UNIVERSITY OF SÃO PAULO
SÃO CARLOS SCHOOL OF ENGINEERING

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# O elo intermediário do planejamento: um estudo multicasos do processo de Sales and Operations Execution

# The intermediate link in planning: a multicase study of the Sales and Operations Execution process

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**Corrected Version**

Dissertation presented to the São Carlos School of Engineering of University of São Paulo, to obtain the degree of Master of Science in Production Engineering.

Concentration area: Processes and Operations Management

Advisor: Prof. Dr. Kleber Francisco Espôsto

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# DEDICATION

*To science and knowledge, for all the wonders it does for, but specially to, mankind.*

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# RESUMO

CARVALHO, A. L. **O elo intermediário do planejamento**: um estudo multicasos do processo de Sales and Operations Execution. 2018. 119 f. Dissertação (Mestrado em Engenharia de Produção) – Escola de Engenharia de São Carlos, Universidade de São Paulo, São Carlos, 2018.

Durante muitos anos, o processo de *Sales and Operations Plannning*, ou S&OP, foi visto como a promessa de alinhamento entre demanda e suprimentos que traria a solução para todos os problemas de planejamento nas empresas. Entretanto, o tempo mostrou que em ambientes de planejamento voláteis e com alto nível de incertezas, a hierarquia de planejamento tradicional, S&OP alinhado ao MPS, já não proporciona todos os benefícios esperados, falhando em atender as expectativas das inúmeras organizações que empregaram grandes esforços em sua implementação. Como resultado, nos últimos anos, surgiram adaptações dos processos de planejamento para atender a necessidade de alinhamento em ambientes altamente dinâmicos. Estas adaptações apareceram, muitas vezes, no formato de um "S&OP semanal", com horizonte de curto prazo, frequência semanal e baixo nível de agregação dos planos. Entretanto, uma solução mais sofisticada que o mercado encontrou para sanar a necessidade de planejamentos mais ágeis foi a criação de um novo processo que faz o elo entre o S&OP e o *Master Production Schedule* (MPS), chamado *Sales and Operations Execution*, o S&OE. Apesar de já ter surgido há algum tempo, estudos sobre o tema são bastante escassos. Assim, o objetivo desta pesquisa foi formalizar este processo na literatura acadêmica de maneira aprofundada. Para tal, foi realizada uma ampla revisão de literatura, estudos de caso em quatro empresas que buscaram explorar como o processo de S&OE ocorre na prática. A partir da análise resultante dos estudos de caso, tanto individual quanto inter-casos, foi proposto um modelo do processo em linguagem BPMN e uma listagem de todas as principais características do processo. Este modelo foi comparado à literatura existente para analisar sua convergência e pode ser considerado transferível dadas as mesmas condições de aplicação. Foi possível concluir que o S&OE é um processo que desagrega os planos do S&OP para a execução de uma maneira mais alinhada com os objetivos do negócio do que a aplicação isolada tradicional do MPS.

Palavras-chave: Sales and Operations Execution, S&OE, Weekly Sales and Operations Planning, Weekly S&OP.

# ABSTRACT

CARVALHO, A. L. **The intermediate link in planning:** a multicase study of the Sales and Operations Execution process. 2018. 119 f. Dissertation (Masters in Production Engineering) – São Carlos School of Engineering, University of São Paulo, São Carlos, 2018.

For many years, Sales and Operations Plannning process, or S&OP, had been considered as the promise of alignment between demand and supply that would provide the solution to all planning problems to companies. However, time has shown that in volatile planning environments with high levels of uncertainty, the traditional planning hierarchi, S&OP aligned with MPS, no longer provides all the expected benefits, failing to meet the expectations of numerous organizations that have put great efforts to implement it. As result, in recent years, there have been adaptations of planning processes to meet the need for alignment in highly dynamic environments. These adaptations have often appeared in the form of a weekly "S&OP", with short-term horizon, weekly frequency and low level of plans aggregation. However, a more sophisticated solution found to address the need for more agile planning was the creation of a new process that aims to link S&OP to the Master Production Schedule (MPS) called Sales and Operations Execution (S&OE). Although the subject has arisen for some time, studies on the subject are scarce. Thus, the goal of this research is to formalize this process in academic literature in an in-depth way. For this, it was carried out a broad literature review, case studies in four companies that sought to explore how S&OE process occurs in practice. From the analysis resulting from the case studies, both individual and cross-case, it was proposed a model of the process using BPMN language and a list of all the main process characteristics. This model was compared to the existing literature to analyze its convergence and it can be considered transferable given the same conditions of application. It was possible to conclude that S&OE is a process that performs the breakdown of the S&OP plans to the execution in a way that is more aligned with the business goals than the traditional MPS application isolated

Keywords: Sales and Operations Execution, S&OE, Weekly Sales and Operations Planning, Weekly S&OP.

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# LIST OF ABBREVIATIONS

| | | |
|---|---|---|
| APICS | – | American Production and Inventory Control Society |
| APS | – | Advanced Planning and Scheduling |
| ATP | – | Available-to-promise |
| BPMN | – | Business Process Model and Notation |
| DP | – | Demand Planning |
| HP | – | Hierarchical Planning |
| KPI | – | Key Performance Indicator |
| MPC | – | Manufacturing Planning and Control |
| MPS | – | Master Production Schedule |
| MRP | – | Material Requirements Planning |
| MRP II | – | Manufacturing Resource Planning |
| OMG | – | Object Management Group |
| PE | – | Planning Environment |
| PP | – | Production Planning |
| PPC | – | Production Planning and Control |
| S&OE | – | Sales and Operations Execution |
| S&OP | – | Sales and Operations Planning |
| SKU | – | Stock Keeping Unit |
| OTIF | – | On Time In Full |

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# 1 INTRODUCTION

The process of Sales and Operations Planning, commonly known as S&OP, has its early origins in the 1950s with the aggregate production planning, with the work of Holt, Modigliani, Muth and Simon, also including Bonini and Winters (SINGHAL; SINGHAL, 2007). It then evolved to the Manufacturing Resource Planning, or MRP II, in the mid-1980s (THOMÉ et al., 2012). But it was only with Richard Ling and Walter Goddard (1988) that the term S&OP finally came to life in the first book that documented the process: "Orchestrating Success" (SHELDON, 2006). S&OP evolved and became popular through the 90's, until it reached its current form: a process that supports more integrated decisions (COLDRICK; LING; TURNER, 2003).

According to the systematic review about S&OP performed by Thomé et al. (2012), one of the first academic works that significantly mentions S&OP is Gianesi's, (1998), with reference to Production Planning (PP) and defining the process as the element that connects manufacturing to top management and other functional areas of the company. S&OP is the tool that unites different functional plans into an integrated set of plans, aiming to balance demand and supply and align the plans both vertically, from strategic to operational, and horizontally, between functional areas (THOMÉ et al., 2012; TUOMIKANGAS; KAIPIA, 2014).

Among S&OP main roles is to facilitate the Master Production Schedule (MPS), Demand Planning (DP) and the communication between them (OLIVA; WATSON, 2011). To achieve that, the two main components of S&OP are the sales plan, based on demand forecast, and the production plan, that define requirements of capacity, inventory levels and order backlogs (WAGNER; ULLRICH; TRANSCHEL, 2014).

Several authors have already presented mathematical models and empirical research that evidence the positive impacts of S&OP in companies' performance (WAGNER; ULLRICH; TRANSCHEL, 2014). Some of the most common benefits mentioned in literature are shown in Table 1.

However, those benefits are not always perceived by the companies for, despite S&OP being conceptually easy to understand, its implementation as an aligning process is very difficult (WAGNER; ULLRICH; TRANSCHEL, 2014). This phenomenon may happen due to several factors that are still little explored in academic literature. Wagner, Ullrich e Transchel (2014) present a maturity model to help companies in S&OP's implementation. According to the authors, the real benefits of the process are captured only in the superior

maturity levels. Similarly, Coldrick, Ling e Turner (2003) elaborated an evolution model of S&OP composed by three phases, showing the path until the achievement of total integration in the decision making process.

| **Benefits** | **Authors** |
|---|---|
| Improved customer service | (COLDRICK; LING; TURNER, 2003; WAGNER; ULLRICH; TRANSCHEL, 2014; WALLACE, 2001) |
| Reduced inventories | (COLDRICK; LING; TURNER, 2003; WAGNER; ULLRICH; TRANSCHEL, 2014; WALLACE, 2001) |
| Sustained profitability | (COLDRICK; LING; TURNER, 2003) |
| Increased forecast accuracy | (WAGNER; ULLRICH; TRANSCHEL, 2014; WALLACE, 2001) |
| Increased supply chain visibility | (WAGNER; ULLRICH; TRANSCHEL, 2014; WALLACE, 2001) |
| Improved product availability | (WAGNER; ULLRICH; TRANSCHEL, 2014) |
| Reduced number of expedited shipments and rush orders | (WAGNER; ULLRICH; TRANSCHEL, 2014) |
| Reduced number of obsolete products | (WAGNER; ULLRICH; TRANSCHEL, 2014) |
| Increased capacity utilization | (WAGNER; ULLRICH; TRANSCHEL, 2014) |
| Greater level of coordination between areas | (GIANESI, 1998; WALLACE, 2001) |
| Increased productivity | (WALLACE, 2001) |

*Table 1 - Main benefits of S&OP according to several authors*
Source: prepared by the author

One of the most important papers on the subject is from Ivert et al. (2015), that uses the Contingency Theory to approach the difficulties that the Planning Environment (PE), imposes to the S&OP process. Those difficulties demand a more agile planning, with higher frequency cycles, shorter horizons and lower level of plan aggregation, creating the need of a weekly S&OP. Similarly, Lim, Alpan e Penz (2014) propose a model of intermediary planning, hybrid between the S&OP and MPS, that aims to coordinate sales and supply for production planning in high complexity environments, with long procurement lead times, demand uncertainty, progressive order placement, order postponement possibility, flexibility rate for a maximum demand volume, impatient customers and emergency supply utilization in case of raw materials stock out.

This agile planning is a trend that has recently increased, emerging as a new process that aligns the tactical planning of S&OP to the operations in growing dynamic environments. Several industries have already applied it in their routines and countless consulting groups

have published white papers about it. Most of the time, it is called Sales and Operations Execution, or S&OE (ADEXA, 2016; BODENSTAB, 2016; BOWMAN, 2011; CRUZ, 2016; DOMINGOS, 2015; HADAVI, 2016; HUBER, 2016; JULIANELLI, 2016; MASTERS, 2016; PUKKILA, 2016; ROLLINGS, 2015; TOOLSGROUP, 2016).

Several information regarding S&OE can be found in the grey literature, such as white papers from consulting groups, posts in blogs and even a few articles from Gartner. This shows that S&OE emerged to answer a need identified in daily operations and is gaining visibility and becoming more popular with business managers each passing day. However, the literature review performed in this study shows that there are very few academic works that deal with the subject (none using the term S&OE), despite some companies having already implemented it many years ago.

Formed by the rapid evolution of business processes, this research gap is evident and it needs to be fulfilled promptly in order to align the academic literature to the corporations' dynamic reality. That being said, a research question emerges to guide this work towards filling the identified gap: what is the Sales and Operations Execution process and what are its main characteristics?

## 1.1 Research Objectives

The main objective of this research is to formalize the process of Sales and Operations Execution (S&OE). To do so, this main objective can be unfolded in the following specific objectives:

- To identify the main characteristics of the S&OE process, such as objectives, most used indicators, necessary tools, key stakeholders, among others, through case studies with four Brazilian companies of different sectors, and present them in a general manner;
- To highlight some of its key aspects, such as its differences from S&OP, main perceived gains, greater challenges, among others;
- And finally, as an appendix, to present a transferable model of the process, using BPMN notation, to provide the scientific community an easy understanding of a common configuration of the process routines.

# 2 METHODOLOGY

Since the objective of this research is scientific formalization of the process through understanding how it works, the adequate approach is the qualitative. To Eisenhardt (1989), a case study is a strategy that focuses on understanding the dynamics present within single settings. A case study answers research questions in the form of “How?” and “Why?”, requires no control of the behavioral events and focuses on contemporary events (YIN, 2005). Thus, since this research has an exploratory character and takes a first step towards theory building, a case study strategy is appropriate and it will be performed following the eight steps for theory building using case studies proposed by Eisenhardt (1989) (Figure 1) and the guidelines that Yin (2005) suggests as the best practices in case study research.

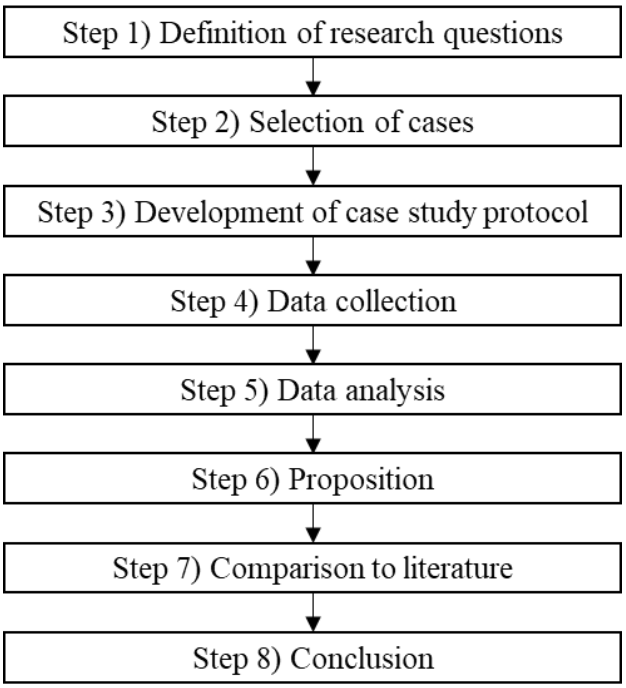



*Figure 1 - Eight steps to build a theory from case study research*
Source: Adapted from (EISENHARDT, 1989, p. 533)

The main proposition of this work is to formalize a transferable model of the S&OE process, given the same conditions of application. Multiple case studies should be adopted when they seek to achieve a replication logic, that is, each study is performed in a similar way and is used to confront or confirm previous studies, resulting in a general model that can be generalized (YIN, 2005). In that sense, it is suitable that this work performs multiple case studies, or a multicase study, instead of using only one case. Also, in multicase studies, the

gathered information is richer, the discoveries can be generalized in a broader way and it shows greater ability of the researcher to do an empirical research (YIN, 2005). Each step proposed in the method is detailed in a following dedicated sub-section.

## 2.1 Definition of research questions

Having a research focus as defined as possible since the beginning helps the data collection step: it guides you through it and prevents you of being overwhelmed by the volume of data collected (EISENHARDT, 1989; VOSS; TSIKRIKTSIS; FROHLICH, 2002). That being said, the development of this work began with an extensive literature review on the subject in order to develop the research questions. That review revealed the lack of papers in this field. The databases accessed were Web of Science, Science Direct, Emerald Insight, Scopus, EBSCO and SciELO. The results and keywords used can be seen in Appendix A.

Thus, a complimentary search in the gray literature was necessary, with the goal of expanding the available material for the development of this study. Results shows that in several occasions S&OP is simply not enough to achieve a smooth business planning, due to failures in the breakdown of the long-term plans into daily operations, thus justifying the need of implementation of the process that is object of this study.

Therefore, the first research question that this work wants to answer is: what is the Sales and Operations Execution process and what are its main characteristics? This question emerged from the identified gap as presented in the “Introduction” chapter. Up to date, there is still no formalized academic definition of this process and no documentations of its attributes or how does it take place in the companies.

From this basic research question, another two research questions can be derived and will guide the case studies and process perspective. Those research question are: 1) why is the S&OE important to the companies that implement it? In the grey literature review, several papers mention the importance of this process to take the companies’ planning processes to another level. It is important to capture the company’s point of view on the importance of S&OE. 2) how does the implementation of the S&OE happen and why did the company want to implement it? To truly understand the process nature, it is important to understand what are the challenges involved in its adoption and what leads a company to choose to implement a new process and face all the adversities of changing its planning hierarchy structure.

## 2.2 Selection of cases

### 2.2.1 Pilot case study

Provided with the theoretical foundation, it was possible to initiate the case studies. The first case study was a pilot directed to the identification of the main characteristics of the S&OE process and its general behavior and context, through an unstructured interview. The choice of a pilot case may come from several reasons that not necessarily are related to the criteria that will be applied to the selection of the final cases of the research, such as a personal contact that facilitates the access, geographic proximity, among others (YIN, 2005). The pilot case study in this research was chosen based on a previous contact between the researcher and the interviewee, that enabled an unstructured interview for a broader understanding of the topic, obtainment of important additional documentation, recommendations of other possible case studies, as well as connections with other interviewees of this study. This pilot case was crucial to the preparation of the case study protocol with the semi-structured interview guide (Appendix B), that was used later with the other cases, as well as the first draft of the process model, that was later refined. All these criteria are in accordance with Yin (2005), that states that the data collection of the pilot case can be much broader and dispersed than of the other cases, being able to include subjective and methodological questions.

After the pilot case study, an international exchange was carried out with the Université de Sherbrooke, in Sherbrooke, QC, Canada. This international exchange had the purpose of improving some aspects of the research, such as usage of BPMN, methodology refinement, case study protocol and interview guide adjustments, as well as go through an ethics committee to increase the reliability of the case studies (research ethics committee – letters and human sciences from the Université de Sherbrooke). Appendix B describes the case study protocol, interview guide and ethics committee.

### 2.2.2 Other cases

Having defined the final version of the interview guide and provided with the approval of the ethics committee, it was possible to carry out the other case studies, aiming to collect data to confront or validate the initial model proposed after the data analysis of the pilot case.

According to Yin (2005), when there is only up to 30 possible cases to be selected for the study, the selection may consist in questioning people with knowledge about each option and even gathering limited documentation about them, and then analyzing this information based on a set of criteria by which it will be possible to judge the options and tell if they are qualified or not to be part of the study.

To Eisenhardt (1989), when choosing the cases, the goal is to choose the ones that are likely to replicate or extend the emergent theory. Therefore, aiming to replicate the theory, the companies invited to participate were selected based on the probability of their having implemented the S&OE process, meaning that they possibly have high demand uncertainty, many SKUs, quick marketing campaigns and product life cycle and an agile supply chain strategy. Ten companies were invited to participate in the case study and five of them replied accepting to participate. The three companies that were selected to participate in the study followed the principle of extending the theory, so they were all from different types of industries: ceramic, footwear and cosmetics. They were studied in that order and since the information gathered in all the cases (including the pilot) was very similar and converged to the same conclusions, the researchers concluded that theoretical saturation was reached (EISENHARDT, 1989), where saturation is when no additional data is being found and the researcher sees similar instances being repeated (GLASER; STRAUSS, 1967). This number of cases was then considered satisfying to achieve reliable results.

The interviewees were selected by the companies, based on their position and link with the planning processes, specially the S&OE process. As required in the e-mail invite attached in Appendix B, “INVITATION TO PARTICIPATE IN RESEARCH STUDY”, they had knowledge about the planning processes in the company. In most cases, only one person was selected to participate in the interview, but in the footwear company, the management understood that both the Corporate Integrated Planning Manager and the S&OP and S&OE Manager were adequate and complementary for the success of the interview.

## 2.3 Case study protocol

According to Yin (2005), the case study protocol is one of the main tactics to increase the reliability of the case study research and it should contain the following sections:

- A general overview of the case study project, including objectives, sponsors, research questions and important literature on the subject;

- Field procedures, such as access to the locations of the study, general sources of information and specific procedures;
- Questions of the case study, that the researcher must keep in mind when collecting data and potential sources for each one of them (for this work it was developed an interview guide);
- Guide to the case study report, with sketch and format for the data, usage of other documents and bibliographic information.

The case study protocol as well as the interview guide can be found in Appendix B.

## 2.4 Data collection method

The data collection step is one of the most important ones. To guarantee that it will be well executed and the data gathered will be relevant it is necessary that appropriate data collection methods are used. For the data collection method, Yin (2005) lists six main types: documentation, archival records, interviews, direct observations, participant-observation and physical artifacts. This dissertation focused on interviews as the major source of data and documentation that the companies were encouraged to share, but were not mandatory, and the companies could choose which documents they would share, so that confidential and sensitive information could be protected. They were used to triangulate the information, in order to obtain greater accuracy in the proposed results (EISENHARDT, 1989; FLYNN et al., 1990; JICK, 1979; VOSS; TSIKRIKTSIS; FROHLICH, 2002; YIN, 2005). The greater advantage when using more than one source of evidences (data triangulation), is the development of convergent lines of investigation, collecting information of several sources but aiming to corroborate the same fact or phenomenon (JICK, 1979; YIN, 2005).

During the first step of data collection, which was the pilot case study, it was used a non-structured interview, since the objective was a general understanding about the main aspects of the subject, in order to propose an initial version of the process and to make a case study protocol with a semi-structured interview guide. The interviewee played a roll of “informant”, suggesting other people that should be interviewed and other sources of evidence (YIN, 2005). Detailed documentation about the topic was also provided by this interviewee, that was later used to validate information obtained during the interview.

Subsequent case studies were performed using the semi-structured interview guide that can be found in the Appendix B. Some of the interviewees provided additional documentation, such as reports, tables and spreadsheets, presentations and others. The most

important utilization for those documents is to confirm and enrich the evidences that were assimilated in the interviews (YIN, 2005).

## 2.4 Data analysis

According to Yin (2005), data analysis can be conceptualized as the execution of the following activities: examination, categorization, classification in tables, testing, or recombination of quantitative and qualitative evidences for the purpose of treating the propositions of a study. The first step that can be taken to explore the results is to perform preliminary manipulations of the data gathered in the field (YIN, 2005). For those manipulations, Voss, Tsikriktsis and Frohlich (2002) suggest data documentation and coding.

- Data documentation: detailed write up of each study, that can include typing up of researcher notes, ideas and insights, interview transcriptions, gathering of documents collected in the field, among others, to produce a case narrative (VOSS; TSIKRIKTSIS; FROHLICH, 2002);
- Coding: incidents of phenomena in the observations and data collected in the field are coded into categories (VOSS; TSIKRIKTSIS; FROHLICH, 2002).

After the preliminary data manipulation it is possible to properly analyze the data collected in the field. Eisenhardt (1989) suggests two steps: analysis of within-case data and search for cross-case patterns.

Within-case analysis involves examination of the data documentation performed previously, with the objective of becoming familiar with each case study as a stand-alone entity, allowing the researcher to observe the unique patterns that emerge before jumping to conclusions and facilitating the cross-case comparison that will be performed later on (EISENHARDT, 1989). A common way to start this analysis is to build a display of the data, being display a range of visual formats to present information systemically so that valid conclusions can be made (VOSS; TSIKRIKTSIS; FROHLICH, 2002).

To perform a good cross-case comparison, data should be looked in many divergent ways and one tactic to do that is to construct and array, typically in the form of spreadsheets or charts, and then select categories or dimensions and use that to look for similarities and differences between each case (EISENHARDT, 1989; VOSS; TSIKRIKTSIS; FROHLICH, 2002).

Following the guidelines proposed by the authors, the results were analyzed through the interpretation of the information generated by the data documentation and coding of the

case studies. They were individually analyzed first, identifying the patterns between the categories used in the coding. After evidencing the particularities of the specific cases, the cross-case analysis took place to expose points of convergence and divergence between them, also evaluating the categories used in the coding step.

## 2.5 Proposition

Overall, the proposition step in theory building research involves measuring constructs and verifying relationships. It is an iterative step, where the frameworks or hypotheses that emerged from the data analysis is compared to the case evidences to assess if the theory fits the data (EISENHARDT, 1989; VOSS; TSIKRIKTSIS; FROHLICH, 2002).

To do this assessment, two steps must be taken: constant comparison between data and proposition so that the evidences converge on a single conception, and verifying if the emergent relationships fit the case data, for when a relationship is confirmed it enhances confidence in the hypothesis, but if it is disconfirmed it provides the opportunity to refine and expand theory (EISENHARDT, 1989; VOSS; TSIKRIKTSIS; FROHLICH, 2002).

This work constantly compared the proposed models and results with the data collected from the cases, to guarantee the validity of the propositions and to confirm the relationships between them. The result, that proposes a process model and highlights key characteristics from the process, can be seen in the section “Results”.

## 2.6 Comparison to literature

The comparison of the emergent theory with the literature involves asking what is it similar to, what does it contradict and why, in order to increase both the quality and the validity of the findings (EISENHARDT, 1989; VOSS; TSIKRIKTSIS; FROHLICH, 2002). Ignoring conflicting theory reduces the confidence in the findings and deprives you from the opportunity of being forced into a more creative way of thinking, at the same time that similar theories help tie together implicit similarities (EISENHARDT, 1989; VOSS; TSIKRIKTSIS; FROHLICH, 2002).

As already presented in the “Introduction” chapter, the enfolding literature on S&OE is very scarce and consists mostly of grey literature. Thus, the comparison made focuses on a large part on this type of material and discusses a few aspects that were found in articles from academic journals. This discussion is also found in the “Results” chapter.

## 2.7 Conclusion

The iteration between theory and data stops when the incremental improvement to the theory is minimal. The final product may take the form of concepts, frameworks, propositions or even mid-range theory and can be both groundbreaking or disappointing, just replicating prior theory or not finding any pattern in the data (EISENHARDT, 1989).

As a conclusion, this work proposed a transferable model of the S&OE process, using BPMN notation; highlighted its key characteristics, such as its differences from S&OP, main perceived gains, greater challenges, objectives, most used indicators, necessary tools, key stakeholders, among others; and answered the main research question “what is the Sales and Operations Execution process and what are its main characteristics?”, as well as the two secondary research questions “why is the S&OE important to the companies that implement it?” and “how does the implementation of the S&OE happen and why did the company want to implement it?”.

# 3 LITERATURE REVIEW

## 3.1 Business process and BPMN

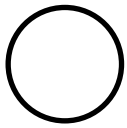
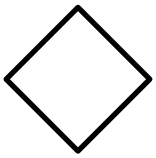
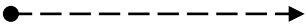
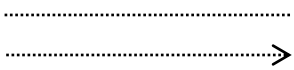
According to Baldam, Valle and Rozenfeld (2014), a business process is a set of activities that are related or interactive that turn inputs into outputs, frequently possessing a repetitiveness characteristic. It can be broken down into sub-processes and finally into tasks, which are the smallest unit of a process, usually performed by a single resource in a single work station. The purpose of any process is to transform any input into one or more outputs, with greater economic or social value. Baldam, Valle and Rozenfeld (2014) also define a process model as an abstract representation of the reality, in a certain context, with a higher or lower level of formality. The process models are the products of the process modeling activity.

With the necessity of a clear business process modeling language, one that could be understood both by experts and end users but still being expressive and formal enough, the Business Process Model and Notation (BPMN) was created (CHINOSI; TROMBETTA, 2012). BPMN was originally published in 2004 by the Business Process Modeling Initiative as a graphical notation, but the growing adoption from companies and interest upon the notation turned BPMN into an Object Management Group (OMG) standard in 2006 (CHINOSI; TROMBETTA, 2012).

The primary goal of BPMN is to provide a notation that can be easily understood by all business users, including business analysts, technical developers and business staff (CHINOSI; TROMBETTA, 2012). As stablished by OMG (2011) it provides five basic categories that can be used to model the process, each one of them containing several elements:

- Flow objects: events, activities and gateways;
- Data: data objects, data inputs, data outputs and data stores;
- Connecting objects: sequence flows, message flows, associations and data associations;
- Swimlanes: pools and lanes;
- Artifacts: group and text annotation.

A brief description of each element provided by OMG (2011) can be seen in Table 2:

| Element | Description | Notation |
|---|---|---|
| Event | Something that "happens" during the course of a Process. They affect the flow of the model and usually have a cause or an impact. There are three types: Start, Intermediate and End. |  |
| Activity | An Activity is a generic term for work that a company performs in a Process. The types of Activities that are a part of a Process Model are: Sub-Process and Task. |  |
| Gateway | A Gateway is used to control the divergence and convergence of Sequence Flows in a Process. Thus, it will determine branching, forking, merging, and joining of paths. |  |
| Sequence Flow | A Sequence Flow is used to show the order that Activities will be performed in a Process. |  |
| Message Flow | A Message Flow is used to show the flow of Messages between two Participants that are prepared to send and receive them. |  |
| Association | An Association is used to link information and Artifacts with BPMN graphical elements. |  |
| Pool | A Pool is the graphical representation of a Participant in a Collaboration. It also acts as a "swimlane" and a graphical container for partitioning a set of Activities from other Pools. |   |
| Lane | A Lane is a sub-partition within a Process, sometimes within a Pool, and will extend the entire length of the Process, either vertically or horizontally. Lanes are used to organize and categorize Activities. |   |

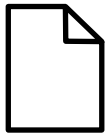
| | | |
|---|---|---|
| Data Object | Data Objects provide information about what Activities require to be performed and/or what they produce, and can represent a singular object or a collection of objects. |  |
| Message | A Message is used to depict the contents of a communication between two Participants. |  |
| Group (a box around a group of objects within the same category) | A Group is a grouping of graphical elements that are within the same Category. This type of grouping does not affect the Sequence Flows within the Group. Categories can be used for documentation or analysis purposes. |  |
| Text Annotation (attached with an Association) | Text Annotations are a mechanism for a modeler to provide additional text information for the reader of a BPMN Diagram. |   |

*Table 2 - Basic Modeling Elements*
Source: Adapted from (OBJECT MANAGEMENT GROUP (OMG), 2011, p. 29)

It is not the objective of this topic to approach the notation in a deeper way, since it is assumed that the readers of this dissertation have knowledge regarding business processes and BPMN. OMG's standard should be consulted if further explanation of BPMN is required.

## 3.2 Planning Hierarchy and Scheduling

With the work of Anthony (1965), the idea of three levels of hierarchical control were proposed: strategic planning, tactical planning and operations control (BITRAN; TIRUPATI, 1993; DE KOK; FRANSOO, 2003; FLEISCHMANN; MEYR, 2003). Strategic planning deals with managerial policies and development of resources in a manner aligned with the organizational goals, such as location of new plants, new product lines, logistics networks, and so forth. The scope should be broad, with a long planning horizon and the decisions made by top management (BITRAN; TIRUPATI, 1993). Tactical planning focus on resource utilization processes, such as capacity, storage and distribution. It has a medium range

horizon, with items aggregated into product families and is called in the literature as aggregate planning models (BITRAN; TIRUPATI, 1993). Operations control approaches day to day operational and scheduling problems with complete disaggregation of the information, for example production sequencing and lot sizing, expedition, vehicle scheduling, and others. The planning horizon is short, with low management involved (BITRAN; TIRUPATI, 1993). The hierarchical triangle that derives is shown below, in Figure 2:

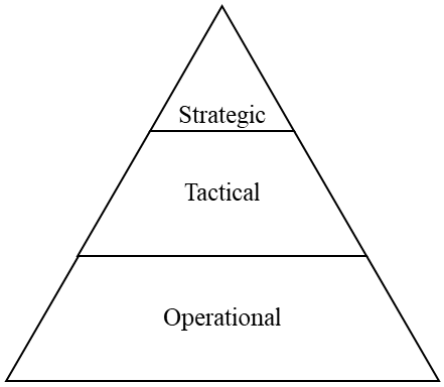



*Figure 2 - Anthony's hierarchical control*
Source: Adapted from (ANTHONY, 1965)

To handle production scheduling decisions in the production planning hierarchy, manufacturing companies commonly apply the Master Production Schedule, or MPS (AKHOONDI; LOTFI, 2016). The aggregate production planning is used for the assessment of capacity with items aggregated in family groups, but it needs to be broken in the scheduling of individual products and services at the critical working centers, and MPS is responsible for this task (AKHOONDI; LOTFI, 2016).

According to Slack, Chambers and Johnston (2002), MPS contains a declaration of the quantity and the moment in which the final products should be produced, driving all the operations in terms of what should be assembled, manufactured and bought, and is the main input for the MRP. To do so, MPS contains records with time scales for each final product, with inputted data of demand and current stock. Using this information, MPS can project the amount of stock needed to fulfill the demand and analyze if the current stock is enough. When it is not the case, new order quantities are inserted in MPS (SLACK; CHAMBERS; JOHNSTON, 2002). It is important that all demand sources are taken into consideration when using MPS, since little last minute orders are usually the ones that create the most disturbance in the planning scheduling (SLACK; CHAMBERS; JOHNSTON, 2002).

Vollmann, Berry and Whybark propose a simplified framework (Figure 3) of a modern Manufacturing Planning and Control (MPC) system, that shows the connections between the required activities, including the relationship between the MPS and MRP, specified by the authors as a "Detailed Material Planning".

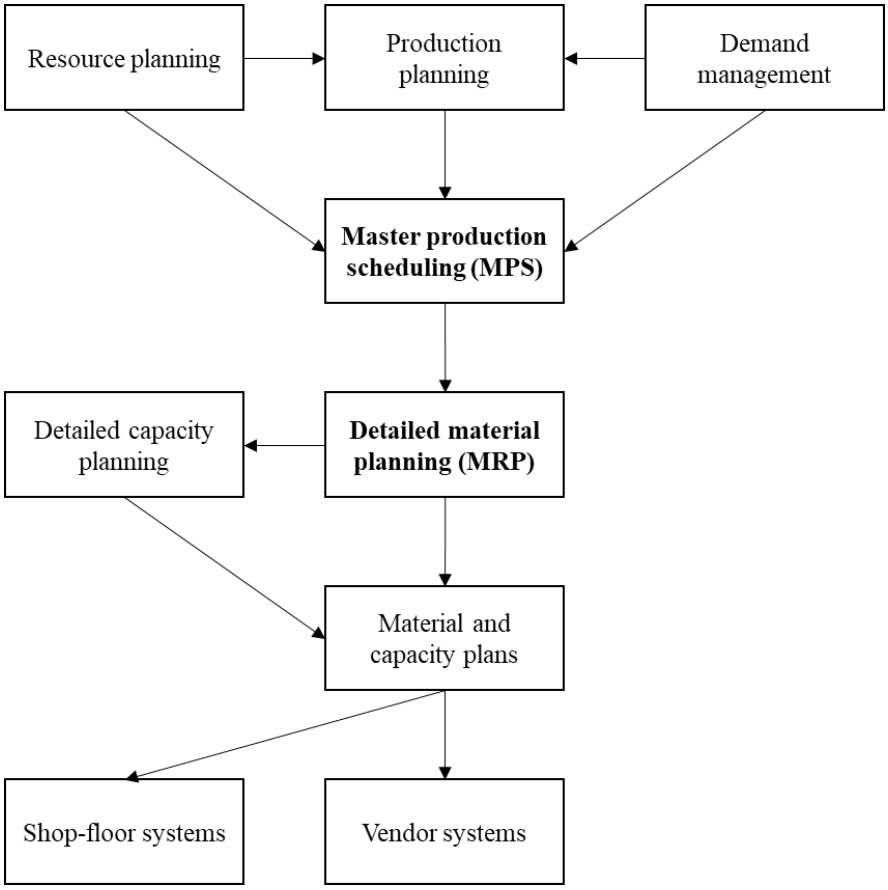



*Figure 3 - Framework of a modern MPC system*
Source: Adapted from (VOLLMANN; BERRY; WHYBARK, 1997, p.5)

Despite being a powerful resource for planning and scheduling, MPS lacks a process approach, as it is seen by most authors mainly as a scheduling tool. It became popular as a functionality inside the MRP II, with manufacturing firms specially attracted by the available-to-promise (ATP) logic in the master-schedule (OLHAGER, 2013). A strong evidence of this is the APICS definition for Master Schedule:

> [...] A format that includes time periods (dates), the forecast, customer orders, projected available balance, available-to-promise, and the master production schedule. It takes into account the forecast; the production plan, and other important considerations such as backlog, availability of material, availability of capacity, and management policies and goals. (APICS, 2016)

In general, operations planning and control could be viewed as a four-level structure consisting S&OP, MPS, materials planning (e.g. MRP) and shop floor control, where S&OP links planning and control approaches to the strategic perspective (OLHAGER, 2013; VAN NIEUWENHUYSE et al., 2011). For Olhager (2013), S&OP concerns volume planning and MPS concerns product mix planning.

## 3.3 The process of Sales and Operations Planning

S&OP is a monthly planning process that reviews and evaluates several business plans, to create an unique set of plans that maximizes the company's profit, ensuring the participation of all the main stakeholders (WAGNER; ULLRICH; TRANSCHEL, 2014). To do that, S&OP uses two perspectives: organizational perspective, that involves the coordination between departments inside the company and between the supply chain participants, and planning perspective, that coordinates material, financial and information flows (TUOMIKANGAS; KAIPIA, 2014).

To APICS (American Production and Inventory Control Society), S&OP is

> [...] a process to develop tactical plans that provide management the ability to strategically direct its businesses to achieve competitive advantage on a continuous basis by integrating customer-focused marketing plans for new and existing products with the management of the supply chain. The process brings together all the plans for the business (sales, marketing, development, manufacturing, sourcing, and financial) into one integrated set of plans. (APICS, 2016)

One of the main authors in the characterization of S&OP is Wallace (2001) in his handbook of how to implement it. He proposes a model of planning of resources that introduces S&OP in the planning hierarchy between business planning and MPS, reflecting its character of integration between sales and operations (Figure 5). In the operations planning hierarchy, S&OP possess a tactical role, bridging strategic plans with operations (WALLACE, 2001). This positioning is shown in Figure 4, aligned with the proposition of Anthony (1965).

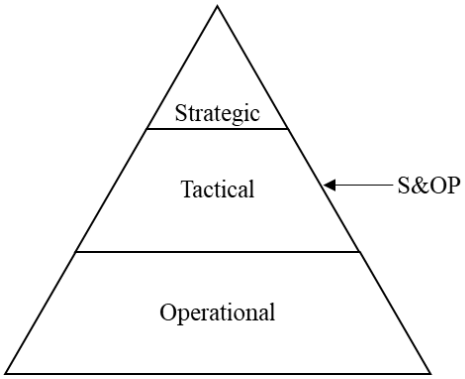



*Figure 4 - S&OP role in Operations Planning hierachy, according to Anthony's triangle*
Source: Made by the author

In general, the information that are used for the process are sales forecast, with monthly bucket and level of aggregation of products families, and production capacity. The planning horizon may vary from 12 to 18 months (WALLACE, 2001). There is not much consensus between authors concerning the horizon of S&OP, with possibilities such as 12 months (GIANESI, 1998), 3 to 18 months (THOMÉ et al., 2012), 12 to 18 months (WALLACE, 2001), 18 months (COLDRICK; LING; TURNER, 2003; GRIMSON; PYKE, 2007) or even 6 to 36 months (LIM; ALPAN; PENZ, 2014). However, both monthly bucket (APICS, 2016; COLDRICK; LING; TURNER, 2003; GRIMSON; PYKE, 2007; THOMÉ et al., 2012; WAGNER; ULLRICH; TRANSCHEL, 2014; WALLACE, 2001), and aggregation level in product families (APICS, 2016; COLDRICK; LING; TURNER, 2003; GRIMSON; PYKE, 2007; LIM; ALPAN; PENZ, 2014; WALLACE, 2001), are consensus. This information feed a monthly process that has a standard execution composed by five generic steps, or macro-activities, as shown in Figure 6. Although, in more recent papers, it is possible to find reference of S&OP processes that are operated differently, with shorter planning horizons, demand forecast aggregation in SKU (Stock Keeping Unit) level and even weekly cycles. In "2012 Sales and Operations Planning Insights and Innovations Executive Summary", a study done by APICS and IBF (2015) with approximately 15 thousand professionals of operations and supply chain from all over the world, S&OP is performed weekly in 7% of the cases and in 19% of the cases the planning horizon is shorter than or equal to 6 months. That evidences that, in some specific cases, there is a need of a process that is more agile than the S&OP.

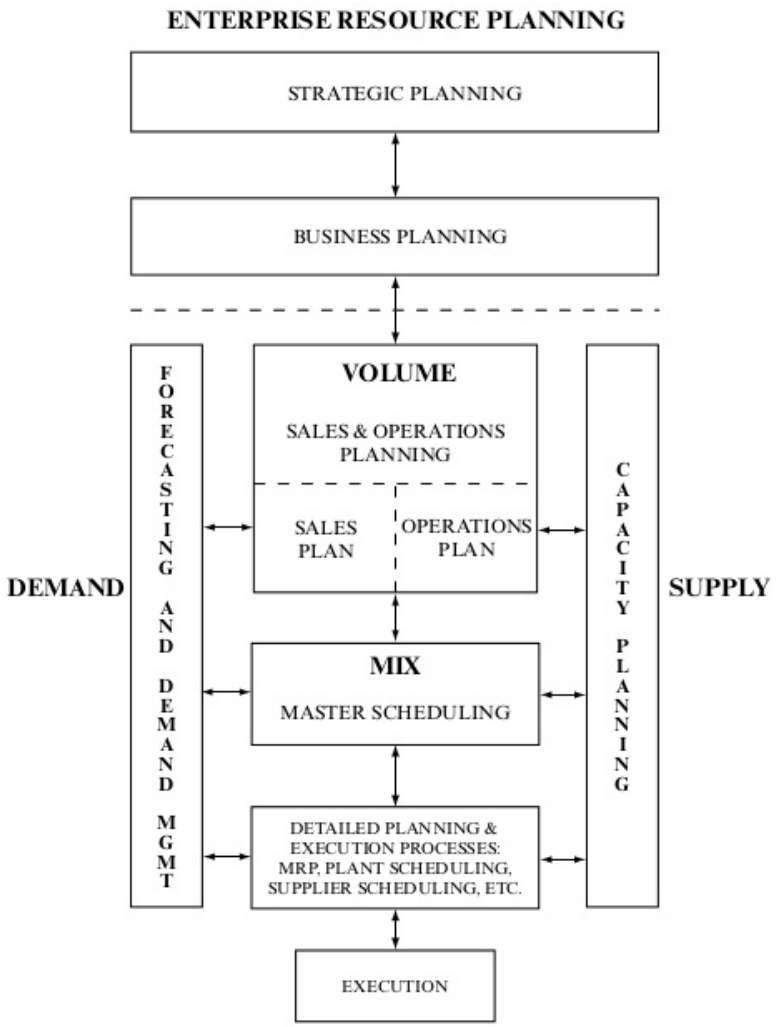



*Figure 5 - Planning of resources model with the inclusion of S&OP*
Source: (WALLACE, 2001, p.23)

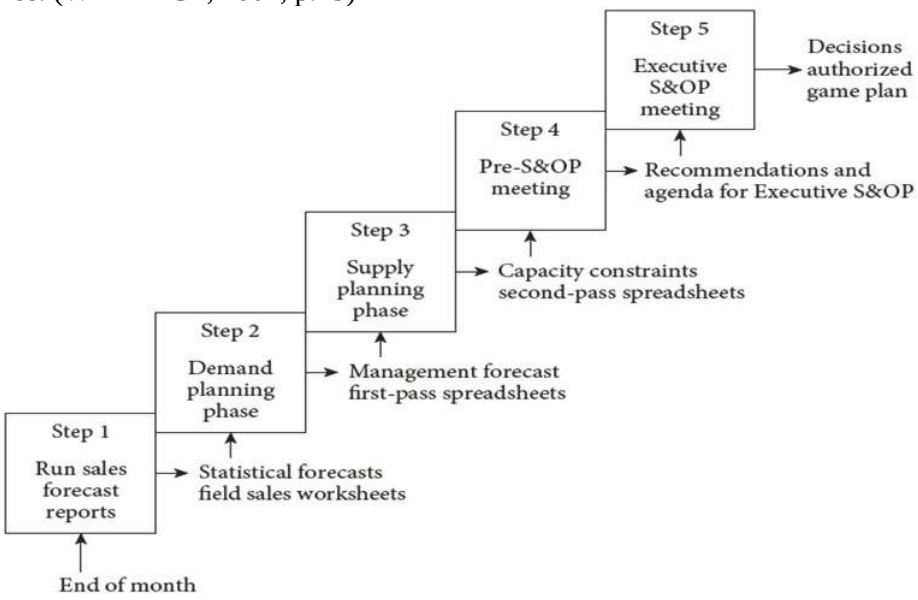



*Figure 6 – Monthly S&OP process*
Source: (WALLACE, 2001, p.55)

## 3.4 The process of Sales and Operations Execution

The adaptation of the S&OP process to a more agile format aiming to attain certain business requirements is a reality that already exists for quite some time. In a quick search in the grey literature it is possible to find several articles in Supply Chain specialized blogs or white papers from consulting groups. They approach the subject from the points of view of operations where sometimes S&OP alone is not capable of meeting business requirements, as well as of customized S&OP operations, and of the new S&OE process that emerged to fill this gap in planning. It is known that the grey literature is not the most recommended source for theoretical background of an academic research. Still, it is extremely helpful if used as inspiration for studies that seek to identify new trends emerging in the market and in cases where there are still no academic papers regarding the matter. Appendix C shows a table with the main documents about the S&OE found in the grey literature.

From those works, it is convenient to mention a few that, despite being pertained to the grey literature, possess high quality and important concepts and discussions on the matter. The main works on the theme are the magazine article by Franciosi and Bremer (2011) and the Gartner Webinar with Pukkila (2016).

Franciosi and Bremer (2011) published a magazine article in Mundo Logística, a very famous Brazilian magazine about Operations Management and Logistics. They refer to the S&OE as Gestão de Atendimento (GATE), or Fulfillment Management in Portuguese. They approach the subject explaining how the world has been changing over the last years and how those changes, including globalization, have contributed to increase significantly the variabilities in the supply chain. To help manage those variabilities, they present the GATE, a weekly process that enabled a significative improvement in the stock rupture index, through the analysis, discussion and decision making activities always looking at deviations and opportunities in the short-term planning (FRANCIOSI; BREMER, 2011).

In the webinar “S&OE: The Secret Ingredient for Delivering Planned Business Results” (PUKKILA, 2016), Marko Pukkila, a research director from Gartner, states that S&OE is a planning process with a horizon from 0 to 12 weeks, weekly cadence, focus on SKUs, orders and shipments, and its main goal is to keep on track S&OP’s plans. S&OE unfolds S&OP’s plans to the short-term planning. For him, S&OP and S&OE are very dependent from each other, but they both have their specific role and one cannot substitute the other. Pukkila (2016) also states that there is no such thing as a short-term S&OP, since it loses its essence if it is performed in a short time span. S&OP sets the direction that must be

pursued by the operations and S&OE is responsible for analyzing the scenarios and solving problems, with focus on the delivery of S&OP's results but with granularity and frequency small enough to answer specific questions and operate in the business speed.

Pukkila (2016) explains that when both processes are implemented in the company, each one fulfills its role and the operations flow is smoother, exceptions are detected with anticipation and the problems are solved in the correct forums, with the right stakeholders. S&OE allows corrections in the plans, through adjustments considering the order book. The frozen horizon depends deeply of the production cycle, so it is very particular of each company. ERP is very important to S&OE, helping the monitoring of the operations. The main roles and responsibilities are the supply chain leader, the demand planner and the supply planner, for they are the ones that make the decisions regarding trade-offs. The most used KPIs are forecast consumption, schedule attainment and delivery performance.

Some other works have a more commercial approach, but are also worth mentioning, given the fact that few sources are available on the matter. Hadavi (2016) states that S&OP and S&OE are essential to one another, and to be able to perform that execution correctly there are three requirements: accurate plans, unified data model between planning and execution and ability to adjust the plan as needed. Cruz (2016), mentions that unfolding the S&OP to S&OE is becoming more imperative each passing day, to enable a better allocation of resources through a clear and precise coordination of priorities. In accordance with that, Huber (2016), brings to attention that the succinct vision of S&OP makes it difficult to translate important decision into actual execution. She points that, to companies inserted in highly competitive and dynamic markets, the solution is adding the weekly S&OE process, that she defines as "the process of unfolding the S&OP that seeks to detail the weekly updated sales plans to the weekly plans of production, receipt and expedition, allowing adjustments and the best resource allocation possible compared to demand variations" (HUBER, 2016). Julianelli (2016) defines S&OE as "a shorter planning cycle that begins with the review of the sales forecast for the next week, analysis of net inventory requirements that result from this review and, from that point on, the elaboration of the plans of receipt, production and expedition for the whole week", and mentions an S&OE meeting, that happens every Friday, that discusses and agree on those planned numbers.

However, despite the existence of important material about S&OE on the grey literature, there are no papers that describe the S&OE, only a few ones that show it as a customization of S&OP and even less the ones that approach it in a detailed way. Table 3 presents the result of a comprehensive literature review on the subject, with a classification of

the papers alignment in relation to the theme, according to the depth with which it is approached. Altogether, 26 papers were analyzed, where 6 were classified as possessing high level of alignment, 4 as medium level, 3 as low level and 12 as none. The search results documentation is presented in Appendix A.

The main work found is the one from Lim, Alpan and Penz (2014), that reports the case of a new planning process, hybrid between S&OP and MPS, applied in the automotive industry Renault. The planning environment in which Renault is inserted is highly complex, with long procurement lead times, demand uncertainty, progressive order placement, order postponement possibility, flexibility rate for a maximum demand volume, impatient customers and emergency supply utilization in case of raw materials stock out (LIM; ALPAN; PENZ, 2014). A demand forecast is updated twice a year and comprise a two years horizon. Sales department uses this forecast to generate a weekly demand forecast, with low product aggregation level and three months horizon. For sales order placement, it is used an order book, that allocate orders in the next available window. The horizon comprised in the book is six months, with a frozen period of four weeks. The daily sales volume varies according to demand forecast that was established plus a maximum tolerance percentage, called flexibility rate, which is agreed upon weekly between sales and supply chain departments. This rate provides greater bargaining power to the salesman without creating big impact to manufacturing. In case the demand volume exceeds the maximum available in the book, new orders will be postponed to the next available date. Lastly, materials requirements are unfolded using the software for Material Requirements Planning, or MRP.

Another paper that needs to be highlighted is the one by Jonsson and Ivert (2015), that references MPS through a process approach, going against most authors, that usually treats MPS simply as a scheduling tool. Previous studies focused on technical aspects, including methods and parameters, without mentioning the aspects connected to the process itself and its performance when used (JONSSON; IVERT, 2015). This work presents a maturity analysis of the MPS process, based on propositions of S&OP's maturity evaluations found in the academic literature, grounding the positive impact of models more sophisticated than MPS. One of the features that represents MPS sophistication is the execution of weekly meetings between functions to align the programs that will be generated, in the molds of S&OP's consensus meeting, with a horizon that may vary from 1 to 6 months and low level of product aggregation.

Lastly, it is worth mentioning the research performed by Ivert et al. (2015). The paper aimed to comprehend the behavior of several S&OP processes in different companies, in

planning environments (PE) that possess high level of uncertainty, be it of demand, supply or others, such as the food industry. Case studies were conducted in eight different companies that have unique PEs, although all of them belong to the same type of industry. Using the Contingency Theory and observing the characteristics of planning in those companies, such as horizon, level of product aggregation, cycle frequency, inputs, outputs and activities, the authors were capable to conclude that the main environmental factors that influence the design of an S&OP process are demand and supply uncertainty, frequent product launching and network complexity (plants, distribution centers, among others). The paper's main contribution was to provide evidence that the S&OP needs adjustment depending on the planning environment in which the company is inserted (IVERT et al., 2015).

Despite all these studies present an invaluable contribution to the academy some limitations can be pointed out, such as only one paper identified that the object of analysis is a new hybrid process and not a customization of processes that already exists and that ended up losing the character of the original process (S&OP and MPS). Another limitation identified and maybe even a consequence from the other, is the lack of a study similar to the one that Wallace (2001) developed for the S&OP, that describes the S&OE in a detailed way and in accordance with the terminology used in the grey literature.

Through this literature review, it is evident the need of a detailed research on the subject, that brings to academy the S&OE process with a critical look, that properly register it as a new process in planning hierarchy and shows the real value perceived by those who implement it.

| Author | Alignment | Content |
|---|---|---|
| (GRIMSON; PYKE, 2007) | High | Makes reference to the traditional approach of S&OP, that is monthly planning cycles, average horizon of 6 to 18 months (even up to 3 years, usually coinciding with the planning horizon of the fiscal year budgeting process and some use a rolling horizon) and aggregation level of product families. However, it also mentions some market tendencies of adopting more frequent meetings (even daily and also triggered by special events), shorter horizons (products without seasonality and with reduced lead times) and analysis in the SKU level (example of Philips Electronics). In its model of process maturity, regarding "Meetings & Collaboration", the levels 3, 4 and 5 have monthly or weekly consensus meetings and in level 5 they also happen due to special events (such as shortage of a component, e.g.), and this frequency should be determined by the dynamism of the market and production environment. |
| (THOMÉ et al., 2012) | High | Reviews the literature evidencing S&OP's traditional model, inserted in the tactical level of the planning hierarchy, with monthly meetings, horizons from 3 to 18 months and aggregation level of product families. However, it shows that in the literature there are alternatives to this model, such as: weekly or ad hoc meetings (despite some authors suggesting that a high frequency of meetings in the S&OP process can make its behavior become disruptive), short planning horizons and analysis in the SKU level (or both). |
| (LIM; ALPAN; PENZ, 2014) | High | Describes a new planning process that is used in Renault, being a hybrid intermediary between S&OP and MPS, due to long supply lead times that force the inclusion of strategic and sales objectives in the weekly planning process. Demand forecast is made twice a year, with a 2 years horizon, and it helps the estimative of future investments and demand trends. Besides the annual production plan, every month the sales department performs a weekly demand forecast for the next 3 months, with low product aggregation level, similarly to MPS, but with a weekly bucket. This demand planning is sent to the order book and used to calculate a maximum tolerance percentage for salesmen orders. All the plants own an order book with a 6 months horizon, with a frozen period of 4 frozen. New orders that are placed fill the forecast until the maximum value is obtained (including the tolerance percentage), postponing new orders to the next available window. Materials need are deployed using MRP. This is the approach found in the literature that best approximates the S&OE process. |
| (IVERT et al., 2015) | High | Describes a planning environment (PE) that incluences the design of S&OP and that may make it different than the traditional design shown in the literature (main influences: supply |

| | | |
|---|---|---|
| | | and demand uncertainty, frequent product launches and production network complexity). It evidences one case of weekly planning of some product launches (aligned to monthly planning of other items), several cases of SKU aggregation level (due to factors such as product grouping complexity, low number of SKUs or the need of a detailed analysis), and some cases with variable horizon. It concludes that S&OP is very flexible and it should be adapted to the company's reality. |
| (JONSSON; IVERT, 2015) | High | Analyses the contribution of sophisticated MPS methods to planning processes. The approach is more focused on process and less focused on systems (differently than other studies about it), analyzing the maturity of the MPS process (based in previous studies about S&OP), where different functional areas of the company participate in the process. This approach is one the closest ones to the S&OE, using an average horizon of 1 to 6 months, weekly cycles, low level of product aggregation and cross-areas consensus meetings. However, it still lacks a description of how this process works. |
| (JONSSON; MYRELID, 2016) | High | Presents a case study about the exchange of information between manufacturers and 3 suppliers from the automotive industry in the European Union. Supplier A has a monthly planning with a 24 months horizon, supplier B does not possess a formal planning process and supplier C runs a monthly planning process, with weekly bucket and 3 months horizon (besides a short-term production planning that is performed weekly, with a 2 weeks horizon, one of those being frozen). |
| (GUSTAVSSON, 2008) | Medium | One of the companies used in the case study owns a monthly S&OP cycle, with SKU level, 3 years horizon, resulting in a demand plan by client. However, the S&OP can be updated weekly in case the clients' requests changes. This S&OP is deployed to an MPS that has 18 months horizon and daily bucket. |
| (CHAE, 2009) | Medium | Talks about the pressure for shorter planning cycles (including weekly), specifically from S&OP, due to several adversities, such as rapid changes in the environment, necessity of a better service level and high level of uncertainty in the supply chain. |
| (CAULFIELD, 2013) | Medium | Describes the process of S&OP implemented to improve the Blood Supply Management (BSM) of Australian Red Cross Blood Service. One of the steps of S&OP is a series of local weekly meetings that seek to evaluate deviations in stock levels and take corrective action to adjust it. |
| (GOH; ELDRIDGE, 2015) | Medium | One of the case companies implemented an S&OP that performs weekly consensus meetings, in SKU level, however the plan is monthly. It also presents the schematic of the |

| | | |
|---|---|---|
| | | process of order fulfillment. |
| (COLLIN; LORENZIN, 2006) | Low | Presents the planning of an agile chain through a case study in Nokia. The global process of S&OP has a rolling horizon of 13 months and monthly bucket. Within the S&OP there is a sub-process of Demand Planning, that can be of short term (3 first months of the horizon, weekly updating cycles) or mid-term (months 4 to 13, monthly updating). |
| (LIM; ALPAN; PENZ, 2013) | Low | Mentions that the company object of study performs a weekly S&OP and that there is a tolerance percentage in the demand forecast for order placement. Besides, the frozen horizon of 4 weeks, but it is not mentioned the total planning horizon. |
| (GORETZKI; MESSNER, 2016) | Low | Mentions in the end of the conclusions that a theme that must be approached in future research is the fact of how and why the organizations may adapt their planning processes to longer or shorter horizons, increase or decrease the level of aggregation of the analysis, include different people in their decision forums and dedicate more or less time to the planning process as a whole. |
| (GIANESI, 1998) | None | Mentions that some companies that were studied still used a planning horizon of no more than 4 or 5 months, for they consider that their demand forecast is unreliable in the long term. For the author, this would not be the ideal scenario. Thus, this work was classified as no alignment with the theme. |

*Table 3 - Main results of the literature review of S&OE*
Source: Made by the author

# 4 RESULTS

This “Results” section addresses first the process of developing the coding categories and subcategories for data analysis. Then, it presents data documentation of each case that used the coding categories, highlighted the main perceptions collected during the interviews and analysis of documents, important statements made by the interviewees, frameworks, among others. After that, it shows the cross-case analysis that was performed, comparing the information of the individual cases, searching for differences and similarities between them. Fourth is the theory proposition, with the transferable process model, main characteristics and frameworks, using the coding categories to generate theory that could be compared with the data of each case and check its validity. Finally, comes the comparison of the generated theory with the existing literature that permitted the binding of the similarities in a final solid theory. The Figure 7 shown below represents this section structure in a simplified framework.

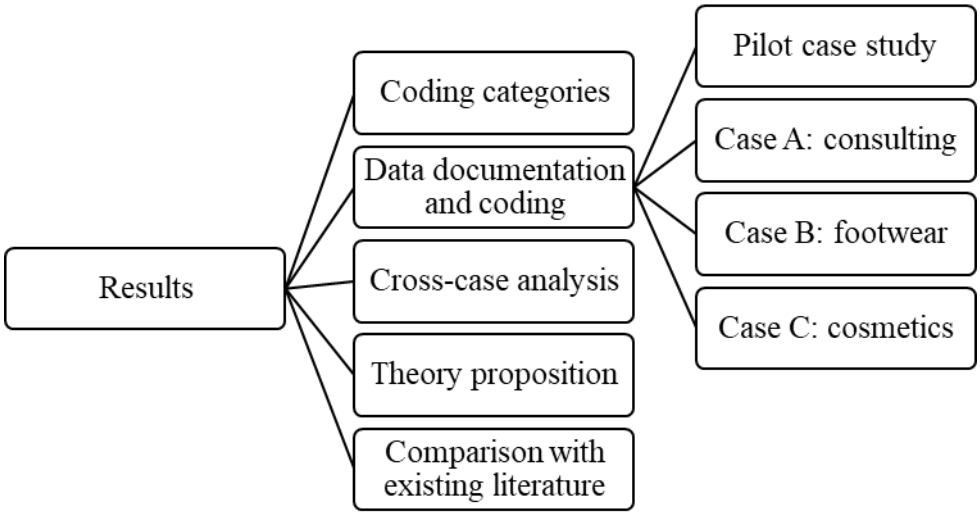



*Figure 7 - "Results" section structure*
Source: Made by the author

## 4.1 Coding categories

Based on the research questions that this work aims to answer and the data collected in the field, three categories and seventeen subcategories were created to code the data and enable the data analysis. The rationale behind the development of the coding categories was that the data collected needs to be analyzed in a way that results in the answer of the research questions. Therefore, each research question was translated into one category of analysis, originating three categories: conceptual model, relevance and history.

The data was then submitted to the first round of categorization that allowed the identification of seventeen subcategories: eight inside conceptual model, three inside relevance and six inside history. The Table 4 below shows the categories and subcategories that emerged from each research question.

| **Research Questions** | **Categories** | **Subcategories** |
|---|---|---|
| What is the Sales and Operations Execution process, how is it formalized in the literature and how is it performed by the companies that have it implemented? | S&OE process | Process model<br>Stakeholders<br>Roles and responsibilities<br>Decision making<br>Functional areas<br>Tools and technologies<br>Key Performance Indicators<br>Process dynamism |
| Why is the S&OE important to the companies that implement it? | Relevance | Strategic alignment<br>Value creation<br>Goals and expectations |
| How does the implementation of the S&OE happen and why do the companies want to implement it? | History | Implementation<br>Motivation<br>Investment<br>Changes<br>Efforts<br>Benefits |

*Table 4 - Coding categories and subcategories*
Source: Made by the author

## 4.2 Data documentation and coding

The data collected in each case will be presented in the form of a text briefing about the company and a table containing the coding of the information in the categories and sub-categories, to summarize the most relevant points that will be crucial to this study. The first two columns of the table are the categories and sub-categories presented before (Table 4). The third column is the gathered information summarized, with quoted examples extracted from the material. Finally, the fourth column tells if the information in each row was collected in the point of view of the S&OE in general or only that specific case.

### 4.2.1 Pilot case study – Case Energy

The pilot case, as described before in the "Methodology" section, was chosen based on a previous contact between the researcher and the interviewee. The interviewee is a supply chain senior consultant, identified as "Energy consultant" or EC, that participated in the team that implemented the S&OE in a global power distribution company, focused in construction planning of the distribution business unit (energy substation constructions, among others). Due to new government regulations in the power distribution market, the company Energy was facing reduction in its financial results. Besides, a scenario of excess stocks and stock-outs at the same time, low service level perception and lack of visibility for the leadership, was also affecting the construction services in the company. All this encouraged the company to look for ways to improve its efficiency in general. Therefore, both S&OP and S&OE appeared as solutions to improve the operations of construction services in the distribution network. An informative table about the case is shown below (Table 5).

| **Information** | **Description** |
|---|---|
| Case | Energy |
| Interviewee | Energy consultant (EC) |
| Business type | Electric Power Company (Generation, Transmission and Distribution) |
| Position of interviewee | Supply Chain senior consultant |
| Time in the position | 2 years |
| Number of employees | Over 3,000 (Brazil) |
| Number of SKUs | 5090 |
| Number of facilities | 87 (deposits for construction material) |
| Global presence | European company with global presence |
| Business units | 1 (only Distribution was in the scope of the project) |
| Net operating revenue (2016) | Over R$ 8 billion |

*Table 5 - General information of case: Energy*
Source: Made by the author

The interview had an unstructured character, thus it was initiated with an open generic question: "what is S&OE?". From the answers obtained, new questions were asked, as to obtain a general overview about the process. The interview was not recorded and the data available was researcher notes and documents. The questions asked with the researcher notes for each one of them can be found in Appendix D.

The interviewee, “Energy consultant” (EC), describes the S&OE process as a conflict resolution process, where the main sources of conflict would come from commercial and operations. It unfolds the S&OP to the short-term and is a guardian of the plans, that is, makes sure the plans developed in the S&OP are possible to be executed without being hijacked by the unpredicted events of the short term.

The table presenting the data coding of the Energy case is presented below (Table 6).

| Categories | Subcategories | Information | Point of view |
|---|---|---|---|
| **S&OE process** | **Process model** | S&OE is a conflict resolution process, with cross-areas meetings and consensus, that unfolds S&OP to the short term. The frozen horizon must be defined in each case, and the purpose is to give stability to order promising. | general |
| | | Steps: Disaggregate plans, generate and program orders, evaluate opportunities and deviations, define fulfillment, confirm orders. | general |
| | | Horizon: 2 to 3 months. | general |
| | | Planning bucket: weekly. | general |
| | | Product aggregation level: usually SKU. | general |
| | | Meeting frequency: Once or twice a week. | general |
| | | Analyses order fulfillment. | general |
| | | Usual frozen horizon: frozen period is current week (week 0), slushy period is weeks 1 to 8 and liquid period is month 2 and on. | general |
| | | S&OE was responsible for disaggregating the plans for the executive projects and purchasing, and also monitoring the actions needed to enable those plans. It also verified the available capacity versus the utilization projection for materials and services. | case specific |
| | **Stakeholders** | Meetings with operational forums. | general |
| | | Managers, coordinators, analysts and programmers. | general |
| | | The consensus meetings happened weekly but the discussed topics were distributed fortnightly, in order to optimize the participation of each functional area. | case specific |
| | **Roles and responsibilities** | With time, people acquire a greater comprehension about what is expected of them during the meetings. | general |
| | | S&OE team: make sure that construction projects approved in the S&OP would be registered in the ERP; follow-up in the projects execution (deviations and opportunities); same with procurement; monitoring of consume pointing in construction. | case specific |
| | **Decision making** | Contrasts with the S&OP, that is more focused in planning. | general |
| | | Execution decisions. | general |
| | **Functional areas** | Several arrangements for the functional area, depending on the company structure and needs. | general |

| | | | |
|---|---|---|---|
| **S&OE process** | **Functional areas** | Examples: S&OE management under Planning and Logistics directory; S&OE management under Brazil's general directory (multinational); S&OE coordination under Supply Chain management; S&OE management under Supply Chain directory; S&OE inside Integrated Planning management, under Marketing general management, under Commercial directory, and several other possibilities. | general |
| | **Tools and technologies** | Use of ERP systems.<br>Information tool with logic to operationalize the process. | general |
| | **Key Performance Indicators** | On Time In Full (OTIF); adherence to the distribution program; adherence to the production program; stock-out and excess stock; adherence to purchasing program; change in sales orders. | general |
| | **Process dynamism** | Each new cycle that is performed, the S&OE evolves, perfects itself. | general |
| | | Adaptation of the traditional logic to a different business model: electric power companies; "model of synchrony between availability of raw materials and manpower to execute the construction". | case specific |
| | | Successful adaptation to different types of business models (not only traditional demand versus production coordination, but also construction, services, among others). | case specific |
| | | Not all the steps of S&OE were suitable to the business model of the case. The steps "generate and program orders" and "confirm orders" were not used in this S&OE model. | case specific |
| **Relevance** | **Strategic alignment** | Validation of the models with operational team, management, directory, sponsors and CEO. | general |
| | **Value creation** | Makes the planning tangible. | general |
| | **Goals and expectations** | Successful adaptation of the S&OE for the energy distribution company opens doors for other adaptations, in other types of companies and also other planning processes or a whole value chain management model. | case specific |
| **History** | **Implementation** | Usually the companies already have an S&OP.<br>Parameters for the S&OE are determined in the S&OP.<br>The design process starts understanding the reality of the company followed by a proposal construction that involves the company employees and the consultants.<br>There are validation stages, with project follow-up meetings and implementation adherence analysis. | general |
| | **Motivation** | Nervous operations inserted in high variability environments. | general |
| | **Investment** | Consulting group. | general |
| | **Changes** | In the beginning people still don't trust the process, so they keep running their routine process in parallel. | general |

| | | | |
|---|---|---|---|
| **History** | **Efforts** | Data quality in the system is insufficient to perform a good execution.<br>Get people involved.<br>Development of the monitoring tool is laborious.<br>The resistance starts to decrease when people understand their roles. | general |
| | **Benefits** | Reduction of inventories. | general |
| | | Cash flow release. | general |
| | | Independent of the types of offer or demand, S&OE has a great potential to generate benefits in the medium and long range, avoiding waste and granting more control over the investments. | general |
| | | Reduction of inventory levels without harming the service level. | case specific |
| | | Visibility for the leadership about future demands and necessary investments. | case specific |

*Table 6 - Data coding of Energy case*
Source: Made by the author

### 4.2.2 Case Ceramic

The second case studied was of a ceramic tiles industry that was going through an accelerated growth process that made the whole management of the company a lot more complex. As a result, the company Ceramic started suffering from increasing customer dissatisfaction and loss of sales and margin. The interviewee is a supply chain senior consultant, identified here as "Ceramic consultant", that participated in the team that implemented the S&OE in the Ceramic company. Table 7 below shows more information about the case.

| **Information** | **Description** |
|---|---|
| Case | Ceramic |
| Interviewee | Ceramic consultant (CC) |
| Business type | Ceramic tiles industry |
| Position of interviewee | Supply chain senior consultant |
| Time in the position | 1 year |
| Number of employees | Around 3,000 |
| Number of SKUs | Around 32,000 |
| Number of facilities | 6 (all in Brazil) |
| Global presence | Brazilian company with global presence (export to over 60 countries) |
| Business units | 4 (1 corporate brand and 3 commercial brands) |
| Net operating revenue (2016) | Over R$ 1 billion |

*Table 7 - General information of case: Ceramic*
Source: Made by the author

The interview for this case was semi-structured, following the interview guide shown in the case study protocol (Appendix B). The interview was recorded and documentation was provided, so the table below (Table 8) shows the coding of the information gathered in the coding categories that were already discussed previously (Table 4).

| Categories | Subcategories | Information | Point of view |
|---|---|---|---|
| **S&OE process** | **Process model** | S&OE is: “A process that acts tactically, between planning and execution, to evaluate opportunities and deviations and manage customer service following clear prioritization rules set by the executive leadership", "The channel that connects sales and production in the company's daily routine", "It is the step after S&OP and before the Operational Orders Management (that happens in the ERP system), serving as a bridge between them". | general |
| | | Planning bucket: weekly. | general |
| | | Horizon: 1 month. | general |
| | | S&OP had 3 planning scenarios: optimist, realist and pessimist. All of them were inputs for the S&OE. | case specific |
| | | 5 Steps: Disaggregate plans (by product and by sales channel), generate and program orders along with PPC (programs: production and purchasing of finished product, considering safety stocks, capacity restrictions and calendars of phase-in and phase-out of products; done almost simultaneous with scheduling, since there were around only one order per day), evaluate opportunities and deviations (daily basis, in order to keep track of the backlog, make some minor decisions to improve the fulfillment flow and also to gather decisions that should be taken in the weekly forum with the different areas), define fulfillment (weekly, with an Access tool based in defined priorities by sales channel; also the weekly meeting that defined the orders that would be fulfilled), confirm orders. | case specific |
| | | The generation of the order programs was made looking at the month's production but also checking a 3 months span, to make sure that some lots that only ran once every 3 months were not forgotten. | case specific |
| | | S&OP plans were broken down into a less aggregated planning hierarch, for the S&OE (once a month). Based on this breakdown, some production orders were generated and were scheduled along with some sales orders. | case specific |
| | | The promised date for the customer was a logic called Fast ATP: if the product is not available at the time of purchase, the available fulfillment date was based in a fixed standard lead time (3 months). If there was stock available, the promised date was based in the regular fulfillment lead times (logistics, and others). | case specific |
| | | It can involve sales quotas and inventory reservation. | general |
| | | The 5 steps are not sequential. The sequence of activities follows a calendar that has a generic structure, but can be customized to the company’s necessity. | general |

| | | | |
|---|---|---|---|
| **S&OE process** | **Process model** | The flexibilities must be managed. It is important that the company knows where are the flexibilities. Is it in the production order quantity? Is it in the product mix? Is it in my stocks? Is it regarding which customer or sales channel I will serve? And so forth. It depends on company's strategy and business type. | general |
| | | The main differences to the MPS are: MPS is a tool that schedules the orders, S&OE is a process much broader, that analyzes in a longer bucket and horizon; MPS is a schedule that reacts to changes and S&OE tries to predict the changes (both opportunities and deviations) and treat them before it happens, so that the scheduling can be more smooth, less nervous; MPS does not negotiate, the fulfillment logic inputted in the MPS is revised in a frequency that is not enough to accompany the changes and MPS does not know qualitative characteristics of the customers, sales channels, products, etc. | general |
| | | To treat in the meetings the product aggregation granularity of SKU: this is not done for all SKUs. The SKUs chosen to be treated in the meeting depend on several factors, such as if it has high or low inventory turns, if it is a new product that was just released, if the inventory levels for that SKU are very high or very low, if it is going to participate in marketing incentive campaigns, and so on. There are always the main SKUs that need to be treated each week (and it changes every week), and the rest is analyzed as a product family or sub-family. It all depends on the agreed flexibility. The rule is: aggregation level is smaller than S&OP. | general |
| | **Stakeholders** | The most important is always the commercial team, for they understand customer priorities, high impact actions and can unfold a future strategy that will feedback into the S&OP. | general |
| | | Commercial team; production team (to obtain alignment with the commercial team). | general |
| | | Dependent of the company's strategy (Make-to-Order or Make-to-Stock), the production team will be more involved or the logistics and inventory team. | general |
| | | The company's organizational structure followed the planning hierarchy: supervisors for order management, coordinators for S&OE, managers for S&OP and directors for strategic planning. | case specific |
| | | In the weekly meeting: inventory, logistics, production, outsourcing, commercial and S&OE team. | case specific |
| | **Roles and responsibilities** | S&OE Leader with an aligner role. Should be a neutral person (no functional area bias), that must think about the company as a whole (systemic vision), must understand trade-offs. Usually participates in the S&OP process as well. | general |
| | | S&OE analyst. It can be more than one, depending on the company. Responsible for analyzing KPIs, daily follow up of deviations, search for fulfillment opportunities. Must also have a systemic vision and analyze what is the best scenario for the whole company and not for specific areas. | general |

| | | | |
|---|---|---|---|
| **S&OE process** | **Roles and responsibilities** | Coordinators or managers from the areas that will have a degree of integration with S&OE, such as PPC, logistics, sales, S&OP participants). It depends on the reality of each company. | general |
| | **Decision making** | Some decisions can be made by the S&OE team on a daily basis, as long as it does not interfere (consequences) in the next time bucket. E.g. change to Friday an order that is scheduled to run on Wednesday, produce 10% more units in one order that is already scheduled, etc. | general |
| | | Decisions that affect future time buckets (e.g. next week, next month) have to be decided in the S&OE meetings, or sometimes even in the S&OP forum (if it affects in the long term). | general |
| | | The main drivers for the decisions are: regain margin, regain customer, influence stock, improve customer relationship and, mainly, guarantee S&OP's plans and company's strategy. | general |
| | **Functional areas** | The owners of the process were Customer Service Call Center (responsible for phone calls, social media, an others). After a while, it changed to PPC. | case specific |
| | | In general, the owner is the planning department (PPC). | general |
| | | Ideally, it would not be owned by any functional area, being a neutral area. | general |
| | **Tools and technologies** | Excel for disaggregation of plans and generation of order program. | case specific |
| | | ERP, MPS and MRP functionalities that derive from the order programs. | case specific |
| | | Access tool for fulfillment definition and decisions (data treatment). | case specific |
| | | KPIs dashboard in Excel (report extracted from the Access tool). | case specific |
| | | Warehouse management module that followed the inventory that was analyzed in the S&OE. | case specific |
| | | Usually the KPIs dashboard is inserted in the ERP, in the warehouse module, or other BI tools. | general |
| | **Key Performance Indicators** | Delayed money value (based on revenue percentage), inventory health and daily billing. | case specific |
| | | Changes in sales orders, adherence of the production/purchasing program, inventory stock management, OTIF, orders with delayed promised date. | case specific |
| | **Process dynamism** | Very dynamic. The main purpose of S&OE is to deal with changes and flexibilities, so it is intrinsically flexible in its structure as well. | general |
| | | The process adaptation can be easy or difficult, depending if the people are adept or resistant to changes. | general |
| | | The power balance between areas in S&OE must be neutral, or all adaptations will tend to benefit more the powerful areas. | general |
| | | The way it was implemented in this case (agile startup model) made it extremely adaptable. The process began with quick wins and with time it was developed to become a more complete and robust process. | case specific |
| **Relevance** | **Strategic alignment** | The most important strategic attribute was reliability. The improvements in the fulfillment flow and in the promised date enable the evolution in reliability. | case specific |
| | | It completely aligns the strategy to the fulfillment rules and criteria of prioritization. | general |

| | | | |
|---|---|---|---|
| **Relevance** | **Strategic alignment** | S&OE KPIs derive from the company's strategy (e.g. if the strategy is to reduce costs, costs KPIs will be monitored). | general |
| | | It guarantees that the S&OP plans will be met and customers will be fulfilled accordingly. | general |
| | **Value creation** | Minimizes costs related to operational inefficiencies. | general |
| | | Potentiates the revenue, by minimizing deviations and increasing opportunities. | general |
| | **Goals and expectations** | The main goal of S&OE is to balance demand and availability. | general |
| | | Manage problems and challenges that rise in the short term through the monitoring of the order book. | case specific |
| | | Focused on service level improvement, aligned with order fulfillment prioritization and a logic of realistic dates promises. | case specific |
| **History** | **Implementation** | A whole planning hierarchy was implemented, with S&OE, Order management (contemplating sales, production, logistics and return orders) and inventory management. The company had strategic planning and S&OP (which was also revised.). | case specific |
| | | The project followed the steps of visibility (problem comprehension), design (solution), implementation and stabilization (make sure all that was implemented was ok). In accordance with the agile startup logic, constant cycles of design, implementation and stabilization followed. | case specific |
| | **Motivation** | The consulting group was hired in 2012 to help with order backlog, since there was a lot of customer complaint about it. | case specific |
| | | Customer dissatisfaction, loss of sales, loss of margin, stock out, delivery delays, demand greater than production capacity. | case specific |
| | **Investment** | Consulting group. | case specific |
| | **Changes** | Strong organizational changes: creation of a new functional area and end of the manual allocator function. | case specific |
| | | Before S&OE, all order allocation for each customer (fulfillment) was done by a person that manually allocated the orders based on a fulfillment priority logic that only he knew. Therefore, there was a great deal of responsibility in the hands of only one person. The S&OE process brought a lot of transparency to the process. | case specific |
| | | Also, a functionality inside the ERP was responsible for disaggregating S&OP plans to SKU level, that was then scheduled and allocated in sales orders (fulfillment). | case specific |
| | | Some system adaptations. | case specific |
| | | Fulfillment rules were inputted in the Access tool (more transparency in the allocations). | case specific |
| | | On-the-job training in a collaboration between consulting group and company. | case specific |

| | | | |
|---|---|---|---|
| **History** | **Efforts** | People is always the greatest effort. They are usually reluctant with changes, especially in the organizational structure. | general |
| | | In this case, this was overcome with the creation of a new area for S&OE (instead of changing the role of an already existing functional area), that was very multidisciplinary, with no previous bias | case specific |
| | | Eventually systems can be a difficulty, but that is easy to overcome. | general |
| | | The effort to implement the S&OE was not so great, since the agile startup method was used and the company is a family business, which facilitates approvals and communication. | case specific |
| | **Benefits** | Improvements in service level. | general |
| | | Integration between functional areas. | general |
| | | Costs decrease. | general |
| | | Revenue growth. | general |
| | | 80% less delayed volume. | case specific |
| | | OTIF improved in 12%. | case specific |
| | | 40% less changes in sales orders. | case specific |
| | | 20% increase in the adherence of the production program. | case specific |
| | | Increased data reliability. | case specific |

*Table 8 - Data coding of Ceramic case*
Source: Made by the author

### 4.2.3 Case Footwear

The third studied case was in a footwear company that is known for having six different brands, annual change of collections, intense seasonality and fast product cycles, all intrinsic characteristics of the fashion industry. The company always brings innovation with new shapes, technologies, colors and models. All that results in a lot of SKUs (over 5,000) and brings high demand variability. More information about the case is found in the table below (Table 9).

| **Information** | **Description** |
|---|---|
| Case | Footwear |
| Interviewee 1 | Footwear Corporative Manager (FCM) |
| Interviewee 2 | Footwear Process Manager (FPM) |
| Business type | Footwear and sportswear industry |
| Position of interviewee 1 | Corporate Integrated Planning Manager |
| Position of interviewee 2 | S&OP and S&OE Manager |
| Time in the position 1 | 6 months |
| Time in the position 2 | 1 year and 7 months |
| Number of employees | Around 20,000 |
| Number of SKUs | Over 5,000 (estimative) |
| Number of facilities | 11 in Brazil, 7 factories in Argentina, and also presence in Europe and USA. |
| Global presence | Brazilian company with global presence (export to over 112 countries) |
| Business units | 6 (different brands) |
| Net operating revenue (2016) | Over R$ 4 billion |

*Table 9 – General information of case: Footwear*
Source: Made by the author

They divide their planning operations in two branches: sandals and sports goods. Their planning hierarchy involves a strategic planning called Multiannual Planning that unfolds for a Budget Planning, with more details. From that Budget Planning derives the traditional S&OP, that is later deployed for the S&OE, object of this study. The S&OE is responsible for running the MPS, that is biweekly for the sandals branch and monthly for the sports goods. After the S&OE is PPC, responsible for disaggregating the MPS programs into orders for the factories and running monthly the MRP for sports goods. Sandals does not use MRP in its planning process, the breakdown is done manually, daily, following the order book rolling

logic, for the next five days. The purchasing programs are deployed from the MPS manually, outside the system.

The interviewees, a corporative manager and a process manager from the company Footwear (here identified as Footwear Corporative Manager and Footwear Process Manager, respectively), both declare that the S&OE process is fundamental to the company and that they cannot imagine the planning process happening without it.

The interview for this case was semi-structured, following the interview guide shown in the case study protocol (Appendix B). The interview was recorded but no documentation was provided, only public documents were found on the internet, such as Annual Reports, but they did not contain much information about Footwear's planning processes. Table 10 shows the coding of the information gathered in the coding categories that were already discussed previously (Table 4).

| Categories | Subcategories | Information | Point of view |
|---|---|---|---|
| S&OE process | Process model | The first thing to stablish are the two technical boundaries that separates S&OE and S&OP and S&OE and PPC. The first boundary is the planning horizon and the second one is the product aggregation level. | case specific |
| | | Horizons: Sandals - 2 months; Sports Goods - 3 months (due to the supply lead time). | case specific |
| | | Product Aggregation Level: Sandals - Model and color; Sports Goods: Model, color and size (which defines the SKU), since a lot of raw materials depend on the size as well. The MPS runs in model and color for both branches, but the purchasing program has to be opened to size in sports goods. In the S&OP, the aggregation level is the model or the technology. | case specific |
| | | Number of SKUs: Sandals - around 4,000; Sports Goods: around 700. | case specific |
| | | Production lead times: Sandals - 5 days; Sports Goods: 10 to 15 days. | case specific |
| | | Sandals production lines have flexibility in the technology level, but not in production volume, since manpower is the biggest limiting aspect. Sports Goods are not so flexible, because the raw materials are much more specific for each SKU, so the planning is more detailed and accepts less variations than the Sandals planning. | case specific |
| | | For sandals there is not a lot of inventory available, since the production lead time is very short, so they produce and fulfill in the same month, adding flexibility. Sports goods also lose some of its flexibility due to the longer lead time. | case specific |
| | | Sandals: The cycle begins with MPS in the beginning of the month, using a demand review based on the order book of the last months, monthly bucket and 2 months horizon (current month and next month). The program is then released to the factories, so they can balance their production. However, during the month, S&OE evaluates the order book and re-plans the production based on the actual demand versus the forecasted demand (e.g. changing the production volume of one technology to another), leaving the initial program that was generated by the MPS, but always ensuring the production balance is correct over the month, that the inventory is healthy and the costs are not very high. This happens daily. PPC then checks the order book versus the inventory and schedule the production runs every day. S&OE changes the plan in the ERP to adjust the availability in the ATP. In the beginning of the month (second week) there are less adjustments, since they have just run the MPS and there is still no need for re-planning. So, they take advantage of this quieter period to generate all the reports and KPIs from last month. In the end of the second week, the evaluation of opportunities begins with re-planning activities and in the last week the team is very focused on re-planning and billing. Every month, the cycle starts all over again. | case specific |

| | | | |
|---|---|---|---|
| **S&OE process** | **Process model** | Sports goods: The cycle also starts with a MPS run in the beginning of the month, followed by the deployment of the purchasing for each factory (since the raw materials are very specific), then a MRP run. The raw materials are not purchased in the same month, because of the lead time (therefore, to start the monthly planning, all the materials needed have to be already at home). S&OE monitors the consumption of raw materials, because the BOM is estimated (e.g. fabrics usage) and sometimes does not reflect the reality, affecting the available materials for the next month. In this logic, S&OE serves a role of programming and prioritizing of the production orders, deployment of MPS for the next 2 months to analyze materials requirements, to ensure their inventories for the next months. There are much more limitations to the entrance of new orders than in Sandals, and last-minute orders are only accepted when there is available inventory of the finished product. | case specific |
| | | The greatest input from S&OE to S&OP is the closing stock of the moth, to feed the plans for the next two months. In the other hand, S&OP should guarantee that the generated plans will not become a limitation for the S&OE (limitation of the ability of absorbing variabilities). | case specific |
| | | Every Tuesday morning the S&OE meeting takes place, to evaluate 5 topics: 1) How is the order book and the chance of meeting the demand; 2) Opportunities and deviations (commercial actions and production); 3) Billing rate; 4) Order fulfillment (what is in stock, in production or programmed); 5) How is the production going. Sometimes, after sales are also discussed, when there is an issue to finish the order. | case specific |
| | | There are rules for prioritizing the fulfillment. First priority is backlog and then the regular incoming demand. Sandals also breaks by sales channel and Sports Goods breaks by customer. | case specific |
| | **Stakeholders** | The main stakeholders are the participants of the S&OE meeting. The owner of the S&OE meeting is the S&OE manager. The areas involved are: factory (all the factory managers, PPC from each factory, eventually the industrial manager), supply chain (planning analysts, S&OE manager and corporate integrated planning manager), customer service (senior analyst or manager), logistics (manager or senior manager), business units (national sales manager, product marketing team, direct channels analysts, exportation manager, finance). | case specific |
| | | Information Technology participates in the process in daily issues, but not so much in the meetings. | case specific |
| | | The financial areas of the business units also participate in the meeting with a certain frequency. | case specific |
| | | Directors also demand several information that S&OE generates. | case specific |
| | **Roles and responsibilities** | There are 5 analysts in the process (4 for sandals and 1 for sports goods). 3 of the sandals analysts are responsible for factories, including the production planning for the factory, new orders rate, MPS, negotiation, phase-out forum, among others. They also make the S&OE meeting material. Another sandals analyst is responsible for the short-term demand review, reports and KPIs, shop fulfillment support, information for the phase-out forum. | case specific |

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|---|---|---|---|
| **S&OE process** | **Roles and responsibilities** | The S&OE manager coordinate activities, leads the S&OE meeting, align the most important decisions between the business units and the factories. | case specific |
| | **Decision making** | Analysts take small, routine decisions, such as changing the production volume of one technology to another. | case specific |
| | | The S&OE manager takes more important decisions, the ones that truly affect the demand, during the S&OE meeting. | case specific |
| | | One important decision inside S&OE is the "unfold" of an order (to bill a sales order partially, e.g. the order is for 200 pairs but there is only 100 available in stock to be billed, the rest needs to be produced). Customer service is the responsible for checking which customers accept or not the "unfold", and S&OE decides if it will be done or not. This decision is done on a daily basis. | case specific |
| | | The main drivers for the decisions are to meet the demand, then costs and inventory health. | case specific |
| | **Functional areas** | S&OE in inserted in the Supply Chain directory, that answers directly to the CEO. | case specific |
| | **Tools and technologies** | The main system is an ERP solution for clothing and accessories, that runs the production attendance, invoicing, information bases. | case specific |
| | | Web Portal for sales and commercial management. | case specific |
| | | Excel (including the S&OE tracking tool). | case specific |
| | | Business Intelligence tool (reports, order book tracking). | case specific |
| | | The numbers in the ERP that disaggregate the planning for the scheduling, are reviewed every 3 months. | case specific |
| | **Key Performance Indicators** | The main used KPIs are "leakage" (which is the order book backlog that is not fulfilled when the month ends), pending level (demand that cannot be met with stock and has to wait for production), inventory health. | case specific |
| | **Process dynamism** | S&OE is very dynamic, flexible and always evolving. | general |
| | | Changes in the process can happen, by the decision of Planning and other areas. It depends on the year time, the scenario and context in which the company is inserted. | case specific |
| | | There were some changes in the process from what was designed to what it ir now. Strategically the process did not change much, but in the point of view of daily operations, it took a much more pragmatic and practical approach, eliminating some reports that demanded a lot of work from the team but did not added much value. | case specific |
| **Relevance** | **Strategic alignment** | S&OE ensures the respect for the fulfillment prioritization, ensures that the fabric will be directed to the demand fulfillment, ensures that they are making the best possible decisions to meet the demand | general |
| | | Footwear is a company with high margin in its products, so the optimization of the company's results comes from fulfilling the demand and not from reducing costs. Therefore, the focus is on ensuring demand fulfillment and billing. | case specific |

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| **Relevance** | **Value creation** | S&OE reacts inside the month to change the plans according to the incoming orders, making sure they will meet all the demand. | general |
| | | It helps the company to react in the short-term in the best possible way, almost optimizing the process in the short-term. | general |
| | **Goals and expectations** | The margin is very high, so the goal is always to fulfill the demand and balance inventory. | case specific |
| | | The S&OE team seeks to keep improving their efficiency, through changes and improvements in the process, as well as advances in technology to increase the robustness of their platforms and reduce the number of manual activities. Their process is mature enough to seek new technologies. | case specific |
| | | The company is following a strategic plan of growing in the international market, demanding the creation of new fulfillment models specific for that market and challenging the current logic of new collection launches and trade-offs analysis. | case specific |
| | | They also want to analyze more deeply financial KPIs in the S&OP and S&OE routines. | case specific |
| **History** | **Implementation** | Footwear implemented S&OE with the aid of a consulting project, and the project lasted 3 years, from 2010 to 2012 (one year for sports goods, one year for sandals and one year for the new factory that was being open at the time). | case specific |
| | | Along with S&OE, S&OP was implemented, as well as a project to provide visibility and control of the shop floor. | case specific |
| | **Motivation** | The motivation was to transform Footwear operations, operational planning, to follow the new complexity that it was facing, in terms of portfolio and commercial operations (international expansion). | case specific |
| | | If the operations stayed the way it was, the company would have collapsed, because they could not handle the complexity. | case specific |
| | **Investment** | The major investment was the consulting group project. | case specific |
| | | There was no system acquisition, but there was a lot of customization, configurations and adjustments in AFS. | |
| | | The consulting team specialized in ABAP and responsible for technology implementations was just as big as the functional process team. | case specific |
| | | The whole planning structure was created, so there was a lot of hiring. | case specific |
| | | However, when talking about the financial return, the project had its payback in 2 years, even before the project was over, and only with the sports goods S&OE, not even counting sandals. | case specific |
| | **Changes** | Before implementing S&OP and S&OE, planning was a centralized MPS, run once a month, with the deployment to operations in factory and branch level, done by the PPC team (that was a 2 or 3 people area). It used a demand forecast as input and sent an unstructured direction for the factories, due to the manpower limitation. Some minor daily adjustments were made directly from PPC and the factories. | case specific |

| | | | |
|---|---|---|---|
| **History** | **Changes** | Today, S&OP discusses demand, look at investments, approves investments, approves hiring, discusses centralized trade-offs, production leveling, elaborates inventory construction strategies, among other activities, instead of just deploying the demand to the factories as it was done before, and all that is aligned with the S&OE and its feedback logic into the S&OP. | case specific |
| | | There was a lot of training for the stakeholders of the process. | case specific |
| | **Efforts** | The implementation of the process was fast and complex (especially when talking about technology), with a heavy workload. | case specific |
| | | Culturally speaking, it was easy, since Footwear is a company that embraces changes and the people are not very resistant there. | case specific |
| | | The greatest challenge was the implementation of the project to provide visibility and control of the shop floor, since there was almost no information about the shop floor activities, scheduling and programming. | case specific |
| | | Besides the shop floor initiative, the second greatest challenge was systemic (to parameterize and connect all the homemade solutions that they needed with the ERP clothing solution). | case specific |
| | | The transition to the new operations was hard, with a complex stabilization phase, because of the several new processes that were implemented, some worked fine from the start, some did not, with the need of fast adjustments. Therefore, the stabilization phase was more complex than the implementation itself. | case specific |
| | **Benefits** | Improvement in service level. | case specific |
| | | Improvement in customer service. | case specific |
| | | Higher profitability. | case specific |
| | | More visibility of the short-term operations to the planning and commercial areas. | case specific |

*Table 10 - Data coding of Footwear case*
Source: Made by the author

### 4.2.4 Case Cosmetics

The fourth case is the company Cosmetics. It is a national group of the Cosmetics, Fragrances and Toiletries (CFT) market. The company was facing an increased complexity in commercial and operations management, due to the creation of three new business units in the group. They are inserted in a very volatile market, that is closely connected to the fashion industry, just like the Footwear company. Therefore, they face challenges that are similar to the last case.

The CFT market always grew much more than the Gross Domestic Product (GDP), but in the last three years it started to face slow growth, becoming smaller than the GDP and stimulating more competitiveness between the companies that started more aggressive campaigns, fighting for prices and discounts. That increased the market volatility and demand variations, and most of those variations happen in the short-term. Table 11 shows more information about the company.

| **Information** | **Description** |
|---|---|
| Case | Cosmetics |
| Interviewee | Cosmetics Manager (CM) |
| Business type | Cosmetics, fragrances and toiletries (CFT) |
| Position of interviewee | S&OE Manager |
| Time in the position | 4 years |
| Number of employees | Around 7,000 |
| Number of SKUs | Over 4,500 |
| Number of facilities | 4 (all in Brazil) |
| Global presence | Brazilian company with global presence (export to 8 countries) |
| Business units | 4 (different brands) |
| Net operating revenue (2016) | Over R$ 4 billion |

*Table 11 - General information of case: Cosmetics*
Source: Made by the author

The planning hierarchy of the company starts with a strategic planning, that performs the business plan of the BUs with a horizon of three years. This strategic planning is input for the planning processes (mostly looking at the network footprint), that performs the Integrated Demand Planning (IDP), with a horizon of two years, analyzing mostly the campaigns and new product launches. IDP is unfolded for a traditional S&OP, that is later deployed to the S&OE, followed by an Order Management process and the shop floor execution.

The interview for this case was semi-structured, following the interview guide shown in the case study protocol (Appendix B). The interview was recorded and little documentation was provided. Table 12 shows the coding of the information gathered in the coding categories that were already discussed previously (Table 4).

| Categories | Subcategories | Information | Point of view |
|---|---|---|---|
| S&OE process | Process model | S&OE works for BUs, the planning analysis is done together, but the rest of the activities are done separately. | case specific |
| | | Horizon: 3 months. | case specific |
| | | Planning bucket: weekly. | case specific |
| | | S&OE looks for opportunities and restrictions with a very formal weekly forum that is acknowledged for the entire company, with the participation of over 20 people. | case specific |
| | | The meeting discusses all the KPIs involved in the process, related both to the industry and to sales, but mostly all the restrictions, according to the Advanced Planning and Scheduling (APS) runs, and all the opportunities. | case specific |
| | | There are different environments inside APS, such as the unrestricted production environment with the plans that comes from the BUs (S&OP). Once a month, this plan goes to the S&OE so that it is possible to run the restricted plan, showing what can and what cannot be produced. The result is used to run the APS one more time, to generate the new plans. One week this is done for the production plans, the other is for the material plans. | case specific |
| | | Frozen period is week 0 for production and week 0 and 1 for purchasing, slushy period is only for production in week 1and the rest of the horizon is liquid period | case specific |
| | | S&OP feedbacks in the latest version of the S&OE in the end of the month. | case specific |
| | Stakeholders | The main areas involved are supply chain, demand, BU commercial, BU marketing, communications. | case specific |
| | | The meeting participants are ideally managers, but sometimes they are replaced by coordinators, but they need to have the power to make decisions. | case specific |
| | Roles and responsibilities | The most important role is the one of following the process, identifying opportunities in the KPIs and working with all the restrictions. | case specific |
| | | Today, the weekly meeting is led by the S&OE manager, but it is a cooperative forum, that is no longer responsibility of only supply chain. The BU's also bring subjects to be discussed by all the participants. | case specific |

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| **S&OE process** | **Decision making** | Decisions are taken by the people that participates in the meetings and are communicated in a meeting minute and shared for the group, depending on the size and nature if the problem. | case specific |
| | | There is no pre-established fulfillment rule for the decisions, since the objective is to serve everybody and to do an apportionment if that is not possible. There are different rules for every BU and for every sales channel. | case specific |
| | | The margin is quite high, so the cost of stock out has a great impact on retail sales, especially when the disruption is in the retail. The company always avoid losing a sale. | case specific |
| | **Functional areas** | The main owners are Supply Chain, but it is shared with other BUs, such as operational logistics, E-Commerce, service centers and planning areas. It is a cross BUs process. | case specific |
| | **Tools and technologies** | There is no dedicated tool for the S&OE, just the APS. The S&OE cockpit is also inside the APS. | case specific |
| | | Cosmetics used to run MPS and MRP, but they do not anymore, since the APS tool does all the job. | case specific |
| | | The main challenge in the technology aspect is to increase the frequency of APS runs, so that the planning process can be even faster than once a week, to increase the flexibility in the supply chain. | case specific |
| | **Key Performance Indicators** | The main process KPI is the service level. | case specific |
| | | Inventory levels (open by types of inventory, such as useful, excess, blocked, reproved, among others) is also an important KPI. | case specific |
| | **Process dynamism** | It is a process that evolved a lot comparing to the design phase, adapting itself to many changes in the reality of each sales channel. | case specific |
| | | The changes are always aligned with the leadership of the BUs, checking all the factors that are crucial to each BU. There is an alignment phase, followed by an adaptation proposition and only after everything is approved the changes are implemented. | case specific |
| **Relevance** | **Strategic alignment** | The company has a strategic planning for the next 3 years, with several of its initiatives being attached to the S&OE (such as running the planning process every week). | case specific |
| | | The S&OE team also participates in the strategic planning, since they have a privileged view of the entire chain, with the perception of which problems affect the most . | case specific |

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| **Relevance** | **Value creation** | The main goal is always service level, and S&OE enables that. | case specific |
| | | S&OE provides integration between the processes and between functional areas. | case specific |
| | | It is a fundamental process for the execution of the BUs strategies. | case specific |
| | **Goals and expectations** | The processes will have to be restructured again soon, because the business keeps evolving and growing. | case specific |
| | | The main expectation is the increase in the frequency that S&OE runs, to run the S&OE for the entire company every week. Currently not done because of the amount of analysis that are needed each run, so they need to automatize the process a little. | case specific |
| **History** | **Implementation** | The implementation started in 2013, along with the restructuring of all the planning processes of the group. It was performed in 3 waves, the first one focused in the processes, the second implemented the APS technology and the third focused in data quality, to improve the quality of all the processes across the company. | case specific |
| | **Motivation** | At the time (2013) the group was facing an increase of complexity in its supply chain, caused by the creation of three new Business Units. | case specific |
| | | They used the traditional MPS/MRP planning hierarchy, but they realized it was not going to be enough for the new reality that was coming. | case specific |
| | **Investment** | They hired a consulting group to help them in the project, that was very expensive. | case specific |
| | | In the second wave, there was the acquisition of the APS module, that is also very expensive. | case specific |
| | | In the third wave, the analytics implementations also costed a lot. | case specific |
| | | New employees, with APS knowledge, were hired. | case specific |
| | | However, besides the high costs, they had a great return, especially because the company would not be able to do what they do today without this process. | case specific |
| | **Changes** | The greatest change was the division of the planning horizons. For 30 years the same team looked at all the horizons. They analyzed everything as only one horizon, so they received the plan and the output went directly to the factory. The restrictions to the plan were treated later. | case specific |
| | | There was a lot of training for the team, both in processes theory and technology capacitation. | case specific |
| | | There is a new technical coordination structure inside Supply Chain, with several planners that are responsible for maintenance in the tools, creating a degree of independence from IT. | case specific |

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| **History** | **Efforts** | The efforts were very high, so the implementation strategy became crucial to the project's success. | case specific |
| | | One big challenge that is still not overcome is the consolidation of the S&OP process as a reliable process. S&OE has much more credibility in the company than S&OP. In their current S&OP, the variability of the numbers is very high, so they have to rebuild it in order to obtain numbers with better quality. | case specific |
| | | During the implementation, the greatest challenge was to perceive the magnitude and value that this new process would have in the company, and the great advantage that they have for running a process like S&OE. When the results started to arrive, was the moment that changed their perception, providing credibility and high-quality discussions in the company. | case specific |
| | | Changing the mindset of the team to start looking at different horizons was hard and a "wall" between the areas began to appear. | case specific |
| | | In the beginning of the implementation, new product launches were not discussed properly and nobody was truly responsible for this information. The result was a lot of issues and confusion in the process. | case specific |
| | **Benefits** | More integration between the Bus. | case specific |
| | | Improvement in service and inventory KPIs. | case specific |
| | | Increase in the chain flexibility (more revenue coming from flexibility). | case specific |

*Table 12 - Data coding of Cosmetics case*

Source: Made by the author

## 4.3 Cross case analysis

After careful coding of all the data gathered, it was possible to perform a cross-case analysis, that compared the similarities and differences between the cases in each category. To do so, the categories and subcategories from each case were analyzed to discover patterns in them. A few patterns emerged inside the subcategories, in the format of aspects discussed during the interviews or found in the documentation collected. Those aspects showed the need to breakdown the analysis a bit more, and that is reflected on the analysis table (Table 13), in the field “Main aspects”.

The table analysis structure starts with the “Category - Subcategory” grouping, followed by the “Main Aspects” (as discussed previously), the cases (“Pilot”, “Ceramic”, “Footwear” and “Cosmetics”) which brings a brief resume of the highlights of the case in each aspect, and finally the “Cross-Case Convergence” with the result of the analysis, divided between “Convergent”, “Neutral” or “Divergent”.

The “Convergent” aspects are those in which the description is exactly the same in all the cases or with very few differences, which means that this aspect is prone to be the same in almost every S&OE application and can be generalized with a high degree of reliability. The aspects classified as “Neutral” present slightly different descriptions, expressive enough to generate customizations, but not enough to be considered a totally different scenario in each case, e.g. the S&OE calendar of activities. “Neutral” aspects can be generalized with a certain level of reliability, but with reservations. Finally, “Divergent” aspects are the ones that each case presents a very different scenario, being hard to generalize and describe with precision in the proposition model. Usually, they are closely related to the company’s characteristics, procedures or leadership, which make them a very particular aspect for each case and can be totally adapted to the company’s reality in a S&OE implementation.

| Categories and Subcategories | Main Aspects | Pilot | Ceramic | Footwear | Cosmetics | Cross-Case Convergence |
|---|---|---|---|---|---|---|
| **S&OE process - Process Model** | **Definition** | A process that unfolds S&OP short-term planning. It brings consensus between the areas, resolve conflicts. | A process that connects the tactical planning with the operational planning (S&OP to Operational Orders Management), treating deviations, looking for opportunities and managing customer service through clear prioritization rules. | A process that connects S&OP to the execution, using MPS and MRP, reacting inside the month to change the plans according to the incoming orders, analyzing opportunities and treating deviations. | A planning process between S&OP and Order Management (short-term planning), that provides integration between the areas, identify opportunities in the KPIs and work around restrictions. | Convergent |
| | **Horizon** | 2 to 3 months. | 1 month for regular production plan and 3 months for low-frequency production lots. | 2 or 3 months. | 3 months. | Convergent |
| | **Frozen horizon** | Usual frozen horizon: frozen period is current week (week 0), slushy period is weeks 1 to 8 and liquid period is month 2 and on. | No frozen period, since order programming is done almost simultaneously with scheduling (close to a make-to-order logic). | Sandals: no frozen period for technology, current month (m0) only for volume; Sports Goods: m0, due to purchasing lead time (can only reprioritize programmed orders inside the month. | Frozen period is week 0 for production and week 0 and 1 for purchasing, slushy period is only for production in week 1and the rest of the horizon is liquid period. | Divergent. The time span of frozen period varies a lot from one case to another. This aspect is closely related to lead times (both production and purchasing), making it very particular to each company. |
| | **Bucket** | Weekly. | Weekly. | Weekly. | Weekly. | Convergent |
| | **Product aggregation level** | Usually SKU. | Smaller than in S&OP: can be SKU or sub-family, depending on the necessity of analysis. | SKU or sub-family, depending on the BU. | SKU or sub-family, depending on the criticality of the product/raw materials involved. | Convergent |

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|---|---|---|---|---|---|---|
| **S&OE process - Process Model** | **Steps** | 5 steps: Disaggregate plans, generate and program orders, evaluate opportunities and deviations, define fulfillment, confirm orders. Non- sequential. | 5 Steps: Disaggregate plans (by product and by sales channel), generate and program orders along with PPC (programs: production and purchasing of finished product; done almost simultaneously with scheduling), evaluate opportunities and deviations (daily basis), define fulfillment (weekly, with an Access tool based in defined priorities by sales channel and weekly meeting that defined the orders that would be fulfilled), confirm orders. Non- sequential. | Disaggregate plans (MPS run), generate and program orders (release the program to the factories and PPC check the order book versus inventory and program production runs), evaluate opportunities and deviations (S&OE evaluates the order book daily and re-plans the production based on the actual demand versus the forecasted demand), define fulfillment (weekly meeting), confirm orders (for customer fulfillment). | 5 steps: Disaggregate plans, generate and program orders, evaluate opportunities and deviations, define fulfillment, confirm orders. Non- sequential. | Convergent |
| | **Meeting frequency** | Once or twice a week. | Once a week. | Once a week. | Once a week. | Convergent |
| | **Calendar** | Stablished for the week. | Stablished for the month, but several activities repeat every week. | Stablished for the month, but several activities repeat every week. | Not available. | Neutral. There is a variance from one case to another, but not so expressive. |

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|---|---|---|---|---|---|---|
| **S&OE process - Stakeholders** | **Meeting Owner** | Not available. | S&OE Leader. | S&OE manager. | S&OE manager. | Convergent |
| | **Meeting participants** | Managers, coordinators, analysts and programmers from the involved areas. | Coordinators from the functional areas: inventory, logistics, production, outsourcing, commercial; and S&OE team. | The areas involved are: factory (all the factory managers, PPC from each factory, eventually the industrial manager), supply chain (planning analysts, S&OE manager and corporate integrated planning manager), customer service (senior analyst or manager), logistics (manager or senior manager), business units (national sales manager, product marketing team, direct channels analysts, exportation manager, finance). The financial areas of the business units also participate in the meeting with a certain frequency. Information Technology participates in the process in daily issues, but not so much in the meetings. | Managers or coordinators (if they have the autonomy to make the decisions) of the functional areas: supply chain, demand, BU commercial, BU marketing, communications. | Neutral. The hierarchical position of the participants varies between coordinators and managers. |

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| **S&OE process - Roles and responsibilities** | **S&OE leader and team** | S&OE team: make sure that construction projects approved in the S&OP would be registered in the ERP; follow-up in the projects execution (deviations and opportunities); same with procurement; monitoring of consume pointing in construction | S&OE Leader: aligner role. Should be a neutral person, that must think about the company as a whole, must understand trade-offs. Usually participates in the S&OP process as well. S&OE analysts: responsible for analyzing KPIs, daily follow up of deviations, search for fulfillment opportunities. Must also have a systemic vision and analyze what is the best scenario for the whole company. Coordinators or managers from the areas that will have a degree of integration with S&OE, such as PPC, logistics, sales, S&OP participants). | S&OE manager: coordinate activities, leads the S&OE meeting, align the most important decisions between the business units and the factories. S&OE analysts: responsible for the production planning for the factory, new orders rate, MPS, negotiation, phase-out forum, short-term demand review, reports and KPIs, shop fulfillment support. They also make the S&OE meeting material. | S&OE manager: responsible for the S&OE meeting. The most important role is the one of following the process, identifying opportunities in the KPIs and working with all the restrictions. | Convergent |

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|---|---|---|---|---|---|---|
| **S&OE process - Decision making** | **Scope and triggers** | Execution decisions | The main drivers for the decisions are: regain margin, regain customer, influence stock, improve customer relationship and, mainly, guarantee S&OP's plans and company's strategy. | One important decision inside S&OE is the "unfold" of an order (to bill a sales order partially, e.g. the order is for 200 pairs but there is only 100 available in stock to be billed, the rest needs to be produced). The main drivers for the decisions are to meet the demand, then costs and inventory health. | There is no pre-established fulfillment rule for the decisions, the objective is to serve everybody. There are different rules for every BU and for every sales channel. The margin is quite high, so the company always avoid losing a sale. | Convergent |
| | **Autonomy** | Not available. | Some decisions made by the S&OE team on a daily basis (does not interfere in the next time bucket), other decisions in the S&OE meetings (decisions that affect future time buckets). | Analysts make small, routine decisions. The S&OE manager makes more important decisions, the ones that truly affect the demand, during the S&OE meeting. Customer service is the responsible for checking on a daily basis which customers accept or not the "unfold", and S&OE decides if it will be done or not. | Decisions are taken by the people that participates in the meetings and are communicated in a meeting minute and shared for the group, depending on the size and nature of the problem. | Convergent |
| **S&OE process - Functional areas** | **Owners** | Several arrangements for the functional area, depending on the company structure and needs. | The owners of the process were Customer Service Call Center. After a while, it changed to PPC (which is normally the owner). | S&OE in inserted in the Supply Chain directory, that answers directly to the CEO. | The main owners are Supply Chain, but it is shared with other BUs. | Neutral. Several arrangements are possible, but usually it is Supply Chain or Planning (that, in most cases, is also under Supply Chain). |

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|---|---|---|---|---|---|---|
| **S&OE process - Tools and technologies** | **Supporting technologies** | ERP systems. | ERP, MPS and MRP functionalities, warehouse management modules, BI tools, Excel. | ERP clothing solution, Web Portal, BI tool. | Used to run MPS and MRP, but now it is only APS. | Convergent. Despite the APS being more sophisticated than a regular ERP, the difference between them is not so expressive. |
| | **S&OE cockpit** | Information tool with logic to operationalize the process. | Access tool for fulfillment definition and decisions, KPIs dashboard in Excel. | Excel. | APS. | Neutral. The difference between the sophistication of the tool employed varies greatly, depending on the company's necessity and level of maturity in S&OE. However, the most used tools are Excel or Access. |
| **S&OE processes - Key Performance Indicators** | **Key Performance Indicators** | On Time In Full (OTIF), adherence to the distribution program, adherence to the production program, stock-out and excess stock, adherence to purchasing program, change in sales orders. | Delayed money value (based on revenue percentage), inventory health and daily billing, changes in sales orders, adherence of the production/purchasing program, inventory stock management, OTIF, orders with delayed promised date. | "Leakage" (which is the order book backlog that is not fulfilled when the month ends), pending level (demand that cannot be met with stock and has to wait for production), inventory health. | Service level, inventory levels (open by types of inventory, such as useful, excess, blocked, reproved, among others). | Convergent |

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|---|---|---|---|---|---|---|
| **S&OE process - Process dynamism** | **Adaptability** | S&OE can be applied in any business model, both product based and service based types. After the model is adapted to the company's peculiarities and implemented, it perfects itself every new cycle. | Very dynamic and adaptable. The process adaptation can be easy or difficult, depending if the people are adept or resistant to changes, but it must be neutral, or all adaptations will tend to benefit more the powerful areas. | S&OE is very dynamic, flexible and always evolving. Changes in the process can happen, depending on the year time, the scenario and context in which the company is inserted. | It is a process that evolved a lot comparing to the design phase, adapting itself to many changes in the reality of each sales channel. | Convergent |
| **Relevance - Strategic alignment** | **Strategic alignment** | Validation of the models with operational team, management, directory, sponsors and CEO. | S&OE enables evolution in reliability, aligns the strategy to the fulfillment rules and prioritization criteria, aligns strategic KPIs and guarantee that S&OP plans will be met and orders will be fulfilled. | S&OE ensures the respect for the fulfillment prioritization, ensures that the fabric will be directed to the demand fulfillment, ensures that they are making the best possible decisions to meet the demand and the demand fulfillment and billing. | S&OE teams participate in the strategic planning, valuable inputs from the short-term planning and daily operations. | Neutral. It is a consensus that S&OE is aligned with the company's strategy, but in each company it helps in a different way, depending on the context. |
| **Relevance - Value creation** | **Value creation** | S&OE makes the planning tangible. | S&OE minimizes costs related to operational inefficiencies and potentiates the revenue, by minimizing deviations and increasing opportunities. | S&OE helps in the short-term reactions, making sure the demand will be met, almost optimizing the process. | S&OE enables the goal of service level, provides integration between the processes and between functional areas and is vital to the execution of the strategies of the BUs. | Convergent |

| | | | | | | |
|---|---|---|---|---|---|---|
| **Relevance - Goals and expectations** | **Goals** | Unfolds S&OP plans to the short-term planning, bringing stability to the execution | The main goal of S&OE is to balance demand and availability, manage problems and challenges that rise in the short term and seeks service level improvement. | The margin is very high, so the goal is always to fulfill the demand and balance inventory. | The main goal is always service level. | Convergent |
| | **Expectations** | Expectation of the process model adaptations in other business models. | Not available. | The S&OE team seeks to keep improving their efficiency, through changes and improvements in the process, as well as advances in technology, new fulfillment models for strategic growth in international market, integrate financial KPIs in routine analysis. | The main expectation is the increase in the frequency that S&OE runs, automating the process a little. The processes will have to be restructured again soon, because the business keeps evolving and growing. | Divergent. This aspect is very intrinsic to each company. |

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|---|---|---|---|---|---|---|
| **History - Implementation** | **Implemen-tation** | Usually the companies already have an S&OP. S&OE parameters are determined in the S&OP. The design process starts understanding the reality of the company, followed by a proposal construction that involves the company employees and the consultants. There are validation stages, project follow-up meetings and implementation adherence analysis, to make sure all that was implemented is coherent. | A whole planning hierarchy was implemented. The project followed the steps of visibility, design, implementation and stabilization. In accordance with the agile startup logic, constant cycles of design, implementation and stabilization followed. | In a 3 years project with a consulting group, it was implemented S&OE, S&OP and a project to provide visibility and control of the shop floor. | The implementation happened with the restructuring of all the planning processes of the group, and performed in 3 waves (focus in the processes, implementation of the APS technology and focus in data quality). | Convergent |
| **History - Motivation** | **Motivation** | Operation was nervous, the company was inserted in high variability environments. | Order backlog was a problem, there was a lot of customer complaints about it. There was a scenario of customer dissatisfaction, loss of sales, loss of margin, stock out, delivery delays and demand greater than production capacity. | The motivation was to transform operations to follow the new complexity that it was facing. If the operations stayed the way it was, the company would have collapsed, because they could not handle the complexity. | Traditional MPS/MRP planning hierarchy was used, but they realized it was not going to be enough for the new reality that was coming: an increase of complexity in the supply chain, (three new BUs). | Neutral. Some cases needed to improve customer service, the others were facing complexity issues |
| **History - Investment** | **Investment** | Consulting group | Consulting group | Consulting group, ABAP team for AFS customization, staff hiring. | Consulting group, acquisition of APS, analytics implementations, staff hiring. | Convergent |

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|---|---|---|---|---|---|---|
| **History - Changes** | **Process** | Not available. | A functionality inside the ERP that disaggregates the plans, provide the schedules and program the sales orders. | From a centralized MPS, run once a month, with poorly executed deployment and minor daily adjustments, to a planning structure with S&OP that discusses demand, discusses trade-offs, production leveling, among other activities, all aligned with the S&OE and its feedback logic into the S&OP. | Division of the planning horizons, instead of the same team analyzing everything as only one horizon, and leaving the restrictions to the plan to be treated later. | Neutral. Every company had its own changes, depending on the planning scenario that it was inserted before the implementation. However, changes in the process and in people are very similar. |
| | **System** | Not available. | System adaptations, fulfillment rules as input to an Access tool. | Not available. | Implementation of the APS. | |
| | **Organizational** | Not available. | Creation of a new functional area and end of the manual allocator function. | Not available. | New technical coordination structure with several planners that are responsible for maintenance in the tools. | |
| | **People** | People have to start seeing the benefits to trust the new process so that they start changing their habits. Otherwise, they keep doing their old tasks in parallel. | On-the-job training to those involved. | Trainings for the stakeholders. | Training for the team, both in processes theory and technology capacitation | |

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|---|---|---|---|---|---|---|
| **History - Efforts** | **Efforts** | The major efforts usually are: when data quality in the system is insufficient to perform a good execution, to get people involved and development of the monitoring tool is laborious. | People is always the greatest effort, for they are usually reluctant with changes, especially in the organizational structure; eventually systems can be a difficulty, but that is easy to overcome; using the agile startup method, the implementation effort can be easy. | The implementation of the process was fast and complex, especially regarding technology implementation, with a heavy workload. The greatest challenges were: the implementation of the project to provide visibility and control of the shop floor, parameterization of systems and transition to the new operations (the stabilization phase was more complex than the implementation itself). Culturally speaking, it was easy, since the company embraces changes. | The efforts were very high and the greatest challenges were: people's mindset (to make them realize the magnitude and value that this new process would have in the company and the great advantage that they have for running a process like S&OE, also to make them start looking at different horizons) and forgetting to deal with product launches (inputs of the process not mapped properly). One challenge still not overcome is the consolidation of the S&OP as a reliable process. | Convergent |
| **History - Benefits** | **Benefits** | Reduction of inventories, cash flow release, less waste and more control over the investments, reduction of inventory levels without harming the service level, visibility for the leadership about future demands and necessary investments. | Improvements in service level, integration between functional areas, costs decrease, revenue growth, 80% less delayed volume, OTIF improved in 12%, 40% less changes in sales order, 20% increase in the adherence of the production program, increased data reliability. | Improvement in service level, improvement in customer service, higher profitability, more visibility of the short-term operations to the planning and commercial areas. | More integration between the BUs, improvement in service and inventory KPIs, increase in the chain flexibility (more revenue coming from flexibility). | Convergent |

*Table 13 - Cross-case convergence analysis*
Source: Made by the author

## 4.4 Proposition

After careful analysis of all the data collected in the case studies, first individually and followed by a cross-case convergence, it is possible the proposition of formalization of a transferable model of the S&OE process, including a definition of S&OE, a modeling in BPMN and highlights of the key characteristics (such as most common KPIs, stakeholders, among others).

### 4.4.1 S&OE definition

First, what is the Sales and Operations Execution process?

Sales and Operations Execution process, or simply S&OE, is a process that connects the tactical planning to the operational planning and execution, through the unfolding of the tactical plans into less aggregated information, with a shorter horizon and more frequent time bucket, looking for opportunities, reacting to deviations and managing the impacts of the demand volatility to guarantee the fulfillment via the integration between functional areas. It is the guardian that secures the alignment between what was planned and what is, in fact, being executed.

And what does that mean?

S&OE disaggregate the plans generated in the tactical level, usually S&OP plans, into programs with lower product aggregation level (e.g. product families to sub-families or SKUs), looking at a shorter horizon (e.g. 12 or 18 months to 3 months) and divided by a more frequent time bucket (e.g. month to week). In the planning hierarchy, S&OE would be displayed between the second and third layers of Anthony's triangle (ANTHONY, 1965), as shown in Figure 8.


*Figure 8 - S&OE representation in the planning hierarchy using Anthony's triangle*

Source: Made by the author

### 4.4.2 Main characteristics of S&OE

The main characteristics of a process help to illustrate how the process works, its peculiarities and how does it add value to the stakeholders. A tabulation of the proposition of those characteristics is found in Table 14. Notice that the aspects presented are only the ones that were classified as “Convergent” or “Neutral”, due to the particularity and individuality of each company in the “Divergent” aspects.

| **Categories and Subcategories** | **Main Aspects** | **General model proposition** |
|---|---|---|
| **S&OE process - Process Model** | **Horizon** | 3 months (m0 to m2). |
| | **Bucket** | Weekly. |
| | **Product aggregation level** | SKU for critical products, sub-family for non-critic products. |
| | **Steps** | 5 steps displayed in the process modeling in BPMN. |
| | **Meeting frequency** | Once a week. |
| | **Calendar** | Stablished for the month, but with several activities that repeat every week. |
| **S&OE process - Stakeholders** | **Meeting Owner** | S&OE leader. |
| | **Meeting participants** | Managers or coordinators (depending on the decision autonomy of each position in the company's hierarchy), from the areas: production, industrial, inventory, logistics, sales, supply chain, marketing, outsourcing, export, finance and IT, as long as it is coherent with the company's context and structure. |
| **S&OE process - Roles and responsibilities** | **S&OE leader** | Manager or coordinator, depending where S&OE is positioned in the company's hierarchy. Unbiased person, responsible for coordination of S&OE activities with an aligner role (find the best consensus). Owner of the S&OE weekly meeting and participant in the S&OP meeting. |

| | | |
|---|---|---|
| | **S&OE team** | Team of analysts responsible for running the systems to generate the programs, analyzing information to elaborate reports, monitoring KPIs, daily following-up deviations and looking for opportunities. Must have autonomy for making small, routine decisions. |
| **S&OE process - Decision making** | **Scope and triggers** | Guarantee S&OP's plans, balance order book with production and purchasing plan, ensure fulfillment maintaining the agreed service level. |
| | **Autonomy** | Routine decisions that are provided in daily operations, enabled by the intrinsic flexibility of the company, can be made by the S&OE team, as long as they have the knowledge and autonomy to do so. Decisions that affect longer periods, sometimes even leaving S&OE's horizon, that impact several functional areas or that can represent risky trade-offs, should be made by the forum present in the S&OE weekly meeting. |
| **S&OE process - Functional areas** | **Owners** | Production Planning and Control or Supply Chain, depending on the company's organizational structure. |
| **S&OE process - Tools and technologies** | **Supporting technologies** | Usually an ERP system, with MPS and MRP functionalities serve well. However, an APS can be used if the company has a high maturity in their IT processes. |
| | **S&OE cockpit** | Can be followed in an Excel or Access tool. In case the company has an APS, the cockpit can be followed inside the system. |
| **S&OE processes - Key Performance Indicators** | **Key Performance Indicators** | S&OE KPIs are usually associated with service level, order fulfillment and balance between production and order book. Common used KPIs are: OTIF (On Time In Full), adherence to the programs (production, distribution, purchasing), inventory health (stock out, excess stock, reproved stock, etc.), service level, backlog, change in sales order, among others. The choice of the KPIs that will be monitored depends on the company's strategies and adequacy to the business model. |

| | | |
|---|---|---|
| **S&OE process - Process dynamism** | **Adaptability** | Very dynamic, can be adapted to almost every type of business model and operation, being shaped according to the necessity. Over time, after several cycles of S&OE, the necessary adjustments are made and the process keep perfecting itself. |
| **Relevance - Strategic alignment** | **Strategic alignment** | S&OE is an enabling process, that aligns with strategy by ensuring that the drivers for the business agreed in the strategic planning and passed to the S&OP will be respected in the execution. E.g. ensuring demand will always be met, keeping service level as a priority, guaranteeing that the prioritization rules for fulfillment will be respected. It also aligns the strategic KPIs for operations and is the guardian of the S&OP process (plans will be met). |
| **Relevance - Value creation** | **Value creation** | S&OE creates value by making the S&OP plans tangible, through reaction in the short-term to changes in demand forecasts, sales orders and minimizing inefficiencies costs related to rescheduling of production and sales orders. |
| **Relevance - Goals and expectations** | **Goals** | S&OE main goals are to connect tactical planning to operational planning, unfold the tactical plans into less aggregated information, balance demand and availability, maintain the service level agreement and bring stability to the execution. |
| **History - Implementation** | **Implementation** | Implementation of S&OE usually comes in times of difficulty or crisis, when the company seeks for a new solution to deal with variabilities in the supply chain and improve service level and fulfillment management. It can be very hard, especially if the people is not cooperating and embracing change, if the systems require a lot of customization or if there is the restructuring of other processes in the company at the same time. |
| **History - Motivation** | **Motivation** | Usually derives from problems in the order fulfillment process, such as low service levels or customer dissatisfaction. The motives can also be difficulties in managing the variability in the supply chain or dealing with an unexpected and accelerated growth that is compromising operations. |

| | | |
|---|---|---|
| **History - Investment** | **Investment** | It is very common to hire a consulting group to help in the implementation, providing additional manpower and transferring knowledge and best practices. Another common investment is in new or improved technology (customizations or even new systems) to facilitate the process. |
| **History - Changes** | **Process** | Restructuring of the planning process, assigning more defined roles for each planning step, redesigning the operations to better level production and decrease nervousness. |
| | **System** | Some system adaptations or new systems implementations. Desired, but not mandatory. |
| | **Organizational** | There is usually the creation of a new functional area (management or coordination) dedicated to S&OE. |
| | **People** | Training in the new processes and tools is required to capacitate the team to run S&OE accordingly. |
| **History - Efforts** | **Efforts** | Major efforts and challenges are: resistance from people, systems parametrizations, data quality, implementation of other related processes at the same time, heavy workload during the implementation. |
| **History - Benefits** | **Benefits** | Most common observed benefits are: improvement in service level, reduction of inventories, integration between areas, revenue growth, costs reduction, higher flexibility in the supply chain, among others. |

*Table 14 - General model proposition of S&OE aspects*
Source: Made by the author

### 4.4.3 Process modeling in BPMN

As already presented previously in the “Literature Review” chapter, to properly represent the steps of the process, the usage of a modeling language is necessary. Due to the renown of BPMN in modeling applications, this was the notation chosen in this dissertation. The modeling of the process reflects the five steps mentioned in the cases, that are not linear, with some activities being performed daily and other only once a week (such as the S&OE meeting).

The proposed model can be seen in the figures below (Figure 9 to Figure 14).

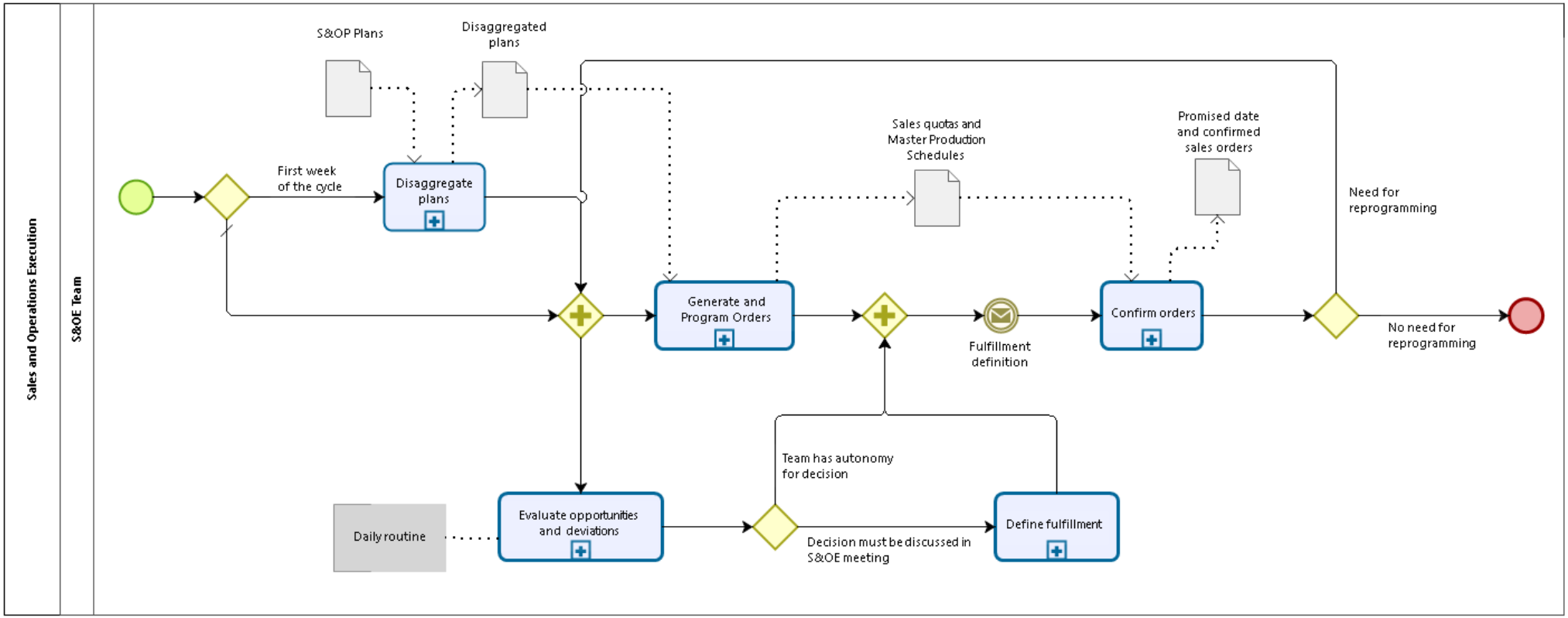


*Figure 9 - BPMN model of S&OE process*
Source: Made by the author

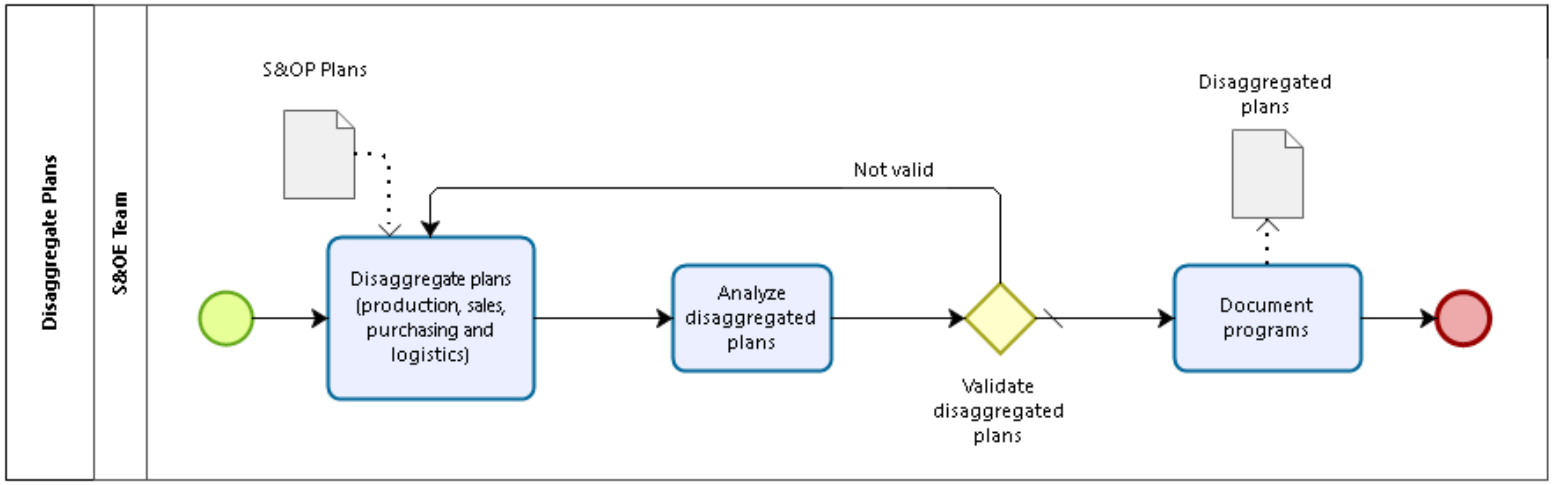


*Figure 10 - BPMN model of S&OE process: Disaggregate Plans*
Source: Made by the author

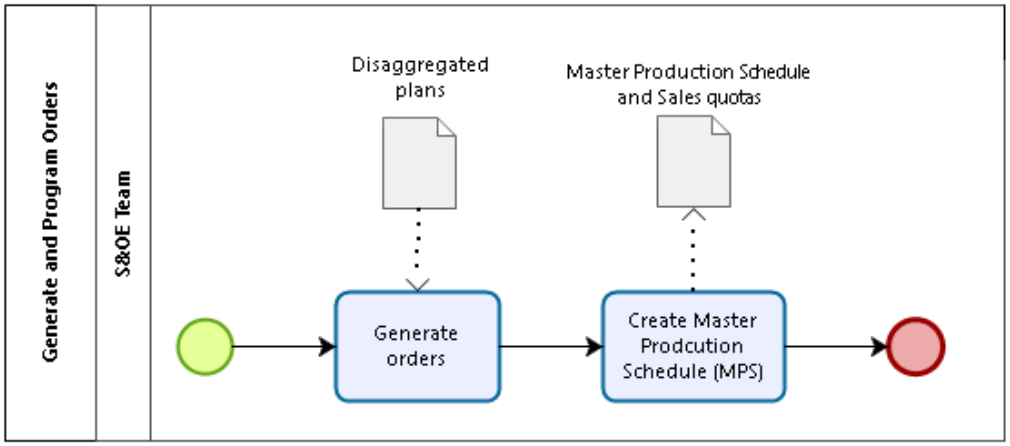


*Figure 11 - BPMN model of S&OE process: Generate and Program Orders*
Source: Made by the author

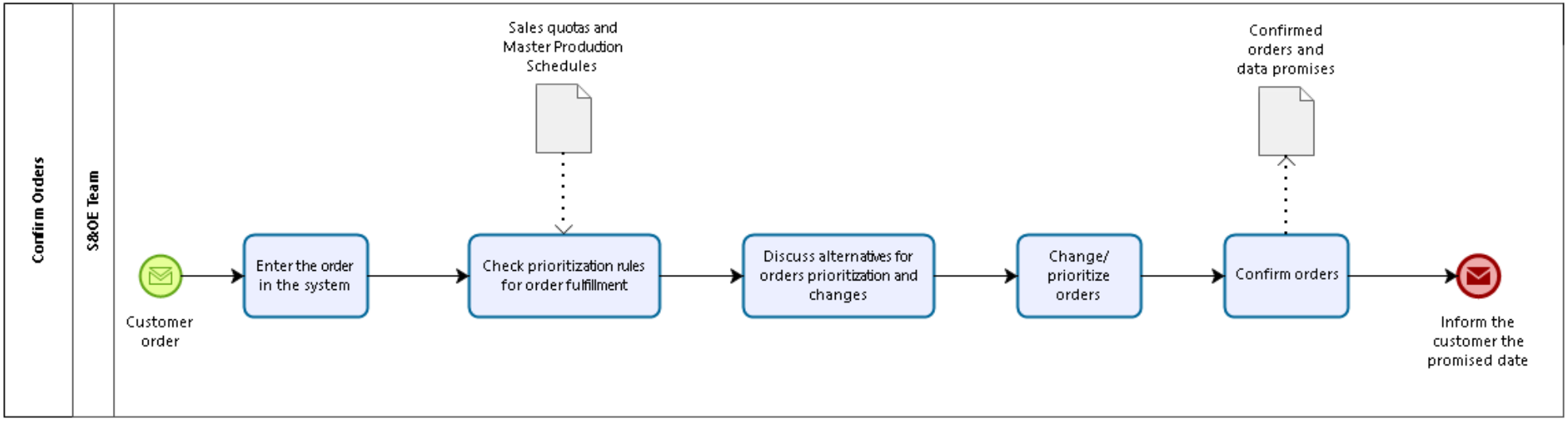


*Figure 12 - BPMN model of S&OE process: Confirm Orders*
Source: Made by the author

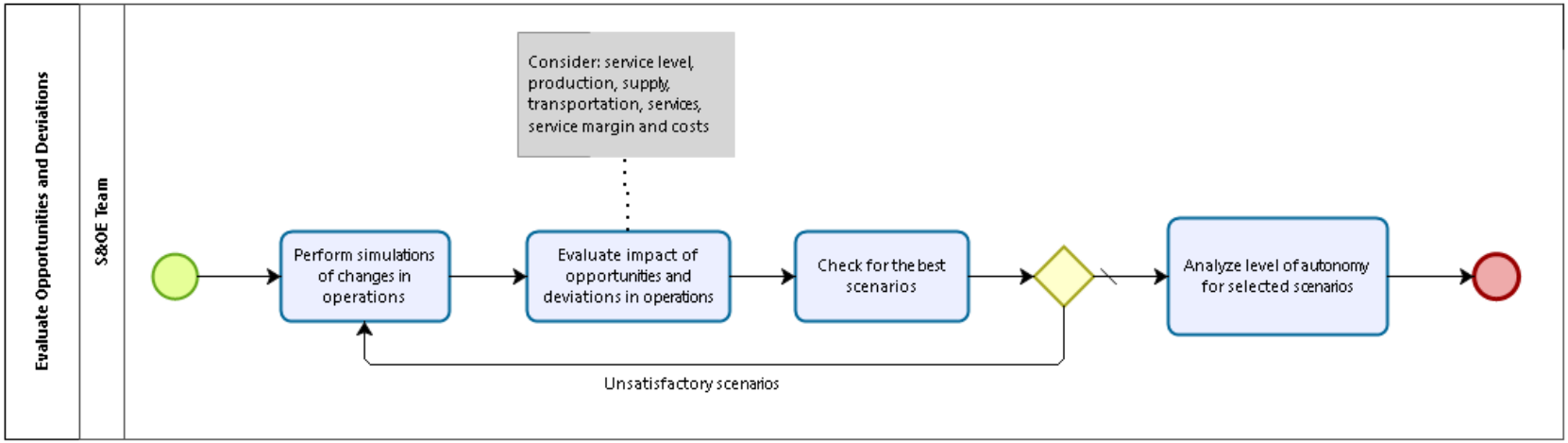


*Figure 13 - BPMN model of S&OE process: Evaluate Opportunities and Deviations*
Source: Made by the author

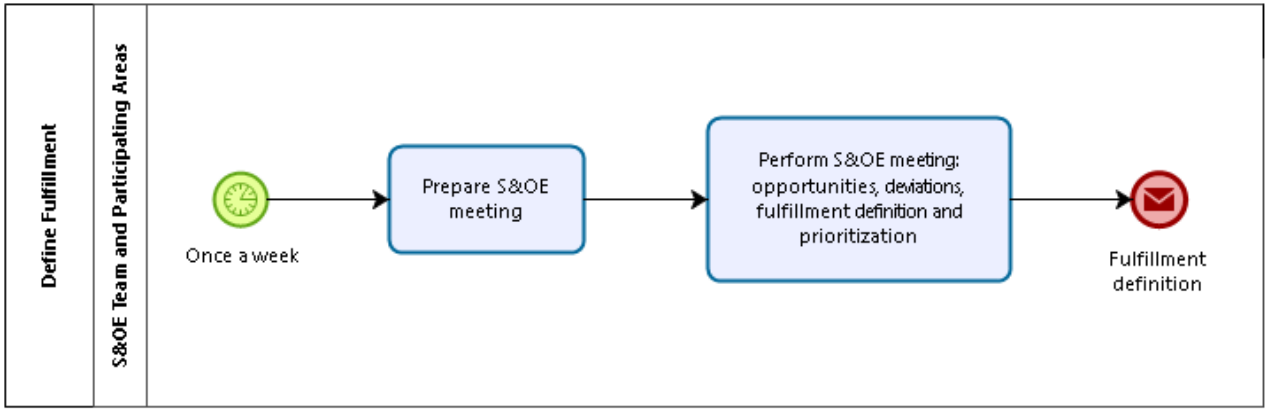


*Figure 14 - BPMN model of S&OE process: Define Fulfillment*
Source: Made by the author

## 4.5 Comparison with literature

After careful analysis of individual cases data, followed by cross-case convergence and the effort to propose a transferable model of S&OE, it is possible to compare the proposition with the existing literature on the matter.

There is an explicit lack of references regarding S&OE in the academic literature. The best approximation of a S&OE description in a paper, is the one by Lim, Alpan and Penz (2014). They describe a new planning process, hybrid intermediary between S&OP and MPS, with a weekly planning bucket. Both characteristics are very aligned with the proposition of the S&OP process. In their case study, every month the sales department performs a weekly demand forecast for the next three months, with low product aggregation level, similarly to MPS, but with a weekly bucket. S&OE also looks at a horizon of three months, divided in a weekly bucket and low product aggregation level. Both the processes plan the fulfillment looking at the order book, with a logic of fulfillment date promise based on ATP and scheduled production runs. They also use the MRP to deploy materials requirements.

This paper is the one that describes a process that is, by far, the most similar to S&OE. However, it focuses deeply on the tool developed to run it, and lacks explanation about the process behavior itself, only mentioning a few key processual aspects that are essential to the development of the tool. Therefore, despite being a good approximation of an S&OE, it is still very focused on the technology aspect and does not present a systemic vision, so important to the comprehension and visualization of the process.

That being said, the best source of comparison to the proposed model is still the grey literature, especially the webinar from Gartner presented by Pukkila (2016). The main highlights that can be pointed from the comparison between Pukkila's webinar and the S&OE proposition in this dissertation are shown in Table 15. Some aspects were omitted in the analysis, since not all of them are discussed in the webinar, e.g. the process steps.

It is possible to conclude that the proposed model can be seen as a good approximation of a general S&OE model, given the same conditions of application, since it has achieved good cross-case convergence between four case studies in different companies and it has also achieved a very satisfactory degree of convergence to the existing literature on the subject.

| Categories and Subcategories | Main Aspects | General model proposition | Gartner Webinar |
|---|---|---|---|
| **S&OE process - Process Model** | **Horizon** | 3 months (m0 to m2). | 3 months (m0 to m2) |
| | **Bucket** | Weekly. | Weekly. |
| | **Product aggregation level** | SKU for critical products, sub-family for non-critic products. | SKUs. |
| **S&OE process - Roles and responsibilities** | **S&OE leader** | Manager or coordinator, depending where S&OE is positioned in the company's hierarchy. Unbiased person, responsible for coordination of S&OE activities with an aligner role (find the best consensus). Owner of the S&OE weekly meeting and participant in the S&OP meeting. | Supply Chain leader, makes decisions regarding trade-offs. |
| | **S&OE team** | Team of analysts responsible for running the systems to generate the programs, analyzing information to elaborate reports, monitoring KPIs, daily following-up deviations and looking for opportunities. Must have autonomy for making small, routine decisions. | Demand planner and supply planner, also make decisions regarding trade-offs. |
| **S&OE process - Decision making** | **Scope and triggers** | Guarantee S&OP's plans, balance order book with production and purchasing plan, ensure fulfillment maintaining the agreed service level. | Allows corrections in the plans, through adjustments considering the order book. |
| | **Autonomy** | Routine decisions that are provided in daily operations, enabled by the intrinsic flexibility of the company, can be made by the S&OE team, as long as they have the knowledge and autonomy to do so. Decisions that affect longer periods, sometimes even leaving S&OE's horizon, that impact several functional areas or that can represent risky trade-offs, should be made by the forum present in the S&OE weekly meeting. | Decisions made both by the leader and some by the team. |
| **S&OE process - Functional areas** | **Owners** | Production Planning and Control or Supply Chain, depending on the company's organizational structure. | Supply Chain. |
| **S&OE process - Tools and technologies** | **Supporting technologies** | Usually an ERP system, with MPS and MRP functionalities serve well. However, an APS can be used if the company has a high maturity in their IT processes. | ERP |

| | | | |
|---|---|---|---|
| **S&OE processes - Key Performance Indicators** | **Key Performance Indicators** | S&OE KPIs are usually associated with service level, order fulfillment and balance between production and order book. Common used KPIs are: OTIF (On Time In Full), adherence to the programs (production, distribution, purchasing), inventory health (stock out, excess stock, reproved stock, etc.), service level, backlog, change in sales order, among others. The choice of the KPIs that will be monitored depends on the company's strategies and adequacy to the business model. | Forecast consumption, schedule attainment (adherence to the programs) delivery performance (OTIF). |
| **Relevance - Strategic alignment** | **Strategic alignment** | S&OE is an enabling process, that aligns with strategy by ensuring that the drivers for the business agreed in the strategic planning and passed to the S&OP will be respected in the execution. E.g. ensuring demand will always be met, keeping service level as a priority, guaranteeing that the prioritization rules for fulfillment will be respected. It also aligns the strategic KPIs for operations and is the guardian of the S&OP process (plans will be met). | S&OP sets the direction that must be pursued by the operations and S&OE is responsible for analyzing the scenarios and solving problems, with focus on the delivery of S&OP's results but with granularity and frequency small enough to answer specific questions and operate in the business speed. |
| **Relevance - Value creation** | **Value creation** | S&OE creates value by making the S&OP plans tangible, through reaction in the short-term to changes in demand forecasts, sales orders and minimizing inefficiencies costs related to rescheduling of production and sales orders. | The operations flow is smoother, exceptions are detected with anticipation and the problems are solved in the correct forums, with the right stakeholders. |
| **Relevance - Goals and expectations** | **Goals** | S&OE main goals are to connect tactical planning to operational planning, unfold the tactical plans into less aggregated information, balance demand and availability, maintain the service level agreement and bring stability to the execution. | Its main goal is to keep on track S&OP's plans, unfolding S&OP's plans to the short-term planning. |

*Table 15 - Comparison between Gartner's S&OE webinar and S&OE proposition*
Source: Made by the author

# 5 CONCLUSION

This work performed a case study using the steps proposed by Eisenhardt (1989) and the best practices presented by Yin (2005). Through the collection of data from documents and interviews of four cases of companies from different segments (power distribution, ceramic tiles, footwear and cosmetics), it was possible to analyze the S&OE process regarding several aspects that were used as data coding, and answer the following research questions:

- What is the Sales and Operations Execution process and what are its main characteristics?
- Why is the S&OE important to the companies that implement it?
- How does the implementation of the S&OE happen and why do the companies want to implement it?

As main results, we can highlight three: the categorization of the main characteristics of the S&OE process from the case studies, according to level of convergence (Table 13); the general proposition of the key characteristics that a traditional S&OE process should have to guarantee good results (answering to the three research questions); and finally, as a minor result, the proposition of a transferable process model using BPMN language to facilitate understanding, given its universal character. This last one is considered as a minor result due to the aspect of this process modeling being transferable only given the same conditions of application. Considering as a whole, this contribution may be used by the companies that want to adopt the S&OE inside their planning hierarchy as best practices guidance, but not as the universal truth, since each company has its own context and background of market and operations.

A few categories of the process that were analyzed with the objective of convergence analysis were shown to be very particular to each company, presenting divergence in the cross-case analysis (e.g. frozen horizon, future expectations for the process). However, most of the subcategories taken into consideration were liable to be assumed as transferable to other traditional applications, which is an excellent result, adding reliability to the model proposition made in this dissertation.

Some aspects of the S&OE process need to be highlighted. It is possible to perceive that the S&OE is a process that performs the breakdown of the S&OP plans to the execution in a way that is more aligned with the business goals than the traditional MPS application isolated. This breakdown is guaranteed by a few aspects of the process, such as:

- The disaggregation of the plans into a more granular view, allowing a " look into the future" perspective of the forecast but, at the same time, keeping an eye in the actual demand and their impact on the operations;
- Cross-areas consensus meetings, that ensure a view of the global optimum and help avoiding silo culture;
- Definition of service rules to sales orders fulfillment, following the business strategic guidelines, ensuring that daily unforeseen events do not drive the execution away from the company's goals;
- A whole step dedicated exclusively to the analysis of opportunities and deviations generated by the order fulfillment;
- High level of S&OP integration, including analyzing of deviations and opportunities to be taken into consideration in the S&OP process;
- Balance of forecast and actual demand through monitoring of the order book.

It is possible to conclude that, for companies that suffer in a high volatility environment, or possess characteristics such as high demand uncertainty, a large number of SKUs, quick marketing campaigns and product life cycle and an agile supply chain strategy, implementation of an S&OE process to help them dealing with daily uncertainties may add great value to the overall company performance.

## 5.1 Limitations and opportunities for future works

The major limitation of this work is the fact that it is one of the first researches on the subject, implicating in: lack of literature, especially academic, to base the studies and to perform the comparison against the results; a great amount of data to be analyzed and categorized given the novelty of all the information gathered; the results and conclusion that are still embryonic to the discussion, due to the exploratory character that this work assumes. Another limitation is that the case studies were performed only in Brazil, which can possibly add a regional bias. Another limitation is the fact that all the companies studied in the cases used the aid of a consulting group to implement the process, using expert know-how in the project, possibly facilitating the implementation efforts.

This dissertation serves as a first step towards theory building and it aims to open a wide range of discussions on the subject, serving its purpose of an exploratory research. All the future works that evolve from this one will be able to focus on more specific aspects of the process, therefore originating more assertive results. As suggestion for future works that focus

in improving in the limitations of this one, is to perform more case studies, both in Brazil and in different countries, to verify the validity of the transferable propositions brought here but also to reduce the probability of regional bias. Another suggestion is to perform studies in companies that implemented the S&OE by themselves, analyzing success factors and main pitfalls.

However, to take this general proposition to another level, it is recommended to explore the branches of subjects that are naturally born in an exploratory study. One of the most recurring questions during the elaboration of this dissertation is the discussion of the inclusion of the S&OE in the traditional planning hierarchy. Should another level be included in Anthony's triangle or not? How representative is the necessity of the S&OE when the universe of the business types studied is expanded, and not only companies inserted in a volatile and dynamic context?

Another approach would be towards the technology aspects behind the planning and control systems. A study that could be performed is one focused on developed tools and enabling technologies, to deeply understand all the system integrations of the process, which can be very intricated and complex. In that sense, it is convenient to approach the connection of the S&OE process and industries 4.0 and how one can feedback the other using real time data access, analytics and Internet-of-Things.

Another road that can be taken in this expansion is the verification of the synergy between the S&OE process and the both the Agile and Demand Driven supply chains. S&OE could be seen as a process that contributes, or even enables, supply chain strategies that focus on keeping up with demand changes in the quickest way possible.

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# Appendix A – Search results documentation

Represented here is the documentation used to perform the searches in the databases, including the number of results, which documents were selected for deeper reading, their relevance in the search index and their degree of alignment with S&OE. The first inclusion criteria were reading the title, abstract and key-words. In some cases, the whole article content was also briefly examined, as to avoid the exclusion of any articles that could be relevant.

The databases used for the research were: Emerald Insight, Science Direct, Web of Science, EBSCO and SciELO. Within EBSCO, the databases consulted were:

- Academic Search Premier
- Information Science & Technology Abstracts (ISTA)
- eBook Collection (EBSCOhost)
- Computers & Applied Sciences Complete
- Business Book Summaries
- Regional Business News
- American Doctoral Dissertations
- Business Source Complete

The first search was in March 1st 2016, with constant updates to check the possibility of new publications. The last update was in October 17th 2016.

The searches considered all the available fields, or "Anywhere" ("Topic" for the database Web of Science), and were structured as specific keywords as a result of discussions about the possible words that could be used to search for relevant articles in the academic literature. Broader searches, such as only "S&OP" or "sales and operations planning" were discarded, due to the effort that would be necessary to filter only the relevant material among countless results, since literature about S&OP is extensive, but with few references to weekly S&OP. Systematic literature reviews using elaborated search strings were also discarded, since the main purpose of the SLR is to base studies that dig deeper in specific subjects in an already consolidated literature. Due to the originality of this work, this kind of search methodology could not be well applied in this context.

Subtitles for the documentation are also included.

| ID | Busca | Resultados | | | | | |
|---|---|---|---|---|---|---|---|
| | | Emerald Insight | Science Direct | Web of Science | EBSCO | Scopus | SciELO |
| 1 | "weekly S&OP" | 1 | 0 | 0 | 0 | 0 | 0 |
| 2 | "gestão de atendimento" | 0 | 2 | 0 | 1 | 0 | 0 |
| 3 | "S&OP semanal" | 0 | 0 | 0 | 0 | 0 | 0 |
| 4 | "weekly sales and operations planning" | 1 | 1 | 0 | 0 | 0 | 0 |
| 5 | "frequent S&OP" | 1 | 0 | 0 | 0 | 1 | 0 |
| 6 | "frequent sales and operations planning" | 0 | 0 | 0 | 0 | 0 | 0 |
| 7 | "renewal of the S&OP" | 0 | 0 | 0 | 0 | 0 | 0 |
| 8 | "renewal of S&OP" | 0 | 0 | 0 | 0 | 0 | 0 |
| 9 | "S&OP renewal" | 0 | 0 | 0 | 0 | 0 | 0 |
| 10 | "renewal of the sales and operations planning" | 0 | 0 | 0 | 0 | 0 | 0 |
| 11 | "renewal of sales and operations planning" | 0 | 0 | 0 | 0 | 0 | 0 |
| 12 | "sales and operations planning renewal" | 0 | 0 | 0 | 0 | 0 | 0 |
| 13 | weekly and "S&OP" | 23 | 25 | 0 | 1 | 1 | 0 |
| 14 | weekly and "sales and operations planning" | 32 | 32 | 0 | 7 | 5 | 0 |
| 15 | "S&OP" and semanal | 0 | 3 | 0 | 0 | 0 | 0 |
| 16 | "S&OP" and renewal | 3 | 16 | 0 | 1 | 5 | 0 |
| 17 | "sales and operations planning" and renewal | 5 | 1 | 0 | 0 | 3 | 0 |
| 18 | "S&OE" | 9 | 3 | 41 | 8 | 0 | 0 |
| 19 | "sales and operations execution" | 0 | 0 | 0 | 1 | 0 | 0 |

**Legenda:**

- Todos os arquivos retornados são relevantes
- Alguns arquivos retornados são relevantes
- Nenhum arquivo retornado relevante
- Arquivos não disponíveis

*Table 16 - - Search results by keyword and database*
Source: Made by the author

| ID | Base | Autor | Ano | Relevância | Afinidade com o Tema |
|---|---|---|---|---|---|
| 13 | Emerald Insight | GRIMSON e PYKE | 2007 | 4 | Alta |
| 14 | Emerald Insight | GRIMSON e PYKE | 2007 | 3 | Alta |
| 5 | Emerald Insight | IVERT ET AL | 2015 | 1 | Alta |
| 13 | Emerald Insight | IVERT ET AL | 2015 | 1 | Alta |
| 14 | Emerald Insight | IVERT ET AL | 2015 | 6 | Alta |
| 13 | Science Direct | JONSSON e IVERT | 2015 | 8 | Alta |
| 14 | Science Direct | JONSSON e IVERT | 2015 | 17 | Alta |
| 14 | Emerald Insight | JONSSON e MYRELID | 2016 | 14 | Alta |
| 14 | Science Direct | LIM, ALPAN e PENZ | 2014 | 4 | Alta |
| 13 | Science Direct | THOMÉ ET AL | 2012 | 4 | Alta |
| 14 | Science Direct | THOMÉ ET AL | 2012 | 5 | Alta |
| 14 | Emerald Insight | COLLIN e LORENZIN | 2006 | 8 | Baixa |
| 13 | Emerald Insight | GORETZKI e MESSNER | 2016 | 21 | Baixa |
| 14 | Emerald Insight | GORETZKI e MESSNER | 2016 | 21 | Baixa |
| 4 | Science Direct | LIM, ALPAN e PENZ | 2013 | 1 | Baixa |
| 14 | Science Direct | LIM, ALPAN e PENZ | 2013 | 3 | Baixa |
| 13 | EBSCO | CAULFIELD | 2013 | 1 | Média |
| 14 | EBSCO | CAULFIELD | 2013 | 1 | Média |
| 4 | Emerald Insight | CHAE | 2009 | 1 | Média |
| 13 | Emerald Insight | CHAE | 2009 | 9 | Média |
| 14 | Emerald Insight | CHAE | 2009 | 9 | Média |
| 1 | Emerald Insight | GOH e ELDRIDGE | 2015 | 1 | Média |
| 13 | Emerald Insight | GOH e ELDRIDGE | 2015 | 3 | Média |
| 14 | Emerald Insight | GOH e ELDRIDGE | 2015 | 2 | Média |
| 14 | Emerald Insight | GUSTAVSSON | 2008 | 10 | Média |
| 13 | Science Direct | CHEN e COCHRAN | 2005 | 10 | Nenhuma |
| 13 | Science Direct | FENG, D'AMOURS e BEAUREGARD | 2008 | 3 | Nenhuma |
| 14 | Science Direct | FENG, D'AMOURS e BEAUREGARD | 2008 | 6 | Nenhuma |
| 13 | Emerald Insight | GIANESI | 1998 | 11 | Nenhuma |
| 14 | Emerald Insight | GIANESI | 1998 | 7 | Nenhuma |
| 13 | Emerald Insight | GODSELL, BIRTWISTLE e HOEK | 2010 | 7 | Nenhuma |
| 14 | Emerald Insight | GODSELL, BIRTWISTLE e HOEK | 2010 | 23 | Nenhuma |
| 13 | Emerald Insight | IVERT e JONSSON | 2010 | 5 | Nenhuma |
| 14 | Emerald Insight | IVERT e JONSSON | 2010 | 5 | Nenhuma |
| 13 | Emerald Insight | IVERT e JONSSON | 2014 | 2 | Nenhuma |
| 14 | Emerald Insight | IVERT e JONSSON | 2014 | 4 | Nenhuma |
| 14 | Emerald Insight | JONSSON, KJELLSDOTTER e RUDBERG | 2007 | 13 | Nenhuma |
| 13 | Science Direct | MATSEBATLELA e MPOFU | 2015 | 18 | Nenhuma |
| 14 | Science Direct | MICLO ET AL | 2016 | 10 | Nenhuma |
| 14 | Science Direct | OLHAGER | 2010 | 13 | Nenhuma |
| 13 | Science Direct | OLIVA e WATSON | 2011 | 14 | Nenhuma |
| 14 | Science Direct | OLIVA e WATSON | 2011 | 7 | Nenhuma |
| 13 | Science Direct | SOUZA | 2014 | 12 | Nenhuma |
| 14 | Science Direct | SOUZA | 2014 | 15 | Nenhuma |
| 13 | Emerald Insight | SWAIM ET AL | 2016 | 6 | Nenhuma |
| 14 | Emerald Insight | SWAIM ET AL | 2016 | 1 | Nenhuma |

| Legenda: | Afinidade com o Tema |
|---|---|
| Alta | Aborda o tema de maneira detalhada |
| Média | Aborda o tema com poucos detalhes |
| Baixa | Apenas cita o tema, sem nenhum detalhamento |
| Nenhuma | Não menciona o tema |

*Table 17 -Detailing of all analyzed articles about S&OE, by search ID*
Source: Made by the author

# Appendix B – Case study protocol and interview guide

## 1 General overview of the case study project

The main objective of this study is to formalize the process of Sales and Operations Execution (S&OE) with the investigation of the process of S&OE through case studies with four Brazilian companies of different sectors, identifying its main characteristics, such as its differences from S&OP, main perceived gains, greater challenges, among others. As a result, it will present a general model of the process, using BPMN notation, as well as other particularities of the process, such as objectives, most used indicators, necessary tools, key stakeholders, among others.

This study is approved by the research ethics committee – letters and human sciences from the Université de Sherbrooke, and all the documents that must be signed and/or presented to the companies and interviewees to validate the case study are found attached in the end of this protocol. It ensures that all the data collected, as well as the company's and interviewee's names, will remain confidential and will be used for scientific purposes only.

The research received funding from the Brazilian government through CAPES (Coordination for the Improvement of Higher Education Personnel) and from the Canadian government through ELAP (Emerging Leaders in the Americas Program).

The first research question that this work wants to answer is: what is the Sales and Operations Execution process and what are its main characteristics ? There is still no formalized academic definition of this process and no documentations of how does it take place in the companies.

Another research question is: why is the S&OE important to the companies that implement it? In the grey literature review, several papers mention the importance of this process to take the companies' planning processes to another level. It is important to capture the company's point of view on the importance of S&OE.

Finally, the last research question is: how does the implementation of the S&OE happen and why do the companies want to implement it? To truly understand the process nature, it is important to understand what are the challenges involved in its adoption and what leads a company to choose to implement a new process and face all the adversities of changing its planning hierarchy structure.

All the pertaining literature on the subject will be presented on the section of "Literature Review" on the dissertation, that can be sent to the participants if they wish.

## 2 Field procedures

The field procedures comprehend the general sources of information, data collection plan and the interview preparation procedures.

### 2.1 General sources of information

The general sources of information that will be used in this study are:

- public information, available on the companies' websites;
- documents that the companies are encouraged to share to help the understanding of intricate details about the studied process;
- interviews with employees that are professionals of the supply chain or operations management field and that work for companies that are strong candidates for having the S&OE process or similar, since they probably have high demand uncertainty, a large number of Stock Keeping Units (SKU), quick marketing campaigns and product life cycle and an agile supply chain strategy.

### 2.2 Data collection plan

For the data collection plan, one (or more) employees of each company will be invited to participate in a semi-structured interview of about 1 hour and 30 minutes, scheduled according to their availability and at the location of their choice (it can also be done via Skype). They will be asked to answer questions regarding the company's planning process, especially the S&OP process and its integration with short term planning. The interviewee must have deep knowledge about the planning processes in the company. The interviews will be recorded in audio format and notes will be taken by the researcher, if the participant agrees.

Also, the company is encouraged to share documents to help the understanding of intricate details about the studied process. They are not mandatory, will only be asked for if necessary and the company can choose what they want to share, so that confidential and

sensitive information can be protected. All the materials (researcher notes, audios and shared documents) will be used for academic purposes only.

## 2.3 Interview preparation procedures

The first contact will be through e-mail, using a pre-determined template (attached in the end of the protocol as “INVITATION TO PARTICIPATE IN RESEARCH STUDY”). If the company accepts to participate in the study, two documents explaining all the details about the participation, one destined to the authorized company representative and the other to the interviewees, will be sent to formalize the acceptance (attached in the end of the protocol as “INFORMATION AND AUTHORIZATION FORM”, for the authorized company representative, and “INFORMATION AND CONSENT FORM”, for the interviewee). Participation will be voluntary and neither the company nor the interviewee will receive any monetary compensation. All the material, as well as the company’s name, will remain confidential and will be used for academic purposes only. To designate participants and companies, a code will be used. For example, it can be mentioned that the quote comes from "Manager 1". Explanation will be provided demonstrating that the researcher is engaged to respect the requirements of the research ethics committee – letters and human sciences from the Université de Sherbrooke concerning research involving human beings.

For the interview, the only material used will be:

- the interview guide, for the researcher and interviewees;
- a cellphone to record the interview;
- a laptop, a notebook and a pen to take notes.

# 3 Questions of the case study

For the best progress of the interview, it was developed a semi-structured interview guide that will guide the conversation but without limiting the interviewee that may feel free to add as much relevant information as he wants to.

The interview guide was structured considering two possible situations: the company has implemented the S&OE process or not. Therefore, depending on the scenario, different questions will be asked. To do that, the interview guide is divided into three parts: the first one deals with the general overview of the company as well as assess if it has or not

implemented the S&OE process; the second will be used if the company does not have S&OE and it focuses on identifying if they feel the need for or if it would be desirable to have it implemented; and finally, the third part captures the details about the S&OE in the studied company, both current operation as well as the history of the implementation.

The interview guide is presented attached in the end of this protocol as “Interview Guide”.

## 4 Guide to the case study report

This case study report will follow the linear-analytic structure, which means the standard way to perform a research report, including the theme being studied, a literature review on the subject, methodology, results of data collection and conclusions (CHINOSI; TROMBETTA, 2012). It will be presented as a dissertation to the São Carlos School of Engineering of University of São Paulo, to obtain the degree of Master of Science in Production Engineering.

The results will include a transferable model of the process, using BPMN notation, to provide to the scientific community an easy understanding. It will also present, in the form of tables and frameworks, other particularities of the process, such as objectives, most used indicators, necessary tools, key stakeholders, among others.

UNIVERSITÉ DE SHERBROOKE

Sherbrooke, le 10 juillet 2017

Mme Ana Lima De Carvalho
ÉCOLE DE GESTION (études)
Université de Sherbrooke

**N/Réf. 2017-1528/Lima De Carvalho**

**Objet : Approbation finale de votre projet de recherche**

Madame,

Le Comité d'éthique de la recherche – Lettres et sciences humaines a reçu les clarifications ou les modifications demandées concernant votre projet de recherche intitulé **« The Intermediate Link in Planning: a multicase study of the Sales and Operations Execution process ».**

Les documents suivants ont été analysés :

- Formulaire de réponse aux condiftions (F20-933)

Le comité a le plaisir de vous informer que votre projet de recherche a été **approuvé**.

Cette approbation étant **valide jusqu'au 10 juillet 2018**, il est de votre responsabilité de remplir le formulaire de suivi (formulaire F5-LSH) que nous vous ferons parvenir annuellement. Il est également de votre responsabilité d'aviser le comité de toute modification au projet de recherche (formulaire F4-LSH) ou de la fin de votre projet (formulaire F6-LSH). Ces deux derniers formulaires sont disponibles dans Nagano.

Le comité vous remercie d'avoir soumis votre demande d'approbation à son attention et vous souhaite, Madame, le plus grand succès dans la réalisation de cette recherche.

Olivier Laverdière
Président du CÉR - Lettres et sciences humaines
Professeur au département de psychologie
Faculté des lettres et sciences humaines

c. c. Vice-décanat à la recherche
Directeur ou directrice de recherche (le cas échéant)
Service d'appui à la recherche, à l'innovation et à la création (le cas échéant)

**INVITATION TO PARTICIPATE IN RESEARCH STUDY**

Your company is invited to participate in a research study called: "The intermediate link in planning: a multicase study of the sales and operations execution process".

The purpose of this study is to scientifically formalize the planning process that links the Sales and Operations Planning (S&OP) process and a shorter term planning, usually called S&OE (Sales and Operations Execution).

We invite one (or more) of your company's employees to take part in this research study, since we believe your company is a strong candidate for having the S&OE process or similar.

They will participate in an interview of about 1 hour and 30 minutes, scheduled according to their availability and at the location of their choice (it can also be done via Skype). They will be asked to answer questions regarding the company's planning process, especially the S&OP process and its integration with short term planning. The employee who will participate in the interview must have knowledge about the planning processes.

All the material, as well as the company's name, will remain confidential and will be used for scientific purposes only. The sole significant inconvenience for the company is the time the employees will dedicate for the interviews. By participating in this project, your company will contribute to the advancement of knowledge in the field of Production Planning and Control and to the Supply Chain community in general. There will be no direct benefit for the company for the participation in this study.

If the participation in this project interests you, the researcher will forward you an Information and Authorization Form that contains further details regarding the study.

For more information, please contact me through any of the following contacts below.

Best regards,

Ana Lima de Carvalho
Master's Student in Production Engineering
ana.lima.de.carvalho2@usherbrooke.ca
+1 (819) 588-9119

# INFORMATION AND AUTHORIZATION FORM

[Company Name] is invited to participate in a research study. This document describes the study procedures. To take part in the study, the consent section at the end of this document must be signed by an authorized company officer; a signed and dated copy will be returned to the company. **The employees that will participate in the interviews must equally sign a distinct individual Information and Consent Form.**

## Research Study Title

The intermediate link in planning: a multicase study of the sales and operations execution process.

## Researcher Responsible for the Research Study

Ana Lima de Carvalho, research assistant at Université de Sherbrooke and master's student in production engineering in University of São Paulo. Under the supervision of Professor Luis Antonio de Santa-Eulalia of Université de Sherbrooke and Professor Kleber Francisco Espôsto of University of São Paulo. For more information, you may contact the research team by phone or by email at:
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## Funding of the Research Study

The researcher responsible for this study received funding from CAPES (Coordination for the Improvement of Higher Education Personnel) and ELAP (Emerging Leaders in the Americas Program) to carry out this study.

## Purpose of the Research Study

The purpose of this study is to formalize the planning process that links the Sales and Operations Planning (S&OP) and the short term planning, usually called S&OE (Sales and Operations Execution).

## Description of the Research Procedures

We invite one (or more) of [Company Name] employees to take part in this research study because they are professionals of the supply chain or operations management field. In addition, we strongly believe [Company Name] is a candidate for having the S&OE process or similar, since it probably has high demand uncertainty, a large number of Stock Keeping Units (SKU), quick marketing campaigns and product life cycle and an agile supply chain strategy.

They would be invited to participate in an interview of about 1 hour and 30 minutes, scheduled according to their availability and at the location of their choice (it can also be done via Skype). They will be asked to answer questions regarding the company's planning

process, especially the S&OP process and its integration with short term planning. The employee who will participate in the interview must have deep knowledge about the planning processes in the company. If [Company Name] believe that it is desirable the participation of more than one employee, please let us know as soon as possible through an email to the researcher. The interviews will be recorded in audio format and notes will be taken by the researcher, if the employee agrees. Also, the company is encouraged to share documents to help the understanding of intricate details about the studied process. They are not mandatory, will only be asked for if necessary and the company can choose what they want to share, so that confidential and sensitive information can be protected. All the materials (researcher notes, audios and shared documents) will be used for academic purposes only.

Does the company consent the sharing of documents that respect the conditions stated above?

Yes ☐ No ☐ Authorized company officer initials_____

**Potential Benefits**

By participating in this project, [Company Name] will contribute to the advancement of knowledge in the field of Production Planning and Control and to the Supply Chain community in general. There will be no direct benefit for the company for the participation in this study.

**Potential Risks**

The sole significant inconvenience for [Company Name] is the time the employees will dedicate for the interviews.

**Voluntary Participation and the Right to Withdraw**

[Company Name] participation in this research project is voluntary. Therefore, it may refuse to participate. It may also withdraw from the project at any time, without giving any reason, by informing a member of the research team.

If the company withdraw from the study, does it ask that the audio or written documents pertaining to it be destroyed?

Yes ☐ No ☐ Authorized company officer initials_____

In this eventuality, the researcher will validate the company's preferences regarding data destruction.

Any new findings that could influence the company's decision to stay in the research project will be shared as soon as possible.

**Confidentiality**

All the information collected during the research project will remain confidential to the extent provided by law. [Company Name] will only be identified by a code number. The researcher

responsible for this study will keep the key to the code linking the company's name to its study file.

The study data will be stored for 5 years by the researcher responsible for this study for research purposes as described in this Information and Authorization Form.

The data may be published or shared during scientific meetings; however, it will not be possible to identify the company.

For monitoring and control, [Company Name] study file may be examined by a person mandated by regulatory authorities, as well as by representatives of the funding agency, the institution, or the Research Ethics Board. All these individuals and organizations adhere to policies on confidentiality.

[Company Name] have the right to consult the company's study file in order to verify the information gathered, and to have it corrected if necessary.

**Study Results**

If the company wishes to receive a summary of the study results when they are completed, please provide an address

Email: _____

**Contact Information**

If [Company Name] has questions or if it has a problem that may be related to the participation in this research study, or if it would like to withdraw, the company may communicate with the researcher responsible of this research study or with someone on the research team at the following number:

Ana Lima de Carvalho: (819) 588-9119
Luis Antonio de Santa-Eulalia: (819) 821-8000 #65042
Or toll-free at +1 800 267-8337

**Approval of the Research Ethics Board**

The Research Ethics Board of the Université de Sherbrooke (CÉR Lettres et sciences humaines) approved this research and is responsible for the monitoring of the study.

For any question concerning the company's rights as a research participant taking part in this study, or if it has comments, or wish to file a complaint, the company may communicate with the Research Ethics Board at the following phone number 819-821-8000 (or toll free at 1-800-267-8337) extension 62644, or by email at cer_lsh@USherbrooke.ca.

**Signature of the Authorized Company Officer**

I have reviewed the Information and Authorization Form. Both the research study and the Information and Authorization Form were explained to me. My questions were answered, and I was given sufficient time to make a decision. After reflection, I consent one (or more)

employee(s) to participate in this research study in accordance with the conditions stated above.

Yes ☐ No ☐

Name of Authorized Company Officer

Signature Date

**Commitment of the Researcher Responsible of the Research Study**

I certify that this Information and Authorization Form were explained to the authorized company officer, and that his/hers questions were answered.

I undertake, together with the research team, to respect what was agreed upon in the Information and Authorization Form, and to give a signed and dated copy of this form to the company.

Name of the Researcher Responsible

Signature Date

# INFORMATION AND CONSENT FORM

You are invited to participate in a research study. This document describes the study procedures. Feel free to ask questions about any words or paragraphs you do not understand. To take part in the study, you must sign the consent section at the end of this document; a signed and dated copy will be returned to you. Please take all the time you need to make your decision.

## Research Study Title

The intermediate link in planning: a multicase study of the sales and operations execution process.

## Researcher Responsible for the Research Study

Ana Lima de Carvalho, research assistant at Université de Sherbrooke and master's student in production engineering in University of São Paulo. Under the supervision of Professor Luis Antonio de Santa-Eulalia of Université de Sherbrooke and Professor Kleber Francisco Espôsto of University of São Paulo. For more information, you may contact the research team by phone or by email at:
Ana Lima de Carvalho: +1 819-588-9119 ana.lima.de.carvalho2@USherbrooke.ca.
Prof. Luis Antonio de Santa-Eulalia: +1 (819) 821-8000 #65042 L.Santa-Eulalia@USherbrooke.ca
Prof. Kleber Francisco Espôsto: +55 16 3373-8606 kleber@sc.usp.br

## Funding of the Research Study

The researcher responsible for this study received funding from CAPES (Coordination for the Improvement of Higher Education Personnel) and ELAP (Emerging Leaders in the Americas Program) to carry out this study.

## Purpose of the Research Study

The purpose of this study is to formalize the planning process that links the Sales and Operations Planning (S&OP) and the short term planning, usually called S&OE (Sales and Operations Execution).

## Description of the Research Procedures

You are being invited to take part in this research study because you are a professional of the supply chain or operations management field. In addition, we strongly believe your company is a candidate for having the S&OE process or similar, since it probably has high demand uncertainty, a large number of Stock Keeping Units (SKU), quick marketing campaigns and product life cycle and an agile supply chain strategy.

Your participation will involve interview of about 1 hour and 30 minutes, scheduled according to your availability and at the location of your choice (it can also be done via Skype). You will be asked to answer questions regarding your company's planning process, especially the S&OP process and its integration with short term planning. The interview will

be recorded in audio format and notes will be taken by the researcher. They will be used for academic purposes only.

Do you accept that the researcher takes notes during the interview?

Yes ☐ No ☐ Participant's initials_____

Do you accept the recording of the interview?

Yes ☐ No ☐ Participant's initials_____

**Potential Benefits**

By participating in this project, you will contribute to the advancement of knowledge in the field of Production Planning and Control and to the Supply Chain community in general. Also, you will have the opportunity to observe the company's performance, understand better the planning processes and gain awareness of the importance of S&OE process. There will be no direct benefit for you or your company for the participation in this study.

**Potential Risks**

The sole significant inconvenience of your participation is the dedicated time for the interview. You may ask to take a break or to continue the interview at a more convenient time.

**Voluntary Participation and the Right to Withdraw**

Your participation in this research project is voluntary. Therefore, you may refuse to participate. You may also withdraw from the project at any time, without giving any reason, by informing a member of the research team.

If you withdraw from the study, do you ask that the audio/video or written documents pertaining to you be destroyed?

Yes ☐ No ☐ Participant's initials_____

In this eventuality, the researcher will validate your preferences regarding data destruction.

Any new findings that could influence your decision to stay in the research project will be shared with you as soon as possible.

**Confidentiality**

During your participation in this study, the researcher responsible and the research team will collect and record information about you in a study file. They will only collect information required to meet the scientific goals of the study.

Your research file may include information such as your name, sex, audio recording or interviews.

All the information collected during the research project will remain confidential to the extent provided by law. You will only be identified by a code number. The researcher responsible for this study will keep the key to the code linking your name to your study file.

The study data will be stored for 5 years by the researcher responsible for this study for research purposes as described in this Information and Consent Form.

The data may be published or shared during scientific meetings; however, it will not be possible to identify you.

For monitoring and control, your study file may be examined by a person mandated by regulatory authorities, as well as by representatives of the funding agency, the institution, or the Research Ethics Board. All these individuals and organizations adhere to policies on confidentiality.

You have the right to consult your study file in order to verify the information gathered, and to have it corrected if necessary.

**Study Results**

If you wish to receive a summary of the study results when they are completed, please provide an address

Email: _____

**Contact Information**

If you have questions or if you have a problem you think may be related to your participation in this research study, or if you would like to withdraw, you may communicate with the researcher responsible of this research study or with someone on the research team at the following number:

Ana Lima de Carvalho: (819) 588-9119
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**Approval of the Research Ethics Board**

The Research Ethics Board of the Université de Sherbrooke (CÉR Lettres et sciences humaines) approved this research and is responsible for the monitoring of the study.

For any question concerning your rights as a research participant taking part in this study, or if you have comments, or wish to file a complaint, you may communicate with the Research Ethics Board at the following phone number 819-821-8000 (or toll free at 1-800-267-8337) extension 62644, or by email at cer_lsh@USherbrooke.ca.

**Signature of the Participant**

I have reviewed the Information and Consent Form. Both the research study and the Information and Consent Form were explained to me. My questions were answered, and I was

given sufficient time to make a decision. After reflection, I consent to participate in this research study in accordance with the conditions stated above.

Yes ☐ No ☐

Name of participant

Signature Date

**Commitment of the Researcher Responsible of the Research Study**

I certify that this Information and Consent Form were explained to the research participant, and that the questions the participant had were answered.

I undertake, together with the research team, to respect what was agreed upon in the Information and Consent Form, and to give a signed and dated copy of this form to the research participant.

Name of the Researcher Responsible

Signature Date

# Interview Guide

## The Intermediate Link in Planning: a multicase study of the Sales and Operations Execution process

**Name of the Company:**

**Company code:**

**Interviewee Data:**

Name/Code:

Position/Time in position:

Does the participant agree with interview documentation?

☐Yes, researcher notes ☐Yes, recording ☐No

**General Overview:**

1. What are the company's big numbers (e.g. employees, SKUs, global presence, facilities, business units, revenue, market information)?
2. Please speak about the environment in which the company is inserted (volatility, changes in demand preferences, etc.).
3. Explain the hierarchy of planning processes for managing operations in the company?
4. Is there a process that links the Sales and Operations Planning (or similar, e.g. Sales, Inventory and Operations Planning, Integrated Business Plan) with the short-term execution (e.g. Master Production Schedules, order placement)?

**Does not have S&OE:**

If the company does not have an S&OE process (or similar), we will evaluate if they feel the need for it or if it would be desirable to have it implemented.

1. How do you evaluate the planning process in the company?
2. Are there any difficulties in the deployment of S&OP to the execution? Please describe them and why you think that happens.
3. Do these difficulties (if any) affect the company's results? Why?

4. Do you think that the company could benefit from the implementation of a process like S&OE? Why?

**Has S&OE:**

If the company has implemented an S&OE process, we will capture the details about it.

Current S&OE operation:

1. Please tell me about the S&OE process. How does it happen? What are the steps? How does it interact with the S&OP? Where is it inserted in the planning hierarchy?
2. Who are the main stakeholders involved in it? Why?
3. What are the roles and responsibilities in the process?
4. How are decisions made? Who makes them?
5. What are the main drivers for the decisions?
6. Where is S&OE inserted in the organizational structure of the company? (Owners)
7. Which systems and tools are involved with the execution of S&OE (e.g. MRP, MPS, ERP)? Any dedicated tool?
8. How does the company measure S&OE performance? Which KPIs are used?
9. How is the S&OE aligned with the company's strategic goals?
10. In which way do you think the process adds value to the company?
11. Does the process have a dynamic structure, adapting itself to environment changes? How does this flexibility happen? How do the changes in the process take place?

S&OE history:

1. How was the S&OE process implemented in the company and how did the implementation go?
2. When was the process implemented? What were the main motives?
3. What were the main difficulties and how were they overcome?
4. What were the costs to the process implementation? Do you think the return over the investment was worthwhile?

5. What were the necessary changes to the S&OE implementation? Were there any training, new software acquisition, etc.? Were there any changes in S&OP and/or MPS operations?
6. How was the S&OP deployment to the operational level executed before the implementation of the S&OE?
7. In which way would you portray the efforts required for the implementation of the process in the company?
8. Was new knowledge necessary for the implementation of the process?
9. What were the main benefits brought by the process?
10. What are the current goals and expectations for the S&OE process?

# Appendix C – Documentation of results found in the grey literature

| **Author** | **Year*** | **Source** | **Type of material** | **Main highlight on the theme** |
|---|---|---|---|---|
| ACCERA | 2016 | ACCERA | Blog | S&OE (named GATE) |
| ToolsGroup | 2016 | ToolsGroup | White Paper | S&OE |
| Cruz, Gabriel | 2016 | ILOS | Blog | S&OE |
| Adexa | 2016 | Adexa | White Paper | S&OE |
| Julianelli, Leonardo (a) | 2016 | ILOS | Blog | S&OE |
| Bodenstab, Jeff | 2016 | ToolsGroup | Blog | S&OE |
| Hadavi, Cyrus | 2016 | Adexa | Blog | S&OE |
| Masters, Kristin | 2016 | Flexis | Blog | S&OE |
| Huber, Beatris | 2016 | ILOS | Blog | S&OE |
| Pukkila, Marko | 2016 | Gartner Inc. | Webinar | S&OE |
| Domingos, Alexandre | 2015 | Administradores | Blog | S&OE |
| Rollings, Sean | 2015 | Supply Chain 24/7 | Blog | S&OE |
| Bowman, Robert J. | 2011 | Supply Chain Brain | Blog | S&OE |
| Bremer, Franciosi e Pintão | 2009 | Mundo Logística | Magazine article | S&OE (named GATE) |
| Franciosi e Bremer | 2011 | Mundo Logística | Magazine article | S&OE (named GATE) |

*Table 18 - Results about S&OE found in the grey literature*
Source: Made by the author

Year* When the publishing year is not available, date of first access was used

# Appendix D – Researcher notes on the pilot case interview

**1. What is the S&OE?**

**a.** The S&OE is first a conflict resolution process, mainly between commercial and production areas. It is much more than just a tool, like the MPS or a scheduling spreadsheet. S&OE involves cross-areas meetings, consensus. Therefore, without a well-structured tool and reliable data, it is not possible to make the right decisions.

**2. What are the main differences between the S&OE and the S&OP?**

**a.** There are several. The planning horizon is two to three months, in contrast with the 12 to 18 months of the S&OP, the planning bucket is weekly and S&OP is monthly, the product aggregation level is also lower than product families, usually in the SKU level. Besides, the consensus meetings generally occur one or two times a week and the forums are more operational, involving managers, coordinators and even analysts and programmers. There is also a difference in the strategic importance of the decisions taken in each of the processes. The S&OP is more focused in planning, while S&OE pay close attention to the execution. It unfolds the S&OP to the short term. One consequence of that is the fact that the S&OE analyses the order fulfillment in its process, evaluating deviations and opportunities.

**3. So, the S&OE fills the gap between the S&OP and daily operations?**

**a.** Yes. The S&OP possess a very aggregate feature, with plans prepared for product families and its horizon is too long, especially when dealing with nervous operations inserted in high variability environments. S&OE makes the planning tangible, that is, turns what was planned into something concrete, real, because it works in a more disaggregated level and possess the input of what is happening in the order fulfillment process.

**4. And what were the bigger challenges that you encountered during the implementation?**

**a.** The greater difficulty in most implementations is the data quality in the systems that a lot of times is insufficient to perform a good execution. Another great challenge is to get people involved, make them understand the benefits of the change so that there is real engagement. People are skeptical. In the beginning of the implementation, people involved still don’t trust the process, so they keep running their routine processes in parallel. Consequently, they become overloaded with work and feel less motivated or even resistant to

change, until the moment when it is possible to start seeing results. Besides, there is a whole learning curve for those involved, both in the supply chain technical content and in the process and tool. The development of the tool, called S&OE monitoring panel, is also laborious.

**5. How to design and implement the process?**

**a.** In general, S&OE is only implemented when there is already a S&OP implemented. The design of the S&OE reminds the one of S&OP. The parameters for the S&OE are defined in the S&OP. The main parameters are: horizon, bucket, product aggregation level, meeting frequency, participants (both functional areas and people), roles and responsibilities, calendars, detailed schedules, among others.

**b.** The process design start with interviews to understand the reality of the company. The main factors to be observed are: which processes are already running, how do they happen, who participates, which tools are used, what are the main challenges, besides more specific questions for the company's business.

**c.** After the interview phase, the consulting team gathers, analyzes the collected data (interviews, the existent processes, system information, master data, among others) and makes a proposition of the model that will be implemented. The proposal construction also involves the company's team (project managers, analysts, among others).

**d.** Finally, validation workshops are performed, in that order: technical validation (operational team), executive validation (management and directory), validation with the Project sponsor (a person of high hierarchy level inside the company, that endorses the project) and finally with the CEO.

**6. And the implementation?**

**a.** The first step is to build the tool. Using information from the ERP system it is possible to build a logic to operationalize the S&OE, especially the fulfillment logic, and after how to treat exceptions.

**b.** After that the meeting pilots begin, to identify adjustments that will be necessary in the process design. The pilots are also used to define the meeting templates (which data will be discussed and in what format).

**c.** Each new cycle that is performed, the S&OE evolves, perfects itself and the involved people acquire a greater comprehension about what is expected of each one of them during the meetings. It is then that, usually, the resistance to change starts to decrease.

**d.** One important point to be highlighted is the project management follow-up meetings, that involves both the consulting group and the project manager designated by company. Those meetings are important to observe the process evolution and to capture the difficulties that are being encountered during the implementation, so that it is possible to attack them in a more effective way.

Finally, eventually some implementation adherence analysis is executed, through a tool developed by the consulting group. The tool shows the evolution of all the process aspects, if they are under or above expected and helps in the targeting of action plans to correct the deviations found.