

Framework for transition from traditional to PSS products

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Product-Service Systems, PSS Product.*

Abstract— *As the globalization process has intensified environmental issues and the competitive pressure among organizations, business proposals based on circularity, such as Product-Service Systems (PSS), represent an alternative in face of sustainable development. However, the literature does not present an orientation for the implementation process of business proposals classified as Product-Service Systems. This research gap supports the objective of this work: to develop a framework to enable the transition from traditional products (based exclusively on products or services) to products that compose a Product-Service System proposal. In order to meet this goal, this research performs a systematic literature review, where 55 papers are analyzed in order to answer the following research questions: i) What is the difference between servitization and Product-Service Systems? and ii) What is the strategic organizational alignment needed to promote the transition from a traditional product to a PSS product? The bibliographic results were the basis for the development of the framework, where strategies to promote this transition process are presented and classified according to the ReSOLVE structure. Thus, the originality and value of this research is concentrated in the development of the framework, which can be used as an orientation for companies and researchers when characterizing a PSS product or when making the transition to PSS business proposals.*

I. INTRODUCTION

The intensification of industrial activities, added to the development paradigm based on linear economy [12], brings negative externalities to the environment and socioeconomic aspects [3]. In this context, the approach on sustainable design gains academic and organizational notoriety [45] due to the search for alternatives to offer products and services under the perspective of sustainable development [6], considering the principles of Circular Economy [7], [8].

Looking for solutions capable of meeting the three dimensions of sustainability (environmental, social and economic) [5], [9] highlight the contribution of Product-Service Systems (PSS) business proposals. This approach was first presented by Goedkoop [10], and represents an opportunity for differentiation in the value chain [11], since it contributes to waste minimization [12] and to the extension of product lifetime [13] through functional optimization [14]. Therefore, to ensure the sustainability of PSS business proposals, it is necessary to adopt a systemic perspective [15], considering the entire life cycle of

products and services [16], from conception to final disposal [17].

However, the transition from a traditional business proposition (based exclusively on products or services) to a PSS business model represents a challenge for both researchers and the job market, since this topic of investigation is still poorly developed in the literature [18]. Furthermore, there is no clarification about the relationship that sustainability establishes with the PSS business proposal, since there are authors who present the denomination Sustainable Product-Service Systems (SPSS) [19]–[21], others state that sustainability represents one of its foundations [5], [10], [22], [23], while others treat servitization and Product-Service Systems as synonyms. In view of this, [20] highlights the need to collect data regarding product design aiming at the extension of its life cycle and the best performance of a PSS business proposition.

Based on the above, the objective of this work is to develop a framework to enable the transition from traditional products to PSS products. To this end, this study i) conducts a systematic literature review in order to answer the following research questions: 1) What is the difference between servitization and Product-Service Systems? 2) What is the strategic organizational alignment needed to promote the transition from a traditional product to a PSS product? ii) proposes a framework to enable this transition process.

This paper is structured as follows: section 2 describes the methods employed in this research. Section 3 presents the results of the systematic literature review (bibliometric and content analysis). Section 4 presents the discussions of this work and proposes the framework for the transition from a traditional product to a PSS product, based on sustainability. Finally, section 5 concludes this work and points out perspectives for future studies.

II. RESEARCH METHODS

A systematic review was conducted in order to understand the state of the art of the topic of this research, retrieving collective perceptions based on the theoretical synthesis of existing studies [24]. Moreover, [25] point out that systematic reviews are widely conducted in works concerning Product-Service Systems, (e.g. [16], [26]–[28]), highlighting the relevance and academic interest in this research method.

The report for systematic reviews and meta-analyses (PRISMA) [29], [30] was used to structure the literature review into four steps: I - identification of articles, II - screening of articles, III - eligibility, and IV - inclusion of

studies [31]; as presented in Figure 1.

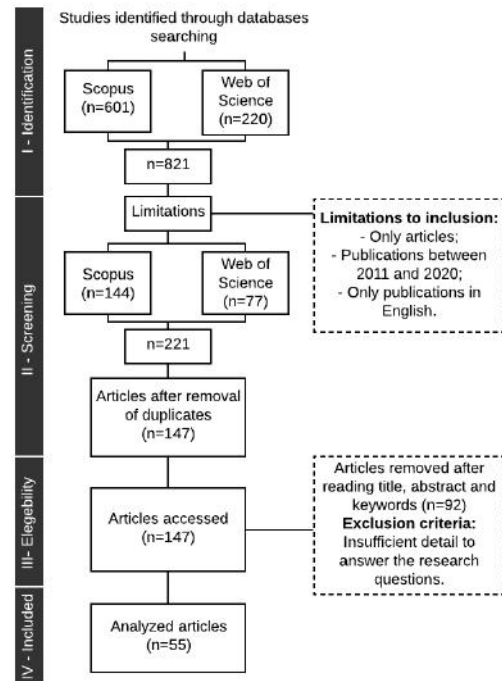


Fig. 1: PRISMA - Search parameters

For the selection of scientific articles (step I of the PRISMA method), the Scopus and Web of Science databases were used, considered the most comprehensive [32]. The combination of keywords presented in Table 1 was used to compose the initial sample of papers to be analyzed.

To further refine the results obtained in stage I, a bibliographic search was performed using search filters (stage II), limiting the results to scientific articles published between 2011 and 2020 and written in English. Thus, 221 articles were identified, as shown in Table 1.

Table.1: Keyword combinations

Keywords	Scopus	Web of Science
"PSS product"	13	4
"Product service system*" and "product* development"	59	43
"Product service system*" and " product life cycle"	24	14
"Product service system*" and "product* design" and "sustainab*"	48	16

Excluding the duplicates, 147 papers were selected, which composed the bibliometric analyses, presented in section 3.1. According to [33] bibliometric analyses allow for a quantitative analysis of research trends in a research domain, through knowledge maps, such as cooperation and co-citation relationships. Bibliometric tools provided by the VOSviewer® and Excel® software were used in the following analyses: temporal trend of publications, main journals, geographical distribution of publications and co-citation of authors. Since VOSviewer® limits the use of only one database, Scopus (144 papers) was used because it presented a greater number of results than Web of Science (77 papers) [34].

In steps III and IV, title, abstract and keywords of the articles were analyzed. Thus, 55 papers were selected to compose the content analysis, which presents the answers to the following research questions: i) What is the difference between servitization and Product-Service Systems? ii) What is the strategic organizational alignment required to promote the transition from a traditional product to a PSS product?

To answer the second research question, characteristics of a PSS product were identified and presented through a generic model. Aiming to organize and synthesize the information obtained in the literature, these characteristics were classified according to the ReSOLVE structure [35]. According to [14] the ReSOLVE framework organizes the principles of the Circular Economy according to six dimensions: regenerate, share, optimize, loop, virtualize and exchange. Therefore, the Circular Economy is approached in this work as a facilitator of the transition process from a traditional product to a PSS product.

In order to organize the bibliographic information, the characteristics of a PSS product present a coding system, applied in each dimension of the ReSOLVE structure. In this way, the characteristics were presented as follows: Re1 to Re7 represent the guidelines of the regenerate dimension; S1 to S6, of the share dimension; O1 to O6 correspond to the characteristics of optimize; L1 to L7, loop; V1 to V6, virtualize and; E1 to E6, exchange.

III. RESULTS

The first section of this chapter (3.1) presents the results of the bibliometric analysis. Section 3.2 presents the content analysis, where the difference between servitization and Product-Service Systems is presented, in addition to a brief state of the art on the models that exist in the literature, on which the framework proposed in this work is based.

3.1 Bibliometric analysis

Figure 2 presents the annual evolution of publications, highlighting the progressive increase of papers referring to the topic of this research, since publications in the last three years represent 44% of the total, emphasizing the trend and the academic relevance of this approach.

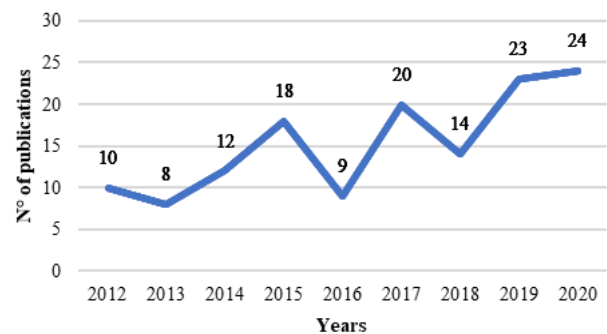


Fig. 2: Temporal trend of publications

Figure 2 highlights a sharp increase in publications in 2017 and 2019, of 122% and 64%, respectively. It can be observed that in this period there was a large amount of articles published in the *Journal of Cleaner Production* and *Sustainability* journals, which presented several special issues referring to Circular Economy and the Product-Service System, justifying this increase in publications.

Figure 3 corroborates this finding, highlighting that the *Journal of Cleaner Production* and *Sustainability* journals have the largest number of publications in the sample analyzed, since together they represent 31% of the total number of papers in the bibliographic portfolio.

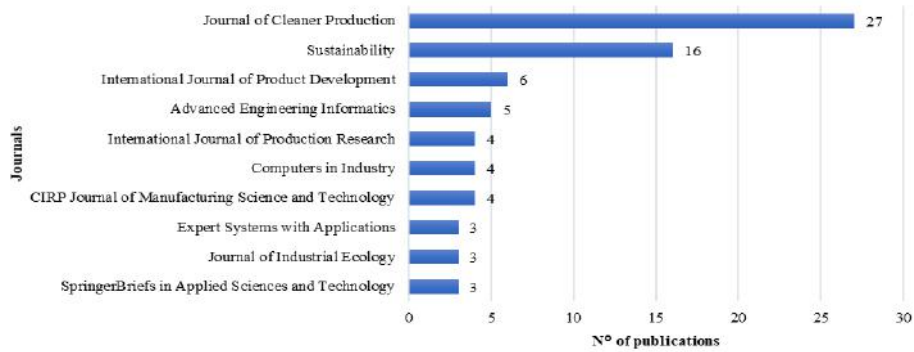


Fig. 3: Main journals

Figure 4 highlights that although there is global involvement with the topic of this research, publications are predominantly concentrated in countries with developed economies. The works of [36] and [9] corroborate this finding, highlighting the need for investment in Research and Development (R&D) in all spheres of the economy, so that they mutually meet the guidelines of sustainable development.

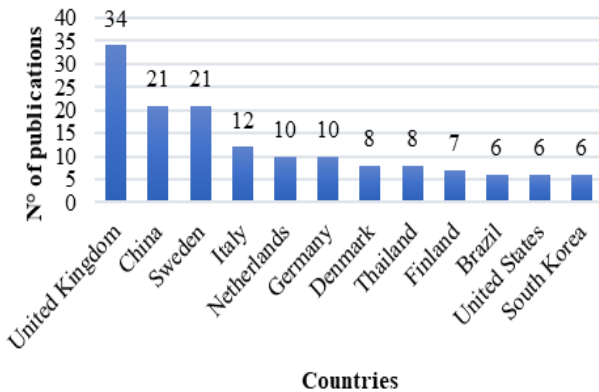


Fig. 4: Geographical distribution of publications

Figure 5 shows an author co-citation network, where we observe the formation of three clusters, forming a bibliometric network composed of 26 nodes.

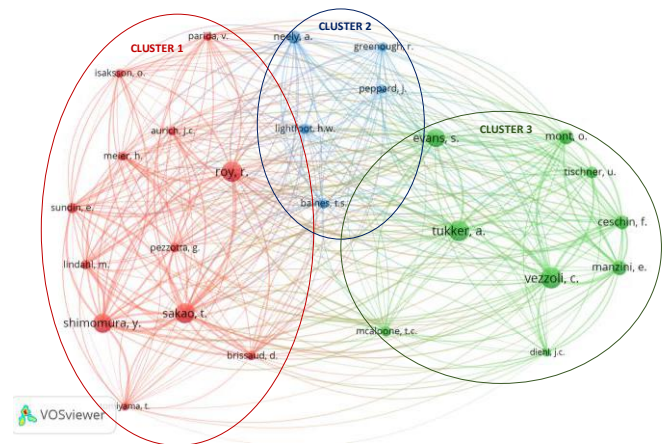


Fig. 6: Co-citation of authors

The predominant approach of group 1 is about sustainable design, where the authors Roy, R. (138 citations) and Sakao, T. (130 citations) stand out. [39] point out that the value proposition is tied to the durability of products, which should be designed considering the principles of Life Cycle Engineering. Furthermore, Sakao, T. points out the importance of ecodesign and Circular Economy to enable the transition to sustainable proposals [40,41].

Group 2 deals predominantly with servitization, with emphasis on the authors Neely, A. (78 citations) and Baines, T. S. (60 citations). In this group, two literature review papers are widely cited, developed by Baines in 2007 [11] (in partnership with Neely, A.) and by Baines in 2009 [40]. The high citation rate of these works is due to the definition of the concept of servitization by [40], where the author highlights its potential for differentiation and increased competitiveness in the labor market [11], [40].

Finally, group 3 deals with servitization from the perspective of sustainability (mainly in the environmental

aspect), where the main approach is related to the Product-Service System. This group presents pioneer authors in the studies about PSS, such as Tukker, A., Manzini, E., Vezzoli, C. and Mont, O., where they stand out with a great amount of citations. These authors present definitions and classifications of [22], [41], [42], and highlight its systemic perspective by mutually contributing to the environmental, social and economic spheres of the Triple Bottom Line (TBL).

3.2 Análise de conteúdo

Several authors highlight that the adoption of sustainable manufacturing and eco-friendly operations represents a competitive advantage [14], [43]–[45], as it captures new revenue streams [1], [43], [46] and expands the target audience, given the consumer's increased awareness of sustainable development [12], [20]. Seeing the relevance and urgency for alternatives engaged with this context, [47] highlights the need to foster continuous innovation in reducing environmental impacts and improving equity and social cohesion.

[43] point out that the transition from the exclusive sale of products to a proposal based on servitization represents a promising perspective of value proposition,

since it encompasses a systemic vision of the entire life cycle of products and services [2], [12], [16], [43]. Therefore, it is essential to make information available during all phases of the life cycle, especially in the early stages of development, since they demand more strategic planning [44], [48], [49]. Furthermore, [44] point out that the relationship of a business proposal with sustainability is largely determined in the early stages of the life cycle.

Based on these principles, Product-Service Systems differ by considering the environmental, social and economic scopes since the conception of products and services [5]. In view of this, [5] highlight that it is necessary to conduct research on how to develop, implement and monitor business proposals based on sustainability, since there is scarce literature on ecodesign and PSS design [50]. However, there is no consensus in the literature about what relationship sustainability establishes with business proposals classified as servitization or Product-Service Systems. Thus, Table 4 presents the main differences between these approaches.

Table.2: Differences between servitization and Product-Service Systems

	Servitization	Product-Service Systems
Definition	Servitization is the innovation of an organization's capabilities and processes to shift from selling products to selling products and services, adding value to the use or functionality [40].	A Product-Service System is composed of products, services, actor networks, and infrastructure, which aim to increase competitiveness, satisfy customer needs and reduce environmental impacts, when compared to traditional product and service proposals [10].
Scope with greater focus on the Triple Bottom Line (environmental, social and economic)	Economic [43]. The transition from selling traditional products to servitized propositions represents an economic value proposition, capturing new revenue streams, increasing profitability, and sustaining a competitive advantage [43].	Environmental [9], [21], [43], [44]. One of the main reasons for driving the adoption of PSS solutions is their ability to drastically reduce resource consumption and environmental degradation, without reducing the customer's sense of well-being and satisfaction [19], in order to consider sustainability under socio-ethical aspects [9].
Main competitive differentials	Capturing new revenue streams [43].	Customer engagement, offering maintenance, repair, upgrade, and other services [51].
	Broader value proposition [43].	Sustainable innovation, integrating environmental, social, and economic development [5].
	Efficient use of resources [52].	Product development based on lean manufacturing [53].
Cases	Kindle. The e-book content is delivered instantly at a more affordable cost and with easier access and payment; therefore, Kindle enriches the core value Amazon offers customers as an online bookstore [54].	Water purifier. The business proposal presents a concern with the raw material used in the conception of the product, opting for alternatives with less environmental degradation and more durability [55].

Empresas como *General Electric, Xerox, Canon e Parkersell* mostraram um aumento considerável nas vendas e lucros de serviços desde meados da década de 1990. Estas empresas destacam-se por manter a competitividade e a originalidade ao promover uma oferta integrada de produtos e serviços [54].

Electric car sharing system. The work of [57] uses Life Cycle Analysis (LCA) to identify the impacts of the proposal with respect to global warming, photochemical oxidation, eutrophication, and abiotic resource depletion. Thus, products and services are designed from the perspective of sustainable development.

Table 2 highlights that the main difference between servitization and Product-Service Systems is the greater relationship of PSS with sustainability. Although servitization contributes to a more efficient use of resources [52], the relationship of PSS with sustainable development occurs from the conception of the product offered to its final destination [5].

Given this context, the work of [49] provides a perspective of implementation of business proposals based on sustainable development, where the authors emphasize that it is not only the production process that must be environmentally friendly, but also its supply, distribution and retail. In view of this, [49] present a framework proposing waste and supply chain management, which is structured according to the stages of the Product Development Process (PDP): pre-development, development and post-development.

[58] corroborate with the work of [49] highlighting that, according to the principle of product integrity, designers should aim to avoid obsolescence and make sure that resources can be recovered with the highest level of integrity. Through this perspective, the authors point out that business proposals become engaged with the Circular

Economy, where efforts are directed towards extending the useful life of products, extending their intervention horizon for final disposal.

[59] emphasize that Product-Service Systems correspond to a strategy capable of contributing to the circularity of business proposals. The authors substantiate this assertion through a case study in the textile industry, which supported the development of a framework that presents five PSS strategies capable of contributing to the Circular Economy: operational support, periodic maintenance, product sharing, end-of-life management (EoL) and optimized outcome. However, the work of [13] highlights the need for a strategic organizational alignment to promote the adequacy of a business proposal to the principles of Product-Service Systems.

IV. DISCUSSIONS

Based on the literature results, this section presents the strategic alignment needed to promote the transition from a traditional product to a PSS product. To this end, the literature data were arranged according to the ReSOLVE structure and synthesized into a framework (Figure 7).

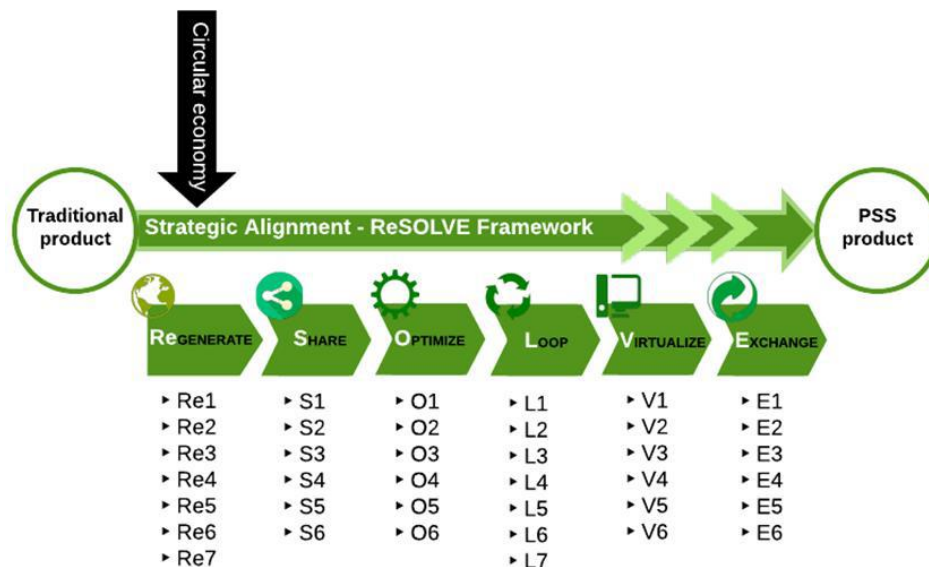


Fig.7: Framework - Transition to a PSS product

In view of this, Table 3 presents the characteristics of a PSS product according to the "Regenerate" dimension.

Table.3: Characteristics of a PSS Product: Regenerate Dimension

Coding	Characteristics	Sources
Re1	Design for final disposal	[45], [59]
Re2	Modular design	[1], [2], [18], [20], [45], [46], [50], [60]–[65]
Re3	Ecodesign or Design for X (DfX)	[14], [20], [45], [50], [52], [66]
Re4	Cleaner Production (CP) - Lean Manufacturing	[12], [45], [52], [53], [62], [67], [68]
Re5	Avoiding the rebound effect	[59], [65]
Re6	Ease of composting	[45]
Re7	Repair or reform	[1], [2], [4], [12], [14], [18]–[20], [45], [52], [59]–[62], [64], [65], [69]–[74]

Table 3 highlighted that "Repair or reform" (Re7) and "modular design" (Re2) corresponded to the most cited characteristics of this dimension, where several authors point out that modularization facilitates procedures such as repair, reuse, and failure tracking; increasing the efficiency of the business proposal [20], [50], [63]. Moreover, the principles of ecodesign and design for X (DfX) (Re3) should be considered during manufacturing, assembly, disassembly and modularity of parts, in order to increase the quality and reliability of products and services offered [20].

[5] highlights that for the successful adoption of sustainable manufacturing it is essential to take a systematic approach from concept development, product design and manufacturing, to end-of-life product management, which should be planned based on EoL strategies (Re1). Thus, the interdependencies between material, energy, and climate impact need to be taken into

consideration at the product design stage, where possible rebound effects (Re5) should be considered as early as possible to have the lowest possible impact [65].

According to [23], Product-Service Systems are based on lean manufacturing principles (Re4), where the Production Planning & Control (PPC) sector must support a wide variety of alternatives based on the Circular Economy, considering flexible production planning aiming at dematerialization, waste minimization [14], easy disassembly of parts [2], and reuse and composting of materials (Re6) [45].

Next, Table 4 presents the characteristics of a PSS product according to the "Sharing" dimension.

Table.4: Characteristics of a PSS Product: Share dimension

Coding	Characteristics	Sources
S1	Availability and flexibility	[14], [46], [60], [68], [72], [75]
S2	Extended product life cycle or intensified use	[1], [9], [13], [14], [24], [45], [59], [64], [65], [69], [73]
S3	Redistribution	[12], [59]
S4	Reduce obsolescence	[1], [4], [14]
S5	Reuse	[1], [2], [4], [9], [12], [14], [18], [20], [24], [45], [46], [50], [59], [64], [65], [67], [68], [72], [73], [75]–[77]
S6	Shared use	[14], [64], [78]

In order to meet the challenges of climate change and limited resource availability, a PSS product must provide a maximum benefit by extending its useful life (S2) [65] and decreasing obsolescence (S4) [14], while optimal material and resource decisions must be made, taking into account the entire life cycle and Circular Economy goals [65].

In this context, the sharing of products and services (S6), through business proposals such as Product-Service Systems, represent a path to a reduced level of product obsolescence [14], since design centered on the functional outcome, encourages organizations to design alternatives

based on redistribution (S3) [12] and reuse (S5) [46]. Thus, the close relationship with the customer is vital to design versatile products [14] that offer high availability and flexibility (S1) [60].

To maintain the user's engagement and loyalty to the business proposition, it is necessary to constantly monitor the business proposition [48], in order to identify possible flaws in the system and opportunities to optimize the products and services offered. In view of this, Table 7 highlights the characteristics of a PSS product according to the "Optimize" dimension of the ReSOLVE framework.

Table.5: Characteristics of a PSS Product: Optimize Dimension

Coding	Characteristics	Sources
O1	Updates	[2], [4], [14], [18], [19], [24], [45], [51], [52], [62], [70], [72], [73], [79], [80]
O2	Durability and functional optimization	[1], [4], [14], [24], [45], [52], [64], [70], [73]
O3	Easy to disassemble parts	[1], [2], [4], [9], [14], [20], [64], [73]
O4	Warranty and spare parts supply	[18], [20], [25]
O5	Maintenance	[1], [2], [14], [18]–[20], [24], [25], [43], [45], [46], [51]–[53], [59]–[62], [64], [65], [67], [68], [70]–[73], [76], [77], [79]
O6	Standardization of parts	[1], [62]

As highlighted in the "Sharing" dimension, a PSS business proposition contributes to reducing product obsolescence. For this, it is necessary to promote functional optimization (O2) [52], in order to support the customer by providing warranty [18], maintenance [43] and the supply of spare parts [20] (O4 and O5). This increases the reliability of the business proposition and customer satisfaction [81], making the customer more likely to remain an active consumer.

In this context, [1] analyze how product upgradeability (O1) is associated with a PSS business proposition. The

authors identify that component upgradability extends the life of products, and point out that design during the early life (BoF) phase enables the deployment of innovations during the mid-life (MoL) and end-of-life (EoL) phases [1]. Thus, designers are in charge of designing for ease of upgrading and prolonging the use of products [58]. This requires standardization of parts (O6), aiming at ease of assembly and disassembly (O3), in order to restructure production patterns [19], making them more circular.

Next, Table 6 presents the characteristics of a PSS product according to the "Loop" dimension.

Table.6: Characteristics of a PSS product: Loop dimension

Coding	Characteristics	Sources
L1	“Cradle to Cradle” Approach	[18], [65], [66], [69], [73]
L2	Circular design	[4], [12], [14], [43], [45], [49], [65], [73], [82]
L3	Reverse manufacturing	[73]
L4	Recycling	[1], [2], [4], [9], [12], [14], [18], [20], [24], [50], [52], [59], [64], [65], [67], [68], [71], [73], [76], [77]
L5	Reconditioning	[1], [14], [19], [59], [62], [65], [69], [72]
L6	Remanufacturing	[1], [2], [4], [9], [14], [18], [20], [24], [45], [50], [52], [59], [62], [64], [65], [68], [72], [75]–[77]
L7	Cascade use	[12], [14], [45], [73]

The work of [66] highlights that while natural materials are biologically reused, synthetically produced resources must be kept in a closed circuit, through a "cradle to cradle" approach (L1). [12] corroborates the work of [66] by stating that Reverse Logistics represents a value creation tool, since it contributes to several practices guided by the Circular Economy, such as recycling (L4), remanufacturing (L6), and reconditioning (L5). Thus, [12] point out that this holistic perspective of manufacturing and Reverse Logistics (L1) should be approached according to the principles of circular design (L2), where [9] highlight the importance of adopting a comprehensive perception of the entire life cycle of products and services, using Life Cycle Analysis (LCA) methods.

However, for the effectiveness of a PSS business proposal, it is necessary to engage stakeholders in order to mobilize the State, organizations and citizens [83] towards sustainable production and consumption patterns (SDG 12) [84]. To this end, [83] points out the need to implement the 5R's of Circular Economy: refuse, rethink, reduce, reuse and recycle [85]. In this way, the client takes responsibility to follow the sorting and recycling guidelines [83], enabling the reuse and cascading use of products (L7).

Table 7 shows the characteristics of a PSS product according to the "Virtualize" dimension of the ReSOLVE structure.

Table.7: Characteristics of a PSS product: Virtualize dimension

Coding	Characteristics	Sources
V1	Consulting and advisory services	[24], [59], [62], [70], [71]
V2	Co-creation	[19], [74]
V3	Customization or personalization	[14], [19], [53], [60]–[62], [86]
V4	Traceability and transparency	[14], [18]
V5	Operational support, advise on efficient use	[2], [12]
V6	Virtualization to improve eco-design (Ex: Additive Manufacturing and Big Data)	[14], [52], [68]

[87] and [14] point out that virtualization (V6) through Information Technology (IT) tools, Big Data systems and additive manufacturing (3D printing) increase the performance of PSS business proposals, besides contributing with waste elimination, since they enable an understanding of the whole life cycle of products. Therefore, the incorporation of technologies in business proposals represents an alternative to sustainable development [50].

[18] highlight that the use of IoT and Big Data-based technologies improve product design and attract new customers through co-creation (V2) [74], customization and personalization [86]. Moreover, these technologies facilitate product monitoring and tracking, enable the provision of advice and consulting (V1) [18], [71],

provide technical and operational support (V5), and facilitate upgrading, maintenance (preventive and predictive), and deployment of end-of-life (EoL) strategies [18].

In this context, keeping the engagement between provider and consumer drives the development of optimizations and the increase of customer satisfaction [20]. In view of this, [14] highlight that the use of electronic devices improves the traceability and transparency (V4) of the flow of materials and information, enabling the identification of customer demands and the opportunity for optimizations in the business proposals.

Finally, Table 8 presents the characteristics of a PSS product according to the "Exchange" dimension.

Table.8: Characteristics of a PSS Product: Dimension Exchange

Coding	Characteristics	Sources
E1	Increased performance and efficiency	[64]
E2	Switch to resource- and energy-	[4], [9], [12], [14], [43], [45], [52], [53],

	efficient alternatives	[59], [64], [65], [67], [73], [76]
E3	Elimination of waste	[12], [68]
E4	Redesign	[9], [13], [20], [65], [69], [71], [72]
E5	Rethink	[1], [12]
E6	Replacing non-renewable materials with more sustainable alternatives	[12], [14], [50]

In the face of climate change and limited resource availability [65], PSS business proposals have the potential to promote energy efficiency (E2) [69] through functional selling [88], where PSS product design is based on waste elimination (E3) [12]. Furthermore, this energy efficiency potential is extended by adopting an approach that integrates Product-Service Systems and Circular Economy, where the remanufacturing of components has a large potential to reduce CO2 emissions [89]. In this context, the seventh Sustainable Development Goal (affordable and clean energy) extols the need to promote access to research and innovation in the face of energy efficiency, including the deployment of renewable and clean alternatives (E6) [90].

[47] emphasizes that it is essential to rethink (E5) and redesign (E4) production and consumption patterns, in order to maintain the balance between the environmental, social, and economic spheres [91], where [70] extols the need to adopt a closed loop system, based on the increase in performance (E1) and the reuse of components. In this way, benchmarking decisions that lead to the replacement of linear production patterns represents a value creation strategy, where organizations can advertise their engagement with sustainable development (green marketing) [92].

V. CONCLUSION

This investigation employs a two-pronged approach, combining bibliometric and content analysis, which provided a broad overview to meet the objective of this research, in order to propose a conceptual model to enable the transition from a traditional product to a PSS product. The bibliometric analysis highlighted that although the publications referring to the topic of this research are increasing over the years, they are concentrated in developed or developing countries. In this context, a research opportunity emerges, where one can address how to disseminate PSS business propositions in economies of different levels of economic development.

The answer to the first research question (What is the difference between servitization and Product-Service Systems?) provided an understanding of the fundamentals

of a PSS business proposal, where it is concluded that the engagement of Product-Service Systems with sustainability is not only an externality of the dematerialization process, since the relationship with the environmental scope of the Triple Bottom Line must occur since the conception of the products and services. The answer to the second research question (What is the strategic organizational alignment needed to promote the transition from a traditional product to a PSS product?) highlights the contribution of the Circular Economy (ReSOLVE structure) with this transition process, and has as a result the development of a framework, which can be used as a guideline for companies and researchers when characterizing a PSS product or when making the transition to this business model.

Although this study focused on the PSS product, it is observed that its characteristics are related to its other dimensions (services, actors network and infrastructure), highlighting the systemic approach of Product-Service Systems. Based on the results of this research, future studies can focus on the validation of the proposed framework with PSS experts and on the analysis of its practical feasibility, analyzing it in cases, in order to measure the contribution of the strategies identified and organized according to the ReSOLVE structure. Thus, these conclusions provide a theoretical basis for the development of research with empirical approaches that allow the contributions of the inter-relationship between Product-Service Systems and Circular Economy to be amplified.

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