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Preliminary Review on Product and Services Integrated Development

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Abstract. The service sector has been gaining more space and consolidating in the market, being currently the great employer of labor in the world. This scenario intensifies the debate on the various aspects that can result from a structured management oriented to the sector: to improve the economy, productivity, competitiveness, sustainability and sector of goods and manufacture. In addition, the goods industry has been incorporating services associated with its products as a strategy of differentiation. Thus, to integrate manufactured goods and the services in a single value package for customers is strengthened. This work is to preliminarily review the development of integrated products and services, in order to obtain an overview of the subject, as well as to analyze possible implications and contributions between the themes. For this, a systematic review of the literature was carried out, in order to determine the main papers using the inductive method for reading, to identify the main elements of the articles and their contributions. Bibliometric indicators were constructed as main journals and number of articles published per year, as well as general results, in which it was possible to observe the orientations and correlated areas. Finally, the results made it possible to highlight the trend in the researched area, emphasizing the evolution of the theme over the years and its main contributions.

Keywords. Product development, Service Development, Product Service System, Systematic Review.

Introduction

In the current market context, offering a product that is at the same time feasible for the business and satisfying to the customer becomes critical. The product or service resulting from a production process is the link between the company and the consumer. In a globalized environment dominated by increasingly effective technologies, it has become relevant and strategic to seek new ways to add value to the product / service in order to ensure not only the perpetuation of the company in the market, but also to stand out from competitors in concept, quality, efficiency, technology and knowledge.

The process of product and service development is often structured through phases, stages, and activities, becoming reference models. These reference models in product development aim to provide a means to introduce products profitably into the market [1].

According to Salgado et al. [2], the Product Development Process involves the design of a new product or service development, or improvement in an existing one, from the initial idea to the product discontinuation, in order to systematize this process.

Alvarez et al. [3] state that there is an emerging trend to offer services in many industry sectors. The authors concluded that a typical manufacturing company that provides after-sales services initially follows a product-dominant logic. However, through the relationship with the client, new opportunities can be identified that aim at a change of strategy (mission), requiring the modification of the organizational structure and the interaction with the external environment to understand the new logic that must be followed. In this way, the results demonstrate a recent industry trend and an alternative that can differentiate them from their competitors.

According to Bikfalvi et al. [4] recent changes in the business environment, such as increasing the competitiveness of developing countries, globalizing markets and changing customer demands make it difficult to rely solely on the traditional strategy, which offers only the product without worrying or value service process.

Therefore, the objective of this work is to preliminarily review the development of integrated products and services, in order to obtain an overview on the subject, as well as to analyze possible implications and contributions between the themes.

1. Literature Review

1.1. Product Development

Developing a flow of new products requires more than aware of issues such as specialized skills, knowledge, processes, mindsets, problem solving, and management philosophies [5].

Some methodologies can be used as a reference for the product development process. In a simplified way, we can mention some that have become better known:

- Development funnel: proposed by Clark and Wheelwright [6], allows generating and reviewing alternatives, in which the funnel shape signals decision points that reduce the number of options available in the project activity;
- Stage-gate Process: diffused by Cooper [7], the model brings stages in which, as they pass through a gate, they progress to the next stage;
- Back et al. Model [8]: according to the strategies of the organization efforts are directed towards the search for new product ideas, which should be developed and selected, considering market and production information to define a product development project which should be planned, executed and controlled.

Bessant and Francis [5] saw the development of a new product as an organizational development task with an elaborate and comprehensive set of procedures.

1.2. Service Development

Fitzsimmons and Fitzsimmons [9] emphasize that ideas developed for service sector innovations can come from a variety of sources. Customers can make suggestions,

front-line customers can be trained to listen to customer complaints and customer databases can be explored for possible service extensions. Another point highlighted by the authors are the trends in demography and the advancement in technology that are drivers for ever faster.

The creation of new services can be defined as the overall process of developing new services, from idea generation to market launch [10,11].

In recent years, companies have offered many different services. This behavior leads to a myriad of service offerings and therefore often to an inefficient service design and achievement. In order to avoid such problems, a systematic process of customer service development is necessary, allowing companies to develop services that meet the quality and efficiency demanded by the market [12]. Also in this direction, Alix [13] states that service design and manufacturing are today considered the truly vital issues and a methodology to systematize these activities and simulate sustainable development: the economic, ecological and social viability of the solution for both supplier and customer, it is necessary.

1.3. Product and Services Integrated Development

For Aurich et al. [12] because of the need for innovative services, service companies, as well as products, need to focus on service-oriented products and services to maintain and/or enhance their market competitiveness. This development results in an extension of the service sector and can also be emphasized by the following trends: customer orientation through product development and service oriented products.

This change of focus, from a product-to-service orientation, is called servitization in the literature [14].

In his work, Baines et al. [15] first present the terms Servitization and Product-Service System (PSS), and then the growth of related topics, such as service operations and service sciences, as indicators of a growing interest in competitive strategies led by services academia, business, and government. One reason for this, according to the authors, is the belief that a move towards serviceability is a means of creating value-added capabilities that are distinctive, sustainable, and easier to defend from the competition based on lower-cost economies. In addition to this, Alvarez et al. [3] state that transformation of typical manufacturing companies into service providers can be considered an important contribution to the creation and supply of new businesses.

The process of servitization, according to Alvarez et. al [3], changes the way the company interacts with the environment based on critical requirements related to customers, suppliers and the market. Servicing occurs when a service portfolio is directly coupled to a product offering [15,3].

Alix [13] explains that this trend of product and service integration corresponds to the expectations of the new customers expressed in terms of results: an adherence to product performances and not to technical conformities and may also indicate a preference for the prevention of failure rather than repair and an evolution of the relation quality/price for relation quality/cost of use. According to the authors, the PSS has two objectives:

- The first is to meet users functional needs and foster customer loyalty through an individual, personalized, ecological offering as customers become increasingly sensitive to environmental issues and the sustainable aspect of performance (economic, environmental and social); and

- The second objective is to allow suppliers to differentiate themselves from competitors and respond to the incentive to reduce the environmental impact of their production.

The strategic role played by services has become, over the years, a key element for companies to distinguish themselves from their competitors [13]. According to the author, services should be considered as mandatory for their contribution to improving incomes and profits, since the sale of services is more profitable than that of products and, in addition, services can also increase margins because they favor the development of customer loyalty and differentiation.

Tukker [16] presents three types of PSS: product-oriented services, service-oriented services, and results-oriented services, and their subtypes, as shown in Figure 1.

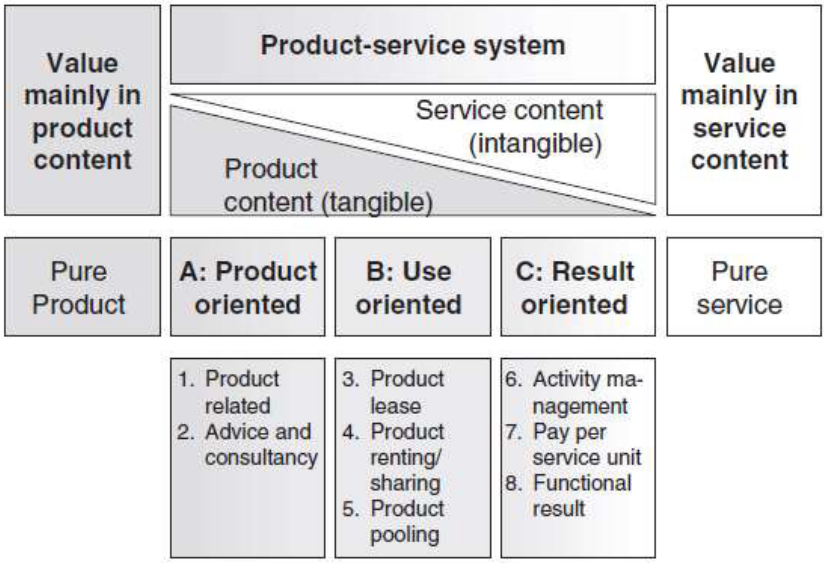

Figure 1. Main categories of PSS and its subcategories [16].

According to the Figure 1, it is possible to notice that the three main categories of PSS take the intermediate axis between the pure product and the pure service. The PSS research field shows that, within an integrated product-service system, the product model, service and business needs to be developed in an integrated way [17] and that has a fundamental characteristic a strong centralization of the client [18].

2. Materials and methods

This research is theoretical and aims to carry out a conceptual analysis on the theme "integrated product and service development", with a focus on models that represent structured processes. To achieve this goal, a systematic review of the literature was carried out. According to Kitchenham [19], this review aims to present an evaluation of a research topic, making use of a review methodology that is reliable, rigorous and that allows auditing.

The systematic review was divided into three stages. In the first stage, the databases were chosen (Scopus, Web of Science and Emerald), the keywords used were "servitization", "productization", "product service", "value pack", "service oriented product" all separated by "or" and combined with "Model" or "Process" or "Framework". The fields to be consulted were: Title, Summary and Keywords, there being no temporal clipping, in order to search for everything that had already been published on the subjects and what the main trends.

Subsequently, the articles were searched in the databases and then exported through EndNote® management software. In the last step, the pre-selection of the articles was carried out, considering: the alignment by the title and the summary, by means of readings, of title and, afterward, summary, in order to build a portfolio of priority articles, that best characterize the researched topic. To filter the articles, the following criteria were used: articles should necessarily present products and services being offered in an integrated way in their content; and should contain some structured form to demonstrate the integrated product and service process, being able to be presented in the form of model, framework, step by step, among others.

With the final portfolio defined, a sequence was developed for the accomplishment of the bibliometric data and preliminary analysis of the content, highlighting the main characteristics and tendencies in the theme.

3. Results

The searches performed in the databases resulted in 303 articles and after the readings of the title and abstract 101 articles were aligned with the purpose of the study, distributed in several journals. Table 1 presents the most relevant journals in terms of the number of articles published in the period studied and Figure 2 shows the distribution of articles per.

Table 1. Distribution of articles by journals.

Journal	Amount
Journal of Operations and Production Management	12
International Journal of Production Research	6
International Journal of Advanced Manufacturing Technology	5
International Journal of Operations and Production Management	5
Journal of Cleaner Production	5
CIRP Journal of Manufacturing Science and Technology	4
International Journal of Computer Integrated Manufacturing	3
Production Planning and Control	3
Research Technology Management	3
Service Business	3
Service Industries Journal	3
CIRP Annals - Manufacturing Technology	2
Computers in Industry	2
Expert Systems with Applications	2

Intangible Capital	2
International Journal of Technology Intelligence and Planning	2
Journal of Design Research	2
Journal of Engineering and Technology Management - JET-M	2
Journal of Intelligent Manufacturing	2
Proceedings of the Institution of Mechanical Engineers, Part B: Journal of Engineering	2
Universia Business Review	2

Table 1 presents several journals in which the articles are distributed, highlighting those that have the largest number of articles published: Journal of Operations and Production Management, International Journal of Production Research, International Journal of Advanced Manufacturing Technology, International Journal of Operations and Production Management and Journal of Cleaner Production.

It is still possible to verify some areas that had a greater relevance in the concentration of the articles, being able to indicate possible areas to be focused on future researchers. They are Operations, Production Management, Manufacturing, Business and Services, which corroborates with one of the results of the Baines, Lightfoot, and Kay [18].

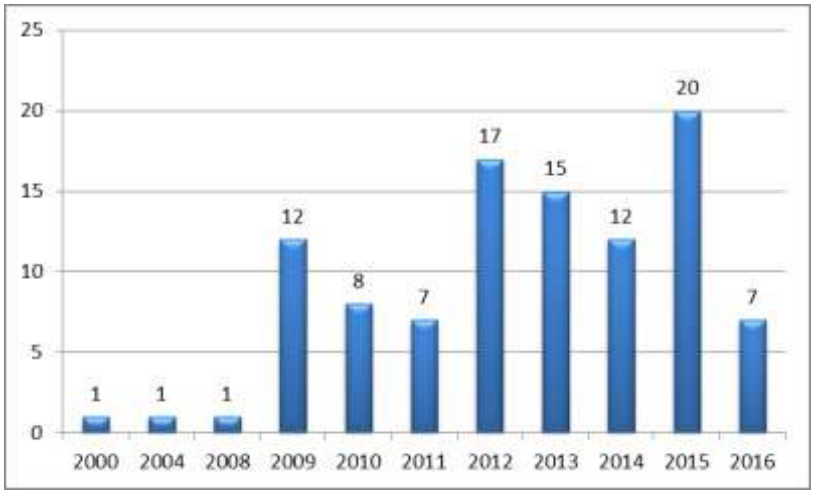

Figure 2. The number of articles published per year.

Figure 2 shows the growth of interest in the area of PSS in recent years, highlighting from the year 2009, that there is a relevant growth in the publication of articles in relation to other years. It can be said that the subject is relatively new, since the articles begin around the year 2000, although there are records of products integrating services by Eiglier and Langeard [20], with the introduction of the idea of 'extended products' and the process of value creation by adding services to products, by Vandermerwe and Rada [21].

An identification of the keywords contained in the articles of the final portfolio was carried out. To compose table 2, keywords with the same name, only added with some specific characteristic, were grouped in the same term. Also, we considered only keywords that appeared more than once and discarded the specific terms of other areas.

Table 2. Keywords.

Keywords		Amount
Business	Business Development	1
	Business model	9
	Business processes re-engineering	1
	Business strategy	1
Change management		3
Customer	Customer service	1
	Customer service management	1
Decision	Decision making	3
	Decision process	1
Design	Design	2
	Design for service	1
	Design for sustainability	1
	Design process	2
Industrial services		2
Integrated products and services		2
Operations	Operational practices	1
	Operations management	2
	Operations strategy	1
Organisational	Organisational design	2
	Organisational structure	1
Product	Product-centric firms (company)	2
	Product design	2
	Product development	2
	Product innovation	2
	Product-service lifecycle	1
	product–service performance	1
	product–service relationship	1
Product-service system	Product-service system	52
	Product-Service offering	1
	PSS model	3
	PSS design	1
	PSS implementation issues	1
Service	Service Innovation	5
	Service complexity	1
	Service concept	1
	Service delivery (systems)	3
	Service design	3
	Service development	2
	Service engineering	4
	Service infusion	2
	Service management	1
	Service operations	1
	Service orientation	1
	Service-oriented manufacturing	1
	Service providing	1
	Service strategy	2
	Service structure	1

	Service supply chains	2
	Service systems	1
	Services	8
	Services marketing	1
	Servitization policy/framework	34
	Servitization management	1
Servitization	Servitization simulation	2
	Servitization strategies	1
	Simulation of production systems	1
Small and medium enterprises		2
Sustainability/Sustentable		4
Transformation		2
Value	Value chain	1
	Value creation	2

Of the 72 keywords presented, the highest concentration of terms were used for:

- Product-Service Systems (PSS): 58 times;
- Service (and their combinations): 41 times;
- Servitization: 39 times;
- Product (and their combinations): 12 times;
- Business (and their combinations): 12 times;
- Design (and their combinations): 6 times.

Thus, it is possible to perceive the main areas and terms related to the researched topic. Terms such as business model, service (along with the terms innovation, engineering, delivery, design), as well as simulation, strategy, operations, appeared several times and combined in a variety of ways. All these considerations allow us to see that the process of integrated product and service development involves new forms and business models, projects and differentiated strategies to achieve results. In addition, almost all articles that presented the word servitization also used the term PSS in their keywords, which can be justified by the fact that many authors consider the synonymous words, evolution of the concept or even as one being part of the other , for example Servitization, which was sometimes cited as part of the Product and Service System.

After reading the articles in the final portfolio, 70 articles were considered relevant, of these 32 articles portrayed models, frameworks and structured processes of integrated products and services. Although the main objective of this article is not to deepen the analysis of content, but to present general characteristics of the subject, it is possible to perceive that the subject is not yet fully matured as regards how to integrate the two areas, nor presents generic and which may be considered as a reference.

Through literature review, it is clear that PSS can provide several benefits and becomes potentially beneficial to the business, as shown in the course of the work. It can be said that this is directly proportional to the amount of implications and care required to shift from a product logic to delivery of a value package that integrates product and service. Thus, it is possible to summarize the factors that must be taken into account in this integration of Products and Services:

- Strategy and positioning within the value chain;
- Integration of product, service and business development;

- Centralization in the client;
- Client management configured to deliver the core product and services related to product use support;
- New principles, structures, operational support, and production processes.

The factors presented above, emerge from the arguments presented by the authors of the articles analyzed. Baxter et al. [17] and Aurich et al. [12] point out in their work a need to present successful PSS applications and that a project at a systemic level is essential. In addition, most of the articles focus on the need to better serve their customers, in this sense, Sutanto et al. [22] point out in their work that there is a need for a framework that can be used to determine the list of design requirements for a development process that meets customer needs. Some articles such as [15], [23] and [3] point to a need to create a new internal configuration so that companies can have all the support and present the appropriate production processes to deliver the package of products and services. Therefore, it is important that proposals be developed that present an integrated structure of products and services from the strategy and business model, through the system design, to the operational activities of the process.

4. Conclusion

The development of products and services in an integrated way is still surrounded by several interrelationships. The subject involves the development of two outcomes of a process that have distinct natures but are equally relevant and complementary.

By reviewing the preliminary development of integrated products and services, it was possible to identify the main areas related to the themes, as well as the main trends and characteristics involved. The distribution of articles per year allowed us to see the growing interest in the theme in recent years. The other results point to the areas related to Operations, Production Management, Manufacturing, Business and Services, and make it possible to highlight that the process of integrated product and service development involves new forms and business models, organizational changes, projects and strategies to achieve results. The work is finalized bringing some contruibuições, implications and factors that must be taken into account in the integration of products and services.

Finally, it is possible to perceive that the subject is not yet fully matured as regards how to integrate the two areas, there are some models proposed, tested, but still lacking models that can be considered references and that clarify the integration stages of themes in practice. This article is limited to make a preliminary review, without seeking a deepening in the analysis of the content of the articles, this proposal is for future articles. For future research, it is suggested to focus on guidelines and models that present the integrated design of products and services at a systemic level.

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