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Simplifying sales and operations planning: Analysing the influence of process steps on soft issues using design and engineering methodology for organisations

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Abstract

Purpose: This research aims to explore the relationship between the steps of Sales & Operations Planning (S&OP) and the emergence of soft issues such as communication challenges, coordination bottlenecks and conflict resolution difficulties.

Design/methodology/approach: Employing the business process mapping tool Design & Engineering Methodology for Organisations (DEMO), this research describes the steps within S&OP, uncovering its complexity and identifying key interaction points. By mapping S&OP through DEMO, the study simplifies the process, uncovering potential sources of soft issues encountered by S&OP members.

Findings: Anticipated findings include an interaction model illustrating communication patterns within the S&OP process to aid in identifying conflictual stages. The research also identifies key soft issues associated with each step of S&OP, and confirms the robustness of certain process steps while recommending improvements, particularly regarding the involvement of top management.

Research limitations/implications: Given that it is a conceptual study, this research acknowledges some limitations. DEMO has multiple models, each serving a distinct purpose, and all of them must be developed to have a complete picture. However, since this research was limited to specific research questions, only the interaction model was mapped. Implications include the need for further validation of the identified soft issues and continuous refinement of S&OP to address the challenges highlighted.

Practical implications: This research also confirms the robustness of some of the steps and their importance, with recommendations for improvements in specific stages where certain issues may arise, such as the possible bullwhip effect during the initial stage and top management impeding the agility of the process.

Originality/value: This research contributes to the existing literature on S&OP by addressing both the soft aspects and the complexity of the process. The use of DEMO as a novel methodology adds originality to the study, paving the way for its potential application in future research within the operation field.

Keywords: S&OP, Supply chain management, DEMO, HRM, Soft issues, Process mapping, Enterprise ontology

Jel Codes: O10

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1. Introduction

Sales and Operations Planning (S&OP) is a supply chain management process brought to attention recently in academic research (Pedroso, da Silva & Tate, 2016; Pedroso, Calache, Junior, da Silva & Carpinetti 2017; Seeling, Panitz & Cassel, 2021). It is a process that seeks to align demand with supply, link strategic and executive actions, and cover middle and top management (Pedroso et al., 2016). The process helps organisations bypass the "silos culture" by following a multi-step process. Although S&OP has been put into practice for two decades, it is still nascent in the academic literature (Kreuter, Scavarda, Thomé, Hellingrath & Seeling, 2021), where it is considered an emergent operations topic in need of further exploratory research (Kreuter et al., 2021). S&OP is based on five consecutive steps (Thomé, Scavarda, Fernandez & Scavarda, 2012; Boorman, 2013; Goh and Eldridge 2019; Ambrose, Matthews & Rutherford, 2021), requiring different decision-makers to work together and coordinate to approach related issues as efficiently as possible (Pedroso et al., 2016). In this regard, S&OP relies primarily on human interactions to reach a consensus on plans (Stentoft, Freytag & Mikkelsen, 2020). In addition, the nature of the functions involved in making S&OP-related decisions is contradictory. For instance, sales and marketing is concerned with turnover, production with units/volume, logistics and supply with capacity, and top management with the overall budget (Stentoft et al., 2020). The differences among these departments result in various "soft issues" such as communication difficulties, challenges in conflict resolution, and lack of coordination, among others (Stentoft, Freytag & Mikkelsen, 2019).

The purpose of this article is to explore the soft issues within the steps of S&OP, and to understand whether the steps themselves contribute to the emergence of the soft issues. To do so, it uses Design and Engineering Methodology for Organisations (DEMO), a process mapping tool that simplifies business processes and eliminates any ambiguity that can arise from poorly defined processes (Dietz & Mulder, 2020). DEMO was designed to alleviate the illustration of different systems at a high, abstract level, and works as a demonstrative tool to map a given system with all its components while removing unnecessary details that do not add value (Dietz & Mulder, 2020). For this research, DEMO is used to map S&OP by simplifying the process steps, the functions involved, initiators and executors of the steps, the different interactions, and the activities included. This mapping helps streamline all the stages of the process and detect whether these steps can be susceptible to some social or human interaction problems. This is possible mainly because DEMO maps both the communication patterns and the actors within a process.

The findings of this research, and especially the generated interaction model, are significant, particularly considering that the DEMO methodology has never before been used to assess S&OP. They confirm the robustness of some of the pre-identified steps of S&OP in the literature, and they also allow us to make recommendations about some of the steps to mitigate these issues, such as better positioning the top management contribution in the process. Additionally, this research highlights a list of soft issues that can be encountered in each stage of the process. By simplifying the steps of S&OP, identification of these issues is facilitated, and more attention is drawn to addressing this aspect, which is often neglected in favour of technical and quantitative aspects.

By streamlining a process, organisations can reduce uncertainties and minimise potential complications. As a result, they can improve the effectiveness of their S&OP, which leads to better alignment between demand and supply. Moreover, this research can help practitioners in the field to reorganise the process based on their current human interaction challenges, and develop strategies to overcome interaction problems, such as improving communication channels, enhancing conflict resolution skills, and promoting a culture of process ownership.

This article is organised as follows: The following section contains a literature review of S&OP that explores the hypothetical development of the research question. The DEMO methodology is explained in the second section. The third section tackles the results obtained from the mapping process. Last, the discussion and conclusions are presented in sections four and five, respectively.

2. Theoretical Background

2.1. Sales and Operations Planning:

S&OP is a business process that encapsulates different functions for the purpose of developing a common plan to balance demand and supply (Scott, Lundgren, Thompson, Scott, Lundgren & Thompson, 2018). It is a process that is generally performed at least once a month and is reviewed by the management at an aggregate (product family) level. To this effect, S&OP connects operational planning with strategic planning (Kreuter et al., 2021).

The terms "S&OP" appeared in academic circles in the early 2000s. It was originally the outcome of professional practices and years of planning to harmonise the supply and demand sides (Treiblmaier 2018; Scott et al., 2018). The activities included in the process are now considered the definitive statement of the company's plans for the near to intermediate term, covering a horizon that is both sufficient to plan for resources and to support the annual business planning process (Danese, Molinaro & Romano, 2018).

The S&OP process has been widely discussed across various fields of business management. Its multi-disciplinary nature makes it an important topic involving the coordination of multiple functions (Pedroso et al., 2016). The earliest S&OP was a planning procedure between supply and demand, but a matured S&OP within an organisation now involves multiple departments, including sales, supply chain, marketing, finance and general management (Thomé et al., 2012).

The widespread use of S&OP both in academia and in professional practice is due to the advantages it can deliver. If executed properly, S&OP links the strategic plans with their execution and review performance measures for continuous improvement (Blackstone & Cox, 2002). The benefits can be classified as hard or soft, as pointed out in Stentoft et al. (2020). Hard benefits include sales growth (Thomé et al., 2012; Tuomikangas & Kaipia, 2014), cost reductions (Thomé et al., 2012; Wallace & Stahl, 2008), working capital improvement (Thomé et al., 2012; Wallace & Stahl, 2008), and end-result benefits (Thomé et al., 2012), and soft benefits include better alignment, cooperation and socialisation (Kjellsdotter-Ivert & Jonsson, 2010; Lapide, 2014; Wagner, Ullrich & Transchel, 2014; Hulthén, Näslund & Norrman, 2016), and prosocial behavioural factors (Papier & Thonemann., 2021).

The literature agrees on a five-step framework to perform S&OP (Boorman, 2013, Pedroso et al., 2016). As discussed in the work of Stahl (2010), these steps consider a set of activities and scheduled meetings to produce a balanced, agreed and final plan. These five steps are as follows:

Step 1: Create unconstrained demand forecast

The initial step of the S&OP process involves the gathering of sales data, which are used as the basis for an initial forecast. This is generally performed by the sales department. The projected forecast should focus on what customers need, regardless of the production constraints. The output of this step is a demand plan that is named as unconstrained because it is based on demand forecasts only.

Step 2: Create an initial supply plan

In the second step of the process, operations/supply chain teams gather data about the production constraints that are overlooked by the demand team. They consider data on internal capacities, such as inventory capacity and strategies, manufacturing, logistics and supply chain capacities. The retrieved data are then combined with the demand forecast delivered by the demand team. The two inputs combined produce an initial supply plan, which represents how the demand is either going to be met or be restricted.

Step 3: Develop a final consensus operating plan

In the third step, the S&OP team, including members from sales, marketing, operations and finance, meet to agree on the final demand and supply plans, setting the guidelines for the upcoming cycle. In this meeting, issues

are debated, and different scenarios such as the consequences of each decision, risks and opportunities are analysed. Once consensus is reached by the team members, the company's management revises the final plan and gives its assent for implementation in the next cycle.

Step 4: Communicate and implement plan

The fourth step of S&OP entails the publication and communication of the final agreed S&OP plan, and its implementation across all functions.

Step 5: Measure process performance

The final step of the S&OP process involves measuring and controlling the effectiveness of the plans and the process itself by means of specific Key Performance Indicators (KPIs).

Performing S&OP is a complex task because of the intricacies involved in integrating various functions to work together (Danese et al., 2018). This balance becomes more vital in current supply chains that seek to be adaptative, aligned and agile (Arana-Solares, Alfalla-Luque & Machuca, 2012)

Various authors have discussed this complexity of S&OP implementation (Hulthén et al., 2016). However, as the subject has matured, different areas of S&OP have been considered. For instance, Thomé et al. (2012) studied the performance of an organisation and its link to S&OP; Pedroso et al. (2016) was concerned with the implementation of S&OP while addressing its enablers and barriers, and Neto, Barcellos and Panizzon (2022) suggested a framework of guided steps for successful implementation to make the process less complex. Pedroso et al. (2017) also studied the importance of assessing S&OP maturity.

S&OP is concerned with soft issues that deal with human problems such as communication, conflict resolution and coordination mechanisms, among others (Stentoft et al., 2020). In addition, the people in S&OP are not necessarily trained to be team members, making soft skills essential for performing their roles (Terry, Beasle, Davidz, van den Hoek-Ostende & Glover, 2014). These issues are the least covered by previous research (Stentoft et al., 2019).

The soft side of S&OP has been considered a gap in the literature, although numerous authors have made recommendations to deal with problems of this sort within S&OP. They include Harrison (2009), which discussed how to deal with the softer side of S&OP, and Stentoft et al. (2020), which raised the question of the necessity of involving behavioural research and assessing the different personality types in the functioning of S&OP. However, more research is needed on this side of the process (Stentoft et al., 2020).

Despite extensive discussions, research and advancements in the technological and implementation aspects of S&OP, its adoption remains challenging for many organisations. While the tangible benefits of the hard side of S&OP, such as improved organisational performance, are well-recognised, many companies still perceive the process as complex, inflexible and even unnecessary. This is largely due to the immaturity of improvements on the soft side of S&OP. Consequently, further research in this area is essential. Even with technological advancements, optimal S&OP performance cannot be achieved without skilled individuals executing the process.

This study is motivated by the need to illuminate the soft side and the human factors within S&OP. It aims to explore the specific steps involved in conducting S&OP at each stage, focusing on the interactions among its practitioners. By examining these interactions, the research seeks to explore the potential soft issues that may arise during the process. Based on this premise, the research question is formulated as follows:

RQ: How do the steps of S&OP contribute to the emergence of the soft issues, and can the application of DEMO simplify this relationship?

To provide firm and coherent answers to this research question, the methodology described below was followed.

3. Methodology

This research is positioned as a conceptual modelling study stimulated by a literature review of the core concepts and starting with an in-depth analysis of the S&OP process steps in the literature. For mapping purposes, several rounds of literature analyses were made to come up with a coherent framework for S&OP steps.

A study of the literature on DEMO methodology was also conducted. Unlike S&OP, DEMO is a theory-based modelling approach that is well rooted in literature and philosophy. A literature study was therefore conducted, focused on refining the key principles of this modelling approach.

This research then followed the DEMO approach for the rest of the study, which mainly involved mapping and interpreting the retrieved model.

3.1. DEMO Methodology

DEMO is a modelling methodology developed to illustrate abstract models that aims to present the operation and construction of organisations independently of their state of implementation (Hunka & Matula, 2019). Unlike other mapping tools such as Value Stream Mapping, Business Process Model and Notation and similar methods, DEMO stands out first because of its robust theoretical approach based on Enterprise Ontology and how it defines the essence of an organisation through its firm principles; and second, because DEMO maps every possible transaction occurring between the agents of a process, thereby allowing the mapping of the interaction of the people involved in the process, which is the goal of this research (Dietz & Mulder, 2020).

The foundation of DEMO is enterprise ontology principles, which ensures that the models mapped by DEMO are correct. Dietz and Mulder (2020) stated that if different individuals mapped a given process using DEMO steps, they would eventually produce the same model. This is due to the high level of abstraction of DEMO models, which are coherent, concise, representative and essential (Hunka & Matula, 2019).

The theory behind DEMO is based on four axioms. First, the Operation Axiom asserts that an organisation consists of human beings (Balagué-Gómez & Arimany-Serrat, 2023), named as social individuals, who play different roles via actions. These actions are identified as performed acts. An actor role has a particular amount of authority and responsibility, hence the name actor. Furthermore, this actor can perform two kinds of acts: Production acts (P-Acts) and Coordination acts (C-Acts). P-acts are concerned with the action that leads to producing services and materials delivered to the environment of the organisation, while by performing a C-Act, the actor is showing commitment and agreement towards other actors within the environment of an organisation (Dietz & Mulder, 2020). Second, the Transaction Axiom defines the condition to successfully complete the different acts (P-acts and C-acts). This axiom states that C-acts are performed in a series of steps within a universal pattern, called transactions. A transaction requires two actor roles, an initiator who initiates the transaction and can complete it, and the executor, who is responsible for carrying out the transaction and thereby executing a P-act (Dietz & Mulder, 2020). In the transaction axiom, when a P-act is successfully completed (e.g., a delivery has been shipped to the target destination) it then becomes a P-fact. A P-fact is therefore the actual becoming and successful execution of a transaction. Likewise, when a C-act has been successfully completed, it is then called a C-fact. Third, the Composition Axiom is concerned with identifying how the transactions can interact. Here, a transaction can either be integrated into another transaction, initiated by an external party or self-activated (Dietz & Mulder, 2020). Last, the final axiom is the Distinction Axiom, which states that the actors have three different qualities identified as performa, informa and forma, as explained in Table 1.

Coordination	Human ability	Production
Exposing commitment (as performer) Evoking commitment (as addressee)	Performa	Ontological action (Deciding, Judging)
Expressing thought (formulating) Educing thought (Interpreting)	Informa	Indological action (Reproducing, Deducting, Reasoning, Computing, etc.)
Uttering information (Speaking, writing) Perceiving information (Listening, Reading)	Forma	Datalogical action (Storing, Transmitting, Copying, Destroying, etc.)

Table 1. The distinction axiom and human abilities. (Dietz & Mulder, 2020)

An ontological production act (performa) is an act that leads to the production of original and new things, for instance deciding or judging. Meanwhile, requesting or making a promise are typical ontological coordination acts. Performa ability is considered the most essential human ability for actors to conduct businesses, thereby making it the focal foundation of DEMO. For its part, informa ability is concerned with the content of the

information. As proposed by Dietz and Mulder (2020) inquiring, calculating and reasoning are typical Informa P-acts, while formulating thoughts (in written or spoken sentences) and interpreting (through listening or reading) are typical infological coordination acts. Third, actions such as copying, storing and transmitting data are typical datalogical acts, while speaking, listening and writing are typical datalogical coordination acts" (Dietz & Mulder, 2020).

3.2. DEMO Models and Mapping Steps

DEMO consists of four main models, each of which is mapped through a specific diagram, as depicted in Figure 2. A model of DEMO can be produced according to mapping purposes, the segment of the process and the required result, each model seeking to illustrate a specific feature of the process. For this research, only the interaction model was mapped. The objective of the research was to explore possible subtle issues emerging from human interactions in the S&OP Process, the interaction model being the one that targets the mapping of the transactions and interactions between the actors. The decision to use just one model of DEMO was therefore purposeful.

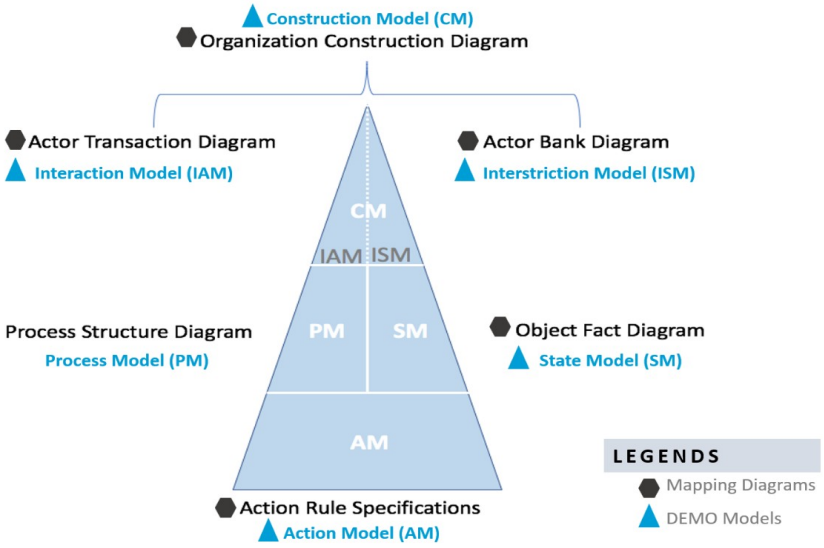

Figure 1. DEMO models and their diagrams. (Dietz & Mulder, 2020)

The interaction Model is illustrated by producing the so-called "Actor Transaction Diagram (ATD)". The ATD is mapped using different symbols:

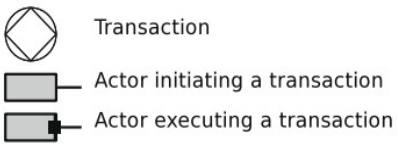

Figure 2. ATD Legends. (Dietz & Mulder, 2020)

Subsequently, the steps to map the ATD of S&OP consists of three analyses and three syntheses steps, as elaborated by Dietz and Mulder (2020):

1. Available documentation: This is the departure stage and the condition of having a solid foundation of all available documentation and descriptions of the process. The documentation can be either digital or paper, generally consisting of descriptive texts about the functioning of the process and describing the key activities and how they are performed, who the actors responsible are, the coordination acts, and the procedures followed. During this stage, Dietz and Mulder (2020) makes no statement about any

restrictions or specific requirements. However, the more descriptive the foundation is, the more accurate its modelling will be. For this research, documentation refers to the literature description of the steps of S&OP.

2. The Performa-Informa-Forma Analysis: The descriptive documentation obtained (Step 0) is analysed in this stage. Dietz and Mulder (2020) argues that the analysis can be done best by colouring the different parts of the descriptive text, for instance red for Performa items, green for Informa items, and blue for Forma items. These colours were used in this paper.
3. The coordination-Actors-Production Analysis: The coloured items from stage 1 are further analysed in this stage. During this step, only the Performa items (coloured in red) are considered, separating them into coordination acts/facts (C-acts/C-facts) and production acts/facts (P-acts/P-facts), according to the operation axiom. This is done by placing a piece of text indicating an actor role between square brackets "["and"]", a C-act/result between round brackets "("and")", and a P-act/result between the greater-than and less-than signs "<"and">".
4. The transaction pattern synthesis: During this stage, a transaction results table is produced, which presents all the transaction types in a template, associating each transaction with its result according to the transaction axiom.
5. The results structure analysis: This analysis is to verify the flow of transactions and how it is initiated according to the composition axiom.
6. The Construction Synthesis: This step associates an initiating actor role and an executing actor role for every transaction type, which then becomes the Actor Transaction Diagram (ATD).
7. The Organisation Synthesis: This step is concerned with identifying which elements should be included in the kernel of the modelled system, and which ones should become part of its environment. This step completes the ATD.

4. Results

The application of the ATD mapping for S&OP steps is as follows:

4.1. The Performa-Informa-Forma Analysis and the Coordination-Actors-Production Results: (Step 0, 1 and 2):

4.1.1.Descriptive Text of the Steps of S&OP

Step 1: Demand forecast creation and demand plan.

The initial step of the S&OP process consists in gathering data, often by means of the demand planner, to create an unconstrained demand forecast. In a practical sense, the demand planner collects data about sales from the previous period, then [he[<develops< an unrestricted forecast of what could potentially be ordered and sold to customers. This demand forecast is elaborated with no consideration of the company's capacity or any other constraints.

Step 2: Development of an initial supply plan

In the second step of the S&OP process, the operations/supply chain team gathers data about internal capacity, which includes information about strategies, inventories capacity, logistics and supply chain capacities. The supply chain team uses the data about capacity and the unconstrained demand forecast previously developed by the sales/demand department as inputs to <create< an initial supply plan. The operations team tries to find a balance point between the expected sales and the present capacity restrictions. To this effect, the operation team analyses all alternatives and selects the option that has the greatest consensus with regards to profitability, business plan and customer services. The supply plan is thereby appropriately <created<.

Step 3: Development of an agreed and integrated set of plans

In the S&OP process, the concerned members have a pre-scheduled date for the next S&OP meeting in their agenda, which was determined in previous meetings. Before this date, [the S&OP team] (meets) together and

discusses both the demand plan elaborated by the sales department, and the initial supply plan developed by the operations team. The S&OP team should reach a consensus about the final plan. At this point, the supply team should point out all the inherent constraints, if applicable, and the demand side should negotiate any urgent matters. The main outcome of this meeting is to have balanced demand and supply plans, which are <approved< by [all participating parties[. After this step, [the top management[<approves< the final integrated plans and [it[<establishes< the actions to be taken to execute them.

Step 4: Final plans communication

The final integrated S&OP plans approved in the previous steps are now being communicated and published to all other involved parties. This typically includes operations, sales, marketing and finance. These departments should all be aware of the quantities they are expecting to sell and/or make. At this point, [all the parties[(commit (to deliver the agreed volumes and to help achieve the objectives set in the plans.

Step 5: Process performance measurement

The final step of S&OP consists in measuring and <controlling< the effectiveness of the business plans and the process itself. This is possible by means of the S&OP teams' monitoring of Key Performance Indicators (KPIs). The metrics used to measure and control the process can vary among multiple organisations and industries, but above all, the main KPIs should be able to track operational and commercial progress, and they must then be communicated to all the other parties that are taking part in the S&OP process.

4.1.2. Transaction Pattern synthesis results: (Step 3)

Steps 1 and 2 of the DEMO results led to the identification of all the transactions (coordination and production actions) that are essential for the execution of S&OP. These transactions were further analysed in this stage and their results were identified for each transaction:

Transactions (TN)	Results (RN)
T01 Demand forecast creation	R01 Demand forecast has been created
T02 Initial supply plan creation	R02 Supply plan has been created
T03 S&OP meeting attendance	R03 S&OP participants have attended the meeting
T04 Approval of the final plan	R04 Final plan has been approved by all S&OP members
T05 Top management approval	R05 Top management has agreed on the final S&OP plan
T06 Action plan establishment	R06 The action plan has been established
T07 Commitment of all members	R07 S&OP members have all promised to meet the plans' deadlines and volumes
T08 Performance control	R08 S&OP performance has been measured, monitored, and controlled.

Table 2. Transaction Pattern synthesis of S&OP

4.2. Result structure Analysis Results: (Step 4)

The order and flow of the transaction are confirmed during this step. Since S&OP is carried out in consecutive steps, one activity (Transaction) cannot be initiated until the previous one has ended. For instance, the supply plan cannot be created unless the demand forecast has been generated and delivered by the demand team.

4.3. Construction Synthesis Results: (Step 5)

The actor roles were identified for all the transactions identified in the previous step, specifying the actor responsible actor for the initiation and execution of each transaction. The transactions T04 and T06 were self-activated. This means that the actor roles of these transactions are both initiator and executor.

The actor roles were also numbered and given an identification number to facilitate their mapping, following the same order of the transactions in step 3. They are as presented in Table 4.

Since the S&OP team and the general management have transactions that are self-activated, they are named Composite Actor-roles, referring to CA04 and CA05 for the S&OP team and General management, respectively.

The identification of the actor roles is the final element needed to produce the ATD and obtain the interaction model and construct DEMO for S&OP.

Transactions	Initiator	Executor
T01 Demand forecast creation	Sales team	Demand planner
T02 Initial supply plan creation	Demand planner	Supply team
T03 S&OP meeting attendance	Supply team	S&OP Team
T04 Approval of the final plan	S&OP Team | self-activated	S&OP Team
T05 Top management approval	S&OP team	Top management
T06 Action plan establishment	Top management | self-activated	Top management
T07 Compromise of all members	Top management	S&OP teams
T08 Performance measurement and control	Top management	S&OP teams

Table 3. Construction Synthesis of S&OP

ID	Actor Role
A01	Sales Team
A02	Demand Team
A03	Supply Team
CA04	S&OP Team
CA05	General Management

Table 4. S&OP's actor roles and their identification

4.4. Organisation Synthesis Results: (Step 6)

The final step consisted in positioning all identified actors in the organisation. In the case of this research, the pre-identified actor roles were those (functions/departments) that pertained to the organisation's scope, whereas in some mature S&OPs, there is the participation of external actor roles such as customers and suppliers in S&OP meetings, or their commitment to agree on delivering certain plans. In this case, these actor roles should be mapped outside the kernel of the organisation.

The DEMO approach followed to map the interaction model for S&OP steps generated the following model (Figure 4):

The ATD of an S&OP process, as depicted in Figure 3, represents the interaction model of S&OP. This model consists of four actor roles, each one responsible for initiating at least one transaction, where all actor roles are executors of at least one transaction, except for A01, which only initiates T01 and executes none.

The breakdown of the five S&OP steps following DEMO resulted in the identification of eight transactions. All involved actor roles needed to come together consecutively on eight occasions, in contrast to the five regular steps identified in the literature. Additionally, the demand planner and the supply team both executed one transaction each, T01 by the demand planner and T02 by the supply team. Meanwhile, the S&OP team executed four transactions (T03, T04, T07, and T08), while the general management executed two transactions (T05 and T06).

In the ATD, it is visually clear that after the execution of the T03, the rest of the transactions are executed between CA04 and CA05. Subsequently, and after the execution of T03 and T04 by the S&OP team, the execution is then transferred to CA05 (who executes T05 and T06) before it is once again exchanged by CA04 for the execution of T07 and T08. Notably, after the execution of T06 by the general management, this actor role (CA05) is then to initiate two transactions to be executed simultaneously by the S&OP team (T07 and T08).

The two last transactions, T07 and T08, are initiated at the same time but are executed consecutively. This means that the S&OP team should first agree and give their commitment to execute the action plan established by the

general management (T07), after which they proceed to the performance evaluation and monitoring (T08), which is being executed in different cycles and proportionally with the implementation of the S&OP plan.

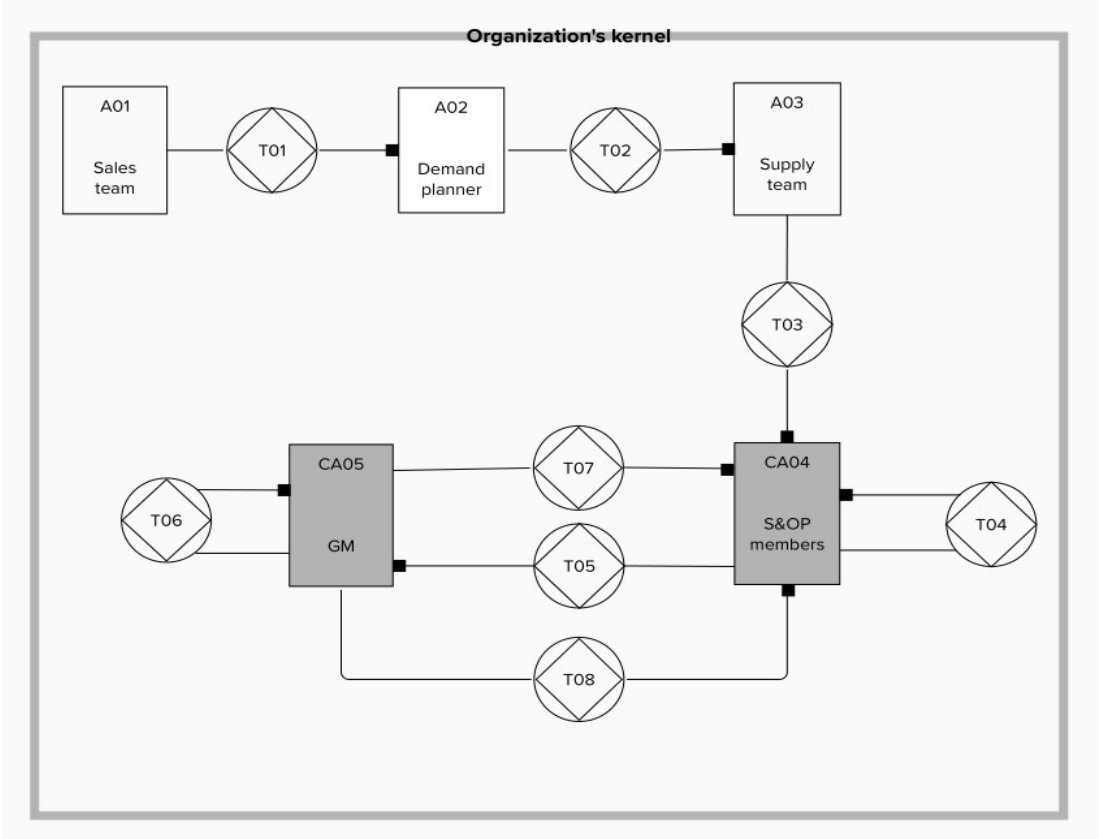

Figure 3. The ATD of an S&OP process

In this model, there are two self-activated transactions, namely T04 by CA04 and T06 by CA05. The two transactions are separated by T05, which is initiated by C04 and executed by C05. The self-activated transactions mark the activities that are under full authority and the responsibility of the respective actor roles (S&OP team and general management).

5. Discussion

After the ATD, it appears that the process is carried out in a way whereby every actor role initiates just one transaction, which is executed by the next actor role. For instance, T01 is initiated by A01 and executed by A02, and T02 is initiated by A02 and executed by A03. This way of transacting is maintained up to and including T03. Thereafter, the flow of the transactions becomes very interactive. For instance, after T03 is executed, transactions such as T04 and T06 take place, which are self-activated. Additionally, at this stage, most of the transactions are transferred among CA04 and CA05. In other words, unlike T01 and T02, where the stream of activities goes downstream to engage other actor roles, after T03 most of the transactions are exchanged repeatedly among CA04 and CA05.

The ATD model of S&OP can therefore be classified into two parts based on the type of flow and the complexity of the interactions. This classification helps in understanding the correlation between S&OP steps and the emergence of soft issues.

Two parts of the model can be determined from the ATD Model displayed in Figure 4, if we are looking at the type of transactions and the complexity of interaction between the actor roles. A detailed examination of the first and second parts of the model clearly shows that S&OP benefits from its organisation into consecutive steps, making the flow of activities well organised. This helps actor roles understand their responsibilities and

deliverables. The interaction model differentiates between areas with more interactions and areas where transitioning is subtler, stressing the importance of following the five-step guide from the literature for effective S&OP implementation.

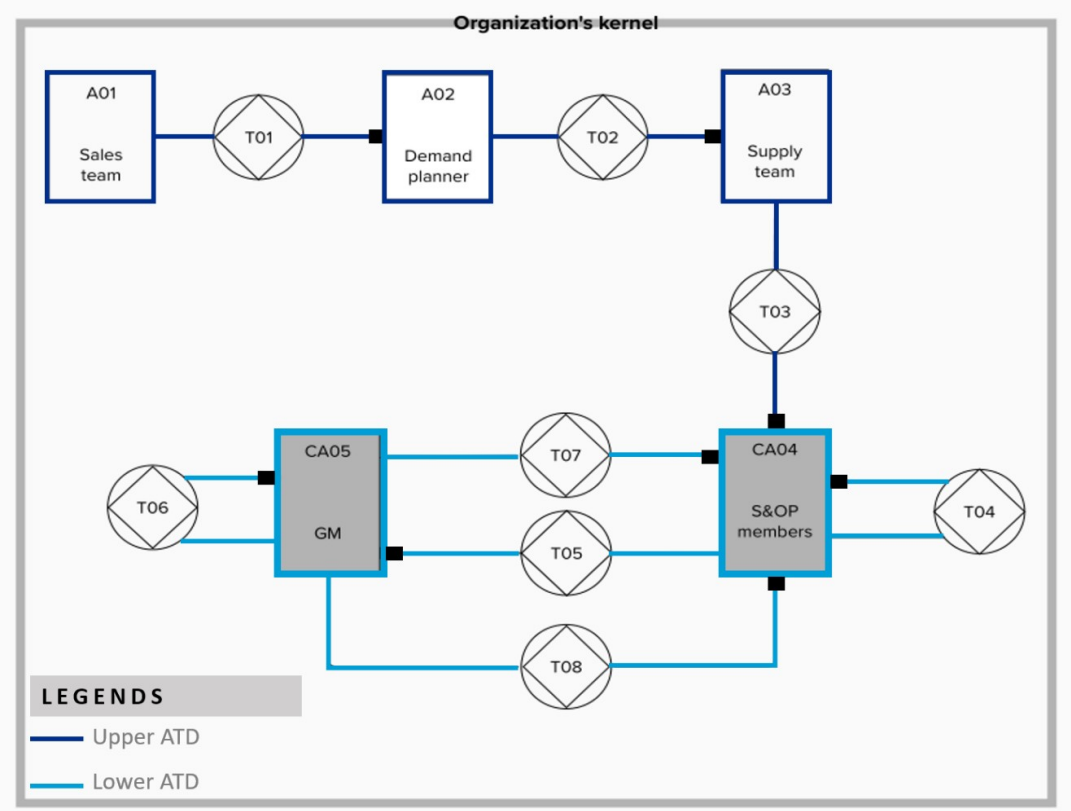

Figure 4. The Upper and Lower Parts of S&OP's ATD Model

However, S&OP via DEMO reveals multiple intersection nodes that can be sources of conflicts or bottlenecks when considering the soft side of S&OP. The first part of the interaction model, which includes T01, T02 and T03, highlights the dependency between actor roles and how such tight reliance can lead to delays and obstacles. This dependency can provide false information, resulting in biased planning or a bullwhip effect from the get-go.

The upper part of the ATD of the S&OP is characterised by a standardised flow of transactions. To this effect, the activities carried out here are simple and require fewer interactions. Each transaction is pending the cessation of the previous one before it begins. No actor role has more than one transaction with another actor role, indicating minimal exchange between actors (e.g., confirmation, agreement and delivery of output). From the perspective of the S&OP, the sales team informs the demand planner to develop a representative demand forecast. This "simple" transaction flow shows full dependency of the executing actor on the initiating actor, wherein each actor role delivers an output that is the basis for the execution of the next transaction. Proper production of the delivery is key for a smooth flow of subsequent activities. For example, if the demand planner cannot obtain solid market inputs to produce a representative demand forecast, the resulting supply plan may not accurately reflect the capacity to meet market demands.

The lower part of the interaction model, going from T04 to T08, involves two composite actor roles, CA04 and CA05. This part of the S&OP's interaction model is marked by multiple transactions frequently exchanged between two actor roles. The complexity here arises from the number of transactions each actor role either executes or initiates, with CA04 having the highest transaction traffic. In contrast to the first part, in the second part, each actor role must coordinate repeatedly with the other actor roles, indicating a higher degree of interaction and potential for miscommunication or conflict. Validation of a transaction within the second part of the interaction model is often done by CA05 or general management. The top management role in the S&OP

involves overall control of the process flow, while execution is the responsibility of other actor roles. This strategic and operational integration is a core objective of S&OP. However, the involvement of general management can lead to conflicts and a lack of process ownership, especially if one actor role consists of multiple members such as the S&OP team.

Notably, then, the first part of the interaction model reveals that emphasis should be on the extent of dependency between the actor roles. Similarly, the lower part of the interaction model may illustrate the importance of both the S&OP team and the general management as the only authorities conducting at least one self-activating transaction.

In addition, the constant exchange between the general management and the S&OP team suggests the need for smooth communication that should be both strategic and operational, in line with the research of Gambetti, Biraghi, Martinelli and Tunisini (2018), who identified communication in the supply chain as a lever that fosters its identity. The governance of S&OP by the general management adds to the complexity of interactions between the actors. In the literature, the importance of top management engagement in the process is clear. However, it is equally important to delineate the scope of this governance to keep the cycle of S&OP pliable.

If such issues failed to be considered and identified in S&OP, the first direct consequences would be the confusion caused in terms of duplicated efforts, missed deadlines and suboptimal procedures within S&OP. This is especially true at the beginning of the process, where misalignment between the demand and supply teams could cause discrepancies in data interpretation, especially regarding the supply plan, which can have serious gaps in terms of what the demand team initially forecasted. This alone would cause a failure in the cycle of S&OP right at the start. Similarly, inventory imbalances can easily emerge with slight interdepartmental silos. Failure to convey information about the portfolio stock level promptly would directly result in delays in the schedule for the whole operations to adapt to any market disruption.

In addition, one of the common issues in most businesses is the gap between strategic and operational levels. While the purpose of involving the management in S&OP is to heed this gap, failure of the operational S&OP team to reach a consensus would directly produce an S&OP plan that is restricted at the strategic level. If the process is not owned strategically, S&OP simply causes a lack of accountability, heightened operational risks, and eventual business unsustainability.

Correlation between the complexity of the steps of S&OP and the existence of potential soft issues is to be noted positively from the ATD model, where the more interactive a step is, the more it is susceptible to potential threats. Last, the ATD model shows not only a correlation between the complexity of the step of S&OP and the soft issue, but also that these issues differ between the actors of S&OP and their hierarchy.

In the same vein, the potential emergent soft issues that can be concluded from the ATD model throughout the S&OP steps can be summarised as follows:

List of soft issues deducted from S&OP's interaction model of DEMO
1. Overdependency between the participants of S&OP
2. Lack of process ownership to avoid conflicts among members
3. Lack of common language and communication that is either strategic or operational
4. Lack of coordination
5. Over-monitoring by top management and rigid governance of the process

Table 5. List of identified soft issues within S&OP

6. Conclusions and Contributions

This paper seeks to highlight the soft issues within S&OP related to its decision-makers, mainly by exploring the existing relationship between the process steps and the emergence of soft issues during its execution. Starting from the evaluated literature and the expressed need to bridge the gap with the soft issues within S&OP, this study used DEMO as a mapping tool to develop the interaction model of S&OP, seeking to illustrate the

different transactions among actor roles. The results identified a set of soft issues that could arise in different stages of the process, such as the dependency between members in initiating a transaction and the over-monitoring of the process by the top management, as well as the risk of a bullwhip effect at the beginning of the process, thereby confirming a positive correlation between the steps of S&OP and the raising of these issues. The analysis of this model also identified the actor roles that are more vulnerable to these issues and the origin of this complexity.

6.1. Main Contributions

This study has theoretical and practical contributions. The initial focus of this investigation was the rising need to address the gap in the literature by shedding light on the previously underexplored area of soft issues within S&OP. This is important because there are tangible outcomes in overseeing the soft side of S&OP. Many practitioners find that the implementation of S&OP is hindered by the lack of efficient HRM. It remains to suggest solutions for these aspects, however, because no previous studies have shown what to resolve in the process, and which skill to focus on during the cycle of S&OP. Identifying the interactions each step of the way provides a more holistic understanding of S&OP, beyond its technical and quantitative aspects. With this mapping, practitioners gain clarity on their tasks since each step shows the necessary exchange of information, responsibilities and coordination, helping organisations to effectively assign the right roles.

The model validates the steps of S&OP outlined in the literature, demonstrating consistency and alignment between them. However, effective management involvement and the reliance on the S&OP team are the cornerstones of the cycle's success. Successful cycle implementation of the process will remain subject to competent leadership and a cohesive S&OP team capable of executing tasks efficiently and flexibly. This research thereby contributes to the existing literature by taking the known framework of S&OP further and systematically identifying the interaction required in each step.

6.2. Limitations

This study has its limitations, the main one being that the interaction model was developed for S&OP, while the other models were not. This choice was made because the objective of this research was to explore the soft issues that emerge during the interactions of S&OP members. This can be adequately studied using the interaction model alone. The ATD allows the mapping to focus on the relational and communicative aspects of the process, which alleviates other details and uncovers the interaction points among the actor roles. However, incorporating other models could shed light on other aspects of S&OP and contribute to the understanding of S&OP in general. Similarly, producing a complete DEMO for S&OP with all its models may result in greater contributions.

The conceptual nature of this study inherently limits its immediate practical application, and empirical validation is necessary for future research. However, the conceptual approach helps in framing key issues and hypotheses, especially for a process that lacks a robust conceptual base in the literature and is a by-product of business practices only. This foundational knowledge is crucial to establish the first roadmap for future research on a nascent subject such as the softer side of S&OP.

6.3. Further Research

Future research can contribute by conducting other analyses on the process of S&OP and assessing the other models of DEMO that were not covered in this research. Additionally, the application of the ATD on the steps of S&OP can add more value for businesses if it is applied in specific sectors or industries using case studies.

Declaration of Conflicting Interests

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