

## Article

# From Goods to Services and from Linear to Circular: The Role of Servitization's Challenges and Drivers in the Shifting Process

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**Abstract:** To move closer to achieving the United Nations' Sustainable Development Goals (SDGs), a change from the traditional paradigm of the linear economy towards the circular economy is of paramount importance. One of the key promoters of this shift is servitization, which involves a shift from a purely transactional product-selling model to customer satisfaction through providing the service inherent to the product. Although servitization is a promising field for academics and practitioners, its adoption faces different challenges and drivers that need to be understood and addressed. A latent issue is the lack of common language around the topic. In the present study, a systematic literature review has been conducted to allow the identification and classification of the main challenges and drivers. Based on the findings, we propose a classification framework that identifies, classifies, and groups common challenges and drivers to different areas of knowledge on servitization through intensity heat maps. From a managerial point of view, our results highlight the importance of embracing servitization as a collective effort from the different departments within a company.

**Keywords:** circular supply chains; product-service systems (PSS); business model innovation; systematic literature review; barriers; enablers



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## 1. Introduction

Production and consumption models need to change in order to continue generating prosperity in our societies while preserving natural and social capital. As the interlinks between the ongoing COVID-19 crisis and biodiversity loss become evident [1,2], humankind's current linear model, based on take-make-use-dispose and unlimited energy from carbon-based fossil fuels, has already overtaken some key planetary boundaries [3]. In addition, COVID-19 lockdowns, restrictions, and the subsequent social and economic crisis are widening existing inequality gaps [4], which makes Agenda 2030 and its "leaving no one behind" pledge more relevant than ever.

The pandemic reconstruction scenarios at the European Union level are mostly based on a green and digital transformation, which calls for using digitalization and advances in information and communication technologies to decouple economic development from natural resource utilization, while boosting investment in infrastructure and job creation. At the core of this decoupling concept, the circular economy or circular value chains emerges as a key building block. The circular economy concept is an integrative framework comprising a variety of approaches and disciplines developed over the last 30 years around the idea of creating a production-distribution-consumption model that is regenerative and restorative by design. The 1990s saw the emergence of reverse logistics [5,6] and industrial ecology [7,8]. Those approaches continued to be refined between 2000 and 2010 with the emergence of closed-loop supply chains [9], the cradle-to-cradle (C2C) design approach [10], and the

“zero waste” movement [11,12]. In the last decade (2010–2020), those paradigms and approaches have been enriched and merged with existing trends around the function-based economy [13] and the industrial product-service systems or PSS [14–17]—also known as servitization processes [18,19]—particularly when they are approached from the perspective of the industrial manufacturer that provides the product/service. Moreover, these trends have shifted their focus towards customer service [20,21] and customer experience [22–24]. Another emerging and important ingredient for decoupling and circularity are the new digital platforms that allow sharing of underutilized assets in the collaborative or access economy (sharing economy, see [25], for an approximation to this term).

Although the scholarly discourse has dealt with repair, reuse, and refurbishment for decades, it was not until the advent of digitalization that shifting from a product-centric mindset to a service-oriented model became possible. Products will be manufactured, distributed, and recovered, but the shift in their ownership will not be the cornerstone of value creation. They become a mere means to provide function, which is where economic value resides, enabling a different perspective for manufacturers when designing their products and their supply chains. Digitalization and platforms play a key role in this dematerialization process [26], of course, as they will advance the conversion of existing products or services into digital variants [27], supported by emerging and evolving technology (digital twins, 3D printing, remote maintenance, big data, and fast data, etc.) [28–31]. Servitized business models are less resource-intensive than traditional manufacturing business models and facilitate the transition towards a circular, regenerative, and restorative economy by design.

Although servitization seems to present a series of benefits and opportunities for the advancement towards circular business models, and also in terms of customer retention [32], value delivery, and value creation [33], it is not exempt from challenges [34]. Otherwise, servitized business models would already be ubiquitous. The shift from the traditional model of developing, selling, and delivering products, towards the provision of services, spanning over the product life cycle, requires new technical capabilities in companies, such as designing products and manufacturing processes for durability, increasing repair and technical service capabilities, and developing new disassembly and refurbishing processes. Customer–firm relationships are subject to a profound transformation, as they have to shift from the traditional transactional approach, as in [20], to a new relational approach that requires a long-term customer–firm relationship, value co-creation with customers, and risk-sharing. In the servitization transition of a firm, contracts need to change and organizational structures need to evolve, inside the firm and in its value chain. Rethinking the business model impacts the product design [35,36], the supply chain [35,37,38], information and communication technologies (ICT) [39,40], and the ownership of the product [41,42], among others. In addition to all those challenges that might arise in the transition process, it should be mentioned that not all types of products are suitable for a service-based or sharing business model: personal items that cannot be shared are an extreme example. There is also an ongoing debate [43] on the interlinks between “servitized consumption” and inequality, which points out the risk of ending up in an ownership-based business model for the elite and a service-based accessibility model for the greater part of the population.

On the other hand, servitization is not only subject to challenges, barriers, or inhibitors [19,44,45]. There are a number of drivers, facilitators, enablers, motivations, rationales, and levers that ease and foster the transition from goods to services [18,19,44,46–48]. Environmental regulations and material scarcity are already moving firms towards the servitization path. A more stable and regular income flow that is typically linked to the provision of services, when compared to selling goods, is particularly valued in stock exchange markets and can also be a lever for the servitization shift [49,50].

The aim of the present study is to shed light on the challenges and drivers for servitization, given that servitization is one of the underlying phenomena that make the rise of the circular economy possible. To do this, we used a systematic literature review as our main methodological approach. We identify the different challenges and drivers that have

been explored in the literature and classify them into an own-development framework that provides a comprehensive view of all the challenges and drivers that may arise in the goods-to-services shift. The framework also seeks to build a common ground terminology used in the servitization discussion, serving as support for the scientific community to deliver its message in a more understandable manner. Our goal is to answer the following question: How do the challenges and drivers faced by servitization support the shifting process towards a circular business model to achieve the SDGs?

The remainder of the paper is organized as follows: In Section 2, we present the systematic literature review method used in the research. In Section 3, we introduce the main contribution of the paper, the challenges and drivers framework, which emerges from the literature review described in Section 2. Section 3.1 describes the building blocks of the framework. Section 3.2 presents two intensity maps that show that extant literature had not yet fully grasped all the challenges and drivers, both hard and soft, related to servitization processes. Those results reinforce the value of the framework put forward in this study for academics, practitioners, and policy-makers. In the discussion section (Section 4) we address the insights obtained from the framework and the literature analysis. Finally, in Section 5 we present our conclusions, considering both academic and managerial implications of the study, its limitations, and further research opportunities.

## 2. Materials and Methods

An exploratory study is a valuable means of finding out what is happening; to seek new insights; to ask questions and assess phenomena in a new light [51]. Given its multidisciplinary approach [52], and its effectiveness in reducing research bias towards certain studies [53], it has been frequently used to shed light on topics where information requires further development, such as sustainable supply chains [54], the definition of the sharing economy [25], or the definition of sustainable organizations [55].

Although literature reviews have been conducted on this topic [17,19,56,57], and some have focused either on the challenges [58–60] or drivers [45,61], and the development of new concepts engaging servitization [34,62,63], there is still a need to standardize the growing language (academic and practitioner) around the topic [64,65].

In this section, we present the methodology that we followed to tackle the issue related to language standardization by performing a systematic literature review of academic documents. The steps developed by Tranfield et al. [52] and Moher et al. [53] are summarized and presented in this section.

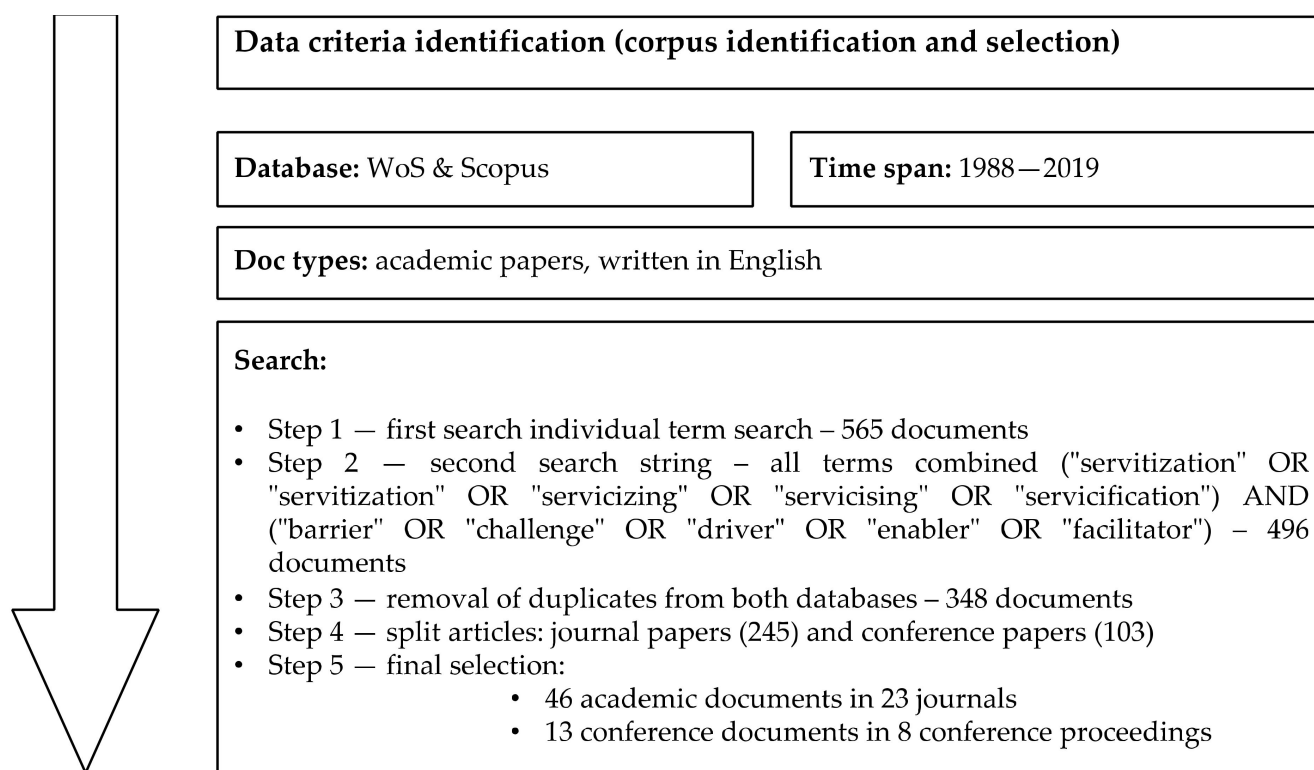
### 2.1. Selection of References

Although Tukker [17] stated in his literature review that Scopus “is probably the best tool available for an electronic literature search, particularly for articles published after 1995”, we have also included Web of Science (WoS) as a database to ensure that our systematic literature review is comparable to previous ones in this field [19,45,56,58,66–68]. The research procedure described in Figure 1 follows the criteria recommended by Newbert [69], briefly summarized as follows:

- Theme—papers must be related to servitization challenges and drivers
- Time range—papers had to be published in the period 1988–2019
- Language—papers should be written in English
- Journal type—papers must be part of peer-reviewed journals and be available in full text

To complete the systematic literature review, it is necessary to clearly define the scope of the research. Regarding servitization, a critical issue is that there is not a standardized language among researchers regarding the wording to precisely describe the “transition to services in manufacturing firms” [19] and, moreover, the boundaries among the different concepts are still blurred [58] as these vary depending on the research area. Therefore, the following search strings have been used: “servitization”, “servitisation”, “servicizing”, “servicising”, and “servicification”. These strings were combined with “barrier”, “chal-

“challenge”, “driver”, “enabler”, and “facilitator”, providing a total of 25 research strings for this systematic literature review.



**Figure 1.** Research design.

Following the same approach taken by Tukker [17], we estimated the total amount of articles for each of the databases. The two databases contain approximately 80 million articles: (The process followed by Tukker [17] suggests simply entering the keyword “The” for each of the search engines, as it is likely to be used in all papers in the English-language domain. This process was carried out on each search database obtaining the estimated total number of articles, on every field, that is published on that database.) Scopus contains about 47 million articles and Web of Science contains an estimated 33 million. After this first step was completed, the keywords on the research strings were used to determine the initial total amount of articles relevant to this literature review. This step resulted in 565 documents being obtained, including duplicates: Scopus with 323 and Web of Science with 242.

## 2.2. Research String Results

As mentioned above, there is a lack of consensus in terms of the language that researchers use regarding the servitization field, which could be clearly seen through the research strings. Nevertheless, it is not surprising to find that the term “Servitization” produced the highest number of results when combined with the other strings (“barrier”, “challenge”, “driver”, “enabler”, AND “facilitator”) as the literature has been largely developed around this wording. At first, an individual search was made by matching each of the strings individually, producing a total of 565 articles.

Afterward, and to avoid having duplicates that could look for similar terms in the keywords or the title, a complete search was made using the following strings: (“servitization” OR “servitisation” OR “servicizing” OR “servicising” OR “servicification”) AND (“barrier” OR “challenge” OR “driver” OR “enabler” OR “facilitator”). This second combined search produced a total of 496 articles. Table 1 presents the information related to the total number of published articles and the respective matching keywords on the combined research

strings, on both databases. There is a clear growing trend for research around this topic, which started to peak steadily since 2013, increasing the number of publications over time.

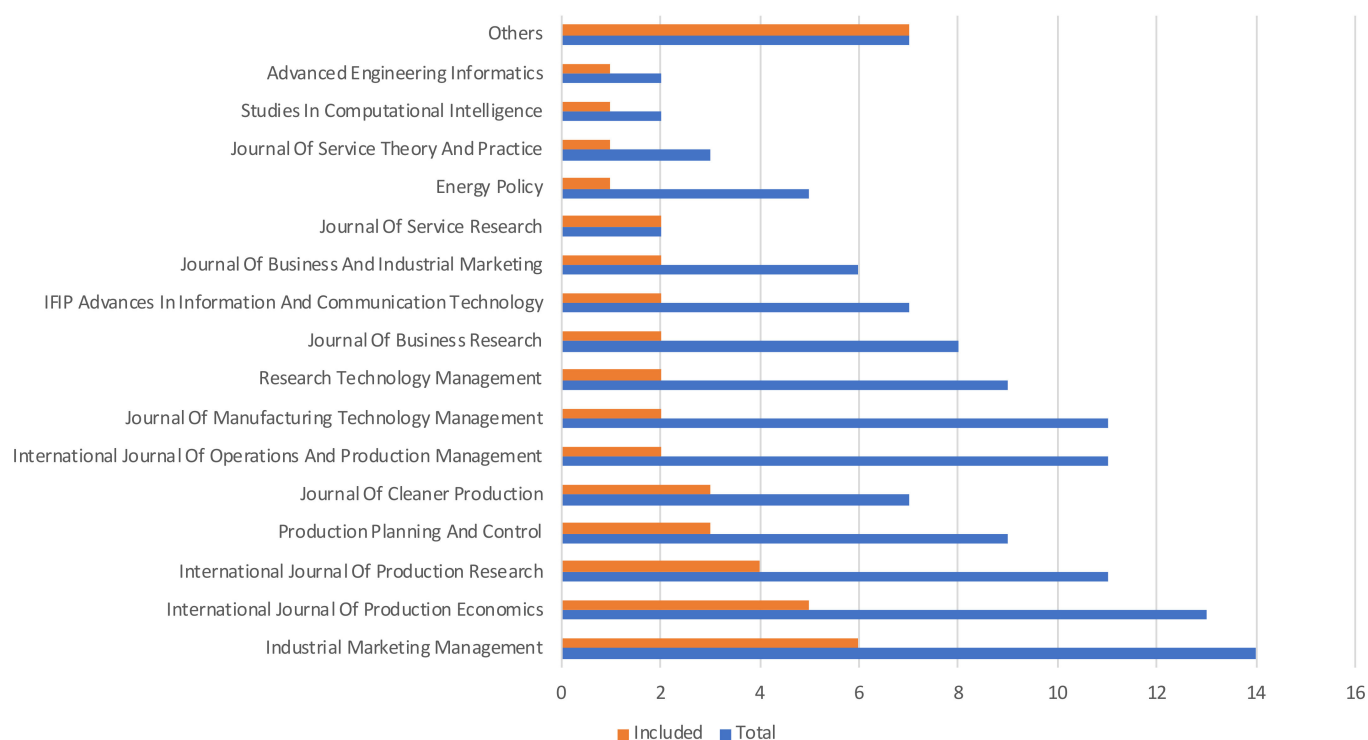
**Table 1.** Combined research strings per year and per database.

| Research String (Combined) | ("servitization" OR "servitisation" OR "servicizing" OR "servicising" OR "servicification")<br>AND ("barrier" OR "challenge" OR "driver" OR "enabler" OR "facilitator") |                      |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|
| Year                       | Scopus                                                                                                                                                                  | Web of Science (WoS) |
| 1988                       | 1                                                                                                                                                                       |                      |
| 2000                       |                                                                                                                                                                         | 1                    |
| 2006                       | 1                                                                                                                                                                       | 1                    |
| 2007                       | 2                                                                                                                                                                       | 2                    |
| 2008                       | 1                                                                                                                                                                       | 2                    |
| 2009                       | 7                                                                                                                                                                       | 3                    |
| 2010                       | 4                                                                                                                                                                       | 2                    |
| 2011                       | 9                                                                                                                                                                       | 6                    |
| 2012                       | 4                                                                                                                                                                       | 2                    |
| 2013                       | 10                                                                                                                                                                      | 9                    |
| 2014                       | 24                                                                                                                                                                      | 20                   |
| 2015                       | 22                                                                                                                                                                      | 23                   |
| 2016                       | 30                                                                                                                                                                      | 41                   |
| 2017                       | 36                                                                                                                                                                      | 55                   |
| 2018                       | 54                                                                                                                                                                      | 58                   |
| 2019                       | 37                                                                                                                                                                      | 29                   |
| Total                      | 242                                                                                                                                                                     | 254                  |

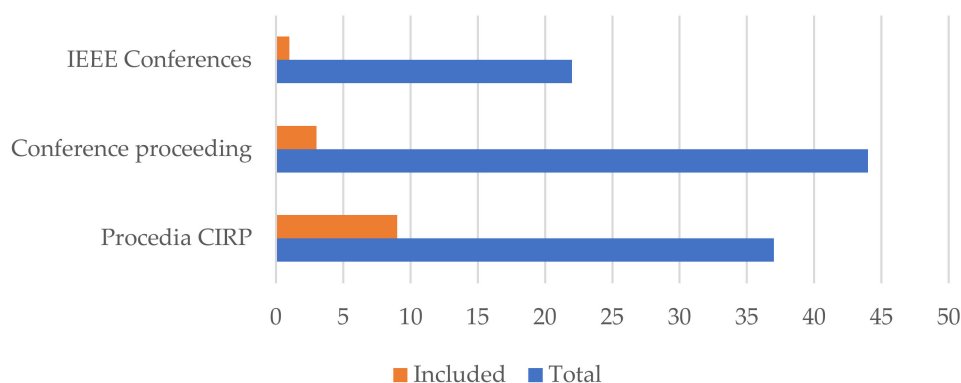
After the first review of 496 documents, duplicate removal led to a total of 348 documents, which were split into conference papers (103 documents) and academic journal papers (245). All documents were analyzed following the predefined standard according to year, keywords, and relevance to this research in Steps 5. Those steps are consistent with our decision criteria to only include peer-reviewed journal papers and highly relevant conference papers. In Step 5, based on relevance to the research subject, the total number was first shortlisted to 178 documents, which became the base of this study. Subsequently, a final review was made in Step 6 to identify the most relevant documents (46 articles in 23 scientific journals and 13 conference papers in eight different conference proceedings). The aim was to identify all possible constructs related to servitization challenges (challenges or barriers) and drivers (drivers, enablers, and facilitators) and their relevant indicators.

Interestingly, the research discourse about challenges/drivers in servitization appears to be scattered across journals belonging to research fields other than service studies, which could be understood as the focus study field of servitization. Among those other fields, we can find, at least, the following: strategy, marketing, production, supply chain, sustainability, and technology. Regarding the article distribution per journal, *Industrial Marketing Management* and *International Journal of Production Economics* are the leading sources of published articles related to servitization, with six and five papers included in the final sample, respectively. This distribution can be seen in Figure 2, which highlights the selected set of included articles per journal.

To avoid distorting Figure 2 by including numerous conference proceedings (which compile a large number of publications with the most recent research results), we have decided to condense these in Figure 3. Given the wide range of conference names (Proceedings IEEE International Conference on Big Data; Proceedings of Spring Servitization Conference; Proceedings of the European Conference on Innovation and Entrepreneurship, ECIE; ICIS: Transforming Society With Digital Innovation; Spring Servitization Conference, among others), these have been homogenized and consolidated under a common name, such as Conference proceeding, Procedia CIRP, or IEEE conferences, to facilitate their visualization.



**Figure 2.** Distribution of research articles by journal.



**Figure 3.** Distribution of research articles by conference.

As can be seen from Figures 2 and 3, the discussion around the topic has increased over time and covers a wide range of topics, which is attested by the large variety of academic publications and conference proceedings in the area.

### 3. Results

Although there is a common consensus that “drivers are factors which have a positive influence, [while] barriers are factors which have a negative influence” [70], our findings from the search string show that the terms have been largely used interchangeably in servitization and without clarifying its notion. We opted to select “challenges” and “drivers”, as these two terms embrace the broader scope of the definitions. On one hand, challenges are defined as “general hurdles and difficulties in achieving the objective of becoming more service-oriented and having an extended service offering” [71]. On the other hand, drivers are stated as “a condition, strategy, or decision that allows subsequent conditions or decisions to occur” [72].

The 59 selected documents (46 journal articles and 13 conference papers) were descriptively analyzed to classify the identified challenges and drivers, determining that there is not an exact classification as each author based their findings on their research area of expertise.

A large number of challenges and drivers have been identified, so we have translated the proposed categorization by Stoneman [73] to servitization. The multi-cited work by Stoneman, [73] cited in 67 academic documents and [74] cited in 330 academic documents, is considered a cornerstone in conceptualizing drivers and challenges under hard and soft classification. This categorization considers the innovation types as soft (non-functional innovations) and hard (change product function and/or production methods), based on the distinction of soft/hard heuristics applied by Nye [75]. Additionally, de Jesus and Mendonça [76] argued that, in this context, “hard [innovation] power refers to the ability to force change (through technical or economic means) while soft [innovation] power is associated with the ability to bring about change by attracting others through values and institutional practices that shape their attitudes and preferences.” Researchers have already looked at servitization with internal and external as independent factors [77,78]. We opted to look at the same issue through a new lens: the hard and soft approaches. To the best of our knowledge, this is a novel approach. It is possible that a more holistic and transverse view of servitization can be depicted.

Therefore, we adopted this classification to organize the identified challenges and drivers by proposing a simple matrix that compiles these classifications into two main categories: hard and soft. Within each category, the following inner classification is proposed, in accordance with a number of authors:

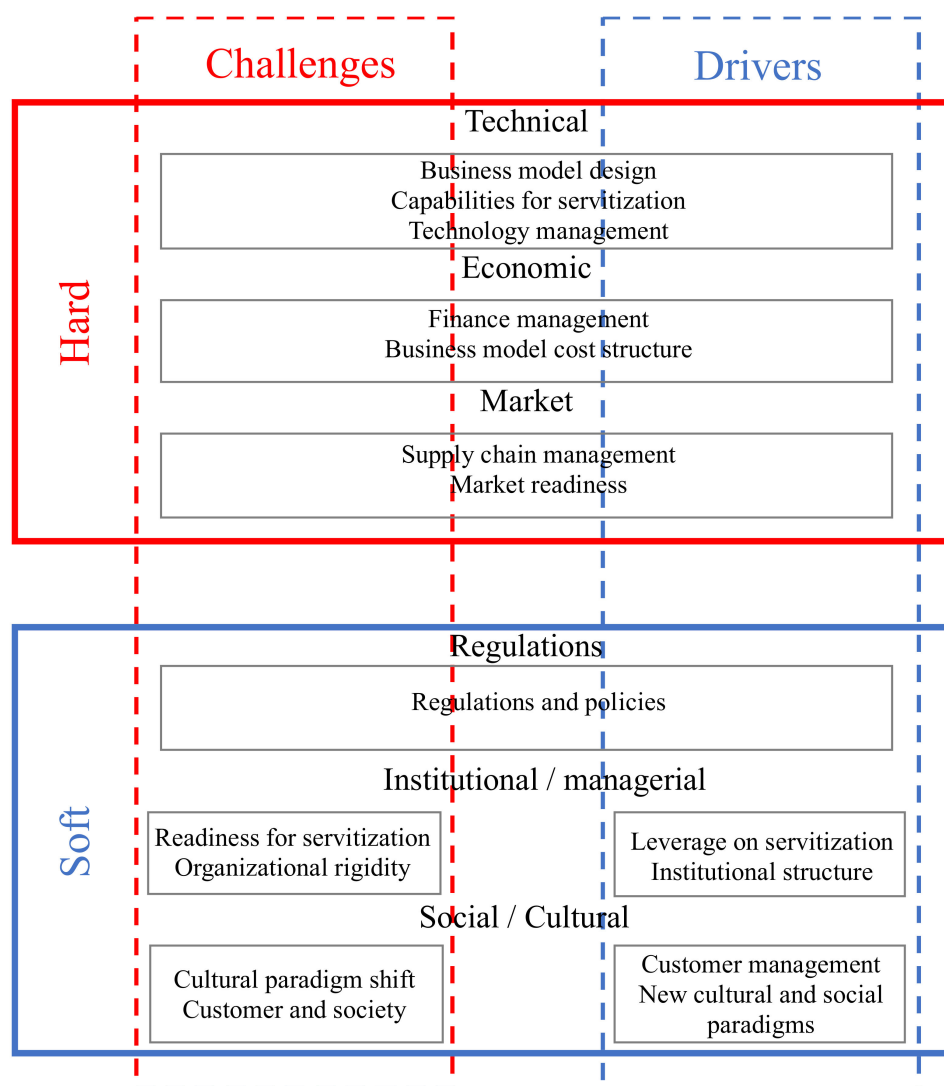
- Hard
  - Technical [79,80]
  - Economic [81,82]
  - Market [83,84]
- Soft
  - Institutional/Management [85–87]
  - Regulatory [88–90]
  - Social and cultural [76,82,83,91]

Based on this classification, each of the two categories consolidated the challenges (challenges and barriers) and drivers (driver, enabler, and facilitator) into hard challenge, soft challenge, hard drivers, and soft drivers. This proposed framework is presented, in a simplified version, in Figure 4.

As Figure 4 shows, in terms of hard factors classification, the same terms can be used for both challenges and drivers. Contrarily, soft challenges/drivers appear to be more dissimilar, although their initial classification is the same.

### 3.1. Clustering and Classification

As mentioned, one of the key issues we have encountered during the literature review and classification of the different challenges and drivers is that there is a huge lack of standardization on the terms, as many papers refer to similar terms or subcategories with different names (for example, coordination among interdependent actors, coordination and cooperation from different actors, or supplier integration, to refer to supply chain collaboration/cooperation). Therefore, our findings determined that many of the terms most commonly used in the literature to name the different challenges are drivers. Lastly, it is worth mentioning that the total number of identified terms that fall under the “challenge” category (106 hard and 81 soft, a total of 187) is larger than the total number of identified terms related to the “driver” category (82 hard and 64 soft, 146 terms in total).



**Figure 4.** General classification framework of challenges and drivers.

For the classification, each subcategory was proposed based on similar characteristics of the challenge/driver per paper identification. While it was possible to observe that some of these challenges/drivers were transversal to multiple areas, they were clustered into the one that, according to the best of our knowledge and based on suggestions in the literature, best fits the proposed matrix (Figure 4).

The following sections present definitions to provide clarity on the categories and how we have reached this classification. It is worth noting that some of the subcategories or specific challenges/drivers fall into both classifications because of their specific nature as a challenge and a driver at the same time. In the next subsections, challenges/drivers are categorized into hard and soft.

### 3.1.1. Hard Challenges and Hard Drivers

We have classified hard challenges and drivers into three main categories: technical, economic, and market (Figure 4, upper red segment). Within technical issues, we identified three subcategories: (1) business model design, (2) capabilities for servitization, and (3) technology management.

For the business model design, we followed the definition presented by Teece, which intends to “create value for customers by integrating the effective planning and structuration process for a business strategy to create a product or service (product design, service

design and/or product-service design), with a specific objective” [92]. In addition, it is important to recognize the impact of business model design in creating a new business model [93,94]. Among our findings, we discovered in the literature that the shift from selling products to providing services involves relevant changes not only in product design, but also in the services bundle that either come along with the product or substitute it and, most importantly, in the value proposition offered by the company (the core of its business model). Therefore, the re-design of the service/product involves a major challenge for most firms, as it must consider operational risks, customization of product/service, scalability, and sourcing, among other issues. However, this redesign can also be considered an opportunity for the firm and, therefore, a driver for change towards a function-based business model: the new design of the service/product could be used to prolong the life-cycle, improve functionality, infuse differentiation, and propose implementation guidelines for services, among other things.

Capabilities for servitization are defined as “the assets, attributes or abilities that are required for the successful provision of the servitization” [95]. It is important to highlight that the capability per se is not a solution for a problem, but requires additional features to address customer needs [96]. In the case of challenges, for example, resource utilization is a key challenge as it directly impacts the product/service manufacturing, considering additional assets and its innovation availability. As per the driver’s area, resource utilization can be related to the optimization of available resources (that is, facilities, personnel, materials) to reduce machine downtime.

Technology management follows the definition by Baden-Fuller and Haefliger [97] as “planning, execution, monitoring and control of technological products or systems, aiming to satisfy a specific goal”. In our findings we propose information and communication technologies (ICT) as an example of a challenge, because the increasing number of interconnected devices impacts the amount of available data. We also present ICT as a driver considering that real-time data, through interconnected devices (including Internet of Things) could potentiate and optimize the data-driven decision-making process. Servitization is enabled by ICT and digital platforms: both digitalization and servitization are strongly interlinked. It is also important to note that just as the type and amount of accompanying services depend on the core product [98], the same rule of thumb will apply when talking about digitalized services around a digital product [99].

Economic issues include (1) financial management and (2) changes in the cost structure. For financial management, we stick to the definition by Behzadian et al. [100] as “all the stages from planning to controlling of different financial activities that utilize financial resources aiming to a specific goal”. We found different challenges linked to financial resources management when shifting towards a servitized business model, such as financial vulnerability due to revenue uncertainty, investment risks, and low profits. On the other hand, reduced volatility in servitized business models is one of the drivers or levers that lead firms towards a function-based value proposition. Companies that have shifted from selling products to delivering services benefit from stable income, risk pooling, contract negotiation, and profitable service/product transformation.

On business model cost structure, we refer to “all the different costs and expenses (foreseen and unexpected, fixed, and variable) aiming to meet some financial targets to make a business model work properly” [101]. The new costing mechanism in the servitized business model can be a challenge as it should consider different cost structures, unexpected costs, financial targets, insurances, and other practices based on a product-centric business model. At the same time, the new cost structure can also be a driver, as an improved total cost is expected by considering cost reduction (such as stock, material, energy, directly linked to resource efficiency and environmental sustainability), higher profit margins, and a total cost for ownership vs. cost for the use of the product/service.

The final building block refers to market issues, including (1) supply chain management and (2) market readiness. Supply chain management is defined as “the administration of all logistic operations, carried by different actors along the value (supply) chain, aiming

to deliver a good or service, including all processes from raw material extraction, processing and transformation, to the delivery and waste management" [102]. Some of the key challenges that have been identified in the servitization process are sourcing decision, partnership, and competitors, supply chain disruptions, and information sharing along the supply chain. Supply chain factors can also play a role as drivers for servitization; for instance, the need for coordination along the supply chain, the inclusion of extended producer responsibility (EPR) policies in the supply chain, or the need for higher levels of supply chain visibility.

Market readiness is the "analysis made by a company to ensure that a product or service is ready to meet market needs and should be deployed" [103]. Challenges for servitization include market acceptance of the proposed product/service considering the predominant product-centric logic, pricing, lag between design and implementation, and even product-service cannibalization. On the other hand, drivers consider a market expansion through a broader service portfolio by bundling products and services, considering the different characteristics of the service/product, generating a differentiation instrument, and even rethinking the maintenance, repair, and overhaul (MRO) processes to align with the business model proposition.

As a final remark on hard challenges/drivers, it should be highlighted that they can hardly be discussed in terms of the classical view of external (acting from the environment) and internal (depending on own company's characteristics) factors. In fact, the seven factors have to do with activities such as planning, executing, or monitoring, which would speak to the companies' internal factors. At the same time, however, model business design, technology management, financial management, supply chain management, and market readiness need to be fed with information taken from outside the company, which allows for identification with external factors. In other words, in hard challenges/drivers both external and internal factors can be found.

### 3.1.2. Soft Challenges and Soft Drivers

In terms of soft issues, we have classified challenges and drivers into three more main categories: regulations, institutional/managerial issues, and social/cultural issues (Figure 4, lower blue segment).

Regulations indicate the different "internal policies within [the company] and the external regulations to comply" [104], to ensure that the servitization provision is properly made and meets all the requirements by the country or industry standards. For example, some challenges to servitization are related to digital regulations, privacy concerns, safety policies, among others. On the other hand, in terms of drivers, there is an opportunity to propose new policies to be in an advantageous position when facing current and upcoming regulations (online, economic, environmental, supply chain, etc.), setting new industry standards (improving waste management directives, proposing regulations in product life-cycle, etc.). In general terms, environmental regulations constitute a driver for servitization.

We now move into the second category, which includes institutional/managerial challenges, such as (1) lack of readiness for servitization or (2) organizational rigidity, as well as institutional/managerial drivers such as (3) the opportunities brought about by function-based business models (leverage on servitization) and (4) institutional structures that favor organizational innovation.

The lack of readiness for servitization follows the idea proposed by Teso and Walters [105] and refers to the challenges related to the (lack of the) required soft skills necessary in the organization for a satisfactory provision of servitization. This includes, but is not limited to, employee skills and training, information sharing, expertise, and shifting from centralized to decentralized work structures.

Organizational rigidity poses a challenge "related to reluctance to change due to the lack of information or development of a culture that fits external trends and changes" [106]. Some examples are deficient institutional framework, lack of vertical and horizontal integration, lack of inter-department collaboration, internal resistance to servitization, or even the

absence of performance measurement metrics. Servitization activity cannot be attributed to a single department within a company. As highlighted by Jovanovic [107]: [108]) in the view of “silos” inside the company, a successful shift from selling products to selling services can only be undertaken as a collective effort that goes above and beyond the responsibilities of a single department.

On the other hand, organizational factors can also foster the transition towards a service-centric business model (drivers). In servitization, leverage denotes the “set of benefits that any current system or business model could obtain if value-added services are included” [109] as part of the equation (that is, XaaS in general—IaaS, PaaS, SaaS). This increases partnership opportunities, marketing opportunities, brand positioning, and higher employment opportunities, among other things.

Flexible institutional structures that are oriented towards innovation help to reap “the benefits associated with changes to the organizational chart and their impact on the traditional relationships” [110] and facilitate the transition by decentralizing traditional teams and engaging team members in interdisciplinary collaboration, promoting vertical and horizontal integration, leading to better decision-making processes, providing internal consistency and alignment with external needs.

The third category encompasses social/cultural factors, including challenges, such as the (1) the cultural paradigm shift needed in the transition from owning products to receiving services and (2) the need to develop a new relationship with customers; and also drivers, such as (3) new approaches to customer management and (4) new cultural and social values.

One of the challenges to servitization is the cultural paradigm shift required. Firms and their surrounding society need to “move away from the old ways on which the company has traditionally made its decisions and based its goals, towards a different approach more consistent with current needs” [111]. From inside the firm, this cultural paradigm shift ranges from silos working towards inter-department collaboration, and changing traditional business routines, and is strongly linked to the challenges mentioned in the category of institutional/managerial issues. Outside the firm, this cultural paradigm shift means changing transactional behavior towards a service behavior, considering factors such as a change in product ownership or minimum order quantity.

This cultural paradigm shift also involves changing the approach to customer management, which discusses the process of “successfully managing the relationship between a company and its customer and social environment over a period of time” [112]. This includes customer relationship and engagement, satisfaction, willingness to engage, and how the company is meeting its needs. In function-based business models, the customer relationship is not merely transactional but much more profound and long-term, and becomes closer to a partnership. This involves changes in the commercial approach of the firm, in contract management and also changes in the procurement processes on the customer side.

However, this new approach to customer management can also be considered a driver of servitization, based on the shift from a traditional product-centric business model towards a customer-centric business model, integrating the customer in decision-making process, generating more value for the company as it becomes not only a user of a product, but also a “freelance” promoter (if satisfied with the company’s product and/or service) due to its position as part of different collectives or social constructs.

In the same vein, new cultural and social paradigms are also fostering service-centric business models. We refer to “current and future trends that impact the way that on which the company and society interact through the offered product/service”, following the propositions presented by Strehovec [113] regarding new social paradigms, and cultural paradigm by Zheng and Zhong [114] and Afrooz et al. [115]. Some of these paradigms are related to the circular economy and the prolonged life-cycle of products, customer willingness to pay for access and not ownership of a product, different layers of awareness

(digital, social, green, well-being, etc.), and the impact of the product and/or service in daily life, such as increasing local jobs due to localization.

Lastly, it should be noted that both external and internal factors appear to have an effect on the set of identified soft drivers.

### 3.2. Intensity Map of the Identified Factors

Table 2 summarizes the classification of hard and soft challenges and Table 3 does the same for hard and soft drivers with the corresponding paper in which at least one of them has been identified. We propose a simple metric to measure the intensity of identification from the literature, classifying this intensity into four main categories: null/no identified (blank); weak, or fewer than three factors identified (+); medium, or between three and six factors identified (++); and strong, for more than six factors identified (+++). To ease the interpretation of the heat map, we have assigned colors to the intensity being the darker colors the stronger intensity (+++) and the lighter colors the weaker intensity (+). In addition, to differentiate from hard and soft, we have assigned red for hard (challenges and drivers) and blue for soft (challenges and drivers).

Following the intensity of classification presented in Tables 2 and 3, we found that only nine papers fall into the category of strong intensity classification, overwhelmingly inclined to challenges. Eight papers were identified with strong intensity for challenges, as presented in Table 2, categorized as soft and hard as follows: de Jesus Pacheco et al. [116] and Lütjen et al. [117] on the technical category (hard challenge), Cinquini and Tenucci [118] on the economic (hard challenge), Schüritz et al. [71], Andrews et al. [119], and Rabetino et al. [120] on the institutional/managerial category (soft challenge), and Zhang and Banerji [59] and Hou and Neely [121] on the social/cultural category (soft challenge). From the driver perspective presented in Table 3, only one paper was identified with strong intensity: Zheng et al. [122] under the technical category (hard driver).

An intensity measure has been obtained for each paper in the sample. The intensity ranges between 0 and 3 for each of the 12 presented factors, and an average is calculated for hard challenges/drivers, soft challenges/drivers, and the complete set of factors. The obtained averaged measures for the sample are presented in Table 4.

**Table 2.** Intensity of identification per literature classification for hard and soft challenges.

| REF.  | Author(s)                             | Hard Challenges |          |        | Soft Challenges          |            |                 |
|-------|---------------------------------------|-----------------|----------|--------|--------------------------|------------|-----------------|
|       |                                       | Technical       | Economic | Market | Institutional/Managerial | Regulatory | Social/Cultural |
| [19]  | Baines, et al. (2009)                 | +               |          | +      | +                        |            | +               |
| [34]  | Reim, Sjödin, & Parida (2019)         | +               | ++       | +      | +                        | +          | +               |
| [36]  | Spring & Araujo (2017)                | +               | +        | +      | +                        |            | +               |
| [44]  | Martinez, et al. (2017)               | +               |          |        | +                        |            |                 |
| [57]  | Calabrese, et al. (2019)              | +               | +        |        | +                        |            | +               |
| [58]  | Hou & Neely (2013)                    | +               | ++       | +      | +                        | +          | +               |
| [59]  | Zhang & Banerji (2017)                | ++              | ++       | +      | ++                       |            | +++             |
| [60]  | Marcon, et al. (2019)                 | ++              | ++       | +      | ++                       | +          | +               |
| [64]  | Kowalkowski, et al. (2015)            |                 | +        | +      | +                        | +          |                 |
| [68]  | Baines, et al. (2017)                 | +               |          | +      | +                        |            | +               |
| [71]  | Schüritz, et al. (2017)               | ++              | +        | ++     | +++                      |            | ++              |
| [76]  | de Jesus & Medonça (2018)             | +               |          | +      | +                        | +          | ++              |
| [77]  | Alghisi & Saccani (2015)              | ++              | +        | +      | +                        |            | +               |
| [107] | Jovanovic, Engwall, & Jerbrant (2016) | +               | +        | +      | +                        |            | +               |
| [116] | de Jesus Pacheco, et al. (2019)       | +++             | +        | +      | ++                       | +          | ++              |
| [117] | Lütjen, Tietze, & Schultz (2017)      | +++             | ++       | ++     | +                        |            | +               |
| [118] | Cinquini & Tenucci (2016)             | +               | +++      | ++     | +                        |            | +               |
| [119] | Andrews, et al. (2018)                | +               | +        |        | +++                      |            | ++              |
| [120] | Rabetino, Kohtamäki, & Gebauer (2017) | +               | +        | +      | +++                      |            | ++              |
| [121] | Hou & Neely (2018)                    | +               | ++       | ++     | ++                       |            | +++             |
| [122] | Zheng, et al. (2019)                  | ++              |          |        |                          | +          | +               |
| [123] | Ostrom, et al. (2015)                 | +               |          | +      | +                        |            | +               |
| [124] | Martinez, et al. (2010)               | +               | +        | +      | ++                       |            | +               |
| [125] | Crozet & Milet (2017)                 |                 |          |        | +                        |            |                 |
| [126] | Kaňovská & Tomášková (2018)           | +               |          |        |                          |            |                 |
| [127] | Lienert, et al. (2019)                | ++              | +        | +      | +                        |            |                 |
| [128] | Klein, Biehl, & Friedli (2018)        | ++              | +        | +      | ++                       | +          | ++              |
| [129] | Taipale-Eräväla & Muhos (2018)        | +               | ++       | +      | ++                       |            | ++              |

Table 2. Cont.

| REF.  | Author(s)                                     | Hard Challenges |          |        | Soft Challenges          |            |                 |
|-------|-----------------------------------------------|-----------------|----------|--------|--------------------------|------------|-----------------|
|       |                                               | Technical       | Economic | Market | Institutional/Managerial | Regulatory | Social/Cultural |
| [130] | Raja & Frandsen (2017)                        | +               | +        | +      | +                        | +          | +               |
| [131] | Niño, Blanco, & Illarramendi (2015)           | +               | +        | +      | +                        |            | +               |
| [132] | Elfving, et al. (2014)                        | +               |          |        | +                        |            | +               |
| [133] | Forkmann, et al. (2017)                       | +               |          | +      |                          |            | +               |
| [134] | Coreynen, Matthyssens, & Van Bockhaven (2017) | ++              | +        | +      | +                        | +          | +               |
| [135] | Kowalkowski, et al. (2017)                    | +               | +        | +      | +                        |            | +               |
| [136] | Eloranta & Turunen (2016)                     | +               | +        | +      | +                        |            | +               |
| [137] | Ren, et al. (2019)                            | ++              | +        | +      |                          | +          | +               |
| [138] | Peillon & Dubruc (2019)                       | ++              | +        |        | ++                       | +          | ++              |
| [139] | Diaz & Trentesaux (2019)                      | +               | +        | +      | +                        |            | +               |
| [140] | Lenka, et al. (2018)                          | +               | +        | +      | ++                       |            | +               |
| [141] | Crowley, Burton, & Zolkiewski (2018)          | +               | +        | +      | ++                       | +          | +               |
| [142] | Matschewsky, Kambanou, & Sakao (2018)         | ++              | +        | +      | +                        |            | +               |
| [143] | Grubic & Jennions (2018)                      | ++              | +        |        | +                        |            | +               |
| [144] | Ziaee Bigdeli, et al. (2018)                  |                 | ++       | +      | ++                       |            | +               |
| [145] | Oláh, et al. (2018)                           | +               | +        | ++     |                          | +          | +               |
| [146] | Green, Davies, & Ng (2017)                    | +               | +        | +      | +                        |            |                 |
| [147] | Pereira, Turnes, & Vence (2017)               | +               | +        |        | +                        | +          | +               |
| [148] | Gonçalves, Mendes, & de Oliveira (2017)       | ++              | ++       | ++     | +                        |            | +               |
| [149] | Burton, et al. (2017)                         | +               | +        | +      | ++                       | +          | +               |
| [150] | Smith & Wuest (2017)                          |                 |          | +      |                          |            | +               |
| [151] | Wiesner, Marilungo, & Thoben (2017)           | ++              | +        | +      | +                        |            | +               |
| [152] | Nudurupati, Lascelles, & Wright (2016)        | ++              | ++       | +      | +                        |            | +               |
| [153] | Paslauskis, et al. (2016)                     | +               |          | +      | +                        |            | +               |
| [154] | Battaglia, Borchardt, & Patrício (2016)       | +               |          | +      | ++                       |            | +               |
| [155] | Helms (2016)                                  | +               | +        | +      | ++                       | +          | ++              |
| [156] | Buschmeyer, Schuh, & Wentzel (2016)           | +               |          |        | +                        |            |                 |
| [157] | Löfberg, Witell, & Gustafsson (2015)          | +               | +        | +      | +                        |            | +               |
| [158] | Confente, Buratti, & Russo (2015)             | +               | +        | ++     | +                        |            | ++              |
| [159] | Vasantha, Roy, & Corney (2014)                | +               | +        | ++     | +                        |            | +               |
| [160] | Maiwald, Wieseke, & Everhartz (2014)          | +               | ++       | +      | ++                       |            | +               |

Table 3. Intensity of identification per literature classification for hard and soft drivers.

| REF.  | Author(s)                             | Hard Drivers |          |        | Soft Drivers             |            |                 |
|-------|---------------------------------------|--------------|----------|--------|--------------------------|------------|-----------------|
|       |                                       | Technical    | Economic | Market | Institutional/Managerial | Regulatory | Social/Cultural |
| [19]  | Baines, et al. (2009)                 | +            | +        | +      | +                        |            | +               |
| [34]  | Reim, Sjödin, & Parida (2019)         | +            |          | +      | +                        |            | +               |
| [36]  | Spring & Araujo (2017)                | +            | +        | +      |                          | +          | +               |
| [44]  | Martinez, et al. (2017)               | +            | +        | +      | +                        | +          | +               |
| [57]  | Calabrese, et al. (2019)              |              |          |        |                          |            |                 |
| [58]  | Hou & Neely (2013)                    |              |          |        |                          |            |                 |
| [59]  | Zhang & Banerji (2017)                |              |          |        |                          |            |                 |
| [60]  | Marcon, et al. (2019)                 |              |          |        |                          |            |                 |
| [64]  | Kowalkowski, et al. (2015)            | +            | +        | +      | +                        |            |                 |
| [68]  | Baines, et al. (2017)                 |              |          | +      |                          |            | +               |
| [71]  | Schüritz, et al. (2017)               | +            | +        | +      | +                        |            | +               |
| [76]  | de Jesus & Medonça (2018)             | +            | +        | +      |                          | +          | +               |
| [77]  | Alghisi & Saccani (2015)              | +            |          | +      | +                        |            | +               |
| [107] | Jovanovic, Engwall, & Jerbrant (2016) | +            | +        | +      | +                        |            | +               |
| [116] | de Jesus Pacheco, et al. (2019)       | ++           | ++       | +      | ++                       | +          | ++              |
| [117] | Lütjen, Tietze, & Schultz (2017)      | +            |          |        | +                        |            | +               |
| [118] | Cinquini & Tenucci (2016)             | +            | +        |        |                          |            | +               |
| [119] | Andrews, et al. (2018)                | +            | +        |        | +                        | +          | ++              |
| [120] | Rabetino, Kohtamäki, & Gebauer (2017) | ++           | +        | +      | +                        |            | +               |
| [121] | Hou & Neely (2018)                    |              |          |        |                          |            |                 |
| [122] | Zheng, et al. (2019)                  | +++          |          | +      |                          | +          | +               |
| [123] | Ostrom, et al. (2015)                 | +            |          | +      | +                        |            | ++              |
| [124] | Martinez, et al. (2010)               | +            |          | +      |                          |            |                 |
| [125] | Crozet & Milet (2017)                 |              | +        | +      | +                        |            |                 |
| [126] | Kaňovská & Tomášková (2018)           | ++           | ++       | +      | +                        | +          | +               |
| [127] | Lienert, et al. (2019)                |              |          |        |                          |            |                 |
| [128] | Klein, Biehl, & Friedli (2018)        |              |          |        |                          |            |                 |
| [129] | Taipale-Eräväla & Muhos (2018)        |              |          |        |                          |            |                 |
| [130] | Raja & Frandsen (2017)                |              |          |        |                          |            |                 |
| [131] | Niño, Blanco, & Illarramendi (2015)   |              |          |        |                          |            |                 |
| [132] | Elfving, et al. (2014)                |              |          |        | +                        |            |                 |
| [133] | Forkmann, et al. (2017)               | +            |          | +      |                          |            | +               |

Table 3. Cont.

| REF.  | Author(s)                                     | Hard Drivers |          |        | Soft Drivers             |            |                 |
|-------|-----------------------------------------------|--------------|----------|--------|--------------------------|------------|-----------------|
|       |                                               | Technical    | Economic | Market | Institutional/Managerial | Regulatory | Social/Cultural |
| [134] | Coreynen, Matthyssens, & Van Bockhaven (2017) | +            | +        | +      |                          |            | +               |
| [135] | Kowalkowski, et al. (2017)                    | ++           | +        | +      | +                        |            | +               |
| [136] | Eloranta & Turunen (2016)                     | +            | +        | +      | +                        |            | ++              |
| [137] | Ren, et al. (2019)                            | +            | +        | +      | +                        | +          | +               |
| [138] | Peillon & Dubruc (2019)                       | +            |          | +      |                          |            | +               |
| [139] | Diaz & Trentesaux (2019)                      | +            | +        | +      | +                        | +          |                 |
| [140] | Lenka, et al. (2018)                          | +            | +        | +      | +                        | +          |                 |
| [141] | Crowley, Burton, & Zolkiewski (2018)          | +            |          | +      | +                        |            | +               |
| [142] | Matschewsky, Kambanou, & Sakao (2018)         | +            | +        | +      | +                        |            | +               |
| [143] | Grubic & Jennions (2018)                      | +            | +        |        | +                        |            | +               |
| [144] | Ziaee Bigdeli, et al. (2018)                  | +            | +        | +      | +                        | +          | +               |
| [145] | Oláh, et al. (2018)                           |              | +        | +      |                          |            | +               |
| [146] | Green, Davies, & Ng (2017)                    | ++           |          | ++     | +                        |            | +               |
| [147] | Pereira, Turnes, & Vence (2017)               | +            |          |        | +                        | +          | +               |
| [148] | Gonçalves, Mendes, & de Oliveira (2017)       | +            | ++       | ++     | ++                       |            | +               |
| [149] | Burton, et al. (2017)                         | +            | +        |        | +                        |            | +               |
| [150] | Smith & Wuest (2017)                          | ++           | +        | +      |                          | +          | +               |
| [151] | Wiesner, Marilungo, & Thoben (2017)           | +            |          | +      |                          |            | +               |
| [152] | Nudurupati, Lascelles, & Wright (2016)        |              | +        | +      |                          |            | +               |
| [153] | Paslauskis, et al. (2016)                     | +            |          | +      |                          |            | +               |
| [154] | Battaglia, Borchardt, & Patricio (2016)       | ++           | +        | +      | +                        |            | +               |
| [155] | Helms (2016)                                  | +            | ++       | +      | ++                       | +          | +               |
| [156] | Buschmeyer, Schuh, & Wentzel (2016)           | +            |          | +      | ++                       |            | +               |
| [157] | Löfberg, Witell, & Gustafsson (2015)          | +            | +        | +      | +                        |            | +               |
| [158] | Confente, Buratti, & Russo (2015)             | +            | +        | +      | +                        |            | +               |
| [159] | Vasanth, Roy, & Corney (2014)                 | +            |          | +      |                          |            | +               |
| [160] | Maiwald, Wieseke, & Everhartz (2014)          |              |          | +      |                          | +          | +               |

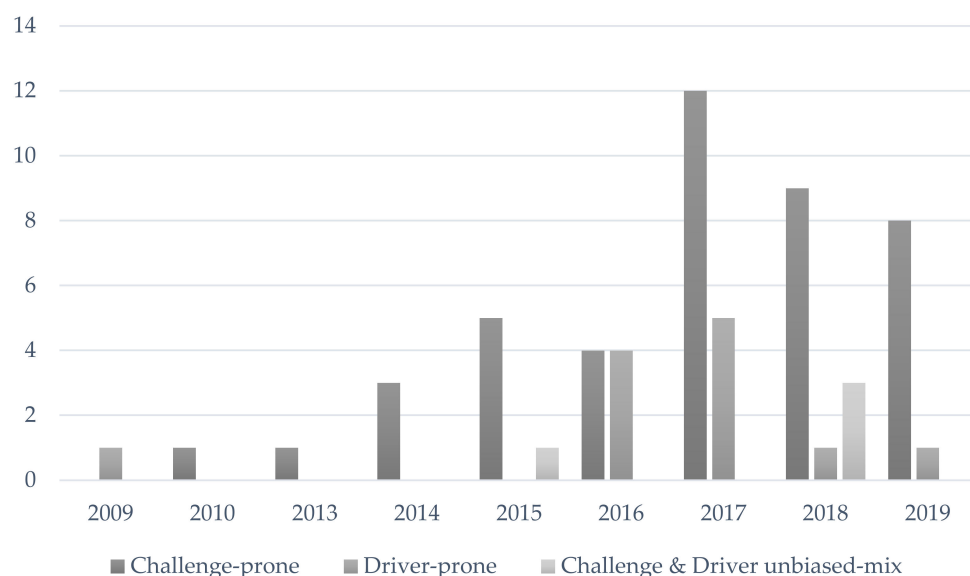
Table 4. Average measures for the sample.

|                                         |       |                                         |       |
|-----------------------------------------|-------|-----------------------------------------|-------|
| Hard challenges                         | 1.062 | Soft challenges                         | 0.881 |
| Std. dev. hard challenges               | 0.457 | Std. dev. soft challenges               | 0.420 |
| Hard drivers                            | 0.740 | Soft drivers                            | 0.559 |
| Std. dev. hard drivers                  | 0.468 | Std. dev. soft drivers                  | 0.381 |
| Averaged number hard challenges/drivers | 0.901 | Averaged number soft challenges/drivers | 0.720 |

Strong intensity of identification was evident in technical (challenges and drivers) and institutional or managerial (challenges) categories. Medium and weak intensity were associated with most of the other factors, which speaks to an averaged medium to low intensity of hard and soft challenges/drivers in each paper in the sample. That is, most of the papers only focus on a limited number of challenges/drivers. This result shows the lack of a comprehensive overview on the challenges and drivers of servitization, and supports the framework put forward in this paper as a value-added result for the scientific community and for managerial and policy-making practice.

As can be seen in Figure 5, it should be emphasized that challenge-prone literature has grown continuously since 2010 and it outnumbered the driver-prone literature during that time. Nevertheless, it is necessary to mention that driver-prone literature was introduced earlier than challenge-prone literature, in 2009, but had no further development until 2016. Additionally, it is interesting to note that challenge and driver unbiased-mix literature first appeared in 2015 and has shown a steady increase in publications since 2018.

It is noteworthy that challenge-prone papers account for 2898 citations (53 percent) of the total citations, which indicates that academia has greater interest in the challenges than the drivers. driver-prone papers account for 2171 citations (39 percent) of the total citations, challenge and driver unbiased-mix account for 456 citations (8 percent) of the total citations. However, it is necessary to point out that the most-cited paper in the sample, [19], falls into the driver-prone group, with 1628 citations representing 29 percent of the total citations; this could explain why the literature is later focused on determining challenges rather than drivers.

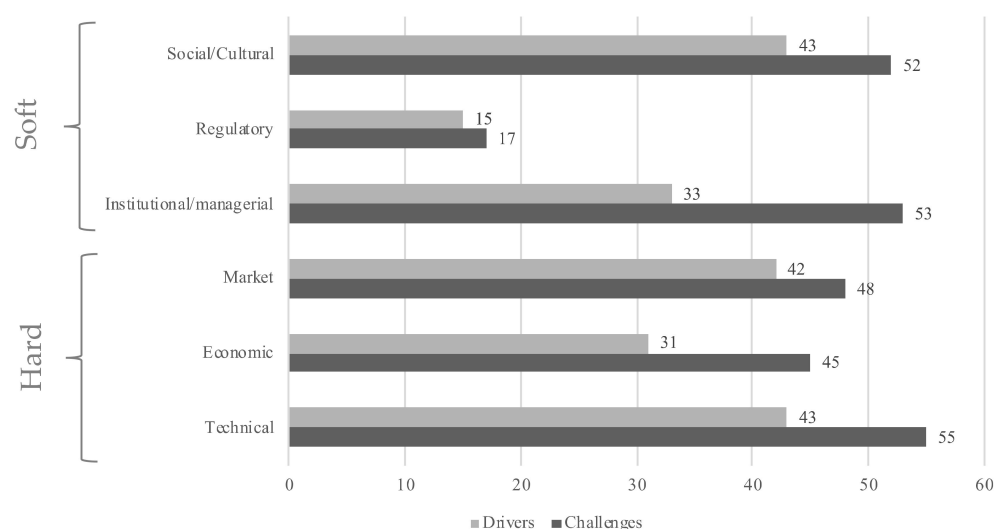


**Figure 5.** Number of publications per year under challenge-prone, driver-prone and challenge, and Driver unbiased-mix.

Among the challenge-prone papers, Ostrom et al. [123] and Martinez et al. [124] represent 1497 citations, which corresponds to 27 percent of the total citations, which is roughly the same percentage as Baines et al. [19]. It is also interesting to note that the first published paper of the challenge-prone, Martinez et al. [124], is only the second-most-cited in the group, after Ostrom et al. [123].

#### 4. Discussion

In this section, we present further details about each of the subgroups and their inner components that made the categorization possible. We found that different papers were able to identify more challenges than drivers, and also found that hard characteristics (challenges and drivers) outnumbered soft characteristics (challenges and drivers), as described in the previous section. A comparison between the number of papers that identified challenges and drivers for each of the hard characteristics and soft characteristics is presented in Figure 6.



**Figure 6.** Number of papers identifying hard challenges/drivers and soft challenges/drivers.

Regarding hard challenges, it is worth noting that most of the papers focused their findings on technical and market challenges, while economic challenges received less attention. Only one paper, Crozet and Milet [125], failed to identify at least one hard challenge. Concerning soft challenges, papers have focused largely on institutional/managerial and social/cultural challenges, while regulatory challenges have received the least attention. Furthermore, one paper, Kaňovská and Tomášková [126], failed to identify at least one soft challenge.

In the case of the drivers, it was found that 10 papers did not identify either a hard driver or a soft driver [57–60,121,127–131]; that is, they focused exclusively on the challenges instead of looking for the levers or opportunities that servitization may also bring to firms and that could overcome those challenges. For hard drivers, most papers also focus their findings on technical and market drivers, while economic drivers (less financial volatility, reduced costs in function-based business models) have received less attention. A total of 11 papers failed to identify at least one hard driver (the aforementioned 10 papers and Elfving et al. [132]). With respect to soft drivers, papers have also largely focused on social/cultural and institutional/managerial issues, while regulatory aspects have received less attention. Twelve papers failed to identify at least one soft driver (the aforementioned 10 papers plus Martinez et al. [124] and Forkmann et al. [133]).

Both the average intensity measure and the clustering analysis presented suggest that a researcher or practitioner interested in challenges and drivers for servitization would be misled if he/she approached the topic with a limited sample of papers. That is to say, if two or three papers were selected randomly from our sample, it is most likely that the intensity measure of those papers would be well below the average we obtained for our sample. Therefore, it is likely that a poor image of the existing challenges/drivers would be obtained. To avoid this, the researcher/practitioner could refer to the present study. Should this paper not be found in the scientific search we have conducted, one could ask about the extent to which a good image can be obtained by exclusively reading the top 10 cited papers in our sample.

We found a total of 6369 citations (6207 for journal papers and 162 for conference papers) on Google Scholar (number of citations measured on October 20th, 2020) for the 59 academic documents used in this research. From this sample, the 10 most-cited articles (17 percent of academic work) were considered to cover 77 percent of the total citations (4906 citations), which is consistent with Pareto's Principle of Unequal Distribution [161]. The averaged intensity measure for these 10 papers is 0.741. The complete list of top-cited papers is presented in Table 5.

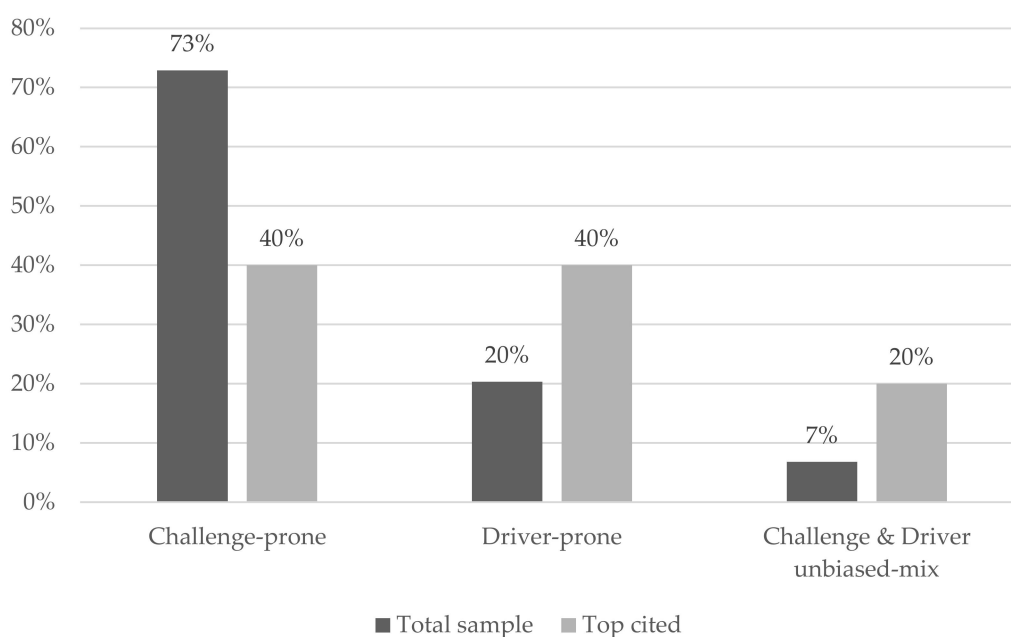
**Table 5.** Top 10 cited papers per Google Scholar citations.

| REF.  | Author(s)                                     | Title                                                                                                          |
|-------|-----------------------------------------------|----------------------------------------------------------------------------------------------------------------|
| [19]  | Baines, et al. (2009)                         | The servitization of manufacturing: A review of literature and reflection on future challenges                 |
| [64]  | Kowalkowski, et al. (2015)                    | What service transition? Rethinking established assumptions about manufacturers' service-led growth strategies |
| [68]  | Baines, et al. (2017)                         | Servitization: revisiting the state-of-the-art and research priorities                                         |
| [76]  | de Jesus & Medonça (2018)                     | Lost in transition? Drivers and barriers in the Eco-innovation road to the circular economy                    |
| [123] | Ostrom, et al. (2015)                         | Service Research Priorities in a Rapidly Changing Context                                                      |
| [124] | Martinez, et al. (2010)                       | Challenges in transforming manufacturing organizations into product-service providers                          |
| [125] | Crozet & Milet (2017)                         | Should everybody be in services? The effect of servitization on manufacturing firm performance                 |
| [135] | Coreynen, Matthyssens, & Van Bockhaven (2017) | Boosting servitization through digitization: Pathways and dynamic resource configurations for manufacturers    |
| [136] | Kowalkowski, et al. (2017)                    | Servitization and deservitization: Overview, concepts, and definitions                                         |
| [137] | Eloranta & Turunen (2016)                     | Platforms in service-driven manufacturing: Leveraging complexity by connecting, sharing, and integrating       |

Challenges account for 54 percent of the total factors determined by the top 10 articles (30 percent for hard challenges and 23 percent for soft challenges), meaning that these papers have mainly focused on the challenges area rather than the drivers (46 percent of the total factors). It is also worth noting that soft drivers are covered less by the papers (in general), accounting for only 17 percent of the total of factors for top-cited papers and 15 percent of the complete sample of papers.

From the literature perspective, it should be pointed out that the top papers were able to identify at least one factor (further subcategories) within the subcategories of each of the general categories for challenges and drivers. It is also worth noting that all of the top-cited papers identified one or more institutional/managerial challenges (soft challenge) as well as one or more market drivers (hard driver). It is also worth noting that the least discussed category was regulatory, which was discussed in only three papers for challenges and in one paper for drivers.

Among the top-cited papers, despite the total number of identified challenges (81) being higher than the total number of identified drivers (70), there is a balance in terms of the number of papers that are more biased towards the identification of challenges—challenge-prone [68,123,124,134], and biased toward the identification of drivers—driver-prone [19,125,135,136], with room for an additional group that is non-biased towards either side—challenge and driver unbiased mix [64,76], as evidenced in Figure 7.



**Figure 7.** Total papers vs. top-cited papers classified under challenge-prone, driver-prone, and challenge and driver unbiased-mix groups.

In addition, this is inconsistent with the general findings on the total sample of the literature review as 43 papers are challenge-prone (73% percent), 12 papers are driver-prone (20% percent), and only four authors are challenge and driver unbiased-mix (7 percent).

## 5. Conclusions

Global concern, from both researchers and public institutions, about global warming suggests a change in the paradigm of consumption. This change must lead towards generating less waste; that is, shifting from a linear to a circular use of resources. For this reason, the implementation of circular economy models is a critical element in achieving the SDGs. However, this design is not possible without relying on servitization, which is the underlying facilitator of the phenomenon. Therefore, it is of crucial importance to study the factors that hinder and foster this event. The present study addresses this through a systematic literature search focused on the challenges and drivers of servitization.

Literature around the servitization topic has increased since the term was first introduced by Vandermerwe and Rada [18]. It has evolved over the years to include not only the downstream relationships (customers), but also how companies are internally organized and their upstream relationships (stakeholders) along the whole supply chain.

The results of our study highlight the blurriness of the boundaries among commodities, services, goods, experiences, and their transformations that companies experience when trying to fulfill changing customer demands, as also observed by Schwab [162] and Seidman [163]. This means that some factors (such as integration along the supply chain management) can be both a challenge and a driver at the same time. For instance, we have gathered hard challenges and drivers under the same main categories, but, at the individual level, there are plenty of differences. To illustrate, technology is a challenge (technical) as it requires increased capabilities (market) and the updating of some skills (such as interfacing with multiple devices and platforms) (economic), but, at the same time, technology is a driver as it allows successful implementation of new business models (technical), as well as easing communication (market) and joint work among different actors (economic) regardless of geographic location (market). The same logic has been used to analyze and classify the rest of the challenges and drivers into their corresponding hard/soft categories.

It can be seen from the research conducted that servitization research has attracted interest from different research fields. This is derived from the variety of the journal typology comprised in the sample of our literature review, and the myriad different points of view they represent. Apart from the service business research, strategy, marketing, production, supply chain, sustainability, and technology are fields that are clearly linked to servitization and call for a multi-disciplinary and cross-functional approach when dealing with servitization issues.

We found that most of the academic work focuses on identifying challenges rather than recognizing the drivers related to servitization. The literature review shows that all 59 papers were able to identify at least one challenge, while only 49 acknowledged at least one driver.

Another far-reaching finding from our study is that challenges/drivers for servitization do not allow for a clear classification of external versus internal factors. This means that using business tools to analyze external or internal factors in a disaggregated manner will most likely miss the complex structure that we found for challenges/drivers. These findings can have different implications for academia and managers, as discussed in the following Sections 5.1 and 5.2.

### 5.1. Academic Implications

Our research presents a review of the different challenges and drivers that have been explored in the literature, proposing a simple classification matrix that intends to provide standardization on the terminology used in the servitization area.

We analyzed the focus of the papers based on the identified number of terms related to challenges and/or drivers, classifying the papers into three main groups: challenge-prone, driver-prone, and challenge and driver unbiased-mix. We found that 73 percent of the total sample of papers falls into the challenge-prone category, 20 percent under the driver-prone category, and 7 percent in the challenge and driver unbiased-mix.

The first implication for academia is that there is a lack of common language for the different challenges and drivers, finding 187 terms associated with challenges (106 related to hard challenges and 81 with soft challenges), and 146 terms associated with drivers (82 as hard drivers and 64 as soft drivers). This implies that most papers present their own definition for a particular challenge or driver, meaning that similar terms are named differently in the literature (for example, stakeholder inclusion, involving stakeholders, sharing data with stakeholders, stakeholder relationships), which expands the issue of lack of common language. Likewise, the scientific community has largely focused on identifying challenges over drivers, which could be consistent with the rise of new technologies,

policies, and business practices, incentivized by changing customer needs, and with an important shift from product-centric business model towards service-centric and customer-centric business models.

Once the classification was performed, a metric to measure the intensity of identification was proposed, clustering the number of identified challenges or drivers in four categories (null, weak, medium, and strong). Papers included in the sample cite at least one term belonging to a challenge or driver. However, in general terms, a “weak intensity of identification” has been noted. From the whole sample, it was found that only eight papers present a “strong intensity of identification” for particular challenges and only one presents it for drivers. Surprisingly, it was found that the papers that strongly identify one particular challenge/driver with strong intensity are mostly related to soft challenges (five papers) rather than hard challenges (three papers) or hard drivers (one paper).

It is also worth mentioning that a researcher could obtain an improper image of challenges/drivers for servitization if he/she draws on a limited number of papers. This could be overcome by referring to the results obtained in this study. Alternatively, reviewing the top 10 cited papers on our sample can provide a moderately good image of challenges/drivers for servitization. In the authors’ opinion, the research process that leads to citing previous works is an expression of collective intelligence, upon which one can rely for further research endeavors.

The continuous growth trend in digitalization demands the development of new concepts concerning servitization and the circular economy, taking advantage of the gaps identified in the literature [30,164] and the changing business environment [165]. As can be seen in Figure 4, among the hard challenges and hard drivers, the market area presents opportunities for research on topics related to market readiness (customer readiness, product ownership, etc.) and supply chain management (logistics data sharing, risks in the supply chain, etc.). Likewise, soft challenges present research opportunities in topics related to the social/cultural area (customer integration, customer behavior, purchasing patterns, etc.). Lastly, soft drivers in the area of regulations have the potential to generate new legislation and policies related to digitalization and digital services around a (digital and physical) product, through servitization. We believe that this presents a huge opportunity, as regulations related to digital service provision are incipient and will be required because new technology is emerging and evolving constantly (digital twins, 3D printing, remote maintenance, big data and fast data, etc.).

In addition, freelance is a new digital opportunity that has been identified but requires further development and analysis, as it supports the development of digitalized services around a digital product [99,166], even though it also presents its own challenges [61,167]. Consequently, freelance has not been included in this study.

Finally, we must remark that this topic calls for multi-collaborative research, as there are other areas of knowledge that can be included. For example, psychology could collaborate with marketing to create unique customer profiles, while health sciences could work along with engineering to improve research on biomedicine and services around it. There are plenty of opportunities to create this collaboration and pass along the challenge of working as silos in each individual science.

## 5.2. Managerial Implications

As mentioned by Schwab [162], decision-makers are usually driven by the “traditional, linear (and non-disruptive) thinking”, which does not help them recognize possible “forces of disruption and innovation shaping our future”. The intention of the current paper is to present managers with a tool to understand the different challenges and drivers most commonly discussed regarding servitization in order to identify and seize innovation opportunities together with the risks that emerge, to make a comprehensive evaluation of the factors involved in the decision, together with the maturity of servitization approaches, both in its company and within the industry.

Our results illustrate that servitization is an activity that should be undertaken by the different departments of the company as a collective effort. It represents a whole new vision of the company that should be embraced, trying to avoid the situation in which one or several business units act as “silos”. The culture of the company should be flexible enough to allow for the shift from producing and selling goods to service offering.

Challenges and drivers for servitization appear to be erroneously classified when examined under the lens of external versus internal factors. This result suggests that traditionally oriented business tools such as PESTEL or Five Forces (which focuses exclusively on external factors) or the value chain (which focuses on internal factors) may not be appropriate for setting a servitizing strategy. Other tools that can look at internal and external factors together, such as value ecosystem analysis, might be preferable.

Customer-centric strategies like omnichannel distribution, renting and leasing structures, collaborative platforms, human-to-human interactions, and more sustainable business practices leading to circular economies would be more appropriate for servitization.

It is also relevant that managers pay attention to the digital transformation happening along the supply chain, which implies a change in the traditional paradigm moving from purely physical products or services to products that combine digital and physical attributes, known as “‘digital’ products” [168], aiming to increase the value proposition. This requires a multi-dimensional collaboration to integrate humans and machines, providing multiple learning approaches. This presents an opportunity to improve supply chain management through digital supply chain transformation, with implications for customer management, and transforming the cultural and social paradigms.

This also presents new perspectives for collaboration between different parties to provide a better digitalized service to the customer. Although this could be seen as an opportunity to fine-tune collaboration between the parties, it also creates new challenges related to the increased number of actors participating in it. Furthermore, this adds layers to the product–service complexity, which will create additional requirements. Nevertheless, it is worth noting that this will also push the innovation frontier for the whole system.

Lastly, despite the trend for digitalization and pushing everything towards a digital world (driven by customers and providers), plenty of activities are still conducted in the physical world. Physical products, moved and delivered physically, will still require physical services. Consequently, digitalization in servitization cannot (and will not) completely take over servitization in physical products, but must instead be considered as an additional tool for expanding it to reach more customers and expand the service offering.

### 5.3. Limitations and Avenues for Further Research

The limitations of this study are derived from the actual techniques in use. The search was conducted in academic journals, which is why we have omitted commercial journals, practitioner reports, and other grey literature is left out. Secondly, the selection and classification of materials require an interpretation that can be biased, even though the work was conducted by three researchers, with the aim of systematically reducing bias through triangulation.

As an avenue for further research, we would like to propose focusing on the global trend of the individuals’ reluctance to the traditional paradigm of owning things (product ownership), as everything is “rentable” [25,169]. This means that companies need to extend products’ lifecycles to emphasize the durability and practicality of the products, instead of simply appealing to the traditional strategy of planned obsolescence, impacting all stages along the supply chain. This will benefit the user experience and also expand the company’s market share as users will likely recommend the product. This will impact company profits, as there will be a decrease in the number of unitary product sales, although companies will provide additional services (MRO) not only for their own products.

Finally, as can be seen in Figure 4, Tables 2 and 3 and, to the best of our knowledge, there are some areas that need further exploration, as these present opportunities to identify challenges and drivers. These have been discussed in the last section of this document.

We encourage research to focus on filling these identified gaps, especially to identify new challenges and take advantage of the opportunities presented through drivers.

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