcoming the challenges. *Prod. Plann. Control* 26(14–15), 1219–1232 (2015). <https://doi.org/10.1080/09537287.2015.1033496>
- Baines, T., et al.: Framing the servitization transformation process: a model to understand and facilitate the servitization journey. *Int. J. Prod. Econ.* 221, 107463 (2020). <https://doi.org/10.1016/j.ijpe.2019.07.036>
- Kowalkowski, C., Witell, L., Gustafsson, A.: Any way goes: identifying value constellations for service infusion in SMEs. *Ind. Market. Manag.* 42(1), 18–30 (2013). <https://doi.org/10.1016/j.indmarman.2012.11.004>
- Ambroise, L., et al.: The environment strategy structure fit and performance of industrial servitized SMEs. *J. Serv. Manag.* 29(2), 301–328 (2018). <https://doi.org/10.1108/josm-10-2016-0276>
- Coreynen, W., Matthyssens, P., Van Bockhaven, W.: Boosting servitization through digitization: pathways and dynamic resource configurations for manufacturers. *Ind. Market. Manag.* 60, 42–53 (2017). <https://doi.org/10.1016/j.indmarman.2016.04.012>
- Baines, T., et al.: Servitization: revisiting the state-of-the-art and research priorities. *Int. J. Oper. Prod. Manag.* 37(2), 256–278 (2017). <https://doi.org/10.1108/ijopm-06-2015-0312>
- Zhang, W., Banerji, S.: Challenges of servitization: a systematic literature review. *Ind. Market. Manag.* 65, 217–227 (2017). <https://doi.org/10.1016/j.indmarman.2017.06.003>
- Struyf, B., et al.: Toward a multilevel perspective on digital servitization. *Int. J. Oper. Prod. Manag.* 41(5), 668–693 (2021). <https://doi.org/10.1108/ijopm-08-2020-0538>
- Eloranta, V., Ardolino, M., Saccani, N.: A complexity management approach to servitization: the role of digital platforms. *Int. J. Oper. Prod. Manag.* 41(5), 622–644 (2021). <https://doi.org/10.1108/ijopm-08-2020-0582>

29. Dmitrijeva, J., et al.: Paradoxes in servitization: a processual perspective. *Ind. Market. Manag.* 101, 141–152 (2022). <https://doi.org/10.1016/j.indmarman.2021.12.007>
30. Lewis, M.W.: Exploring paradox: toward a more comprehensive guide. *Acad. Manag. Rev.* 25(4), 760–776 (2000). <https://doi.org/10.5465/amr.2000.3707712>
31. Bigdeli, A.Z., et al.: Exploring the root causes of servitization challenges: an organisational boundary perspective. *Int. J. Oper. Prod. Manag.* 41(5), 547–573 (2021). <https://doi.org/10.1108/ijopm-08-2020-0507>
32. Adrodegari, F., et al.: The transition towards service-oriented business models: a European survey on capital goods manufacturers. *Int. J. Eng. Bus. Manag.* 10, 1847979018754469 (2018). <https://doi.org/10.1177/1847979018754469>
33. Thomé, A.M.T., Scavarda, L.F., Scavarda, A.J.: Conducting systematic literature review in operations management. *Prod. Plann. Control* 27(5), 408–420 (2016). <https://doi.org/10.1080/09537287.2015.1129464>
34. Kowalkowski, C., Gebauer, H., Oliva, R.: Service growth in product firms: past, present, and future. *Ind. Market. Manag.* 60, 82–88 (2017). <https://doi.org/10.1016/j.indmarman.2016.10.015>
35. Hsieh, Y.H., Chou, Y.H.: Modeling the impact of service innovation for small and medium enterprises: a system dynamics approach. *Simulat. Model. Pract. Theor.* 82, 84–102 (2018). <https://doi.org/10.1016/j.simpat.2017.12.004>
36. Dubruc, N., Peillon, S., Farah, A.: The impact of servitization on corporate culture. *Procedia CIRP* 16, 289–294 (2014). <https://doi.org/10.1016/j.procir.2014.01.028>
37. Dahmani, S., et al.: A reliability diagnosis to support servitization decision-making process. *J. Manuf. Technol. Manag.* 27(4), 502–534 (2016). <https://doi.org/10.1108/jmtm-06-2015-0044>
38. Rapaccini, M., et al.: Servitization of SMEs through strategic alliances: a case study. *Procedia CIRP* 83, 176–181 (2019). <https://doi.org/10.1016/j.procir.2019.04.010>
39. Sundin, E., Nasslander, E., Lelah, A.: Sustainability Indicators for small and medium sized enterprises (SMEs) in the transition to provide product-service systems (PSS). *Procedia CIRP* 30, 149–154 (2015). <https://doi.org/10.1016/j.procir.2015.02.155>
40. Kanovska, L., Tomaskova, E.: Drivers for smart servitization in manufacturing companies. *AGRIS On-Line Pap. Econ. Inf.* 10(3), 57–68 (2018). <https://doi.org/10.7160/aol.2018.100305>
41. Peillon, S., Dubruc, N.: Barriers to digital servitization in French manufacturing SMEs. *Procedia CIRP* 83, 146–150 (2019). <https://doi.org/10.1016/j.procir.2019.04.008>
42. Hernandez Pardo, R.J., Bhamra, T., Bhamra, R.: Exploring SME perceptions of sustainable product service systems. *IEEE Trans. Eng. Manag.* 60(3), 483–495 (2013). <https://doi.org/10.1109/tem.2012.2215961>
43. Turunen, T., Finne, M.: The organisational environment's impact on the servitization of manufacturers. *Eur. Manag. J.* 32(4), 603–615 (2014). <https://doi.org/10.1016/j.emj.2013.11.002>
44. Kindström, D.: Towards a service-based business model - key aspects for future competitive advantage. *Eur. Manag. J.* 28(6), 479–490 (2010). <https://doi.org/10.1016/j.emj.2010.07.002>
45. Kohtamäki, M., et al.: The relationship between digitalization and servitization: the role of servitization in capturing the financial potential of digitalization. *Technol. Forecast. Soc. Change* 151, 119804 (2020). <https://doi.org/10.1016/j.techfore.2019.119804>
46. Mittal, S., et al.: A critical review of smart manufacturing and industry 4.0 maturity models: implications for small and medium-sized enterprises (SMEs). *J. Manuf. Syst.* 49, 194–214 (2018). <https://doi.org/10.1016/j.jmsy.2018.10.005>
47. Müller, J.M., Buliga, O., Voigt, K.-I.: Fortune favors the prepared: how SMEs approach business model innovations in industry 4.0. *Technol. Forecast. Soc. Change* 132, 2–17 (2018). <https://doi.org/10.1016/j.techfore.2017.12.019>
48. Mahmood, A., et al.: Developing an interplay among the psychological barriers for the adoption of industry 4.0 phenomenon. *PLoS One* 16(8), e0255115 (2021). <https://doi.org/10.1371/journal.pone.0255115>
49. Linstone, H.A., Turoff, M. (eds.) *The Delphi Method*, pp. 3–12. Addison-Wesley, Reading (1975)
50. Luoto, S., Brax, S.A., Kohtamäki, M.: Critical meta-analysis of servitization research: constructing a model-narrative to reveal paradigmatic assumptions. *Ind. Market. Manag.* 60, 89–100 (2017). <https://doi.org/10.1016/j.indmarman.2016.04.008>
51. Rauch, W.: Scientific information and documentation systems tomorrow: the example of Austria. *J. Inf. Sci.* 1(1), 35–41 (1979). <https://doi.org/10.1177/016555157900100106>
52. Kameoka, A., Yokoo, Y., Kuwahara, T.: A challenge of integrating technology foresight and assessment in industrial strategy development and policymaking. *Technol. Forecast. Soc. Change* 71(6), 579–598 (2004). [https://doi.org/10.1016/s0040-1625\(02\)00397-9](https://doi.org/10.1016/s0040-1625(02)00397-9)
53. Landeta, J.: Current validity of the Delphi method in social sciences. *Technol. Forecast. Soc. Change* 73(5), 467–482 (2006). <https://doi.org/10.1016/j.techfore.2005.09.002>
54. Bigdeli, A., et al.: Measuring servitization progress and outcome: the case of advanced services. *Prod. Plann. Control* 29(4), 315–332 (2018). <https://doi.org/10.1080/09537287.2018.1429029>
55. Sutton, S.G., Arnold, V.: Focus group methods: using interactive and nominal groups to explore emerging technology-driven phenomena in accounting and information systems. *Int. J. Account. Inf. Syst.* 14(2), 81–88 (2013). <https://doi.org/10.1016/j.accinf.2011.10.001>
56. Kimita, K., et al.: Servitization maturity model: developing distinctive capabilities for successful servitization in manufacturing companies. *J. Manuf. Technol. Manag.* 33(9), 61–87 (2022). <https://doi.org/10.1108/jmtm-07-2021-0248>
57. Rengarajan, S., Moser, R., Narayanamurthy, G.: Strategy tools in dynamic environments - an expert-panel study. *Technol. Forecast. Soc. Change* 165, 120560 (2021). <https://doi.org/10.1016/j.techfore.2020.120560>
58. Daniel, E.M., White, A.: The future of inter-organisational system linkages: findings of an international Delphi study. *Eur. J. Inf. Syst.* 14(2), 188–203 (2005). <https://doi.org/10.1057/palgrave.ejis.3000529>
59. Gnatzy, T., et al.: Validating an innovative real-time Delphi approach-A methodological comparison between real-time and conventional Delphi studies. *Technol. Forecast. Soc. Change* 78(9), 1681–1694 (2011). <https://doi.org/10.1016/j.techfore.2011.04.006>
60. Markmann, C., Darkow, I.L., Von Der Gracht, H.: A Delphi-based risk analysis—identifying and assessing future challenges for supply chain security in a multi-stakeholder environment. *Technol. Forecast. Soc. Change* 80(9), 1815–1833 (2013). <https://doi.org/10.1016/j.techfore.2012.10.019>
61. Camarinha-Matos, L.M.: Collaborative networked organizations: status and trends in manufacturing. *Annu. Rev. Control* 33(2), 199–208 (2009). <https://doi.org/10.1016/j.arcontrol.2009.05.006>
62. Batz, A., Kunath, M., Winkler, H.: Discrepancies between cluster services and SMEs' needs constraining the creation of a culture of innovation amidst. *Logforum* 14(3), 387–405 (2018). <https://doi.org/10.17270/j.log.2018.286>
63. Grefen, P., et al.: Dynamic business network process management in instant virtual enterprises. *Comput. Ind. Eng.* 60(2), 86–103 (2009). <https://doi.org/10.1016/j.compind.2008.06.006>
64. Paiola, M., et al.: Moving from products to solutions: strategic approaches for developing capabilities. *Eur. Manag. J.* 31(4), 390–409 (2013). <https://doi.org/10.1016/j.emj.2012.10.002>
65. Robu, M.: The dynamic and importance of SMEs in economy. *USV Ann. Econ. Pub. Adm.* 13, 84–89 (2013)
66. Virkkala, P., et al.: Business Maturity Models for Small and Medium-Sized Enterprises: A Systematic Literature Review (2020)

How to cite this article: Rapaccini, M., et al.: Overcoming the knowledge gaps in early-stage servitization journey: a guide for small and medium enterprises. *IET Collab. Intell. Manuf.* e12106 (2024). <https://doi.org/10.1049/cim2.12106>