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Proposing a level of maturity in strategic sourcing: A case study and survey in Brazil

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A B S T R A C T

The objective of this study is to propose an instrument for identifying the level of maturity of purchasing and supply management in relation to Strategic Sourcing. Based on an initial model, a maturity measurement instrument was applied to a case study company in a chemical industry company in Vale dos Sinos, in order to validate the tool. Based on this, a survey was carried out with the aim of capturing the perception of purchasing professionals on the topic. By sending a questionnaire to 250 professionals in the purchasing and supply management area, a return rate of 28% (70 respondents) was obtained from this sample. For the data obtained, structural equation modeling (SEM) was carried out using Smart PLS 3.0® software. With the modeling, a load of 0.428 was obtained for the suppliers construct, 0.555 for the inventory construct and 0.158 for the indicators construct. Overall, the satisfactory constructs for this sample positively impact 67.8% on the Strategic Sourcing construct. Therefore, for this specific sample, the constructs referring to suppliers, inventory and indicators jointly impact Strategic Sourcing. The research in question proposed a model for a better understanding of Strategic Sourcing structures and aims to contribute to practical and organizational contexts regarding the maturity of this topic among purchasing professionals. This understanding aims to provide readers with greater empirical and academic understanding of this emerging and important topic for business and company competitiveness.

1. Introduction

Competitive pressures drive the evolution of corporate structures, exposing companies to shifts in markets, technological advancements, and evolving customer preferences. Consequently, management teams must refine supply chain strategies to thrive in these new environments. Strategic Sourcing (SS) leverages proactive planning and strategic alliances to enhance corporate value (Yildiz Çankaya, 2020). This competitiveness extends beyond individual companies to encompass entire supply chains (Tontini et al., 2016). Consequently, the procurement function assumes increasing strategic importance, underscoring its pivotal role within supply management frameworks (Kim; Suresh and Kocabasoglu-Hillmer, 2015). Given the growing significance of strategic purchasing within supply chain management and the heightened competitiveness among relevant organizations in the market, SS emerges as a potent force influencing the quality, quantity, opportunities, and pricing of procured products and services. This influence hinges on meticulous supplier selection and fostering strong supplier relationships, both pivotal for supply chain success (Yildiz Çankaya, 2020). Globally, empirical studies demonstrate the positive impact of SS on companies, particularly in terms of performance enhancement. SS exhibits flexibility, effectively enhancing performance across key dimensions including financial, operational, and supply chain aspects (Kim et al., 2015). It operates both as an economic tool for short-term cost minimization and as a strategic mechanism for long-term risk reduction, the

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latter being a central focus of SS (Jensen, 2017). The evolution, implementation, and advancement of SS rely heavily on the discretion of strategic buyers, who must navigate organizational planning and may employ multiple strategies to achieve objectives (Huma et al., 2020).

Efforts such as outsourcing, inventory reduction, just-in-time practices, and fostering long-term partnerships among companies can yield advantages in terms of cost reduction and competitive edge. However, they also entail risks. Relying on single sources of supply, maintaining low inventory levels, and dealing with increased product complexity leave little room for error and render the procurement sector vulnerable. This vulnerability is particularly pronounced in industries such as automotive manufacturing, where any disruption can lead to production stoppages and substantial financial losses. Nonetheless, this situation has spurred interest in risk management, operational efficiency, and supply chain management within these industries (Kumar Sharma et al., 2018).Consequently, the strategic decisions surrounding outsourcing, supplier selection, and the establishment of robust supply partnerships have emerged as pivotal components of corporate supply chain strategies. By refining the supply chain system, companies can optimize their supplier base, mitigate overall supply costs, enhance the value derived from contracted products and services, and conduct thorough risk assessments (Landale et al., 2017). Research indicates that sourcing-related expenses typically account for 50% to 90% of revenue within the manufacturing industry, prompting increased investment in this domain to enable organizations to categorize commodities and broaden their supplier base (Boehmke et al., 2020). However, there exists a need for research that establishes correlations between varying levels of SS. Despite the existence of different proposals and implementation models, there lacks a unified understanding capable of translating purchasing strategies into actionable plans aligned with organizational objectives (Formentini et al., 2019). Against this backdrop, the objective of this study is to introduce a tool for assessing the maturity level of purchasing and supply management concerning SS. The goal is to underscore the significance of employing such a tool to gauge process maturity and, subsequently, address identified weaknesses to enhance performance levels and fully integrate methodologies, exemplified by SS.

Maturity models serve as invaluable tools for delineating a company's current position along the trajectory of continuous improvement. Their outputs play a crucial role in the decision-making process, furnishing information that bolsters investment justifications and offers a comprehensive assessment of the organization's strengths and weaknesses (Özturan et al., 2019). SS, in essence, aims to structure and optimize procurement operations while fostering a holistic perspective of the supply chain, with a primary focus on enhancing end customer service. It represents a strategic operational framework aligned with the company's overarching strategy and service objectives (Khan & Pillania, 2008). The resulting benefits for the company include cost reduction, enhanced process flexibility, access to superior inputs and services, and economies of scope through diversification (Mandal, 2020). Many approaches to SS focus on the efficiency of supplier selection, promoting models that at the end of the process will provide the company with a solid structure for supplying and evaluating these suppliers, while optimizing the purchasing area and reducing costs (Knight et al., 2017).
While certain SS models lack quantitative indicators to demonstrate organizational performance gains post-implementation, qualitative assessments are often employed to validate improvements.

2. Background

The role of supply management has undergone significant transformations over the past four decades. A pivotal moment occurred in the early 1980s with the publication of “Purchasing must become Supply Management” by Kräljic (1983) (Ellram and Tate, 2015). Kräljic's framework introduced a model for devising sourcing strategies for products and services (Landale et al., 2017), establishing supply management and acquisition activities as strategic functions within organizations, particularly in manufacturing sectors. These functions play a crucial role in enhancing sustainability and fostering competitive advantage for the entire company (Huma et al., 2020). According to Kräljic (1983), the necessity for a strategic supply model hinges on several factors: strategic importance measured by added value per product line, impact on company profitability, representation in total costs, complexity of the supplier market and logistical conditions, scarcity of supply, the pace of technological or material advancements, and even monopolistic market conditions. Evaluating these factors in the context of the company's scenarios, senior management and procurement professionals must determine a supply strategy that empowers the company to fortify its purchasing prowess with key suppliers, thereby minimizing risks. An effective supply chain is not only marked by the company's adept management but also by its suppliers' role in meeting delivery deadlines for raw and indirect materials efficiently. Additionally, suppliers increasingly contribute to fostering innovative practices such as integrating new technologies into products and services (Mandal, 2020).

The purchasing function within the supply chain is primarily tasked with providing material and service solutions to fulfill the needs of other departments promptly. It oversees the process of creating and overseeing purchase orders until their complete receipt and storage, focusing on an organization's procurement needs (Dias, 2010).The objectives of the purchasing function encompass acquiring inputs, both products and services, in sufficient quantities and meeting company stipulated standards in terms of technical specifications and quality. This pursuit involves securing the most competitive prices, ensuring optimal service, and aligning delivery schedules with the company's requirements. It also involves documenting all agreements with supply sources and fostering strong relationships with current and potential suppliers, as well as internal customers (Ayres, 2009).

2.1 Strategic sourcing

In recent years, sourcing has emerged as a compelling topic for companies looking to focus their resources on core issues, leading to significant evolution in the concept of Strategic Sourcing (SS) over the past two decades. Broadly, SS involves managing and orchestrating a supply network in alignment with the company's operational and performance objectives (Åkesson et al., 2007; Sislian & Satir, 2000). It can also be described as a supply management framework facilitating the organization and selection of suppliers (Kocabasoglu and Suresh, 2006). However, SS decisions extend beyond merely choosing and nurturing strategic suppliers; they encompass executing and cultivating long-term partnerships with suppliers as well (Yildiz Çankaya, 2020). To effectively engage in SS, companies must identify all processes, services, and products that hold strategic significance, ensuring focused attention and allocation of appropriate resources (Talluri et al., 2013).

SS necessitates aligning sourcing activities with the company's long-term strategies, presenting an opportunity for the company to attract capital investments from external sources while reducing its own investments in capital, equipment, and infrastructure (Talluri et al., 2013). Consequently, SS can be delineated by four key dimensions or subconstructs: i) strategic purchasing, ii) internal integration, iii) shared information, and iv) supplier development. Strategic purchasing involves showcasing the strategic significance of the purchasing function in the company's long-term planning, exerting influence on the agility of the supply chain and strategic relationships. Internal integration manifests in enhanced communication between the purchasing department and other company departments, occurring with increased frequency and depth, thereby facilitating decision-making processes. Shared information pertains to the methods employed to cultivate mutually beneficial long-term relationships with suppliers, thereby enhancing supply chain performance. Conversely, supplier development entails harnessing the potential of key suppliers to mitigate risks, enhance performance, and bolster capacity to meet supply requirements (Eltantawy & Giunipero, 2013). Thus, SS evolves through the implementation, reinforcement, and unfolding of these fundamental concepts, progressing in tandem with the evolution of its dimensions. Within the realm of scientific research, studies on SS adopt various approaches, enabling categorization based on their primary themes. For instance, many studies adopt the Make or Buy decision approach (Medinaserrano et al., 2020). Additionally, extensive exploration is conducted on the effects stemming from Strategic Sourcing implementation, focusing on its impacts across different performance dimensions and encompassing topics such as supplier selection and evaluation (Chiang et al., 2012; Yildiz Çankaya, 2020). Moreover, investigations delve into different dimensions and/or stages of SS, broadening the scope of study possibilities (Formentini et al., 2019; Sislian and Satir, 2000; Tontini et al., 2016). Consequently, this research scrutinizes and monitors the levels of development across purchasing dimensions, utilizing an instrument capable of discerning various stages of maturity.

2.2 Defining Purchasing and Supply Chain Maturity Levels

Purchasing and supply management professionals continuously seek alternatives for process improvement. However, determining the most effective action or initiative to positively impact company performance can be challenging, rendering the area's development process highly complex (Schweiger, 2014). Consequently, linking the development of an area to the performance it can achieve has become a focal point for studies. The ability to analyze a system and propose improvements to attain higher levels of performance forms the basis of maturity models (Tontini et al., 2016). In this context, maturity can be interpreted as "the level of professionalism of the purchasing function," and the models provide auditable stages that organizations are expected to reach (Schiele, 2007). Academic interest in research considering the variable "maturity" in processes as a focal point or in measurement models and self-assessment of system maturity has grown. Examples include self-assessment models of maturity in risk management for clients in the public construction industry (Wibowo & Taufik, 2017), maturity assessment of the quality regulatory capacity of government procurement systems for public service (Xu & Li, 2019), market maturity and purchasing as factors affecting private sector project grant performance (Opawole & Jagboro, 2017), and a study closely aligned with the theme of this research— the maturity model of purchasing and supply management in small and medium-sized companies, which emphasizes that a maturity model consists of a sequence of levels for a particular class of objects (Tontini et al., 2016; Belvedere et al., 2018).

Considering existing methods of measuring the maturity of purchasing processes, numerous opportunities arise. While models may mention three to ten distinct and progressive levels of evolution, they are commonly condensed to four. These models aim to assess the maturity of purchasing and supply management based on four levels, founded on the principles of knowledge, formalization, and management (Schiele, 2007; Schweiger, 2014; Tontini et al., 2016):

Level 1: Indicates that the company lacks awareness of or does not apply structured purchasing and supply management activities.
Level 2: The organization possesses knowledge regarding purchasing and supply management models, yet implementation occurs without integration, formalization, and activity control, leading to suboptimal resource utilization and potential loss of earnings performance.
Level 3: Signifies that the organization is undergoing adjustments and developing management models. While purchasing and supply management concepts are applied extensively, integration is lacking, resulting in outcomes below their potential.
Level 4: The organization demonstrates adequate purchasing and supply management, optimizing resources and maximizing company results.

Employing maturity profiles facilitates communication and offers pathways for immediate decision-making in improvement actions, enhancing the company's reliability, strategic analysis, innovation mastery, and managerial significance (Schiele, 2007). Additionally, it furnishes a standardized and systematic methodology enabling supply chain performance comparison with other companies and market averages (Huang & Handfield, 2015).

3. Method

This research aims to apply an instrument to identify the level of maturity in purchasing concerning SS. The instrument has been previously validated in research by Tontini et al., 2016, across metal-mechanical, chemical, and manufacturing industries spread throughout Brazil. A convenience sample method was employed for the researcher's convenience. The research employed a combination of survey methods, case studies, and structural equation modeling. Structural Equation Modeling (SEM) is utilized within the aspect of validating constructs and ensuring their reliability. SEM offers a measurement model that delineates relationships between measured and latent variables, facilitating the estimation of reliability for both dependent and independent variables. This approach allows researchers to assess the reliability of measured sets and establish connections between constructs (Hair et al., 2009). An online questionnaire was developed using the Google Forms® tool to test the hypotheses of the instrument. Professionals from various sectors of the supply chain participated, with a primary focus on individuals with recent experience in purchasing or materials management within the supply chain. The responses were generated using the degree of formalization and implementation technique. The assessment of maturity is based on objective responses regarding the level of implementation (not implemented, under implementation, or implemented) and formalization (formal or informal) (Tontini et al., 2016). This research aims to analyze four hypotheses:

H1: materials management positively influences the level of general maturity regarding SS.
H2: purchasing planning positively influences the level of general maturity regarding SS.
H3: the selection and development of suppliers positively influences the level of general maturity regarding SS.
H4: the purchasing process positively influences the level of general maturity regarding SS.

To validate the instrument in the defined sample, a pre-test was used. In this research, a sample of 13 respondents was used to test the validity and accuracy of the questionnaire. In the pre-test of this questionnaire, the overall Cronbach's Alpha obtained was 0.981 for a total of 53 questions. As this result was greater than 0.7, it was considered that the questionnaire was valid and reliable. With the approval of the pre-test, the research began by sending the final questionnaire to the sample groups, reaching buyers and other managers in the supply areas throughout Brazil, with the purpose of validating the research. The sample used for the final survey included approximately 250 participants who were contacted over a period of 45 days, resulting in a return rate of 28% (70 respondents).To carry out data analysis, a factorial model aided by IBM – SPSS software was used. With the prior definition of the constructs and their variables, it was necessary to determine the indicators. At this stage, general research acronyms were defined, such as MM(materials management), PP (procurement planning), PR (procurement process), SS (supplier selection/evaluation) and VD (dependent variables: performance and service) to represent the constructs, for each indicator. In the next stage, the results of the model were interpreted, and when considered approved, it was then subjected to analysis to extract considerations about the findings, which were related to the studies undertaken so far.

4. Results

The study was conducted at an American multinational corporation, established in 1918 in the United States. Operating globally, the company offers a diverse portfolio of chemical products and specialties to the market. In Brazil, it has been active since 1997, serving the engineering materials sector. The company operates in two of Brazil's primary states, with manufacturing facilities located in Campo Bom, Rio Grande do Sul, and Suzano, São Paulo, Brazil. Regarding suppliers, they vary locally from plant to plant based on specific needs. While certain services are shared, each unit focuses on distinct product portfolios. This necessitates greater flexibility and attention to regional particularities to ensure they do not compromise the company’s strategic planning. Due to the multitude of variables involved, this study focused solely on analyzing the local purchasing and supply areas.

4.1 Analysis of the Company’s Current Processes

The company's purchasing process commences with planning, where demands are entered into the purchasing system or managed by the Material Requirements Planning system. Control and inventory turnover, as highlighted by authors in the field, are fundamental aspects of Strategic Sourcing. Cost reductions are achieved through internal systems by minimizing waste and stock, enhancing process efficiency, speed, and quality through clear stock replacement policies. However, low stocks and increased product complexity leave little room for error, exposing the company to market risks and vulnerability to suppliers. Communication among all involved areas in the purchasing process and formalization when communicating and placing orders with suppliers are significant factors observed within the company. Clear communication underscores a positive relationship with suppliers, a point supported by literature emphasizing communication as crucial for optimal performance and fostering long-term relationships with suppliers and internal departments.

The importance of the company's policies and its relationship with key suppliers is also evident. These characteristics align with literature on Strategic Sourcing, which emphasizes the strategic positioning of the process and the definition of specific purchasing strategies for demand cases to ensure greater risk and opportunity control.
After analyzing these key points, it is imperative to apply the instrument to assess the company's maturity according to the model.

4.2 Application of the Maturity Identification Tool and Analysis

Once validated, the questionnaire was administered to the company under study to ascertain its maturity level concerning the established constructs. Responses were gathered from individuals responsible for the purchasing and supply management departments and recorded in an Excel spreadsheet. The results obtained for each question are illustrated in Fig. 1:

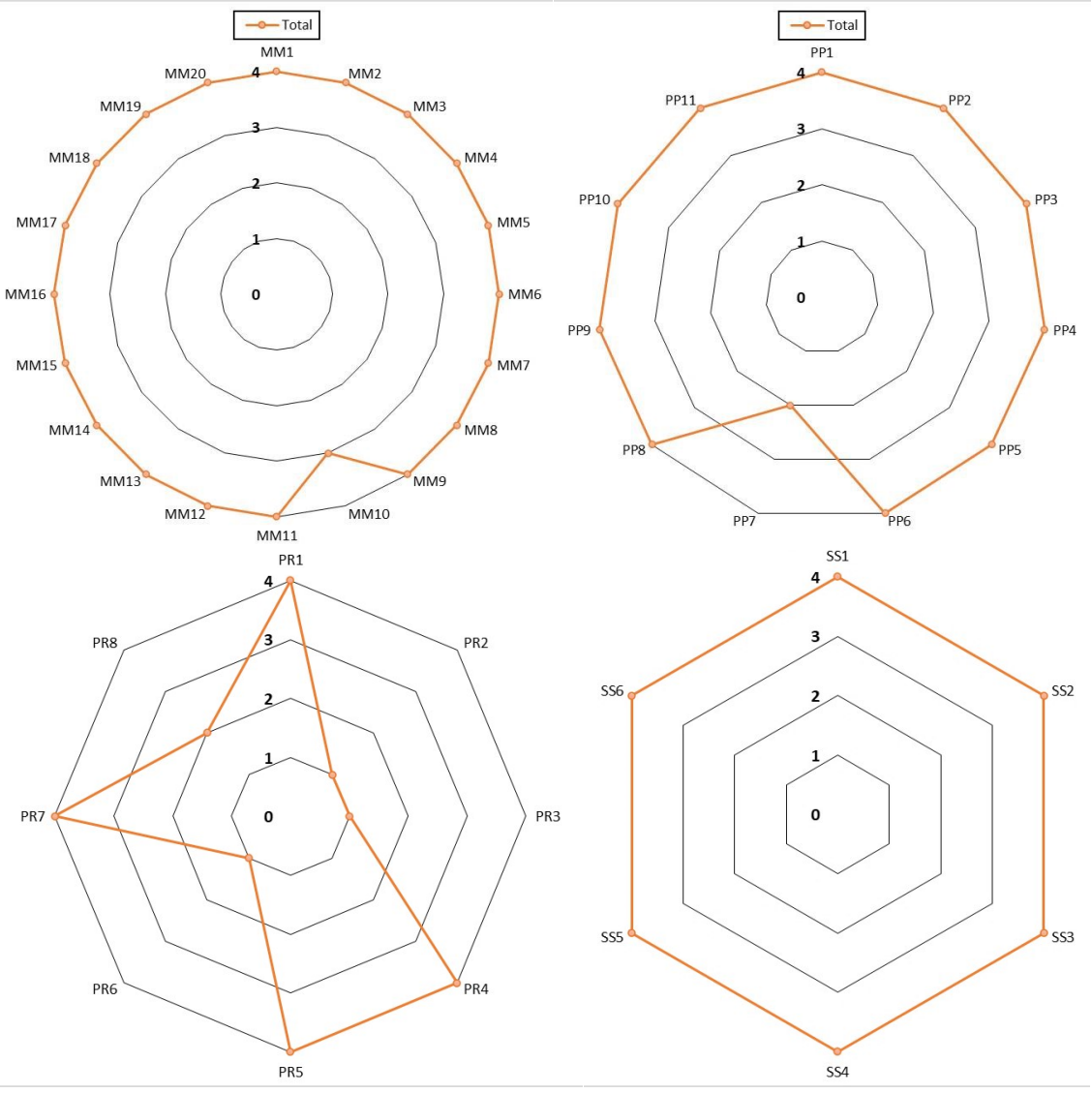

Fig. 1. Results obtained by the level model applied in the case study

Source: By the authors.

Fig. 1 depicts the constructs of materials management (H1), procurement planning (H2), supplier selection/evaluation (H3), and procurement process (H4). Based on the results obtained for each indicator within these constructs, analysis can be conducted. Within the materials management construct, a maturity level of 4 was observed for 95% of the indicators, with responses indicating the process as “effectively implemented and functioning”. This suggests a high level of maturity close to 4 for the entire sample, indicating a well-developed materials management process. The indicator MM10, which assesses the

implementation of supplier performance indicators periodically monitored by the supply area manager, is identified as needing improvement, as it was rated as “formally implemented”.

In terms of procurement planning, the majority of responses (90.9%) indicated a maturity level of 4, with the process described as "effectively implemented and functioning." The variable PP7, which relates to a purchasing policy predominantly based on the ABC curve and its correlation with critical aspects from the XYZ curve, is identified as requiring further development. Regarding the procurement process, 50% of the indicators in the case study sample achieved maturity level 4, indicating that they are "effectively implemented and functioning." These indicators include criteria for adopting formal quotation and budgeting systems, prioritizing suppliers in purchasing processes, and contracting the supply of essential products. However, 37.5% of the sample presented maturity level 1 in this construct, particularly in variables such as the adoption of tools for electronic quoting, participation in purchasing groups, and a formal, defined, and controlled process for urgent purchases. These areas require improvement to enhance the overall performance of the construct. Additionally, the PR8 construct indicated a maturity level of 2 concerning the monitoring and control of urgent purchases, highlighting the necessity for improvements in this aspect. Finally, in the supplier selection/evaluation, a maturity level of 4 was attained in all analyzed constructs, with 100% of responses indicating that the process is “effectively implemented and functioning.” This suggests that the purchasing sector is fully developed in the proposed criteria for selection, qualification, approval, control, and revalidation of suppliers outlined in this research.

4.3 Application of the survey with professionals in the area of purchasing and supply management

To facilitate comparison between the data obtained from the company under study and other companies within the Brazilian context, a survey was conducted to gauge the perceptions of professionals in purchasing and supply management across various industries. The objective was twofold: to identify the level of maturity in purchasing and supply management and to validate the chosen instrument. The survey targeted 70 respondents selected through a non-probabilistic convenience sampling method, considering the characteristics of the group. It was acknowledged that these respondents represent a subset of the broader study population, comprising buyers and supply area managers (Freitas et al., 2000; Oliveira, 2001).

5. Discussion

By obtaining the necessary data through the questionnaire, it became possible to verify the sampling using the SPSS software, with the objective of finding the adequacy of the sample represented by the Kaiser-Meyer-Olkin (KMO) and Barlett measurement, of according to Table 1.

Table 1
KMO and Barlett

Kaiser-Olkin measure of sampling adequacy				0.75
Bartlett's sphericity test	Qui-quadrado	3797.915	Df 990	Sig. 0.000

Source: By the authors.

Following the verification of sampling compliance, exploratory factor analysis (EFA) of the data was conducted using SPSS software. In this study, Varimax rotation with Kaiser normalization was employed to attain the smallest number of columns in the matrix. Factor loads were identified based on the criteria outlined in Table 2, which correlates the sample size with the respective factor loads.

Table 2
Factor loadings based on sample size

Factor loading	Sample Size Required for Significance
0.30	350
0.35	250
0.40	200
0.45	150
0.50	120
0.55	100
0.60	85
0.65	70
0.70	60
0.75	50

Source: Hair *et al.* (2009).

Based on the presented criteria, 23 variables were eliminated as they had a factor loading lower than 0.65 in the matrix of rotated components for a sample size of 70. The remaining variables that exhibited a factor loading higher than 0.65 were retained based on this criterion. In addition to the rotation with eight factors, tests were conducted with two to seven factors to explore better results. However, none of these configurations yielded grouping similar to or superior to the rotation with

eight factors. Following this factor analysis, it was necessary to reorganize the nomenclature of the previously used indicators belonging to the four initial constructs, grouping them into eight constructs (see Chart 1).

Chart 1
New nomenclature of constructs

Previous name	New nomenclature after EFA	Final construct
MM4	MMP1	
MM5	MMP2	MMP
MM7	MMP3	
MM8	MMR1	MMR
MM10	MPRS1	
PR5	MPRS2	
PR7	MPRS3	
SS1	MPRS4	
SS2	MPRS5	MPRS
SS3	MPRS6	
SS4	MPRS7	
SS5	MPRS8	
SS6	MPRS9	
MM12	MMA1	MMA
MM16	MMPPE1	
PP2	MMPPE2	MMPPE
PP3	MMPPE3	
PP7	PPPR1	PPPR
PR8	PPPR2	
PR1	PRS1	PRS
PR2	PRO1	PRO
PR3	PRO2	

Source: By the authors.

The new groupings resulted in eight constructs. The MPRS (Suppliers) construct emerged as the largest group, comprising nine variables (MPRS1 to MPRS9). These variables encompass evaluation criteria related to: (1) quantitative performance of suppliers; (2) prioritization of participants in quotation processes; (3) procurement of essential products; (4) processes for supplier selection, qualification, and approval; (5) control of suppliers' technical documentation; (6) initial qualification audits for suppliers; (7) formal and periodic evaluation of suppliers; (8) revalidation and analysis of supplier performance indicators; and (9) provision of evaluation feedback to suppliers for improvement or development. The MPRS construct distinctly addresses aspects of continuous improvement, the supplier market, and fostering long-term partnership relationships, aligning with the principles of Strategic Sourcing (Eltantawy & Giunipero, 2013; Kocabasoglu & Suresh, 2006; Talluri et al., 2013; Yildiz Çankaya, 2020). The constructs MMR (MMR1), MMA (MMA1), and PRS (PRS1) encompass criteria related to the receipt process (whether centralized and formally defined), storage conditions (whether compliant with the necessary material requirements), and formalization (existence of a formal quotation and budget system aiding purchasing decisions), respectively. Prior to conducting the factor analysis, the variables of the MMR and MMA constructs were part of the materials management construct, while the PRS variable belonged to the initial procurement process construct (Tontini et al., 2016).
Two constructs, PPPR and PRO, were formed, each comprising two variables. The PPPR variables pertain to inquiries about indicators of supplier value accumulation, criticality for acquisition determinations, and indicators of urgent purchases. On the other hand, both variables in PRO relate to the utilization of tools aimed at optimizing processes, expediting operations, and identifying the most advantageous market proposals to strategically guide buyers in their purchasing decisions. Lastly, the constructs MMP (Standardization) and MMPE (Stock) consist of three variables each. MMP variables focus on product standardization criteria and defining technical material standards. Conversely, MMPR includes variables centered around stock control, order tracking, and inventory turnover, all crucial components for facilitating a strategic, efficient, and standardized purchasing flow. Leveraging Strategic Sourcing principles, these constructs aim to capitalize on opportunities to reduce waste and inventory, while establishing clear policies for managing more complex products (Kumar Sharma et al., 2018; Thomas et al., 1989; Yildiz Çankaya, 2020). From these constructs, it was necessary to adjust the initial proposed model, which included four hypotheses, to align with the scenario presented by the eight hypotheses in the new model derived from factor analysis. The eight hypotheses generated from the exploratory factor analysis (EFA) are as follows:

H_1: *Product standardization influences the overall maturity level of SS.*
H_2: *The product receiving process influences the overall maturity level of SS.*
H_3: *Suppliers influence the overall maturity level of SS.*
H_4: *The product storage process influences the overall maturity level of SS.*
H_5: *Inventory turnover influences the overall maturity level of SS.*
H_6: *Performance indicators of processes influence the overall maturity level of SS.*
H_7: *Formal purchasing guidance systems influence the overall maturity level of SS.*

H_8: *Optimization and agility tools for the purchasing and supply management area influence the overall maturity level of SS.*

The expansion of these hypotheses can be visualized in the model depicted in Fig. 2.

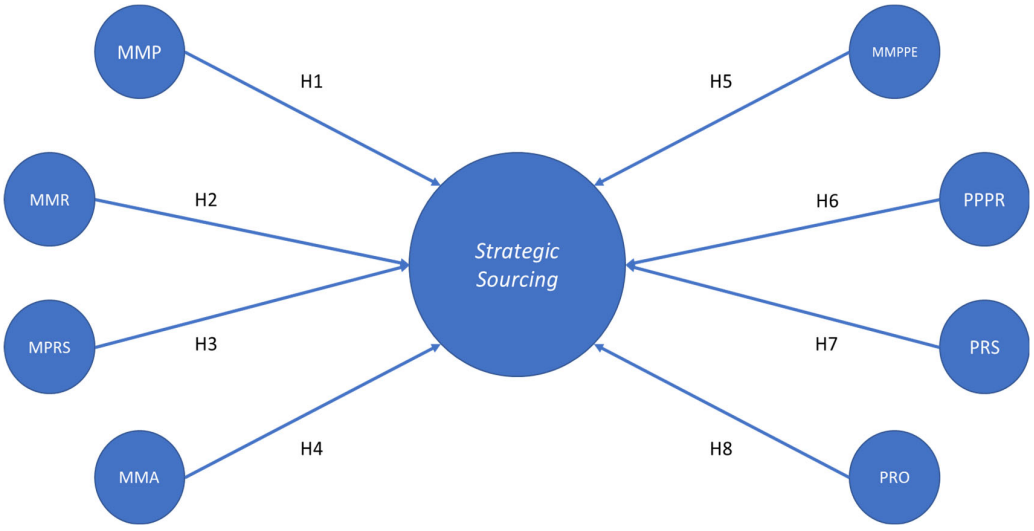

Fig. 2. Model representation after factor analysis

Source: By the authors.

With the establishment of this model and the results obtained from the conducted factor analysis, the structural equation modeling process commenced using Smart PLS 3.0®. In Fig. 3, it is possible to highlight the layout of the model for the proposed constructs and variables. The latent constructs are represented by circles, composed of latent variables, while the observed variables or indicators are represented by rectangles, these being the independent variables. The relationships between the constructs and indicators, in turn, are presented through arrows, which when directed in the same direction are considered a predictive relationship or causal relationship (Hair et al., 2009; Prates et al., 2003).

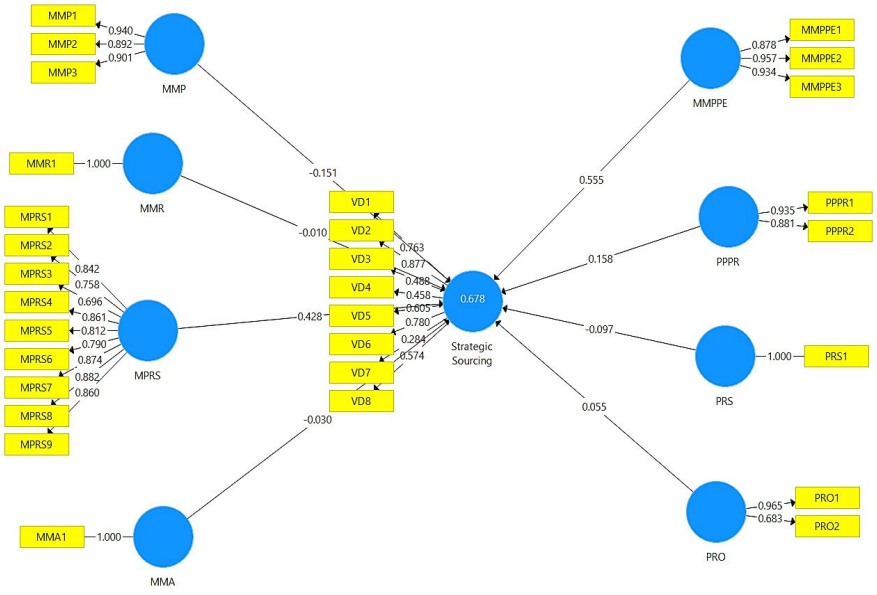

Fig. 3. Final model

Source: By the authors.

The value depicted in the central circle represents the R^2 of the SS construct, assessing the proportion of variance explained by the endogenous variables in the structural model. The remaining blue circles are denoted by acronyms for each construct, named in accordance with Chart 2, which outlines the relationship between the acronym and the construct, along with the composition of its variables (Ringle et al., 2014).

Chart 2
Relationship of constructs and their compositions in the proposed model

Acronym	Construct	Variable composition
MMP	Standardization	Product standardization criteria
MMR	Receipt	Product receiving process
MPRS	Suppliers	Selection, qualification, evaluation, approval and revalidation of suppliers
MMA	Storage	Proper storage of materials
MMPPE	Stock	Inventory control and turnover
PPPR	Indicators	Purchase policy based on indicators and control of urgent purchases
PRS	Formalization	Formal purchasing guidance system
PRO	Tools	Auxiliary tools for purchasing optimization and agility

Source: By the authors.

After conducting the structural modeling, it becomes imperative to validate the measurement model. At this juncture, the conducted checks assess how well the researcher's theory regarding the relationships between the constructs aligns with reality. Thus, the PLS-SEM structural model establishes a set of criteria that must be met in the evaluation: (1) composite reliability; (2) convergent validity; (3) discriminant validity; (4) indicator reliability (Hair et al., 2014).

Composite reliability assesses the consistency of the set of sample responses. This indicator pertains to the quality of a measure, evaluating the structural model in terms of its reliability (Hair et al., 2014). Values exceeding 0.7 are deemed acceptable (Chin and Newsted, 1998). In exploratory research, there is some flexibility in what is considered adequate, typically ranging between 0.6 and 0.7, while for other types of research, satisfactory results often fall between 0.7 and 0.9 (Hair et al., 2014). For the present research, the composite reliability of the constructs were as follows: MMP: 0.936, MMR: 1.000, MPRS: 0.949, MMA: 1.000, MMPPE: 0.946, PPPR: 0.904, PRS: 1.000, and PRO: 0.819, with the central construct SS (Strategic Sourcing) reaching 0.829, thus meeting the criteria established by the literature.

Convergent validity is achieved through positive correlations between the variables and their respective constructs, which are elucidated by each latent construct. Therefore, this indicator is termed Average Variance Extracted (AVE), with convergence to a satisfactory outcome considered when it exceeds 0.5 (Fornell & Larcker, 1981; Ringle et al., 2014). The respective AVEs for the constructs in this sample are as follows: MMP: 0.831, MMR: 1.000, MPRS: 0.675, MMA: 1.000, MMPPE: 0.853, PPPR: 0.825, PRS: 1.000, and PRO: 0.699. Thus, these results affirm the convergent validity of the observed variables, maintaining positive correlations between the validated constructs as evidenced by the AVEs.

Lastly, indicator reliability refers to constructs with high loads, indicating that the indicators share the latent construct being measured. External loads exceeding 0.7 are considered above the recommended threshold in the literature, while in exploratory studies, values greater than 0.4 are acceptable (Hair et al., 2014). Table 3 displays the indicator reliability, wherein squaring the loads reveals values greater than 0.4, ensuring the reliability of the factors (Hulland, 1999).

Table 3
Indicator reliability

Indicator reliability			
Construct	**Variable**	**External load**	**Confiability**
MMP	MMP1	0.940	0.884
	MMP3	0.901	0.812
MMR	MMR1	1.000	1.000
MPRS	MPRS1	0.842	0.709
	MPRS6	0.790	0.624
	MPRS7	0.874	0.764
	MPRS8	0.882	0.778
	MPRS9	0.860	0.740
MMA	MMA1	1.000	1.000
MMPPE	MMPPE1	0.878	0.771
	MMPPE3	0.934	0.872
PPPR	PPPR1	0.935	0.874
PRS	PRS1	1.000	1.000
PRO	PRO1	0.965	0.931

Source: By the authors

In relation to the objective of this structural equation modeling, which was to test and validate the research hypotheses regarding the factors for identifying the level of purchasing maturity and supply management regarding Strategic Sourcing, it

can be considered that the The proposed model according to figure 3 is valid, being verified based on the quantitative values obtained in Table 3 and its qualitative composition of variables (Chart 2) (Chin and Newsted, 1998; Hair et al., 2014).

5.1 Analysis of hypotheses

After conducting the factor analysis, which encompassed all the proposed indicators, it became possible to address certain inquiries regarding the influence of each construct in identifying the maturity level of purchasing and supply management concerning SS fundamentals. Concerning H1 (hypothesis 1), which posits that product standardization affects the overall maturity level concerning SS, it can be concluded that it does not exert a positive influence on the central SS construct. Its factor loading of -0.151 fails to meet the minimum criterion for values greater than 0.10, which are considered significant in the literature (HAIR et al., 2014). This construct also exhibits the lowest coefficient among the latent samples for the tested sample, indicating a weak correlation (SILVA, 2006). Therefore, for this sample, the hypothesis does not positively impact the central construct.

As for H2 (hypothesis 2), which suggests that factors associated with the product receiving process could influence the concept of a more mature SS, the hypothesis is not supported by the data. The factor loading of -0.010, lower than 0.10, suggests that the receiving process does not positively influence achieving higher levels of maturity regarding the SS construct (Hair et al., 2014). Thus, this hypothesis does not positively impact the intended central construct for this sample.

In response to H3 (hypothesis 3), which encompasses factors directly related to suppliers as criteria influencing the maturity of purchasing and supply management regarding SS fundamentals, a factor loading of 0.428 was obtained after factor analysis, confirming its positive impact on the central SS construct (Hair et al., 2014). This hypothesis is classified as the second most influential within the context of the other constructs, aligning with the basic tenets of SS where suppliers play a crucial role in its execution (Schiele, 2007).

Regarding H4 (hypothesis 4), which evaluates the relationship between the process of proper material storage and its influence on the SS construct, the factor analysis yielded a loading factor of -0.030. Consequently, it is deemed to have no impact on the SS construct as it does not meet the established criteria (Hair et al., 2014). Therefore, hypothesis 4 does not positively influence the central SS construct for the utilized sample.

Moving on to H5 (hypothesis 5), this construct focuses on inventory control and turnover, aiming to positively influence the primary SS construct by enhancing maturity levels. After conducting the factor analysis, the index was 0.555, indicating and validating its positive impact on the Strategic Sourcing construct (Hair et al., 2014). This construct, being the most significant within the proposed model, is supported by the literature as the key determinant not only in stock and replacement policies, control criteria, and stock turnover but also in managing the maintenance of minimum stocks and overall stock analysis aimed at eliminating excess and obsolete stocks.

Regarding hypothesis 6 (H6), it pertains to indicators guiding process performance and the establishment of purchasing policies based on area indicators, thereby aiming to influence SS-related decisions. This hypothesis is classified positively in terms of its impact on the SS construct, achieving a factor of 0.158 post-factor analysis, thus affirming its influence as per the model (HAIR et al., 2014). The literature supports this construct by advocating for the application of indicators ensuring process performance through SS tools (Medina-Serrano et al., 2020).

Hypothesis 7 (H7) posits that formal purchasing guidance systems affect the maturity of purchasing and supply management concerning Strategic Sourcing. However, post-factor analysis, the construct in question attained an index of -0.097, failing to meet the minimum significance criterion established by the literature, which stipulates factor values greater than 0.10 (Hair et al., 2014). Consequently, the construct represented by hypothesis 7 does not positively impact the SS construct for the utilized sample.

Lastly, H8 (hypothesis 8), representing optimization and agility tools for the purchasing and supply management area, seeks to exert a certain influence on the SS construct. Nonetheless, post-factor analysis, the result indicates that this construct does not positively impact the identification of purchasing and supply management maturity regarding Strategic Sourcing in the proposed model. With a load of 0.055 on this factor, it is concluded that this construct does not impact SS (HAIR et al., 2014).

The model generally yields an R^2 of 0.678 for the endogenous variable Strategic Sourcing. This indicates that the impactful latent variables in this model, mainly MPRS (suppliers), MMPPE (stock), and PPPR (indicators), elucidate the variance of the proposed model in SS. Collectively, these variables influence 67.8% of the SS latent variable. The coefficients calculated for MPRS, MMPPE, and PPPR are significant for this construct as they exhibit values exceeding 0.10 in their paths (Hair et al., 2014; Wong, 2013). Therefore, the variables with values of 0.428, 0.555, and 0.158, respectively, positively impact the SS latent variable, with MMPPE being the most influential coefficient and PPPR representing the lowest among the impacting variables in the sample.

Considering the research context, the hypotheses affirm their positive impact on the proposed SS construct, as they exhibit correlations and interactions within the specified framework of the purchasing and supply management maturity model.

6. Final considerations

The primary aim of this study was to propose an instrument for assessing the maturity level of purchasing and supply management, with a focus on correlating it with the principles of Strategic Sourcing, thus validating the proposed model. Utilizing a case study approach involving a company and engaging professionals from purchasing and supply management fields, we employed structural equation modeling via Smart PLS 3.0® to develop a diagram and determine correlation loads between the constructs. This instrument was then applied to validate the initial maturity identification model, obtaining insights into the purchasing and supply management processes of the case study company vis-à-vis the Strategic Sourcing principles.

Upon applying the initial instrument to assess the maturity of purchasing and supply management processes within the case study company, it became evident that improvements are necessary in several key areas. Specifically, the organization would benefit from enhancing indicators such as MM10 for materials management (H1), PP7 for purchasing planning (H2), and PR2, PR3, PR6, and PR8 pertaining to the purchasing process (H4). However, regarding supplier selection and evaluation (H3), no significant improvements were identified based on the criteria evaluated in this research.

To address the identified areas for improvement, specific recommendations are proposed. Firstly, to enhance MM10 planning, it is suggested to develop a supplier performance indicator to monitor corrective actions, thereby fostering continuous improvement in the supplier relationship process. For PP7 strategies, implementing a purchasing policy based on the ABC curve, focusing on high-value items, in conjunction with aspects of the XYZ curve, is recommended to optimize performance. Moreover, to address constructs related to PR2, PR3, PR6, and PR8, which involve electronic quotation tools, participation in purchasing groups, formalized procedures for urgent purchases, and monitoring of emergencies, respectively, it is advisable to further develop these areas to streamline processes, reduce costs, and ensure effective control and monitoring, as suggested in the literature.

Upon validating the instrument with the case study company, it became apparent that further studies involving professionals from the market were necessary to corroborate the findings. Subsequently, a questionnaire was administered to a sample of buyers and supply managers, and data obtained from the survey, along with insights from the literature, were used to create constructs through factor analysis. These constructs were aimed at testing and achieving the objectives outlined in the study, resulting in hypotheses delineated for each construct.

To ensure the validity of the questionnaire, a pre-test was conducted with a reduced sample, yielding positive results based on the Cronbach's Alpha reliability test, in line with literature recommendations. Following the validation of the pre-test, the research proceeded to the final sample. Subsequent analysis of the sample size adequacy involved the KMO and Bartlett test, which demonstrated suitable values to validate the model, followed by factor analysis to group related variables and unfold constructs. Notably, constructs such as standardization (MMP), collection (MMR), suppliers (MPRS), storage (MMA), stock (MMPPE), indicators (PPPR), formalization (PRS), and tools (PRO) were identified.

Among the conditional hypotheses, it was determined that constructs such as MPRS, MMPPE, and PPPR had a positive impact on the central construct of Strategic Sourcing (SS), surpassing the factor load recommended in the literature. This underscores the clarity in the relationship between constructs and their influence on the central focus of this research.

The analyses conducted to validate the measurement model yielded results superior to those suggested by the literature for tests of composite reliability, convergent validity, discriminant validity, and indicator reliability within the constructs. Success was achieved in developing, validating, and implementing the proposed instrument, aligning with the central theme of this research.

In line with the overarching objective of this study, it was observed that constructs pertaining to suppliers, stock, and indicators positively impacted the Strategic Sourcing construct within this specific sample. However, it's crucial to acknowledge that the main limitation of this study lies in the sample format, as it was based on a non-probability sample for convenience. The constructs identified as impacting purchasing maturity and supply management concerning Strategic Sourcing are only applicable within the scope of this respondent group. Therefore, while this research cannot be considered definitive due to its reliance on responses from seventy participants, it does mark a significant completion. It is recommended to apply this proposed model in scenarios where Strategic Sourcing is effectively practiced, analyzing resulting behaviors. Additionally, future research could explore the challenges and opportunities encountered by companies in implementing Strategic Sourcing as a strategic model for their purchasing and supply management areas.

Ultimately, this study contributes to a deeper understanding of Strategic Sourcing frameworks, expands knowledge about various perceptions related to purchasing, and underscores the research and methodology used in conceptualizing this study, thereby enhancing understanding across multiple dimensions.

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