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Servitization research: A review and bibliometric analysis of past achievements and future promises

Sayantan Khanra [a], Amandeep Dhir [b,c,d], Vinit Parida [e,f,*], Marko Kohtamäki [f]

[a] School of Business, Woxsen University, Hyderabad, India
[b] Department of Management, School of Business & Law, University of Agder, Norway
[c] Norwegian School of Hotel Management, University of Stavanger, Stavanger, Norway
[d] Optentia Research Focus Area, North-West University, Vanderbijlpark, South Africa
[e] Entrepreneurship and Innovation, Luleå University of Technology, Sweden
[f] University of Vaasa, School of Management / University of South-Eastern Norway, USN Business School, PO Box 700, FI-65101 Vaasa, Finland

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ABSTRACT

Manufacturing firms are increasingly adopting a strategy known as 'servitization' to add services to existing product-based offerings to stimulate additional revenue and growth. While the emerging research domain of servitization is mobilizing relevant knowledge across academic establishments, the present study aims to perform a comprehensive bibliometric analysis to organize the prior knowledge in this area, more importantly, highlights areas for future research. This study acknowledges important contributions from authors and organizations, as identified through analyses of citation chains and co-authorship networks. Next, a co-citation analysis of the prior literature is used to identify four main thematic areas relating to capability development, customer involvement, business models, and transformational challenges for servitization. Finally, the dynamic co-citation analysis technique reveals the development of these thematic areas. This study assumes importance in the extant literature by delivering valuable insights from the prior research on servitization and by providing guidance for future avenues of study.

1. Introduction

Facing a declining margin in revenues from the sale of innovative products, manufacturing firms are seeking to generate additional financial value by shifting instead to offering their customers services associated with these products (Fliess & Lexutt, 2017; Lexutt, 2020). This phenomenon, commonly termed 'servitization', has been crucial in establishing a competitive industry advantage as two-thirds of large manufacturing firms now service their offerings (Martinez, Neely, Velu, Leinster-Evans, & Bisessar, 2019). These firms, including Bombardier, Caterpillar, Hitachi, and Rolls-Royce, among others, earn additional revenue from delivering outcome-based services to their customers (Visnjic, Jovanovic, Neely, & Engwall, 2017). The effectiveness of a firm's servitization strategy is often determined by customers' readiness and willingness to buy complex product–service systems (Morgan, Anokhin, & Wincent, 2019). Therefore, a successful performance outcome for a firm is largely uncertain because servitization and performance exist in a nonlinear relationship that depends on multiple moderators (Burton, Story, Raddats, & Zolkiewski, 2017; Kohtamäki, Parida, Patel, & Gebauer, 2020). Firms not only need to cope with manufacturing complex products but they must also enrich their value proposition through additional services (Cenamor, Sjödin, & Parida, 2017; Kohtamäki, Einola & Rabetino, 2020; Sklyar, Kowalkowski, Tronvoll, & Sörhammar, 2019, Palo, Åkesson, & Löfberg, 2019). Furthermore, the market for servitization has been growing exponentially and is estimated to grow to approximately 33 billion euro by 2025 (compared with 4.5 billion euro in 2016), yielding significantly higher profit margins on services than on products sold by manufacturing firms (Probst, Frideres, Cambier, Ankeraa, & Lide, 2016). Manufacturing firms are thus striving to successfully implement servitization-centric business models because these types of service contracts guarantee regular recurring revenue (Kohtamäki et al., 2020) from a loyal customer base (Kohtamäki, Parida, Oghazi, Gebauer, & Baines, 2019).

The trade-offs between the challenges and benefits of servitization

* Corresponding author at: Entrepreneurship and Innovation, Luleå University of Technology, Sweden (V. Parida).
E-mail addresses: sayantan.khanra@woxsen.edu.in (S. Khanra), amandeep.dhir@uia.no (A. Dhir), vinit.parida@ltu.se (V. Parida), marko.kohtamaki@uva.fi (M. Kohtamäki).

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have gradually gained clarity as scholars have honed a greater understanding of the conceptual foundations of developing and implementing a servitization strategy (Bustinza, Vendrell-Herrero, & Baines, 2017). A key discussion on the successful servitization of a firm has been related to the proper alignment of its business interests with those of the stakeholders in the firm's value chain or ecosystem (Kohtamäki et al., 2019). Hence, manufacturing firms are encouraged to form a close partnership with their distributors (Reim, Sjödin, & Parida, 2019) and other partner firms specializing in knowledge-based resources within a collaborative ecosystem (Bustinza, Lafuente, Rabetino, Vaillant, & Vendrell-Herrero, 2019). The range of services that manufacturing firms may offer – and, consequently, the nature of their relationships with partnering firms – are critical in such cases (Saccani, Visintin, & Rapaccini, 2014). In this regard, three major challenges in servitization have been identified – namely, conflict of interests among key stakeholders in a firm's partnership network, misalignment between the intended strategy for servitization and the emergent managerial focus, and unsuccessful knowledge transfer within the ecosystem of stakeholders (Hullova, Laczko, & Frishammar, 2019). Thus, the achievement of the financial benefits of servitization is contingent on a multitude of factors, such as the corresponding transition of the manufacturing firm's service network (Reim et al., 2019), the acquisition of capabilities required to servitize (Jovanovic, Raja, Visnjic, & Wiengarten, 2019), and the development of an organizational culture that facilitates the delivery of servitized offerings (Baik, Kim, & Patel, 2019).

The practical importance of servitization in ensuring manufacturing firms' future competitiveness (Lexutt, 2020), combined with increased academic interest (Fliess & Lexutt, 2017), has led to the growth of servitization research in recent decades. This rapid growth, which is usually associated with emerging research fields, therefore calls for a systematic review of extant knowledge. For example, a recent analysis of the servitization literature by Kowalkowski, Gebauer, and Oliva (2017) set the boundaries and conceptual foundations for research in this area. Another study clustered the relevant servitization literature into five themes: service offerings from firms, the strategy and structure of firms, motivations and firm performance, the resources and capabilities possessed by firms, and service development, sales, and service delivery (Raddats, Kowalkowski, Benedettini, Burton, & Gebauer, 2019). Owing to such efforts, the research on servitization has achieved a significant level of differentiation from other domains in the academic establishment. Therefore, it is now essential to recognize the key contributors shaping research in this area to build the legitimacy of the emerging servitization domain among scholars (Hambrick, & Chen, 2008). However, very few attempts have been made to conduct a comprehensive bibliometric analysis of the past achievements and future promises of servitization research. The only significant attempt at the legitimacy-building process was from a 2018 bibliometric study (Rabetino, Harmsen, Kohtamäki, & Sihvonen, 2018) that reviewed 78 keywords for the selection of prior research from different scholarly communities and, consequently, offered a broad perspective of research on servitization and its related topics. Despite the commendable attempts to consolidate the research on servitization, there is still a gap in the extant literature that makes it a struggle to obtain a comprehensive understanding of this topic. Present knowledge about servitization currently appears fragmented and lacks clarity due to this research gap.

Furthermore, a narrow but in-depth bibliometric analysis of servitization can add value to the future development of servitization research by recognizing leading scholars in the field. Therefore, the present study aims to review the servitization literature published in quality journals in business management and related subject areas to identify and discuss current themes and propose areas for future research. More specifically, this study is dedicated to addressing three research questions (RQs), as follows. RQ1: Who are the prominent contributors to the literature on servitization? RQ2: Which prominent thematic areas emerge from the literature on servitization? RQ3: How can the literature on servitization be advanced? We answered the RQs by analyzing the literature on servitization following a set of bibliometric techniques (Caviggioli & Ughetto, 2019; Fahimnia, Sarkis, & Davarzani, 2015; Xu, Chen, Jia, Brown, Gong, & Xu, 2018). Such techniques are well positioned to contribute to standardizing current research knowledge from a multidisciplinary viewpoint through a review of a vast number of documents (Caviggioli & Ughetto, 2019). Moreover, bibliometric techniques are focused on statistical foundations, leaving no space for the subjective biases that may influence literature reviews (Xu et al., 2018).

We address RQ1 through bibliographic coupling, co-occurrence analysis, citation analysis, and co-authorship analysis of the prior studies. Our co-citation analysis helped us answer RQ2 by identifying four main thematic areas in the literature. Consequently, the dynamic co-citation analysis traced the evolution of these thematic areas. Our content analysis of leading articles within the important thematic areas, meanwhile, briefs discussions from prior research and identifies actionable future research agendas, as required by RQ3. The study findings enrich the industrial marketing research by organizing the fragmented literature on servitization and offer a conceptual framework to overcome the challenges in servitization, thereby providing important insights for managers and offering inspiration for future academic research.

2. Bibliometric data analysis

2.1. Literature selection

Prior studies (Caviggioli & Ughetto, 2019; Fahimnia et al., 2015; Xu et al., 2018) have implemented bibliometric techniques to organize the current literature on different research topics in management domains. Following a comprehensive protocol from a bibliometric methodological standpoint (see Fig. 1) (Khanra, Dhir, & Mäntymäki, 2020a), we conducted the literature selection across three sequential phases of scanning, curating, and reporting the sample (Khanra et al., 2020a).

2.1.1. Scanning phase

Resources suitable for exploring this study were drawn from the *Scopus* database (Khanra et al., 2020a; Tandon, Dhir, Islam, & Mäntymäki, 2020). This exploration identified that "product-service systems" was a related term that frequently stood for the term "servitization", following prior studies (Khanra, Dhir, Islam, & Mäntymäki, 2020b; Ruparel, Dhir, Tandon, Kaur, & Islam, 2020). Accordingly, the search string "Servitization OR product-service systems" was used, which helped us identify 862 documents published before October 15, 2019. The sources of these articles were journals, books, and conference proceedings in the subject area of business management and other related fields.

2.1.2. Curating phase

The results from the scanning phase are refined in this phase (Khanra et al., 2020a; Tandon et al., 2020). We followed the Association of Business Schools' (ABS) Academic Journal Guide (AJG, 2018) to ensure the high quality of articles to be analyzed (Xu et al., 2018). This study included 275 articles from journals rated three or more (3, 4, 4*) in ABS AJG (AJG, 2018).

2.1.3. Analyzing phase

A total of 601 authors affiliated with 563 organizations spread across 40 countries contributed to the literature on servitization. However, over 80% (225 articles) of these articles were published between 2014 and 2019, exhibiting a recent boost in research interest on the topic (see Fig. 2). *International Journal of Production Economics* (24 articles) was found to lead the publication on servitization, followed by *Industrial Marketing Management* (22 articles) and *International Journal of Operations and Production Management* (21 articles).

The top 10 authors, organizations, and countries by volume of publications are listed in Tables 1a, 1b, and 1c, respectively. Baines (19

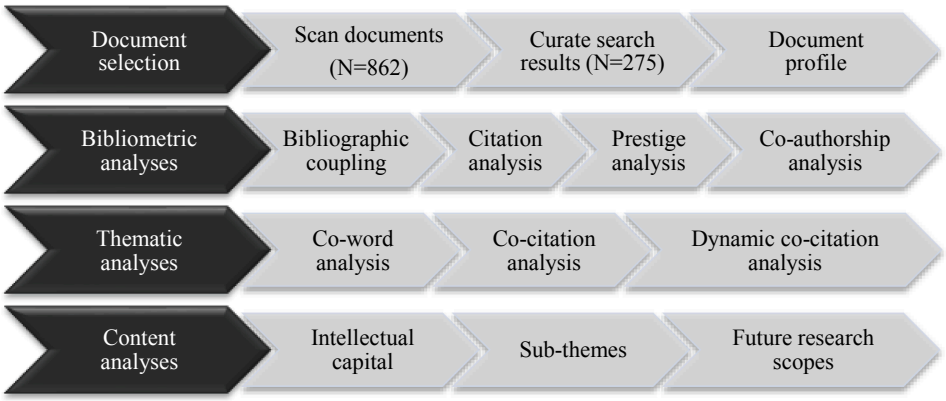

Fig. 1. Protocol for a bibliometric study. [This protocol was prepared by Khanra et al. (2020a).]

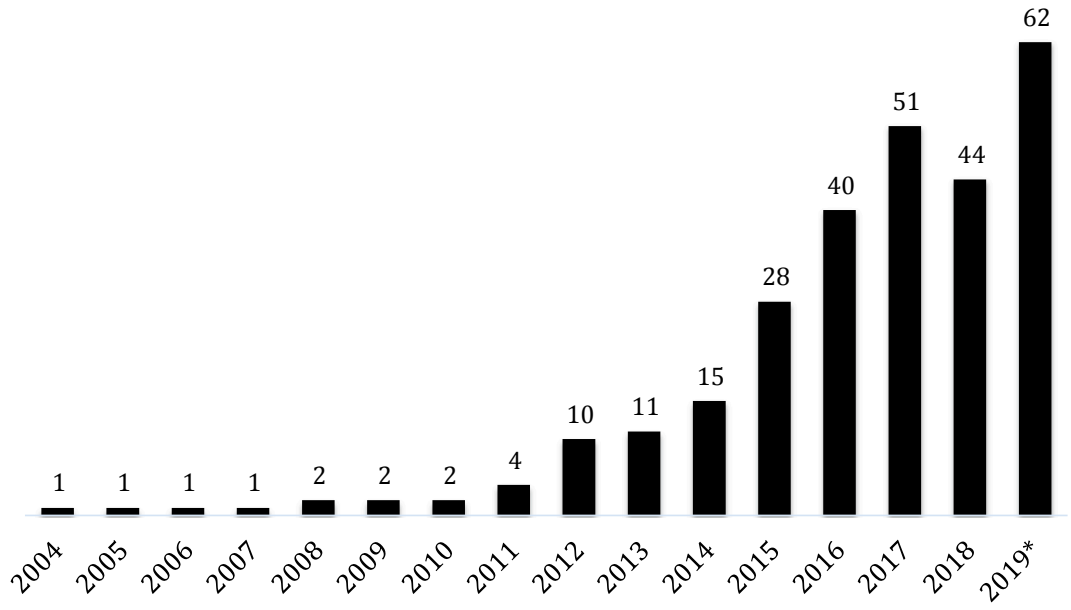

Fig. 2. Articles published per year. * as of October 15, 2019. Data source: Scopus search string. TITLE-ABS-KEY (servitization) AND (LIMIT-TO (SRCTYPE,"j")) AND (LIMIT-TO (DOCTYPE,"ar")) AND (LIMIT-TO (LANGUAGE,"English")). Note: The search results are further limited to articles published in journals rated 3, 4, 4* in AJG (2018).

Table 1a
Top 10 authors based on number of publications.

Author	Articles
Baines, T.	19
Parida, V.	16
Kohtamäki, M.	9
Raddats, C.	9
Bustinza, O.	8
Kowalkowski, C.	8
Lightfoot, H.	8
Neely, A.	8
Wincent, J.	8
Saccani, N.	7

Table 1b
Top 10 organizations based on number of publications.

Organization	Articles
Aston University, UK	34
University of Vaasa, Finland	26
University of Manchester, UK	21
University of Luleå, Sweden	21
Cranfield University, UK	19
University of Linköping, Sweden	16
Hanken School of Economics, Finland	15
University of Cambridge, UK	15
Aalto University, Finland	14
University of Liverpool, UK	12

articles), Parida (16 articles), and Kohtamäki and Raddats (9 articles each) co-authored the largest number of articles (see Table 1a), while Aston University in the United Kingdom (UK) stands out among the organizations by contributing 34 articles on the selected research topic, followed by the University of Vaasa, Finland (26 articles), the University of Manchester, UK, and the University of Luleå, Sweden (21 articles each) (see Table 1b). Moreover, the UK (86 articles), US (60 articles), and Sweden (53 articles) have been identified as leading the research on servitization (see Table 1c).

2.2. Data analysis

We conducted bibliographic coupling, citation analysis, and co-authorship analysis using the fractional counting of bibliometric links on VOSviewer, which is a reliable tool to evaluate and visualize bibliometric data utilizing sophisticated options (Khanra, Dhir, Kaur, & Mäntymäki, 2021a; van Eck & Waltman, 2014). In particular, we used VOSviewer to analyze the co-occurrences of keywords from bibliometric

Table 1c
Top 10 countries based on number of publications.

Country	Articles
UK	86
Finland	60
Sweden	53
Italy	30
Spain	26
US	19
China	16
Denmark	14
Brazil	13
Germany	12

datasets (Fahimnia et al., 2015; van Eck & Waltman, 2014). The Gephi modularity tool, on the other hand, is suitable for clustering articles from co-citation analysis (Khanra et al., 2020a) as it possesses the specialized capability required for dynamic analyses (Xu et al., 2018). Therefore, the co-word analysis was performed using VOSviewer, while the co-citation and dynamic co-citation analyses were performed using Gephi (Khanra et al., 2020a). The prestige analysis was also performed using Gephi because it follows a sophisticated ranking algorithm (Xu et al., 2018).

2.2.1. Bibliographic coupling

In this technique, two articles citing a publication are coupled because high instances of mutual reference suggest an intellectual capital common to both. (Khanra et al., 2020a; Xu et al., 2018). Tables 2a, 2b, and 2c acknowledge the influential authors who have produced important contributions to this study's sample and recognize their organizations and countries of affiliation, respectively. We identified Baines as the most influential author in the literature related to servitization, followed by Parida and Kowalkowski (see Table 2a). The University of Linköping (Sweden), the University of Vaasa (Finland), and the University of Luleå (Sweden), were found to be the most influential organizations in the extant literature (see Table 2b). This study also found that the UK was the most influential country in the literature on servitization, followed by Finland and Sweden (see Table 2c). However, the bibliographic coupling technique, which is built on backward citation chaining, has drawn criticism because of its limitations in evaluating older documents (Khanra et al., 2020a).

2.2.2. Citation analysis

This technique determines the intensity of appreciation for a publication based on its citation count (Khanra et al., 2020a; Xu et al., 2018). Tables 3a, 3b, and 3c acknowledge the top 10 authors, organizations, and countries, respectively, from the citation analysis. Baines is the most popular author in the extant literature on servitization, followed by Neely and Parida (see Table 3a). Table 3b reports that the University of Cambridge, Cranfield University, and Aston University (all from the UK) are among the most popular institutes for research in this area. Furthermore, research on servitization from the UK, Finland, and Sweden registered as having the highest popularity (see Table 3c). However, this technique merely helps determine the popularity of the publication and not its importance in the academic field (Khanra et al., 2021a).

Table 2a
Top 10 authors from the bibliographic coupling.

Author	Total link strength
Baines, T.	1236.58
Parida, V.	958.43
Kowalkowski, C.	689.52
Bustinza, O.	670.34
Kohtamäki, M.	649.66
Neely, A.	603.27
Raddats, C.	579.37
Bigdeli, A.	550.83
Vendrell-Herrero, F.	502.97
Zolkiewski, J.	492.55

Table 2b
Top 10 organizations from the bibliographic coupling.

Organization	Total link strength
University of Linköping, Sweden	953.18
University of Vaasa, Finland	781.05
University of Luleå, Sweden	536.13
Hanken School of Economics, Finland	417.05
University of Granada, Spain	364.05
Cranfield University, UK	342.98
Aston University, UK	334.25
University of Cambridge, UK	320.95
Harvard Business School, US	313.98
University of Manchester, UK	311.43

Table 2c
Top 10 countries from the bibliographic coupling.

Country	Total link strength
UK	4117.06
Finland	3502.83
Sweden	3173.22
US	1677.49
Spain	1653.70
Italy	1584.73
Brazil	997.58
China	852.79
Germany	712.41
Denmark	703.96

Table 3a
Top 10 authors from citation analysis.

Author	Total link strength
Baines, T.	1022
Neely, A.	859
Parida, V.	682
Lightfoot, H.	665
Bustinza, O.	539
Bigdeli, A.	526
Kohtamäki, M.	442
Raddats, C.	426
Johnson, M.	423
Sjödin, D.	361

Table 3b
Top 10 organizations from citation analysis.

Organization	Total link strength
University of Cambridge, UK	416
Cranfield University, UK	379
Aston University, UK	365
University of Vaasa, Finland	361
University of Linköping, Sweden	295
University of Granada, Spain	248
Hanken School of Economics, Finland	193
University of Luleå, Sweden	188
University of Manchester, UK	175
University of Sheffield, UK	162

2.2.3. Prestige analysis

This technique detects publications that are essential to the development of a research field, following an improved variant of the PageRank algorithm (Khanra et al., 2020a; Xu et al., 2018). This algorithm gives preference to publications co-cited in well-regarded publications

Table 3c
Top 10 countries from citation analysis.

Country	Total link strength
UK	1406
Finland	878
Sweden	849
Spain	547
Italy	517
US	331
Denmark	198
Brazil	197
Switzerland	170
Belgium	137

(Fahimnia et al., 2015). In view of the fact that publication ρ_i (positive integer $i \in [1,\eta]$; where η is the number of publications in a cluster) cited publication ρ_0, and ρ_i is cited $\lambda(\rho_i)$ times, PageRank ($\Re$) of ρ_0 is obtained from the following expression:

$$\Re(\rho o) = \frac{(1-\varepsilon)}{\eta} + \varepsilon\left[\frac{\Re(\rho 1)}{\lambda(\rho 1)} + \frac{\Re(\rho 2)}{\lambda(\rho 2)} + \cdots + \frac{\Re(\rho \eta)}{\lambda(\rho \eta)}\right]$$ where ε ($\varepsilon \in [0,1]$) is a damping factor (Brin & Page, 1998). Table 4 presents the 10 most prestigious articles from the 275 analyzed in this study.

2.2.4. Co-authorship analysis

The propensity of co-authors to cite similar publications inside a network can significantly affect the literature on a research topic (Khanra et al., 2020a). Thus, it is important to duly recognise influential networks of authors to better understand the structure of literature on the research topic (Khanra et al., 2021a). In this study, articles that received 10 or more citations on Scopus were considered critical collaborations (see Fig. 3). Hence, only 51 of the 601 contributing authors appeared in the co-authorship network, spanning four groups (see Fig. 3). In the first group, Kohtamäki, Kowalkowski, and Gebauer are linked with seven, six, and five authors, respectively. Authors in the second group include Neely (8 links), Johnson (6 links), and Lightfoot (6 links), while the third group is led by Bains (12 links), followed by Bigdeli (9 links), and Raddats (7 links). Lastly, among the fourth group, which consisted of six authors, Parida (6 links), Wincent (5 links), and Sjodin (5 links) are prominent.

2.2.5. Co-word analysis

An analysis of the keywords assigned to articles provides a snippet of the literature related to those studies (Khanra et al., 2020a). The authors of the articles in our sample provided 786 keywords, while the articles were indexed with 787 keywords. Servitization, product-service system (s), and manufacture(ing) were the terms most frequently used (see Table 5a and 5b). The keywords listed in Table 5a indicate that authors emphasize the service aspects of servitization (keywords: service innovation, service infusion, service-dominant logic), whereas indexers highlighted the product aspects of servitization (keywords: industrial research, product design, industrial engineering), as revealed by Table 5b. The density diagrams of the 36 author keywords (see Fig. 4) and 42 index keywords (see Fig. 5) exhibit two similar clusters: a) operational aspects (keywords: manufacturing, outsourcing, maintenance, buyer–supplier relationship) and b) strategic aspects (keywords: competitive advantage, competitive strategy, dynamic capabilities, resource-based view). In addition to these clusters, the author keywords also encompassed product-service integration (keywords: product-service system, advanced services, business model) and product-service delivery (keywords: service innovation, performance, service-dominant logic). Additionally, the index keywords were related to industrial economics (keywords: industrial research, manufacturing firms, economics) and business model innovation (keywords: business models, service innovation, Internet-of-things).

Table 4
Top 10 articles from prestige analysis.

Article	PageRank score	Local citation count*	Global citation count#
Ulaga & Reinartz (2011)	0.022608	78	790
Martinez, Bastl, Kingston, & Evans (2010)	0.016754	39	519
Fang, Palmatier, & Steenkamp (2008)	0.015463	24	657
Matthyssens & Vandenbempt (2010)	0.015277	29	169
Storbacka (2011)	0.013567	42	402
Kohtamäki, Partanen, Parida, & Wincent (2013)	0.013042	40	182
Kowalkowski, Windahl, Kindström, & Gebauer (2015)	0.012471	42	216
Suarez, Cusumano, & Kahl (2013)	0.012172	36	235
Spring & Araujo (2013)	0.011887	32	139
Vargo & Lusch (2008)	0.011839	22	6546

* Source: Scopus (October 15, 2019).
\# Source: Google Scholar (November 30, 2019).

2.2.6. Co-citation analysis

If two articles refer to a pair of documents, then those two documents are considered to be co-cited (Caviggioli & Ughetto, 2019; Khanra et al., 2020a). Co-cited publications may form a cluster within the extant literature based on semantic similarities (Khanra et al., 2021a; Xu et al., 2018). Semantic similarity is calculated from the modularity index (Λ), which is based on the intensity of the intra-cluster links relative to the inter-cluster links in the Louvain algorithm (Fahimnia et al., 2015).

$$\Lambda = \frac{1}{\sigma}\sum_{ij}\left[\Psi ij - \frac{\omega i.\omega j}{\sigma}\right]\phi(\alpha i, \alpha j);$$

$$where\ \omega i = \sum_{j}\Psi ij,$$

$$and\ \sigma = 2\sum_{ij}\Psi ij.$$

In this equation, Ψij symbolizes the weightage of the edge linking i^{th} article with j^{th} article, α denotes the cluster where the respective articles are assigned, $\phi(\alpha i, \alpha j) = 1$ if both i^{th} article and j^{th} article are assigned to the same cluster, and $\phi(\alpha i, \alpha j) = 0$ if i^{th} article and j^{th} article are assigned to different clusters (Khanra et al., 2020a; 2021a).

The modularity tool in Gephi identified a co-citation network of 1,192 edges connecting 228 articles (nodes) in our sample. Four major clusters identified using the Louvain algorithm captured 87.28% of the nodes (=199 articles), representing 92.45% of the connections (=1102 edges) within the co-citation network. The ten most prestigious articles in the four major clusters are reported in Tables 6a, 6b, 6c, and 6d, respectively. The articles corresponding to a cluster are associated with a key thematic area (Khanra et al., 2020a; Xu et al., 2018), which includes the capabilities for servitization, value creation and delivery for servitization, business models for servitization, and transformational challenges for servitization.

2.2.7. Dynamic co-citation analysis

The results of this technique helped to clarify the growth of the thematic areas identified during the co-citation analysis (Khanra et al., 2020a; Xu et al., 2018). The annual inflow of articles for each cluster is shown in Table 7, while Fig. 6 illustrates how the four major clusters have progressed in different directions. Cluster 1 and Cluster 3, discussing the capability development and business model for servitization, respectively, both received major attention from scholars between 2008 and 2015. These thematic areas could be presumed to be sufficiently mature at present, as no article has been introduced to these two clusters since 2017. Similarly, Cluster 4 appeared in 2004 and attained

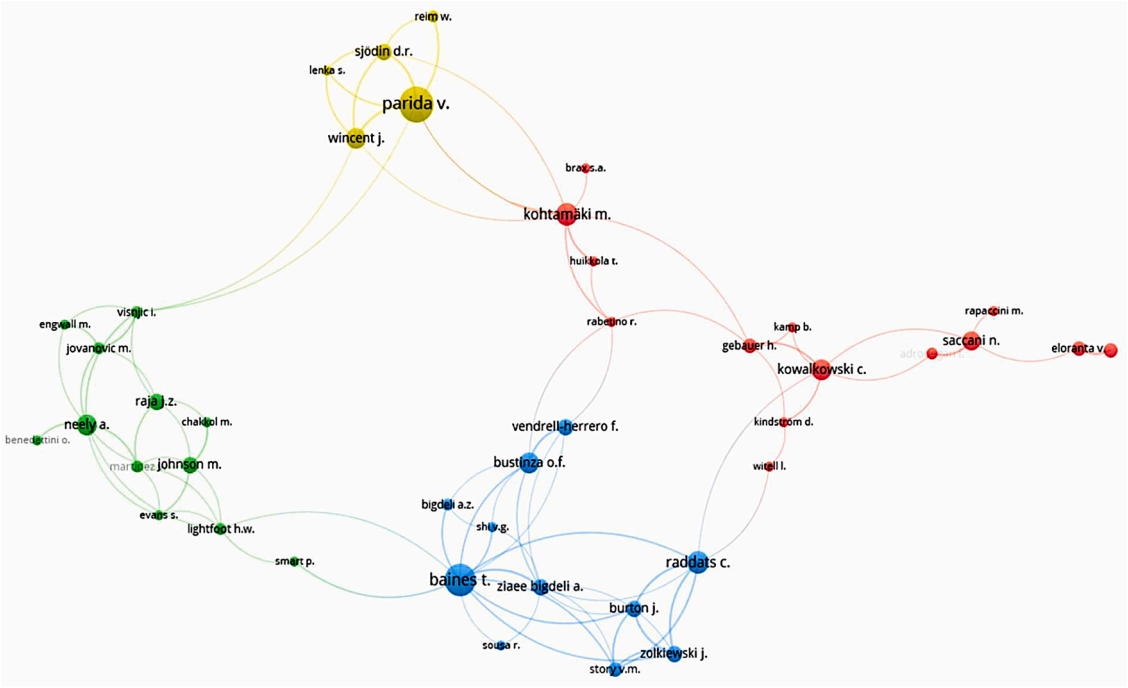

Fig. 3. Network of authors from co-authorship analysis*. Minimum number of publications = 3.

Table 5a
Top 10 author keywords from co-word analysis.

Author keyword	Occurrence
Servitization	262
Product-service system(s)	51
Manufacturing	22
Business model(s)	19
Service innovation	17
Service infusion	13
Capabilities	12
Service-dominant logic	10
Internet of things	8
Sustainability	8

Table 5b
Top 10 index keywords from co-word analysis.

Index keyword	Occurrence
Servitization	114
Manufacture	54
Product-service systems	28
Sales	18
Competition	14
Industrial research	12
Product design	12
Service innovation	11
Industrial engineering	11
Manufacturing firms	10

saturation in 2013, while Cluster 2 has registered substantial growth from 2013 onwards. This finding indicates that the major academic emphasis has moved from defining the transformational challenges in servitization to addressing the customers' involvement in this process.

3. Content analysis of thematic areas

Thematic areas connecting articles in each cluster were identified from a content analysis of the articles listed in Table 6a-d. Content analyses of the most prestigious articles in each theme yielded sub-themes within their respective areas. Furthermore, content analyses of these thematic areas helped us identify several research gaps, which we seek to address by proposing appropriate directions for future research.

3.1. Cluster 1: Firm capabilities for servitization

Manufacturing firms may significantly grow business revenue by adding services to their product offerings (Matthyssens & Vandenbempt, 2010). This transition in business offerings is possible by acquiring suitable resources and leveraging them by developing the appropriate firm capabilities (Matthyssens & Vandenbempt, 2010; Ulaga & Reinartz, 2011). Building on the resource-based view (RBV), four unique resources for manufacturing firms to servitize have been recognized – namely, data on product usage, the principles for product development and manufacturing, a well-directed product distribution channel, and well-trained field agents (Ulaga & Reinartz, 2011). These resources can be exploited with capabilities for data processing, risk mitigation, designing hybrid offerings (products and services), and selling and deploying them, in turn (Ulaga & Reinartz, 2011).

Servitization researchers have recognized that allocating firm resources to the development of the core capabilities required to innovate a new business model is a dynamic process (Fang, Palmatier, & Steenkamp, 2008). A study by Kindström, Kowalkowski, and Sandberg (2013), for example, identified the basis of realignment for essential dynamic capabilities – namely, sensing, seizing, and reconfiguring routines. However, the exploration of dynamic capabilities to capture new market opportunities may run in parallel with a firm's operational capabilities to maintain its existing offerings (Raddats et al., 2017). Therefore, firms willing to servitize may embrace ambidexterity in synergizing the co-existence of capabilities to manufacture products and offer services (Kowalkowski, Windahl, Kindström, & Gebauer, 2015). Service-centric capabilities may be developed both within firms and through partnerships with specialists from their networks (Paiola, Saccani, Perona, & Gebauer, 2013; Reim et al., 2020).

Other studies have taken a micro-foundational view of this capabilities development by recognizing that numerous capabilities for servitization have specific advantages. For instance, the network capabilities relating to managing, integrating, and learning may moderate the

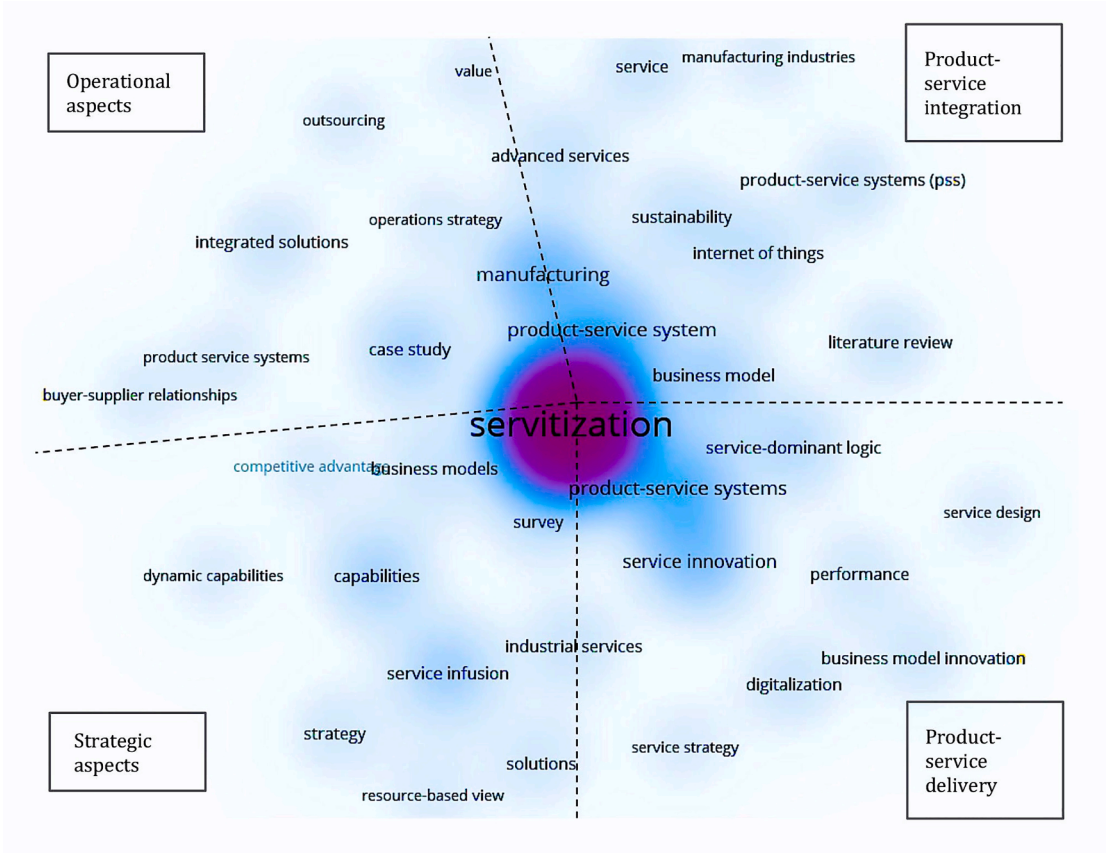

Fig. 4. Density diagram of author keywords*. Threshold: 5 co-occurrences.

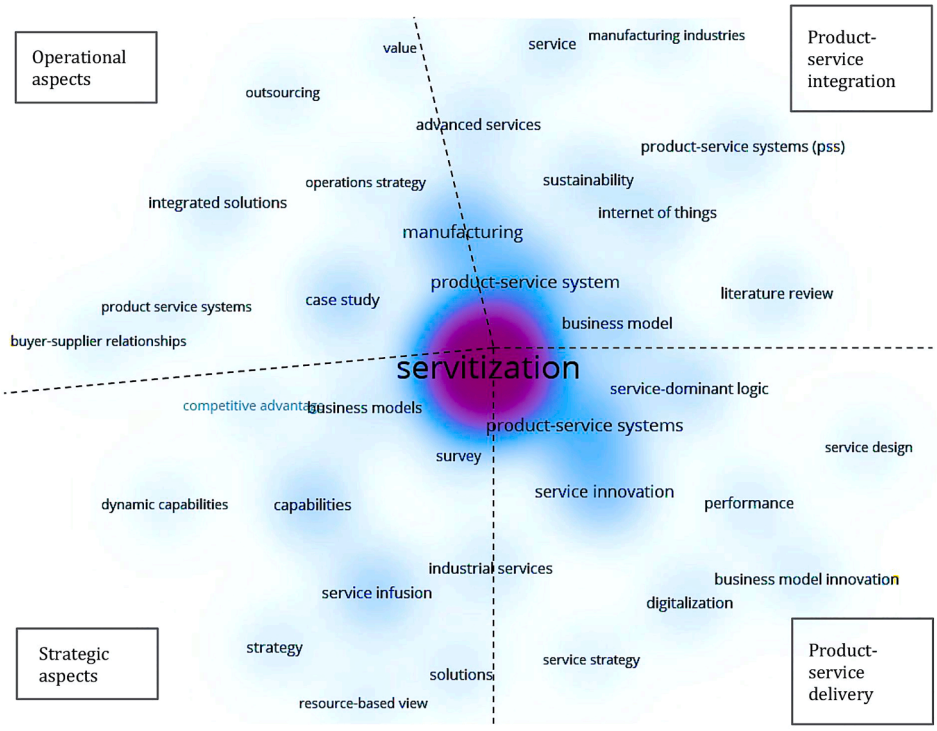

Fig. 5. Density diagram of index keywords*. Threshold: 5 co-occurrences.

Table 6a
Top 10 prestigious articles in Cluster 1.

Articles in Cluster 1	PageRank score
Ulaga & Reinartz (2011)	0.022608
Fang, Palmatier, & Steenkamp (2008)	0.015463
Matthyssens & Vandenbempt (2010)	0.015277
Kohtamäki, Partanen, Parida, & Wincent (2013)	0.013042
Kowalkowski, Windahl, Kindström, & Gebauer (2015)	0.012471
Spring & Araujo (2013)	0.011887
Paiola, Saccani, Perona, & Gebauer (2013)	0.011042
Baines et al. (2009)	0.010936
Kindström, Kowalkowski, & Sandberg (2013)	0.010849
Raddats et al. (2017)	0.010659

Table 6b
Top 10 prestigious articles in Cluster 2.

Articles in Cluster 2	PageRank score
Suarez, Cusumano, & Kahl (2013)	0.012172
Cusumano, Kahl, & Suarez (2015)	0.009314
Smith, Maull, & Ng (2014)	0.008275
Story, Raddats, Burton, Zolkiewski, & Baines (2017)	0.007361
Baines et al. (2017)	0.007247
Brax & Visintin (2017)	0.006927
Rabetino, Kohtamäki, & Gebauer (2017)	0.006299
Huikkola, Kohtamäki, & Rabetino (2016)	0.006001
Baines & Lightfoot (2014)	0.005992
Sjödin, Parida, & Wincent (2016)	0.005671

Table 6c
Top 10 prestigious articles in Cluster 3.

Articles in Cluster 3	PageRank score
Storbacka (2011)	0.013567
Vargo & Lusch (2008)	0.011839
Chesbrough (2011)	0.008260
Cavalieri & Pezzotta (2012)	0.006992
Hartmann, Roehrich, Frederiksen, & Davies (2014)	0.005842
Steinberger, van Niel, & Bourg (2009)	0.005214
Parida, Sjödin, Wincent, & Kohtamäki (2014)	0.005035
Reim, Parida, & Örtqvist (2015)	0.004821
Baines, Lightfoot, Smart & Fletcher (2013)	0.004735
Gebauer, Gustafsson, & Witell (2011)	0.004521

Table 6d
Top 10 prestigious articles in Cluster 4.

Articles in Cluster 4	PageRank score
Martinez, Bastl, Kingston, & Evans (2010)	0.016754
Schmenner (2009)	0.010426
Bastl, Johnson, Lightfoot, & Evans (2012)	0.010163
Pawar, Beltagui, & Riedel (2009)	0.009493
Baines, Lightfoot, Benedettini, & Kay (2009)	0.008425
Neely (2008)	0.007565
Beuren, Ferreira, & Miguel (2013)	0.006534
Lockett, Johnson, Evans, & Bastl (2011)	0.005789
Kindström (2010)	0.005422
Spring & Araujo (2009)	0.005175

relationship between service offerings and revenue growth (Kohtamäki, Partanen, Parida, & Wincent, 2013). Baines et al. (2009) proposed a roadmap for firms to servitize their offerings by augmenting their operational principles, organizational structures, and manufacturing processes. Manufacturing firms, for example, tend to infuse services through network reconfiguration rather than move downstream of their value chains (Spring & Araujo, 2013). In addition, digitalization capabilities can enable firms to interact and co-create value with their customers. Thus, three underlining routines represent the micro-foundational capabilities for servitization in the business-to-business context, representing the intelligence capability, the connect capability, and the analytic capability (Lenka et al., 2017).

Table 7
Evolution of clusters from dynamic co-citation analysis.

Year	Number of articles published			
	Cluster 1	Cluster 2	Cluster 3	Cluster 4
2004	0	0	0	1
2005	0	0	0	1
2006	1	0	1	1
2007	4	1	0	6
2008	10	2	4	3
2009	7	2	5	7
2010	12	0	2	6
2011	11	0	6	2
2012	4	1	5	4
2013	16	8	6	1
2014	5	6	2	0
2015	4	10	7	0
2016	2	5	0	0
2017	5	10	1	0
2018	0	2	0	0
2019*	0	0	0	0
Total	81	47	39	32
Color code	Pink	Green	Blue	Black

* as of October 15, 2019.

Future research on servitization capabilities may be advanced from the following directions:

- The development of capabilities for servitization may be explored from perspectives such as the capability maturity model and the capability life cycle assessment. Future researchers could identify ways to develop and formalize capabilities for servitization.
- Building on recent developments within the capability-based view, studies have increasingly connected organizational-level capability development with individual-level actions (Sjödin et al., 2019). Future research is encouraged to identify the roles of individuals within an organization in developing organizational-level capabilities.
- A prior study by Kohtamäki et al. (2013) recognized the importance of work capability in profitable servitization. Alliance and network management capabilities within a servitization ecosystem also require further attention from future researchers.
- The literature on servitization has mainly focused on the capabilities of large firms. However, as small and medium enterprises (SMEs) require more agile capability development practices, and SME-related capability development has not yet received much attention, future research on these topics is needed.
- Future researchers may also explore the possibility of developing a contingency framework to show when certain capabilities for servitization are more suitable than others, depending on the degree of servitization – namely, basic, intermediate, and advanced services.

3.2. Cluster 2: Customer involvement in servitization

A practice central to successful servitization requires a revised focus on the value-creation and value-delivery processes. In this context, efficient business processes to manage supplier and customer relationships, deploy skilled human resources, and advance the use of information and communication technologies are among the most essential practices to servitize manufacturing firms (Baines & Lightfoot, 2014). While manufacturing firms may strategically and effectively implement such processes, the value creation and delivery to customers has become increasingly complex and uncertain (Rabetino, Kohtamäki, & Gebauer, 2017). As firms focus on earning higher revenue from services, they are not confined to the sale of the offer but must handle the delivery of the offer as well (Suarez, Cusumano, & Kahl, 2013). However, these firms often attempt to imitate other firms' service delivery practices while disregarding the uncertainty of achieving their desired outcomes

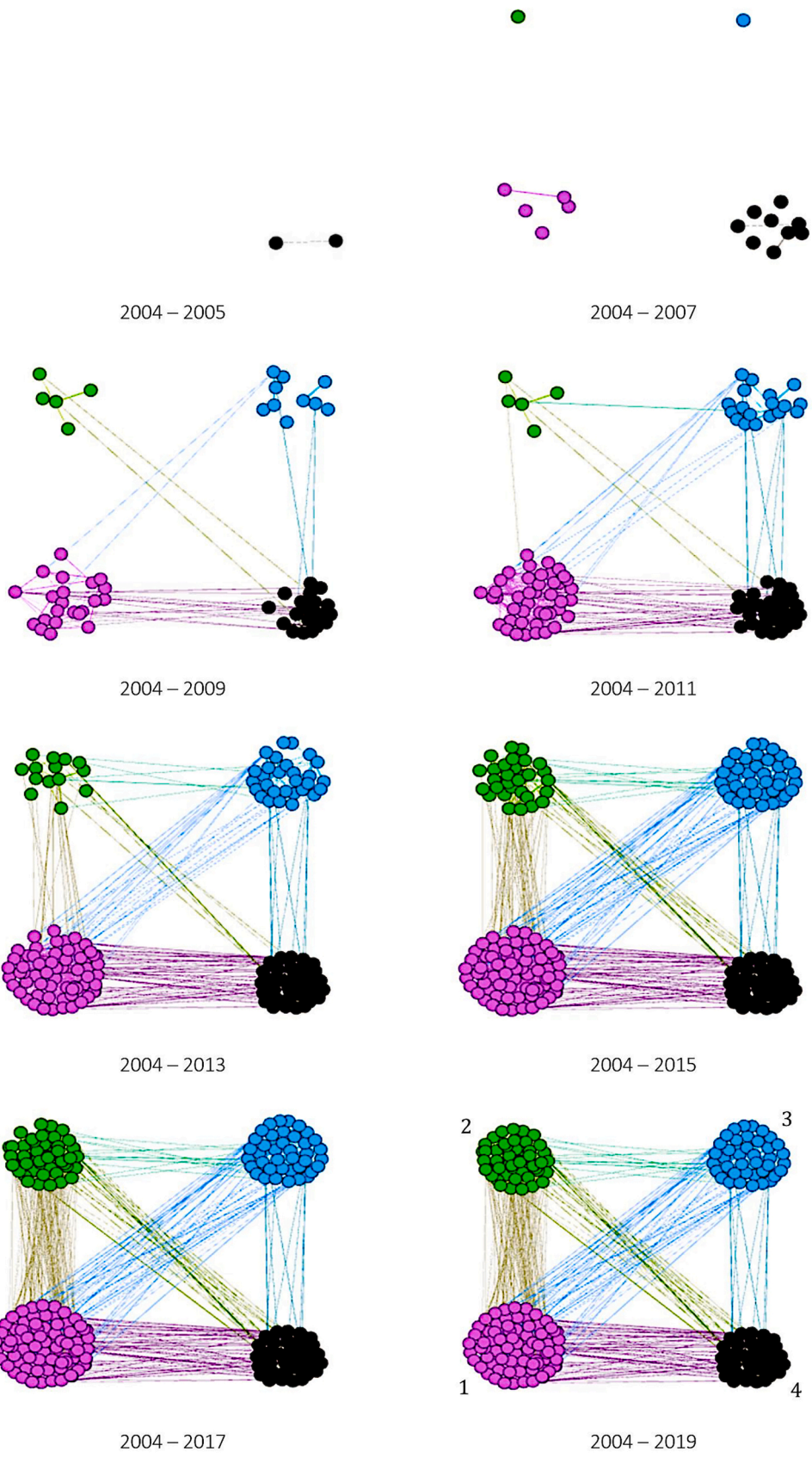

Fig. 6. Evolution of clusters from dynamic co-citation analysis.

Table 8
Future scopes to advance research on servitization.

Thematic area	Prior literature	Research gap
Firm capabilities in servitization	The development of capabilities for servitization may be explored from perspectives such as the maturity model and life cycle assessment	How are such capabilities developed and formalized?
	Capability-based view studies connect the organizational-level capability development to individual-level actions (Sjödin et al., 2019)	What are the roles of individuals in developing organizational-level capabilities?
	Capabilities development is not only subject to a manufacturing firm but also its service network to realize the servitization strategy	How can firms develop partnering capabilities within a servitization ecosystem?
	Small and medium enterprises may require more ad-hoc-based capabilities than the formalized ones of larger firms	How do capabilities based on firm sizes impact the success of a servitization strategy?
	Certain capabilities for servitization are more suitable than others depending upon the degree of servitization, i.e., basic, intermediate, and advanced services	How should a contingency framework that reports which capabilities for servitization are critical in a given situation be developed?
Customer involvement in servitization	Value leakage in service delivery is prevalent all through a value network as solutions move from ideation to implementation	How can firms avoid value leakage due to business model misalignment?
	Service modularity needs more attention for a better understanding of a high degree of customization	How can a modularity approach enable value creation and configuration in a servitization strategy?
	Cooperation may be helpful to identify different collaboration strategies for value creation and delivery	How can the competition strategy, which partners a firm with its competitors, facilitate value delivery from servitization?
	The role of the service network or distributors for servitization may provide novel insights	How can manufacturing firms manage the tension between the front end and back end in servitization for value delivery?
	Successful servitization of large manufacturing firms needs a global market perspective	How can market heterogeneity and partnerships in the global value-delivery process be managed?
Business models for servitization	Digital servitization is significantly influencing business-to-business interdependencies by the dematerialization of physical products	How should the changing dynamics in profit sharing in a value chain be assessed?
	Successful digital servitization of a manufacturing firm requires the proper alignment of business models of other firms within its ecosystem	How can an ecosystem-based business model be developed by aligning incentives with diverse actors?
	Servitization may enable manufacturing firms to follow sustainable practices in value creation, value delivery, and value capturing of their offerings	How should business model innovation be adopted so that firms can create, deliver, and capture value in a sustainable manner?
Multi-level transformational challenges for servitization	Firms often struggle to manage multiple business models in parallel with their offerings	How do manufacturing firms manage and cope with multiple business models?
	Coping with organizational inertia can be challenging for effective servitization	Why is organizational change challenging for servitization?
	Individual-level transformational challenges can inhibit effective servitization	What are suitable coping mechanisms for individuals facing transformational challenges to facilitate servitization?
	Challenges for transformation may vary based on the type of servitization	How can a contingency framework be developed that presents the specific challenges faced in a particular type of servitization?

(Cusumano, Kahl, & Suarez, 2015). Thus, the transition in a firm's focus from manufacturing to service necessitates a proper understanding of the complex interactions among customer needs, the availability of the product when required, the product usage, the delivery of the outcome promised, and the recovery of the product's performance, if required (Smith, Maull, & Ng, 2014). Furthermore, a manufacturing firm's ability to servitize depends on the ability of its downstream network to advance services (Story, Raddats, Burton, Zolkiewski, & Baines, 2017).

Value co-creation needs to be considered for successful servitization, meaning that manufacturing firms must work closely to involve the customer as a co-creator in this process. In undergoing servitization, the firm can better understand the customer process and adapt the service creation and delivery activities accordingly. Thus, the relationship between providers and customers changes from transactional to relational and extends into the operational phase, which can last for many years due to service contracts (Tuli, Kohli, & Bharadwaj, 2007; Sjödin et al., 2016).

These firms can explore value-creation practices to better design and use service modules, frame suitable service contracts, and charge customers in innovative ways for the services delivered (Suarez et al., 2013). Brax and Visintin (2017), for example, identified the following value-creation measures and propositions of servitization: products accompanied by limited support, installed and well-supported products, complementary services with products, product-based solutions offerings, systems on lease, operating services, well-managed service solutions, and comprehensive solutions. The value creation is arranged according to the complexity in the servitization practices and the firms' responsibilities in offering these services (Brax & Visintin, 2017).

Future research about value creation and delivery in servitization may be advanced from the following directions:

- Value leakage in service delivery is often prevalent throughout a value network as solutions move from ideation to implementation. Therefore, manufacturing firms offering servitized business solutions could take measures to avoid value leakage due to the business model's misalignment. Future researchers may wish to identify ways to achieve value creation and value capture.
- Servitization can be achieved by a custom-made arrangement of service modules that offer well-characterized functionalities through accurately conceptualized interfaces. Hence, service modularity needs a closer investigation to better understand the high degree of customization required. Future researchers are encouraged to investigate how the modularity approach enables value creation and configuration.
- Value delivery using a coopetition strategy, whereby a firm collaborates with its competitors, deserves greater attention from

researchers studying servitization. Building on the cooperation literature in this way can be helpful, therefore, in identifying different partnership strategies for value creation and delivery.
- The role of the service network or distributors in servitization could provide novel insights. More specifically, how manufacturing firms manage the tension between the front end (delivery network) and the back end (research and development) for value delivery needs further exploration by future researchers.
- Most of the larger firms operate in global markets. Therefore, the successful servitization of large manufacturing firms demands a global market perspective. However, this global perspective has been largely overlooked in the servitization literature. Future researchers may wish to identify ways to manage the market heterogeneity and partnerships in the global value-delivery process.

3.3. Cluster 3: Business models for servitization

Service-dominant logic may provide an appropriate conception of servitization and guide firms in developing efficient business models accordingly (Vargo & Lusch, 2008). Firms that generate economic value by implementing servitization commonly follow three business models: a) offering services pivoted on a product sold (e.g., maintenance), b) assuring the usability of a product-service package (e.g., leasing), and c) delivering units of the desired outcome against payments (e.g., customized results) (Reim, Parida, & Örtqvist, 2015). Thus, the core service-dominant logic calls for a new business model implementation. Reim et al. (2015) proposed five operational tactics relating to contracts, marketing, networks, design, and sustainability, respectively, to ensure value generation from these business models. Storbacka (2011) proposed a business model to offer product-service solutions in four phases: developing the solution, creating demand for the solution, selling the solution, and delivering the solution. The success of this business model, however, relies on the coordination of firm resources and organizational processes in addressing cross-functionality issues related to commercialization, industrialization, and platform solution (Storbacka, 2011). While a manufacturing firm emphasizes service differentiation, sensitivity to complex customer needs may increase the firm's payoff from customer centricity (Gebauer, Gustafsson, & Witell, 2011).

Furthermore, the seamless integration of services into products that offer high-value solutions to consumers requires advanced service design methods (Cavalieri & Pezzotta, 2012). A business model that shares economic benefits obtained from servitization with consumers who use products optimally can improve a firm's competitiveness and, consequently, generate steady profits (Steinberger, van Niel, & Bourg, 2009). It is important for firms adopting servitization-centric business models to pay due attention to organizing front-line agents for service delivery, supporting them with the required skill sets and training them on desirable behavior when interacting with customers (Baines, Lightfoot, Smart, & Fletcher, 2013). Prior studies have recognized that diverse servitization business models have their own set of challenges and opportunities, such as the pay-per-use model or outcome-based models.

Traditional manufacturing firms seeking to bundle simple services with their existing products often fail to deliver financial gains (Parida, Sjödin, Wincent, & Kohtamäki, 2014). Therefore, Chesbrough (2011) proposed open innovation to improve under-designed and inefficiently developed services offered in such attempts to servitize. Moreover, buyers on board with the value co-creation model often seek a set of complex performances from a servitizing firm in lieu of a single product-service package (Hartmann, Roehrich, Frederiksen, & Davies, 2014). Therefore, business models based on network interactions may be able to combine benefits from product and service modularity more effectively than traditional models centered on products (Parida et al., 2014; Reim et al., 2015).

Future research into business models for servitization may be advanced from the following directions:

- The literature on the revenue and profit generation of servitized business models needs further enrichment. Specifically, the varieties of value-capturing mechanisms and practices, such as the applicability of different pricing models under various circumstances, would be better understood if future research efforts are applied.
- Digital servitization is significantly influencing business-to-business interdependencies due to the dematerialization of physical products. Thus, digital servitization may benefit the upstream firms in a value chain by reducing production and transport costs. Hence, an assessment of the changing dynamics in profit sharing in a value chain requires the attention of future researchers.
- The successful digital servitization of a manufacturing firm demands proper business model alignment with the other firms in its ecosystem. Future researchers could study how best to develop ecosystem-based business models by aligning incentives with diverse actors.
- Servitization may enable manufacturing firms to follow sustainable practices in the value creation, value delivery, and value capture of their offerings (Parida, Sjödin, & Reim, 2019; Reim, Lenka, Frishammar, & Parida, 2017). Future researchers could usefully explore how manufacturing firms should adopt business model innovation so that firms can create, deliver, and capture value in a sustainable manner.

3.4. Cluster 4: Transformational challenges for servitization

Firms possessing the valuable capabilities for manufacturing often resist integrating services into their product offerings despite recognizing the advantages of servitization (Schmenner, 2009). This resistance may be attributed to significant cultural challenges that firms adopting servitization commonly face (Baines, Lightfoot, Benedettini, & Kay, 2009), including embedding the mindset for integration in an organizational culture, delivering integrated offerings, augmenting internal processes and acquiring capabilities, strategically aligning service provisions, and managing relationships with suppliers (Martinez, Bastl, Kingston, & Evans, 2010). Neely (2008), in turn, categorized these challenges into three broad groups: a) shifting mindsets on sales, marketing, and consumers, b) the timescale for managing long-term partnerships, controlling long-term risk, and profit realization, and c) adjusting business models by communicating the value delivered to customers, acquiring capabilities, and developing a service-oriented organizational culture.

Manufacturing firms partnering with third-party service providers often struggle with determining the locations of service centers as well as with ensuring that the service quality matches the firm's reputation (Pawar, Beltagui, & Riedel, 2009). Furthermore, buyer–supplier relationships may be challenged when firms adopting servitization lack clarity about the implementation guidelines (Beuren, Ferreira, & Miguel, 2013). Firms adopting servitization may similarly face challenges in these relationships. These may arise from various perspectives, such as openness in information exchange, the strength of operational linkages, rearrangements in the structure of the relationships, legal contracts complementing relational norms, and an increased collaboration in offering integrated solutions to customers (Bastl, Johnson, Lightfoot, & Evans, 2012).

Kindström (2010) asserted that firms may struggle to develop relationships with customers, build a portfolio of dynamic product and service offerings matching their customers' needs, and charge accurately for the intangible value delivered to their customers. Moreover, a greater share of performance uncertainties needs to be owned by firms offering a portfolio of products and services than firms offering products alone (Spring & Araujo, 2009). Therefore, servitizing firms may realign the incentive structures across their value chains to compensate for possible financial losses from this increased ownership of performance uncertainties (Lockett, Johnson, Evans, & Bastl, 2011). However, firms with few manufacturing strengths may develop expertise in managing

challenges associated with servitization to establish entry barriers for firms with many manufacturing strengths (Schmenner, 2009).

Future research about multi-level transformational challenges for servitization may be advanced from the following directions:

- Firms often struggle to manage multiple business models in parallel with their offerings. For example, the basic service-oriented business model may compete and even cannibalize other advanced service-oriented business models. Future researchers could investigate how manufacturing firms might manage to cope with multiple business models.
- Future research on how to cope with organizational inertia can be valuable in achieving a better understanding of why servitization-related organizational changes are challenging. This would require a longitudinal data analysis, which has largely been lacking in the servitization literature.
- Future researchers could focus on individual-level transformational challenges and coping mechanisms to facilitate servitization. Future researchers may wish to conduct in-depth interviews with decision makers in large manufacturing firms to explore this subject.
- A contingency framework explaining which challenges are likely to be faced with a certain type of servitization may be helpful in gaining a deeper understanding of servitization transformation. Consequently, suitable action plans to overcome such challenges could be developed by future researchers.

4. Contribution and discussion

This study uses a bibliometric analysis to organize the fragmented literature on servitization and provide a structure for future research in a domain that lacks well-defined boundaries. The key findings of this study are discussed in the following subsections.

4.1. Identification of key contributors

This study identified the key contributors shaping servitization research in answer to RQ1. Tables 1a, 2a, and 3a recognize that five authors – namely, Baines, Parida, Bustinza, Kohtamäki, Neely, and Raddats – are among the top contributors in the area. Tables 1b, 2b, and 3b suggest that the University of Vaasa (Finland), Aston University (UK), the University of Linköping (Sweden), Cranfield University (UK), the University of Luleå (Sweden), the University of Cambridge (UK), the Hanken School of Economics (Finland), and the University of Manchester (UK) are the organizations driving the research on servitization. The contributions of eight countries – namely, the UK, Finland, Sweden, Spain, Italy, the United States (US), Brazil, and Denmark – are acknowledged in Tables 1c, 2c, and 3c. Subsequently, our co-authorship analysis (see Fig. 3) identified the collaborative networks that are strongly associated with the extant literature. Collaborative patterns indicate that research on servitization is significantly spread across four key communities within a broad network of contributors.

It is important to acknowledge that our study findings adhere to the intrinsic limitations of the sample analyzed. Our sample consisted of articles published in journals rated 3, 4, and 4* in AJG. Future studies could overcome this intrinsic limitation by exploring a wider range of journals.

4.2. A conceptual framework to overcome challenges in servitization

We addressed RQ2, which was intended to highlight the significant thematic areas found in the literature, by clustering the current body of research using co-citation analysis (Tandon et al., 2020). The thematic areas of the four major clusters identified relate to the capabilities, value creation and delivery, business logic and models, and transformational challenges for servitization.

The oldest among the four thematic areas discusses multi-level transformational challenges facing servitization. Such challenges are often attributed to cultural challenges in adopting servitization (Baines et al., 2009; Neely, 2008), firm-level challenges in managing business models (Neely, 2008; Pawar et al., 2009), and ecosystem-level challenges among different stakeholders in a firm (Bastl et al., 2012; Lockett et al., 2011). A decline in such discussions has been witnessed in the literature as researchers have opted to explore the possible development of capabilities, a greater understanding of business logic, and the design of suitable business models for servitization. The thematic area relating to capabilities for servitization commonly focus on the value-generating capabilities of firm resources (Baines & Lightfoot, 2014; Story et al., 2017), the micro-foundation of capabilities (Brax & Visintin, 2017; Suarez et al., 2013), and the dynamic capabilities for servitization (Tuli et al., 2007; Sjödin et al., 2016). Next, the third thematic area highlights the implementation of servitization-centric business models (Reim et al., 2015; Storbacka, 2011) and the perspective of ecosystem partners in business logic (Baines et al., 2013; Parida et al., 2014). However, the most active thematic area is dedicated to the value creation and delivery in servitization. This thematic area captures the aspects of service network partners (Smith et al., 2014; Story et al., 2017), value co-creation (Tuli et al., 2007; Sjödin et al., 2016), and customer value maximization (Brax & Visintin, 2017; Suarez et al., 2013).

We developed a conceptual framework to overcome these challenges by summarizing the findings of our co-citation analysis and dynamic co-citation analysis (see Fig. 7). This framework posits that firms could address challenges in servitization by following suitable business logic and the right models to develop servitization capabilities and focus on value creation and delivery.

4.3. Future scopes to advance research on servitization

In a quest to address RQ3, we identified a total of 18 future research directions that emerged from four main thematic areas in Section 6. We present these future research directions in Table 8. In addition, our conceptual framework features future research scopes that we consider key (see Fig. 7). Fig. 7 and Table 8 can serve to guide potential researchers in creating the fundamental state-of-the-art elements to advance the research on servitization. Among these proposed research directions, the following three may dominate the servitization literature in the near future:

- *Digital servitization:* The importance of digital servitization is rising in tandem with the availability of service business extensions using digital technologies (Gebauer, Paiola, Saccani, & Rapaccini, 2021; Raddats, Kowalkowski, Benedettini, Burton, & Gebauer, 2019). However, manufacturers are focusing too much on technology in their quest to drive service growth with digital servitization and, consequently, are often failing to attain the outcomes they desire (Tronvoll, Sklyar, Sörhammar, & Kowalkowski, 2020). Tronvoll et al. (2020) suggested that successful digital servitization requires an agile mindset from manufacturing firms to foster a digitally servitized identity, to dematerialize resources, and to create a collaborative organizational culture. Future research could apply game theory to identify strategies to maximize a firm's revenue from digital servitization (Kamalaldin, Linde, Sjödin, & Parida, 2020) and pricing strategies for physical and digital offerings (Vendrell-Herrero, Bustinza, Parry, & Georgantzis, 2017). Furthermore, the consumers' intention in adopting innovative digital services needs to be understood more fully (Khanra, Dhir, Kaur, & Joseph, 2021b), since boundaries between humans and technology are disappearing with digital servitization (Tronvoll et al., 2020).
- *Ecosystem servitization*: Digital servitization may influence the resource integration patterns that connect ecosystem actors (Sklyar, Kowalkowski, Sörhammar, & Tronvoll, 2019) and the alignment of the business models among them (Kohtamäki, Parida, Oghazi, Gebauer, & Baines, 2019). The enhanced relational and structural

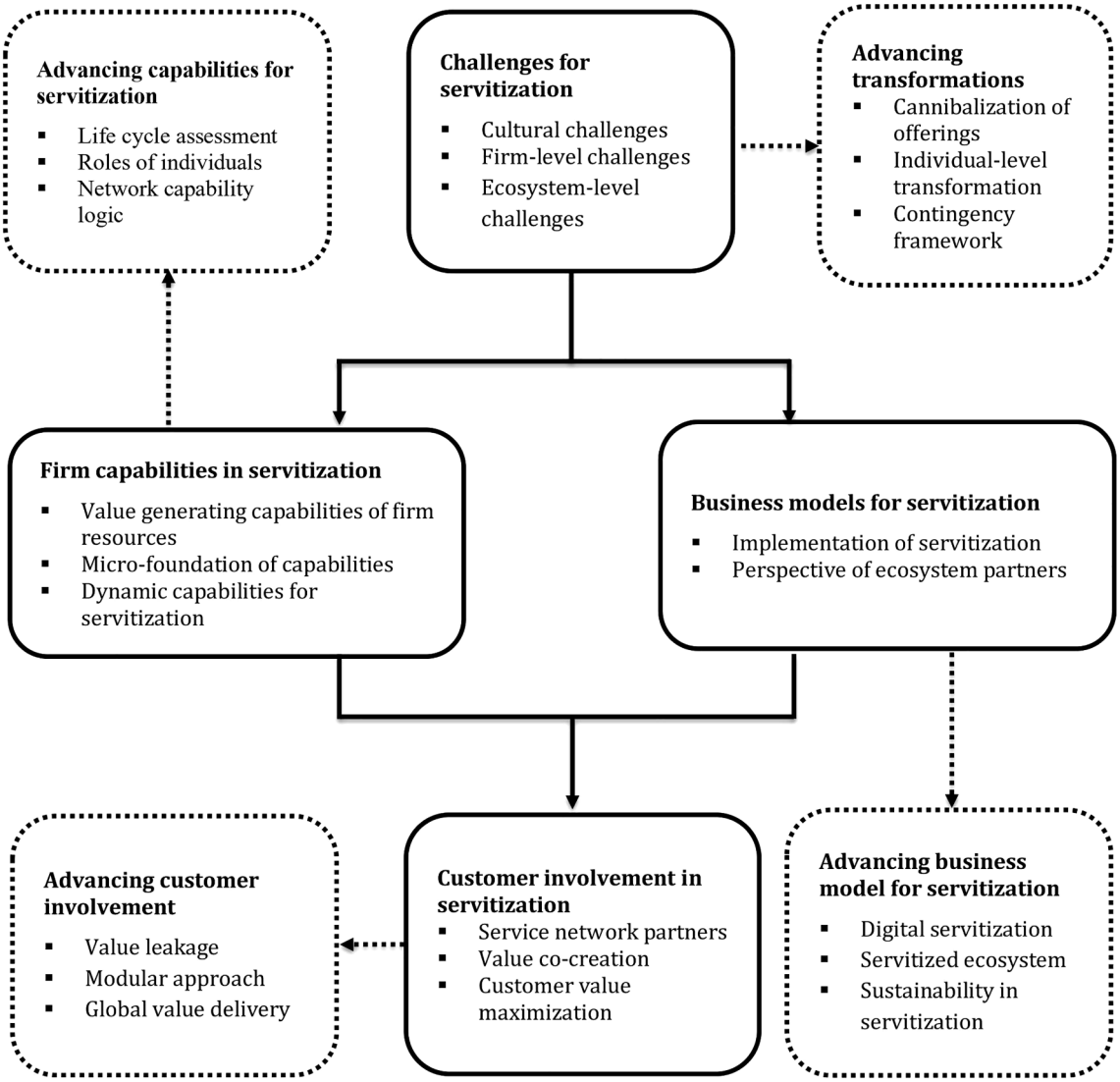

Fig. 7. A conceptual framework to overcome challenges for servitization. Note: Solid lines represent themes from prior research. Dotted lines represent future research scopes.

embeddedness from partner firms included in a manufacturing firm's network is critical for the success of a firm's digital servitization (Sklyar, Kowalkowski, Tronvoll, & Sörhammar, 2019). Therefore, an analysis of an ecosystem-wide digital infrastructure is necessary to understand the inter-firm and intra-firm change processes impacting a firm pursuing digital servitization (Sklyar, Kowalkowski, Tronvoll, & Sörhammar, 2019). Furthermore, the dynamism in a digital transformation among different network actors in an ecosystem may advance research on digital servitization from a multi-actor perspective (Kamalaldin, Linde, Sjödin, & Parida, 2020).

- *Sustainable servitization:* Sustainability in servitization may be achieved by increasing the durability and recyclability of products to reduce the number of units produced (Reim, Lenka, Frishammar, & Parida, 2017), by designing recyclable products to increase resource efficiency (Gelbmann & Hammerl, 2015) and by fostering stakeholder interactions in favor of environmental and socio-ethical benefits (Vezzoli, Ceschin, Diehl, & Kohtala, 2015). The advanced analysis of customer usage data from digital servitization may, therefore, aid sustainability by supporting service innovation, predictive maintenance, and product tracking, among other intelligent functionalities (Parida, Sjödin, & Reim, 2019). However, offering sustainable servitization is challenging because of the complexity in designing sustainable product-service combinations, aligning the interests of various stakeholders, and transforming the mindsets of employees and customers. Future research could aim to address such challenges in achieving sustainability in servitization. Furthermore, future researchers exploring the scope of sustainability in digital servitization could usefully examine possible ways to develop the organizational capabilities of using big data analytics in manufacturing firms to contribute to the management of the triple bottom line.

5. Study implications

This study aims to address the paucity of research on servitization by offering a comprehensive view of the extant literature and addressing three RQs related to the key contributors, important thematic areas, and future research agendas in the field. We answered RQ1 via a series of bibliometric techniques. Furthermore, a key contribution of the present study is the description of four main thematic areas in the literature on servitization, as initiated by RQ2. In-depth content analyses within these thematic areas helped us address RQ3 by recommending actionable future research agendas. In addition, a conceptual framework to overcome challenges in servitization provides greater structure to the

fragmented literature in this domain. This study is, therefore, an important addition to the extant literature as it has synthesized prior research and has provided a state-of-the-art conceptual foundation to advance the research on servitization.

5.1. Theoretical implications

Kowalkowski et al. (2017) established the boundaries and conceptual foundations of the research on servitization. Raddats et al. (2017) aided the research on servitization by achieving a significant level of differentiation from the established domains in management education. However, there have been insufficient attempts in the extant literature to build the legitimacy of the research on servitization among scholarly communities. The present study has, in consequence, conducted a comprehensive bibliometric analysis of the prior research to acknowledge the key contributors who are shaping the research in this area. Identifying such contributors is a major step toward legitimizing an emerging research domain (Hambrick & Chen 2008).

This study identified four main thematic areas in servitization research and reported the prestigious articles from each (see Table 6a-d). In addition, the evolution of these thematic areas has been traced through dynamic co-citation analysis. Although the thematic area concerning transformational challenges facing servitization has approached saturation, the thematic areas discussing capability development, value delivery, and business models for servitization have sustained interest from academia. These research foci signify the increasing success of servitization in helping firms to approach sustainable business practices by negating the environmental impacts of material-heavy supply chains.

The findings from the co-citation analysis and dynamic co-citation analysis are further summarized in a conceptual framework to overcome the challenges in servitization. This framework offers a process to address these challenges by focusing on value creation and delivery. The process involves the development of capabilities for servitization and the formulation of a suitable business logic and appropriate models. Furthermore, a total of 17 future research directions have been conceptualized that can help steer the emerging scholarship on servitization.

5.2. Practical implications

The findings from this study signify that the research focus has shifted from identifying the transformational challenges in servitization to discussing how value delivery can address these challenges. The key managerial insights emerging from this study are as follows:

First, the transition in the business offerings of servitizing firms may require the acquisition of suitable resources and the development of capabilities to exploit them. Therefore, managers in servitizing firms should embrace ambidexterity in manufacturing products and offering services.

Second, selling high-value solutions to the customers of a servitizing firm requires advanced service design methods. Therefore, managers in servitizing firms may tune their business models such that they share benefits obtained from servitization with select consumers who use their products optimally.

Third, the success of servitization often depends on the value-creation and value-delivery processes in servitized offerings. Therefore, managers in servitizing firms should consider involving customers as co-creators of value.

Declaration of Competing Interest

The authors declared that there is no conflict of interest.

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Sayantan Khanra is an assistant professor at the School of Business, Woxsen University, and a visiting researcher at Turku School of Economics, University of Turku, Finland. He has obtained his Ph.D. from Indian Institute of Management Rohtak, India. His research interests lie primarily in the domain of technology innovation. His doctoral thesis addressed several research problems specific to e-Government services. He has specialised in narrative, meta-analysis and bibliometric reviews. He has presented some of his research at renowned conferences and published in quality academic journals.

Amandeep Dhir is a Professor of Research Methods at University of Agder, Norway. He is also a visiting professor at Norwegian School of Hotel Management, University of Stavanger, Norway. His research appears in the Technology Forecasting and Social Change, Journal of Business Research, Business Strategy and the Environment, International

Journal of Production Research, Internet Research, Information & Management, Journal of Retailing and Consumer Services, International Journal of Information Management, Computers in Human Behaviour, Computers in Industry, Production Planning & Control, International Journal of Consumer Studies, Tourism Management Perspectives, Journal of Hospitality and Tourism Management, International Journal of Hospitality Management, International Journal of Contemporary Hospitality Management, Journal of Sustainable Tourism, Journal of Destination Marketing & Management, Journal of Cleaner Production, Food Quality and Preferences, Appetite, British Food Journal, Information Technology & People, Australasian Marketing Journal, Enterprise Information Systems among others.

Vinit Parida is a chaired professor of entrepreneurship and innovation at Luleå University of Technology, Sweden. He is an associate editor for Journal of Business Research in Business-to-Business (B2B) track. He conducts research on the topics of business model innovation, digitalization, circular economy, and organizational capabilities. He has published 80+ papers in distinguished international journals, including Strategic Management Journal, Journal of Management Studies, Industrial Marketing Management, Production and Operation Management, Strategic Entrepreneurship Journal, and others. He is the recipient of multiple awards for his research work.

Marko Kohtamäki is Professor of Strategy and Director of the 'Networked Value Systems' (NeVS) research program at the University of Vaasa, Finland. Professor Kohtamäki is also a visiting professor at Luleå University of Technology, Sweden, and takes special interest in industrial service business or servitization, strategic practices, and business intelligence or management information systems in technology companies. He has published in several distinguished international journals, such as Strategic Management Journal, Industrial Marketing Management, Journal of Business Research, and Strategic Entrepreneurship.