

What do we know about the servitization strategy? A bibliometric answer

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Abstract

As a shift towards the creation of holistic value and the addition of services to the offer of manufacturing companies, servitization represents a strategic orientation with significant effects on the firms' competitiveness. The growing interest in servitization in practice is accompanied by growing research interest as well. With an aim of identifying the scope and the productivity of the research activity as well as the intellectual structure of knowledge on servitization strategy as a relatively young but growing research field, a bibliometric analysis is conducted on a sample of 575 articles available in the WoS database. The results indicate that research interest in servitization as a strategy is growing from year to year, that it is dispersed among a large number of authors, journals and WoS categories (although still dominantly related to Business and Management), but relatively consolidated among a smaller number of countries, with a prominent dominance of developed European countries. As for the intellectual structure, it began to be formed with conceptualizations of the servitization phenomenon, and then developed by exploring barriers to strategy implementation, business model changes to be undertaken, impact on firm's performance and supply chain relationships, and, recently, relationship to digitalization. By capturing and analyzing a large volume of data, the study's bibliometric approach reveals the structure of performance and knowledge in the field of servitization strategy. Moreover, based on the obtained results, the study maps the research gaps and promising avenues of future research in the field, and it offers valuable insights for practitioners.

Keywords: *servitization, strategy, competitiveness, business models, manufacturing*

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1. INTRODUCTION

Expanding the product portfolio by including services is a phenomenon called servitization (Baines et al., 2009; Baines & Lightfoot, 2014; Feng et al., 2021; Simonsson & Agarwal, 2021). The term servitization was introduced by Vandermerwe and Rada in 1988, when they defined it as an offering of a bundle that, in addition to products, includes services, support and knowledge; an offering that adds value by holistically satisfying the consumer needs, enables companies to compete on new bases and influences the competitive dynamics (Vandermerwe & Rada, 1988).

Servitization is about designing and delivering a new type of offer; a system of products and services that is complementary to the company's capabilities, aligned with consumer requirements and that leads to the business performance improvement (Golgeci et al., 2021; Le-Dain et al., 2023; Martín-Peña et al., 2017; Simonsson & Agarwal, 2021). Servitization transforms the business, it innovates capabilities and processes in an effort to shift the focus from traditional products to a package of products and services, from the exchange of products

to the exchange of values (Abou-Foul et al., 2021; Green et al., 2017; Naik et al., 2020). With an aim to increase the value of the offer in order to achieve competitiveness in an increasingly demanding, uncertain, globalized and competitive environment, servitization changes business models and repositions the servitizer (Feng et al., 2021; Martín-Peña et al., 2017).

Although servitization is not exclusive to the manufacturing industry (Vandermerwe & Rada, 1988), it is nevertheless most often discussed in the manufacturing context (Martín-Peña et al., 2017). The orientation of manufacturing companies towards developing services and incorporating them into the offer is older than the term servitization itself (Feng et al., 2021; Opresnik & Taisch, 2015), and today it is becoming more and more common practices of manufacturers (Khanra et al., 2021). It represents a way for manufacturing companies to support their competitive position by changing the logic of designing, creating, delivering and capturing the value. Looking for a way to increase their competitiveness, a growing number of traditional manufacturers are transforming their business models to provide greater value by providing services combined with an existing product portfolio (Simonsson & Agarwal, 2021). Thus, servitization becomes an increasingly pronounced trend in the manufacturing industry (Karatzas et al., 2020; Kharlamov & Parry, 2021; Kowalkowski et al., 2017a; Martín-Peña et al., 2023; Raddats et al., 2016; Sakyi-Gyinae & Holmlund, 2018).

In parallel with more pronounced implementation in practice, research interest in servitization is also growing (Kohtamäki et al., 2019b; Zhou & Song, 2021). The growth of services in manufacturing firms is one of the most active and the most important domains of service research, so much that it declared a strategic research priority (Kowalkowski et al., 2017a). The subject of servitization is multidisciplinary and has been researched within various disciplines, including business and management, supply chain management, marketing, operations management, but also engineering, sustainability and IT (Díaz-Garrido et al., 2018; Kowalkowski et al., 2017a; Rabetino et al., 2018). This research field is growing fast, but also abounds in different perspectives and terminology (Pinillos et al., 2022). Seen as a transformation with strategic effects on the company's competitiveness (Gomes et al., 2021; Rabetino et al., 2015), servitization is investigated from a strategic focus as well (Díaz-Garrido et al., 2018; Khanra et al., 2021; Rabetino et al., 2018). Moreover, strategy becomes the core term in the definitions of servitization, while the perspective of strategic management becomes the research field's core perspective and an approach that dominates the servitization research (Pinillos et al., 2022). With a growing body of knowledge about servitization as a strategic commitment of companies, there is a need to identify research dynamics and to systematize the results. Therefore, this paper answers the following research questions (RQ):

RQ1: How has research on servitization as a strategic business orientation evolved over time?

RQ2: What are the intellectual interactions and structural connections between the elements of the servitization strategy research field, i.e., what is the intellectual structure of the field?

A literature review is a common method used to identify the state-of-the art of a certain field and to systematize its contributions. In the field of servitization, the number of review studies is increasing, but most of them are qualitative in nature (Rabetino et al., 2018; Zhou & Song, 2021). Although certainly important, narrative review studies cannot capture the extensive research production. There is a lack of bibliometric analyses in the field, analyses that can cover a large volume of data, to identify the scope and the impact of the research activity, as well as the relationships within the research field (Díaz-Garrido et al., 2018). Bibliometric analysis quantitatively describes the published data and thus sheds light on knowledge distribution and intellectual structure of a field (Zhou & Song, 2021). It gives sense to a large amount of unstructured data (Donthu et al., 2021), and, as such, it is especially important for new research fields such as servitization (Martín-Peña et al., 2017). For this reason, the bibliometric analysis

of large number of documents is chosen as an adequate approach to systematize the existing knowledge on servitization as a strategic business orientation.

This is certainly not the first bibliographic study in the field of servitization. But, unlike the others that are broadly focused on servitization phenomenon in general, this study is specifically focused only on exploring servitization as a strategy. As such, it is one of the few studies (if not the first one) that uses the bibliometric analysis approach to identify performance and patterns in researching servitization from a strategic perspective.

The remainder of the paper is structured as follows. The next section of the paper discusses servitization as a strategic commitment of the company, answering the question why it is important to research servitization as a strategic issue. After that, the steps in the chosen bibliometric analysis procedure are explained. Then, the results of the conducted analysis are presented and discussed. The paper ends with conclusions, limitations of the study and directions for further research.

2. THEORETICAL BACKGROUND: SERVITIZATION AS A STRATEGIC ISSUE

The last decade of the twentieth century was good for business, unless you were a manufacturer (Wise & Baumgartner, 1999). A small number of producers from different industries were successful, but what they had in common was that they went downstream in search of profit. By entering new domains and exploiting the sources of competitiveness there, servitization is a way for manufacturers to respond to market demands, competitive pressures and reduced profit potential of their mature industries (Cao et al., 2016; Kowalkowski et al., 2017a; Martinez et al., 2010; Naik et al., 2020; Rabetino et al., 2015; Sakyi-Gyinae & Holmlund, 2018). As an opportunity for traditional manufacturers to create new capabilities that add value and to build business models to offer solutions to consumers, servitization is becoming a key factor in industrial success in the twenty-first century (Baines et al., 2009; Baines & Lightfoot, 2014; Li et al., 2022).

With servitization, a manufacturer meets a wider range of consumer demands (Kharlamov & Parry, 2021; Le-Dain et al., 2023; Visnjic Kastalli & Van Looy, 2013), and it creates a new differentiation basis (Kamalaldin et al., 2020; Martín-Peña et al., 2023; Opresnik & Taisch, 2015; Raddats et al., 2016; Visnjic Kastalli & Van Looy, 2013), which is harder to imitate (Martinez et al., 2010; Oliva & Kallenberg, 2003). Servitization helps in building brand image and assets, especially in those industries where product differentiation is difficult to achieve (Benedettini et al., 2015; Kowalkowski et al., 2017a; Oliva & Kallenberg, 2003). Services as a part of the offering open new, more stable revenue streams with a higher margin (Benedettini et al., 2015; Bustinza et al., 2015; Oliva & Kallenberg, 2003; Wise & Baumgartner, 1999). The servitization strategy changes the relationships and structure of the supply chains (Benedettini et al., 2015; Cusumano et al., 2015; Kamalaldin et al., 2020; Neely, 2008; Vendrell-Herrero et al., 2017). It affects industry dynamics and structure by building competitive barriers, increasing dependence, but also consumer loyalty (Cusumano et al., 2015; Gomes et al., 2021; Naik et al., 2020; Neely, 2008; Vandermerwe & Rada, 1988). Although it is often assumed that the importance of services increases as the industry matures (Benedettini et al., 2015; Kowalkowski et al., 2017a; Opresnik & Taisch, 2015; Wise & Baumgartner, 1999), this may not always be the case. By introducing services, companies can respond to various competitive challenges, not only to the maturity of the industry (Cusumano et al., 2015). To summarize, a servitization decision is driven by the expected financial, strategic and market benefits (Abou-Foul et al., 2021; Gebauer et al., 2005; Kharlamov & Parry, 2021; Oliva & Kallenberg, 2003). In order for them to be realized, it is necessary to change the elements of the business model (Kindström & Kowalkowski, 2014; Kimita et al., 2022; Visnjic Kastalli & Van Looy, 2013;

Zighan & Abualqumboz, 2022) so that they can support the proposition, creation, delivery and appropriation of the new type of value.

However, this path is not an easy one, and there are no guarantees that the expected positive results will be achieved (Li et al., 2022; Rabetino et al., 2017; Sakyi-Gyinae & Holmlund, 2018). Almost certainly, servitization creates value for the buyer, but sometimes not for the producer (Visnjic Kastalli & Van Looy, 2013). Servitization changes the structure and the level of a firm's exposure to external and internal risks (Abou-Foul et al., 2021; Benedettini et al., 2015; Kharlamov & Parry, 2021). It requires new investments and significant changes in the business models of those who implement it (Khanra et al., 2021; Kharlamov & Parry, 2021; Kimita et al., 2022). There is no consensus regarding the nature of the relationship between the servitization and financial performance of the servitizers. Basically, the results indicate that these relationships can be linearly positive or negative, non-linear, or no correlation (Feng et al., 2021; Simonsson & Agarwal, 2021). There is even a services paradox, which implies that additional investment in services has a negative effect on the financial result (Baines & Lightfoot, 2014; Benedettini et al., 2015; Neely, 2008; Suarez et al., 2013).

Servitization is a significant change in business orientation with even more significant consequences, and they are not necessarily desirable. So, servitization does not automatically lead to success. Instead, success depends on the company's ability to adapt to various changes and challenges that servitization brings (Li et al., 2022; Kohtamäki et al., 2019a; Raja et al., 2022). Although full of challenges, this opportunity must not be ignored, or the future of manufacturers will be bleak (Wise & Baumgartner, 1999).

Considering the obvious strategic character and importance of servitization for business, as well as the growing research interest in it, it is necessary to identify contributions and trends, and to systematize knowledge in this field.

3. METHODOLOGY AND DATA

Bibliometric analysis uses a scientific and structured method to quantitatively analyze a large number of articles in the field and to display knowledge maps in order to gain insights into the knowledge structure and trends in the field (Zhou & Song, 2021). With the development of statistics and information technologies, bibliometrics has become a sophisticated method for analyzing trends in data. It is used in numerous disciplines, and its popularity in the field of business research is growing (Chen et al., 2022; Donthu et al., 2021). Bibliometric analysis results in two groups of indicators: activity or performance and relation indicators (Donthu et al., 2021; Martín-Peña et al., 2017). The former indicates the volume of the research activities and the contribution of the individual elements (authors, institutions, journals, etc.), while the latter map the intellectual structure of the field.

The process of bibliometric analysis can be presented as a multi-phase, iterative procedure (Annarelli, et al., 2021; Chen et al., 2022; Feng et al., 2021). Following the bibliometric analysis procedure suggested by Donthu et al. (2021), the bibliometric analysis is carried out through four steps (Figure 1).

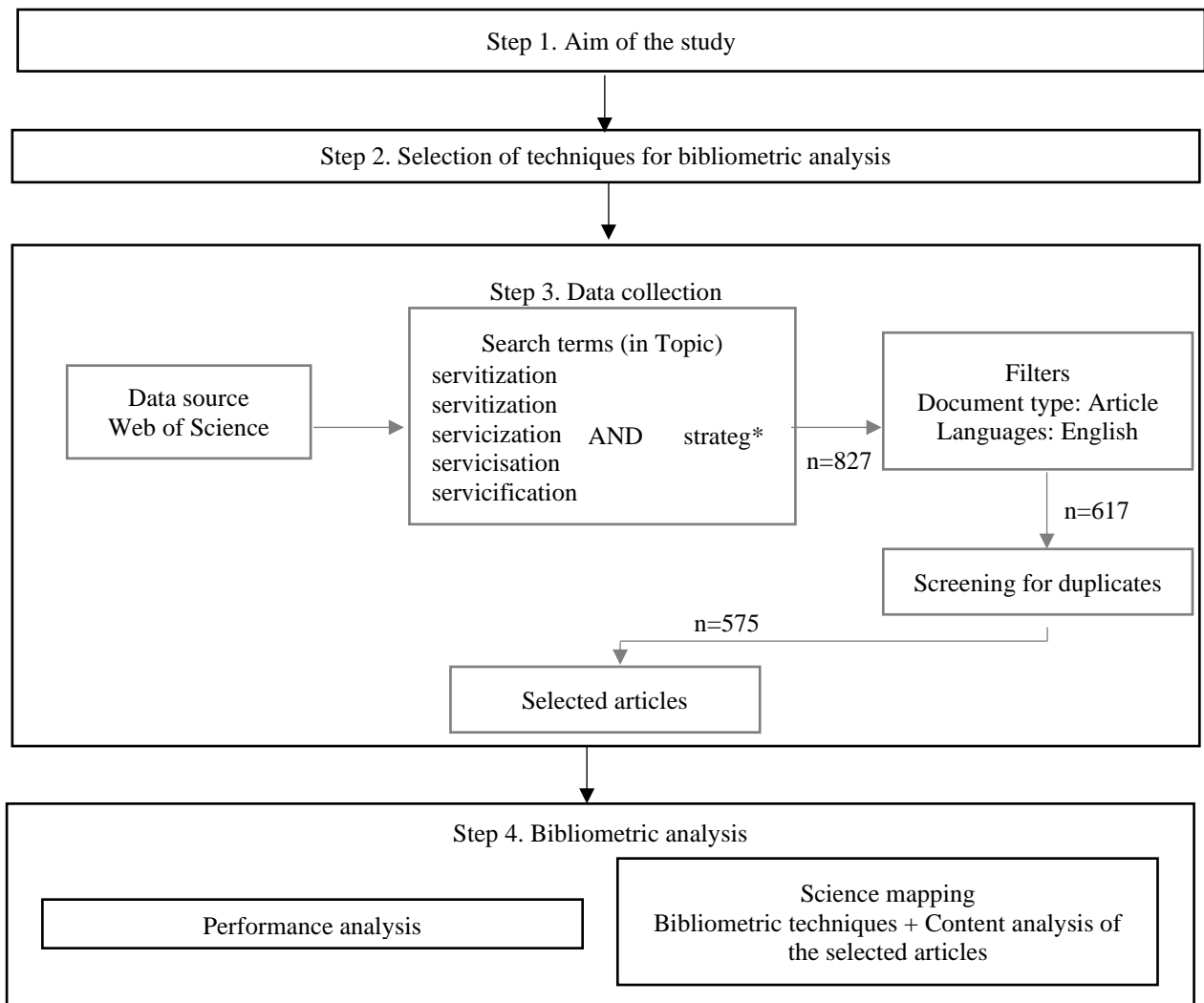


Fig. 1 – Bibliometric analysis procedure. Source: adapted from Donthu et al., 2021.

3.1. Step 1. Aim of the study

Due to the great strategic importance of servitization and the growing research interest in this issue, this study identifies the scope and the productivity of the research activity as well as the intellectual structure of knowledge on servitization as a strategic orientation of a company.

3.2. Step 2. Selection of techniques for bibliometric analysis

In order to answer the research questions, both categories of bibliometric analysis are conducted: performance analysis and science mapping.

The number of publications per author, per journals and per countries is used to assess the productivity of the research constituents (performance analysis). Moreover, the state in the field is descriptively examined through number of publications per year and per Web of Science (hereafter WoS) categories. While the performance analysis evaluates the contribution of the research constituents, the science mapping is the part of the bibliometric analysis that identifies intellectual interactions, structural connections and relationships between research constituents. The following bibliometric techniques are used for mapping the field of servitization strategy:

- Co-citation analysis of cited references is used to examine the relationships between cited articles and to portray the key topics of this research field.

- Bibliometric coupling of documents (articles) is used to examine the relationships between citing articles and to map both the broad topics and newer research directions in the field.
- Author keywords co-occurrence analysis to identify relationships between topics in the research field.

3.3. Step 3. Data collection

For gathering the data for a bibliometric analysis, a proper database should be chosen. Although different scientific databases are available, WoS and Scopus are considered the most reliable (Corrêa et al., 2021; Norris & Oppenheim, 2007; Rodrigues et al., 2022). In fact, given that the coverage and the sophistication of different databases differ, before choosing a specific database, a researcher should make a decision on whether to use one or more scientific databases. Although using multiple databases for data collection is possible, this option may raise certain issues, as combining different databases requires additional data consolidation and cleaning, a procedure prone to human error (Donthu et al., 2022). Therefore, it is recommended to choose one appropriate database for conducting a bibliometric study. This approach is adopted in this study by choosing the WoS database for identifying the units (documents) for the bibliometric analysis. Due to its coverage, functionality and sophistication, the WoS is widely recognized as one of the most relevant and pertinent databases for scientific analysis (Chen et al., 2022; Norris & Oppenheim, 2007; Rodrigues et al., 2022). Moreover, the majority of bibliometric studies use the WoS database as their source of data (Zhou & Song, 2021). Finally, using only the WoS to conduct a bibliometric analysis is not an uncommon approach and has been widely followed by other researchers (e.g. Chen et al., 2022; Díaz-Garrido et al., 2018; Martín-Peña et al., 2017; Pinillos et al., 2022; Zhou & Song, 2021).

The search terms are defined in a way to provide search results that are extensive enough to justify the bibliometric analysis, but also focused enough to remain in the field of servitization strategy. After consulting other studies presenting the results of the bibliometric analysis of the field of servitization (e.g. Annarelli et al., 2021; Feng et al., 2021; Rabetino et al., 2018), the following combinations of search terms are defined: servitization AND strateg*; servitisation AND strateg*; servicization AND strateg*; servicisation AND strateg*; servicification AND strateg*.

With respect to the relevant literature, the search terms are defined in such a way as to fulfill the purpose of this particular study and to take into account the fact that the scope of the study is not the entire field of servitization, but only one of its specific domains related to the research of servitization as a strategy and strategic business orientation. Therefore, other terms that broader-oriented studies use are not included here, such as product-service system, integrated offering, service-transition, service-transformation, service infusion, service provision, solution business model, etc. That is, the term strateg* is included to cover the specific domain of interest. The form strateg* is used in order to cover both the terms strategy and strategic.

Without any time restrictions, the terms are searched in the field topic, which includes title, abstract, author keywords, and keywords plus. Search results containing a total of 827 documents were then filtered by document type and language, in order to ensure that only articles in English are included. Excluding documents referring to proceedings, books, letters and editorials, as well as documents not published in English, is a common approach in forming a database for a bibliometric analysis (Chen et al., 2022; Díaz-Garrido et al., 2018; Rabetino et al., 2018). Including only articles in a bibliometric study is a standard practice that ensures the reliability of the results (Ramos-Rodríguez & Ruíz-Navarro, 2004). This approach of not including books, doctoral thesis and proceedings is based on the understanding that only papers published in peer-reviewed journals are a source of the so-called certified knowledge, which is

a knowledge that has been (more rigorously) reviewed and approved by fellow researchers (Ramos-Rodríguez & Ruíz-Navarro, 2004, p. 982). Moreover, journals are the most important media for the publication of research results in the social sciences (Norris & Oppenheim, 2007). This means that the selection of articles published in journals not only enables the analysis of certified knowledge, but it also captures the majority of the available knowledge in a specific field. As for the review studies, they are excluded because they can be a source of bibliometric bias (Annarelli et al., 2021). This step left a total of 617 articles to be further analyzed. As the WoS database is not specifically designed for bibliometric analysis, additional data cleaning is performed. After reviewing the database and deleting documents which were duplicated, a research database containing a total of 575 documents has been generated.

3.4. Step 4. Bibliometric analysis

3.4.1. Performance analysis

To answer the first research question, a performance analysis is conducted. It has provided results on the research productivity of individual authors, journals and countries. Moreover, the dynamics and the key features of the field are identified by analyzing the number of publications per year and per WoS category. SPSS v. 22 is used to obtain the descriptive statistics results.

3.4.2. Science mapping

The bibliometric and the intellectual structure of the field is identified by using the science mapping techniques, including co-citation analysis, bibliometric coupling and co-occurrence analysis. These techniques are based on the assumption that units of analysis that share common bibliographic features are thematically related (Donthu et al., 2021; Khanra et al., 2021; Rabetino et al., 2018). To put it differently, publications that are frequently cited together (co-citation analysis), publications that have the same references (bibliometric coupling analysis) and words that are often used together are thematically related or similar, and they form thematic clusters in the research field.

The science mapping analysis and visualization is performed by using the VOSviewer v. 1.16.9 (Van Eck & Waltman, 2023). Co-occurrence analysis is performed on author keywords, while cited references and documents are used as units of the co-citation and the bibliometric coupling analysis, respectively. The full counting method is used throughout the analysis.

For the co-citation analysis, the threshold is set on 20 as a minimum number of citations of a cited reference. Of 22,411 cited documents, 225 meet the threshold. For including documents in the bibliographic coupling analysis, a threshold of a minimum of 20 citations of a document is set. Of 575 documents, 200 meet the threshold. Selected units of co-citations and bibliographic coupling analysis are grouped in clusters containing a minimum of 10 units, and their network visualization is shown with the number of citations as weight. In order to appropriately map this research domain, a content analysis is used to complement the bibliographic observations and to interpret the bibliometric analysis results (Khanra et al., 2021; Zhou & Song, 2021).

For the author keywords co-occurrence analysis, data were cleaned in order to merge synonyms (for example, manufacturer-manufacturing firm, digitalization-digitization) and abbreviations with full terms (for example, IoT-Internet-of-Things, PSS-product-service system), for correcting spelling differences (for example, servitization-servitisation, digitalization-digitalisation) and plural-singular use of a same term (for example, business model-business models, innovation-innovations, product service system-product service systems). For this purpose, a VOSviewer thesaurus file is created. For performing the analysis, the threshold is

set on 10 minimum number of occurrence of a keyword. Out of 1,589 keywords, 20 meet the threshold, which are then clustered in 3 clusters, containing a minimum of 5 units.

4. RESULTS AND DISCUSSIONS

4.1. Performance in the servitization strategy research field

Since the publication of the first analyzed article in 2002, the number of documents is constantly increasing, reaching a maximum in 2022 with 114 published articles (the number of articles in 2023 is expectedly smaller, as the analysis is performed in February 2023) – Figure 2. This dynamic shows that the strategic connotation of servitization is gaining importance, and this is consistent with other findings (Díaz-Garrido et al., 2018; Martín-Peña et al., 2017; Pinillos et al., 2022).

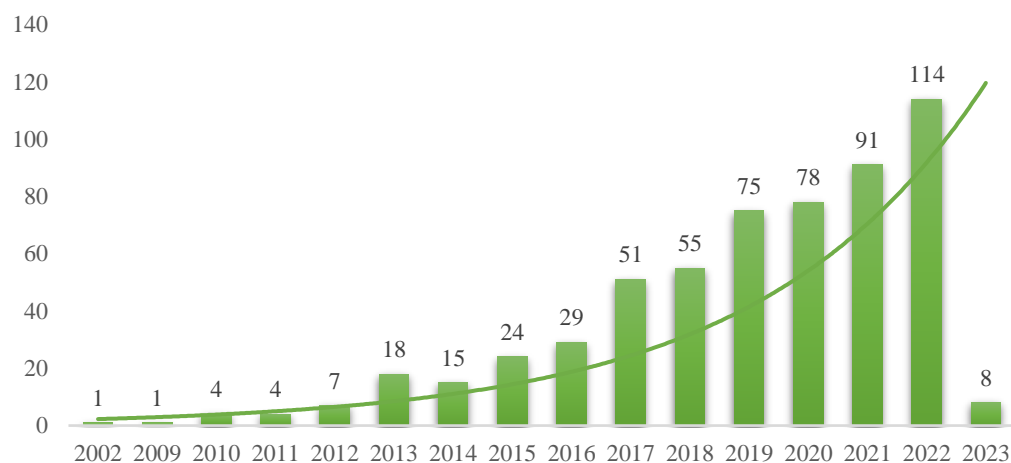


Fig. 2 – Number of articles by year. Source: own research

The authorship of the selected 575 articles involves a total of 1,336 authors (Table 1). Their individual contributions range from 1 to 23 papers, with the largest number of authors (80.08%) authoring only one paper, while the average number of papers per author is 1.44. The ten most productive authors have published 10 or more papers, ranging from 10 to a maximum of 23 papers.

The analyzed 575 papers are published in a total of 174 journals. On average, a journal has published 3.3 papers on the topic. However, the range of the number of published articles is large, from a minimum of 1 to a maximum of 59 published papers. However, the majority of journals (64.4%) have published only one paper on the topic.

Authors publishing articles on servitization strategy have listed affiliations from 67 different countries. The largest proportion of countries (26.9%) is listed as a country of affiliation in only one paper. England is listed as the country of affiliation of (co)authors of as many as 126 articles, which is the maximum number of papers per one country. Of the 10 most productive countries, 8 are European, indicating that this research field is especially active in Europe. However, significant research interest in this topic also exists in China. This geographical dispersion of research interest in the strategy of servitization is similar to that which exists in the field of servitization in general (Chen et al., 2022; Zhou & Song, 2021).

Journals in which the analyzed papers are published are categorized into a total of 59 WoS categories. In most cases (35.60%), only one paper is published in one of the categories. On average, 18.81 papers are published per WoS category, ranging from 1 to as many as 241 papers. Similar to the results for the field of servitization in general (Annarelli et al., 2021; Chen et al., 2022), the list of WoS categories is dominated by categories management and business, which is not surprising considering the nature of the research field. But, again, taking into account the very nature of the field and its inseparability from production (operations), this list also includes categories related to engineering, technology and environmental sciences.

In summary, the performance analysis indicates that research interest in servitization as a strategy is growing from year to year, that it is dispersed among a large number of authors, journals and WoS categories, but relatively consolidated between a smaller number of countries, dominantly from Europe.

Tab. 1 – Performance of the research field. Source: own research

	Authors	Journals	Countries	WoS categories
Total number	1,336	174	67	59
Mean	1.44	3.30	13.93	18.81
Median	1.00	1.00	3.00	2.00
Minimum-Maximum	1.00-23.00	1.00-59.00	1.00-126.00	1.00-241.00
Frequencies	1.00 paper in 1,080 cases (80.08%)	1.00 paper in 112 cases (64.40%)	1.00 paper in 18 cases (26.90%)	1 paper in 21 cases (35.60%)

Ten most productive

Author	Number of articles	Journals	Number of articles	Countries	Number of articles	WoS categories	Number of articles
Kohtamäki, Marko	23	<i>Industrial marketing management</i>	59	England	126	Management	241
Parida, Vinit	22	<i>Sustainability</i>	43	China	95	Business	211
Baines, Tim	18	<i>International journal of operations production management</i>	31	Sweden	91	Engineering Industrial	118
Bustinza, Oscar F.	18	<i>International journal of production economics</i>	31	Finland	83	Engineering Manufacturing	100
Gebauer, Heiko	15	<i>Journal of business industrial marketing</i>	29	Italy	69	Operations Research Management Science	93
Vendrell-Herrero, Ferran	15	<i>Journal of business research</i>	23	Spain	65	Environmental Sciences	58
Kowalkowski, Christian	14	<i>Production planning control</i>	19	Germany	39	Green Sustainable Science Technology	55
Bigdeli, Ali Ziaee	11	<i>Journal of manufacturing technology management</i>	17	USA	38	Environmental Studies	47
Raddats, Chris	11	<i>International journal of production research</i>	13	Denmark	30	Economics	20
Burton, Jamie	10	<i>Journal of service management</i>	13	France	28	Business Finance	15

4.2. Map of the research field

4.2.1. Co-citation analysis

Co-citation analysis determines the most influential publications and the knowledge basis of a field (Díaz-Garrido et al., 2018; Donthu et al., 2021; Feng et al., 2021). Thematic clusters identified by the co-citation analysis are formed out of publications that are linked by being cited together (co-cited). The obvious disadvantage of this technique is that it gives priority to the publications that have been published earlier (and thus have more citations). This is why it is said that the co-citation analysis gives a picture of the past of a certain field (Donthu et al., 2021).

The co-citation analysis of the field of strategy of servitization has identified three thematic clusters (Figure 3).

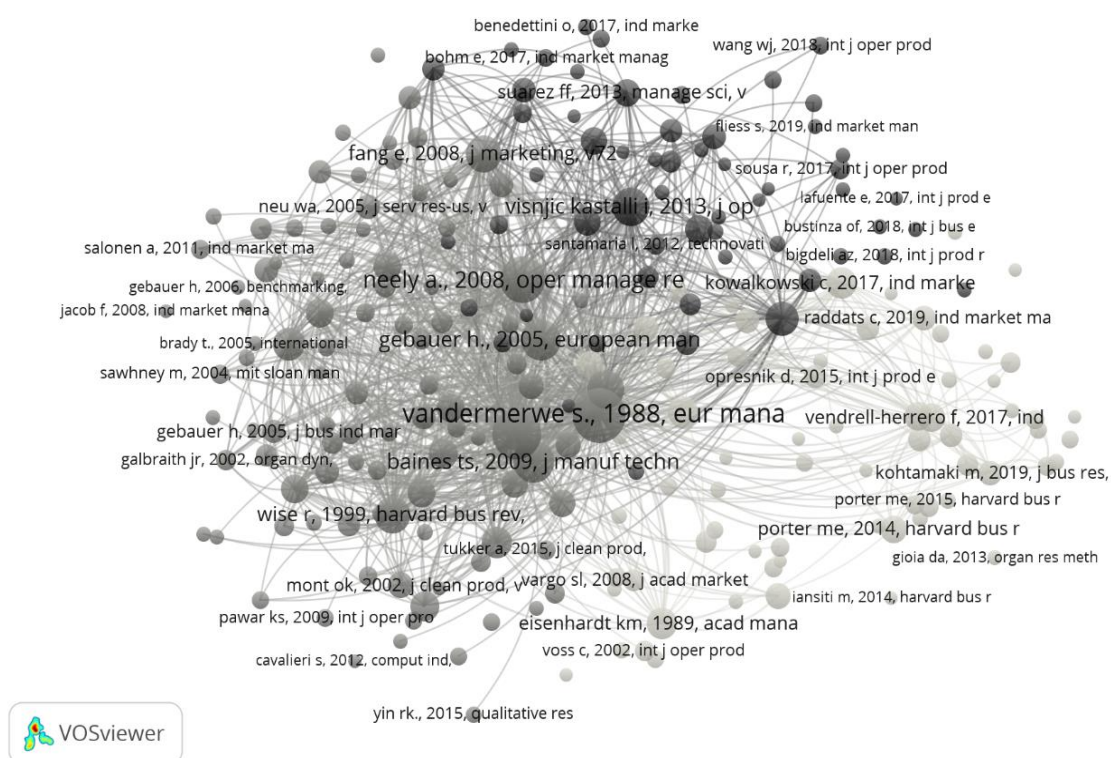


Fig. 3 – Co-citation analysis network visualization (legend: ● First cluster, ● Second cluster, ● Third cluster). Source: own research

The first cluster is the one referring to the conceptual foundations of servitization. This is the largest cluster that includes 100 papers, it is followed by the cluster servitization business models with 68 papers, while the smallest cluster is the one labeled as servitization, firm's and industry's performance, which contains 57 papers. The content of the first five ranked papers in each cluster is analyzed in order to understand the content of the clusters themselves (Table 2).

Tab. 2 – Content analysis of the co-citation clusters. Source: own research

Thematic cluster	Author(s)	Research method	Main findings
	Vandermerwe & Rada, 1988	Multiple case study	<p>Conceptualization of:</p> <ul style="list-style-type: none"> • Servitization; • Motives for servitization; • Competitive potential of servitization; • Changes of the competitive dynamics triggered by servitization.
	Oliva & Kallenberg, 2003	Multiple case study	<p>Defining the process model of developing installed base service capabilities with four phases:</p> <ul style="list-style-type: none"> • Consolidating product-related services; • Entering the installed base service market; • Expanding the service offering; • Taking over the end-user's operation.
Conceptual foundations of servitization	Neely 2008	Descriptive statistics and regression analysis	<p>Empirical findings on the range and extent of servitization which show that:</p> <ul style="list-style-type: none"> • There are different approaches to servitization, which extend the traditional three-options approach (product oriented, use oriented, result oriented) by adding: integration oriented and service oriented product-service systems; • Servitized manufacturers are larger but generate lower profit as a share of sales, compared to the traditional manufacturers. • Size of a firm play a role in the servitization, where larger firms encounter more challenges. • Servitization adds more risks for the business.
<i>What is servitization, what triggers it and what limits it, what is needed to implement it, which path does the transition to services take?</i>	Gebauer et al., 2005	Multiple case study	<p>Revealing the organizational and behavioral dimensions of the service paradox. The paradox arises because:</p> <ul style="list-style-type: none"> • There is no adequate motivation of managers to expand the range offerings by introducing services; • The company is not organizationally adapted for servitization. • The organizational mismatch exists because certain side effects occur during the implementation of servitization strategy (credibility gap, service quality erosion, and dominant focus on symptoms instead on causes)
	Ulaga & Reinartz, 2011	Multiple case study	<p>Developing a resource-capability framework for successful implementation of the servitization strategy. The framework includes:</p> <ul style="list-style-type: none"> • Resources: product usage and process data, product development and manufacturing assets, distribution network and experienced sales force, field service organization. • Capabilities: data processing and interpretation, risk assessment and mitigation, design-to-service, hybrid offering sales and deployment.
Servitization business models	Eisenhardt, 1989	Conceptual paper	<p>Proposing a typology of industrial services.</p> <p>Case study research approach is an iterative process containing the eight phases: getting started, selecting cases, creating instruments and protocols, entering the</p>

<p><i>What directions do the business models changes take place, what resources, capabilities and practices do they incorporate, and how do these changes affect relationships in the supply chain?</i></p>	<p>Baines, & Lightfoot, 2014</p>	<p>Multiple case study</p>	<p>field, analyzing data, shaping hypotheses, enfolded literature, reaching closure.</p> <hr/> <p>In order to successfully include and deliver services in their offering, companies should:</p> <ul style="list-style-type: none"> • Co-locate and distribute their service facilities close to customers operations; • Integrate both forwards and backwards in their supply chains; • Provide personnel who are flexible, relationship-building, service-centric, authentic, technically adept, and resilient. • Design own business processes in a way that they are integrated into their customer's operations, and supported by ICT; <p>Changes to the performance measurement system, by introducing new indicators aimed at measuring product performance, specifically for each customer.</p>
	<p>Kowalkowski et al., 2017b</p>	<p>Conceptual paper</p>	<p>Although the research field of servitization is maturing, there is a pronounced terminological inconsistency. To overcome this, concepts, such as: servitization, service infusion, deservitization and service dilution.</p> <p>Implementation of the strategy of servitization requires change and reconfiguration of the business model (resource base, organizational capabilities and structure, mission, routines, shared norms and values).</p>
	<p>Vendrell-Herrero et al., 2017</p>	<p>Single case study</p>	<p>Digital servitization business models affect the competitive dynamics by increasing the power of downstream participants. However, upstream firms can turn this asymmetry of interdependence to their advantage if they have unique resources which are important to the customer.</p>
	<p>Coreynen et al., 2017</p>	<p>Multiple case study</p>	<p>There are three distinct servitization pathways supported by digitalization: industrial, commercial and value servitization; and these lead to different level of service offering.</p> <p>Each of the servitization pathways open specific challenges and require specific resource and capabilities support and each of them contribute to the competitive advantage in a specific way.</p>
	<p>Servitization, firm's and industry's performance</p>	<p>Visnjic Kastalli & Van Looy, 2013</p>	<p>Longitudinal econometric study</p>
<p><i>What is the nature of the relationship between products and services as elements of the company's integrated</i></p>	<p>Cusumano et al., 2015</p>	<p>et al., 2015</p>	<p>Two broad categories of services are identified:</p> <ul style="list-style-type: none"> • Complementary with products (smoothing and adapting); • Replacement or substituting services. <p>The relative importance of specific type of service for business performance differ depending on the stage of the industry life-cycle.</p>

<i>offer, what is the nature of the relationship between servitization and company's and industry's performance?</i>			<ul style="list-style-type: none"> • Servitization impacts the industry dynamics and structure, by affecting: the competition entry and exit from the industry, the vertical integration and disintegration and financial performance of the competitors.
	Benedittini et al., 2015	Empirical study using various statistical techniques	<p>Because of its underlying logic, the servitization business model:</p> <ul style="list-style-type: none"> • Introduces higher level of internal failure risks for a servitizer; • Does not expose the servitizer to more (but also not to less), external failure risks. • Different service types are not associated with different failure risks.
	Suarez et al., 2013	Dynamic panel estimation	<p>There is a convex non-linear relationship between the portion of revenue that comes from services and the operating margin.</p> <p>There is an inflection point, after which the increase in the level of services begins to have a positive effect on the financial performance of the servitizing firm.</p>
	Kohtamaki et al., 2013	Regression analysis	<p>The relationship between level of service offering and sales growth is not linear.</p> <p>Effect of the service offering on sales growth can be enhanced by network capabilities of a firm.</p>

4.2.1.1. Conceptual foundations of servitization

The analyzed papers from this cluster are conceptualizing the servitization phenomena, dealing with aspects such as motives for servitization and changes that it brings, the process of transition to a hybrid offer, the dimensions of the service paradox and resource-capabilities framework for servitization. Moreover, the cluster contains empirical research with a broad focus on the range and extend of servitization.

The term servitization is introduced by Vandermerwe and Rada (1988) to denote a fuller offer of combinations of goods, services, support and knowledge. The servitization is a move toward services as an answer to a more holistic view of consumer demands and business offering with an aim to gain competitive advantage (Oliva & Kallenberg, 2003; Vandermerwe & Rada, 1988). Servitization is seen as a strategic and dominantly market-driven way to create value (Gebauer et al., 2005; Neely, 2008; Vandermerwe & Rada, 1988).

This process of transition to services is an intended process of developing the capabilities needed for a new type of relationships with customers (Oliva & Kallenberg, 2003). Firms that have successfully servitized their offer have done so by investing a deliberate, systematic, well-structured and iterative effort towards transformation, from consolidating existing product-related services to becoming a pure service organization by taking over the user's operations. The range and the extent of the servitization differ, and it results in different types of product-service systems, such as product-oriented, use-oriented, result-oriented, integration-oriented and service-oriented product-service systems (Neely, 2008).

This is a challenging process, which can expose the company to greater risk; it requires new organizational principles, structures and processes, new resources and capabilities, metrics and compensation systems (Gebauer, et al., 2005; Neely, 2008; Oliva & Kallenberg, 2003; Ulaga & Reinartz, 2011). Certain manufacturer-specific resources and capabilities are needed for a

successful hybrid offering, and they have different relative importance for achieving the cost leadership and differentiation competitive advantage (Ulaga & Reinartz, 2011). As services are diverse, the specific type and combination of goods and services may require different critical resources and capabilities.

If applied correctly, servitization is a strategy that utilizes a firm's unique portfolio of resources and capabilities to create a competitive advantage. If done wrong, it can produce the so-called service paradox: investment in service expansion increases the service offering and costs, but this do not lead to expected higher returns. The service paradox has its behavioral and organizational dimension (Gebauer et al., 2005). First, it arises from cognitive phenomena that limit the motivation of managers to expand business by offering services. Successful business expansion, then, requires certain organizational preconditions to be met (adequate service development process, services focused on value offered, adequate relations with consumers, clear service strategy, adequate organizational structure and culture) and to overcome the side effects that occur in that process (credibility gap, service quality erosion and focus on symptoms, rather than causes).

4.2.1.2. Servitization business models

The analyzed papers from this cluster deal with specific changes in business models needed to support the servitization path of a firm. These papers seek answers to questions such as, in what directions do the business models changes take place, what resources, capabilities and practices do they incorporate, and how do these changes affect relationships in the supply chain.

Changing the business model towards the service growth in offerings and use of digital technologies to support the servitization asks for changes in the value proposal, its creation and appropriation (Kowalkowski et al., 2017b; Coreynen et al., 2017). It is necessary to adapt internal processes and operations, ensure an adequate base of resources and capabilities, and change the organizational structure and culture. In addition, the servitization also affects the structure and the relationships in the supply chains (Baines & Lightfoot, 2014). For example, digital servitization can increase the dependence of upstream on downstream companies (Vendrell-Herrero et al., 2017). However, at the same time, it provides an opportunity for the upstream members to regain control over communication with customers, thus establishing balance, i.e., symmetrical interdependence in the supply chain. Unique resources allow upstream companies to reduce their relative dependence on downstream supply chain members. The servitization business models are not a homogeneous field. There are multiple possible servitization paths that result in different levels of services and require different resource and capabilities base to overcome barriers specific to the chosen servitization path each of which contributes to the business competitiveness in a specific way (Coreynen et al., 2017).

4.2.1.3. Servitization, firm's and industry's performance

The nature of the relationship between products and services as elements of the company's integrated offer, and particularly the nature of the relationship between servitization and performance of the servitizers and their industry, are the thematic focus of the analyzed papers from this cluster.

The relationship between the two key elements of a servitized offering (product and service) is complex and supportive. Due to the possibility for the producer to realize the economies of scale, the increased sales of products increase the sales of services (Visnjic Kastalli & Van Looy, 2013). On the other hand, the increase in sales of services is a platform for increasing the volume of product sales, due to the establishment of a higher level of relationships with customers and a better understanding of their requirements.

The interdependence of products and services is also reflected in the fact that the relative importance of different types of services in the integrated offering varies depending on the stage of the product (industry) life-cycle (Cusumano et al., 2015). Starting from the ferment, through transition to the mature phase of the industry life-cycle, the relative investment and the contribution of different types of services (complementary with two variations – smoothing and adapting, and substituting) change. Though it is usually thought that services are an important way to reach competitiveness (only) in mature industries, Cusumano et al. (2015), as well as Suarez et al. (2013) find that this does not have to be the case, and that different service types have to be considered in different phases of an industry life-cycle.

Servitization impacts the industry dynamics and structure by affecting the new entrances and industry exits, vertical (de)integration and financial performance of competitors (Cusumano et al., 2015). However, this relationship between the servitization and profitability is not linear and simple. After a steep profitability increase, there is a profitability hurdle that the servitizer should overcome by investing more in the service scale (Visnjic Kastalli & Van Looy, 2013). Suarez et al. (2013) find a convex non-linear relationship between the share of service revenues and the operating margin. Exclusive focus on products results in highest profitability, while increasing the share of services reduces profitability. But, there is a certain inflection point (services as a relative share of the sales), after which service starts to have a positive effect on financial performance. Similarly, Kohtamäki et al. (2013) identify a non-linear relationship between the service offering and the sales growth, where the positive effects of services exist only at moderate to higher levels of service offering. Nevertheless, this non-linear relationship can be positively moderated by a firm's network capabilities. Including services into the offer increases the complexity of the exchange process and establishes the need to develop cooperation between supply chain partners. Co-creation of value requires the active participation of both the upstream and downstream partners. These interactions enable more efficient value creation and provide new experiences and knowledge for all of the participants. That is why the network capabilities, that is the capabilities to develop, manage and exploit inter-organizational relationships, can boost the positive effects of services on the servitizer's sales. In addition to this external factor, servitization settings also increase internal complexity (Benedittini et al., 2015). As the company's offer becomes more complex by adding services, there is a need to expand the base of resources and competences, and to change organizational elements. All this increases the costs of coordination, as well as the probability that wrong decisions will be made. Therefore, servitization can increase the company's exposure to external and internal risks of failure, which ultimately affects its financial performance.

4.2.2. Bibliometric coupling analysis

Clusters formed by bibliometric coupling analysis represent a group of publications that cite the same references. In other words, the clusters are formed out of citing publications. Therefore, unlike in the co-citations analysis, the bibliometric coupling analysis allows the more recently published documents to become visible. As such, this analysis helps to identify broad topics in a certain field, as well as newer directions of research. In a way, it can give a present picture of a certain field (Donthu et al., 2021).

The bibliometric coupling analysis of the field of strategy of servitization has identified four thematic clusters (Figure 4).

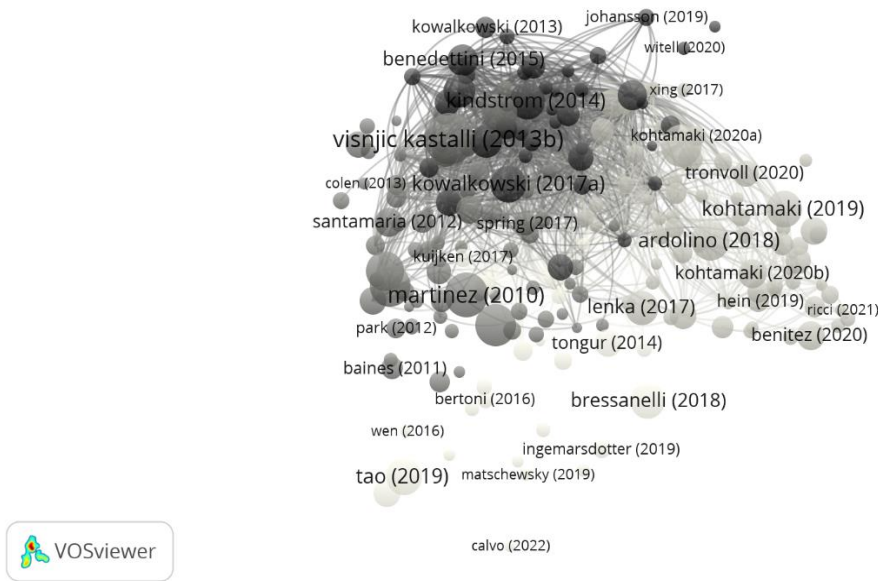


Fig. 4 – Bibliometric coupling analysis network visualization (legend: ● First cluster, ● Second cluster, ● Third cluster, ● Fourth cluster). Source: own research

Challenges of servitization is the theme covered by the largest bibliometric coupling cluster, which consists of 71 papers. A total of 64 papers are clustered within the servitization and digitalization group, which is followed by the servitization business models cluster including 41 papers. The smallest cluster with 24 papers is the one referring to servitization and technology changes. As within the co-citation analysis, the bibliographic analysis is supplemented by a content analysis of the first five ranked papers in each cluster (Table 3).

Tab. 3 – Content analysis of the bibliometric coupling clusters. Source: own research

Thematic cluster	Author(s)	Research method	Main findings
Challenges of servitization	Baines et al., 2009	Single case study	<p>The main challenges during implementation of a servitization strategy are:</p> <ul style="list-style-type: none"> • Inadequate hard and soft organizational elements that do not support the servitization strategy; • Inadequate service design and delivery processes; • Challenges arising from the changing character of the relations with consumers.
<i>What are the key challenges when implementing the servitization strategy and how to respond to them?</i>	Baines & Lightfoot, 2014	Multiple case study	<p>In order to respond to the key challenges of servitization, companies should:</p> <ul style="list-style-type: none"> • Co-locate and distribute their service facilities close to customers operations; • Integrate both forwards and backwards in their supply chains; • Provide personnel who are flexible, relationship-building, service-centric, authentic, technically adept, and resilient. • Design own business processes in a way that they are integrated into their customer's operations, and supported by ICT;

			<ul style="list-style-type: none"> • Changes to the performance measurement system, by introducing new indicators aimed at measuring product performance, specifically for each customer.
			<p>The main challenges during implementation of a servitization strategy (<i>pillars of transformation challenges</i>) are:</p> <ul style="list-style-type: none"> • Inadequate organizational culture; • Inadequate delivery of the integrated offer; • Processes and capabilities that do not support the new value creation and appropriation; • Insufficient internal (within a focal firm) and external (along the supply chain) strategic alignment; • Need for changing the relationships with suppliers.
	Martinez et al., 2010	Single case study	
			<p>In order to respond to the new challenge of mainly servitized markets, a company should:</p> <ul style="list-style-type: none"> • Differentiate from other servitized producers by adding a new layer to the servitization strategy – information. Adding this new layer is necessary when customers perceive services as something that is usual part of a company's offer and when the rest of the competitors are largely servitized. For doing this, a Big Data Strategy framework is offered.
	Opresnik & Taisch, 2015	Conceptual simulation	
			<p>One of the leading challenges of implementing servitization is:</p> <ul style="list-style-type: none"> • Service paradox; that is performance decline as a result of servitization (here <i>profitability hurdle</i>). <p>The company response to this challenge should be:</p> <ul style="list-style-type: none"> • Identification of the inflection points of the relationship between the servitization strategy and performance, and then selection of either a lower or a sufficiently high scale of service activities (high enough to provide the economies of scale).
	Visnjic Kastali & van Looy, 2013	Longitudinal econometric study	
Servitization and digitalization			<p>Three-dimensional framework for digital servitization business models' typology is defined.</p> <p>Depending on solution: customization, pricing and digitalization; the following digital servitization business models are identified: Product provider, Industrializer, Integrated solutions provider, Outcome provider, Platform provider.</p> <p>Each of the five digitalization business models is analyzed within four theoretical frameworks: Resource-based view, Power approach, Organizational identity, Transaction cost approach.</p>
What are the business models of digital servitization? What digital capabilities are used in them to create and appropriate value? What are the challenges posed by digital servitization and how does it affect the financial	Kohtamäki et al., 2019b	Conceptual paper	
			<p>The interaction between digitalization and servitization does not necessarily result in positive effects on financial performance:</p> <ul style="list-style-type: none"> • At lower and medium levels of digitization, this interaction produces negative effects on financial performance. The effects become positive from medium to higher levels of digitalization.
	Kohtamäki et al., 2020	Regression analysis	
			<p>Digitalization capabilities which support the perceptive and responsive value co-creation mechanisms are related to:</p> <ul style="list-style-type: none"> • Intelligence capability; • Connect capability; • Analytic capability.
	Lenka et al., 2017	Multiple case study	

<i>performance of companies?</i>	Vendrell-Herrero et al., 2017	Single case study	Digital servitization affects the competitive dynamics by increasing the power of downstream participants. However, upstream firms can turn this asymmetry of interdependence to their advantage if they have unique resources which are important to the customer.
	Ardolino et al., 2018	Multiple case study	<p>The study identifies:</p> <ul style="list-style-type: none"> • Capabilities essential for service transformation (identification (of user, of product), geo-localization, time stamping, intensity assessment, condition monitoring, usage monitoring, prediction, adaptive control, optimization and prescriptions, autonomy); and • How are these capabilities related to specific digital technologies (Predictive Analytics, Cloud Computing and Internet-of-Things).
<p>Servitization business models</p> <p><i>What innovations (changes) are needed in the servitization business model? What is the path of this innovation? And what novelties the new business model brings?</i></p>	Benedittini et al., 2015	Empirical study using various statistical techniques	<p>Because of its underlying logic, the servitization business model:</p> <ul style="list-style-type: none"> • Introduces higher level of internal failure risks for a servitizer; • Does not expose the servitizer to more (but also not to less), external failure risks. • Different service types are not associated with different failure risks.
	Kindström & Kowalkowski, 2014	Multiple case study	<p>Elements of the business model for servitization:</p> <ul style="list-style-type: none"> • The main elements of the business model supporting servitization are: strategy, structure, offering, revenue model, development process, sales process, delivery process, customer relationships, value network, culture. • Strategy and structure are the <i>overarching elements</i>, while the rest of the eight are the <i>vertical elements</i> of the business model for servitization. • Require adequate resources and capabilities.
	Kowalkowski et al., 2015	Multiple case study	<p>The path of a transformation of a servitizer's business model is:</p> <ul style="list-style-type: none"> • Expansion, rather than a simple and unidirectional transition along product-service continuum from product, over less to more advanced services.
	Kowalkowski et al., 2017b	Conceptual paper	<p>Although the research field of servitization is maturing, there is a pronounced terminological inconsistency. Therefore, the paper defines core servitization concepts, such as: servitization, service infusion, deservitization and service dilution.</p> <p>Implementation of the strategy of servitization requires change and reconfiguration of the business model (resource base, organizational capabilities and structure, mission, routines, shared norms and values).</p>
	Rabetino et al., 2017	Multiple case study	<p>Business model's strategic logic is crucial for the success of a strategy, not the strategy itself.</p> <p>Business models for servitization should be built holistically across different perspectives (financial, customers, internal processes and learning).</p> <p>Each of the perspectives of the holistic business model (strategic logic) should contain different initiatives and</p>

			practices between which cause-and-effect relationships should be identified.
			Operational efficiency, customer management, and portfolio development are the DNA of the servitization strategy which should be supported by servitizer's business model.
Servitization and technological changes	Cao et al., 2016	Mathematical modeling and experimental simulation	Multi-objective optimization of services selection and scheduling in service-oriented systems of cloud production. Key optimization criteria are: time, quality, costs and service.
	Bressanelli et al., 2018	Single case study	The functionalities of digital technologies influence the circular economy value drivers in the servitization business models. In order for this effect to be manifested, these functionalities should be applied in an adequate product life-cycle stage.
<i>What kind of servitization business models are needed in an environment of intensive and disruptive technological and environmental changes?</i>	Rabetino et al., 2015	Multiple case study	Introduces time as an important analytical dimension in the classification of industrial services. A life-cycle service offering typology is obtained, which contain main categories and subcategories in a time perspective (pre-sales, sales, after-sales and de-commissioning), whereby these categories are further classified into broader groups of relational-based and transactional-based services.
	Tao & Qi, 2019	Conceptual paper	New IT driven service-oriented smart manufacturing (SoSM) framework is proposed with an aim to facilitate the visions of smart manufacturing by making full use of IT and services.
	Tongur & Engwal, 2014	Multiple case study	The response to the environmental dynamics should be based on business models changes that include both technological innovation and servitization of the offer.

4.2.2.1. Challenges of servitization

The analyzed papers from this cluster are thematically focused on the challenges faced by companies that have servitized their offer. They also identify certain ways for companies to respond to the challenges they face while implementing the servitization strategy.

Servitization strategy implementation is a complex process, which poses numerous challenges to the servitizer (Martinez et al., 2010). There are different strategic, operational and social tests that a firm faces when it wants to implement the servitization strategy. Challenges within the supply chain relations (primarily with consumers and suppliers), those referring to the process of designing and delivering services, as well as those related to the organizational structure and culture, are recognized as key problems faced by companies that have implemented a servitization strategy (Baines et al., 2009). All of the internal and external challenges can be condensed into the five pillars of transformational challenges: product-service culture, integrated offering delivery, internal processes and capabilities, strategic alignment, and supplier relationships (Martinez et al., 2010). The higher the level of servitization, the stronger these pillars must be to support it.

Changing principles, structures and processes, both internally (within the servitizing company) and externally (in the supply chain), and securing new resources and capabilities, are seen as key ways of responding to these challenges (Baines & Lightfoot, 2014). Servitization has become a way for manufacturers to support their competitive position. However, as more and more producers servitize their offer, services will become a necessary but insufficient source of competitive advantage. Therefore, in addition, there is a need to complement the servitization

strategy with a new, informational layer to the existing ones (product and service). This is seen as a way to resolve the challenges of the reduced potential for differentiation based only on the two traditional layers of this strategy (Opresnik & Taisch, 2015).

One of the important servitization challenges is the fact that the servitization strategy does not necessarily lead to the expected (financial) results (the well-known services paradox). Though positive, the relationship between scale of service and profitability is not linear (Visnjic Kastalli & van Looy, 2013). This is why it is important to know that there are some inflection points, after which changes in this relationship can be expected. The relationship between the scale of the service activity and the profit margin is curvilinear and has two characteristics: while very low levels of service activity show a steep increase in margin, middle levels of service volume show a relative decline in the margin, which then rises as soon as sufficient economies of scale are achieved.

4.2.2.2. *Servitization and digitalization*

The thematic focus of the analyzed articles from this cluster is on the characteristics of digital servitization business models, digital capabilities that enable the creation and appropriation of value in these business models, as well as the challenges posed by digital servitization and its impact on the financial performance of companies.

Business models are dynamic categories; they are continuously defined and redefined. Digitalization is one of the impulses for this business processes' dynamics. Digitalization opens up new business opportunities, but it also represents a powerful tool for improving business efficiency (Ardolino et al., 2018; Kohtamäki et al., 2019b; Vendrell-Herrero et al., 2017). In the servitization context, the digital component leads to the digital servitization, which is a transition to smart systems that combine products, services and software (Kohtamäki et al., 2019b; Vendrell-Herrero et al., 2017). This transition implies a business model's change and the emergence of digital servitization business models as a result. Depending on solution customization, pricing customization and solution digitalization, digital servitization business can be classified as follows: product provider, industrializer, integrated solutions provider, outcome provider, and platform provider (Kohtamäki et al., 2019b). Each requires a certain base of resources and abilities, affects the organizational identity, builds a certain source of power and affects the transaction costs.

Main digitalization capabilities that support the value creation process refer to intelligence capability, connect capability, and analytic capability (Lenka et al., 2017). Although they categorize them differently, Ardolino et al. (2018) identify a similar set of digital capabilities, which can be used for value creation in the digital servitization business models, and which can be related to specific digital technologies referring to predictive analytics, cloud computing and the Internet-of-things.

However, in addition to positive effects, digital servitization poses certain challenges (Vendrell-Herrero et al., 2017). Digital servitization affects the competitive dynamics by increasing the power of the downstream participant. In addition to the supply chain transformation (Kohtamäki et al., 2019b; Kohtamäki et al., 2020), it changes the way the customers evaluate the new, smart offer (Vendrell-Herrero et al., 2017). All of the above leads to the fact that the relationship between digitalization, digital servitization and financial performance of a firm is not simple or linear (Kohtamäki et al., 2020). At lower and medium levels of digitization, this interaction produces negative effects on financial performance. The effects become positive from medium to higher levels of digitalization.

4.2.2.3. *Servitization business models*

The analyzed papers from this cluster are discussing innovations (changes) in the business models to support servitization, the path of the business model transition, and both the positive and the negative novelties that the new business models bring.

The transition to services requires strategic adjustments. It requires a change in strategic vision, financial goals, value proposition, processes and resources (Rabetino et al., 2017). In other words, the implementation of the servitization strategy requires a change and adaptation of the servitizer's business model. In order for the servitization strategy to be successful, it is necessary to make adjustments to all of the business model elements, such as strategy, structure, offering, revenue model, development process, sales process, delivery process, customer relationships, value network, and culture (Benedettini et al., 2015; Kowalkowski et al., 2017b; Kindström & Kowalkowski, 2014). For each of these elements, adequate, often new and different resources and capabilities, specific to the services, should be provided. Also, the successful implementation of the servitization strategy requires that the elements of the business model related to the value creation and appropriation are holistically evaluated and defined. Using the balanced scorecard framework, Rabetino et al. (2017) suggest that in each of the value creation and appropriation dimensions, key initiatives, practices and processes should be defined and then linked to each other in a cause-and-effect manner. Such a strategy map identifies the strategic logic of servitization, which is key to success, rather than the strategy itself.

This process of business model transition is a process of repositioning the company on the product-service continuum. Although, this transitional path is most often framed as Oliva and Kallenberg (2003) suggest, as a unidirectional movement from simple through product-oriented and process-oriented services to the offer of complete solutions. However, practice shows that this transition has several aspects, and that it is not always a unidirectional path to higher level of service (Kowalkowski et al., 2015). Servitizers are expanding rather than moving to a completely new role in the process of transitioning business models.

The change of business models is most often seen in the light of the positive effects it should achieve, while the possibility that new elements of the business model increase the internal and external risks faced by the servitizer is neglected (Benedettini et al., 2015). Novelties and changes that need to be made in business models in order to implement the servitization strategy can increase both the external and the internal risks. Servitization exposes a firm to new competitors, may require new supply chain partners, and increases contact with consumers, all of which raises the level of uncertainty. Moreover, when there is an insufficient level of similarity between the elements of the integrated offer of products and services to achieve the effects of economies of scale, a new resource base is needed. A new resource base requires investment and thus increases financial risks and diverts resources from the production business. A wider resource base is more difficult to control. Furthermore, organizational elements need to be adapted (organizational structure, culture, human resources, and performance measurement systems). All this increases the probability that managers will make the wrong decision, which is the main generator of the internal risks.

4.2.2. *Servitization and technological changes*

This is the smallest thematic cluster identified by the bibliometric coupling analysis, and at the same time the cluster that is the most distant from the other clusters (Figure 4). This spatial distance implies the smallest thematic closeness of the articles from this cluster to the papers belonging to the other three clusters. The majority of articles from this cluster are dealing with

changes in production-service business models in an environment of intensive and disruptive technological and environmental changes.

New technological trends make production susceptible to significant changes in terms of business orientation and organization of activities (Bressanelli et al., 2018; Tao & Qi, 2019). To contribute to the organizational part of the new, smart production, Cao et al. (2016) are developing a multi-objective optimization algorithm for services selection and scheduling in service-oriented systems of cloud production, with time, quality, costs and service as key optimization criteria.

The disruptive technologies of Industry 4.0 have fundamentally changed the way companies deliver existing services, enabling the introduction of servitized business models in companies and facilitating the transition to a circular economy (Bressanelli et al., 2018). The functionalities of digital technologies (improving product design, attracting target customers, monitoring and tracking product activity, providing technical support, providing preventive and predictive maintenance, optimizing the product usage, upgrading the product, enhancing renovation and end-of-life activities) influence the circular economy value drivers (increasing resource efficiency, extending lifespan, closing the loop) in the servitization business models. But, in order for this effect to be manifested, these functionalities should be applied in an adequate product life-cycle stage.

Smart production, as the interaction of physical and cyber domains of production, is a future production paradigm that should be developed in a complementary interaction of modern IT tools and service offerings (Tao & Qi, 2019). In other words, the response to the environmental dynamics should trigger business models changes that include both the technological innovation and servitization of the offer (Tongur & Engwal, 2014). If only one direction of change is chosen, there is a risk of losing the value proposition that consumers will be looking for in the future, or losing the technological leadership and being reduced to just another servitized manufacturer whose service offer is similar to the service offer of others.

4.2.3. Co-occurrence analysis

Keywords summarize the article in a concise way, so the co-occurrence analysis with keywords as a unit of analysis allows key research topics and new trends to be identified (Zhou & Song, 2021). Co-occurrence analysis of author keyword has identified three clusters of keywords that often appear together (Figure 5).

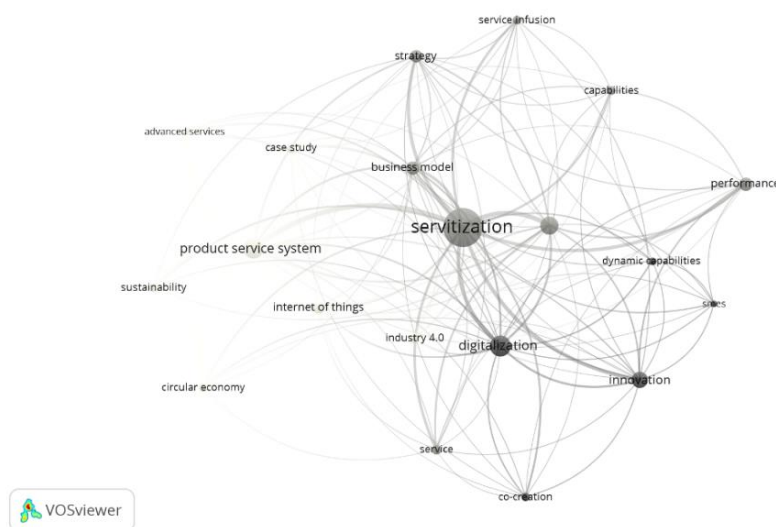


Fig. 5 – Author keywords co-occurrence analysis network visualization (legend: ● First cluster, ● Second cluster, ● Third cluster). Source: own research

In identifying the thematic focus of these clusters, general terms in the field were omitted, such as servitization, services, case study, product service system, and service infusion. Judging by the keywords that are most often used, servitization is investigated as a strategic orientation of the company (strategy cluster), which is inseparable from the modern technological and environmental trends (technology and environment cluster) and which innovates the company's offer, processes and resources (innovation cluster) – Table 4.

Tab. 4 – Author keywords co-occurrence analysis clusters. Source: own research

	Clusters		
	<i>Strategy</i>	<i>Technology and environment</i>	<i>Innovation</i>
Author keywords	manufacturing performance business model strategy capabilities	Internet-of-Things industry 4.0 circular economy sustainability advanced services	digitalization innovation co-creation dynamic capabilities SMEs
	<i>General terms in the field</i>		
	servitization services service infusion	product service system case study	

The strategy cluster is the largest cluster containing 5 of the top 10 keywords (by number of citations). Although servitization does not have to be seen exclusively as a strategic practice of manufacturing companies (Vandermerwe & Rada, 1988; Zhou & Song, 2021), this analysis shows that it is very often seen as such. Servitization as a strategic choice or strategy of manufacturing companies is investigated from the aspect of its impact on performance, characteristics of the business models that should support it, as well as the necessary capabilities for its adequate implementation.

Today, the servitization's implementation is supported by Industry 4.0 technologies (for example, the Internet-of-things), which not only enable the provision of new, more advanced services, but also make the servitization process more efficient. Also, the potential of servitization to contribute to achieving the requirements of the circular economy and sustainability has been recognized and is being explored.

Finally, servitization represents an innovative value proposition, but it also requires innovation in the process of value creation and appropriation. These innovative aspects are explored in the context of co-creating value, ensuring dynamic capabilities for sustainable competitive advantage based on innovation, innovating the offer by including digital elements (digitalization). Moreover, these issues seem to be often explored in the context of their impact on practices and performance, as well as the demands they place on small and medium-sized enterprises (SMEs).

5. CONCLUSIONS

By adding services to the company's offer, servitization is adding value (Vandermerve & Rada, 1988). As such, it has an undoubted strategic implication for all parties involved. It represents a way for manufacturers to support their competitive position through a comprehensive strategic change in their business models. Faced with significant changes in the environment, traditional manufacturers are increasingly adopting business models that involve the integration of products and services. The growing interest in servitization in practice is accompanied by an

increase in research interest in it. Given the strategic importance of servitization, on the one hand, and the growth of research activities in the field of servitization strategy, on the other hand, this study is set to identify the basic indicators of research activity in the field and to shed light on its intellectual structure. The main contribution of the study is that, through bibliometric analysis of a large volume of data, it descriptively looks at the intensity and the productivity of the research in the field, and it systematizes the key research contributions. In this way, the study provides an insight into the structure of performance and knowledge in the field of servitization strategy. This is certainly not the first bibliometric study on servitization, Nevertheless, it is one of the first that investigates the specific domain of servitization as a strategic business orientation. In this way, the study enriches the body of knowledge by supplementing the existing bibliometric results on servitization in general, with specific results on the state and the evolution of the knowledge on servitization as a business strategy.

The results of this research indicate that research on servitization from a strategic perspective is gaining importance. There is a constant annual increase in the number of published papers divided between a large number of authors and journals, but consolidated in a smaller number of countries, with a pronounced dominance of developed European countries but with growing importance for researchers from China. Although multidisciplinary in nature, published in a large number of WoS categories, servitization strategy research is dominantly related to business and management.

As for the body of knowledge, as expected, it began to be formed with conceptualizations of the servitization phenomenon. In addition, knowledge about servitization as a strategy is built on pillars related to the innovations of business models that servitization requires, challenges that companies face when implementing servitization and ways they respond to them, and the impact of servitization on company performance and relationships in the business ecosystem beyond the servitizer's boundaries. Finally, recent research interests are focused on the relationship between servitization and digitalization of business.

The study's limits arise from the adopted methodological approach. First of all, only one of the possible databases (WoS) is selected, so all the data that are not included in this database are left out of the analysis. Furthermore, only the five most cited papers from each cluster are selected for content analysis. Analysis of mainstream research results leaves a significant part of other results out of focus (Annarelli et al., 2021; Rabetino et al., 2018). Nevertheless, despite this obvious shortcoming, narrative analysis of the content of the most influential (most cited) articles is a common approach when supplementing the bibliometric analysis (e.g. in: Díaz-Garrido et al., 2018; Feng et al., 2021; Rabetino et al., 2018).

In addition to enriching the theoretical knowledge on the intellectual state and the evolution of the research field of servitization by focusing on its strategic aspect, the study's results also indicate the shortcomings and gaps in the existing servitization strategy research practice. The identified shortcomings and gaps are the basis for tracing the future direction of research in this field. As within the general servitization field (Rabetino et al., 2018), research on servitization strategy is mainly exploratory qualitative research conducted in Western economies. The results of the present study indicate that research in this field deals with exploration, not explanation of the researched topics. Moreover, the results seem to reinforce Chase's (1991) prediction that the relationship between servitization and performance should become the focus of the research. A methodologically rigorous and theoretically framed study on the relationship between servitization and company performance is a promising research direction. The existing qualitative research has provided a relatively well-built knowledge base that enables the identification and operationalization of the important variables. Therefore, further research should be focused on quantitative research on larger samples. It should aim not only to

determine the nature of the relationship between servitization and performance, but also to shed light on its background, by including moderating and mediating variables. Considering that the research results cannot be automatically transferred from context to context, research in environments other than Western developed economies and China is needed.

Although theoretical, this paper offers certain valuable insights for practitioners as well. For example, the fact that research in the field is intensifying can be seen as a reflection of the practice, that is, of the fact that the servitization strategy is gaining importance as a way for a company to achieve a strategic fit with its environment. Therefore, the paper awakens practitioners' awareness of the potential of this strategic option, which can be even further strengthened by servitization-digitalization interaction. At the same time, the results of this study indicate that, despite the evident competitive potential, the desired results of applying this strategy are not guaranteed. Therefore, managers must be careful when making a decision to servitize their business. The results warn practitioners that the relationship between servitization strategy and performance is neither simple nor linear, that there are limitations and challenges for strategy's successful implementation, and that in order to achieve benefits from the servitization strategy, managers must count on the need to change and adapt the company's business model, to resolve inter-organizational conflicts that will inevitably occur, and to be aware of the greater exposure to risk and the need to mitigate it.

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