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The origin and evolution of the concept of servitization: A co-word and network analysis

Abstract

Purpose – The aim of this paper is to analyze the origins and evolution of the concept of servitization by studying the definitions of servitization provided in the literature. Servitization represents an academic field that has grown rapidly since its inception. However, the conceptualization of servitization varies greatly, in part because of the number of studies on this topic and the fact that it has been analyzed in a range of disciplines using a number of theoretical approaches. There is a need to standardize the vocabulary to create a general definition that can support the development of theory in this domain and help legitimize servitization as a research area.

Design/methodology/approach – We conduct systematic, quantitative analysis of a broad set of definitions of servitization. Specifically, we perform content analysis (combining co-word analysis and social network analysis) and consensus analysis. We develop a strategic diagram to represent the morphology of the research network.

Findings – The definitions of servitization are deconstructed and analyzed in depth to create a comprehensive picture of the research on this topic. This analysis reveals the origins and evolution of this research area. The results show a low degree of consensus among scholars regarding the concept of servitization. We propose a definition that should be widely accepted thanks to its inclusion of the core terms from other definitions. Explicit recognition of multiple approaches to defining the term can help practitioners and researchers. Predictions about future progress in this area are discussed.

Originality – A universal definition of servitization is proposed based on the results of co-word and network analysis. This definition unifies a range of multidisciplinary viewpoints. From a practical perspective, the key vocabulary in servitization research is highlighted.

Keywords: Servitization, Definitions, Co-word analysis, Consensus analysis, Bibliometric analysis, Strategic diagram

1. Introduction

The servitization literature consists of over three decades of multidisciplinary research on service activities in industrial contexts (Rabetino et al., 2021). Servitization research has grown rapidly since its emergence as an academic field, evolving into the diverse area it has become today. The servitization literature draws upon different research streams. The scope and abundance of the literature and the variety of perspectives and vocabulary employed to study servitization mean that numerous definitions of the term *servitization* have been proposed. Kowalkowski *et al.* (2017) reported extensive research, conference activity, and industry engagement concerning servitization but still no broad consensus on the core concepts. Scholars from different scientific communities (strategic management, marketing, operations, service management, etc.) have adopted different perspectives to define the concept of servitization.

Recent years have witnessed the publication of literature reviews on the topic of servitization (Baines *et al.*, 2009a; Lightfoot *et al.*, 2013; Brax and Visintin, 2017; Luoto *et al.*, 2017; Rabetino et al., 2018; Raddats et al., 2019; Kamal et al., 2020; Khanra et al., 2021). These reviews have enabled scholars to describe the state of the art of servitization, highlighting a broad range of topics covered

by the servitization literature. Others have considered the intellectual structure of servitization research (Martín-Peña *et al.,* 2017; Díaz-Garrido *et al.*, 2018) using bibliometric techniques. Meta-analysis has even been employed to analyze the servitization literature using dynamic topic modeling (Rabetino et al., 2021). Despite attempts to create a structured, systematic body of knowledge on servitization, there is no generally accepted definition that can be used as a basis for advances in theoretical or empirical research. The literature contains a plethora of terms used to describe servitization (Green *et al.,* 2017). Despite attempts to consolidate this body of research, there is still a gap in the literature due to the need for a common definition. Díaz-Garrido et al. (2018) highlighted the need for greater insight into the activities of current research communities and a deeper analysis of interactions between communities. For this purpose, a common definition of servitization that is generally accepted by different research communities is needed.

Servitization emerged as an academic discipline in 1988 following the publication of the seminal article by Vandermerwe and Rada (1988). Since then, numerous studies offering different definitions and approaches have been published in different business domains. From a descriptive approach, Kamal et al. (2020) classified servitization definitions to understand how researchers have used the concept of servitization in their research. Given the large number of definitions, the following questions should be answered: How have different scientific disciplines and communities defined servitization? How have these definitions evolved? What theoretical approach is behind these definitions? How does the consideration of a B2B or B2C environment influence these definitions? Consequently, is it possible to provide a general definition that captures the key features of servitization?

The approach when developing a common definition of servitization is not only to add new conceptual elements from the various disciplines in which this concept is studied but also to ask what key concepts should be addressed within the servitization research domain. For instance, Rabetino et al. (2021) noted that, in a scientific field, vocabularies reveal differences between research themes within a domain. Linguistic artifacts act as tools by assigning names to phenomena and managing meanings within a research field (Czarniawska-Joerges & Joerges, 1988). Through repetition of a concept, it can become a key part of a research domain.

Because vocabularies within a research domain develop over time and differ between research themes, they can be used to identify conventions within the domain and to discover evolutionary patterns within a given literature where articles are published over a long period (Blei & Lafferty, 2009). This approach is applicable to the domain of servitization, where vocabulary from different research communities and different research topics has been used over the last 30 years. According to Rabetino et al. (2021), there are conceptual complexities in servitization research due to the presence of different research communities within the domain of servitization. Attempting to reduce these complexities would be a step forward in servitization research that would aid its progress.

This study advances this research domain and fills the gap through systematic, structured analysis of the vocabulary used in this area and through the proposal of a universally accepted definition of servitization. Given that a clear definition is first needed to understand the essence of any concept, the aim of this study is to analyze the origins and evolution of the concept of servitization using the definitions provided in the literature. The deconstruction of the definitions given by researchers from different knowledge areas provides the vocabulary that defines the domain and helps legitimize it. Explicit recognition of multiple approaches to the term can help practitioners and researchers advance in this important field.

To achieve our aim, we conducted quantitative analysis of a broad set of definitions of servitization. Consensus and co-word analyses were used to identify vocabularies and the key conceptual elements of the concept of servitization (origin) and to analyze the transformation of the structure of this concept (evolution).

This study makes two clear contributions. The first is to propose a universal definition of servitization. This definition provides not only greater insight into the phenomenon of servitization but also a basis for further research in this field. This definition was developed based on detailed, systematic, quantitative analysis using bibliometrics. The techniques used have statistical foundations and are therefore freer from the subjective biases that can influence literature reviews (Khanra et al., 2021). Studying the origins and evolution of the servitization research domain using definitions from various scientific communities and disciplines can also establish connections with the underlying theories used to address servitization. The second major contribution of this study is to identify a strategic diagram associated with the concept of servitization. This diagram reflects the morphology of the servitization research network and can support the study of relationships between the concept of servitization and different approaches to the intellectual structure of servitization. The strategic diagram is also useful for predicting future progress in this area. In short, it enhances our knowledge of the vocabulary, conceptual elements, and research streams in the servitization research network, thus helping legitimize this research domain.

This paper is organized as follows. The next section provides the background of the topic of servitization. Following this, the method is described. Section 4 discusses and analyzes the results. The findings and their relevance to the servitization literature are shown in Section 5. Finally, the conclusions, contributions, and limitations are presented.

2. Background

The term *servitization* has been used for more than 30 years in the business world to refer to the introduction of services in manufacturing. Firms increasingly offer customer-focused bundles of goods, services, support, self-service, and knowledge (Vandermerwe and Rada, 1988). Servitization is a means of creating sustainable, value-adding capabilities that distinguish firms from their competitors (Baines *et al*., 2009c).

Interest in servitization has grown over the years. Scholars have conducted literature reviews to identify publications addressing the state of the art in servitization. Baines *et al*. (2009a) and Lightfoot *et al*. (2013) identified the themes that are of most interest to different research communities involved in servitization. Brax and Visintin (2017) identified original patterns of servitization-related organizational transition. Raddats *et al.* (2019) identified the key themes and research priorities in this body of literature based on four major research streams. Certain authors such as Luoto *et al*. (2017) and Rabetino *et al*. (2018) have incorporated other novel approaches in their literature reviews. Bibliometric techniques have also been used to capture as much of the available information as possible in the literature review, providing quantitative and objective reviews of servitization as a research topic (Martín-Peña *et al.*, 2017; Díaz-Garrido *et al.*, 2018; Kamal et al., 2020; Khanra et al., 2021). Gonzalo-Hevia and Martín-Peña (2020) developed an ontology on servitization. Rabetino et al. (2021) applied meta-analysis to analyze the body of knowledge on servitization using dynamic topic modeling. Thus, there have been attempts to build a structured, systematic overview of the field of servitization. This situation is also a result of the relative novelty of this field.

One specific issue of note is that the servitization literature reveals interest in this topic from several scientific communities (Lightfoot *et al*., 2013; Rabetino *et al*., 2018; Raddats et al., 2019).

These communities consist of groups of scholars who are linked by a shared interest in distinct yet related problems in the same research area (Vogel, 2012). Each community addresses the topic of research from a certain viewpoint, which is reflected by the definitions they adopt. It is also reflected by the intellectual structure of servitization, identified using bibliometric analysis (Díaz-Garrido *et al*., 2018, Martín-Peña *et al*., 2017).

Lightfoot *et al*. (2013) reported that servitization research has taken place in five main research communities: services marketing, services management, operations management, product-service systems (PSS), and service science. Rabetino *et al*. (2018) identified three servitization-related communities: PSS, solution business, and service science. Other scholars have identified the majority of these research streams, with some exceptions regarding service science (Baines *et al*., 2009a).

These studies show a lack of consensus regarding the concept of servitization in previous research. A "jungle of terms" (Koontz, 1961) has been identified, as reflected by the range of definitions attributed to the word *servitization* by different research communities. This diversity has given rise to the need for studies to analyze and compare these different definitions. In a scientific community, the level of consensus regarding the definition of a concept reflects the degree of progress in a given discipline.

3. Materials and methods

To achieve the proposed objective, we analyzed the definition of servitization, adopting a similar approach to that of Nag *et al*. (2007) for strategic management, Ronda-Pupo and Guerras-Martín (2012) for the concept of strategy, and Hernández-Linares *et al*. (2018) for family business. Accordingly, we deconstructed selected definitions to identify the nouns, verbs, and adjectives used in those definitions. We identified the key conceptual elements of servitization by employing co-word analysis. More specifically, we performed content analysis in which we combined co-word analysis and social network analysis techniques. The co-word analysis enabled identification of the research themes and specializations in the field of servitization. The method consisted of six stages: 1) identifying the unit of analysis; 2) deconstructing the definitions; 3) creating families of words or conceptual elements; 4) performing consensus analysis; 5) conducting co-word and centrality analyses; and 6) developing a strategic diagram based on co-word analysis (Figure 1).

Figure 1.

Stage 1: Identifying the unit of analysis

We used the concept of servitization as the unit of analysis. It was crucial to consider: 1) the study period and 2) the criteria to determine whether to include a definition in the study.

Stage 1.1. Choosing the study period

We started by identifying publications included in the Web of Science (WoS) and Scopus databases during the period from the publication of the study by Vandermerwe and Rada (1988), in which the authors coined the term *servitization*, to December 2020. We searched for publications with the term "servitization" in the keywords, title, or abstract. Additionally, we considered different ways of writing the same term, namely "servicification," "servicisation," "servicization," "serviti*."

This process resulted in 1,748 publications. Of these studies, 99% were published between 2007 and 2020. Because one of the aims of the study was to analyze the evolution of the concept of servitization, we chose this period and segmented it into two seven-year periods: 2007 to 2013 and

2014 to 2020. This 14-year period was considered suitable because it represented a substantial period that has witnessed the stages of growth and maturity of servitization research.

Stage 1.2. Defining the criteria for definition selection

The number of citations per year was used to assess the relevance of the identified publications, following the approach of Ronda-Pupo and Guerras-Martín (2012). This index was calculated as the number of citations each publication received divided by the number of years between the year of publication and the year 2020. Google Scholar was used as the data source for citations because it comprehensively records all citations received by a document, including those in WoS and Scopus. We thus identified 94 definitions of servitization: 30 for the first period of 2007 to 2013 and 64 for the second period of 2014 to 2020 (see Table I).

Table I

Stage 2: Deconstructing the definitions

The aim of deconstructing each definition was to extract the key terms used by the authors, assuming that these terms capture the ideas that are central to the concept of servitization. We analyzed the nouns, verbs, and adjectives in each definition as the basic elements of the content analysis.

Stage 3: Creating word families

We identified a large number of terms in the 94 definitions. We grouped the resulting terms into word families, or families of conceptual elements, to enable the analysis.(1)

Stage 4: Performing consensus analysis

Consensus analysis showed whether variability in the definitions of servitization occurred because different authors had different conceptions of servitization, in the sense that the different definitions were based on different theoretical approaches, or whether variability was non-significant and the differences could not be attributed to the use of different theoretical approaches. This stage consisted of two steps.

Step 1: Creating an m x n *rectangular matrix for each subperiod of analysis*

The *m* rows corresponded to the *m* definitions for which we sought to determine whether there was consensus. Among these definitions, a row referring to the definition given by Vandermerwe and Rada (1988) was included to determine the degree of consensus of the different definitions with the initial definition of the concept. The *n* columns represented the *n* conceptual elements (nouns, verbs, and adjectives) that were identified.

Step 2: Testing

For each subperiod, the matrix generated in the previous step underwent principal factor analysis. This process resulted in a set of eigenvectors and associated eigenvalues. Consensus analysis yields two outputs. The first is a measure of overall fit, which indicates the existence or absence of a shared conceptual approach. The second output consists of the scores corresponding to each definition in terms of its degree of consensus with the overall model.

Stage 5: Conducting co-word and centrality analyses

The goal of co-word analysis is to determine the frequency with which words appear in texts (Carley, 1993). It enables the identification of themes and the relationships between them (Ravikumar *et al.,* 2015). The analysis consists of building a network of associated words to measure the intensity of the association between two words (co-occurrence). Based on analysis derived from social networks and the concept of centrality from network theory, it is possible to observe the evolution of the content of a set of definitions (Choudhury and Uddin, 2016). We used co-word analysis to analyze the structure

of the definition of the concept. To do so, we analyzed nouns, verbs, and adjectives separately and created word families for each lexical classification.

Once we had built the co-occurrence/co-absence matrix, we obtained the degree centrality of the terms (closeness centrality). In our study, closeness centrality provided a measure of the importance of key terms in the definition of servitization. The more often a key term was linked to others, the more central it was.

We stratified the centrality vector into three segments to interpret the results (Díaz-Garrido, *et al*., 2018; Hernández-Linares *et al*., 2018; Ronda-Pupo and Guerras-Martín, 2012). The first segment comprised the key terms that belonged to the periphery of the network. The second comprised the key terms that belonged to the semi-periphery. The third comprised the key terms that belonged to the core of the network with vector centrality (closeness). Once each key term had been located in the corresponding segment according to its vector centrality, its evolution was traced in relation to changes in its position throughout the subperiods of analysis (Borgatti, 2002; Borgatti *et al*., 2002).

Stage 6: Developing a strategic diagram

Co-word analysis is based on computing the joint appearances of words in a text. The more words that appear together frequently in different texts, the stronger the research themes and linkages between these themes are. We used the index of association (Callon *et al*., 1995). This index enables the identification of relationships between aggregates and the delineation of a network of associated words composed of interlinked aggregates.

An aggregate is defined not only by the words or descriptors it comprises but also by its density and centrality (Cahlík and Jiřina, 2006). Density and centrality can be used to classify themes into the four groups shown in the strategic diagram.

The strategic diagram is a two-dimensional figure in which the horizontal and vertical axes denote centrality and density, respectively. Using these two parameters, a research field can be understood to be a set of research themes. It can then be mapped in two-dimensional space and classified into four groups (Callon *et al*. 1995). Strategic diagrams based on co-word analysis have the advantage of being able to predict the development of a scientific field (Cahlík and Jiřina, 2006). With the help of the strategic diagram, we used co-word analysis to identify trends in the evolution of the concept of servitization.

4. Findings

4.1. Descriptive analysis of nouns, verbs, and adjectives

Table II shows the frequency distribution for the nouns, verbs, and adjectives found in the deconstructed definitions. Six nouns ("product," "service," "manufacturers," "customer," "firm," and "value"), one adjective ("integrated"), and one verb ("to offer") appeared in both periods in more than 11 definitions, thereby emerging as keywords in the definition of *servitization*.

Table II

Analysis of the evolution of the definition from one period to the next revealed a notable increase in the use of nouns, verbs, and adjectives (Tables III, IV, and V). We identified 28 nouns in the first period and 75 in the second, 15 verbs in the first period and 20 in the second, and 4 adjectives in the first period and 51 in the second. This reflects the increase in the complexity of definitions from one period to the next. The fact that many nouns (51%), verbs (50%), and adjectives (57%) appeared just once suggests a certain degree of confusion in the servitization terminology and the need for semantic clarity. The definitions of servitization were taken from different disciplines such as

operations, marketing, and IT. Consensus is necessary, although the specific nature of each discipline should be considered.

Table III

Of the 84 nouns, 18 were grouped into word families as concepts that may be considered to have the same meaning. In the first period, the nouns that appeared most frequently were "product" and "service" (57.14% of definitions each), "shift" (42.86%), and "process," "set of services," and "manufacturers" (28.57% each). In the second period, the terms "service" and "product" were still important because servitization cannot be understood without considering products or services; these two terms are the essence of the concept. In the second period, several new terms emerged: "manufacturers," "customer," "firms," "value," "aim," "offering," "strategy," and "solution." We observed clear growth, which might be linked to a more detailed specification of the characteristics of servitization, as well as its impact on corporate strategy and the value it enables industrial firms to offer customers. For example, the prevalence of the term "shift" decreased from the first period to the second period. In contrast, the term "strategy" appeared in the second period.

We identified 32 verbs. Of these, eight were grouped into word families as concepts that could be considered to have the same meaning. This process resulted in 24 verbs. In the first period, 15 verbs appeared, increasing by approximately 60% in the second period (see Table IV). Only four verbs were used in more than one definition in the first period: "to offer," "to sell," "to create," and "to use." Many more verbs appeared in the second period, although the verb "to offer" was still important, and the verb "to use" ceased to be employed. Notable verbs that appeared were "to increase," "to add," "to develop," and "to shift," while "to reduce," "to stabilize," and "to make" disappeared. The action "to offer" became the most important aspect of the concept of servitization.

Table IV

We identified 26 adjectives. The number of adjectives increased considerably in the second period to 22 from just four in the first period (Table V). The growth in the number of adjectives used per definition confirms the conclusion from the analysis of nouns that the definitions have become broader and more complex over time. Notably, only four adjectives appeared in the first period. The term "integrated" was the most important adjective, with a frequency of 57.14%. The remaining percentage corresponded to the adjectives "additional," "central," and "better." The latter two ceased to be used in the second period, and others such as "greater" and "tangible" appeared instead. The term "integrated" remained important, indicating that the mix of goods and services implicit in servitization should be integrated to provide solutions to customers.

Table V

4.2. Consensus analysis

For each subperiod, we performed consensus analysis of the definitions (Table VI). This analysis was designed to reveal whether a globally shared concept of servitization exists. We did not find evidence of the existence of a core set of terms that appeared in all definitions in any subperiod. The results did not provide evidence supporting a globally shared definition of servitization for either of the subperiods.

For the definitions from the subperiod 2007 to 2013, the ratio of the 1st factor to the 2nd factor was 2.535, which is less than 3. For the definitions from the subperiod 2014 to 2020, the ratio of the 1st factor to the 2nd factor was 2.563. These weak ratios of eigenvalues indicate a lack of fit of the consensus model. Furthermore, in both periods, some negative competency scores indicated a lack of fit, and the average competency score was less than the recommended value of 0.5.

Table VI

The results indicate the existence of different approaches to the concept of servitization. These results are consistent with, for example, research by Green *et al*. (2017), who identified the conceptual divergence of servitization research based on two parallel streams of literature: (1) servitization as an extension of manufacturing research, associated with a goods-dominant logic (G-D logic), and (2) servitization associated with a service-dominant logic (S-D logic).

However, as in other fields, the degree of consensus can be expected to increase as the key terms in the current definitions are reinforced. Once this process has occurred, the discipline may become consolidated, with a denser network of researchers and clearly defined schools of thought.

4.3. Centrality analysis

The evolution of the terms in the definitions of servitization during the analyzed subperiods reveals the following groups of terms:

- The first group comprises terms whose degree centrality increased progressively from the first period to the second period. This group includes the terms "product," whose degree centrality increased from 59.09 in the first period to 73.26 in the second period, and "service," whose degree centrality increased from 66.66 in the first period to 70.46 in the second. Both terms were in the core area in both periods. The centrality analysis again indicates that both of these terms are key terms in the definition of servitization.
- The second group comprises terms that did not appear in the first period but that did appear in the second. In the second period, seven new terms appeared in the core area: "manufacturers," "value," "customer," "firm," "strategy," "aim," and "offering." The first four terms shifted from the periphery to the core. The terms "strategy," "aim," and "offering" were new terms. This finding reflects the evolution of the definitions toward a focus on strategy and the value chain.
- The third group consists of core terms in the first period that shifted to the periphery or disappeared in the second period. The terms "set of services" and "risk" shifted from the core to the periphery. This change indicates the weaker importance attached to risk in servitization. It also indicates that services and solutions were referred to in generic terms. Thus, this term appeared as a new term in the periphery area in the second period, with moderate centrality.
- The final group consists of new terms appearing in the second period (besides the core terms). Notable examples of such terms are "transformation," "capabilities," and "organizational structure." These terms reflect the orientation toward resources and capabilities in the definitions of servitization.

Figures 2 and 3 show the network structure of the definition of servitization in each analyzed subperiod and the position of the key terms in the three areas of the network.

Figure 2

Figure 3

Table VII shows the three areas according to their degree centrality in the network and the position of the concepts used in the definitions of servitization in the two analyzed subperiods. The core of the network was stable in both subperiods as regards the terms "service" and "product." However, the structure of this area in relation to the position of these terms changed. The most notable changes to the core of the network relate to the terms "risk" and "set of services," which shifted from the core to the periphery. In the second period, there was an increase in new terms such as "strategy," "aim," and "offering." While the term "manufacturers" shifted from the semi-periphery to the core in

period 2, the terms "value" and "customer" shifted from the periphery directly to the core. As indicated earlier, the strategic focus of the definitions strengthened in the second period.

Table VII

Most changes took place in the semi-periphery, where the number of terms increased notably from the first period to the second period. However, there was an increase not only in the number of terms but also in the number of movements of terms. More specifically, the terms "shift" and "manufacturers" moved from the semi-periphery in the first period to the core in the second period, with an increase in their centrality. The terms "value in use" and "competitive strategy" moved from the semi-periphery in the first period to the periphery in the second period, although the explanation for this shift may be that they were simply replaced by the terms "value" and "strategy" in the core in the second period. The terms "process" and "business model" appeared in the same position in the network in both periods (i.e., in the semi-periphery), revealing themselves to be important concepts in servitization because of their stability, with moderate centrality.

Regarding the changes that occurred in the periphery of the network, certain terms such as "revenues" remained in the same position in both periods. Terms that moved from the periphery to the semi-periphery were "innovation," "relationship," "way," "differentiation strategy," "product-service system," and "infusion," reflecting their greater prominence in the definitions of servitization. Similarly, several terms appeared only in the first period, disappearing in the second period: "mutual value," "transactional," "sales revenues," "predictable maintenance," "cost," "downstream," and "organizational capabilities."

4.4. Development of the strategic diagram based on co-word analysis

Figure 4 shows the strategic diagram of specializations in servitization research. Specifically, it shows the subnetworks around which the research fields within servitization are clustered. Each research specialization is defined by the terms used to describe it and by the two quantitative measures of centrality and density, which place the specialization in a given strategic position. Of the terms used to define each specialization, the bold words in Figure 4 are those that describe it.

Figure 4

The analysis reveals 10 servitization research specializations. In the diagram, the specializations appear on the x-axis in ascending order of centrality and on the y-axis in ascending order of density. We used the mean values to classify the specializations in three of the four quadrants.

Type 1 aggregates: These form the core of the research field. The themes in this quadrant are highly related and integrated. This quadrant contains three research specializations characterized by 11 terms. These terms ("shift, integrated"; "aim, product, service"; and "capabilities, innovation, strategy, to deliver, to shift") are characterized by their centrality and their density. They formed the core of the network in both periods and systematically constituted the basis of the concept of servitization over time. These findings are somewhat self-evident, in the sense that "product" and "service" are central to servitization research. Similarly, the shifts that firms undergo by integrating products and services lead to new business models. These involve developing new capabilities and innovations, all of which takes place with a clear strategic orientation. These findings show that servitization is studied from a strategic focus. Under this focus, the resource-based view and resource dependence theory seem to have provided the basis for previous research while continuing to offer potential to contribute to the development of future research.

Type 2 aggregates: These aggregates are strongly linked to others, but the density of their internal relationships is weaker than the density of the internal relationships of the Type 1 aggregates.

Two research specializations are located in this quadrant: "new, process, value, solutions" and "manufacturers." These themes are described by terms located in the semi-periphery in the second period in the centrality analysis. The position of this second quadrant indicates that these themes are likely to become core themes because they often represent important themes for the development of the field. These findings show that the transformation from manufacturing through process change and the search for solutions is crucial for the ongoing development of servitization, Therefore, it is noteworthy that the analysis of servitization centers on new processes that increase value in manufacturing firms from an operational perspective.

Type 3 aggregates: These themes have low centrality. The intensity of their internal relationships (i.e., high density) suggests that they correspond to research problems that have been thoroughly studied (Callon, *et al*., 1995). This quadrant contains no scientific specialization. This finding may owe to the fact that servitization is a relatively young topic.

Type 4 aggregates: This quadrant contains five of the 10 scientific specializations identified by the analysis. The low values of centrality and density imply that the aggregates in this quadrant are peripheral themes in which a range of different approaches and theories compete and where only analysis of the evolution of the network over several periods could pinpoint their contribution (Callon *et al*., 1995). The terms show the approaches of different scientific communities. They indicate specializations in the quadrant characterized by peripheral terms relating to tangible and intangible elements of the offering, together with the organizational capabilities of firms that enable differentiation through product-service systems. Therefore, many issues have been studied, and nothing is considered a non-core theme.

As a whole, the strategic diagram shows that the morphology of servitization research has a rich and complex structure. There are families of themes, some of which are central, whereas others are peripheral. There are also various degrees of development (established, emerging, and developing). According to Callon et al. (1995), such a set-up suggests that this is a dynamic field.

5. Discussion

This research answers several questions in relation to the plethora of definitions of servitization. The answers to these questions are important because, since the emergence of servitization, numerous terms have been used to refer to this concept in different scientific communities and disciplines.

Authors such as Kamal et al. (2020) have analyzed the definitions given by researchers to identify the core theme. The present study goes a step further. Specifically, bibliometric analysis was used to deconstruct definitions and find core terms in relation to the scientific communities and the theoretical approaches of the studies that provide definitions. The objective was to develop a unified definition. As reported by Kamal et al. (2020, p. 8), "Regardless of these differing conceptions on servitization or service provision, there is limited agreement as to how to capture the real essence of servitization at a broader scale."

Definitions of servitization have been proposed in various disciplines, including operations management, supply chain management, marketing, business and management, engineering, and information technology (IT). All highlight the strategic value of servitization and the value provided to customers. However, the definitions from operations management, supply chain management, and marketing focus on the "product-service system," "product-based services offering," "integrated product-service offering," and "product-centric approach." That is, the product is central, services are added, and product-service combinations emerge. In the case of business and management, engineering, and IT, the focus is on "service innovation," "service-centric approach," "capabilities,"

and "digital solutions." That is, services are central, innovations to these services are introduced, and capabilities and technology are developed and adopted.

The servitization definitions from the first subperiod mainly derive from operations and management studies. The definitions from the second subperiod also derive from marketing, engineering, and IT. However, servitization continues to be addressed by all of these disciplines. There is a convergence toward more general business and management disciplines, highlighting the strategic importance of servitization.

Thus, based on the terms that formed the core of the definitions of servitization and that remained in this core over the two analyzed subperiods, we conclude that the concept of servitization started as a synonym for service growth in product firms. It has since evolved into an important competitive tool for industrial companies, enabling them to create value by offering services as part of the company's overall strategy and enhancing consumers' user experience. The fact that the terms "product" and "service" remained in the core over the two subperiods reveals a concise lexical configuration based on these two terms. The incorporation of more terms in the definitions reflects the specific nature of the scientific field in which a given definition is rooted. These different terms reveal the diversity of the phenomenon of servitization.

From a conceptual perspective, the terms that have thus far dominated the definitions of servitization (i.e., "product," "service," "manufacturer," "customer," "offering," "value," and "strategy") imply that the essence of the concept of servitization is *a strategy based on the integrated offer of products and services by manufacturing firms to customers to increase added value and improve the user experience*. The proposed definition highlights the terms "strategy," "integrated offer," "added value," and "user experience" as key terms. This definition thus enables a general approach. The consideration of strategic aspects entails the management of resources and capabilities, whereas the focus on adding value and enhancing the user experience places the customer at the center of the offering and implies a need to innovate to provide solutions. As noted by Kamal et al. (2020), in most of the definitions in the literature, servitization is considered important from both strategic (i.e., in terms of innovation) and operational (i.e., in terms of processes) perspectives. Most definitions focus on one of these perspectives. According to our analysis, 51% of definitions have a strategic perspective, whereas 49% have an operational perspective. The proposed definition integrates these two perspectives, including user experience as a key element. Services today are user experiences. We propose the integration of products and services to offer solutions that are also user experiences.

It is of interest to link these findings to the topics and research streams of different scientific communities, following the approach described by Rabetino *et al*. (2018). Given the terms that formed the core of the network during each period, the first period seems to have been dominated during its initial stages by the PSS scientific community. During the first period, the periphery and semi-periphery also contained concepts related to the solution business community. Analysis of the core showed that these concepts became more prominent in the second period. As a strategy, servitization involves innovation in the organization's capabilities and processes to shift from selling products to selling integrated product and service offerings, otherwise known as solutions. The same occurred with the service science community. Related concepts were identified in the semi-periphery and periphery in the first period, and these concepts then appeared more clearly in the second period. Service science integrates the concepts of people, technology, information, and organizations (Spohrer *et al*, 2007). In fact, digital technology is explicitly mentioned in definitions from the last decade. Definitions from the second subperiod derive from engineering and IT studies.

It is therefore impossible to affirm that each period was dominated by the definitions provided by a particular scientific community. Instead, in both periods, all communities played an important role. However, in the first period, the core corresponded more to the PSS community, whereas in the second, the core corresponded more to the solution business community, and to some extent, to the service science community. This finding shows that servitization *is* a multidisciplinary phenomenon, and contributions to the field are rooted in different disciplines.

Changes between the two periods reflect the fact that the services offered by industrial companies are becoming increasingly advanced. By adding advanced services to their offering, manufacturers are seen to move away from product-focused business models toward advanced services, integrated solutions, and product-service systems (Brax & Visintin, 2017; Rabetino et al., 2017). In sum, manufacturing companies are developing more capabilities. Some of the semi-peripheral terms in the first period became core terms in the second. Examples are "customer," "value," and "manufacturers." In turn, some of the semi-peripheral terms in the second period are expected to become core terms in the next period, with core terms from the last five years such as "innovation," "capabilities," and "transformation" becoming less prominent. Digital services and digital servitization may form the focus of convergence across various research communities.

In the same vein, the term B2B, a semi-peripheral term in the second period, may signal a way forward in the context of servitization. In the first period, most studies focused on B2B environments. The B2C environment was studied in the second period, although the dominant environment was still B2B. Our results are consistent with those of Rabetino et al. (2021), who showed that one of the trends in persistent themes in servitization research is customer relationships and business logic in B2B service infusion, and more specifically, defining set-ups for value creation in B2B service infusion. Another possible area for future research is the analysis of servitization from the customer perspective, given that all research so far has adopted the company perspective.

Similarly, the intellectual structure of the topic of servitization (Martín-Peña *et al*., 2017) and dynamic analysis of this intellectual structure (Díaz Garrido *et al*., 2018) also revealed a relationship between changes in the intellectual structure of servitization research and the evolution of the definitions of servitization. The approaches to the analysis of servitization corroborate the conclusion that servitization is a multidisciplinary phenomenon. In the first subperiod, the PSS approach dominated servitization research. Today, the dominant approach relates to strategic management. This shift shows the strategic importance of the incorporation of services into value creation by industrial companies. This finding implies that the approach has shifted from a G-D logic to an S-D logic (Vargo and Lusch, 2004). Furthermore, this conclusion is consistent with the results of the analysis of the definitions of servitization, where the terms "strategy" and "value" appeared in the core in the second period. This finding also highlights the way in which companies have undertaken the transition from providing products or services to providing value through integrated solutions.

The theoretical foundations of the analyzed definitions lie in classical theories such as the resource-based view, transaction cost theory, contingency theory, decision theory, and game theory. However, no particular evolution or pattern of change was observed in the two analyzed subperiods. Instead, these theories were observed in both periods. This observation reveals that the different research topics encompassed by servitization can be analyzed through different theoretical lenses. This finding is consistent with research by Ruiz-Martín and Díaz-Garrido (2021), who showed that servitization is essentially underpinned by four theoretical approaches: the resource-based view, game theory, transaction cost theory, and contingency theory.

Therefore, the study shows that servitization is an evolving research topic. According to the strategic diagram, the structure of this research area is complex. In certain cases, the word families appear as core themes, whereas in others, they appear as peripheral themes. However, a common theme in service provision by industrial companies is how the inclusion of intangible services can supplement the sale or lease of tangible products. This theme can be extended to the importance for the development and competitive success of manufacturing organizations.

The horizontal morphology of the research network unfolds within the scientific and academic community and shows that the elements of the network have a high linkage density in terms of direct knowledge transfer and co-authorship of articles. The first quadrant of the resulting strategic diagram shows the core of the servitization research. The terms are closely related and highly integrated. These terms formed part of the definitions over the two periods of analysis and may continue to do so. The definitions converge through these terms. We also expect the terms from the second and fourth quadrants to be included. As reported by Rabetino et al. (2021), the convergence of research topics on servitization is reflected in terms of the representativeness of servitization topics over time.

The term "servitization" was used in the search for documents to find the most precise definitions possible. As an extension of this research, terms such as "business models," "solutions," and "customization" could be incorporated to offer broader definitions and add nuances to the analysis. However, the analysis of the results suggests that, in reality, targeting the search as we did offered a better approach and that these nuances are present in the 94 deconstructed definitions.

As noted by Rabetino et al. (2021), servitization scholars come from different academic disciplines, and they have built their scientific servitization narrative by applying the standard vocabulary from their own discipline. In doing so, they have reproduced the vocabulary of their own discipline, incorporating it into the language of servitization. Hence this process is collective, with certain terms being repeated and becoming more common within the discipline.

6. Conclusions

The definitions of servitization found in the literature over the last three decades reveal the origins and evolution of this research domain. Since servitization was first defined by Vandermerwe and Rada in 1988, numerous alternative definitions have been proposed by scholars from a range of scientific disciplines. There is variation in the definitions of servitization used by researchers from different disciplines, including operations, marketing, and IT. The wide range of terms identified in these definitions makes it difficult to provide a generally accepted definition.

We conclude that there exists a low degree of consensus among scholars regarding the concept of servitization, principally because it is a *multidisciplinary phenomenon, contributions to which are rooted in a range of disciplines.* We consider a certain degree of consensus necessary when defining servitization, although the unique nature of each discipline used to analyze servitization should be captured. This approach can aid the development of this research field. Therefore, the main aim of this study was to propose a general definition for servitization. To do so, a multidisciplinary approach was adopted, considering the origins and evolution of this research domain. This study advances the existing literature by using bibliometric techniques to study the selected definitions based on a systematic review. The definitions were deconstructed, and consensus and co-word analyses were performed.

Co-word analysis of the definitions of servitization led to a list of key terms. Two periods were detected. Whereas the terms "product" and "service" form the core of the definition of servitization, the focus has shifted over time from a PSS approach to an approach centered on the

importance of strategy and value creation. Analysis of the key terms used in the definitions considered in this study leads to the proposal of a universal definition that captures the essence of the concept of servitization. The definition of servitization can be stated as *a strategy based on the integrated offer of products and services by manufacturing firms to customers to increase value and improve the user experience*. This definition combines strategic and operational aspects.

From the strategic diagram based on co-word analysis, we also found that the structure of the servitization research network is built around 10 research specializations. It is a complex field in which certain word families appear as core themes, whereas others appear as peripheral themes. Although certain aggregates are stable, others are still developing. This situation is indicative of the field's evolving nature. This evolution is reflected by the growing number of publications on the concept and the increasing complexity of the terminology, which restricts knowledge accumulation. The proposal of an integrated definition can support this knowledge accumulation and help legitimize this research domain.

In summary, according to the vocabulary used in the two periods considered in this study, the state of the art in servitization was analyzed in depth. The aim was to present a comprehensive picture of research on this topic and provide valuable references for researchers who seek convergence and a sharp focus in the accumulation of knowledge. Therefore, this study can aid the development of servitization into a well-established discipline.

We expect there to be a third period in the evolution of this research domain. In fact, this period has probably already begun. We expect it to center on elements that appear as semi-peripheral and peripheral in the second period. Terms such as "technology," "transformation," "sustainable," "culture," and "co-creation" are expected to shape future research. The terms in the third quadrant and the periphery in the second period reveal several research gaps. We offer ways to address these gaps by proposing directions for future research based on the following questions:

- What organizational changes does the adoption of innovation in the business model entail in the servitization process?
- What organizational capabilities must be developed for successful servitization processes? Is it necessary to develop different (or perhaps more) capabilities for different services (basic, support, or advanced)?
- How should innovation in business models be adopted so that companies can sustainably create, deliver, and capture value?
- How will customers respond to servitization processes in the B2C environment, and what differences will there be with respect to the B2B environment?
- How can competitive strategy help servitization strategy? How can strategic fit and its impact on performance be analyzed?
- How should customers be involved in the design of services for servitization? How will it affect value co-creation? What are the differences between B2B and B2C environments?
- What role does servitization play in technology platforms (product as a service)?
- What challenges does digital servitization face? What kind of ecosystems can be developed for servitization?
- How should smart supply chains be developed by incorporating advanced and sustainable services? Is a smart, sustainable, servitized supply chain possible?

From a theoretical perspective, our research makes two major contributions to the servitization literature and scientometric research. The first contribution is to provide a systematic and quantitative

analysis of the definitions of servitization. This analysis builds a strong platform to identify the main dimensions of the core concepts of the field and study evolving time-bound latent topics based on their vocabulary. To conduct this analysis, we considered the period in which almost all research in this area was published. Our robust analysis of the key terms that underpin the definitions of servitization, the way in which these terms have evolved over time, and the relationships between these terms provides an accurate understanding to integrate and gain insight into the interactions among different research communities. Therefore, this study provides theoretical value by using co-word analysis to propose a universal definition of servitization. This definition unifies a range of multidisciplinary viewpoints, establishing connections between the underlying theories used to address the topic of servitization. The identification of opportunities for future research based on these analyses suggests where progress could be made in the resource-based view and contingency theory, as well as the theory of consumer behavior.

Another major contribution is methodological, with the study showing the utility of bibliometric and scientometric techniques, primarily co-word analysis. These techniques helped identify the research themes associated with the concept of servitization. This analysis allowed us to create a strategic diagram that illustrates the morphology of the servitization research network and study the relationships between the concept of servitization and different approaches within the intellectual structure of servitization. The relationships between these themes, the extent to which these themes are central to the entire topic of servitization, and the degree to which these themes are internally structured could be important for practitioners in the future. Similarly, the strategic diagram can help predict the evolution of themes in servitization research and can undoubtedly contribute to legitimizing servitization as a research domain.

In terms of managerial value, our study presents managers with different challenges. For instance, managers should be aware of the development of solutions that integrate goods and services and that are customized to meet the specific demands of customers (in both B2B and B2C environments). They should also pay special attention to innovations in sustainable servitized business models that enable value creation. Digital transformation through digital services can undoubtedly help with this transition.

It seems necessary to propose inclusive definitions that enable progress in this research field, the formation of strong theoretical foundations, and the development of rigorous analysis frameworks upon which to base empirical studies. A good starting point for an inclusive definition is to combine a G-D logic with an S-D logic and to consider B2B and B2C environments. As a whole, as noted by Kanra et al. (2021), there have been insufficient attempts to legitimize research on servitization among scholarly communities. We believe that this study takes a step toward achieving this legitimacy.

Our study has certain limitations that must be noted. The first of these limitations relates to the use of content analysis to study concepts. Such analysis requires key terms to be grouped to create word families of terms with similar meanings. Accordingly, the word families used in this study are not unique; other such word families are possible. The second limitation relates to the choice of study period and subperiods. Although the choice of study period and subperiods has been justified, other choices would have been possible. The third limitation relates to the choice of bibliographical database. Enlarging the bibliographical database might have enabled analysis with a greater scope. We are aware that we may have missed some definitions of servitization or may have overlooked a small number of servitization publications. Furthermore, we focused on literature from 2007 onward. Although we included the study by Vandermerwe and Rada (1988), we may have missed some key

early contributions by focusing on this period. By using consensus analysis, we adopted a pioneering method in the field of servitization. However, we could have used other methods. Examples of valid alternative methods are thematic analysis, latent semantic analysis (LSA), probabilistic latent semantic analysis (PLSA), and Latent Dirichlet Allocation (LDA).

References

Andrews, D., Dmitrijeva, J., Bigdeli, A. Z. and Baines, T. (2018), "Snakes and ladders in servitization: Using a game to capture inhibitors and enablers of transformation", *Research Technology Management*, Vol.61 No.6, pp.37-47. doi:10.1080/08956308.2018.1516930.

Annarelli, A., Battistella, C. and Nonino, F. (2016), "Product service system: A conceptual framework from a systematic review", *Journal of Cleaner Production*, Vol.139, pp. 1011–1032. doi:10.1016/j.jclepro.2016.08.061.

Ayala, N. F., Paslauski, C. A., Ghezzi, A. and Frank, A. G. (2017), "Knowledge sharing dynamics in service suppliers' involvement for servitization of manufacturing companies", *International Journal of Production Economics*, Vol.193, pp.538-553.

Baines, T. (2015), "From the editor : Exploring service innovation and the servitization of the manufacturing firm", *Research Technology Management*, Vol.58 No.5, pp.9–11. doi:10.5437/08956308X5805002.

Baines, T. and Lightfoot, H. (2014). "Servitization of the manufacturing firm Exploring the operations practices and technologies that deliver advanced services", *International Journal of Operations & Production Management*, Vol.34 No.1, pp.2–35. doi:10.1108/IJOPM-02-2012-0086.

Baines, T., Lightfoot, H., Benedettini, O. and Kay, J. M. (2009a), "The servitization of manufacturing A review of literature and reflection on future challenges", *Journal of Manufacturing Technology Management*. Edited by R. Roy, Vol.20 No.5, pp.547–567. doi:10.1108/17410380910960984.

Baines, T., Lightfoot, H., Benedettini, O., Whitney, D. and Kay, J. M. (2010), "The adoption of servitization strategies by UK-based manufacturers", *Proceedings of the Institution of Mechanical Engineers Part B-Journal of Engineering Manufacture*, Vol.224 No.B5, pp.815–829. doi:10.1243/09544054JEM1567.

Baines, T., Lightfoot, H. and Kay, J. M. (2009b), "Servitized manufacture: practical challenges of delivering integrated products and services", *Proceedings of the Institution of Mechanical Engineers Part B-Journal of Engineering Manufacture*, Vol.223 No9, pp.1207–1215. doi:10.1243/09544054JEM1552.

Baines, T., Lightfoot, H. and Smart, P. (2011), "Servitization within manufacturing: Exploring the provision of advanced services and their impact on vertical integration", *Journal of Manufacturing Technology Management*, Vol.22 No.7, pp.947–954. doi:10.1108/17410381111160988.

Baines, T. Lightfoot, H., Smart, P. and Fletcher, S. (2013), "Servitization of manufacture", *Manufacturing Technology Management*, Vol.24 No.4, pp.637–646. doi:10.1108/17410381311327431.

Baines, T., Lightfoot, H. W., Peppard, J., Johnson, M., Tiwari, A., Shehab, E. and Swink, M. (2009c), "Towards an operations strategy for product-centric servitization", *International Journal of Operations & Production Management*, Vol.29 No.5, pp.494–519. doi:10.1108/01443570910953603.

Baines, T. and Shi, V. G. (2015), "A Delphi study to explore the adoption of servitization in UK companies", *Production Planning and Control*, Vol.26 No.14–15, pp.1171–1187. doi:10.1080/09537287.2015.1033490.

Bandinelli, R. and Gamberi, V. (2011), "Servitization in oil and gas sector: Outcomes of a case study research", *Journal of Manufacturing Technology Management*, Vol.23 No.1, pp.87–102. doi:10.1108/17410381211196302.

Benedettini, O., Neely, A. and Swink, M. (2015), "Why do servitized firms fail? A risk-based explanation", *International Journal of Operations & Production Management*, Vol.35 No.6, pp.946–979. doi:10.1108/IJOPM-02-2014-0052.

Beuren, F. H., Gomes Ferreira, M. G. and Cauchick Miguel, P. A. (2013), "Product-service systems: a literature review on integrated products and services", *Journal of Cleaner Production*, Vol.47, pp.222–231. doi:10.1016/j.jclepro2012.12.028.

Bikfalvi, A., Lay, G., Maloca, S. and Waser, B. R. (2013), "Servitization and networking: large-scale survey findings on product-related services", *Service Business*, Vol.7 No.1, pp.61–82. doi:10.1007/s11628-012-0145-y.

Borgatti, S. P. (2002), *NetDraw: Graph Visualization Software*, Analytic Technologies, Harvard, MA.

Borgatti, S. P., Everett, M. G. and Freeman, L. C. (2002), *Ucinet for Windows: Software for Social Network Analysis*, Analytic Technologies, Harvard, MA.

Brax, S. A. and Visintin, F. (2017), "Meta-model of servitization: The integrative profiling approach", *Industrial Marketing Management*, Vol.60, pp.17–32.

Buics, L. and Eisingerné Balassa, B. (2020), Servitization of public service processes with a simulation modelling approach, *Engineering Management in Production and Services,* Vol.12 No3, pp.116-131. doi:10.2478/emj-2020-

0023.

Bustinza, O. F. Bigdeli, A. Z., Baines, T. and Elliot, C. (2015), "Servitization and Competitive Advantage The Importance of Organizational Structure and Value Chain Position", *Research Technology Management*, Vol.58 No.5, pp.53–60. doi:10.5437/08956308X5805354.

Cáceres, R. and Guzmán, J. (2015), "Seeking an innovation structure common to both manufacturing and services", *Service Business*, Vol.9 No.3, pp.361–379. doi:10.1007/s11628-014-0234-1.

Cahlik, T. and Jirina, M. (2006), "Law of cumulative advantages in the evolution of scientific fields", *Scientometrics*, Vol.66 No.3, pp.441–449. doi:10.1007/s11192-006-0032-1.

Callon, M., Courtial, J.-P. and Penan, H. (1995), *Cienciometria. El estudio cuantitativo de la actividad científica: de la bibliometría a la vigilancia tecnológica,* Ediciones Trea, Gijón, Spain.

Carley, K. (1993), "Coding choices for textual analysis: A comparison of content analysis and map analysis", *Sociological Methodology*, Vol.23, pp.75–126.

Chakkol, M. *et al.* (2014), "From goods to solutions: how does the content of an offering affect network configuration?", *International Journal of Physical Distribution & Logistics Management*, Vol.44 No.1/2, pp.132–154. doi:10.1108/IJPDLM-03-2013-0064.

Chalal, M., Boucher, X. and Marques, G. (2015), "Decision support system for servitization of industrial SMEs: a modelling and simulation approach", *Journal of Decision Systems*, Vol.24 No.4, pp.355–382. doi:10.1080/12460125.2015.1074836.

Chen, D. (2015), A methodology for developing service in virtual manufacturing environment, *Annual Reviews in Control*, Vol.39, pp.102–117.

Choudhury, N. and Uddin, S. (2016), Time-aware link prediction to explore network effects on temporal knowledge evolution, *Scientometrics*, Vol.108 No.2, pp.745–776. doi:10.1007/s11192-016-2003-5.

Clayton, R. J., Backhouse, C. J. and Dani, S. (2012), "Evaluating existing approaches to product-service system design: A comparison with industrial practice", *Journal of Manufacturing Technology Management*, Vol.23 No.3, pp.272–298. doi:10.1108/17410381211217371.

Cobo, M. J., López-Herrera, A. G., Herrera-Viedma, E. and Herrera, F. (2011), An approach for detecting, quantifying, and visualizing the evolution of a research field: A practical application to the fuzzy sets theory field, *Journal of informetrics*, Vol.5 No1, pp.146-166. doi:10.1016/j.joi.2010.10.002.

Colen, P. J. and Lambrecht, M. R. (2013), "Product service systems: exploring operational practices", *Service Industries Journal*, Vol.33 No.5, pp.501–515. doi:10.1080/02642069.2011.614344.

Crozet, M. and Milet, E. (2017), Should everybody be in services? the effect of servitization on manufacturing firm performance, *Journal of Economics and Management Strategy,* Vol.26 No4, pp.820-841. doi:doi.org/10.1111/jems.12211.

Di Orio, G., Stokic, D., Matei, O., Barata, J., Scholze, S. and Cenedese, C. (2016), "A Platform to Support the Product Servitization A Platform to Support the Product Servitization", *International Journal of Advanced Computer Science and Application*, Vol.7 No.2, pp.1–9. doi:10.14569/IJACSA.2016.070254.

Díaz-Garrido, E., Pinillos, M.-J., Soriano-Pinar, I. and García-Magro, C. (2018), "Changes in the intellectual basis of servitization research: A dynamic analysis", *Journal of Engineering and Technology Management*, Vol. 48, pp.1–14. doi:10.1016/j.jengtecman.2018.01.005.

Doni, F., Corvino, A. and Bianchi Martini, S. (2019), Servitization and sustainability actions. evidence from european manufacturing companies, *Journal of Environmental Management*, Vol.234, pp.367-378. doi:10.1016/j.jenvman.2019.01.004.

Durugbo, C. and Erkoyuncu, J. A. (2016), "Mitigating uncertainty for industrial service operations: a multi case study", *International Journal of Operations and Production Management*, Vol.36 No.5, pp.532–571. doi:10.1108/IJOPM-04-2015-0196.

Eloranta, V. and Turunen, T. (2015), "Seeking competitive advantage with service infusion: a systematic literature review", *Journal of Service Management,* Vol.26 No.3, pp.394–425. doi:10.1108/JOSM-12-2013-0359.

Eloranta, V. and Turunen, T. (2016), "Platforms in service-driven manufacturing: Leveraging complexity by connecting, sharing, and integrating", *Industrial Marketing Management*, Vol.55, pp.178–186. doi:10.1016/j.indmarman.2015.10.003.

Falk, M. and Peng, F. (2013), "The increasing service intensity of European manufacturing", *Service Industries Journal*, Vol.33 No.15–16, pp.1686–1706. doi:10.1080/02642069.2011.639872.

Fernando, Y., Wah, W. X. and Shaharudin, M. S. (2016), "Does a firm ' s innovation category matter in practising eco-innovation ? Evidence from the lens of Malaysia companies .", *Journal of Manufacturing Technology Mnagement*, Vol.27 No.2, pp.208–233. doi:10.1108/JMTM-02-2015-0008.

Finne, M., Brax, S. and Holmstrom, J. (2013), "Reversed servitization paths: a case analysis of two manufacturers", *Service Business,* Vol.7 No.4, pp.513–537. doi:10.1007/s11628-013-0182-1.

Finne, M. and Holmström, J. (2013), "A manufacturer moving upstream: triadic collaboration for service delivery", *Supply Chain Management: An International Journal*, Vol.18 No.1, pp.21–33. doi:10.1108/13598541311293159.

Goffin, K. Raja, J. Z., Claes, B., Szwejczewski, M. and Martinez, V. (2012), "Rigor in qualitative supply chain management research Lessons from applying repertory grid technique", *Journal of Physical Distribution & Logistics Management*, Vol.42 No.8–9, pp.804–827. doi:10.1108/09600031211269767.

Gonzalo-Hevia, N. and Martin-Pena, M.-L. (2020), "Servitisation in manufacturing: proposal of an ontology", *International Journal of Business Environment*, Vol.11 No.4, pp.417–443. doi:10.1504/IJBE.2020.111404.

Green, M. H., Davies, P. and Ng, I. C. (2017), "Two strands of servitization: A thematic analysis of traditional and customer co-created servitization and future research directions", *International Journal of Production Economics*, Vol.192, pp.40–53.

Greenough, R. M. and Grubic, T. (2011), "Modelling condition-based maintenance to deliver a service to machine tool users", *International Journal of Advanced Manufacturing Technology*, Vol.52 No.9–12, pp.1117–1132. doi:10.1007/s00170-010-2760-x.

Grubic, T. (2014), "Servitization and remote monitoring technology: A literature review and research agenda", *Journal of Manufacturing Technology Management*, Vol.25 No.1, pp.100–124. doi:10.1108/JMTM-05-2012-0056.

Grubic, T. and Peppard, J. (2016), "Servitized manufacturing firms competing through remote monitoring technology", *Journal of Manufacturing Technology Management*, Vol.27 No.2, pp.154–184. doi:10.1108/JMTM-05-2014-0061.

Helms, T. (2016), "Asset transformation and the challenges to servitize a utility business model", *Energy Policy*, Vol.91, pp.98–112. doi:10.1016/j.enpol.2015.12.046.

Hernández-Linares, R., Sarkar, S. and Cobo, M. J. (2018), "Inspecting the Achilles heel : a quantitative analysis of 50 years of family business definitions", *Scientometrics*, Vol.115 No.2, pp.929–951. doi:10.1007/s11192-018-2702-1.

Holmbom, M., Bergquist, B. and Vanhatalo, E. (2014), "Performance-based logistics-an illusive panacea or a concept for the future?", *Journal of Manufacturing Technology Management*, Vol.25 No.7, pp.958–979. doi:10.1108/JMTM-06-2012-0068.

Huikkola, T., Kohtamaki, M. and Rabetino, R. (2016), "Resource Realignment in Servitization", *Research Technology Management*, Vol.59 No.4, pp.30–39. doi:10.1080/08956308.2016.1185341.

Jiang, P., Ding, K. and Leng, J. (2016), "Towards a cyber-physical-social-connected and service-oriented manufacturing paradigm: Social Manufacturing", *Manufacturing Letters*, Vol.7, pp.15–21. doi:10.1016/j.mfglet.2015.12.002.

Johnson, M. and Mena, C. (2008), "Supply chain management for servitized products: a multi-industry case study", *International Journal of Production Economics*, Vol.114 No.1, pp.27–39.

Jovanovic, M., Engwall, M. and Jerbrant, A. (2016), "Matching service offerings and product operations: A key to servitization success", *Research Technology Management*, Vol.59 No.3, pp.29–36. doi:10.1080/08956308.2016.1161403.

Kamal, M. M., Sivarajah, U., Bigdeli, A. Z., Missi, F. and Koliousis, Y. (2020), "Servitization implementation in the manufacturing organisations: Classification of strategies, definitions, benefits and challenges", *International Journal of Information Management,* Vol.55, pp.1-14. doi:10.1016/j.ijinfomgt.2020.102206.

Kastalli, I. V., Looy, B. Van and Neely, A. (2013), "Steering manufacturing firms towards service business model innovation : Embracing indicators that reflect market performance", *California Management Review*, Vol.56 No.1, pp.100–123.

Khanra, S., Dhir, A., Parida, V., and Kohtamäki, M. (2021). "Servitization research: A review and bibliometric analysis of past achievements and future promises". *Journal of Business Research*, Vol. 131, pp.151-166.

Kindstrom, D. and Kowalkowski, C. (2014), "Service innovation in product-centric firms: a multidimensional business model perspective", *Journal of Business & Industrial Marketing*, Vol.29 No.2, pp.96–111. doi:10.1108/JBIM-08-2013-0165.

Kohtamaki, M. Hakala, H., Partanen, J., Parida, V. and Wincent, J. (2015), "The performance impact of industrial services and service orientation on manufacturing companies", *Journal of Service Theory and Practice*, Vol.25 No.4, pp.463–485. doi:10.1108/JSTP-12-2013-0288.

Koontz, H. (1961), "The management theory jungle", *The Journal of the Academy of Management*, Vol.5 No.3, pp.174–189. doi:10.2307/254541.

Kowalkowski, C., Gebauer, H., Kamp, B. and Parry, G. (2017), "Servitization and deservitization: Overview, concepts, and definitions", *Industrial Marketing Management*, Vol.60, pp.4–10. doi:10.1016/j.indmarman.2016.12.007.

Kozłowska, J. (2020), "Servitization of manufacturing: Survey in the polish machinery sector", Engineering Management in Production and Services, Vol.12 No1, pp.20-33. doi:10.2478/emj-2020-0002.

Kreye, M. E. (2016), "Employee motivation in product-service system providers", *Production Planning and Control*, Vol.27 No.15, pp.1249–1259. doi:10.1080/09537287.2016.1206219.

Laine, T., Paranko, J. and Suomala, P. (2012), "Using a business game concept to enhance servitization: a longitudinal

case study", *Managing Service Quality: An International Journal*, Vol.22 No.5, pp.428–446. doi:10.1108/09604521211281369.

Lee, S., Yoo, S. and Kim, D. (2016), "When is servitization a profitable competitive strategy?", *International Journal of Production Economics*, Vol.173, pp.3–53. doi:10.1016/j.ijpe.2015.12.003.

Leiringer, R., Green, S. D. and Raja, J. Z. (2009), "Living up to the value agenda: The empirical realities of through-life value creation in construction", *Construction Management and Economics*, Vol.27 No.3, pp.271–285. doi:10.1080/01446190802699032.

Leoni, L. (2015), "Adding service means adding knowledge: An inductive single-case study", *Business Process Management Journal*, Vol.21 No.3, pp.610–627. doi:10.1108/BPMJ-07-2014-0063.

Lerch, C. and Gotsch, M. (2015), "Digitalized Product-Service Systems in Manufacturing Firms A Case Study Analysis", *Research Technology Management*, Vol.58 No.5, pp.45–52. doi:10.5437/08956308X5805357.

Li, J. H., Lin, L., Chen, D. P. and Ma, L. Y, (2015), "An empirical study of servitization paradox in China", *Journal of High Technology Management Research*, Vol.26 No.1, pp.66–76.

Li, A. Q., Kumar, M., Claes, B. and Found, P. (2020), "The State-of-the-Art of the Theory on Product-Service Systems", *International Journal of Production Economics*, Vol.222 No.107491. doi:10.1016/j.ijpe.2019.09.012.

Lightfoot, H., Baines, T. and Smart, P. (2011), "Examining the information and communication technologies enabling servitized manufacture", *Proceedings of the Institution of Mechanical Engineers Part B-Journal of Engineering Manufacture*, Vol.225 No.B10, pp.1964–1968. doi:10.1177/0954405411399019.

Lightfoot, H., Baines, T. and Smart, P. (2013), "The servitization of manufacturing A systematic literature review of interdependent trends", *Journal of Manufacturing Technology Management*, Vol.33 No.11/12, pp.1408–1434. doi:10.1108/IJOPM-02-2012-0086.

Liu, C. H. Chen, M.-C., Tu, Y.-H. and Wang, C.-C. (2014), "Constructing a sustainable service business model An S-D logic-based integrated product service system (IPSS)", . *International Journal of Physical Distribution & Logistics Management,* Vol.44 No.1–2, pp.80–97. doi:10.1108/IJPDLM-02-2013-0039.

Luoto, S., Brax, S. A. and Kohtamäki, M. (2017), "Critical meta-analysis of servitization research: Constructing a model-narrative to reveal paradigmatic assumptions", *Industrial Marketing Management*, Vol.60, pp.89–100. doi:10.1016/j.indmarman.2016.04.008.

Marjanovic, U., Lalic, B., Medic, N., Prester, J. and Palcic, I. (2020), "Servitization in manufacturing: Role of antecedents and firm characteristics", *International Journal of Industrial Engineering and Management,* Vol.11 No.2, pp.133-143.

Martín-Peña, M.L., Pinillos, M.-J. and Reyes, L.-E. (2017), "The intellectual basis of servitization: A bibliometric analysis", *Journal of Engineering and Technology Management,* Vol 43. doi:10.1016/j.jengtecman.2017.01.005.

Martinez, V., Bastl, M., Kingston, J. and Evans, S. (2010), "Challenges in transforming manufacturing organisations into product-service providers", *Journal of Manufacturing Technology Management*, Vol.21 No.4, pp.449–469. doi:10.1108/17410381011046571.

Mastrogiacomo, L., Barravecchia, F. and Franceschini, F. (2019), "A worldwide survey on manufacturing servitization", *International Journal of Advanced Manufacturing Technology*, Vol.103 No.9-12, pp.3927-3942.

Nag, R., Hambrick, D. C. and Chen, M.-J. (2007), "What is strategic management, really? Inductive derivation of a consensus definition of the field", *Strategic Management Journal*, Vol.28 No.9, pp.935–955. doi:10.1002/smj.

Neely, A. (2008), "Exploring the financial consequences of the servitization of manufacturing", *Operations Management Research*, Vol.1 No.2, pp.103–118.

Niu, Y., Jiang, Z., Geng, N. and Jiang, S. (2020), "Disclosing the formation and value creation of servitization through influential factors: A systematic review and future research agenda", *International Journal of Production Research,* doi:10.1080/00207543.2020.1834158.

Nudurupati, S. S., Lascelles, D., Wright, G. and Yip, N. (2016), "Eight challenges of servitisation for the configuration, measurement and management of organisations", *Journal of Service Theory and Practice*, Vol.26 No.6, pp.745–763. doi:10.1108/JSTP-02-2015-0045.

Opresnik, D. and Taisch, M. (2015a), "The manufacturer's value chain as a service - the case of remanufacturing", *Journal of Remanufacturing*, Vol.5 No.2, pp.1–23. doi:10.1186/s13243-015-0011-x.

Opresnik, D. and Taisch, M. (2015b), "The value of Big Data in servitization", *International Journal of Production Economics*, Vol.165, pp.174–184. doi:10.1016/j.ijpe.2014.12.036.

Ostrom, A. L., Parasuraman, A., Bowen, D. E., Patrício, L. and Voss, C.. (2015), "Service Research Priorities in a Rapidly Changing Context", *Journal of Service Research*, Vol.18 No.2, pp.127–159.

Parida, V., Ronnberg-Sjodin, D., Wincent, J. and Kohtamaki, M. (2014), "Mastering the Transition to Product-Service Provision Insights into Business Models, Learning Activities, and Capabilities", *Research Technology Management*, Vol.57 No.3, pp.44–52. doi:10.5437/08956308X5703227.

Park, Y., Geum, Y. and Lee, H. (2012), "Toward integration of products and services: Taxonomy and typology", *Journal of Engineering and Technology Management*, Vol.29 No.4, pp.528–545. doi:10.1016/j.jengtecman.2012.08.002.

Peillon, S., Pellegrin, C. and Burlat, P. (2015), "Exploring the servitization path: a conceptual framework and a case study from the capital goods industry", *Production Planning & Control*, Vol.26 No.14–15, pp.1264–1277. doi:10.1080/09537287.2015.1033492.

Pei, X., Tian, G. and McAvoy, D. (2019), "Relationships between different types of servitization and operational performance: Considering the effect of cross-function integration", *Revista De Cercetare Si Interventie Sociala*, Vol.64, pp.181-198.

Plepys, A., Heiskanen, E. and Mont, O. (2015), "European policy approaches to promote servicizing", *Journal of Cleaner Production*, Vol.97 No.SI, pp.117–123. doi:10.1016/j.jclepro.2014.04.029.

Prester, J. and Peleš, B. (2017), "Trends in servitization: Evidence from croatia", [Trendovi u pružanju popratnih usluga od strane proizvođača: Hrvatski kontekst] *Ekonomski Pregled,* Vol.68 No.5, pp.507-540.

Rabetino, R., Harmsen, W., Kohtamäki, M. and Sihvonen, J. (2018), "Structuring servitization-related research", *International Journal of Operations & Production Management*, Vol.38 No.2, pp.350-371. doi:10.1108/IJOPM-03-2017-0175.

Rabetino, R., Kohtamäki, M., Brax, S. A. andSihvonen, J. (2021). The tribes in the field of servitization: Discovering latent streams across 30 years of research. *Industrial Marketing Management*, Vol. 95, pp.70-84.

Raddats, C., Burton, J. and Ashman, R. (2015), "Resource configurations for services success in manufacturing companies", *Journal of Service Management,* Vol.26 No.1, pp.97–116. doi:10.1108/JOSM-12-2012-0278.

Raddats, C. and Kowalkowski, C. (2014), "A Reconceptualization of Manufacturers' Service Strategies", *Journal of Business to Business Marketing*, Vol.21 No.1, pp.19–34. doi:10.1080/1051712X.2013.857500.

Raddats, C., Kowalkowski, C., Benedettini, O., Burton, J. and Gebauer, H. (2019), "Servitization: A contemporary thematic review of four major research streams", *Industrial Marketing Management*, Vol.83 No.October 2018, pp.207–223. doi:10.1016/j.indmarman.2019.03.015.

Raja, J. Z., Green, S. D. and Leiringer, R. (2010), "Concurrent and disconnected change programmes: strategies in support of servitization and the implementation of business partnering", *Human Resource Management Journal*, Vol.20 No.3, pp.258–276. doi:10.1111/j.1748-8583.2009.00124.x.

Randhawa, K. and Scerri, M. (2015) *Service innovation: A review of the literature*, *The Handbook of Service Innovation*. Springer-Verlag London Ltd. doi:10.1007/978-1-4471-6590-3_2.

Rapaccini, M. (2015), "Pricing strategies of service offerings in manufacturing companies: a literature review and empirical investigation", *Production Planning & Control*, Vol.26 No.14–15, pp.1247–1263. doi:10.1080/09537287.2015.1033495.

Ravikumar, S., Agrahari, A. and Singh, S. N. (2015), "Mapping the intellectual structure of scientometrics: A co-word analysis of the journal scientometrics (2005–2010)", *Scientometrics*, Vol.102 No.1, pp.929–955. doi:10.1007/s11192-014-1402-8.

Reim, W., Parida, V. and Ortqvist, D. (2015), "Product-Service Systems (PSS) business models and tactics - a systematic literature review", *Journal of Cleaner Production*, Vol.97 No.SI, pp.61–75. doi:10.1016/j.jclepro.2014.07.003.

Ronda-Pupo, G. A. and Guerras-Martín, L. Á. (2012), "Dynamics of the evolution of the strategy concept 1962-2008: A co-word analysis", *Strategic Management Journal*, Vol.33 No.2, pp.162–188. doi:10.1002/smj.948.

Ruiz-Martín, A. and Díaz-Garrido, E. (2021). A review of servitization theoretical foundations. Journal of Industrial Engineering and Management, Vol.14 No3, pp.496-519. https://doi.org/10.3926/jiem.3466.

Schmenner, R. W. (2009), "Manufacturing, service, and their integration: some history and theory", *International Journal of Operations & Production Management*, Vol.29 No.5, pp.431–443. doi:10.1108/01443570910953577.

Shi, V. G., Baines, T., Baldwin, J., Ridgway, K., Petridis, P., Bigdeli, A. Z., Uren, V. and Andrews, D. (2017), "Using gamification to transform the adoption of servitization", *Industrial Marketing Management*, Vol.63, pp.82-91

Smith, L., Maull, R. and Ng, I. C. L. (2014), "Servitization and operations management: a service dominant-logic approach", *International Journal of Operations & Production Management*, Vol.34 No.2, pp.242–269. doi:10.1108/IJOPM-02-2011-0053.

Spohrer, J., Maglio, P. P., Bailey, J. and Gruhl, D. (2007), "Steps toward a science of service systems", *Computer*, Vol.40, pp.71–77. doi:10.1109/MC.2007.33.

Sousa, R. and da Silveira, G. J. C. (2019), "The relationship between servitization and product customization strategies", I*nternational Journal of Operations and Production Management*, Vol.39 No.3, pp.454-474.

Spring, M. and Araujo, L. (2017), "Product biographies in servitization and the circular economy", *Industrial Marketing Management*, Vol.60, pp.126-137. doi:10.1016/j.indmarman.2016.07.001.

Tauqeer, M. A. and Bang, K. E. (2018), "Servitization: A model for the transformation of products into services through a utility-driven approach", *Journal of Open Innovation: Technology, Market and Complexity,* Vol.4 No4, pp.60-80.

Toossi, A. A., Louise Lockett, H., Raja, J. Z. and Martinez, V (2013), "Assessing the value dimensions of outsourced maintenance services", *Journal of Quality in Maintenance Engineering*, Vol.19 No.4, pp.348–363. doi:10.1108/JQME-04-2013-0021.

Trukman, P., Martens, W., Viaene, S. and Gemmel, P. (2015), "From business process management to customer process management", *Business Process Management Journal*, Vol.21 No.2, pp.250–266. doi:10.1108/BPMJ-02-2014-0010.

Turunen, T. and Finne, M. (2014), "The organisational environment's impact on the servitization of manufacturers", *European Management Journal*, Vol.32 No.4, pp.603–615. doi:10.1016/j.emj.2013.11.002.

Vandermerwe, S. and Rada, J. (1988), "Servitization of business: Adding value by adding services", *European Management Journal*, Vol.6 No.4, pp.314–324. doi:10.1016/0263-2373(88)90033-3.

Vargo, S. & Lusch, R. (2004), "Evolving to a new dominant logic for marketing", *Journal of Marketing*, Vol.68, pp.1-17

Velamuri, V. K., Neyer, A.-K. and Möslein, K. M. (2011), "Hybrid value creation: A systematic review of an evolving research area", *Journal fur Betriebswirtschaft*, Vol.61 No.1, pp.3–35. doi:10.1007/s11301-011-0070-5.

Viljakainen, A. and Toivonen, M. (2014), "The futures of magazine publishing: Servitization and co-creation of customer value", *FUTURES*, Vol.64, pp.19–28. doi:10.1016/j.futures.2014.10.004.

Visnjic, I., Wiengarten, F. and Neely, A. (2016), "Only the Brave: Product Innovation, Service Business Model Innovation, and Their Impact on Performance", *Journal of Product Innovation Management,* Vol.33 No.1, pp.36–52. doi:10.1111/jpim.12254.

Vogel, R. (2012), "The visible colleges of management and organization studies: a bibliometric analysis of academic journals", *Organization Studies*, Vol.33 No.8, pp.1015–1043.

Notes:

(1) The list of word families is available on request from the authors.

TABLES

Table I. References containing definitions

Period 1: 30 definitions	
Johnson & Mena, 2008: 28 Neely, 2008:104 Baines *et al.,* 2009a:555 Baines *et al.,* 2009b:1211 Baines *et al.,* 2009c:495 Leiringer *et al.*, 2009:271 Schmenner, 2009:431 Baines *et al.,* 2010:815 Martinez *et al.,* 2010:450-451 Raja *et al.,* 2010:258 Baines *et al.,* 2011: 947 Bandinelli & Gamberi, 2011:87 Greenough & Grubic, 2011:1117 Lightfoot *et al.,* 2011:1964 Velamuri *et al.,* 2011:10	Bastl *et al.,* 2012:652 Clayton *et al.,* 2012:272 Goffin *et al.,* 2012:814 Laine *et al.,*2012:428 Park *et al.,* 2012:528 Baines *et al.,* 2013:638 Beuren *et al.,* 2013:222 Bikfalvi *et al.,* 2013:63 Colen & Lambrecht, 2013:501 Falk & Peng, 2013:1687 Finne *et al.*, 2013:513 Finne & Holmström, 2013:22 Lightfoot *et al.*, 2013:1409 Kastalli *et al.*, 2013:101 Toossi *et al.,* 2013:348-349
Period 2: 64 definitions	
Baines & Lightfoot, 2014:3 Chakkol *et al.,* 2014:133 Grubic, 2014:118 Holmbom *et al.* 2014:959-960 Kindstrom & Kowalkowski, 2014:96 Liu *et al.,* 2014:83 Parida *et al.,* 2014:51 Raddats & Kowalkowski, 2014: 3 Smith *et al.,* 2014:243 Turunen & Finne, 2014:603 Viljakainen & Toivonen, 2014:21 Baines, 2015:9 Baines & Shi, 2015:14 Benedettini *et al.,* 2015:949 Bustinza *et al.,* 2015:53 Cáceres & Guzmán, 2015:363 Chalal *et al.,* 2015:355 Chen, 2015:103 Kohtamaki *et al.,* 2015:464 Lerch & Gotsch, 2015:45 Leoni, 2015:612 Li *et al.*, 2015:66-67 Opresnik & Taisch, 2015a:1 Opresnik & Taisch, 2015b:174 Ostrom *et al.*, 2015:132 Peillon *et al.*, 2015:1265 Plepys *et al.*, 2015:117 Raddats *et al.,* 2015:97 Randhawa & Scerri, 2015:31 Rapaccini, 2015:1247 Reim *et al.,* 2015:64 Trukman *et al.,* 2015:252	Annarelli *et al.*, 2016:1013 Di Orio *et al*., 2016:1 Durugbo & Erkoyuncu, 2016:532 Eloranta & Turunen, 2016:178 Fernando *et al.*, 2016:209 Grubic & Peppard, 2016:155 Helms, 2016:101 Huikkola *et al.*, 2016:30 Jiang *et al.,* 2016:15 Jovanovic *et al.,* 2016:29 Kreye, 2016:1249 Lee *et al.,* 2016:3-4 Nudurupati *et al.*, 2016:745-746 Visnjic *et al.*, 2016:36 Ayala *et al.,* 2017: 538 Crozet, & Milet, 2017: 820 Prester, & Peleš, 2017: 509 Shi *et al.*, 2017: 82 Spring, & Araujo, 2017: 128 Andrews *et al.*, 2018:38 Annarelli *et al.*, 2018:75 Tauqeer, & Bang, 2018: 61 Doni *et al.*, 2019:368 Mastrogiacomo *et al.*, 2019: 3927 Pei *et al.,* 2019: 183 Raddats *et al.*, 2019: 207 Sousa, & Da Silveira, 2019: 455 Buics, & Eisingerné Balassa, 2020: 117 Kamal *et al.*, 2020: 9 Kozłowska, 2020: 22 Marjanovic *et al.*, 2020: 134 Niu *et al.*, 2020

Table II: Frequency distribution of key terms by lexical classification

	Nouns		Verbs		Adjectives	
Word appears in:	Number	%	Number	%	Number	%
1 definition	44	51%	12	50%	16	57%
2 definitions	6	7%	3	13%	8	29%
3–5 definitions	21	24%	6	25%	3	11%
6–10 definitions	7	8%	2	8%	0	0%
11–20 definitions	6	7%	1	4%	1	4%
More than 20 definitions	3	3%	0	0%	0	0%
Total	**87**	**100%**	**24**	**100%**	**28**	**100%**

Table III: Nouns with a frequency of more than 5%

	n = 31		n = 65		n = 96	
	Period 1	%	Period 2	%	Total	%
Product	8	57.14%	29	47.54%	37	49.33%
Service	8	57.14%	38	62.30%	46	61.33%
Shift	6	42.86%	11	18.03%	17	22.67%
Process	4	28.57%	8	13.11%	12	16.00%
Set of services	4	28.57%	2	3.28%	6	8.00%
Manufacturers	4	28.57%	23	37.70%	27	36.00%
Competitive strategy	3	21.43%	1	1.64%	4	5.33%
Product-service system	2	14.29%	4	6.56%	6	8.00%
Innovation	2	14.29%	3	4.92%	5	6.67%
Business model	2	14.29%	8	13.11%	10	13.33%
Way	1	7.14%	3	4.92%	4	5.33%
Customer	1	7.14%	14	22.95%	15	20.00%
Firm	1	7.14%	14	22.95%	15	20.00%
Solutions	1	7.14%	8	13.11%	9	12.00%
Infusion	1	7.14%	3	4.92%	4	5.33%
Value	1	7.14%	12	19.67%	13	17.33%
Strategy	0	0.00%	8	13.11%	8	10.67%
Transformation	0	0.00%	7	11.48%	7	9.33%
Aim	0	0.00%	10	16.39%	10	13.33%
Offering	0	0.00%	14	22.95%	14	18.67%
Combinations	0	0.00%	5	8.20%	5	6.67%
Focus	0	0.00%	4	6.56%	4	5.33%

Table IV. Frequency distribution of verbs

	n = 31		n = 65		n = 96	
	Period 1	%	Period 2	%	Total	%
To offer	5	35.71%	9	14.75%	14	18.67%
To sell	3	21.43%	3	4.92%	6	8.00%
To create	2	14.29%	3	4.92%	5	6.67%
To use	2	14.29%	0	0.00%	2	2.67%
To increase	1	7.14%	3	4.92%	4	5.33%
To reduce	1	7.14%	0	0.00%	1	1.33%
To stabilize	1	7.14%	0	0.00%	1	1.33%
To make	1	7.14%	0	0.00%	1	1.33%
To support	1	7.14%	2	3.28%	3	4.00%
To deliver	1	7.14%	2	3.28%	3	4.00%
To generate	1	7.14%	2	3.28%	3	4.00%
To add	1	7.14%	4	6.56%	5	6.67%
To develop	1	7.14%	3	4.92%	4	5.33%
To enrich	1	7.14%	1	1.64%	2	2.67%
To shift	1	7.14%	5	8.20%	6	8.00%
To undergird	0	0.00%	1	1.64%	1	1.33%
To enable	0	0.00%	1	1.64%	1	1.33%
To satisfy	0	0.00%	1	1.64%	1	1.33%
To compete	0	0.00%	1	1.64%	1	1.33%
To abandon	0	0.00%	1	1.64%	1	1.33%
To conduce	0	0.00%	1	1.64%	1	1.33%
To rethink	0	0.00%	1	1.64%	1	1.33%
To replace	0	0.00%	1	1.64%	1	1.33%
To contain	0	0.00%	1	1.64%	1	1.33%

Table V. Frequency distribution of adjectives

	n = 31		n = 65		n = 96	
	Period 1	%	Period 2	%	Total	%
Integrated	8	57.14%	13	21.31%	21	28.00%
Central	2	14.29%	0	0.00%	2	2.67%
Better	1	7.14%	0	0.00%	1	1.33%
Additional	1	7.14%	3	4.92%	4	5.33%
Component	0	0.00%	1	1.64%	1	1.33%
Pervasive	0	0.00%	1	1.64%	1	1.33%
Growing	0	0.00%	2	3.28%	2	2.67%
Diverse	0	0.00%	1	1.64%	1	1.33%
Complex	0	0.00%	1	1.64%	1	1.33%
Personalized	0	0.00%	2	3.28%	2	2.67%
Supplementary	0	0.00%	1	1.64%	1	1.33%
Greater	0	0.00%	4	6.56%	4	5.33%
New	0	0.00%	2	3.28%	2	2.67%
Compelling	0	0.00%	1	1.64%	1	1.33%
Sustainable	0	0.00%	1	1.64%	1	1.33%
Tangible	0	0.00%	4	6.56%	4	5.33%
Intangible	0	0.00%	2	3.28%	2	2.67%
Traditional	0	0.00%	2	3.28%	2	2.67%
Total	0	0.00%	1	1.64%	1	1.33%
More	0	0.00%	1	1.64%	1	1.33%
Side	0	0.00%	1	1.64%	1	1.33%
Organizational	0	0.00%	1	1.64%	1	1.33%
Timely	0	0.00%	2	3.28%	2	2.67%
Industrial	0	0.00%	2	3.28%	2	2.67%
Ongoing	0	0.00%	1	1.64%	1	1.33%
Transformative	0	0.00%	1	1.64%	1	1.33%

Table VI. Eigenvalues

	2007–2013	**2014–2020**
Largest eigenvalue	1.647	4.005
2nd largest eigenvalue	0.650	1.563
Ratio of largest to 2nd largest eigenvalue	2.535	2.563

Table VII: Evolution of the position of key terms comprising the definition of the servitization over the two stages studied

Position according to centrality degree	2007-2013		2014-2020		
Core	To offer (70,769)	Risk (64,789)	Product (75)	Value (64,171)	
	Integrated (68,657)	Shift (64,789)	Customer (63,492)	Strategy (62,176)	
	Product (66,667)	Process (61,333)	Service (70,588)		
	Service (64,789)	Set of services (61,333)	Manufacturers (68,182)		
Semi-periphery	PSS (58,228)	Manufacturers (53,488)	Firm (61,224)	Capabilities (54,545)	Satisfaction (50,42)
	Organizational capabilities (58,228)	Competitive strategy (52,874)	Offering (61,224)	Differentiation strategy (54,299)	Opportunity (50,42)
	Central (57,5)	To use (52,273)	Aim (60,606)	Way (53,812)	To create (50,42)
	Value in use (56,79)	Revenues (51,685)	Process (60)	To add (53,812)	To support (50,42)
	To sell (56,79)	Sales revenues (51,111)	Shift (60)	Innovation (53,333)	To enrich (50,42)
	To deliver (56,79)	Customer (51,111)	Integrated (60)	Use (53,097)	Orientation (50,209)
	Business model (55,422)	Way (51,111)	To offer (57,692)	Addional (53,097)	Industrial (49,587)
			Business model (57,416)	Combinations (52,863)	Provider (49,383)
			Solutions (56,604)	Focus (52,632)	Business-to-business (49,18)
			Transformation (56,604)	Traditional (52,632)	Development (49,18)
			To shift (55,556)	To deliver (52,402)	Compelling (49,18)
			To sell (54,795)	Timely (50,847)	
Periphery	To create (49,462)	To make (45,545)	Organizational structure (48,98)	To rethink (47,619)	Sector (45,113)
	Innovation (48,421)	To enrich (45,098)	Sale (48,98)	To replace (47,619)	Choice (44,776)
	Addional (46,939)	To develop (45,098)	Trend (48,78)	Sustainable (47,619)	Component (44,118)
	To generate (46,939)	To shift (45,098)	To compete (48,78)	Ongoing (47,619)	Dominance (44,118)
	Differentiation strategy (46,939)	Mutual value (44,66)	To abandon (48,78)	Characteristics (47,244)	Competitive strategy (43,956)
	Firm (46,939)	Better (44,66)	Phenomenon (48,583)	Convenience (47,244)	To undergird (43,956)
	Downstream (46,939)	Relationship (44,231)	Continuum (48,583)	Supplementary (47,244)	Pervasive (43,956)
	Value (46)	Transactional (44,231)	Blending (48,583)	Growing (47,059)	Co-creation (43,478)
	To add (46)	Cost (42,991)	Equipment (48,583)	Risk (46,875)	To enable (43,478)
	To reduce (45,545)	Predictable maintenance (42,	More (48,583)	Transfer (46,875)	Value in use (43,165)
	To increase (45,545)	Infusion (42,202)	Side (48,583)	Intangible (46,875)	Perspectve (43,165)
	To support (45,545)	Solutions (41,071)	Transformative (48,583)	Propensity (46,693)	Exchange (43,165)
	To stabilize (45,545)		Performance (48,387)	Extend (46,693)	Technology (41,812)
			To generate (48,387)	Revenues (45,977)	Knowledge (41,667)
			To contain (48,387)	Aspect (45,627)	Field (40,956)
			Personalized (48,387)	Position (45,627)	Diverse (40,956)
			Set of services (47,809)	Stream (45,627)	Complex (40,956)
			Integration (47,809)	Culture (45,627)	Service-oriented Capabilities (40,678)
			Results (47,619)	Mindset (45,627)	Requirement (40,678)
			Production (47,619)	Workers (45,627)	To satisty (40,678)
			Consumption (47,619)	To conduce (45,627)	Success (39,604)
			Function (47,619)	Organizational (45,627)	Care (36,364)
			Material (47,619)	Convergence (45,113)	Total (36,364)
	Stages				

FIGURES

Figure 1. Stages in co-word and consensus analysis

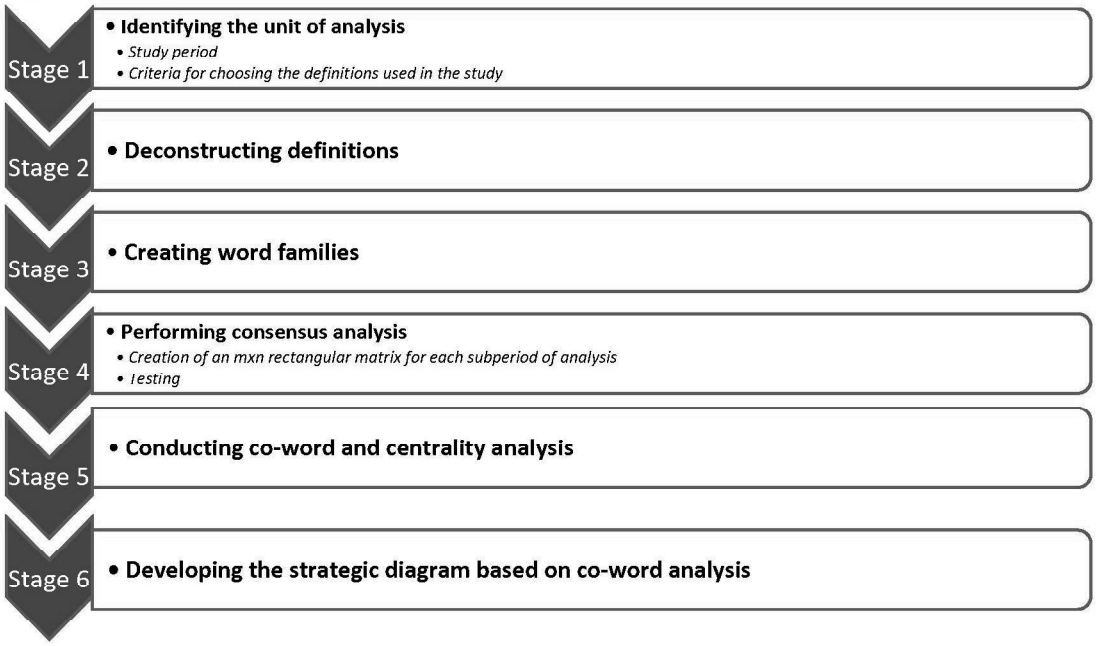
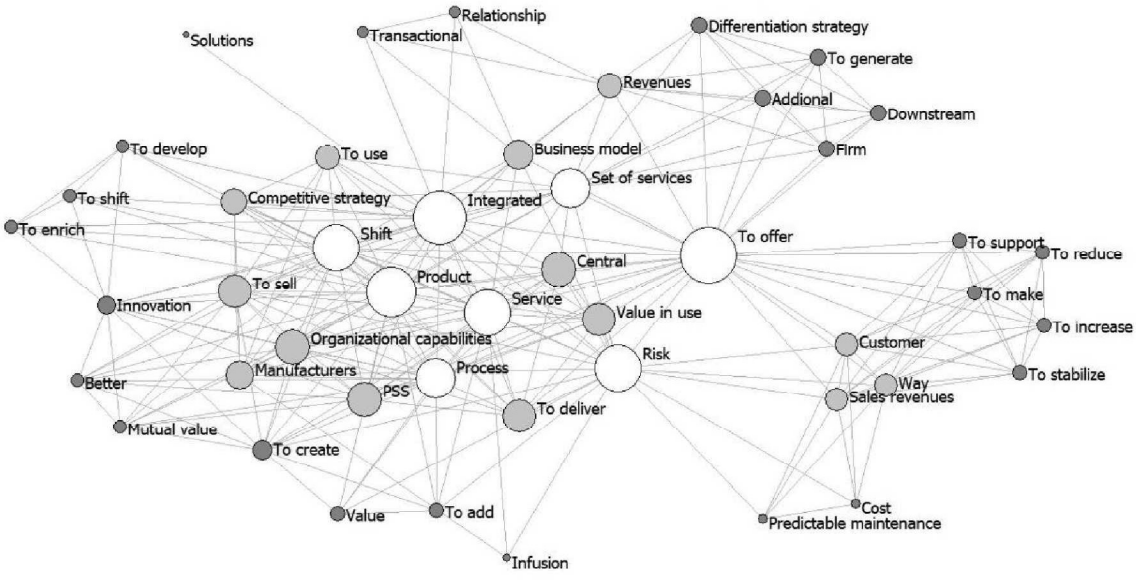
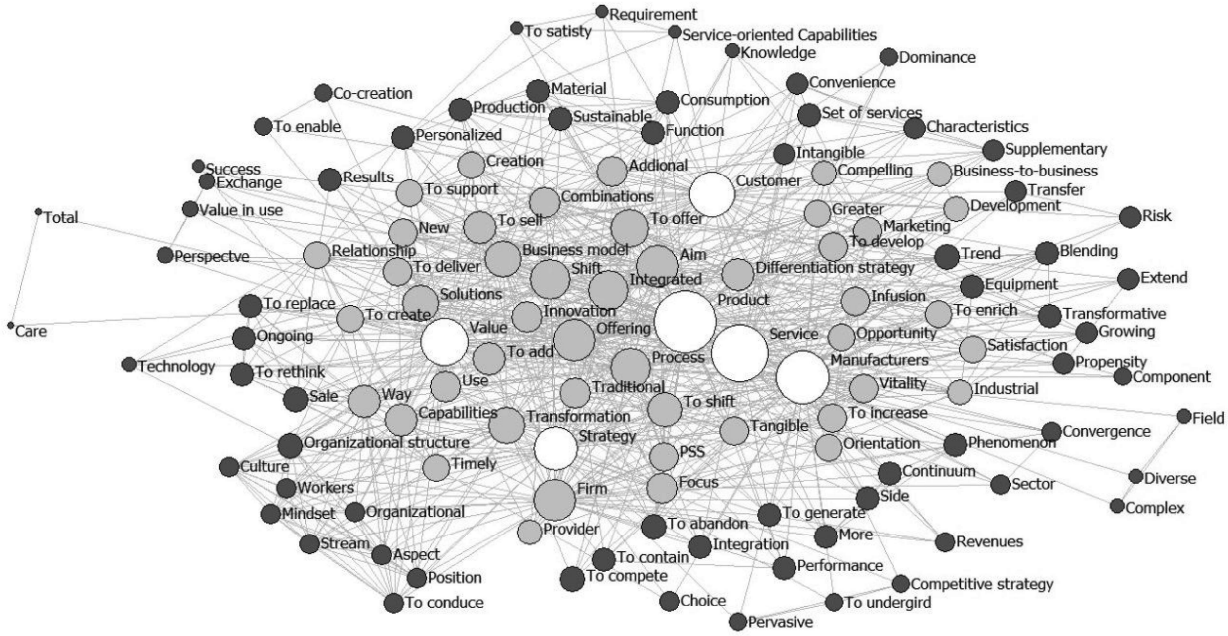


Figure 2: Network structure of the definition of servitization in period 1



Note: Variation in vertex color relates to position in the network: white = core; light grey = semi-periphery; dark grey = periphery. The size of each vertex represents its degree centrality.

Figure 3: Network structure of the definition of servitization in period 2



Note: Variation in vertex color relates to position in the network: white = core; light grey = semi-periphery; dark grey = periphery. The size of each vertex represents degree centrality.

Figure 4. Strategic diagram of servitization research specializations