


**ASSESSMENT OF SALES AND OPERATIONS PLANNING MATURITY IN A
PLASTIC INJECTION MOLDING INDUSTRY**
**AVALIAÇÃO DA MATURIDADE DO PLANEJAMENTO DE VENDAS E OPERAÇÕES
EM UMA INDÚSTRIA DE INJEÇÃO PLÁSTICA**
**EVALUACIÓN DE LA MADUREZ DE LA PLANIFICACIÓN DE VENTAS Y
OPERACIONES EN UNA INDUSTRIA DE MOLDEO POR INYECCIÓN DE PLÁSTICO**


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ABSTRACT: This study analyzed the maturity of the Sales and Operations Planning (S&OP) process in a plastic injection molding industry located in Maringá, Paraná, Brazil, aiming to identify opportunities for improvement and strengthen strategic and functional alignment. The research was based on a literature review of S&OP and maturity models, with an emphasis on the integration between supply and demand. A case study method was adopted, with data collection through interviews, questionnaires, management meetings, and qualitative analysis, comparing the empirical findings with the theoretical framework. The results indicated that S&OP has potential as an integrated management tool, highlighting the process maturity level and areas for improvement, along with advances in interfunctional communication and strategic-operational alignment. The study contributes practical insights for the evolution of S&OP in industrial contexts, emphasizing its application in the plastic injection molding sector.

KEYWORDS: S&OP. Maturity Avaliation. Industry.

RESUMO: *O estudo analisou a maturidade do processo de Sales and Operations Planning (S&OP) em uma indústria de injeção plástica localizada em Maringá-PR, com o objetivo de identificar oportunidades de melhoria e fortalecer o alinhamento estratégico e funcional. A pesquisa fundamentou-se em revisão da literatura sobre S&OP e modelos de maturidade, com ênfase na integração entre oferta e demanda. Adotou-se o método de estudo de caso, com coleta de dados por meio de entrevistas, questionários, reuniões gerenciais e análise qualitativa, comparando os achados empíricos ao referencial teórico. Os resultados indicaram que o S&OP apresenta potencial como ferramenta de gestão integrada, evidenciando o nível de maturidade do processo, pontos de melhoria e avanços na comunicação interfuncional e no alinhamento estratégico-operacional. O estudo contribui com subsídios práticos para a evolução do S&OP em contextos industriais, destacando sua aplicação no setor de injeção plástica.*

PALAVRAS-CHAVE: S&OP. Avaliação da maturidade. Indústria.

RESUMEN: *Este estudio analizó la madurez del proceso de Planificación de Ventas y Operaciones (S&OP) en una industria de moldeo por inyección de plástico ubicada en Maringá, Paraná, Brasil, con el objetivo de identificar oportunidades de mejora y fortalecer la alineación estratégica y funcional. La investigación se basó en una revisión bibliográfica de S&OP y modelos de madurez, con énfasis en la integración entre la oferta y la demanda. Se adoptó un método de estudio de caso, con recopilación de datos mediante entrevistas, cuestionarios, reuniones de gestión y análisis cualitativo, comparando los hallazgos empíricos con el marco teórico. Los resultados indicaron que S&OP tiene potencial como herramienta de gestión integrada, destacando el nivel de madurez del proceso, las áreas de mejora y los avances en la comunicación interfuncional y la alineación estratégico-operativa. El estudio aporta perspectivas prácticas para la evolución de S&OP en contextos industriales, enfatizando su aplicación en el sector de moldeo por inyección de plástico.*

PALABRAS CLAVE: S&OP. Evaluación de madurez. Industria.

Introduction

Every organization is composed of processes aimed at producing assets or services that generate value for the customer. The effectiveness of these processes is fundamental to increasing productivity, reducing costs and losses, and, consequently, increasing profitability and competitiveness. In this scenario, competition between companies has intensified, making the pursuit of high performance and continuous improvement of processes and products essential elements for organizational sustainability. Thus, aligning processes with strategic objectives becomes an indispensable requirement for long-term success (Azevedo, 2016; Gede & Huluka, 2023).

Among the most relevant practices to ensure this alignment is Sales and Operations Planning (S&OP), which seeks to ensure the execution of long-term actions through a more resilient and coordinated supply chain (Calfa et al., 2015).

Although the number of academic publications on the practical implementation of S&OP is still limited, interest in the topic has grown significantly in recent years (Affonso & Marcotte, YEAR; Forno et al., 2024; Grabot, 2008; Grimson & Pyke, 2007; Kalla et al., 2025; Kim & Shin, 2024; Kreuter, Rampon Neto, Barcellos & Panizzon, 2022; Lapede, 2004; Rampon Neto & Barcellos, 2023; Scavarda, Thomé et al., 2012; Thomé, Hellingrath & Seeling, 2022; Tuomikangas & Kaipia, 2014).

The main expectations surrounding S&OP involve improvements in revenue, reduction of operational costs in the logistics chain, and management of volatile demand. The consolidated adoption of the process allows for the creation of optimized plans that balance supply and demand, with the potential to significantly increase companies' profitability (Martins, 2017; Forno et al., 2024; Kalla et al., 2025).

In practice, organizations face challenges in maintaining this balance, which can result in high or insufficient inventories, customer dissatisfaction, and elevated operating costs (Kumar, 2016; Rampon Neto, Barcellos & Panizzon, 2022). The use of more accurate forecasts in production and inventory planning represents a competitive advantage, with S&OP being a strategic tool for this purpose (Jiménez, 2020). Operating on a tactical horizon of 3 to 24 months, the process allows for a proactive and structured approach (Kristensen & Jonsson, 2018; Scavarda, Thomé, Hellingrath & Seeling, 2022).

Given this context, the objective of this study is to conduct a case study in a medium-sized industry located in Maringá – Paraná – Brazil, with the aim of assessing the maturity level of the S&OP process adopted. The research is based on theoretical models available in the

literature and seeks to contribute to the practical understanding of S&OP and its applicability through maturity models.

Theoretical Foundation

The theoretical basis of this study addresses the main concepts related to the S&OP process, highlighting its importance as a tool for integration between functional areas and strategic alignment in organizations. In addition, maturity models applicable to S&OP are explored, which allow for the assessment of the stage of development of the process within companies and the identification of opportunities for continuous improvement.

S&OP

Sales and Operations Planning (S&OP) is a fundamental tactical and cross-functional management process that aims to balance demand and supply between different areas of the supply chain, such as production, distribution, purchasing, and finance, in line with the organization's strategic planning. Historically focused on optimizing production and inventory volumes, S&OP has undergone a significant conceptual evolution. More recently, it has been recognized in the literature as a fully integrated supply chain planning approach, often culminating in the concept of Integrated Business Planning (IBP) (Pereira et al., 2022).

For S&OP integration to be effective, a high degree of collaboration between areas is essential, which is a critical success factor. The authors point out that failures in the performance of any participant compromise the quality of information and hinder the progress of the process (Pereira et al., 2022). Thus, S&OP is classified as tactical planning that operates between the strategic and operational levels, with the purpose of aligning supply and demand in the medium and long terms, integrating organizational functions with business objectives (Biazzin, 2017).

The specialized literature points to several benefits associated with S&OP, such as increased customer satisfaction, reduced and better-balanced inventories, improved delivery times, stable production rates, more accurate predictions, greater cooperation between areas, and more efficient decisions based on structured medium- and long-term planning (Forno et al., 2024; Kalla et al., 2025; Kreuter et al., 2022; Noroozi & Wikner, 2017; Thomé et al., 2012; Tuomikangas & Kaipia, 2014).

However, the implementation of S&OP in current business contexts presents contemporary challenges that deserve attention. In a highly volatile and uncertain market

environment, S&OP requires not only well-defined internal processes but also the adoption of digitization and advanced data analysis technologies to generate accurate demand forecasts in a timely manner (Forno et al., 2024; Kreuter et al., 2022). The lack of data integration between different software programs and the difficulty in maintaining meeting discipline are common barriers to the process reaching its maximum level of maturity and effectiveness, especially in companies seeking to coordinate global operations (Kalla et al., 2025).

Thus, several authors, such as Palmatier and Crum (2003), Lapide (2004), Dougherty and Gray (2006), Grimson and Pyke (2007), Wallace and Stahl (2008), Esper et al. (2009), Thomé et al. (2012), Wagner et al. (2014), Mendes et al. (YEAR), and Correa et al. (2018), propose structured S&OP models consisting of five main stages: information review, demand planning, supply planning, pre-S&OP meetings, and executive S&OP meetings.

According to Correa et al. (2018), the first stage consists of information review, in which sales and production data from the previous month are collected and analyzed, along with current inventory levels, pending orders, and sales projections for the coming periods. Next, in the second stage, demand planning is carried out, with the definition of the sales plan based on statistical data and information from the sales and marketing team. This planning includes the detailing of promotional actions and advertising strategies, which is essential to anticipate and balance supply needs.

The third stage is supply planning, when production and purchasing plans are adjusted according to new sales forecasts, identifying possible restrictions on production capacity or material supply. Next, in the fourth stage, pre-S&OP meetings are held, in which the multidisciplinary team, including representatives from the purchasing, production, and logistics areas, discusses the identified constraints, analyzes impacts on revenue, and collaboratively proposes solutions (Correa et al., 2018).

Finally, in the fifth and final stage of the S&OP executive meeting, the main results and risks are presented to senior management, along with the alternative scenarios discussed in the previous stage, especially those with significant financial impact. This cycle is recurring and usually occurs on a monthly basis, although some companies adopt quarterly, semi-annual, or annual intervals, depending on their structure and operational needs (Correa et al., 2018).

Maturity model

The concept of maturity expresses the progressive advancement of a system toward a desired state. To operationalize this idea, models were developed to identify organizational resources, understood as the specific competencies necessary for the execution of project management processes and for the delivery of associated services and products. These resources are systematically grouped and characterized to represent the degree of consistency, transparency, and control within the organization (Al-Marri et al., 2025).

Thus, the maturity model is a tool that seeks to optimize processes, stimulating efficient and productive behaviors in the development of software, products, and services. These models present levels that must be achieved to obtain maximum efficiency in the processes (White, 2021).

The various maturity models available in the literature were designed for different areas of application, ranging from project and process management to approaches based on quality management and organizational development tools. Models designed to analyze the maturity level of business processes, among other applications, also stand out. The Quality Management Maturity Grid, proposed by Crosby, is widely recognized as the first formally established maturity model. The Capability Maturity Model (CMM), developed by the Software Engineering Institute at Carnegie Mellon University, has become a structural reference, serving as the basis for the development of numerous subsequent models, among which the Capability Maturity Model Integration (CMMI) stands out. In the field of Quality Management Systems, there is also a specific assessment model introduced in the ISO 9004 standard (Hein-Pensel et al., 2023; Poltronieri, Ganga & Gerolamo, 2019).

However, according to Mendes et al. (2016), maturity models applied to the S&OP process generally have three to six levels, with each level being structured into dimensions or process areas and specific standards or activities. Each maturity stage contains a summary description of the expected practices, allowing for the assessment of the degree of process development.

The maturity model proposed by Mendes et al. (2016) is one of the most referenced and applied in the literature on Supply Chain and S&OP in the industrial context (Caiado et al., 2021; Hamidi et al., 2024; Torabizadeh et al., 2020; Roque Júnior et al., 2023; Sharma et al., 2021). The model by Mendes et al. (2016) consists of sixteen categories: Forecasting, S&OP, Collaborative Planning, Forecasting, and Replenishment (CPFR), Vendor-Managed Inventory (VMI), Purchasing, Manufacturing, Warehousing, Distribution, Customer Service, Senior

Management Support, New Product (NP) Forecasting, New Product Supply Chain, Risk Assessment and Management, Product Tracking and Visibility, Portfolio Optimization, and Senior Management Support.

In addition, it has five stages of evolution: Basic Push Operation, Optimized Push, Hybrid Push-Pull, Advanced Demand-Driven, and Demand-Optimized. Details of each stage of the model are presented in Tables 1, 2, and 3.

Table 1
Maturity Model for Demand Management

	Basic Push Operation	Optimized Push	Hybrid push-pull	Advanced demand-driven	Demand-optimized
Forecasting	Rudimentary, informal, untrained personnel, lack of credibility, no incentives, no management support, metrics, or tools	Evolved, organizational, trained personnel, credible, aligned incentives, management support, tools, and metrics applied	Extension of the logistics chain, demand-driven strategy (MTO), promotions, and exception management	Sales increase: 60–80%, accurate demand information, reduced variability, customer-centric, interdepartmental, high level of service, demand-driven replenishment	Sales increase above 80%, high statistical accuracy, integrated marketing and sales with key customers, demand-driven training, efficient IT and communication
S&OP	Informal, disaggregated, no management support or metrics	Formal, management support, supply and demand reconciled, metrics reviewed	Push and pull volumes in one plan, demand signals across functional areas	S&OP as a value-added activity, ad hoc meetings, scenario generation, integrated constraints and demand deficits	Advanced IT, event-driven, new product development, strategic alignment in the logistics chain
Collaborative forecasting and replenishment plan (CPFR)	No CPFR, isolated transactional systems, no demand information	Pilot, limited exchange, few partners, point of sale (POS) not integrated	Expanded, written agreements, causal point of sale (POS) data, IT integrated into the logistics chain	Customer forecasts integrated into production and replenishment	Advanced IT, automated communication, logistics chain with joint plans and metrics
Vendor Managed Inventory (VMI)	Without VMI or visibility into demand or inventory	Key partners in the logistics chain	Expanded, IT tools applied	Includes all pull sales, master data set, and trust	Integrated with production and planning tools

Note. Adapted from Mendes et al. (2016).

In the “basic push operation” stage, the S&OP process lacks formalization, with the company operating in corporate silos without shared management or metrics. The approach is not demand-driven, and the supply and operations areas are not integrated, pushing products to

the customer. There is no CPFR, with isolated transactional systems and no demand information (Mendes et al., 2016).

Table 2
Maturity Model for Supply and Operations Management

	Basic push operation	Optimized push	Hybrid push-pull	Advanced demand-driven	Demand-optimized
Purchasing	Transactional and untrained personnel	Integrated with functional areas, monitored suppliers, applied service levels	Strategic alignment with suppliers, skills development	Supplier relationship management (SRM) established with key suppliers	Advanced IT with suppliers, integrated second-tier suppliers
Manufacturing	Incipient quality and maintenance, without continuous improvement or functional integration	Visible indicators, lean practices (Kaizen, TPM, 5S), SLE at or above 50%	Expansion of lean practices, PCP optimization, SLE above 50%	Lean includes quick tool change (SMED), manufacturing cells, Kanban, flexible multifunctional teams	Deferral applied
Storage	Not customer-oriented, no indicators, basic racks and forklifts, no layout review	Accurate inventories, double racks and forklifts applied, indicators reviewed	5S implemented and adopted by everyone, training, OTIF	Flexible layout, simulation tools, triple or quadruple forklifts	Indicators included in service levels, monthly reports to customers, monitoring of out-of-stock (OOS) situations in the market
Distribution	Not customer-focused, no fleet policies, no balanced territories, no route optimization	Revised indicators, fleet policy applied, basic management of returned SKUs	Manual delivery tracking tool, variance and root cause analysis, formal return management	Automated delivery validation, real-time monitoring and tracking tool, estimated time of arrival (ETA) provided	Estimated time of arrival (ETA) updated along the route and communicated to customers
Customer Service	Not a priority, informal, incipient segmentation or market research	Formal customer policy and segmentation, but no dedicated structure	Policy, market research, customer function in specialized areas	Policy linked to CPFR and VMI, dedicated structure	Structure organized into specialized cells with representatives from functional areas
Support from	None	Basic understanding of the push system	Strong support for the hybrid push-pull system	Adopts demand-driven strategies	Extension to integration with the logistics chain

Note. Adapted from Mendes et al. (2016).

In the “Optimized Push” stage, the S&OP process is formalized, with reconciliation between supply and demand, and shared metrics are implemented (Mendes et al., 2016).

Table 3
Maturity Model for Product Lifecycle Management (PLM).

	Basic push operation	Optimized push	Hybrid push-pull	Driven by advanced demand	Demand-optimized
Forecast for New Product (NP)	Rudimentary, little data available, frequent OOS and price drops	Consumers and retailers, low accuracy (50–60% per SKU)	Used only to increase sales, demand is detected to increase, 60–70% accuracy	Limited to raw materials, finished products based on demand	Demand signals shared across the logistics chain
Logistics Chain for New Products	Operational functional performance pursued, no strategy in the logistics chain for NP and no cost control in the logistics chain	Seeks functional integration, logistics chain costs measured	Products classified and reviewed for pull or push systems based on demand variability or life cycle maturity	The strategy in the logistics chain differentiates between functional and innovative products	Functional products are managed for efficiency and innovative products for responsiveness
NP Risk Assessment and Management	Non-existent, informal	NP teams meet formally and evaluate the launch of the NP	Basic and informal assessment	Formal risk assessment	Failure Mode and Effects Analysis (FMEA) adopted before each launch
Product tracking and visibility	Informal for product launch and withdrawal	Formal sales and volume tracking	Differentiated tracking for push and pull sales, formal tracking of products to be retired	Aligned with VMI and CPFR, retirement communicated to the logistics chain	NP launch, product withdrawal, inventory, and demand shared in the logistics chain
Portfolio optimization	Informal, updated only for NP	Some attempts to withdraw low-performing products	Basic portfolio optimization, use of customer information	Multifunctional portfolio committee formed by senior managers and meets regularly	Portfolio optimization tool, with exception management and product schedule
Support from senior management	NP not supported	Silo culture, limited NP support	NP support and portfolio management	Product lifecycle management (PLM) support integrated into annual planning, culture of innovation	Product lifecycle management (PLM) support extended to the logistics chain, with suppliers and customers integrated into logistics chain optimization

Note. Adapted from Mendes et al. (2016).

The company does not yet operate on a demand-driven basis, but the supply and operations areas work in an integrated manner, with established distribution policies and customer service levels (Mendes et al., 2016).

In the “Hybrid push-pull” stage, the S&OP process is formal, with a unified push and pull volume plan, and demand communication occurs between areas. The company operates with some items driven by demand, seeking strategic alignment in key areas within the supply chain, particularly between the supply and operations areas (Mendes et al., 2016).

In the “Advanced demand-driven” stage, the S&OP process is a value-generating activity, including scenario simulations. More than 60% of items are demand-driven, and the supply and operations areas maintain formal processes with suppliers (Mendes et al., 2016).

Finally, in the “Demand-optimized” stage, the S&OP process is strategically aligned and integrated with the supply chain. The company operates with more than 80% of items driven by demand, with Marketing and Sales integrated into the supply chain, and the supply and operations areas integrated with second-tier suppliers (Mendes et al., 2016).

Maturity model

This study was conducted in the city of Maringá – Paraná – Brazil and is classified as a case study, characterized by its applied nature (Nascimento, 2016), with the main objective of evaluating the S&OP process in a medium-sized plastic injection industry.

The selected case, a medium-sized Brazilian plastic injection molding industry, is relevant due to its operations in a sector with complex production demands and a high need for logistical coordination. The application of an S&OP maturity model in this specific context, which often lacks empirical studies combining supply chain management theory with shop floor practice, gives the study a character of originality and practical applicability in the Brazilian industrial scenario (Forno et al., 2024; Pedroso et al., 2017; Rampon Neto, Barcellos & Panizzon, 2022; Seeling, Panitz & Cassel, 2021).

This research was carried out in four main parts: (1) a literature review to define the concepts of S&OP and maturity models; (2) an alignment meeting with the Industrial Manager and Process Auditor of the company under study; (3) development of questions, interviews with employees, and collection of information through a questionnaire; and (4) comparison of the database with the theoretical framework, allowing for the synthesis of the research, suggestions for improvement, and conclusions.

The literature review phase culminated in the selection of the maturity model by Mendes et al. (2016). This model was selected for its robustness and detailed structure, consisting of sixteen categories and five stages of evolution, which fully cover demand management, supply, operations, and product lifecycle management (PLM). This multidimensionality allowed for a comprehensive and accurate analysis of S&OP practices in different areas of the company.

The data collection instrument was a structured questionnaire, adapted from Martins (2017). The choice of this reference is justified by the fact that it was applied in a Brazilian retail context, providing a set of questions aligned with the reality and terminology of Brazilian businesses. The questions directly related to the S&OP process (Q1 to Q18) were applied to the key sectors involved in planning: PCP, Commercial, Marketing, Finance, Commercial Management, and Production Management, as presented in Appendix A. Martins' questionnaire (2017) was also used for questions related to support areas (indirectly linked to the S&OP process) in this study and was applied in the following sectors: Shipping and Warehousing, also presented in Appendix A.

Although the questionnaire was extensive, it was administered in an assisted manner, combining the questionnaire structure with the semi-structured interview method. Thus, before the application, participants received a detailed explanation of the S&OP concept, stages, and benefits, provided by the researchers jointly with the Process Audit team, with the aim of contextualizing them and ensuring that the answers were aligned with the central theme. The assisted approach allowed the researchers to clarify doubts in real time and ensure understanding of complex questions, such as Q4, Q10, and Q14, minimizing the risk of confusion in the responses and maintaining the participants' concentration.

The empirical data collected were subjected to qualitative analysis, being compared and contrasted with the criteria for each stage of the maturity model developed by Mendes et al. (2016). This comparison allowed the identification of specific gaps in demand management, cross-functional communication, and strategic-operational alignment. Based on this analysis, it was possible to classify the current level of S&OP maturity in the company and, consequently, identify gaps and opportunities for improvement, supporting the development of improvement suggestions.

Results And Discussions

To understand the current situation of the company, a meeting was held with the Industrial Manager and the Process Auditor. The intention was to obtain detailed information about internal processes, identify challenges, and understand the organization's position in the market. The analysis revealed that, although the Industrial Manager was familiar with the S&OP process, the term was not familiar to other employees. Even so, practices compatible with the S&OP model were present in several sectors but were applied in a fragmented manner and without integration with other areas or with senior management.

The post-meeting analysis revealed a gap in communication and alignment between departments, compromising the effectiveness of the process. The need to further study the sectors and promote a strategy to disseminate the S&OP concept was identified, aiming at greater organizational synergy. At the end of the meeting, key employees were also identified to administer the questionnaires, which supported the assessment of maturity levels and the proposal of improvements. It is important to note that, before the questionnaire was administered, participants received a detailed explanation of the S&OP concept, stages, and benefits, which was essential to contextualize them and ensure the understanding and quality of the information obtained.

The company's strategic planning is based on the previous year's results and segmented at the strategic, tactical, and operational levels, being conducted exclusively by the partners. This planning is reviewed annually, although monthly meetings with an external consultant are held to monitor results, based on the analysis of the Income Statement.

Sales planning, in turn, is centralized in the commercial director, who uses a parallel spreadsheet to compile data throughout the year and set goals based on sales per franchisee and the minimum inventory policy. Despite attempts to align sales and production, the lack of a reliable system hinders effective communication with franchisees and compromises the credibility of the targets. In addition, commercial planning is not formally documented, being transmitted orally or via WhatsApp, which hinders control and statistical analysis, especially for new products with no sales history.

For production planning, the company operates with three sales channels (franchises, representatives, and e-commerce) and adopts a strategy of producing above demand to maintain a safety stock of best-selling products. However, the lack of integration between the production and commercial sectors compromises the efficiency of the process. Currently, PCP also relies on a parallel spreadsheet that is manually fed from sales reports, which requires constant

adjustments to the production schedule throughout the month. Unexpected promotions that are not communicated in advance to the production sector exacerbate this misalignment, generating rework, waste, and inefficiency in the use of production resources.

Production planning begins with the system gathering sales reports by channel and minimum inventory, allowing the PCP team to identify the need to replenish components and raw materials based on what is already available. With this information, a spreadsheet that organizes the schedule for assembling devices, refills, and injectors is updated. From there, production orders and purchase requests are generated.

Application of the Maturity Model

The maturity model was applied to understand the current stage of the company’s S&OP process and identify the next steps for its evolution. Before the application, the model by Mendes et al. (2016) was summarized into a few topics, as shown in Table 1.

Table 1
Summary of the Mendes et al. (2016) Model

Stage	Characteristics
Basic push operation	<ul style="list-style-type: none"> • Demand management is practically non-existent, and the few initiatives that do exist are fragmented throughout the chain. • Production and distribution operations work in push mode. • Suppliers are managed in silos, without guidance from customers or senior management. • Product lifecycle management is incipient or non-existent.
Pushed Optimized	<ul style="list-style-type: none"> • The organization still operates in push mode, but forecasts are more accurate using S&OP methods and initiatives, which are still immature in CPFR and CMI. • Supply and operations are integrated into functional areas, with control of key performance indicators (KPIs). • There are formal policies for distribution, and senior management understands the importance of optimized distribution systems. • Product lifecycle management emerges with formalized new product teams, but still with low integration. • Forecasting for new products is weak, and there is no portfolio management.
Hybrid between push-pull	<ul style="list-style-type: none"> • Make-to-order (MTO) strategies, production customization strategies, promotions, and exception handling are introduced. <ul style="list-style-type: none"> • The use of S&OP includes both pull and push demand products. • CPFR and VMI are extended to more products and partners, with IT tools. • Supply and operations seek strategic alignment with key chain partners. • Senior management strongly supports hybrid push-pull systems. • Improved product lifecycle management, with forecasts for new products; NP is restricted to push products. <ul style="list-style-type: none"> • Demand forecasting is performed for pulled products. • New product risk assessment and portfolio management are introduced. <ul style="list-style-type: none"> • There is senior management support for portfolio management.

Advanced demand-driven	<ul style="list-style-type: none"> • Pulled sales already account for more than 60% of the portfolio, with greater accuracy in forecasts. <ul style="list-style-type: none"> • S&OP is a value-added activity, event-driven with “what-if” scenarios. <ul style="list-style-type: none"> • Customer forecasts are integrated into CPFR and VMI. • Supply and operations have formal cooperation mechanisms with key suppliers. • Lean is further expanded with flexible layouts, use of simulation techniques, automatic tracking, and distribution. <ul style="list-style-type: none"> • Customer service is also linked to CPFR and VMI. • Senior management fully supports the demand-driven approach. Support for new product management is based on a culture of innovation. <ul style="list-style-type: none"> • Forecasting for new products is restricted to raw materials. • The chain strategy differentiates between functional and innovative products. <ul style="list-style-type: none"> • Portfolio management is cross-functional.
Optimized demand-driven	<ul style="list-style-type: none"> • Pull sales account for around 80% of the portfolio. <ul style="list-style-type: none"> • Marketing and sales are integrated throughout the chain. • S&OP is managed using advanced technology and automated communication, integrated with CPFR and VMI. <ul style="list-style-type: none"> • Supply and operations are integrated with second-tier suppliers. • KPIs are linked to service levels and managed in specialized, cross-functional customer service cells. • Management support is optimized and extends to supply chain integration. Portfolio management is optimized. <ul style="list-style-type: none"> • Product lifecycle management extends to demand for new products. • The new product chain differentiates functional and innovative networks.

Note. Adapted from Mendes et al. (2016).

When analyzing the maturity model of Mendes et al. (2016) and the summary presented in Table 4, it was possible to observe that the company is in the first stage: Basic push operation. Table 2 represents the characteristics identified in the company under study, aligned with this initial stage.

The categorization observed is solidly based on the questionnaire responses, which confirm the company's alignment with Stage 1. The absence of effective demand management, caused by a lack of formal communication between Sales and Production, and the constant rescheduling caused by unexpected promotions, proves that demand management is practically nonexistent.

Table 2
Characteristics of the Mendes, Leal, and Thomé (2016) model identified in the company

Stage	Characteristics
Basic push operation	<ul style="list-style-type: none"> • Demand management is practically nonexistent, and the few initiatives found are fragmented throughout the chain. • Production and distribution operations work in push mode. • Suppliers are managed in silos, without guidance from customers or senior management. • Product lifecycle management is incipient or non-existent.
Optimized push	-
Hybrid between push and pull	-

Advanced demand-driven	-
Optimized demand-driven	-

Note. Adapted from Mendes et al. (2016).

The responses highlight the lack of initiative by the sectors to promote chain integration, resulting in reactive and disjointed performance, in which departments operate in isolation and without collaboration. The mention of sectoral planning and the lack of documentation of all planning carried out confirm the functioning in corporate silos. In addition, suppliers are only called upon in emergency situations. Problems such as delays in raw materials, delays in supplier payments, and lack of priority in purchasing demonstrate management based on critical events rather than a proactive and integrated relationship strategy.

The company's classification at the “Basic Push Operation” stage implies that the operational failures observed (constant rescheduling, rework, and inefficient use of resources) are not merely isolated problems but rather symptoms of a lack of a formalized tactical process. The disintegration between sectoral planning (Commercial, PCP, Purchasing) prevents the organization from using S&OP as a strategically integrated management tool.

Therefore, the company's main challenge is to evolve from a reactive culture to a proactive model, requiring not only the formalization of routines but also the engagement of senior management and the standardization of indicators to ensure sustainable alignment of processes.

Thus, the application of the adopted maturity model highlighted the relevance of senior management involvement in the S&OP process, as well as the need to formalize meetings, include information from suppliers, and use integrated systems with forecasting tools and specific indicators. The use of the model provided a comprehensive and multidimensional view of the S&OP process in the analyzed company.

Based on the analyses performed, the current stage of the organization can be classified as beginner, since its practices are predominantly aligned with the first levels of the model, situating it between the first and second stages of maturity. This finding makes it possible to identify opportunities for improvement in the process, with the potential to raise the level of S&OP maturity, promote greater integration between areas, and, consequently, generate competitive advantage and better results for the business.

Based on an understanding of the current scenario of the company studied and the stage it is at, it was possible to identify opportunities for improvement so that it can achieve better

results and stand out in the market, improving the existing maturity model in the company. Some opportunities for improvement, directly related to the challenges identified in the questionnaire, include:

- Lack of alignment between departments and management;
- Lack of definition and standardization for calculating indicators;
- Difficulties in predicting future results;
- Promotions carried out for fast-moving items rather than items that have been in stock for a long time;
- Lack of transfer of new commercial strategies to PCP;
- Delays in raw material delivery;
- Delays in supplier payments;
- Lack of a routine between departments to keep plans up to date;
- Launch of promotional campaigns without prior notice;
- Lack of monitoring and adjustments to plans;
- Lack of priority in purchasing raw materials;
- Unplanned advances and increases in production on an urgent basis;
- Sectoral planning;
- Lack of documentation for all plans made;
- Lack of alignment with the purchasing sector.

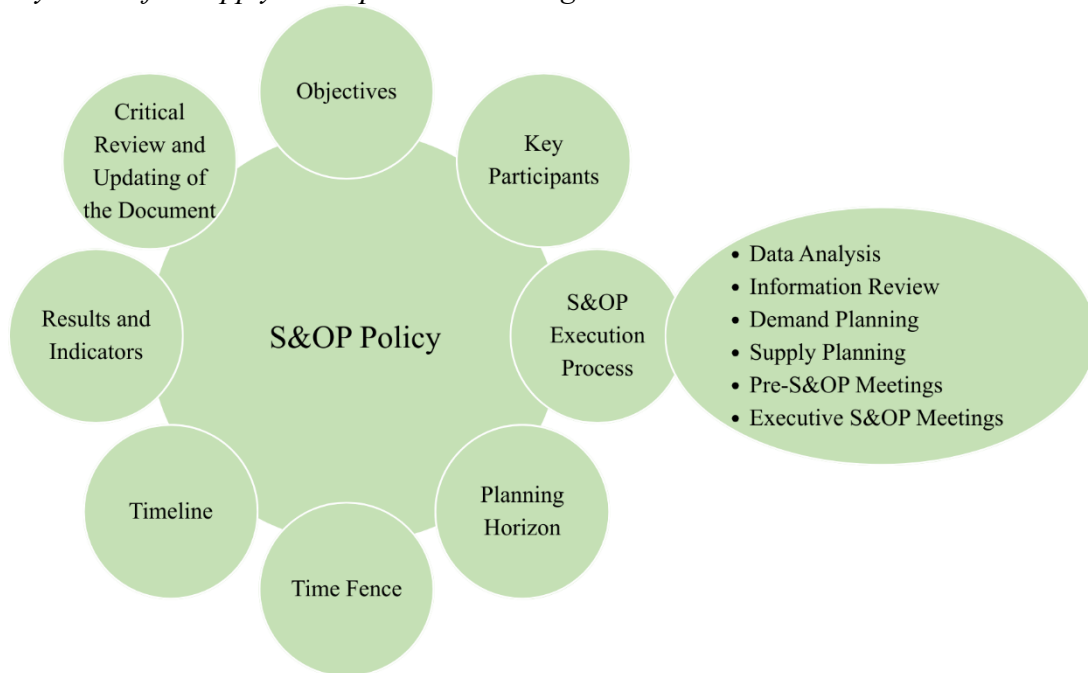
Based on the survey of information and opportunities for improvement, it was necessary to adopt a step-by-step approach to guide the company in its transition to a formal S&OP. Based on the S&OP implementation process, the Rezende (2023) model was chosen. This choice is justified by the fact that the model presents a didactic and structured step-by-step approach, ideal for companies in the early stages, focusing on the development of an S&OP Policy organized into key elements (see Figure 1).

The proposal for implementing and improving S&OP in the company, based on Rezende (2023), encompasses objectives, key participants, the S&OP execution process, planning horizon, time fence, schedule, results and indicators, and critical review and updating of the document.

To define the objectives to be achieved with the application of S&OP, it will be necessary to conduct a detailed brainstorming session with the company's management. Once

the S&OP objectives have been defined, the next step is to define the key participants in the process, i.e., those who have the authority to make decisions related to changes in planning, adjustments to critical resources, setting priorities in responding to customer requests, among other responsibilities.

Figure 1
Maturity Model for Supply and Operations Management



Note. Adapted from Rezende (2023).

As the company does not have indicators, it is necessary to include the “Indicator Survey” stage. Some suggestions have been separated for this stage: Production will have to survey data on resource production capacity, bottlenecks, and inventory levels of raw materials and finished products. On the other hand, the commercial department should survey customer demand (Wanderley & Duarte, 2021).

In the next phase, “Information Review,” the data collected by each department must be submitted into a shared spreadsheet or the system used. This practice aims to speed up the exchange of information among all participants, resulting in optimized communication, time savings, and increased productivity. It is important to note that those responsible for the data must ensure its accuracy, clarity, and updating, in line with the purpose of the decision-making process during Pre-S&OP and Executive S&OP meetings.

For the third stage, “Demand Planning,” the sales plan for the following months must be established, based on statistical data combined with information provided by the sales and

marketing teams. At this stage, it is extremely important to prepare the plan with the sales and product advertising planned for the coming months.

Once demand has been defined, it is necessary to carry out “Supply Planning,” which aims to review supply plans (production and purchasing) with the established sales plan. In this stage, restrictions are identified to fully meet the forecast, such as production capacity and/or the supply of necessary components.

Next, the fifth stage, “Pre-S&OP Meetings,” is responsible for bringing together participants from each department (except for senior management). At this meeting, demand planning should be discussed in relation to the available resources and capacity, raising what purchasing, production, and logistics decisions will be made, as well as analyzing the capacity constraints of the operation as a whole. If critical issues and constraints that cannot be resolved at the Pre-S&OP meeting are identified, participants should establish an action plan to be presented at the executive meeting.

The sixth and final stage, “Executive S&OP Meetings,” brings together participants from each department, along with the executive board, who, after discussions, will give the final directions to be followed. At this meeting, it is crucial to present the main results of the previous month to the company's senior management, highlighting possible risks to be faced in the following months.

In addition, the various scenarios developed in the previous stage are examined, especially if they are related to a significant impact on the company's financial situation. The demand for new orders, the progress of orders in progress, customer satisfaction, and the resolution of specific problems that deviated from previously established objectives are also analyzed. The pending issues from the Pre-S&OP meeting must be presented, as well as the action plans proposed by the participants. Finally, the indicators established to measure the performance of the S&OP process are analyzed. Once the S&OP process has been established, the sales and operations planning horizon will be defined, considering the minimum response time for all departments.

With the planning horizon established, it is necessary to determine the time fence, that is, the period during which the plan cannot be changed. The interval during which no changes to the plan will be allowed must be defined, taking into account that the closer to the current date, the more significantly the costs associated with changes in production and sales planning increase. This covers considerations of priority, inventory, negotiations with suppliers, and other factors.

Once the processes have been defined, it is important to define the monthly schedule of activities. This base schedule should contain the established stages of the S&OP execution process (Data Collection and Processing, Information Review, Demand Planning, Supply Planning, Pre-S&OP Meeting, and Executive S&OP Meeting). It is important to note that participants should organize their schedules considering the meeting schedule so that there is no overlap of commitments that could compromise their participation in the meetings.

Once the monthly schedule has been drawn up, in the results and indicators stage, the expected results for each completed S&OP cycle should be established, analyzing the adherence of the planning to what was executed, as well as points for improvement in the alignment of the process. Among the indicators, those that guide decisions in the S&OP process should be taken into account, such as inventory levels, adherence to planning, fulfillment of orders by the factory, customer satisfaction levels, and assertiveness in planning.

Finally, the topic of critical review and updating of the document seeks to keep the S&OP policy up to date and with the appropriate history of changes. In addition, process improvement should be considered, always seeking to increase its level of maturity. Thus, the implementation of the S&OP Policy, structured according to the Rezende (2023) model, is the recommended path for the company to overcome the “basic push operation” stage and mitigate interfunctional communication failures and reactive planning.

The focus on defining clear objectives and determining key participants will transform dispersed decision-making, currently centralized in the boardroom or conducted via WhatsApp, into a formal and collaborative tactical process. In addition, the inclusion of the “Indicator Survey” stage is crucial, as it allows the company to move away from management based on critical events (such as raw material delays and unexpected promotions) to proactive monitoring of adherence and assertiveness. In essence, the proposed improvement plan aims not only to formalize routines but also to instill the discipline of a planning cycle, which is fundamental to achieving strategic alignment and, consequently, competitive advantage.

Final Considerations

This paper presented an assessment of the maturity level of S&OP in a medium-sized plastic injection industry, drawing attention to the critical need for improvement in operational management and internal communication. The practical analysis, based on the application of the maturity model, revealed that the process is in the initial stage of “Basic push operation,”

highlighting challenges and opportunities that can be effectively addressed through the implementation and formalization of S&OP.

The proposal to adopt S&OP as a strategic tool is supported by the multidimensional diagnosis obtained, which cross-referenced empirical evidence (collected in meetings with the Industrial Manager and Process Auditor, interviews, and questionnaires) with the theoretical framework. By identifying the fragmentation of sectoral planning, S&OP proves to be a solution for the effective integration of functional areas and to support the necessary balance in the logistics chain, promoting the vertical and horizontal alignment of operations.

By aligning operational procedures with S&OP assumptions, it is expected not only to increase the company's level of maturity but also to reap the benefits of effective integration, providing a comprehensive and integrated view of the business. This joint effort, based on the recommendations and action plans presented, aims to increase the company's competitiveness in the business landscape and create a clear path to operational excellence and continuous improvement.

This study offers a relevant theoretical and practical contribution. Academically, it adds empirical insights into the applicability and challenges of S&OP maturity models in the specific context of the Brazilian plastic injection industry, a segment with a scarcity of literature on the subject. Managerially, the work provides a detailed and structured roadmap for the evolution of the process, allowing other companies to advance their maturity levels within this context. However, as a single case study, the main limitation of the research is the impossibility of generalizing the results. Although the diagnosis and proposal are in-depth for the context of the analyzed company, the findings cannot be directly inferred to other industrial sectors.

For future research, we suggest: conducting a longitudinal study to monitor the implementation of the proposed S&OP Policy and measuring, through established indicators, the effective gain in the level of maturity of the process over time; applying the maturity model in multiple companies of the same sector (plastic injection) to perform a comparative analysis and identify regional or sectoral maturity patterns; investigating the impact of adopting integrated systems (ERP and forecasting software) on the speed of transition between maturity stages, addressing the digitization challenges inherent in the contemporary context of S&OP.

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Appendix A - Martins' questionnaire (2017)

Questions applied to the key sectors involved in planning: PCP, Commercial, Marketing, Finance, Commercial Management, and Production Management.

Q1 - Describe your responsibilities.

Q2 - What are your main goals? Describe them.

Q3 - How often are your goals verified and reviewed?

Q4 - How does S&OP work, including processes, inputs, and outputs for each area? (PCP, Shipping, Sales, Marketing, Finance, Sales Management, Production Management, Production, Warehouse).

Q5 - What information from other areas of the company is necessary to carry out your main activities and planning?

Q6 - What are the main planning failures in your area? Give recent example(s).

Q7 - In monitoring S&OP, what are the main execution deviations and how are they handled? Give a recent example.

Q8 - What is the horizon (periodicity) and frequency of review and verification of the planning of your activities?

Q9 - What are the operational constraints within the company that restrict your decisions?

Q10 - How is the coordination of information transfers carried out in each of the areas (Commercial, Planning, Logistics, Marketing, Finance, and IT)? Are there specific tools?

Q11 - How are deadlocks between departments resolved? Give recent examples.

Q12 - Is there a different plan for major events? If so, what are the main events and what are the differences in planning?

Q13 - What metrics are used to monitor the execution of the plan?

Q14 - What are the main indicators that can evaluate the company's S&OP? What is your rating on a scale of 1 to 5? (1 - does not exist; 2 - embryonic; 3 - fair; 4 - advanced; 5 - fully integrated).

Q15 - What are the main gains that S&OP generates for the company?

Q16 - What were the main advances in S&OP and when did they occur?

Q17 - Is the planning process documented in the company or is it informal?

Q18 - What is the budget strategy? How is it monitored?

Questions applied to the support areas (indirectly linked to the S&OP process): Shipping and Warehousing

Q1 - Describe your responsibilities.

Q2 - What information from your area is necessary for the planning and activities of each of the company's areas? (PCP, Shipping, Sales, Marketing, Finance, Sales and Production Management).

Q3 - How is the coordination of information transfers for each of the areas carried out? (PCP, Shipping, Sales, Marketing, Finance, Sales and Production Management).

Q4 - Is specific information provided for major events? If so, what are the main events and what are the differences in planning?

Q5 - What are the main flaws in the company's S&OP? Give a recent example.

Q6 - What are the main indicators that can evaluate the company's S&OP? What is your rating on a scale of 1 to 5? (1 - does not exist; 2 - embryonic; 3 - fair; 4 - advanced; 5 - fully integrated).

Q7 - Is the planning process documented in the company or is it informal?