

Evaluation of the maturity of the S&OP process for a written materials company: a case study

Avaliação da maturidade do processo de S&OP em uma empresa de material de escrita: um estudo de caso

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Abstract: This paper aims to evaluate the maturity stage of S&OP process in a written materials company to identify main deficiencies of this process and to suggest actions to its evolution. Three models were selected to do this task: two qualitative models, proposed by and a quantitative one. There were significant differences between results from the quantitative and the qualitative models, especially because the quantitative model used generic reference value for the metrics, without considering industry in which the company is located, the number of clients as well as the characteristics of its products and processes. For the demand planning accuracy metric, it is proposed a method using an average weighted of product families' accuracy, defining the weights by an ABC classification based on families' revenues. On the practical field, the main difficulty in S&OP process analyzed was the interface between demand and supply, especially because the company has a functional structure focused on meeting demand. The difficulty of this integration is, in fact, the main purpose of S&OP. Therefore, the company expects to reduce the conflicts in this interface in the coming years.

Keywords: S&OP; Maturity model; Sales management; Operations management; Process management.

Resumo: O objetivo desta pesquisa foi avaliar o estágio de maturidade do processo de S&OP da empresa objeto de estudo, identificar as principais deficiências por categoria avaliada e propor ações para sua melhoria. Para tanto, utilizaram-se três modelos, sendo dois modelos qualitativos e um modelo quantitativo. A pesquisa apresentou resultados divergentes entre a classificação oriunda dos modelos qualitativos e quantitativo, especialmente pelo fato de as métricas calculadas serem genéricas, não incorporando fatores como tipo de mercado consumidor, número de clientes e características de seus produtos e processos. Para a métrica acuracidade da previsão de vendas, é proposta a realização de uma média ponderada entre a acuracidade de cada família de produtos, sendo os pesos definidos por meio de uma classificação ABC baseada no faturamento das famílias. Do ponto de vista prático, notou-se que a principal dificuldade do processo de S&OP na empresa estudada reside na interface entre demanda e suprimentos, especialmente pelo fato de a companhia possuir uma estrutura organizacional do tipo funcional orientada ao atendimento da demanda. O fortalecimento dessa integração é a finalidade maior da atuação de um processo de S&OP na empresa, para minimizar conflitos funcionais e melhorar o desempenho da companhia.

Palavras-chave: S&OP; Modelo de maturidade; Gestão da demanda; Gestão de operações; Gestão por processo.

1 Introduction

Because of the increase in competition between companies and the demand for development and/or maintenance of competitive differentials in the market, there is a natural direction of the companies for efficiency increases of the productive,

technical and administrative processes, aiming to increase revenues and reduce costs and expenses. In traditional functional structures, organizational silos drive the business functions to make decisions that benefit their own results, without visualizing

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the impact of those decisions on the company as a whole. Of these relationships, the interface between marketing and operations is one of the most emblematic.

S&OP has emerged precisely to serve the frontiers of functional areas, especially marketing, sales and operations, in order to align decisions that bring gains to the entire company. Expanding its origin, S&OP also included the launch of new products, financial plans, among other plans, in order to integrate them into the decision-making process (Thomé et al., 2012a).

In this research, the company’s S&OP process was evaluated through three models that measure S&OP maturity stage. Namely: Lapede (2005), Grimson & Pyke (2007) and Viswanathan (2009). From the measurement and classification performed, the existing gaps were identified and, in order to advance company’s position to more evolved stages of S&OP, some suggestions were presented throughout the text.

This paper aims to evaluate S&OP maturity level of a written materials company, using the models proposed by Lapede (2005), Grimson & Pyke (2007) and Viswanathan (2009), and to propose actions for its evolution. This paper is organized as follows. Section 2 reviews S&OP literature, with emphasis on fundamental stages of an S&OP process and S&OP maturity models, especially the three models that will be used in this paper. Next, section 3 characterizes the research method and defines the purpose of this research. Section 4 presents the case study, describing the company and its S&OP process. The S&OP process is classified regarding to its maturity level according to the three selected models. Furthermore, the gaps are identified and proposals are made to mitigate them. Finally, section 5 presents the conclusions of this research.

2 Literature review

2.1 Relationship between marketing and operations

Conflicts among the organizational functions study is not recent in literature (Thomé et al., 2012b). Lawrence & Lorsch (1967), in the 1960s, analyzed the integration among the organizational functions and its effects. Among different functions, the conflict between marketing and operations is one of the most important, being the fulfillment of the deadlines and quantities of the requests, the main cause, but not the unique, of the divergences (Brown & Ozgur, 1997; Thomé et al., 2012b), as shown on Figure 1. Shapiro (1977) presents a relevant discussion on the subject, stating that a market-only company loses manufacturing efficiency while the search for manufacturing efficiency alone prevents the company from seizing market opportunities. Malhotra & Sharma (2002), however, question the dependence between functions and the need for coexistence. More recent studies, such as Chen (2014) and Kozlenkova et al. (2015), understand that the integration between functions is essential for the success of the organization.

Not meeting the forecast demand can cause loss of sales and customers, but capacity expansions impact on high investments, usually in the long term (Geng & Jiang, 2009; Martínez-Costa et al., 2014). For this reason, the proper balancing of demand and supply is fundamental, avoiding both the loss of revenues and the costs incurred by maintaining an idle capacity, additional to the planned capacity. In this context, the management of productive capacity is a fundamental element of a good alignment between marketing and supply (Sawhney & Piper, 2002).

Chou et al. (2007) highlight that a well-structured capacity planning is an essential support for organizational strategies and plans, especially regarding the launch of new products or the introduction of new technological

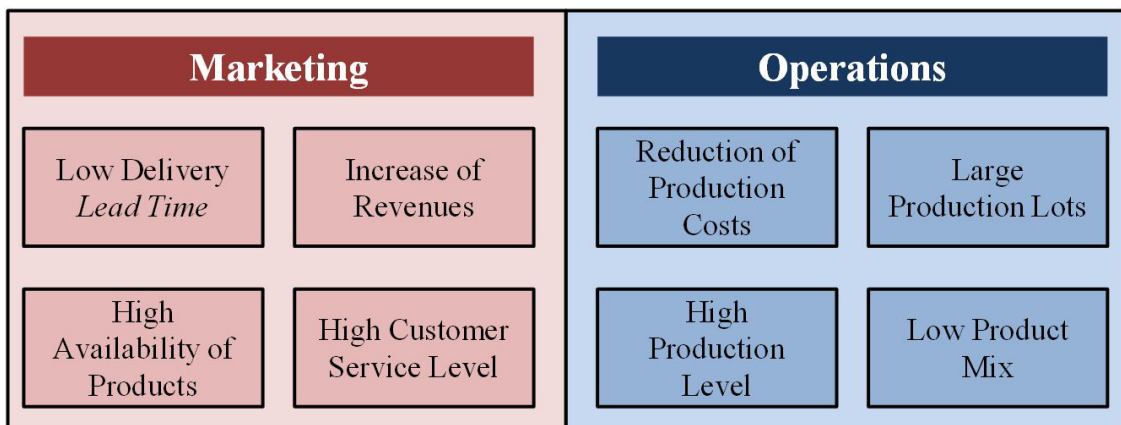


Figure 1. Summary of the conflicts between Marketing and Operations. Source: Elaborated by the authors.

processes in manufacturing. Mollenkopf et al. (2011) go further, stating that manufacturing can support competitive marketing differentials, if well structured.

On the other hand, Shapiro (1977) states that marketers must develop their strategies based on manufacturing constraints. As presented by Marques et al. (2014), through some practical cases, when this consideration is not made, serious problems can occur. In one of the cases presented by these authors, a brewery made a high investment to promote its own brand, resulting in a significant increase in its demand. Paradoxically, the supply chain was not prepared to meet this increase in demand, which caused shortages on sales points and loss of credibility of the brand.

Integration and collaboration in the decisions taken by different functional areas is fundamental, not restricted to marketing and operations. An unexpected increase in demand, for example, can cause imbalance in the company’s cash flow in the short term, since in the initial period there is an increase in manufacturing and purchasing expenses, with a proportional increase in sales only on some time latter. Integrated decisions lead companies to achieve better results in manufacturing, commercial and financial areas, and are critical success factors for the companies (Tang, 2010; Galeazzo et al., 2014).

2.2 Sales and Operations Planning (S&OP)

Each functional area of an organization tends to influence the processes in order to achieve the goals and results assigned to them (Oliva & Watson, 2009). When there is a misalignment of metrics to evaluate the results between functions, conflicts naturally intensify. For example, if the sales area goal are revenue results, it is natural that sales forecasting is overestimated to ensure that products are available.

Given the divergent interests and the importance of collaboration and integration in decision making process among functional areas, the introduction of Sales and Operations Planning (S&OP) in companies is of great value, as the purpose of this process is precisely to deploy the strategic plan of the company in integrated tactical plans for the different areas.

Grimson & Pyke (2007) define S&OP as the process that relates strategic planning to operational activities, also balancing demand and supply chain. Therefore, S&OP performs vertical and horizontal alignment in organizations, as shown in Figure 2 (Kathuria et al., 2007). Vertically by aligning strategies, objectives, action plans and decisions at different organizational levels. Horizontally by aligning the objectives of the different organizational functions.

S&OP, however, is not a new concept, having its origin in the 1950s, with the works of Holt, Modigliani, Muth and Simon (HMMS). This study developed a linear-quadratic model for the aggregate production plan with the selection of production and labor force levels in each period, in order to satisfy purchase orders and to minimize total costs (Singhal & Singhal, 2007; Thomé et al., 2012b). According to Singhal & Singhal (2007), the model make the primary link between strategic and tactical levels, as well as promote the alignment between business functions, analyzing the conflicts between the decisions of each function.

However, it was only in the 1990s that S&OP gained importance in literature (Grimson & Pyke, 2007). This fact is directly related to the way that S&OP has developed, from practice to theory, resulting from the need for process integration and better production capacity management in conjunction with sales plans.

In literature, there are three sets of different S&OP definitions. Olhager & Selldin (2007) fall into the first

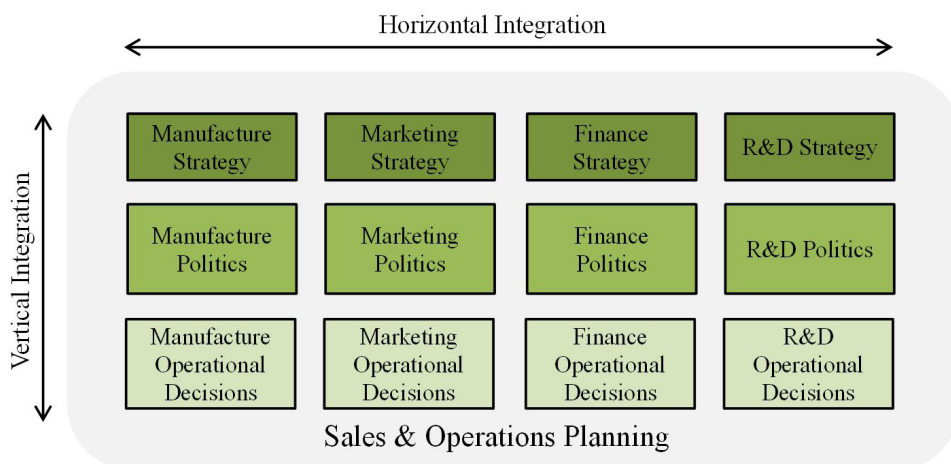


Figure 2. Horizontal and vertical integration provided by S&OP. Source: Corrêa (2010).

group and define S&OP as a high level of planning (integrating the strategic and tactical levels) and of long term, including sales and production planning, management of capacity and demand. In this group, the focus is on unfolding the company’s strategic plans into tactical and operational plans, coordinating and integrating the organization’s business processes.

A second group of authors, including Cox & Blackstone (2005) and Feng et al. (2008) view S&OP as an element of the companies’ tactical level, integrating the needs of consumers with supply chain management, seeking competitive advantages in this interface. For them, S&OP is similar to the Master Production Plan, differentiating from this because of the greater participation of S&OP in sales and marketing processes, especially in the elaboration of the sales forecast.

There is also a third group, of which Sheldon (2006) is a member, which highlight the importance of S&OP as a process in itself, focusing on the cycle of monthly meetings that seeks to adapt the internal processes of the organization to meet customer needs and increase the responsiveness of demand variations. On the one hand, this view is a subset of the two previous views, as it integrates the functional areas at both the strategic and tactical levels. Its relevance, however, lies in the emphasis given on how the process should be structured. This structure will be presented and discussed in section 2.3.

Despite the integration of functional areas, a problem inherent to S&OP is the difficulty of resolving conflicts, especially because its participants usually occupy the same hierarchical level (Rexhausen et al., 2012). For this reason, Crum & Tearnan (2014) emphasize the importance of the existence of a coordinator of S&OP process, acting as a facilitator and mediating the integration between the areas. Wallace & Stahl (2008)

point out that the coordination of the process can be carried out by company executives (top management), attending face-to-face meetings or via the Internet.

S&OP planning horizon is not well defined. It can vary from 6 months to 3 years, according to the characteristics of the industry and its products (Lim et al., 2014). However, it can also extend from 1 to 18 months in the view of other authors (Grimson & Pyke, 2007).

Regarding to the S&OP planning level S&OP there is also no consensus. Although it is usually associate with final goods families (Kallunki et al., 2011), there are references to individual product analyzes (Collin & Lorenzin, 2006), as well as combined analyzes of product families and items, for the most relevant products (Singh, 2010).

As for its scope, S&OP’s core processes are sales and production planning, which may include financial and new product planning (Grimson & Pyke, 2007). Thomé et al. (2012a), however, emphasize that the integration of financial plans into S&OP process is considered only by a limited number of papers.

2.3 S&OP process

Several authors, such as Palmatier & Crum (2003), Lapide (2004), Dougherty & Gray (2006), Grimson & Pyke (2007), Wallace & Stahl (2008), Esper et al. (2009) and Thomé et al. (2012a) present similar models for S&OP process, all composed of five stages (Figure 3). In these models, step 1 consists of collecting and reviewing sales and production data for the last month, current stock levels, back orders, as well as elaborating statistical sales forecasts for the following months.

Step 2 of the model intends to define the sales plan for the coming months. This plan is based on

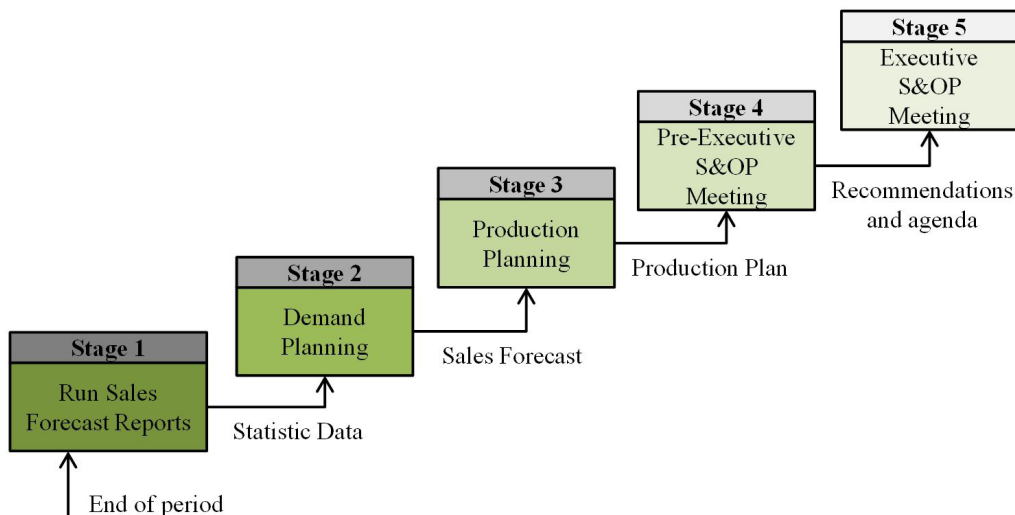


Figure 3. Stages of S&OP process. Source: Adapted from Esper et al. (2009).

statistical information plus those provided by field (sellers), sales managers and the marketing team. At this stage, it is essential to carry out an alignment of the marketing plan regarding to promotions and product announcements planned for the coming months (Grimson & Pyke, 2007).

In the third step, the supply plans (production and purchasing) are reviewed according to the new sales plan. The restrictions for the integral fulfillment of the sales forecast are pointed, referring to the manufacturing capacity or to the delivery of purchased components.

Step 4 consists of a meeting with the entire S&OP team. The supply team, composed of procurement, production planning and logistics supervisors, presents the identified constraints. Impacts on revenues are analyzed and supplies and sales' team together propose solutions and alternatives. At this stage, different scenarios of the supply plan are evaluated.

Finally, step 5 consists of presenting the main results of the previous month to the top management of the company, as well as the risks and opportunities for the coming months. The scenarios generated in the fourth stage are also discussed, especially if there is a significant influence on the financial result of the company.

Most papers mention a monthly cycle as a repetition of this model (Kruse, 2004; Slone, 2004). However, companies in advanced stages of S&OP hold meetings only when there is a significant change in demand or in the supply plan (Lapide, 2004).

2.4 S&OP maturity level

Thomé et al. (2012a) present a review of the different models for measuring the maturity of an S&OP process (Figure 4). While the initial models

were based on specific aspects of S&OP process, such as information technology, in the case of Wing & Perry (2001), the more recent models propose a more comprehensive view, addressing multiple aspects. In the Cacere et al. (2009) model, four dimensions are proposed: balance between demand and supply, process objectives, process owners (definition of responsibilities) and performance indicators. Still based on the work of Thomé et al. (2012a), the main maturity models of an S&OP process rank companies between 3 and 5 stages.

In this research, emphasis will be given to three models will be analyzed - Lapide (2005), Grimson & Pyke (2007) and Viswanathan (2009) - because according to Thomé et al. (2012a), they summarize the dimensions proposed by the other models.

2.5 Lapide model

Lapide (2005) presents a S&OP maturity model based on twelve critical success factors of this process, which were initially listed in Lapide (2004). In the model, the factors were grouped into three dimensions: people, processes and technology. The companies were classified into four stages of maturity (Chart 1).

The formality and participation of the members of the process in the meetings, as well as the dynamics of the process is the focus of the **people dimension**. The **process dimension** focuses on assessing the degree of integration between internal and external sales and supply plans. Finally, in the **technology dimension**, the fundamental elements of analysis are the computerization of data and the level of integration of information systems internal and external to the company.

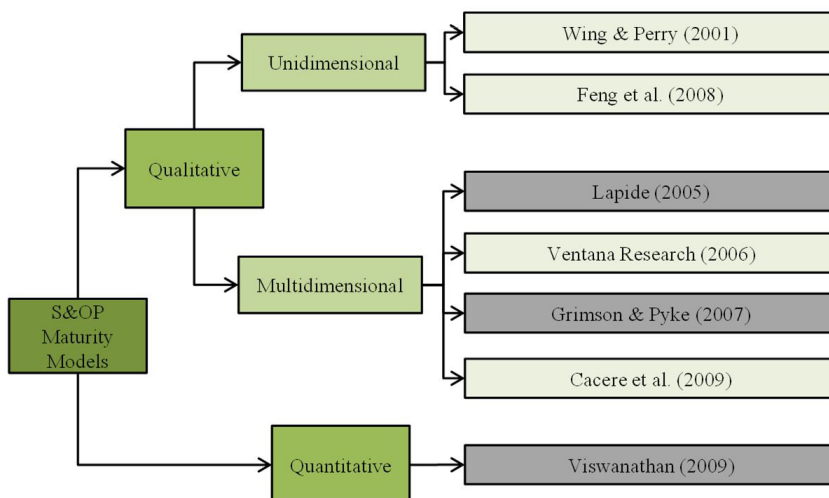


Figure 4. Summary of the main maturity models of S&OP. Source: Elaborated by the authors.

2.6 Grimson and Pyke model

Grimson & Pyke (2007) used the Lapide (2005) model as a reference for the construction of their proposal, structured in five dimensions (Chart 2). The main difference between the two models is the introduction of the organizational structure formality

and the performance indicators as dimensions in the Grimson & Pyke (2007) model, which were not included in the Lapide (2005) proposal.

The **first dimension** of the model, meetings and collaboration, considers the human component of S&OP. One of the aspects evaluated is the scope of the meetings, that is, if there is only top management

Chart 1. Lapide maturity model.

Dimension	Marginal Process	Rudimentary Process	Classic Process	Ideal Process
People	Informal meetings	Schedule meetings.	100% attendance and participation.	Meetings schedule just when there is a change in the alignment between demand and supply.
Process	Supply plans not aligned to demand plans.	Supply plans aligned to demand plans.	Supply plans aligned to demand plans. Participation of some customers and suppliers.	Demand and supply plans aligned internally and externally.
Technology	Isolated and non-systematized information	Stand-alone demand planning system. Stand-alone supply system.	Demand and supply plan systems integrated.	S&OP system. Integration with customers and suppliers systems.

Source: Adapted from Lapide (2005).

Chart 2. Grimson and Pyke maturity model.

Dimension	No S&OP process	S&OP reactive	S&OP standard	S&OP advanced	S&OP proactive
Meetings and collaboration	No formal meetings. No collaboration. Organizational Silos.	Discussed at top-level management meetings. Focus on financial goals.	Involvement of the other levels in pre-executive meetings. Analysis of some operations and sales data.	Supply and sales data incorporated. Participation of key suppliers and customers in meetings.	S&OP meetings are part of the company's calendar. Real-time access to external data.
Organization	No S&OP.	Components of S&OP are in other functions.	S&OP is part of other functions.	S&OP has a formal structure, with participation in the executive level.	S&OP understood as relevant in the organization.
Performance indicators	No measurements.	Measure only how well Operations meets the sales plan.	Previous. Sales measure on forecast accuracy.	Previous. New product introduction.	Previous. Company profitability.
Information Technology	No consolidation of information. Local and isolated systems.	Some consolidation, but done manually.	Centralized information. Revenue or operations planning software.	ERP integrated production and sales software.	S&OP optimization software integrated with ERP and with real-time data.
Integration between Sales and Operations	No formal planning.	Sales plan drives Operations. Capacity utilization dynamics ignored.	Some plan integration. Sales and operations plan aligned with the organization's plan.	Integrated medium-term plans. Capacity analysis used as a constraint in sales planning.	Fully integrated plans focus on optimizing the company's profit.

Source: Adapted from Grimson & Pyke (2007).

participation or if there are also supervisors and specialists. Another aspect is the decentralization in the decision making, in other words, the autonomy that the employee has to decide on how to solve the problems in which it operates. While in the early stages the meetings are informal, restricted to top management and focused on the financial aspect, in more advanced stages of S&OP the meetings have great relevance for the company, and members of different functions attend them, as well as customers and suppliers.

The **second dimension** of the model is the organization, which assesses the organizational structure of S&OP, its formal definition and the existence of specific members. As the process acquires maturity, S&OP is no longer divided between the areas and has a formal structure that is proper and relevant to the organization.

In the **third dimension**, the performance indicators are evaluated for their degree of comprehensiveness among the functions of the organization. While in the early stages they do not exist or only cover supply and sales, in stages of greater maturity they also incorporate the introduction of new products and the financial perspective.

The **fourth dimension** is information technology, especially the level of centralization and interaction of information and the existence of sales and operations planning software.

Finally, the **fifth dimension** is the integration between supply and demand, with the emphasis on the degree to which this integration occurs.

2.7 Viswanathan model

Viswanathan (2009) model was developed from Grimson and Pyke model (2007), being an evolution of this model (Thomé et al., 2012a). It consists of three objective metrics to classify companies. These are: the level of service offered to customers (OTIF - On Time In Full - orders delivered in full quantity and order date), average cash turnover cycle and average accuracy of sales forecast at the aggregate product level. The companies are classified into three levels of maturity (20% in the advanced level, 50% in the middle and 30% in the latter), as shown in Chart 3, in which the average value for each metric and class is presented (according to the average of the companies evaluated in the research of Viswanathan (2009).

Chart 3. Viswanathan maturity model.

Metric	Best in Class	Industry Average	Laggard
Average Service Level	97.5%	92.5%	85.0%
Average cash turnover cycle	15 days	2.5 months	6 months or more
Average Accuracy of Sales Forecast (Product Family)	82.0%	73.0%	54.0%

Source: Adapted from Viswanathan (2009).

The Viswanathan (2009) model differs from the others presented by proposing objective metrics as a classification criterion, reducing the influence of the subjective perception of the researcher in the evaluation of the company. The metrics values, however, were defined based on a survey conducted by the author with 220 companies, concentrated in North America (64%) and predominantly in manufacturing (74%). However, there is a lack of information on the characteristics, production processes, location and market of the analyzed companies, limiting the extension of the model to other companies and production processes.

Considering the weight of the stock in the cash flow, a trade-off between the first two metrics is observed. As inventory increases, there is a tendency to meet a larger number of customer orders, impacting on a larger average cash cycle.

3 Methodology

Based on the classification criterion proposed by Vergara (2006), the present research can be classified as an applied research, because the problems analyzed are concrete and come from the company that is the focus of this research. Moreover, it is also a case study, as a detailed and deep study will be done in a company. As Leonard-Barton (1990) defines, in the case study a history of the phenomenon is constructed from multiple sources, increasing the understanding on this subject.

This research was divided into five phases (Figure 5). In **Phase 1**, the authors realized a survey in literature in orders to identify the main models for maturity classification of an S&OP process.

In **Phase 2**, it was analyzed the importance given to each model literature, and the three most relevant were selected. Namely: Lapede (2005), Grimson & Pyke (2007) and Viswanathan (2009). In **Phase 3**, the main participants in S&OP process (members of S&OP, production planning and sales teams) were interviewed, as well as meeting reports, presentations, indicators, and other documents were analyzed. With this information, the authors mapped the main characteristics of S&OP process in the company focus. In **Phase 4**, the company focus was classified according to the three selected models. Based on the information generated and the results of the classifications, in **Phase 5** suggestions are made to improve S&OP process of the company studied.

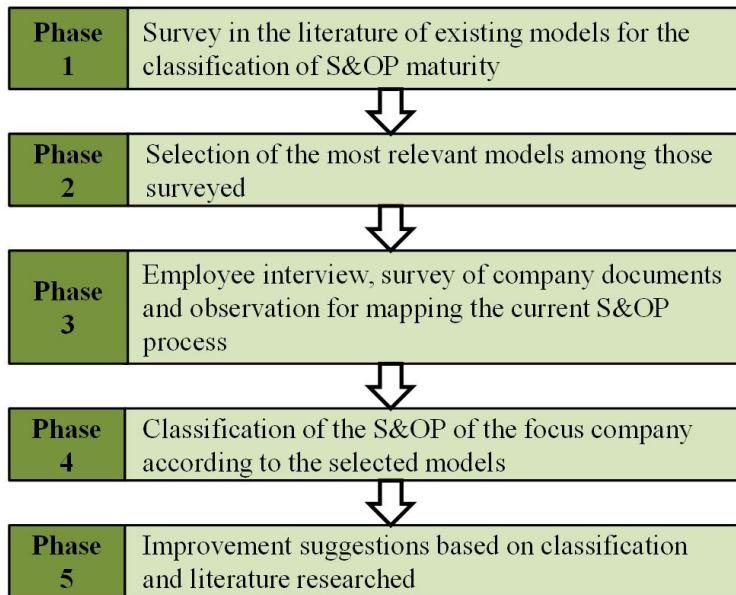


Figure 5. Research method. Source: Elaborated by the authors.

4 Case study

4.1 The company studied

The focus of this research is a company in the writing material industry, which has 15 plants around the world. The three ones located in Brazil were the focus of this study. The company’s product portfolio is sold in more than 120 countries and includes color and black lead pencils, modeling clay, permanent markers, wax crayons, pencil sharpeners, among others.

The company has two main Business Units (BU), domestic market and export, which are the focus of this research. Added to these are the BU of gifts and the one for cosmetic items (Figure 6). For each BU, there is a manager responsible for monthly consolidating the sales forecast for each item for the coming months of the company’s fiscal year, based on the individual demand of each salesperson and/or regional sales manager.

In **export BU**, all Stock Keeping Unit (SKUs) have the MTO (Make to Order) strategy due to some characteristics of this market, such as: reduced number of customers for each item, individual orders of significant volume and the acceptance of customer of a long delivery lead time.

In the **domestic market**, items for specific customers, such as own-brand items (items produced under the customer’s brand), and for Government are also MTO. However, the vast majority of items are MTS (Make to Stock), since, in general, the customers of each item are located in different regions, they buy small quantities and with high frequency. In addition, customers are not willing to accept the total supply lead time of the items, wishing to have the ordered

products as soon as possible. In this BU, availability of items is a winning order criterion.

In the **gifts BU**, clients customize the products they are purchasing. In the case of a black lead pencil, for example, customers can choose the graduation of the lead, the shape (round, hexagonal or triangular), the color of pencil and the color of the eraser, among others. Because product configuration occurs only after customer order confirmation, SKUs from this BU have MTO demand response strategy.

The **cosmetics BU**, also produces only after order confirmation, because of the high portfolio diversity, high variability in the demand for SKU, and high cost of the products which makes it unfeasible to keep them in stock.

Prior to the formal S&OP implementation, some parts of the process were already done in a fragmented way by the Production Planning and Sales departments. At the end of each month, production planning calculated some service indicators for each BU, such as OTIF, forecasting accuracy, back order, among others. It was also measured the total stock of each category and the adherence of real production with the planned one by product families.

Sales planning, on the other hand, measured monthly revenues by product category, as well as the average price and the percentage of discounts granted. The financial sector finally collected the cost of production per item in order to calculate the marginal contribution per product. However, the processes were not formally structured, a fact that occurred only after the introduction of S&OP in the company.



Figure 6. The Business Units (BUs) of the company studied. Source: Elaborated by the authors.

4.2 S&OP process

S&OP was formally introduced in the company in mid-2009, due to the need to approximate the areas of sales planning and production planning. The domestic sales manager was responsible for carrying out the initial mapping of the process along with his team. It was decided to start this way because it was understood that it was necessary to improve the quality of sales forecasting before integrating it with production planning.

Later, a fixed team of three people was defined for S&OP area, with one manager and two specialists, who were respectively, supply manager, production planning manager and the sales analyst of the domestic market. This way, the knowledge of the two main functions was added to S&OP department, as well as it facilitates the communication of S&OP team both with sales and with the areas of supply.

S&OP process begins on the first day of each month with the **Statistic Phase**, called by Esper et al. (2009) as Run Sales Forecast Reports. In this step, the sales forecast of each item for the next periods are revised with statistic methods, as well as end of month stocks are consolidated by product category and the causes of deviations from the targets set at the beginning of each fiscal year (Figure 7).

Next, the **Marketing Phase** takes place. In this step, marketing managers evaluate the sales potential of each of the products, providing a first sales forecast. The Marketing Stage, such as the Sales Step and Sales Validation are grouped and named by Esper et al. (2009) as Demand Planning.

The third step is the **Sales Phase**, in which the managers of each geographic region consolidate the information of each salesperson and transfer it to the BU sales director. Regional managers can change salesperson forecasts by observing the potential to sell a more profitable product B rather than a product A. In that case, the manager may decide to reduce A's forecast and increase B's. If there is a change, communicating the lower levels is fundamental.

After the consolidation and validation of sales review, **Production Planning Phase** begins, which receives the same name in the model of Esper et al. (2009). At this stage, the forecast is compared to the

capacity constraints at the plant and to the component supply constraints (lead time not compatible with the desired term or quantity greater than the supplier's productive capacity). The planner then sets the quantity to be produced from each SKU for each period and checks the situations in which sales forecast cannot be met. The deliverables of this stage are the production plan for each product family and a file with the constraints to meet the forecast.

The plans are discussed in the **Consensus Meeting**, whose focus is to assess the alignment between demand and supply plans for each category. The members that attend this meeting are S&OP team, the production managers of each plant, production planning and purchasing manager. For the alignment of the plans, changes in production averages may be required, with volume postponement or anticipation. This decision is discussed and agreed upon by the group, ensuring that plans are feasible and integrated.

Sales forecasting constraints (by SKU) are discussed at a second meeting, called the **Pre-Executive Meeting**. At this meeting, restrictions are presented and the possibilities to eliminate them are evaluated (increasing workdays or buying items by air modal, for example) and, when it is not possible to eliminate them, sales are directed towards a similar product in order to maintain the total revenue. The members that attend this meeting are the marketing managers of each category, the sales planning manager, production planning manager, new product development manager, and S&OP team. The meeting also evaluates the launches of new products for the next two months, especially the alignment of activities for each project between the company's areas. The Consensus Meeting and the Pre-Executive Meeting are grouped and named in the model of Esper et al. (2009) as the Pre S&OP Meeting.

Finally, the third meeting of S&OP process is called the **Executive Meeting** and uses the discussions of the two previous ones as a basis. S&OP team, directors of each area and the company's president participate in this meeting. This meeting summarizes the results of the previous month and the possible challenges regarding the supply and sales plans of each category, as the main problems faced for the specific items. In addition, the financial aspect is highlighted, also

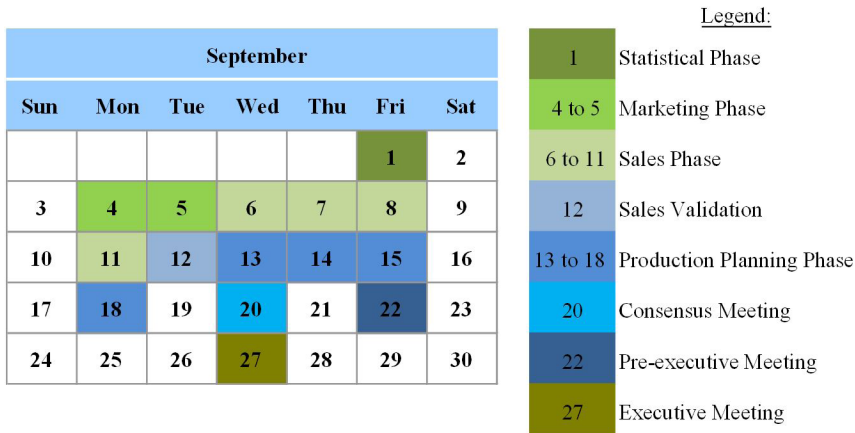


Figure 7. Example of the monthly S&OP calendar of the company studied. Source: Elaborated by the authors.

analyzing sales losses and cost increases for the main product categories of the company.

An S&OP software under implementation will facilitate the integration of sales and production planning, by speeding up data analysis and balancing decisions between areas, in order to optimize company results.

4.3 Evaluation of S&OP process maturity

After the description of S&OP process in the company studied, the process was evaluated using the three maturity models described in literature review, which were: Lapidé (2005), Grimson & Pyke (2007) and Viswanathan (2009).

4.3.1 Evaluation based on Lapidé model

Regarding the **people dimension**, the company is in the classical stage, since the calendar of meetings is annual, being revised monthly for adjustments of dates. S&OP meetings are previously scheduled in the company’s official calendar, a factor that prevents the absence of key people. In addition, the absences are punctual and, when they occur, another employee of the same function participates in the meeting, so that the function is always represented at the meeting.

In relation to the **process dimension**, the company has a sequence of rudimentary activities, according to the authors’ evaluation. Despite the integration between the supply and sales plans, sales dominance still prevails in the chain. In general, there are adjustments in the supply plan to meet variations in the sales plan, with little movement in the opposite direction. In addition, the purchasing supervisor represents the suppliers in the process, as the suppliers themselves are not present and directly involved in the process.

As for the **technology dimension**, the company is also in the rudimentary process, since the demand system is in operation and production planning

system is in implementation. The integrated sales and operations system is embryonic, with the company starting the transition to the next stage.

Given the classification of the three dimensions, the authors understood that according to the Lapidé model (2005), the S&OP process of the focus company is migrating from the second stage (Rudimentary Process) to the third stage (Classic Process).

4.3.2 Evaluation based on Grimson and Pyke model

Regarding **meetings and collaboration dimension**, the company is between the Standard and Advanced Stages, since the scope of the meetings was extended to the tactical level of the company (supervisors and, occasionally, engineers and technicians), although suppliers not attend the meetings. Data on both sales and operations are available for analysis and discussion by the entire group.

In the **organization dimension**, the company is moving from an advanced S&OP to a proactive S&OP. S&OP’s organizational structure is formal and well-defined, with a manager who responds directly to the Chief Executive Officer (CEO). The function is recognized as important by the production planning, purchasing, production and sales departments, although there are uncertainties about the scope of its responsibilities in other functions of the organization.

About **performance indicators**, the company is also evolving from a standard S&OP to an advanced S&OP because transaction and sales data are already fully integrated into the process, but the evaluation of new products is still at an early stage. The financial dimension is also not fully integrated in the process, with emphasis placed only on revenue and marginal contribution margin data.

Information technology can be classified at the same stage of the two antecedent dimensions.

As explained earlier, sales planning software is installed and integrated with the Enterprise resource planning (ERP), while the operations planning is under implementation and S&OP is under development.

Finally, about the **integration between sales and supply**, the medium-term plans are integrated with the sales plan being restricted by capacity analysis. For these reasons, the company is in the Advanced Stage. However, there is a lack of consistency between plans for making decisions that optimize the supply chain.

Evaluating the dimensions of the Grimson and Pyke model (2007), the company fits into a move from the Advanced S&OP Process to a Proactive S&OP Process, with meetings and collaboration dimension not in the same stage as the other ones. However, the authors understand that the formality in S&OP process of the company studied is due to the short time of existence, with the rules of the process under construction and/or consolidation. The high degree of formality of the process is essential for an S&OP in implementation. In addition, improvements in this dimension is not a prerequisite for progress on the other dimensions.

4.3.3 Evaluation based on Viswanathan model

This model is different from previous ones, because it works with quantitative indicators to classify the maturity of S&OP process. The authors had access to the values, indicators and meters of the focus company, although the company did not authorize the exact values to be presented on this paper. For this reason, only the range in which they are located will be presented and, as a result, their classification in the category pre-determined by the model.

Regarding the **service level**, the numerical indicator places the company in the Late Stage (average of 85%). However, some considerations and mitigating factors are possible, in characterizing the company's market with a large customer base, high order spraying, a high number of final products and a preponderance of MTS production. Understanding these reasons and the fact that the metrics values were established based on a group of 220 companies, in addition to a limited characterization in Viswanathan's (2009) research,

in the authors' perception the company is closer to the Medium Stage than to the Late Stage. Therefore, an adjustment is made in the classification of the company for the intermediate maturity level.

Regarding the **average cash flow turnover**, the company is in the Intermediate Stage, with a number close to 2.5 months. A detailed analysis of this indicator showed a significant variation in the different phases of the production process (lower in the raw materials bases and higher in the semi-manufactured and in the finished products). By the authors' understanding, the dominant factor for this phenomenon is the number of items in each phase of the process. The relationship is directly proportional. The higher the number of items, the greater the average cash flow turnover.

Finally, as to the **sales forecast accuracy**, by calculating the arithmetic average among product families, the company was placed in the Late Stage (below 73%). However, in this research, it was noted that there is a need to adapt, this classification since the families of products analyzed are unequally proportional, with families composed of more than 500 items, and families of only 2 items, as well as sales volumes in extremely different levels. For this reason, while smaller families have predictions with very low accuracy, less than 50%, larger families have an accuracy greater than 90%.

To mitigate the interference of these variations and make the result more consistent with the importance of each product family, the authors performed an ABC classification of product families based on their revenues, listing them in descending order. Class A was composed of the highest revenues categories, corresponding to 80% of the company's gross revenue (Chart 4).

After the classification, the accuracy of the sales forecast for each family of products was calculated individually. Then the calculations were adjusted using the weighted mean, giving weight 5 to the families of class A, 2 of class B and 1 for class C. The company was then in the Median Stage, with a sales forecast accuracy between 73% and 82%.

Therefore, using the classification performed and the considerations made, the degree of maturity of S&OP process of the company focus falls on the Medium Stage.

Chart 4. Method for calculating the service level in the focus company.

Class	Class Revenue	Accumulated Revenues	Weight
A	80%	80%	5
B	15%	95%	2
C	5%	100%	1

Source: Elaborated by the authors.

4.4 Comparison among the models and their results

Lapide (2005) and Grimson & Pyke (2007) models provided similar results in the classification of company's focus S&OP. Due to the inclusion of the organizational structure formality and comprehensiveness of the indicators in the Grimson & Pyke (2007) model, the result obtained was slightly higher in the degree of maturity of S&OP. Despite this difference, in the two central elements of S&OP (integration between sales and supplies, and formalization of S&OP process), classifications were similar.

The results obtained with Viswanathan model (2009), however, differ from the previous models in two aspects. First, because the values of the metrics defined are not representative for all environments, as discussed earlier. Second, because in this model the integration between sales and supplies, and the structure of S&OP process are not evaluated explicitly. In this way, the results have great dependence on the particularities of the studied organization, and the metrics defined may not be adequate for all situations. For example, a low inventory turnover may be part of a business strategy for leveling production, not implying that the company's S&OP is less advanced for that reason.

In the authors' view, the proposed intervals for the metrics classification in this model is very extensive, since there are significant differences between a company with a 15-day average cash turnover and one with 2.5-months. Therefore, the authors propose the creation of intermediate stages, for example, with the average values of 1 month and 4 months.

Finally, the need for a subjective adequacy of the studied company in the quantitative model, indicates an opportunity to revise the model to include other metrics and average values for each class, as well as the inclusion of a numerical factor to fit the results obtained with the reality of the company, its process, supply and market constraints.

4.5 Proposal to improve the S&OP process in the company studied

To classify the maturity of company's S&OP process is a recommended activity to identify gaps between the current state of the business and the most advanced stages in each category. In order for the process to evolve, some recommendations are made and the expected benefits of each proposal are mentioned.

The first recommendation is to involve key customers and suppliers in the pre-executive meeting. Packaging, for example, is a critical item as it is highly specific (usually one package for each final item). Delays in packaging delivery impact both service level and production cost, since additional

set ups are required. For this reason, it is essential to have a closer relationship with packaging suppliers, sharing information and aligning the importance of the main deliveries.

In addition to supplier engagement, there is a need for more frequent participation of engineers and technicians at S&OP meetings, as these are the ones who elaborate technical plans and have more control over technological constraints. Without the presence of these experts there is a risk that the analyzes and discussions in the meetings are incomplete.

Covering new products and financial indicators at meetings is also a relevant action to engage these two roles more intensively in S&OP process. For product development, the total development time to production and delivery (time to market) and the number of days of delay in the project schedule are two significant meters. For the financial area, it is suggested to detail the cost of production, purchase, logistics, administrative, among others; and to include indicators of marginal contribution, profitability and revenues by product category.

The advance of the production planning system is indispensable for the plans to be generated with greater speed. Moreover, this tool will allow the simulation of scenarios, a fact that today is not possible due to the time required to prepare the plans. Therefore, the planner can evaluate the impact of each decision on his plan, using some metrics previously defined for the comparison.

The progress in S&OP system will allow to evaluate the decisions in the production, finance, sales, marketing, new projects, among others areas, in a systemic way, understanding the interrelationship between these functions and the searching for optimization of the supply chain.

Finally, some suggestions to promote a better balance between the sales and the production plan are going to be presented, because in this dimension the company obtained the worst evaluations. To refine this process, an initial suggestion is to rethink the concept of general updates for each sales review. In some of the revisions (four critical moments of the year, for example) significant changes would be allowed, and in other periods only minor product mix adjustments. As a result, the main discussions would focus on these four annual events and each area could spend more time analyzing the impact of these major changes.

Another crucial point is to objectively measure the results of each production plan as to the result they provide in service level, cost, inventory levels and speed for delivery of orders and new products, since there are important trade-offs between these variables. With an objective and numerical analysis, the productive area will have greater argumentative power to refuse an increase in sales or an order

fulfillment outside the agreed term. However, it is essential to be fast on these analyzes.

5 Conclusion

A well-structured S&OP process in organizations is paramount to ensure the optimization of multiple supply chains in which they operate, creating a competitive advantage and reinforcing the existing advantages. A mature S&OP process is more robust than a S&OP process at an early development stage. However, soon after classification, it is mandatory to elaborate a plan of action in order to overcome the obstacles that prevent company from reaching higher stages in S&OP process.

From theoretical point of view, this research makes an important contribution to literature by citing and exemplifying the need for an adequacy of the classification of the metrics calculated in the model of Viswanathan (2009). For the accuracy of sales forecasting metrics, the authors propose the use of a weighted average among the accuracy of the family products forecasts, in which the weights are defined based on an ABC classification driven by each family revenue.

From the practical point of view, the company studied emphasized that the greatest difficulty in advancing S&OP process lies in integration of supply and demand, which is basic core of the process. Other activities, such as construction of a formal structure, definition of a fixed calendar of meetings and implementation of specific and integrated planning systems are easier to be execute and, consequently, they were classified as being part of more advanced stages in the evaluation models of the degree of maturity.

As a suggestion for future work, it is recommended to carry out studies to verify adherence, similarity and comparative analysis between the results of maturity of S&OP processes between qualitative and quantitative models. In addition, it is also interesting to investigate if factors such as factory environment, market, product, process technology, with a high degree of differentiation, within the company, and/or between companies, have a significant influence in the classification of the degree of maturity, and propose a weighted structuring of these factors to fit the quantitative model. Therefore, to review the metrics proposed by Viswanathan (2009), to relate them to the types of company and the productive process, to ponder the importance of these metrics in relation to the environment found and to propose other measures pertinent to the classification of the maturity of S&OP system.

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