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NO SETOR DE MÁQUINAS E EQUIPAMENTOS

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SERVITIZATION AND ORGANIZATIONAL PERFORMANCE IN THE MACHINERY AND EQUIPMENT SECTOR

A servitização e o desempenho organizacional no setor de máquinas e equipamentos

La servitización y el desempeño organizacional en el sector de maquinaria y equipos

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ABSTRACT

The role of manufacturing in value chains has become less dominant given the trend of stagnating demand, commoditization of products, and declining profitability. Confronted with this challenging scenario, a growing number of companies seek to add value to their businesses by adopting the approach of "servitization" (offering product-service solutions). However, literature on this subject is divided on the effectiveness of this approach since the intended outcome is not always achieved (service paradox). As such, this study quantitatively evaluates this relationship in manufacturing firms within the machinery and equipment industry. Data on different service categories developed by these firms and their corresponding impacts were collected. It was verified that there is a positive and significant relationship between the majority of these service categories and organizational performance, which indicates that identifying and developing a consistent service bundle may serve as an effective servitization strategy.

KEYWORDS | Servitization, Organizational performance, Service paradox, Machinery and Equipment, Product-service system.

RESUMO

O papel da indústria manufatureira nas cadeias de valor tem se tornado menos expressivo diante da tendência de estagnação da demanda, comoditização dos produtos e diminuição da lucratividade. Diante desse cenário desafiador, um número crescente de empresas busca adicionar valor a seus negócios pela vertente da "servitização" (oferta de soluções produto-serviço). Contudo, a literatura dessa temática encontra-se dividida quanto à efetividade dessa abordagem, dado que, nem sempre, traz o impacto esperado no desempenho organizacional (paradoxo do serviço). Diante disso, o trabalho avaliou quantitativamente essa relação em empresas industriais do setor de Máquinas e Equipamentos. Dados sobre as diferentes categorias de serviços por elas desenvolvidas e seus impactos foram coletados. Verificou-se que há uma relação positiva e relevante entre a oferta da maioria dessas categorias e o desempenho organizacional, o que indica que, identificando e desenvolvendo uma composição de serviços consistente, é possível conduzir uma efetiva estratégia de servitização.

PALAVRAS-CHAVE | *Servitização, paradoxo do serviço, desempenho organizacional, máquinas e equipamentos, sistema produto-serviço.*

RESUMEN

El papel de la industria de manufactura en la cadena de producción se ha vuelto menos significativo debido a la tendencia de estancamiento de la demanda, a la comoditización de productos de consumo masivo y a la disminución de la rentabilidad. Ante este panorama desafiante, un número creciente de empresas ha añadido valor a sus negocios a través de la vertiente de la "servitización" (oferta de soluciones producto-servicio). Sin embargo, la literatura sobre este tema se encuentra dividida en cuanto a la efectividad de este abordaje puesto que, no siempre, genera el impacto esperado en el desempeño organizacional (paradoja del servicio). Debido a lo explicado anteriormente, este trabajo ha evaluado cuantitativamente esta relación en empresas industriales del sector de Maquinaria y Equipos. Se recolectaron datos sobre las categorías de servicios desarrollados por ellas y sus impactos. Se ha verificado que existe una relación positiva y relevante entre la oferta de la mayoría de las categorías y el desempeño organizacional, lo que indica que, identificando y desarrollando una composición de servicios consistente, es posible conducir una estrategia efectiva de servitización.

PALABRAS CLAVE | *Servitización, desempeño de la organización, paradoja del servicio, maquinaria y equipos, sistema producto-servicio.*

INTRODUCTION

To remain competitive, traditional industries in industrialized countries have adopted various strategies; for example, an efficient product development system to meet market demands, supplying high-quality products that satisfy customers, and reducing production costs that enable them to compete on price (Bikfalvi, Lay, Maloca, & Waser, 2013). Recent changes in the business environment, such as the increasing competitiveness of developing countries, globalization of markets, and new customer requirements, have made it more challenging to maintain these traditional strategies (Bikfalvi et al., 2013). In response to these new challenges, a growing number of industrial companies have sought to add value to their businesses by providing services (Bikfalvi et al., 2013; Vandermerwe & Rada, 1988) to achieve potential economic and competitive gains (Oliva & Kallenberg, 2003). This transition from a manufacturer of goods to a supplier of product-service solutions is called servitization (Vandermerwe & Rada, 1988).

Several studies point to the potential positive impacts for supporters of this change, which have stimulated the supply of integrated goods and services promoted by servitization. Oliva and Kallenberg (2003) highlight that the main impacts are economical, since services generally allow higher margins than goods and provide a more stable source of revenue, as they are more resistant to oscillations in economic cycles that drive investment and the purchase of equipment. Furthermore, as services are less visible and more dependent on human labor, they are more difficult to imitate, and therefore, constitute a sustainable source of competitive advantage.

Conversely, some studies indicate that this transition may not be as advantageous. For example, Bascavusoglu-Moreau and Tether (2011) have found evidence that servitized industrial companies may not achieve superior performance than traditional ones in terms of survival rates, although they do achieve higher productivity. These authors observe positive impacts only in industries that have attained a higher degree of servitization. Other studies by Gebauer, Fleisch, and Friedli (2005) revealed that considerable investment in services could temporarily reduce profit margins. These authors call this phenomenon a "service paradox" in that the investments in services often do not produce better financial results. Thus, the literature contains reports of both successful and failed transitions of industrial companies into servitization and those that have chosen to de-servitize by reducing or abandoning service businesses (Valtakoski, 2017).

Recent literature reviews on servitization theory, such as the one by Baines, Bigdeli, Bustinza, Shi, Baldwin, and Ridgway (2017), verified that authors still find it difficult to understand how industrial companies can transform efficiently and effectively to take advantage of servitization opportunities. In this context, topics such as the impact of different servitization strategies on the performance of industrial companies and evaluating the profitability of supplying additional services are still under development and deserve more attention.

In another study, Zhang and Banerji (2017) evaluated ProQuest, Scopus, and Science Direct, as the main databases for servitization research, and identified more than 1000 articles on this topic. They selected a sample of 48 highly relevant articles in B2B contexts (business to business), such as in the present study. The authors emphasize the need to develop more quantitative studies so that the research agenda may progress in this field. Furthermore, they highlight the challenge of developing business models and operating processes that ensure the implementation of an effective service strategy. This implies seeking a better understanding of the connections between achieving the potential benefits of servitization and improving organizational performance through mechanisms like the allocation and efficient use of resources (productivity) and an appropriate system for both financial and operational indicators.

In this context, studies can examine the value or gains that servitization can provide. This work aims to explore this gap and poses the following research question: What is the relationship between servitization and the organizational performance of industrial companies? Therefore, the general objective of this work is to evaluate the impact of servitization on the organizational performance of industrial companies.

THEORETICAL DEVELOPMENT

Servitization can be defined as the transition process wherein companies embrace service orientation and/or develop more and better services to satisfy customer needs, achieve competitive advantage, and enhance firm performance (Ren & Gregory, 2007). As a complement, servitization can be seen as developing the innovative capabilities of an organization whose strategy is limited to supply of products, to begin offering product-service systems, thus, leading to better customer satisfaction and a lower risk of the commoditization trap (Kastalli & Looy, 2013).

There are various reasons why an industrial company begins providing services. For example, studies highlight the benefits of this strategy in facilitating product sales (Brax, 2005), increasing customer loyalty (Brax, 2005; Karlsson, 2007; Prester,

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2011), creating growth opportunities in mature markets (Brax, 2005), and developing more stable revenue streams by combining business cycles with different cash flows (Brax, 2005; Wise & Baumgartner, 1999).

Since it was first mentioned by Vandermerwe and Rada (1988), research on servitization has been continuous and consolidated (Baines et al., 2017). Several nomenclatures have been used to refer to integrated products and services, such as product-service system (PSS), integrated solution and functional products (Park, Geum, & Lee, 2012). In this study, the term "integrated product-service (IPS)" (Park et al., 2012) refers to any offer in which products and services are integrated, regardless of their type, objective(s), and characteristic(s).

Park et al. (2012) have found several examples of services that can be integrated into products, such as installation, training, operation, repair, maintenance, documentation, and consulting. Ultimately, an industrial company can sell the use of equipment, but not the product itself (Schmenner, 2009). Rolls-Royce, for instance, seems to be advancing towards this (Bascavusoglu-Moreau & Tether, 2011). It still sells aircraft engines, but earns an increasing share of its revenues from providing "total care" maintenance services based on the concept of offering enhanced predictability and reliability for a fixed cost charging. Some manufacturers of products like water purifiers that require regular services – e.g., Woongin Coway from Korea – have already moved further and offer them by lease or rent assuming their maintenance, repair, and control (Park et al., 2012).

Given the diversity of services that can be integrated into products, the literature is not emphatic on the existence of different servitization levels among industries or about measuring the integration of services and products. However, some authors seem to find a consensus on the mechanism of this integration, and present ways to measure it. Among the classification models evaluated, the models of Parida, Sjödin, Wincent, and Kohtamäki (2014) and Oliva and Kallenberg (2003) seem to be the most congruent. This evaluation is based on the following aspects: i) the two models are characterized by four stages, having been given similar names, ii) they express the same understanding regarding business stages, both at the initial (product-oriented, due to a greater emphasis on products rather than services) and final stages (user-related and result-oriented, due to a greater focus on services, and greater responsibility assumed by the supplier), iii) they contemplate similar services to exemplify each stage.

As for the effect of servitization focused in this work, the organizational performance, the literature addressing the effectiveness in ascertaining the potential benefits from the implementation of servitization strategy has considered a wide array of factors for evaluation. The perspectives vary from those based on the use of more conventional management indicators (e.g., Baines and Lightfoot (2013); Bascavusoglu-Moreau and Tether (2011); Goffin (1999); Kastalli and Looy (2013); Neely (2008)) to those that suggest more complex constructs, such as "service success in manufacturing companies" (Raddats, Burton, & Ashman, 2015) or even "survival," which is the ultimate measure of organizational performance (Benedettini, Swink, & Neely, 2017).

Hypotheses and conceptual model

The effectiveness of servitization is still a matter of debate. Thus, to elucidate some characteristics identified by qualitative studies and examine them within the context of Brazil, the following central research hypothesis was defined:

> H1: There is a positive and significant relationship between servitization and organizational performance in the machinery and equipment industries.

This hypothesis examines the relationship between two constructs: servitization and organizational performance, which are referred to in the literature based on different multidimensional models. For a more specific understanding of the nature of servitization and its multiple components, the following secondary hypothesis was derived from H_1:

> H2: The degree of servitization is formed by the offer of basic services, maintenance services, research and development services, and functional services in the Brazilian machinery and equipment industry.

Similarly, to further analyze the effects of servitization on different dimensions of organizational performance, a second secondary hypothesis was derived as follows:

> H3: Performance is reflected in financial performance and operational performance.

The examination of the relationships among the two focused constructs and between them and the components considered in hypotheses H_1, H_2, and H_3, led to the construction of the structural model in Figure 1.

An analysis of the whole set of constructs addressed in the theoretical development was conducted as follows, evidencing the associations among them.

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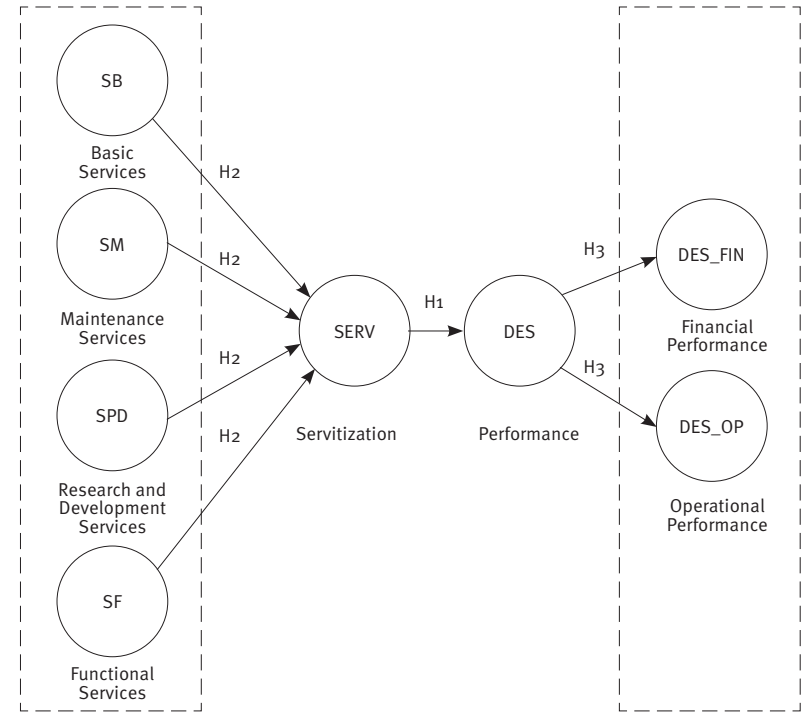
Figure 1. **Relational hypothetical model with the research hypotheses**



Source: Parida et al. (2014) Source: Floriani (2010)

METHODOLOGY

Validating the theoretical model in this study required information about an industry that is already predominantly servitized. Thus, to determine the relationship considered in this model, Brazilian companies operating in the machinery and equipment sector were chosen as the population of interest, as they represent a mature industry characterized by low market growth and little technological innovation. This has induced the segment to try to improve profitability by offering services (Oliva & Kallenberg, 2003).

The data collection procedure to assess the research hypotheses was the direct survey of a target audience (i.e., machinery and equipment industries). Notably, in the sample of papers selected by Zhang and Banerji (2017) in their systematic literature review, only three were classified as surveys. Thus, there remains a lack of theoretical and empirical studies based on primary data collected directly from machinery and equipment manufacturers.

To examine the validity of the theoretical model in this research, multivariate analysis methods based on the structural equation modeling technique (SEM) were adopted. Specifically, to operationalize SEM, the partial least squares estimation (PLS-SEM) method was adopted, which is supported by SmartPLS 3.0 software. This approach was chosen rather than the covariance-based method (CB-SEM), as it is preferable in case of less-developed theories, especially when the main objective is to predict and explain target constructs (Hair, Hult, Ringle, & Sarstedt, 2014, p. 14), as in this study.

Operational definitions for the variables

The variables considered for measuring the inherent aspects of a servitized company are defined below.

Servitization construct

The service categorization model proposed by Parida et al. (2014) was used to analyze servitization. This model considered 14 types of services within four service categories, allowing them to be treated individually or as composites to represent different servitization levels or intensities.

a. Basic services: These include IPSs designed to educate customers about products. These specific types of offers are intended to add marketing value to the product.

b. Maintenance services: These IPSs are generally offered to minimize the cost of durable goods, to ensure their proper functioning, and even to take responsibility for those at the end of life through product improvement. Its focus remains on the product, but its attractiveness is generally strengthened through the aggregation of maintenance services.

c. Research and development services: As industries interact with distinct customers, they need to develop internal know-how of their customers' products and processes. Over time, this understanding can be explored to develop a set of advanced IPSs that would reduce the challenges faced by customers in research and development and improve their profitability.

d. Functional services: These include result-oriented services, such as operating the customer process, or the product sold to them. The purpose of this business model is to sell certain results or capabilities instead of a physical product.

Parida et al. (2014) propose that the constructs listed above be measured using four, three, five, and two manifest variables, respectively, as described in Exhibit 1.

To meet the model's evaluation requirements, a general variable was used for servitization. This construct was operationalized through a single-item variable, as explained below in the Results section (Stage 1). Its operationalization was based on Oliva and Kallenberg (2003), who argue that as the companies incorporate more product-related services, they evolve along increasing servitization levels. Thus, the servitization construct is measured as shown in Exhibit 1.

Exhibit 1. **Servitization construct indicators**

First-order Construct	Abbreviation	Definition
Basic Services (SB)[a]	CB	Cost-benefit calculation services (ex.: helping the customer choose the product with the best cost-benefit ratio for their case)
	CONS	Consulting services for the customer and support by telephone
	INFO	Written information material (ex.: manuals)
	TREI	Technical training services for users
Maintenance Services (SM)[a]	MANUT	Maintenance services (ex.: corrective, preventive)
	UPG	Product upgrading services (ex.: updates, upgrades)
	SUP	Technical support services for similar products by other manufacturers
Research and Development Services (SPD)[a]	MANUF	Services for analyzing product manufacturability (ex.: calculation and optimization of the design for products that are easier to manufacture)
	AP	Services for analyzing problems (ex.: a system that monitors operation data of the product sold to the customer and alerts when potential problems might occur)
	VIAB	Feasibility study services (ex.: feasibility analysis for personalized products requested by the customer)
	DESEN	Prototype design and development services
	PESQ	Research services (ex.: study and development of new Technologies, products)
Functional Services (SF)[a]	OPC	Service for operating customers' process (ex.: The manufacturer uses the product that it produces to operate the customer's process, but does not sell it. The product is only part of the solution.)
	OPV	Service for operating the product sold to the customer (ex.: The manufacturer sells the product that it produces to the customer but operates the customer's process using this purchased product.)
Servitization[b]	GERAL	Company's level of service orientation considering that the main objective of a "completely service-oriented" firm is to offer services to its customers, with the product being just a part of the solution.

[a] Parida et al. (2014)
[b] Oliva & Kallenberg (2003)

Performance construct

To evaluate firm performance within the context of servitization, we sought to examine the nature of conventional managerial indicators, which have been addressed in the literature, as they can be easily understood, and managers are generally more familiar with such data. A greater emphasis was on considering financial indicators, especially for measuring business results and the performance of factors that enable servitization (internal efficiency), and the effectiveness of operations that support servitization (external effectiveness).

Requesting performance data from companies through surveys can greatly reduce the response rate, as managers typically treat this information as confidential. Thus, we searched for measurement models in the literature that evaluate performance indirectly (i.e., managers' perception). However, we did not find any study that presented a validated measurement model to evaluate the performance of servitized industries with structural equation modeling. Thus, we directed the search toward studies that had already validated a form to measure this construct in other contexts indirectly.

Floriani (2010) evaluated the performance of Brazilian companies after internationalization from the perspective of managers and pointed to good results in her measurement model. In this study, the author represented the performance construct by two exogenous constructs: financial performance, and operational performance, as follows:

i. Financial performance: A construct defined by the following indicators – Return on Assets (ROA), which reflects the company's overall performance, its potential for generating profits, that is, its net profit with respect to total investment (Net Profit/Total Assets); General Profit, which indicates the net profits divided by sales; and Net Profitability, which indicates the percentage of return on the capital invested in the company (Net Profit/Total Investment).

ii. Operational Performance: A construct defined by the following indicators – General Sales Volume of the company, which is the overall sales; Market Share, which indicates the percentage share of the market (total number of units sold by the company in relation to the total units sold in the segment in which it operates); and Operational Productivity, which evaluates efficiency and effectiveness, the former applying to the performance measure of the conversion process from input to output and the latter to measuring the degree to which the output meets the requirements.

This approach follows the recommendation to not base the performance measurement of organizations purely on financial indicators, when the purpose is to evaluate the development of long-term strategies (Kaplan & Norton, 1996). It also reflects—although partly and very briefly—evaluating organizational performance through a more integrated set of indicators, considering different perspectives, such as financial, non-financial, internal, and external (Neely et al., 2000).

Thus, the two constructs detailed above are measured by three manifest variables, as illustrated in Exhibit 2, which characterizes their perspectives and connects them to several studies on servitization, which consider them (the variable itself or the associated logic) in the discussion or analysis of the potential benefits of this business strategy.

Although considered in a different context, these variables align with perspectives of studies within the context of servitization of industrial companies, as well as with the aspects that may influence the effects of servitization mentioned in the literature. Therefore, we adopted this measurement model in this study.

Data collection procedures

As a unit of analysis, Brazilian machinery and equipment builders were considered, and the questionnaire was designed to collect data on a company's experience in promoting servitization.

The respondent profiles sought were executives from Service, Operations, or Commercial areas, as the information sought, especially on performance, is usually restricted to the management of these areas. Thus, the survey asked this target audience to evaluate the degree to which the company in question could meet customer needs in providing services within each of the four categories. The following response options were made available: (1) Not at all, (2) Meets very little, (3) Meets a little, (4) Meets partially, (5) Meets moderately, and (6) Fully meets. For the general servitization variable (SERV), they were asked to evaluate the service-orientation of the company in question. The answers were gathered using a 5-point scale ranging from (1) "Not oriented" to (5) "Fully Oriented." For the performance variables (DLG, DRA, DRENT, DPM, DPO, DVEND), the survey asked whether they had increased after initiating the service offer. A 5-point Likert scale was used, ranging from (1) "Strongly Disagree" to (5) "Strongly Agree," in addition to a "Not Applicable" alternative for companies that did not offer any of the mentioned services.

Exhibit 2. **Financial construct indicators based on Floriani's study (2010)**

First-order construct	Abbreviation	Indicator	Nature of indicator	Referential frameworks that associate the Indicator with servitization
Financial performance (DES_FIN)	DLG	General profitability	Financial result measure	Wise & Baumgartner (1999); Allmendinger & Lombreglia (2005); Karlsson (2007); Neely (2008); Prester (2011); Kastkalli & Looy (2013).
	DRA	Return on assets (net profit/total assets)	Financial result measure	Wise & Baumgartner (1999); Lindström (2014).
	DRENT	Net profitability (net profit/total investment)	Financial result measure	Wise & Baumgartner (1999); Goffin (1999); Allmendinger & Lombreglia (2005).
Operational performance (DES_OP)	DPM	Market share	External operational effectiveness measure	Goffin (1999); Vandermerwe & Rada (1988)
	DPO	Operational productivity	Internal measure of operational efficiency and effectiveness	Neely (2008); Bascavusoglu-Moreau & Tether (2011); Baines & Lightfoot (2012)
	DVEND	Sales volume	External operational effectiveness measure	Goffin (1999); Brax (2005); Prester (2011); Kastalli & Looy (2013).

To characterize the sample considered, in addition to the questions about elements of the theoretical model, others were added to the questionnaire to obtain data about the respondent and the company, such as location (state), sector of operation, main type of manufactured machinery/equipment, and size.

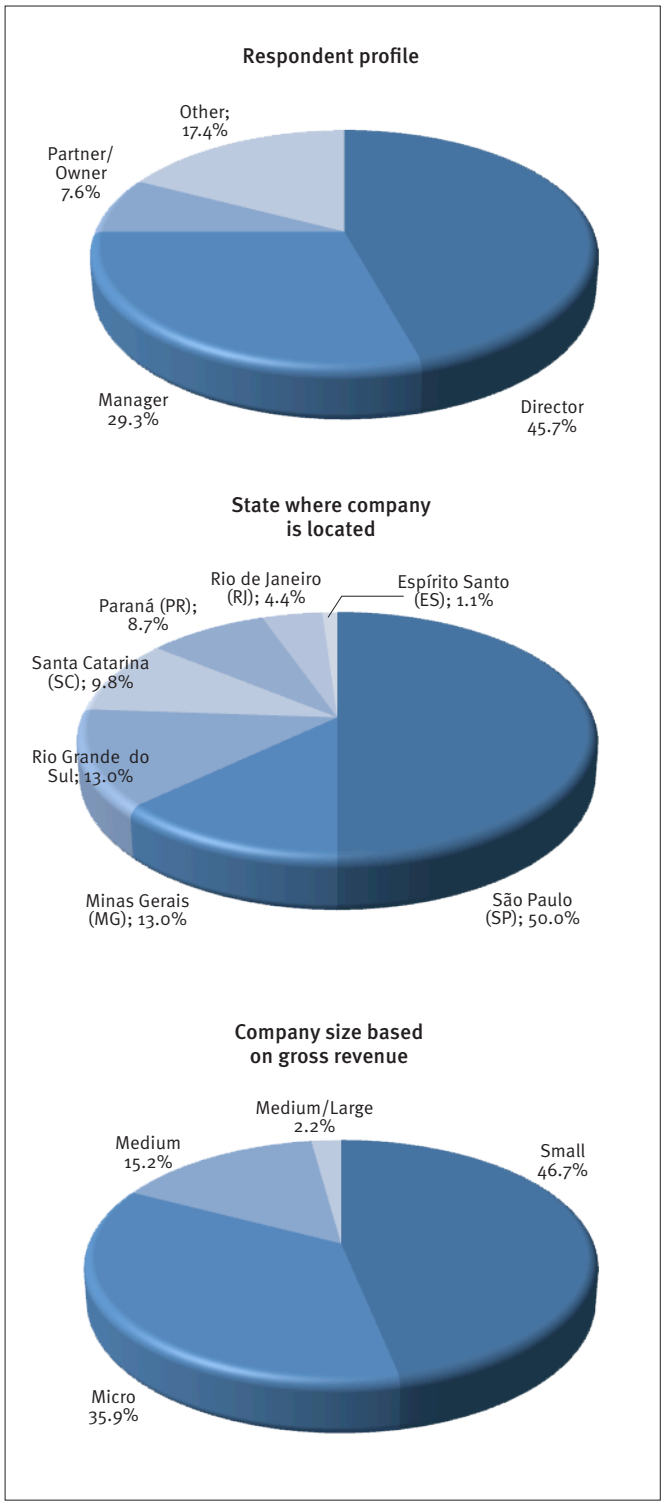
All the manufacturers identified in the portal of the Brazilian Machinery Builders´ Association (Abimaq) were catalogued to obtain access to the target audience. The sample size was scaled considering the most conservative recommendation to take the maximum number of independent variables for reference in the measurement models and/or structural model. As this number is four (four predictors for the servitization construct), it was necessary to obtain a sample with at least 65 observations to ensure a statistical power of 80% and to have coefficient of determination R^2 values of at least 0.25, with a 5% error probability (Hair et al., 2014, p. 21).

To check the semantic appropriateness of the indicators proposed for the constructs measured in the theoretical model delineated in Figure 1, it was submitted to a pre-test composed of six rounds of evaluation by guest researchers, business consultants, and managers of companies with the desired profile for this study. After the rounds of evaluations, an invitation letter was sent by e-mail to the catalogued companies.

RESULTS

Initially, Graph 1 presents a characterization of the companies that make up the sample in terms of geographic distribution, size, and the profile of the respondents. The size was considered based on classification criteria from the Brazilian Development Bank (BNDES) at the time of data collection. It was based on the annual gross operating revenue: micro (less than or equal to BRL 2.4 million); small (between BRL 2.4 million and BRL 16 million); medium (between BRL 16 million and BRL 90 million); medium/large (between BRL 90 million and BRL 300 million), and large (over BRL 300 million).

Graph 1. **Respondent profile, state, and company size**



The sector of operation and the main type of machinery/equipment built by the companies from this sample are shown in Graph 2.

To test the hypotheses, the collected data was analyzed by applying the PLS-SEM, as recommended by Hair et al. (2014). These authors propose that modeling by this method be conducted through the following stages: i) specification of the structural model, ii) specification of the measurement models, iii) data collection and analysis, iv) evaluation of the path model by the PLS-SEM method, v) evaluation of the measurement models, vi) evaluation of the structural model by the PLS-SEM method, and vii) interpretation of the results. The following sub-stages provide further explanations.

Stage 1: Specification of the structural model

The exogenous first-order constructs in the model are basic services (SB), maintenance services (SM), research and development services (SPD), and functional services (SF), which form the second-order construct for servitization. This model's endogenous constructs are servitization (SERV), which is formed by the four exogenous constructs mentioned above; performance (DES), which is a second-order construct; and two first-order constructs that reflect performance: financial performance (DES_FIN) and operational performance (DES_OP). The structural model has two higher order components (HOCs), one to represent the four service categories and another to represent the two performance categories.

For the relationship between constructs SB, SM, SPD, and SF, which are lower order components (LOCs), and the SERV (HOC) construct, formative modeling was adopted, acknowledging the first ones as "causes" of the second concept. Moreover, as advised by Hair et al. (2014), this HOC was chosen to make the PLS path modeling more parsimonious, that is, with a smaller number of relationships.

The portion of the model related to measuring servitization in this study follows the type of hierarchical component model referred to as "reflexive-formative," which indicates formative relationships between the LOCs and the HOC, while each construct is measured by reflexive indicators, as detailed in the following subsection.

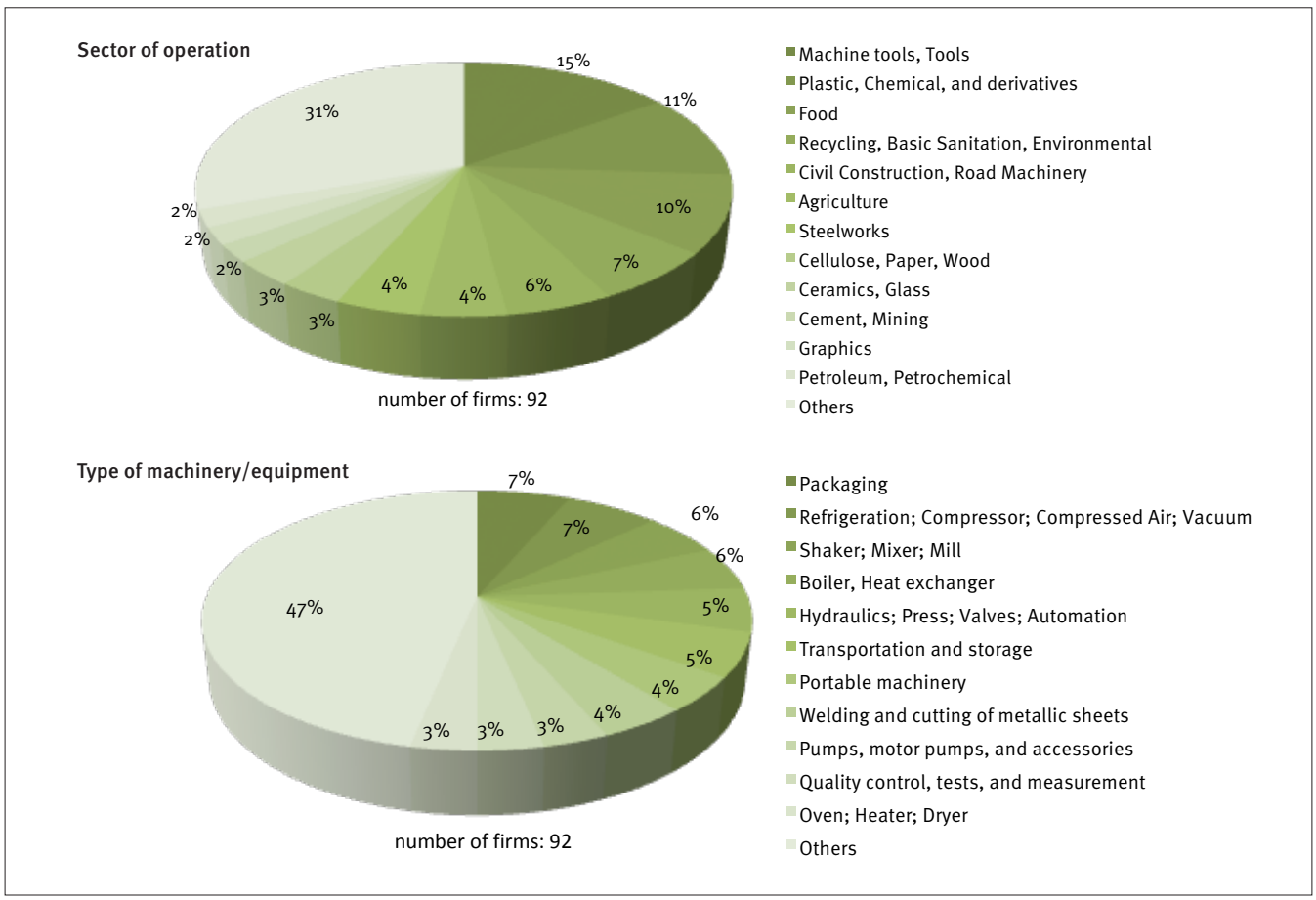
Stage 2: Specification of the measurement model

Each first-order construct was defined by a specific measurement model and was reflexive. To define which of the model's constructs would have a formative or reflexive nature, a careful analysis was made on the content of the questions (indicators) with regard to

the domain of the constructs, as suggested by Hair et al. (2014). The exogenous latent variables, "basic services," "maintenance services," "research and development services," and "functional services" were defined to have a formative nature, as servitization is represented by a construct that combines the concepts of the cited variables, which cannot be mutually interchangeable. The financial performance and operational performance constructs were defined to have a reflexive nature, in that they treat variables that represent consequences (manifestations) of the respective construct.

The second-order constructs followed the measurement nature of the first-order constructs and are also reflexive. For the performance construct, the repeated indicators approach was used, according to which all the LOC indicators were attributed to the HOC measurement model. To apply such an approach, Hair et al. (2014) emphasize that the number of indicators must be similar throughout all the LOCs, which was observed in this case for DES_FIN and DES_OP. However, for the servitization construct, the number of indicators for each LOC was not the same, varying from two to five. In this case, the same authors underscore that the relationships between the HOC and LOCs may be significantly influenced by the inequality in the number of indicators. Therefore, to obtain a formative measurement model for the servitization construct, it was considered an endogenous single-item construct. For this purpose, an overall variable named GERAL was defined, which sums up the essence of the servitization construct, and whose nature was defined to be reflexive, as established for single-item construct (Hair et al., 2014).

Graph 2. **Sector of operation and the main type of machinery/equipment of the companies**



Stage 3: Data collection and analysis

Data collection began at the start of 2015. The invitation letter was sent through the *MailChimp* tool, which enables tracking the opening of and clicks on the links in the e-mail. In total, 5,489 companies received the e-mail. As there were 123 respondents, this represents a response rate of 2.24%. As data collection applied an electronic mechanism for data entry (docs.google.com), all

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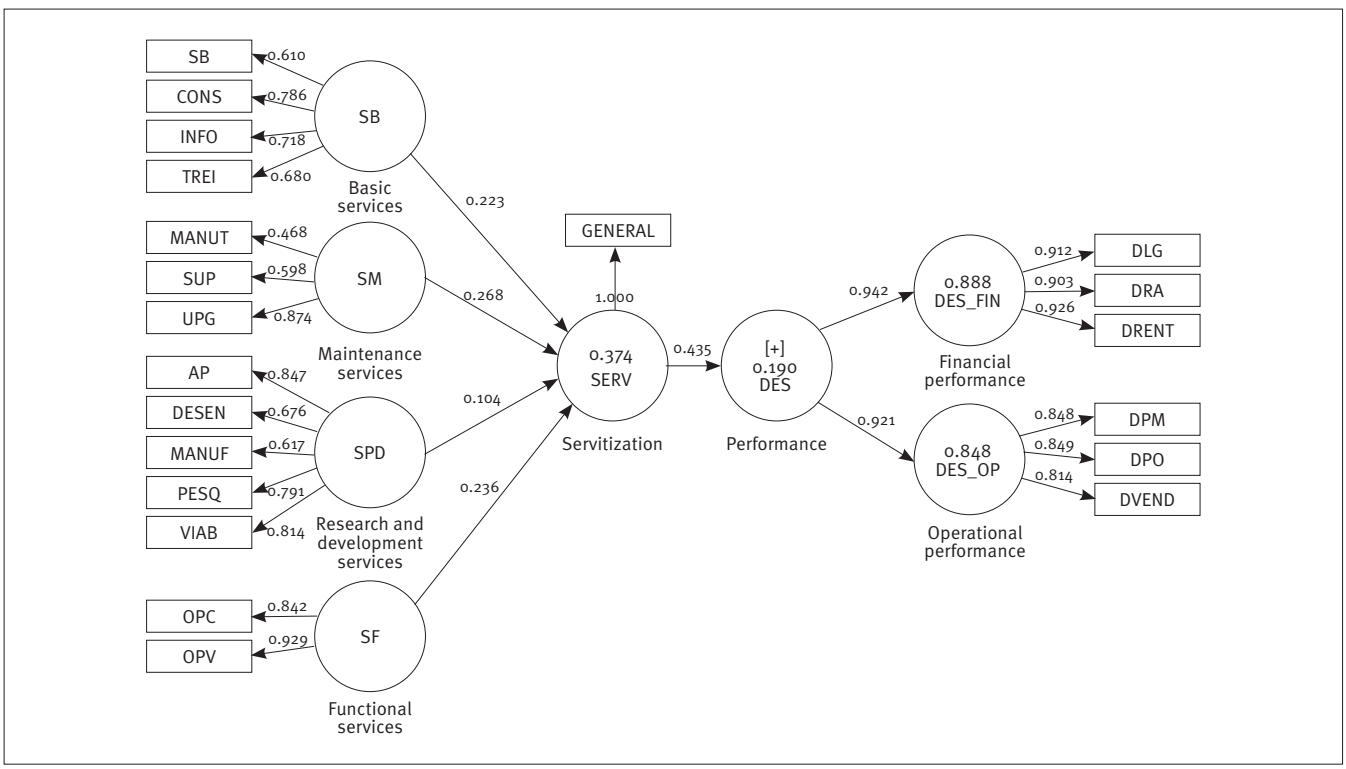
questions required answers, which prevented the occurrence of omitted data. Information from 29 respondent companies was discarded because they either explicitly declared not being service-oriented or that the services offered are not associated with their products, or answered "does not apply" to questions about one or more of the six evaluated performance variables, thus, making it impossible to include them in the structural model. Consequently, 94 cases remained. Among these, a case suspected of straight lining the answers—checking off the same answer for a large proportion of questions (Hair, Black, Babin, Anderson, & Tathan, 2009)—was detected and discarded. Finally, the analysis for outliers employing univariate and multivariate approaches, as suggested by Kline (2011), resulted in identifying only one case with an absolute *z* value over 4 (-4.144). In the end, upon the removal of these observations, we obtained a sample of 92 cases for analysis.

Data distribution was also verified. For this purpose, we tested normality by using the Kolmogorov-Smirnov test, as the sample size was greater than 50 (Mooi & Sarstedt, 2011). All the variables presented significance equal to 0.00, and thus, the normality assumption was rejected using the Kolmogorov-Smirnov test. As the distribution of none of the study's variables is normal, it reinforces the decision to adopt the PLS-SEM, because it is a statistical model that does not require the normal distribution of data (Hair et al., 2014).

Stage 4: Evaluation of the path model by PLS-SEM method

The results from the structural model (Figure 2) show that the exogenous first-order constructs have a servitization effect, varying between 0.104 and 0.268. Maintenance services have the most impact and research and development services the least. Together, the first-order constructs, basic services, maintenance services, research and development services, and functional services, explain 37.4% of the variance of the second-order servitization construct. This, in turn, has an effect of 0.435 on the endogenous performance construct and explains 19% of its variance, which could not be greater due to other factors that also influence organizational performance, which were not contemplated in this study. The second-order performance construct had a direct effect of 0.942 on financial performance and 0.921 on operational performance, and explained 88.8% of the former's variance and 84.8% of the latter's variance.

Figure 2. **Structural model with results from PLS-SEM**



Stage 5: Evaluation of the measurement models

Initially, the model's composite reliability was assessed. The parameters for evaluating composite reliability indicated by Hair et al. (2014) are usually interpreted similarly to those of Cronbach's Alpha, with the appropriate limit between 0.70 and 0.90, although values between 0.60 and 0.70 are acceptable in exploratory research. Table 1 reveals the results of these indices for the constructs considered in this study.

Table 1. **Evaluation of the measurement models**

Construct	Cronbach's Alpha	Composite reliability
SERV	1.000	1.000
SB	0.658	0.793
SM	0.433	0.694
SPD	0.812	0.867
SF	0.736	0.880
DES	0.899	0.923
DES_FIN	0.901	0.938
DES_OP	0.786	0.875

All the values for composite reliability are above the threshold value to be considered satisfactory, except the index for the maintenance services construct, which nevertheless, was considered to be sufficiently close to 0.7 for acceptance. However, two values referring to the performance and financial performance constructs were found to be between 0.90 and 0.95 and were not desirable. Nevertheless, as this is not a deterrent criterion, which prevents analyses, and most of all, considering the validity of the content supported by Parida et al. (2014), we decided to proceed with the analyses without excluding these items' variables.

Subsequently, convergent validity was examined. To establish convergent validity, at the indicator level, the values of their loadings (also referred to as outer loadings or "the indicator's reliability" as a function of the reflexive measurement model) and communality (outer loadings squared) were considered. At the construct level, the average variance extracted (AVE) calculated for each construct based on the average of the commonalities of its variables is considered for being a metric equivalent to communality at the indicator level. All the indicators' outer loadings must be statistically significant. Therefore, as a "golden rule," the standardized value of the outer loadings must be equal to or greater than 0.708 (Hair et al., 2014). Communality at the indicator level represents the extent of variation in one item explained by the construct. In this case, a latent variable must explain a substantial part of each indicator's variation, which is generally at least 50%. All the results for convergent validity are presented in Table 2.

Table 2. **Convergent validity measure (Indicators)**

Latent Variable	Indicator	Outer loading	Communality
SB	CB	0.61	0.372
	CONS	0.786	0.618
	INFO	0.718	0.515
	TREI	0.68	0.462
SM	MANUT	0.468	0.219
	UPG	0.874	0.763
	SUP	0.598	0.357
SPD	MANUF	0.618	0.381
	AP	0.847	0.718
	VIAB	0.814	0.663
	DESEN	0.676	0.457
	PESQ	0.791	0.626
SF	OPC	0.842	0.709
	OPV	0.929	0.862
DES_FIN	DLG	0.912	0.831
	DRA	0.903	0.815
	DRENT	0.926	0.858
DES_OP	DPM	0.848	0.719
	DPO	0.849	0.721
	DVEND	0.814	0.662

Observing the outer loadings for six indicators revealed values under 0.7 (CB, TREI, MANUT, SUP, MANUF, and DESEN). Hair et al. (2014) highlight that researchers frequently observe weaker outer loadings in social science studies, especially when using recently developed scales, such as in this study. Therefore, Hair et al. (2014) suggest that instead of automatically eliminating the indicators when the outer loading is below 0.70, researchers must carefully examine the effects of the item's removal on composite reliability and the construct's content validity. In general,

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indicators with outer loadings between 0.40 and 0.70 must be considered for removal from the scale only when their exclusion leads to an increase in composite reliability over the suggested threshold value (between 0.60 and 0.90 for exploratory studies) or to an AVE greater than 0.50 (as presented in the following).

Another point to consider in excluding an indicator is evaluating the effects of its removal on content validity. Indicators with weaker outer loadings are sometimes withheld based on their contribution to content validity. However, indicators with very low outer loadings (lower than 0.40) must always be eliminated from the scale. Thus, before any alteration to the indicators, we analyzed the constructs' convergent validity.

A common measure for establishing convergent validity at the construct level is AVE. According to Hair et al. (2014), an AVE equal to or greater than 0.50 indicates that, on average, the construct explains more than half of the variation of its indicators. Netemeyer, Bearden, and Sharma (2003) suggest that AVE estimates should be over 0.45. The AVE results for the constructs of this study are displayed in Table 3 (Netemeyer et al., 2003).

Table 3. **Results of the Average Variance Extracted (AVE) for the constructs**

Construct	Average Variance Extracted (AVE)
SERV	1.000
SB	0.492
SF	0.786
SM	0.446
SPD	0.569
DES	0.667
DES_FIN	0.835
DES_OP	0.701

An AVE value less than the limit recommended by Netemeyer et al. (2003) was found for only one construct (SM), while the remaining constructs were verified to have convergent validity (0.492 for SB was considered to be sufficiently close to 0.5).

Investigating further into the possibility of excluding indicators, we analyzed the influence of the exclusion of indicators with outer loading values between 0.4 and 0.7 (CB, TREI, MANUT, SUP, MANUF, and DESEN). Table 4 shows the values for AVE, composite reliability, and the adjusted R^2 value before and after the exclusion of indicators. This last coefficient (adjusted R^2) is considered because it is also a criterion used to decide the exclusion of indicators. It is used to compare results in the PLS-SEM involving models with different numbers of exogenous latent variables. In modeling studies, it is important to look for models that are good at explaining data, but that also have fewer exogenous constructs, that is, which are more "parsimonious." The adjusted R^2 value may be utilized as a criterion to prevent bias toward complex models. Thus, when it increases after exclusion, it suggests that the model has become more parsimonious.

Considering Hair et al.'s (2014) suggestion to remove variables, based on Table 4, only two indicators were assessed: MANUT and SUP, which make up the SM construct, as all other indicators make up constructs (SB and SPD) with AVE and composite reliability values already above the threshold value. Considering the AVE values from Table 4, the MANUT and SUP indicators would be candidates for removal, as this would result in values above the 0.5 limit for both. Nevertheless, in observing the composite reliability value that they compose for the SM construct, we notice that it is already within the limit suggested for exploratory studies (0.6 and 0.9), which meant keeping these indicators. Moreover, the exclusion of SUP would worsen the adjusted R^2 value, making the model less parsimonious. Because of these points and the application of the same set of indicators in a previous study (Parida et al., 2014) that corroborates the content validity, we resolved not to remove any indicators from the model.

Table 4. **Evaluation of the removal of indicators**

Construct	Indicator	AVE		Composite Reliability		Adjusted R^2	
		Before	After	Before	After	Before	After
SB	CB	0.492	0.567	0.793	0.797	0.345	0.352
SB	TREI	0.492	0.550	0.793	0.784	0.345	0.355
SM	MANUT	0.446	0.582	0.694	0.729	0.345	0.357
SM	SUP	0.446	0.591	0.694	0.722	0.345	0.325
SPD	MANUF	0.569	0.626	0.867	0.869	0.345	0.348
SPD	DESEN	0.569	0.611	0.867	0.861	0.345	0.347

Furthermore, the model's discriminant validity was verified by adopting the Fornell-Larcker criterion, as it was the most conservative (Hair et al., 2014). According to this criterion, discriminant validity is evidenced when the AVE of each latent variable is greater than the square of the largest correlation with another latent variable (Henseler, Ringle, & Sinkovics, 2009). As shown in Table 5, the data certifies the model's discriminant validity.

Table 5. **Squared values of the correlations and AVE to apply the Fornell-Larcker Criterion**

Construct	DES_FIN	DES_OP	SERV	SB	SM	SPD	SF
DES_FIN	**0.914**						
DES_OP	0.737	**0.837**					
SERV	0.350	0.471	**1**				
SB	0.221	0.377	0.454	**0.701**			
SM	0.204	0.318	0.507	0.473	**0.763**		
SPD	0.241	0.368	0.459	0.519	0.489	**0.754**	
SF	0.292	0.236	0.393	0.185	0.261	0.442	**0.886**

Note: AVE values in bold

Stage 6: Evaluation of the structural model by the PLS-SEM method

Initially, the occurrence of multicollinearity in the structural model was analyzed. Tolerance levels under 0.20, which correspond to the Variance Inflation Factor (VIF) above 5, in the predicting constructs point to collinearity (Hair et al., 2014). The results presented in Table 6, calculated with the IBM SPSS® version 20 software, do not reveal any multicollinearity issues.

Table 6. **Results of the multicollinearity evaluation**

Construct	Tolerance	Variance Inflation Factor (VIF)
SB	0.652	1.535
SM	0.664	1.505
SPD	0.559	1.788
SF	0.798	1.254

Subsequently, the structural model's relevance and significance were evaluated by obtaining the values for the path coefficients through the two-tailed Student's *t*-test. The results of the statistics for *t* and *p* evidenced that the path coefficients were considered to be valid at a significance level α of at least 5% for all the relationships examined in Table 7, except the relationship between SPD and SERV.

Table 7. **Results of the bootstrapping procedure to calculate *t* statistics**

Hypothesis	Relationship	Path coefficient	*t* Statistics	*P*-value	Evaluation
H1	SERV -› DES	0.435	3.908	.000	Significant at 1%
H2	SB -› SERV	0.223	2.239	.025	Significant at 5%
	SM -› SERV	0.268	2.581	.010	Significant at 5%
	SPD -› SERV	0.104	1.057	.290	Not Significant
	SF -› SERV	0.236	2.595	.009	Significant at 1%
H3	DES -› DES_FIN	0.942	89.608	.000	Significant at 1%
	DES -› DES_OP	0.921	52.084	.000	Significant at 1%

Finally, the coefficient of determination R^2 for the endogenous constructs was examined. This varies between 0 and 1, with elevated levels indicating more predictive precision. According to Hair et al. (2014), in general, R^2 values in the order of 0.25, 0.50, and 0.75 for the target constructs are considered to be weak, average, and substantial, respectively. Chin (1998) describes R^2 values

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of 0.19, 0.33, and 0.67 in PLS path models as weak, moderate, and substantial, respectively. The evaluation of R^2 based on these authors' criteria is summarized in Table 8.

Table 8. **Evaluation of the coefficient of determination**

Construct	Coefficient of Determination R^2	Evaluation by Hair et al.'s Criteria (2014)	Evaluation by Chin's Criteria (1998)
SERV	0.374	Weak	Moderate
DES	0.190	Weak	Weak
DES_FIN	0.888	Substantial	Substantial
DES_OP	0.848	Substantial	Substantial

Stage 7: Interpretation of the results

Table 10 contains the evaluations of the hypotheses. As can be observed from the values of the impact of SERV on DES, the study's main hypothesis (H_1) on the existence of a positive and significant relationship between servitization and performance was corroborated (significant at 1%).

Moreover, H_1 was analyzed by applying another method. Thus, we sought to understand whether financial and operational performances differ as a function of the degree of servitization. For this analysis, based on the general variable of servitization (SERV), the firms from the sample were divided into three groups of companies distinguished by the degree of servitization (Group A – Strongly or fully service-oriented companies, Group B – Reasonably service-oriented companies, and Group C –Poorly service-oriented companies). The proportion of firms in each group that agreed that servitization had significantly increased organizational performance was calculated for each of the six measurement variables for organizational performance. To assess whether that proportion varies among the three groups, the Chi-Squared test was conducted, whose results are in Table 9, evidencing that all the performance variables analyzed were influenced differently by the degree of servitization ($x^2_{calculated} \geq x^2_{critical}$) (Levine, Stephan, & Szabat, 2016). Thus, Cramer's V was computed to examine the degree of association between these two variables. The results around 0.30 point to a moderate relationship between organizational performance and degree of servitization (Cooper & Schindler, 2016).

The Marascuilo Procedure was used to identify groups with significant differences (Levine et al., 2016). The data demonstrate that the proportion of companies agreeing to a significant increase in operational and financial performance dimensions is greater in strongly or fully service-oriented firms (Group A) than in poorly service-oriented firms (Group C). These findings confirm the main hypothesis (H_1) and corroborate the results obtained with structural equation modeling.

Hypotheses H_2 and H_3 were also corroborated, as the empirical criteria of the PLS-SEM method were met. For H_3, the performance of the researched machinery/equipment builders is strongly reflected in the financial performance and operational performance indices (significant at 1%). Notably, H_2 was partially corroborated, as the exogenous research and development services construct was evaluated to be non-significant in the formation of servitization, while the first-order exogenous basic services, maintenance services, and functional services constructs had a relevant effect on the formation of servitization.

The research and development services construct may not be significant due to challenges faced by the firms. As it is a service category considered to be more complex than others (Oliva & Kallenberg, 2003), firms may be encountering difficulties in meeting their clients' expectations. Moreover, the volume of research and development demanded by the client companies may not be sufficient to justify further investments from Brazilian machinery/equipment builders. This may be the consequence of these firms' position within the context of a developing country (International Monetary Fund, 2014), which still lacks a more stimulating environment for innovation. We also underscore the fact that the sample was mostly composed of micro and small firms (Graph 1). The fact that these firms do not possess established research and development capabilities and belong to a sector with a slow pace of technological innovation (Oliva & Kallenberg, 2003) also does not favor the creation and supply of research and development services in a more intense way to their clients.

On the other hand, it is worth mentioning that the variables used to assess the research and development services construct (i.e., analysis of the products' manufacturability – MANUF, analysis of problems – AP, feasibility study – VIAB, prototype design and development – DESEN, and research – PESQ) are more heterogeneous services. For example, MANUF and VIAB do not seem to be closely related to DESEN and PESQ, although there was alignment in composite reliability. It is possible that these variables, being the outcome of a study developed within a different context (Parida et al., 2014), might have influenced the lack of relevance of the research and development services construct observed in this study. Moreover, machinery and equipment builders in Brazil may be offering other types of services characterizing the research and development services construct, which this study did not examine.

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Besides the direct relationships among the constructs examined in the sub-section of Stage 6, the indirect effects of each exogenous construct on the endogenous constructs of the model were analyzed (Table 10). By this assessment, the impact of research and development services was also considered to be non-significant. All the other relationships were significant at a minimum level of 10%, which may be assumed appropriate for an exploratory study such as this one, as suggested by Hair et al. (2014). Therefore, based on the model validated in this study, it is possible to infer part of the organizational performance of a machinery/equipment builder by knowing the level with which it meets its clients' needs in the provision of the contemplated service categories, and thus, formulate more consistent servitization strategies that reduce the risk of the service paradox. For example, this suggests that investments to develop maintenance services, a service category with the highest path coefficient (0.11) along with financial performance, may provide a better financial return than other categories. In the industrial sector analyzed, investments to develop research and development services can be ineffective and may give rise to the service paradox.

Table 9. **Analysis of the degree of servitization regarding operational and financial performance**

Performance Indicator		Proportion of companies that agree that performance increases with servitization				χ^2	*P*-Value	Cramer's V	Result of the Marascuilo Procedure
		Strongly or fully service-oriented firms (Group A)	Reasonably service-oriented firms (Group B)	Poorly service-oriented firms (Group C)	Entire sample				
Financial Performance	Overall Profitability	36/42 85.7%	24/35 68.6%	7/15 46.7%	67/92 72.8%	9.03	.0109 < .05	0.31	Significant difference between Groups A and C
	Return on Assets	30/42 71.4%	17/35 48.6%	5/15 33.3%	52/92 56.5%	7.98	.0185 < .05	0.29	Significant difference between Groups A and C
	Net Profitability	36/42 85.7%	25/35 71.4%	7/15 46.7%	68/92 73.9%	8.92	.0116 < .05	0.31	Significant difference between Groups A and C
Operational Performance	Sales Volume	38/42 90.5%	23/35 65.7%	7/15 46.7%	68/92 73.9%	12.97	.0015 < .01	0.38	Significant difference between Groups A and B and Groups A and C
	Operational Productivity	36/42 85.7%	20/35 57.1%	6/15 40.0%	62/92 67.4%	13.21	.0014 < .01	0.38	Significant difference between Groups A and B and Groups A and C
	Market Share	37/42 88.1%	24/35 68.6%	8/15 53.3%	69/92 75.0%	8.37	.0152 < .05	0.30	Significant difference between Groups A and C

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Table 10. **Evaluation of the indirect effects among the model's constructs**

Relationship between constructs	Path coefficient	*t* Statistics	*P*-Value	Evaluation
SERV -> DES_FIN	0.410	3.892	.000	Significant at 1%
SERV -> DES_OP	0.401	3.833	.000	Significant at 1%
SB -> DES	0.097	1.810	.070	Significant at 10%
SB -> DES_FIN	0.092	1.806	.071	Significant at 10%
SB -> DES_OP	0.090	1.795	.073	Significant at 10%
SM -> DES	0.116	2.186	.029	Significant at 5%
SM -> DES_FIN	0.110	2.186	.029	Significant at 5%
SM -> DES_OP	0.107	2.174	.030	Significant at 5%
SPD -> DES	0.045	0.952	.341	Not Significant
SPD -> DES_FIN	0.043	0.950	.342	Not Significant
SPD -> DES_OP	0.042	0.946	.344	Not Significant
SF -> DES	0.103	2.119	.034	Significant at 5%
SF -> DES_FIN	0.097	2.110	.035	Significant at 5%
SF -> DES_OP	0.095	2.100	.036	Significant at 5%

As for the impact of servitization on financial performance, in general, the results are congruent with previous studies that observed benefits such as greater profitability (Karlsson, 2007; Prester, 2011; Wise & Baumgartner, 1999), and more elevated margins and less demand for assets than the manufacture of products (Wise & Baumgartner, 1999), reinforcing that the service paradox may be prevented with well-planned servitization. Notably, in their transversal study on the effects of servitization in firms from different segments of the French industry, Crozet and Milet (2017) confirmed that the impact on profitability varies considerably throughout the segments considered and that the gains were greater in the manufacturing segments of mechanical machinery, and electric, optical, and transportation equipment. On the impact of servitization on operational performance, overall, the results revealed to be also congruent with previous studies that observed benefits such as increased productivity, new opportunities for growth, and greater competitiveness (Bascavusoglu-Moreau & Tether, 2011; Brax, 2005; Goffin, 1999; Johnston, 1994; Prester, 2011; Vandermerwe & Rada, 1988; Wise & Baumgartner, 1999).

As all firms in the sample have less than 500 employees, the results corroborate the finding by Neely (2008) that smaller servitized firms (with less than 3,000 employees) tend to generate higher net profit with servitization. For a better understanding of the relation between company size and the financial and operational performance in the sample considered, an analysis with greater granularity was conducted. Based on their number of employees, the companies from the sample were divided into three groups of companies distinguished by size (Group A – up to 19 employees; Group B – from 20 to 99; and Group C – from 100 to 499). The proportion of firms in each group that agreed that organizational performance had significantly increased with servitization was computed for each of the six measurement variables for organizational performance. To substantiate whether this proportion varies throughout the three groups, the Chi-squared test was performed (Levine et al., 2016), whose results, as exhibited in Table 11, evidence that all the contemplated performance variables were not influenced differently by size ($x^2_{calculated} > x^2_{critical}$). Therefore, the benefits of servitization for performance do not seem to differ significantly among firms with fewer than 500 employees, both in financial and operational terms. These results are congruent with the finding of Neely (2008) and point out that servitization seems to have a positive impact on organizational performance in the universe of micro, small, and medium-sized companies.

Table 11. **Analysis of firm size regarding financial and operational performance**

	Performance Indicator	Proportion of companies that agree that performance increases with servitization				χ^2	*P*-Value
		Up to 19 employees (Group A)	20 to 99 employees (Group B)	100 to 499 employees (Group C)	Entire sample		
Financial	Overall Profitability	27/38	33/45	7/9	67/92	0.18	.9150
		71.1%	73.3%	77.8%	72.8%		
	Return on Assets	22/38	24/45	6/9	52/92	0.59	.7437
		57.9%	53.3%	66.7%	56.5%		
	Net Profitability	27/38	34/45	7/9	68/92	0.29	.8633
		71.1%	75.6%	77.8%	73.9%		
Operational	Sales Volume	26/38	37/45	5/9	68/92	3.78	.1512
		68.4%	82.2%	55.6%	73.9%		
	Operational Productivity	24/38	32/45	6/9	62/92	0.60	.7425
		63.2%	71.1%	66.7%	67.4%		
	Market Share	24/38	37/45	8/9	69/92	5.02	.0813*
		63.2%	82.2%	88.9%	75.0%		

*Significant difference at 10%

Of the four categories considered to form the servitization construct, maintenance services, and functional services presented more significant indirect effects on performance, which is similar to the results obtained by Parida et al. (2014).

CONCLUSION

This study allowed for further reflection on the service paradox and identified a positive relationship between servitization and performance. This result contrasts with that of Bascavusoglu-Moreau and Tether (2011), who affirmed that servitized industries do not perform better than traditional industries, although they get increased productivity level of manufacturing. Additionally, this study contrasts with Gebauer et al. (2005) because it relies on questions about the perceived changes in financial and operational performance variables after the firm began to offer services, in order to compare its situation before (when still a traditional manufacturer) and after the transition to servitization. However, the non-significant statistical result of research and development services on financial and operational performance is congruent with the hypothesis of the existence of a service paradox, as indicated by Bascavusoglu-Moreau and Tether (2011). On the other hand, this study identified a positive relationship between the adoption of basic services and financial performance (Table 10), which opposes the findings of Parida et al. (2014), as they verified that such basic services diminish a firm's revenue prospects.

The empirical results corroborate the strategy of machinery/equipment builders to invest in the provision of services. Specifically, the analyses summarized in Table 10 suggest that, in view of the investment alternatives in different service categories, such effort should focus on improving the indicators of the maintenance services and functional services constructs. The potential it has to cause a positive impact on performance in both the financial and operational dimensions is significant. Conversely, within the context of the Brazilian machinery and equipment industry, investments in the provision of research and development services do not seem to have clearly contributed to boosting organizational performance. This suggests that the service paradox phenomenon may cause frustration depending on how the servitization strategy is implemented. One of the research fronts suggested by Baines et al. (2017) is the study of factors that influence the successful adoption of services by manufacturing companies. The results discussed above contribute in this sense.

The results of this study hint at the development of future studies on servitization with the following aims:

- Evaluation of others measurement models to assess the servitization construct;

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- Consideration of larger samples that allow comparing the experience of companies from different regions or countries with servitization, as well as ascertain results or patterns with a greater degree of generalization;

- To examine whether the investment volume for the creation and provision of services by industrial firms affects their performance.

This study has some limitations. It is important to note that the results refer to the servitization experience of firms from a particular industrial segment. Moreover, this study does not contemplate the technological stage in which both the manufacturing companies and customers in question find themselves, thereby, restricting a greater generalization of the findings. Regarding the theoretical constructs in assessing the effectiveness in accomplishing the economic benefits of servitization, it is worth mentioning authors such as Baines et al. (2017), Valtakoski (2017), and Zhang and Banerji (2017) who sought to develop a more holistic view of the phenomena that influence the relationships involved in this challenge. Based on an extensive literature review, they identified that it is fundamental to contemplate a marketing perspective encompassing elements such as the value proposition offered, the customers' value perception, and the interaction between the customer and the firm, which were not examined in this study. As Valtakoski (2017) underscores, in order for servitization to be successful, it is necessary to conceive it acknowledging the dyadic nature of the relationship between the solution provider and each customer's organization and to search means for value co-creation.

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