

Sales and Operations Planning: a comparison between the demand-driven and traditional approaches

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Abstract: Supply Chain Management (SCM) is an important concept to establish links among companies. With the aim to reach the SCM goals, companies must define processes that links the decisions areas. In this context, a process to be dealt is the Sales and Operations Planning (S&OP). The S&OP is a tactical planning process, executed on monthly-basis and led by senior management with the aim to balance demand, production, distribution, procurement and finance, to ensure the plans and performance are aligned to support the business strategic plan. In this sense, a literature review was presented in this paper in order to compare the traditional approach and the demand-driven approach for the S&OP. As expected, because of the more complex environment to be dealt in a demand-driven environment, the S&OP evolved to be able to be executed properly. However, further studies in this area should be developed in order to obtain a final framework for the demand-driven S&OP, to analyse applications in industries, to understand performance implications and to develop a performance framework for the demand-driven S&OP.

Key words: Sales and Operations Planning, S&OP, Demand-Driven Environment, Demand-Driven Sales and Operations Planning, Supply Chain Management, Literature Review.

1. Introduction

The companies cannot be considered isolated entities in the competitive environment. This scenario is also motivated by the fact that the companies are tending to focus on their core activities (Novaes, 2007), increasing the demand of partnering in the market and creating the necessity of the Supply Chain Management (SCM) to fulfil the consumer expectations. The importance of SCM increases because of the current reality of the market place (i.e., short lead times, more customization, reduction of working capital and internet-based transactions) that increases the possibility of disruption in the supply chain (Smith and Ptak, 2011).

Lambert and Cooper (2000) argue that the great change in the modern management paradigm is that the companies cannot be dealt as unique and without relations in the supply chain. They complete saying that the new competition will not be among companies, but among supply chains.

Thus, the SCM is an important concept to establish links among companies. The study of SCM subject has been gaining prominence since 1990's. However, after about thirty years of studies, many definitions were created, leading to a difficulty of comprehension and studies of this subject. Stock and Boyer (2009) conducted a study considering 173 different definitions about SCM, from papers

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and books. Thereby, they proposed the following definition to SCM (Stock and Boyer, 2009:706): “The management of a network of relationships within a firm and between interdependent organizations and business units consisting of material suppliers, purchasing, production facilities, logistics, marketing, and related systems that facilitate the forward and reverse flow of materials, services, finances and information from the original producer to final customer with the benefits of adding value, maximizing profitability through efficiencies, and achieving customer satisfaction”.

In this sense, the SCM is a competitive model for the companies (Pires, 2004), being characterized as an approach that links the manufacturing processes, market, purchasing, sales, financial and all distribution network in order to satisfy the consumer expectations (Arnold and Chapman, 2004; Bozutti *et al.*, 2010).

With the aim to reach the SCM goals, companies must define processes that links the areas of decision. Currently, most of the companies use the Enterprise Resource Planning (ERP) systems (Ihme and Stratton, 2015) whose origin was substantiated by the Materials Requirement Planning (MRP) and Manufacturing Resource Planning (MRP-II).

The structure of MRP-II and its relationship with ERP can be represented as shown in Figure 1

(APICS, 2006a, 2006b, 2006c, 2006d; Chase *et al.*, 2006; Corrêa *et al.*, 2007; Fernandes and Godinho, 2010).

It is possible to understand from the Figure 1 that the core of the ERP system is the MRP (Fernandes and Godinho, 2010). When MRP evolves to MRP-II, new features appear in the model, that is, the Operations Strategy, Sales and Operations Planning (S&OP), Master Production Scheduling (MPS), Shop Floor Control (SFC) and the capacity planning analysis of each level. The integration among others company areas is achieved with the ERP. However, Smith and Ptak (2011) cite that MRP rules are old to the current reality, leading to a necessity of a new approach.

In this sense, companies need an operating model, metrics and communication approaches that lead to visibility creation and efficient sharing of information and risks (Smith *et al.*, 2017). The companies need to understand the market and be demand-driven; a first step is to evolve from the “older” MRP to the new demand-driven MRP, which strategically defines buffers in order to decouple direct connections to minimize the total system variability (Smith, 2015). To support the demand-driven MRP, the S&OP takes an important role and shall also be modified to support this new environment.

This study covered the Sales and Operations Planning (S&OP) process. This is an important

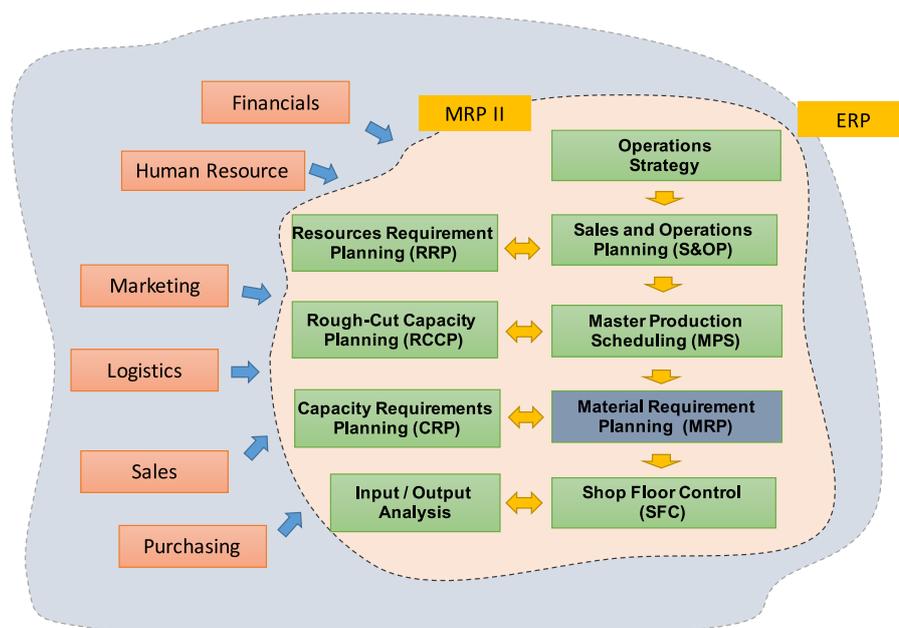


Figure 1. MRP-II Structure and the ERP (source: Adapted from APICS (2006a, 2006b, 2006c, 2006d); Chase *et al.* (2006); Corrêa *et al.* (2007) and Fernandes and Godinho (2010)).

process that integrates manufacturing, sales and marketing, financials and research and development (R&D) areas with the aim to guarantee the company strategic decision be executed in operations level (Corrêa *et al.*, 2007). The integration objective inherent to S&OP is in accordance with the SCM goals and helps the company to reach good results in internal performance and to fulfil consumer requirements (Thomé *et al.*, 2012).

Considering the new demand economy, companies cannot deal with their traditional approach to plan and control their operations in the same way done prior. It is necessary and fundamental to understand their customer and this action must begin in the companies' strategy definition (Burrows, 2012). Thus, to integrate and coordinate the supply chain operations with the aim to match the demand with supply chain requirements (Mendes *et al.*, 2016) is an essential prerequisite to survive and to be competitive in the market (Dreyer *et al.*, 2010).

Currently, a new understanding comes to companies to perceive and fulfil the customer needs. This understanding is called demand-driven approach. To be demand-driven is necessary to establish pattern of responses (Chatzopoulos *et al.*, 2012) to respond quickly and efficiently to customers' orders in accordance of their needs of time, price, quality and quantity (Mendes *et al.*, 2016).

In accordance with this new scenario, Gollamudi (2013) cites that companies must become demand-driven because (i) markets are volatile, (ii) demand fluctuates, (iii) products are specialized, (iv) products has higher variety, (v) necessity of low-cost facilities and (vi) external focus.

Some elements must be integrated and considered to understand the customer and achieve the market goals in this new supply chain environment (Ambe and Badenhorst-Weiss, 2011; Bjartnes *et al.*, 2008; Dreyer *et al.*, 2010; Verdouw *et al.*, 2010):

- Control processes defined;
- Integrated decision support tools and methods integrated;
- Roles clear and defined;
- Collaboration models applied;
- Performance measurement;
- Enabled information and communication technology.

Thus, which are the main differences between the traditional S&OP approach and the demand-driven S&OP approach?

The objective of this paper is to compare the traditional S&OP approach and the demand-driven S&OP approach.

This is an important topic to be dealt, because Bower (2016a) bets for the next ten year in S&OP that: (i) academic research on S&OP will explode, (ii) independent standards will develop, (iii) S&OP will become much more virtual, (iv) S&OP will focus more on supply-side volatility, (v) supporting technology will improve, (vi) S&OP will continue to move inside out, (vii) "assessing risk" will become an S&OP catchphrase, (viii) S&OP will become more range based, (ix) S&OP benefit streams will become more apparent and (x) S&OP will begin to proliferate throughout the service sector.

There are many benefits of a well-executed S&OP, for instance, improved forecast accuracy, reduced inventory, better plant efficiency, fewer schedule cuts, greater profitability, and so on (Bower, 2016a). Besides these benefits, the same author cites others benefits, which are more intangibles: (i) calm – with the S&OP process functional areas work more for results than to fight among them, (ii) rhythm – S&OP establishes a rhythm for operations, because it proposes a well-structured process to plan, (iii) control – plans and forecasts tend to become more accurate and the operations knowledge increases; (iv) unknowns – problems can occur during the operations (for instance, a production line failure, an unplanned customer or promotion that spikes demand), but these problems can be anticipated and alternatives, to these problems, can be proposed, (v) team and engagement- working within the S&OP process builds teamwork among, thus personnel involved becomes more engaged with their work.

Murray (2016) cites that S&OP plays an important role to the company stakeholders because it enables companies to leverage strategy deployment, financial planning, active ownership and engagement by the corporate team. The same author completes saying that S&OP provides the companies with the aid to demonstrate that have a strong team, clear vision and a market-winning strategy.

Thereby, this paper aims to contribute with the evolution of the S&OP processes to be more adherent with the business environment, once its

importance has already been pointed and researches are necessary.

The structure of this paper is:

- Section 1: a contextualization was provided, the objectives were defined and the research importance and relevance were described;
- Section 2: the methodology and the research steps were defined;
- Section 3: a theoretical background was provided, considering the S&OP traditional and demand-driven approaches;
- Section 4: the comparison between the traditional and demand-driven approaches was performed;
- Section 5: concluding comments were presented.

2. Methodology

The Sales and Operations Planning traditional approach was described considering a traditional literature review. Once these are established concepts, the classical authors, newest papers and grey literature papers were considered during the development. A current and updated view of the theme were provided, considering both theoretical and practical sides.

To achieve the better results for the research about Sales and Operations Planning in a Demand-Driven environment, a systematic literature review was conducted. This method provided a consistent approach to locate, evaluate and analyse data to conclude what is known or not about the theme (Denyer and Tranfield, 2009). The systematic review is an essential step to summarize existing knowledge and to find gaps for further researches (Kitchenham, 2004).

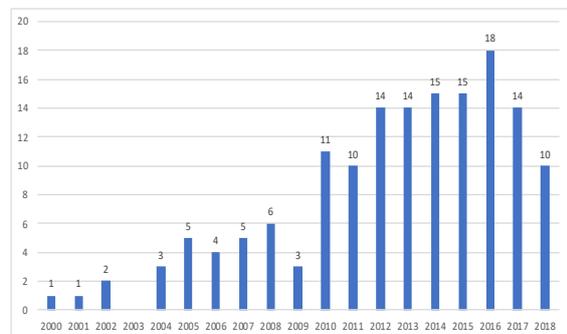
The chosen steps to conduct the systematic literature review were defined considering the best approaches of many authors (Brereton *et al.*, 2007; Conforto *et al.*, 2011; Cook *et al.*, 1997; De Souza *et al.*, 2010; Denyer *et al.*, 2009; Kitchenham, 2004) and are detailed as follow:

1. To define the research problem and the objectives;
2. To select the databases;
3. To define the keywords to conduct the research;
4. To select the exclusion criteria for studies;
5. To review the selected abstracts; and
6. To review the full text of the selected articles emphasizing the analysis of the sales and

operations planning process in a demand driven environment.

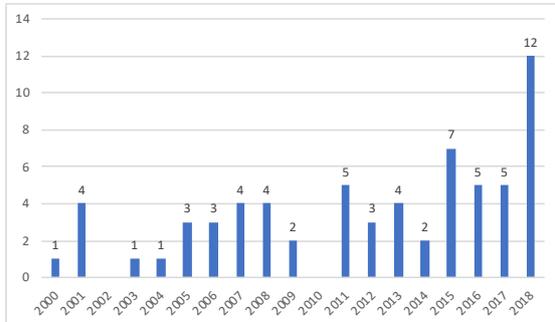
The chosen databases to conduct the research were Emerald and ScienceDirect, which are databases that comprise operations, organizational management, and social sciences researches. Scopus, which is one of largest abstract and citation available database of peer-reviewed literature and considers the main operations and management publishers indexed (for example, Emerald, Elsevier, Springer, Oxford University Press, IEEE, and others), was also used to guarantee a full research. To complete the references bases, it was also considered articles of Sales and Operation Planning from APICS (American Production and Inventory Control Society), which is one of the most important worldwide association of operations management with a strong link with the most important worldwide companies. Other scientific grey literature considered were newsletters, reports, theses and conference papers (Weintraub, 2000).

The following phrases were adopted in the search engine: “demand-driven sales and operations planning” or “demand driven sales and operations planning” or “demand-driven S&OP” or “demand driven S&OP” or “DDS&OP” not “S OP”. The period of publication was limited to 2000-2017 to obtain a current view. A parallel search was conducted to obtain the main concepts of the demand driven approach (considering the same 2000-2017 period). To guarantee the state-of-the-art presentation, other research was also conducted considering the following phrases adopted in the search engine: “sales and operations planning” or “S&OP” or not “S OP” (considering the same 2000-2017 period). For this research were considered both quantitative and qualitative papers. The papers’ frequency along the years is illustrated in Graphic 1 (EBSCO host,

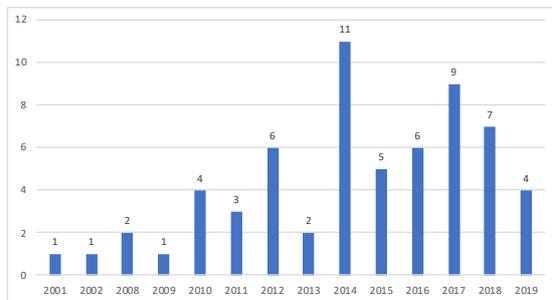


Graphic 1. S&OP papers’ frequency along the years. Source: EBSCO host.

total of 151 papers), Graphic 2 (Emerald, total of 66 papers) and Graphic 3 (ScienceDirect, total of 62 papers).



Graphic 2. S&OP papers' frequency along the years. Source: Emerald.



Graphic 3. S&OP papers' frequency along the years. Source: Science-Direct.

With the found papers, a theoretical background was written and a comparison about the approaches were provided.

Finally, this research considered the principles of the systematic review as suggested by Denyer and Tranfield (2009), i.e., replicable, exclusive and aggregative.

3. Theoretical Background

3.1. S&OP Traditional Approach

3.1.1. Introduction to the S&OP Traditional Approach

The S&OP is a tactical planning process, executed on monthly-basis and led by senior management (Pedroso and Silva, 2015) with the aim to balance demand, production, distribution, procurement and

finance to ensure, the plans and performance are aligned to support the business strategic plan (APICS, 2016; Feng *et al.*, 2008). It could be considered the “steering wheel” for a company’s business, thus planners must driving down to the strategic road to match the supply-demand plans (Lapide, 2009). In this sense, the main role of S&OP is to maintain the balance between supply and demand and, in case of misbalancing, to provide proper warnings for contingency plans (Vollmann *et al.*, 2005) while help the organization to overcome the silo effect, i.e., departments with individuals goals (Swaim *et al.*, 2016). However other S&OP objectives can be found (Pedroso and Silva, 2015):

- To elaborate operational plans and the company performance;
- To evaluate the company’s performance on a continuous base;
- To align the company goals with the operational performance;
- To contribute with the strategic planning of the company;
- To guarantee the changes are done correctly;
- To promote a consistent customer service;
- To elevate workgroup;
- To link different plans and function present in the company;
- To offer consensus in decisions.

The main outputs of S&OP are (Corrêa and Corrêa, 2017:472):

- Establishment of revenues monthly goals;
- Billing projections;
- Inventory projections;
- Cash flow projections;
- Budget for material purchase projections and expenses;
- Definition of the tolerance limits of the MPS variability;
- Definition of monthly quantities to be manufactured during the demand time fence.

Until 1950’s, S&OP was not known by its denomination. Companies used to plan with the Aggregate Production Planning (APP). By mid-1980’s the evolution was to Manufacturing Resources Planning (MRP-II). Currently, S&OP concept considers a business process with the aim to align sales, operations, development and financial (Thomé *et al.*, 2012).

Although, in practice, it is possible to find many definitions to S&OP and it is important to have a well-defined process (McCollum, 2011). In this paper was adopted the American Production and Inventory Control Society (APICS) definition for S&OP; this definition considers a synthesis of the main definitions of this process (considering both academics and practitioners' side). APICS is a global and professional association for operations and SCM and a provider of research, education and certification programs, that involves academics and industry practitioners of SCM. According to APICS Dictionary, 15th Edition (APICS, 2016:164), the definition of S&OP is: "a process to develop tactical plans that provide management the ability to strategically direct its business to achieve competitive advantage on a continuous basis by integrating customer-focused marketing plans for new and existing products with the management of 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."

S&OP shall be a collaborative process (Bower, 2015b) and considering the definition prior described, it is noticed the importance of integrating sales/marketing and manufacturing. This is not a new issue. Shapiro (1977) addresses this issue considering the different point of views existing in these two areas. The author pointed the market perception of lack of production customer-orientation focus and the manufacturing perception of lack of marketing costs, profit and operations orientation. He concluded that a good beginning to minimize this conflict is to have a development and promulgation of clear corporate policies.

APICS (2006d) affirms that the business planning process provides S&OP with the companies and market needs. The functional areas, normally, has no integration and no cooperation, thus the S&OP process should make the plans come together.

3.1.2. *The S&OP Traditional Approach process*

As described prior, S&OP is a process, executed on monthly-basis and led by senior management with the aim to balance demand, production, distribution, procurement and finance. One of the first difficulties in this process is the participation; scheduling time of all senior management could be arduous, but it is essential to the success of the process (Schneider, 2013b). Schneider (2013a) also completes citing

that the meeting will take from one to two hours (depending on the phase) and must happens at least monthly.

Prior to begin the S&OP process is a pre-requisite to have all leaders of functional areas involved. The people should not have the perception that the S&OP preparation work and meetings are an "extra-work", but it is a fundamental process to achieve customer needs (Schneider, 2013b).

The S&OP process could be divided in five steps (APICS, 2006c; Corrêa and Corrêa, 2017; Schneider, 2013b; Wallace and Stahl, 2008).

The **first step** is to run the sales forecast reports. Normally this activity occurs at the end of the month and is executed in the information system department. It consists of three elements (APICS, 2006c):

- Updating the file with data from the ended month (inventories, production, backlog, etc.);
- Generating information for sales and marketing personnel to support the forecasting development;
- Divulging the information to the appropriate people.

It is important to notice that is not good if the sales be superior than the planned, because production would not have capacity to produce this excess or future sales orders could be compromised. For someone, it is difficult to understand this, because the company must sell. The sales quantity must be next to the planned quantity, if this not occurs the root cause of the deviation must be analyzed (Corrêa and Corrêa, 2017).

The **second step** is the demand planning phase. In this phase, sales and marketing personnel review the information received from the first step. The aim of the second step is to update the existing forecast or generate new forecast. The forecast must include all product families and any product life-cycle phase changes.

In this step is generated a sales plan. Once the available resources are limited, it is important to prioritize markets, thus the sales plan shall reflect the strategic positioning of the company in the market (Corrêa and Corrêa, 2017; Wallace and Stahl, 2008).

Schneider (2013a) proposes that the two first steps lasts about seven days. The first two days are spent

on data preparation. On the third day team members gather field intelligence, for that is important that the sales people be closer to the customer. On the seventh day, a demand meeting takes place to analyze the demand forecasts and analysis; this meeting must have the participation of the higher-level managers from sales. It is important to notice that the output of this meeting is an unconstrained forecast.

In the **third step** the operations personnel review the output from the second step. In this phase plans must be validated or changed against the availability of supply resources, using the resource planning. The supply resource shall be understood as the resources necessary to produce and distribute the goods and includes materials, personnel, machines and distribution modals. In this steps is proposed a projection of inventory/production that satisfies the sales plan and production capacity restrictions (Corrêa and Corrêa, 2017; Wallace and Stahl, 2008).

This third step lasts from the eleventh day through the fifteenth day. The master scheduler normally is the facilitator of this step. As prior described, this process identifies any potential constraints with machinery, people or suppliers and develop a supply plan and countermeasures (Schneider, 2013b).

The objectives of the **fourth step**, this is the pre-sales and operations plan meeting, are (APICS, 2006c):

- Decide about the balancing of supply and demand;
- Resolve problems and differences among the functional areas;
- Identify the areas where agreement cannot be reached;
- Develop scenarios to propose actions alternatives to solve a given problem.

Decision-makers of all functional areas (sales, marketing, product development, finance and operations) must participate in this step. Their job is to check resources constraints, establish priorities and review the demand and supply plans of all product families (Wallace and Stahl, 2008). The comparison of the actual versus planned performance shall be done.

The outputs of this step are (Wallace and Stahl, 2008):

- Financial plan updated;
- Action plan for each product family;

- Plans for new product introduction;
- Resource plan changes recommendations;
- Scenarios and impacts for areas where agreement could not be reached;
- Recommendations changes to demand and supply strategies;
- Agenda for the executive S&OP meeting.

This meeting normally occurs on the sixteenth day of the S&OP process. This meeting should last from two to three hours and must be faced as a working session. The leaders' participation is essential and they must feel ownership of the process, by collecting feedback and to make the gathering more effective (Schneider, 2013b).

The **fifth step** is considered the main event of the monthly S&OP process, whose objectives are (APICS, 2006c):

- To make decisions on each product family, considering the outputs of the fourth step;
- To authorize changes in the rates of production and procurement;
- To compare the production plans to the business plan in financial terms;
- To make decisions where there is not agreement, as expected in the fourth step;
- To review business key performance indicators and follow up on areas where is having lack of performance.

The output of this fifth step is an authorized companywide plan which has the meeting minutes, summary of the decisions, summarized action plan with due dates and responsibilities and the complete production plan for each product family (APICS, 2006c).

At the end of the all five-step S&OP process, operations will have (APICS, 2006c):

- The production plan (for manufactured product families);
- The purchase plan (for purchased product families);
- The inventory plan (for make-to-stock product families); and
- The backlog plan (form make-to-order families).

Schneider (2013a) and Bower (2015b) show the importance of the participation of the president or CEO of the organization to lead this last meeting. The

duration of this meeting is from one to two hours and occurs normally on the eighteenth day. In addition, (Schneider, 2013a) lists six rules that should never be broken to have success in a S&OP process:

- The president or chief executive officer (CEO) should own the S&OP process;
- All participants must take meeting attendance seriously;
- Promote a team environment, but encourage healthy debate;
- Supply does not change the forecast;
- Perform a kaizen event on the S&OP process at least twice a year;
- Use an action item list to keep people accountable and ensure what gets measured gets done.

To the entire process be well-succeed is necessary to establish an agenda that is followed by all people involved. Considering mainly the fourth and fifth steps, the following topics should be covered during the meetings (Bower, 2016b):

- Agenda review;
- Review of open items;
- Key Performance Indicators (KPI) analysis;
- Plan assumptions;
- Plan conversation;
- Plan approval;
- Other relevant topics;
- Executive sponsor comments and questions;
- Next steps and action items; and
- Process recap.

3.1.3. *The path to the S&OP Demand-Driven Approach*

The traditional S&OP configuration (that of running periodic, multi-functional planning meetings) should not change in the demand-driven environment, but should consider the increased supply chain uncertainties (Lapide, 2009). The same author describes five target points to take in consideration for the new S&OP scenario:

- Supply-side planners must improve their communication with Sales and Market;
- Rely more on downstream information, to detect more effectively changes in product consumption;
- Better understanding on the economy impacts on demand;

- Focus on products and markets segments to minimize the demand uncertainties;
- Utilize more formal risk management strategies as the supply-demand risks increase.

To identify if the S&OP process is with problems and not running properly, Schneider (2014) proposes a brief checklist, as follow:

- Top management supports the process in name only;
- The financial forecast is not derived from the S&OP forecast;
- Attendance is lacking or discussion during the meetings is stagnant;
- Metrics are not improving despite the efforts.

If problems are found, it is a justification to change to the demand-driven approach.

3.2. Demand-driven S&OP Approach

3.2.1. *Introduction to the Demand-Driven S&OP approach*

In the new Supply Chain Management environment, the planners should not solely react to the market, but they need to plan effectively (Lapide, 2009), thus to keep competitiveness, customers must see value in what the companies are offering (Burrows, 2012). To fulfill customer's requirements, companies must define their performance objectives, considering on time, reducing lead times, reducing working-in-process (WIP), reducing the cost of goods sales, and so on (Miclo *et al.*, 2016). In this scenario, to configure business processes, it is necessary a clear reflection of the specific demand requirements to achieve the customer's need (Verdouw *et al.*, 2010) and to look for insulation from market fluctuation has become essential (Gollamudi, 2013).

The demand-driven environment requires companies to be flexible. Hadaya and Cassivi (2007) considers five flexibility types to be considered in this new environment:

- Volume flexibility: the ability to adjust production to capacity;
- Launch flexibility: the ability to introduce new products in a rapid and effective manner;
- Access flexibility: the ability to cover the distribution network;

- Product flexibility: the ability to produce different products with different characteristics; and
- Responsiveness to target market(s): the ability to respond the needs of the target markets.

Budd *et al.* (2012) considers the importance of the information flow in the demand driven environment, thus, they define a demand driven supply chain as the supply chain that has the capacity to share real-time information with the supply chain's participants. This ability creates to the supply chain's participants the capacity to react rapidly and effectively to the unexpected changes. Winig (2016) conducted a case research in which a bank in South Africa gained competitive advantage by developing a customer relationship considering a data-driven approach, i.e., working effectively with big data and information flows (internally and externally), proving the importance of the information flow in this new demand environment.

Budd *et al.* (2012) also consider four key pillars for the companies within a demand driven environment:

- Visibility: demand and inventory level information must be transparent in the supply chain;
- Infrastructure: robust infrastructure allows companies to respond effectively to market changes;
- Coordination: coordination promotes flawlessly and cost-effectively execution; and
- Optimization: not solely cost reduction, but configuration to best fulfil the customer requirements.

The same authors cite some benefits of the demand-driven supply chain: (i) reduced inventory, (ii) decreased working capital, (iii) improved forecasting accuracy, (iv) reduced transportation costs, (v) optimized infrastructure, (vi) decreased order-expediting costs, (vii) reduced operating costs, (viii) reduced head count, (ix) decreased sales-planning and operations planning time, (x) reduced lost sales, (xi) improved customer sell-through and satisfaction.

Considering the methodology described in section 2, it was not found publications that deals with S&OP in a demand-driven environment. Two papers were found (grey literature) and one book that deals with the theme. Thus, demand-driven S&OP approach is primarily based on the book of Burrows (2012) called "The Market-Driven Supply Chain: a revolutionary model for sales and operations planning in the new

on-demand economy", the paper of Cecere *et al.* (2009) called "Sales and Operations Planning: Transformation From Tradition" and the paper of Gollamudi (2013) called "Demand Driven S&OP – Maximizing Output To Match Demand Variation".

3.2.2. Cecere *et al.* (2009) Demand-Driven S&OP approach

In the the Cecere *et al.* (2009) Demand-Driven S&OP approach, the S&OP process evolved from the five-step-S&OP process to the nine-step-S&OP process, with the aim o be more sensitive and respond correctly to the demand and market complexity.

The **first step**, to collect sales and market inputs, has the aim to collect data, in a collaborative manner, from sales and marketing. The data is historical data and bias shall be evaluated.

The **second step**, to develop a demand plan, has the aim to build multi-period forecasting plan, considering many sources of demand and information from the first step.

The **third step**, demand consensus and refinement, has the aim to find exceptions, understand and deal with them through a comparison between the statistically multi-period forecast and the collective sales forecast.

The **fourth step**, shape demand based on what-if analysis on demand for supply, has the aim to develop a demand plan based on quantity and financial. It can be used marketing intelligence to take advantage from the competitors. At this point the demand shall be shaped.

The **fifth step**, develop a constrained plan by supply, has the aim to identify manufacturing constraints and capacity opportunities for the consensus meeting review. The output from the third step shall be used and options shall be provided considering return on assets, profitability, revenue, customer service and working capital.

The **sixth step**, conduct a what-if analysis by supply to determine trade-offs on the measurements and identify demand-shaping opportunities, has the aim to perform an evaluation of the fourth-step what-if demand shaping based on profitability, revenue, customer service and working capital. The constrains

of demand shortfalls and capacities opportunities shall be clearly identified.

The **seventh step**, review and gain agreement through a consensus meeting, has the aim to review scenarios and have a consensus on an operating plan based on pricing, operational and functional trade-offs.

The **eighth step**, publish the constrained plan, has the aim to communicate the plan to the global operational and financial teams for execution.

The **ninth step**, measure and communicate the plan, has the aim to evaluate how the decision prior taken are being performed during the month. The goal is to have a learning cycle to be used in the next Demand-Driven S&OP monthly cycle.

There are four steps of maturity to achieve the Demand-Driven S&OP (Cecere *et al.*, 2009):

- Step 1: Reacting. At this step the goal is to develop an operations planning. The main metrics are: order fill rate, asset utilization and inventory levels;
- Step 2: Anticipating. At this step the goal is demand and supply matching. The main metrics are: order fill rate, forecasts errors, inventory turns and functional costs;
- Step 3: Collaborating. At this step the goal is profitability. The main metrics are demand error, customer service, working capital and total costs;
- Step 4: Orchestrating. At this step the goal is demand sensing to drive an optimized demand response. The main metrics are: demand risk, customer service, cash flow, market share and profit.

3.2.3. Burrows (2012) Demand-Driven S&OP approach

Burrows (2012) cites that one fundamental point to have success in the Demand-Driven S&OP implementation is education. It is necessary to through people, not solely with them. The main idea is to develop people to be able to work in the entire process and not just in part of process that is on a “prepackaged form”.

Burrows (2012) completes affirming that Demand-Driven S&OP shall be designing to implement

the company’s strategy. For that, two other points, besides education, should be handles carefully:

- Design S&OP to run the business: as S&OP brings all functions together, it becomes the way the business is run. Through the S&OP meeting, handled in a collaborative manner, the team determines how to interpret the information and makes decision with consensus. The responsibility for results belongs to entire team;
- Design to enable customer centricity: the demand-driven S&OP shall be centered on customer and this is possible with a strategy focused on market. The market feedback should be handled in the S&OP’s meeting and the team must have the functions well-defined and briefly described. The metrics and strategical goals are different compared with the traditional process, i.e., not solely considering internal goals but measuring enabling concepts to fulfill customer’s need. For that metrics should consider complexity, flexibility, customization and strategic alignment.

Burrows (2012) considers twenty-six horizontal planning processes that should be aligned during the Demand-Drive S&OP process. The process is illustrated in the Figure 2.

The numbers presented in the Figure 2 may lead to a sequence of steps to be dealt. Nonetheless, it differs from the process proposed by Cecere *et al.* (2009) and from the traditional S&OP process.

The **strategic integration** has the aim to come back to the company’s strategy in order to find gaps between what is being executed and what was planned. It is important to understand such gaps to find errors in the strategic planning or to make corrections in what is being executed during the month.

The **demand planning** receives the information obtained during the strategic integration to plan how explore the market and customers’ segments. At this point, it is not solely a forecasting, but it is a fundamental process that links the company’s strategy to the market exploration.

The **rated-based planning** has the aim to create a production plan that fulfills the demand at a minimal inventory accumulation based on an agreed service level.

The **planning in cross-functional coordinating families** may be considered an enable process that



Figure 2. Burrows (2012) demand-driven S&OP approach (source: Adapted from Burrows (2012)).

lead to the success of the S&OP process. Companies works with a large amount of items, when these items are aggregate in families, planning and forecast errors are minimized and the decision-making process becomes easier. When these families are planned in a cross-functional way, many areas has the visibility of the concerning issues of the families, thus opportunities can be find easily and contingencies plans can be done faster.

The **network design** has the aim to understand the supply chain issues and opportunities, to evaluate which plant would produce which items, to define distribution strategy (inventory's position in the supply chain and modals of transport), to understand leadtimes and to make visible the constraints to reach the market.

The **inventory simulation** has the aim to evaluate and define the quantity and location of the inventory in the supply chain. On the one hand inventory is costly but on the other hand inventory defines the service level. By using simulation (specialized software may be used), it would help the decision makers to define the better strategy concerning inventory issues in the supply chain.

The **cost-to-serve analysis** evaluates all costs incurred to serve the customer segments considering the network design and inventory positions and quantities.

The **view of forecasts** should not be limited to statistical forecast analysis. Multiple views should make part of this process, i.e., sales person forecasts, customer forecasts, trade association forecasts, marketing forecast of promotions, customers' segments forecasts, etc. All these forecasts views shall be displayed on a chart, in order to have a great visibility of different points of view.

The **risk/opportunity analysis** has the aim analyse the agreed prior decisions and look for the risks of them and opportunities. This process is important because issues may occur, depending on made decisions and opportunities may not be foreseen.

The **contingency planning** deals with the information of the risk/opportunity analysis to create system resilience. Issues may occur and, based on the risks prior evaluated, a contingency plan shall be defined in order to keep the plan on the rails.

The **sales-gap closure** is the last foreseen process for sales planning in which sales persons shall present the final considerations about market and customers and based on the value-chain program a final sales planning is defined in order to continue the entire Demand-Driven S&OP process.

The **financial report** brings to financial terms all prior decisions. Not solely costs, but a complete report considering the financial data.

The **integrated projections** considers the financial reports to be formulated. This projections considers the financial impacts in the future in all evolved areas in the process, that's why, it is called integrated. The important aspect of this process is the holistic approach, because some areas, sometimes, need to have a poor result in order that the whole company have a positive result.

The **annual operating planning** is not an exclusive process of the S&OP, but it inputs information in order to make financial decisions and the S&OP process support the creation/review of the annual operating planning. The annual operating planning has the importance to evaluate the company's financial healthy.

The **tilt meetings** has the aim to formalize all financial decisions made during the S&OP process. These meetings also brings the opportunity to find mistakes, to look for opportunities, to evaluate and mitigate financial risks and to make financial information available to the S&OP team.

The **demand sensing** is one of the key process of the Demand-Driven S&OP, that's why, it is a process that is also in evidence at the Cecere *et al.* (2009) proposal. In this process is necessary to identify few and important leading indicators, and not try to go into the terabytes of company's system information. It is important to analyse, besides the internal perspective of the company, the external perspective, i.e., customer trends, point-of-sale data, economy trends, populational changes, habits change, and so on. The idea is to be prepared and aware with the environment the company is inserted. Forecasting may be used to support the decisions of this process.

The **promotional alignment** has the aim to make clear all marketing efforts to promote products. This is an important point to be dealt, because promotions affects the demand and, thus, the necessity of using the manufacturing capacity.

The **supplier alignment** has the aim to communicate the suppliers with the decisions provided by demand sensing and promotional alignment. Suppliers should not be aside of the company's decisions, because, if this happens, raw materials could not be available for production. Strong relationships and enhanced information shared shall be better with key suppliers.

The **competitors analysis** brings the opportunity to understand and analyze the competitors movement and actions in the market. It is important to have

competitiveness advantages with internal capabilities, but it is also necessary to analyze the competitors.

The **monthly S&OP meeting** is a cross-functional meeting in which the decisions must be taken considering the taken considerations foreseen in the previous steps. The areas' leaders must have a participation in this meeting.

The **customer alignment** has the aim to understand the restrictions of customer's segment and to define and make clear the service level of each customer's segment. All areas involved in the process shall know the service level of each customer's segment with the aim to provide with the correct fulfillment strategy.

The **new product planning** brings to all involved the strategy of new products launch. The new product planning is important because action of all areas could be taken, for instance, manufacturing capacity utilization, warehouse occupation, sales-force efforts, marketing efforts, financial assumptions, etc.

The **performance metrics meeting** brings the view of how the company is performing, considering the operational side. Capacity utilization, transportation performance, warehouse occupation and breakdowns analysis are issues that could be analyzed. The metrics shall be shown in a dashboard in order to make the visualization and analysis of each defined key performance indicator easier.

The **generating free cash** is an important process because to be demand-driven companies may face financial issues to perform the proposed service level. This process evaluates financial issues and compares with the agreed service level.

The **customer metrics meeting** is a meeting performed after performance metrics meeting and generating free cash. The aim is to understand and make clear to all involved how the company's customer segments is being fulfilled. Lessons learned may be used to the next monthly cycle and the metrics shall be shown in a dashboard in order to make the visualization and analysis of each defined key performance indicator easier.

The **process governance** is a core process in which all issues must be shared in order to improve the process as a whole. Lessons learned of previous monthly cycles shall be tracked to check if they are being applied. Improvements actions shall also be set to the next cycles.

4. Comparison among S&OP approaches

Three approaches were found with the conduct research. The first approach was the traditional S&OP process, with main contributions from APICS (2006d), Corrêa and Corrêa (2017) and Wallace and Stahl (2008) which are the classic authors of the theme. The second approach, which is a demand-driven approach, was from Cecere *et al.* (2009). The third approach, also a demand-driven approach, was from Burrows (2012).

At this point, it is important to find the main differences between the presented approaches. This comparison among the approaches has the aim to make clear the differences and support the further frameworks development. Fourteen dimensions were defined considering the information and concepts presented in the researched papers. The goal was to structure the information presented in these papers to provide a better and a clear comparison. The defined dimensions are as follow:

- Number of foreseen processes during the S&OP cycles;
- Involved areas and participants;
- Duration of the S&OP cycle;
- Level and/or techniques of production aggregation;
- Demand characteristic;
- Level of product variety that can be dealt efficiently;
- Customers need fulfilment approach;
- Level of cooperation among the areas during the S&OP cycle;
- Organization structure;
- Operations' behaviour to fulfil the demand;
- Financial approach;
- Response to the market approach;
- Risk analysis and mitigation;
- Number of meeting during the S&OP cycle.

The numbers of processes, or steps, during the S&OP cycle vary among the approaches. The traditional approach has five main processes to be dealt, while the Cecere *et al.* (2009) approach deals with nine main processes and Burrows (2012) approach deals with twenty-six main processes. Because of market, manufacturing, logistics, financial and product complexity, more process becomes necessary, the level of details to be dealt increases and the demand-driven approach becomes easier to be properly applied.

The involved areas and participants during the S&OP cycle do not vary among the approaches, i.e., manufacturing, sales, marketing, financial, research and development, logistics are foreseen to participate during the S&OP cycle and meetings. The difference, as it will be after describe, is the level and way of cooperation among these areas.

The duration of the S&OP cycle also does not vary among the approaches. The recommended cycle is one month.

The level and/or techniques of production aggregation is the same for the traditional approach and for the Cecere *et al.* (2009) approach, that is, the planning is done for product families. On the other hands, Burrows (2012) proposes a Cross-Functional Coordinating Families, in which the definition and coordination of the families shall evolve deeply all areas of the S&OP process.

The demand characteristic in which the traditional S&OP process works better is for predictable demand. In the demand-driven environment the demand is unpredictable and might change rapidly, that's why, Cecere *et al.* (2009) and Burrows (2012) considers in their approach the possibility to work with unpredictable demand.

The level of product variety that can be dealt efficiently by the traditional S&OP process is from low to medium variety. Cecere *et al.* (2009) approach deals from medium to high product variety and Burrows (2012) approach deals with high product variety.

The customers need fulfilment approach for the traditional S&OP process takes in consideration customers' demographics, while, for both demand-driven approaches the value proposal is taken in consideration.

The level of cooperation among the areas during the S&OP cycle for the traditional S&OP process is from low to medium. For Cecere *et al.* (2009) approach is considered medium to high collaboration and for Burrows (2012) approach is considered high level of collaboration.

The organization structure for the traditional S&OP approach is functional, that is, the areas are divided in silos. For Cecere *et al.* (2009) is expected to have collaboration through well-defined horizontal process and for Burrows (2012) is expected to have

high level of collaboration through well-defined horizontal process.

The operations' behavior to fulfill the demand for traditional S&OP process is reactive to demand, that's why, it is possible to face stock-outs during the order fulfillment process. For the demand-driven approach is expected to use simulation to have a better understand of the demand, that's why, it can be considered proactive.

The financial approach in the traditional S&OP process focuses on minimize loss and increase profit, blinding the customer's need. For the demand-driven approach, the focus is on balance-sheet, so the service level is considered, customers retention is considered and, of course, profit is also considered.

The response to the market approach for the traditional S&OP process is based on inventory accumulation to fulfill the customer's orders, that's why, stock-outs might happen. On the other side, for the demand-driven approach, demand sensing is used in order to know better customers' needs and behaviors, thus, the level of stock-outs tends to be minimized.

The risk analysis and mitigation is foreseen in all S&OP approaches considered in this text.

The number of meetings during the cycle for the traditional S&OP process is two. For Cecere *et al.* (2009) is three and for Burrows (2012) is seven. With more meetings, the issues can be easily shared, the decisions are taken in consensus and the probability to be more adherent with the customer's expectations becomes higher.

The comparison, considering the fifteen dimensions, is summarized in the Chart 1.

5. Concluding Comments

S&OP has an important role in the companies' planning, because it generates an integrated plan for all areas. Nowadays, with the marketplace complexity, new approaches shall be developed in order to make companies able to have competitive advantage.

This paper compared three approaches for the S&OP, one being the traditional approach and two being the demand-driven approach.

Chart 1. S&OP approaches comparison.

Dimension	Traditional Approach	Cecere et al. (2009) Approach	Burrows (2012) Approach
Number of processes	5	9	26
Involved areas	Manufacturing, Sales, Marketing, Financial, Research and Development, Logistics	Manufacturing, Sales, Marketing, Financial, Research and Development, Logistics	Manufacturing, Sales, Marketing, Financial, Research and Development, Logistics
Duration of the cycle	1 month	1 month	1 month
Product aggregation	Family	Family	Cross-Functional Coordinating Families
Demand Product Variety	Predictable Low to Medium	Unpredictable Medium to High	Unpredictable Medium to High
Customer	Demographic Considerations	Value Proposal	Value Proposal
Level of cooperation	Low to Medium	Medium to High	High
Organization	Functional	Collaboration Approach	High Collaboration Approach
Operations	Reactive to demand	Proactive, with simulations	Proactive, with simulations Proactive balance-sheet focus and free cash generation
Finance	Profit-loss focus	Balance-sheet focus	Demand sensing to understand the customers' behavior
Response to market	Inventory accumulation with stock-outs possibility	Demand sensing to understand the customers' behavior	Demand sensing to understand the customers' behavior
Risk analysis and mitigation	Yes	Yes	Yes
Number of meetings during the cycle	2	3	7

It has been noted that the demand-driven approach is a reality that companies will face, thus this paper contributed with this new approach.

Further studies might come from this paper:

- Final framework development for the demand-driven S&OP;
- Case research of applications of the demand-driven presented approaches;
- Performance implications of the demand-driven S&OP; and
- Development of a performance framework for the demand-driven S&OP.

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