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How to Design S&OP Process Steps? The Case of Global Manufacturing Organizations

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Abstract:

This paper aims at identifying the key Sales and Operations Planning (S&OP) process steps within global manufacturing organizations, which is a topic not sufficiently explored in S&OP literature. It relies on a multiple case study approach with two multinational companies. The study departs from a SLR and then uses a pattern-matching technique to test the theoretical S&OP designs with those identified based on the semi-structured interviews with key stakeholders from the two companies. The findings suggest that global multinational firms are not settled in 5 or 7 step process design and can have more steps, such as a 10-step approach.

Keywords: Global S&OP Steps, S&OP Process Design, Global Manufacturing Planning

Introduction

Our world has never been more volatile, uncertain, complex and ambiguous (VUCA). As a result, organizations are currently struggling to sustain and even promote the growth of their business within such a VUCA context, being this especially the case for global organizations involving multiple actors spread across multiple countries, i.e., in the context of global supply chains(Bier *et al.*, 2020). This complexity is even more exacerbated in manufacturing organizations focused on producing innovative and varied products (Forster et al., 2013), which in turn results in an even higher degree of uncertainty, volatility and ambiguity(Mack and Khare, 2016).

Although the VUCA buzzword was first introduced in the early 1990's as a general war concept, it is now clearly recognized as a critical concept within supply chain management(Packowski and Francas, 2014).Organizations are now forced to deal with an increased risk of disruptions caused by an increasing level of volatility, uncertainty, complexity and ambiguity, which justify the need to look for scientific-based approaches to support their operations to better serve their customers (Almeida *et al.*, 2018; Patil, 2009; Tachizawa and Thomsen, 2007). And it is within this context that Sales and Operations Planning (S&OP) play a key role(Kristensen and Jonsson, 2018).

S&OP has been growing stronger in the last few years, being critical to anticipate the supply chain challenges and to support the companies to be better prepared for demand uncertainties and all other VUCA aspects (Packowski and Francas, 2014; El Sakty and Osama, 2015; Wallace and Stahl, 2008).

Although S&OP is a strong ally to fight disruptions, there is scarcity of academic literature on the topic, especially in what concerns S&OP studies going beyond a local or regional approach (Goh and Eldridge, 2019; Seeling *et al.*, 2021). Numerous authors have emphasized the need for additional empirical research that is applicable to real-world scenarios, particularly in the realm of global supply chains. (Kreuter et al., 2022; Kristensen and Jonsson, 2018). The particular context of manufacturing organizations, which are especially impacted by the VUCA environment, is also not sufficiently addressed within S&OP literature.

Within this setting, this paper aims at exploring the S&OP process within global manufacturing organizations and investigating which S&OP process steps should be followed to support worldwide operations planning for complex and global supply chains. The following research question (RQ) was then defined:

RQ1: How is the S&OP design in global manufacturing organizations?

This research makes use of a multiple case-study approach (Yin, 2017) with two large multinational manufacturing corporations embracing the process end to end (not only local or regional) (Kreuter *et al.*, 2022; Stentoft *et al.*, 2020). The research departs from a systematic literature review and then proceeds by using a pattern-matching approach to compare and contrast the theoretical global S&OP designs with those found through semi-structured interviews with key stakeholders from the two manufacturing organizations.

By following the before mentioned approach, this research is intended to contribute to the theoretical advancement of the S&OP theory, as suggested by previous authors, both by reviewing the theoretical knowledge about S&OP in global manufacturing organizations and also by crossing it with the real practice of multinational organizations.

Literature review

In operations management, evidence of the theory from real-world case scenarios is utmost(Flynn *et al.*, 1990). It is common to find the term "empirical," meaning "practical" or "knowledge based on real world observations or experiment"(Hornby, 2010), which is

related to field-based research from observations or experiments other than data from simulations or mathematical programming techniques(Flynn *et al.*, 1990).

Sales and operations planning falls under the operations management discipline (Kristensen and Jonsson, 2018)and it strives to strategically balance demand and supply with the final objective to improve firms performance. Many authors make definitions of S&OP and they are, at some extent similar, but not the same.

The association for supply chain management (ASCM), one of the most respected association for practitioners, defines S&OP as "A process to develop tactical plans that provide management the ability to strategically direct its businesses to achieve competitive advantage on a continuous basis by integrating customer-focused marketing plans for new and existing products with the management of the supply chain. The process brings together all the plans for the business (sales, marketing, development, manufacturing, sourcing, and financial) into one integrated set of plans"(Pittman and Atwater, 2019).

Thome et al., 2012 states that "Sales and operations planning(S&OP) is a tool that unites different business plans into one integrated set of plans. Its main purpose is twofold: (1)to balance supply and demand and (2)to build bridges between the business or strategic plan and the operational plans of the firm"(Thomé et al., 2012a)

S&OP is visualised as a long-term planning tool not only for production but also for sales, demand forecasting, and supply planning(Olhager, 2013). In this view, the role of S&OP is to maintain a proper balance between supply and demand and to provide early warning signs when they become imbalanced, positioning S&OP at the tactical level as noted by Feng et al., 2008 (Feng et al., 2008).

While there is a significant amount of literature on S&OP in industry and practitioner publications, there is a relative scarcity of academic papers on the topic(Kreuter et al., 2021; Kristensen and Jonsson, 2018) One reason for this is that S&OP is a process that is primarily used in industry, and thus may not be as widely studied in academic circles as other topics(Kreuter *et al.*, 2021). Additionally, S&OP is often considered a proprietary business process, and, with participation of upper management, companies do not will to share their practices or data with researchers(Cecere *et al.*, 2009).

Another reason could be that S&OP is often viewed as a practical, rather than theoretical, process(Kreuter *et al.*, 2022). Many academic papers tend to focus on theoretical models or frameworks(Flynn *et al.*, 1990; Kreuter *et al.*, 2022), whereas S&OP is a process that is often implemented in a practical manner, with less emphasis on theoretical models.

The aforementioned factors also serve as contributing factors to increased prospects in the realm of research. Specifically, a significant number of companies encounter difficulties in realizing the anticipated advantages following the implementation of their practices due to insufficient empirical evidence to support their approach. (Kreuter *et al.*, 2021; Kristensen and Jonsson, 2018; Manoj, 2010). One of the causes is related to the challenges associated with designing and crafting the S&OP process according to the company organizational structure set up (Jonsson *et al.*, 2021; Pedroso *et al.*, 2016; Seeling *et al.*, 2021).

A recent S&OP literature review also suggests that S&OP design depends on the industry, dynamic and detail complexity, and organizational characteristics(Kristensen and Jonsson, 2018). The impact of supply chain complexity on Sales and Operations Planning (S&OP) has been found to be twofold, with potential advantages and disadvantages. (Adamczak *et al.*, 2013). As an organization becomes more complex, its requirement for coordination also increases and the higher the expected S&OP output will be. On the other hand, as complexity increases, the development in other areas such as

information technology, likewise increases and, consequently, the investments related to the execution of the S&OP process.

In addition, it is very common find researchers referring to S&OP process consisting of the following five major steps: data gathering, demand planning, supply planning, pre-meeting, and an executive meeting(Lapide, 2014; Thomé *et al.*, 2012b; Wallace and Stahl, 2008). With the academic publication of Seeling et al., 2021 (Seeling *et al.*, 2021), the traditional 5-step approach was no longer the unique design that a firm should adopt. Seeling et al., 2021 has also made a systematic literature review that confirms the lack of studies about S&OP designs and based on his research, proposes a 7 step approach design to support effectives of S&OP.

The abovementioned observations serve as a driving force for additional research on Sales and Operations Planning (S&OP), specifically regarding the balance between performance associated with the industry, dynamic and detailed complexity, and organizational characteristics. The initial step in guaranteeing the adequacy of a company by ensuring it possesses the appropriate design.

Research Method

Overall Approach

A qualitative multiple-case study approach with two global manufacturing companies was used to answer the before presented RQ.

A multiple-case study methodology was used to overcome the limitations recognized for single case studies (Yin, 2017). It is designed to allow the incorporation of multiple voices from different companies' positions, which is aimed at providing a variety of perspectives about the topic. In fact, although S&OP research is dominated by single-case studies (Jonsson et al., 2021; Seeling et al., 2019), Yin (2017) suggests using case studies with multiple perspectives to address the complexity of a phenomenon (Yin, 2017).

It should also be highlighted that a case study approach was selected for this research because: (1) the focus is on answering a how research question, (2) the study cannot manipulate the participants' behaviour, and (3) the boundaries between the phenomenon and context are still to be clarified (Yin, 2017). And for the particular situation of this research, a multiple-case study.

Data Collection

This study departed from a systematic literature review (SLR) to map existing S&OP design steps, according to the literature in the area. The PRISMA methodology was followed by searching for scientific literature published in Web of Science, Scopus and ABI/Inform with the use of "S&OP", "Sales and Operations Planning", "SIOP", "Sales Inventory and Operations Planning", "IBP", or "Integrated Business Planning" as keywords for search.

Once the SLR was concluded, a set of semi-structured interviews were performed with several executives and non-executives of the two global manufacturing companies selected as case-studies for this research. In both companies, executives responsible for the end-to-end S&OP process were interviewed. In addition, the global process managers/subject matter experts responsible for specific parts of the process were interviewed. Local and regional S&OP process participants were also interviewed. In total, headquarter, hubs, and subsidiaries were interviewed, in a total of 10 interviews (see Table 1). The selection of these interviewees followed a purposive sampling technique, in which only those with the required knowledge in the sector were invited. Selection criteria for being included in the interviews were as follows: working experience in global manufacturing companies higher than 8 years; and those with experience as executive

responsible for the end-to-end S&OP, global managers or local/regional managers that are actively S&OP participants.

Table 1 – Participant list

Participant	Company	Position	Years of industry experience
1	A	Head of department	15
2	A	Head of department	20
3	A	Global Manager	8
4	A	Global Manager	10
5	A	Global Manager	12
6	A	Local Manager	15
7	A	Local Manager	13
8	B	Head of department	12
9	B	Global Manager	8
10	B	Global Manager	10

The protocols of questions were developed and pre-tested with two individuals - 1 academic with expertise in global supply chain management and 1 supply chain executive, being then revised to incorporate feedback. Interviews were then performed at an individual basis, lasting for 45 minutes (on average) during 2 weeks, and were transcribed verbatim consistent. Evidence of process steps was also made available from both researched companies.

Data Analysis

The coding procedure used in this study followed the one proposed by Saldaña (2016), and comprised three stages:

- ✓ Stage I: Interviewees' transcripts are analysed and coded in accordance to the theory identified using the SLR;
- ✓ Stage II: New codes for any new emerging ideas and constructs are created;
- ✓ Stage III: Coding scheme is finalized.

After coding, the pattern-matching technique was used for analysing data across interviewees and determining whether the conclusions taken out from the SLR matched their views and perspectives (Almutairi et al., 2014; Yin 2017). In this study, the stages proposed by Almutairi et al. (2014) as a guide for a pattern-matching analysis are followed:

- ✓ Stage A: The propositions to be studied are defined using the SLR as a basis;
- ✓ Stage B: The empirical propositions build based on each (and both) case(s) are tested and compared to the propositions identified based on the literature;
- ✓ Stage C: Final stage in which theoretical explanations for the matches (and mismatches) found in the second stage are provided.

Case study findings

Systematic Literature Review findings

Following the SLR described before, 108 publications were analysed in detail to ascertain the process steps that were utilized as the foundation for the S&OP investigation. The

process design stages employed were identifiable as a frame of reference in 61 of the articles. The aforementioned steps facilitated the determination that a majority of the authors employed the 5-step methodology posited by Wallace and Stahl (2008). (see Figure 1) According to practitioners, adherence to the 5-step design was deemed unsuitable, a sentiment that was similarly expressed by Cogan (2017) during his effective implementation.

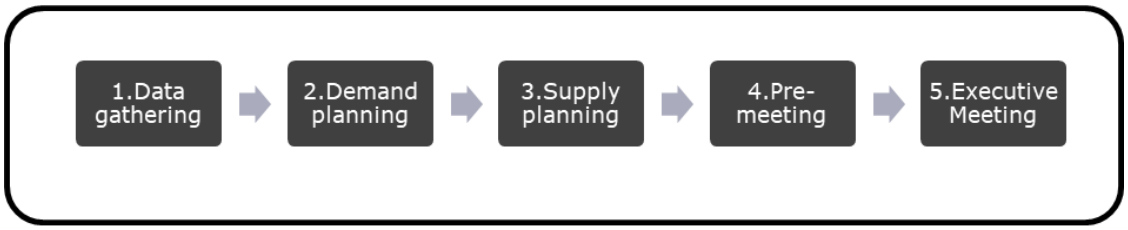


Figure 1 – Wallace and Stahl model (Wallace and Stahl, 2008)

In 2021, Seeling proposed a global rollup approach that incorporates two additional steps to the conventional five steps outlined by Wallace and Stahl (2008). Seeling's research was integrated into a new framework and contributed to the advancement of theory on global sales and operations planning (S&OP) (Seeling *et al.*, 2021).

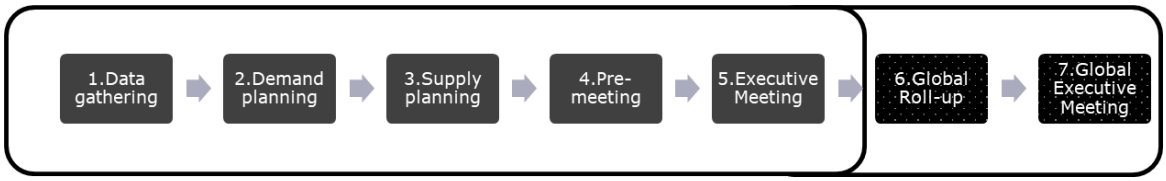


Figure 2 – Seeling et al Model (Seeling *et al.*, 2021)

Semi-structured interviews with companies A and B: Characterizing the selected companies

The researched companies share a revenue around €6.3 and €10.3 billion with manufacturing and distribution operations in different parts of the globe. The complexity lies on the quantity of manufacturing locations that are not serving one specific region nor one specific country (local). In table 2 it is possible to have insights of the complexity of both companies.

Table 2 – Interviewed Companies Characteristics

Selection criteria	Company A	Company B
Company HQ Location	Europe	Europe
Geographical sales/distribution locations	Europe, Asia, Americas, Africa, Oceania	Europe, Asia, Americas, Africa, Oceania
Main product segments	Power tools, anchors, fire protection, measuring tools, diamond tools	Climate solutions, Power solutions, Power electronics and drives
Revenue	~EUR6.3bi	~EUR10.3bi
Employees	~32.000	~42.000
Manufacturing sites for S&OP	11	31
Manufacturing strategies	MTO, MTS, ATO, ETO,PTO	MTO, MTS, ATO, PTO
SKU quantity	>30.000	>15.000

Semi-structured interviews with companies A and B: Interviews' results

Interviews allowed to conclude that both European companies follow the procedures, but not the process, proposed by Wallace and Stahl (2008). The procedures include a predetermined meeting schedule, agenda, and minutes, as well as participants with well-defined roles and responsibilities and measurable objectives. All phases of the process are supported by upper management, and activities are carried out with effective collaboration between functional business sectors.

The two organizations have been implementing their S&OP process for a minimum of five years, thus allowing them to achieve a consistent level of maturity through ongoing evaluations. One company calls the process S&OP (Sales and Operations Planning) and the other SIOP (Sales Inventory and Operations Planning) with both leveling the same objective to balance the demand and supply.

In order to illustrate the intricacies of the Sales and Operations Planning (S&OP) process, it is imperative to comprehend the information dissemination that occurs during the planning phase. Figure 3 illustrates the global approach, there exists a state of demand that is entirely unconstrained, whereby localities and regions possess the ability to place orders for quantities that are unrestricted. Moreover, it is possible for several Business Units (BUs) to function within a single manufacturing facility, while each BU maintains its own exclusive manufacturing lines.

Top-tier executives hailing from various departments such as finance, marketing, sales, sourcing, and manufacturing are participating in each stage of the process in accordance with their designated roles and responsibilities.

Following the distribution planning phase, the execution stage commences, during which each region is served in accordance with its respective forecasted quantity. The proposed process has been divided into distinct phases, which are elaborated upon below. A summary of each phase, in relation to the existing literature, has been presented in Figure 3.

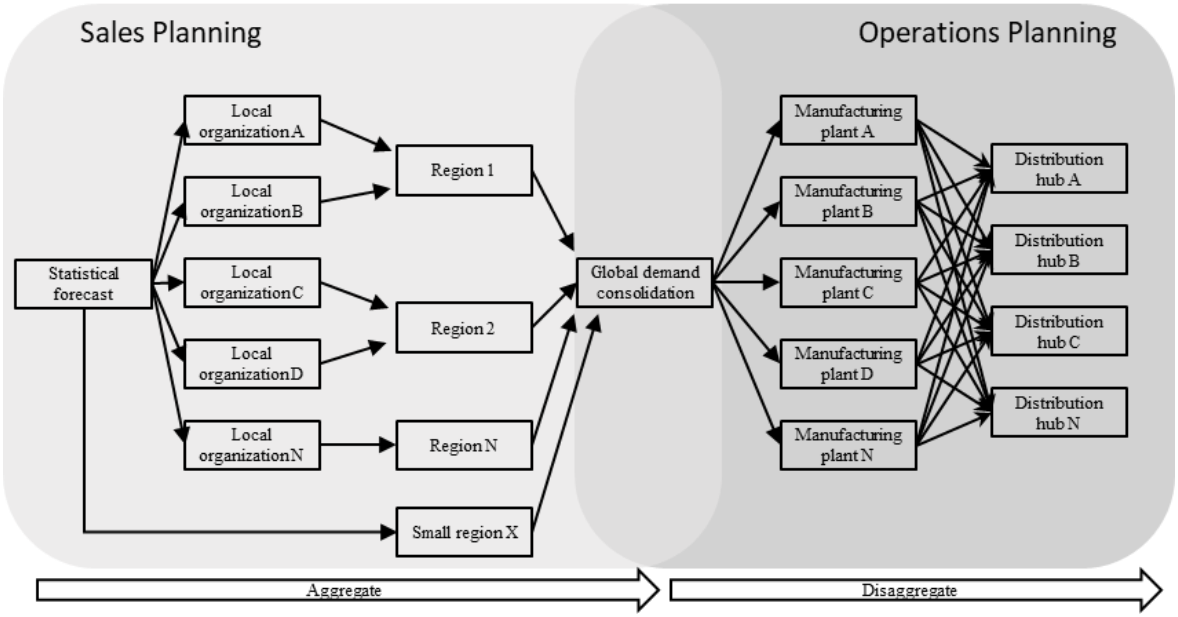


Figure 3 – S&OP Information flow

Through the conduct of interviews, it has been ascertained that the extant S&OP processes employed by the two companies exhibit slight deviations from the ones recommended in the scholarly literature. The present approach retains the fundamental goal posited by Wallace and Stahl (2008), while exhibiting similarities to prior methods. Nevertheless, the current execution of the process is distinct.

The below presented process steps (Figure 4) is designed based on the empirical evidence collected grounded on the interviews and allows the proposition of a novel approach to explore Sales and Operations Planning (S&OP), emphasizing the importance of adopting a comprehensive end-to-end perspective of the entire process.

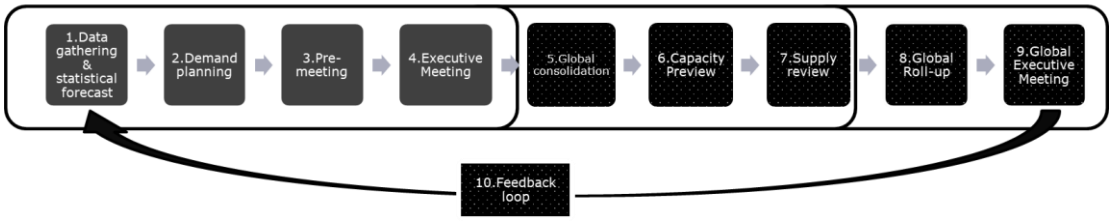


Figure 4 – S&OP Proposal

Semi-structured interviews with companies A and B: Pattern-matching technique

The pattern matching technique permits to compare the two models available in the literature, in this case from Seeling et al. (2021) and from Wallace and Stahl (2008), and allow to identify the differences among each of the process steps (Figure 5).

All of Wallace and Stahl's (2008) process steps, from 1 to 5, are included in the proposal from Seeling et al. (2021) with two additional steps: 6.Global Roll-up and 7.Global Executive meeting.

The study revealed that supplementary process steps were necessary to effectively execute the Sales and Operations Planning (S&OP) process. The proposed 10-step framework is based on the fact that local or regional organizations receive goods not only from one or two specific plants, but from global plants, as depicted in Figure 3.

When comparing each process steps, the variations start in the first one (1. Data Gathering): both companies rely on a monthly statistical forecast run generated from a centralized forecasting team. History correction is prepared before the statistical forecast run. The demand planning happens at local level with unconstrained demand.

In process step 2 (2.Demand planning), differences were not sufficient when comparing with different authors aforementioned, both in content and in objective. In step 3(3.Pre-meeting) the variances start to become more evident, where a supply planning is conducted in local/regional levels according to Seeling (2021) and Wallace and Stahl (2008) and it was detected in the interviews that supply data is available only for sales mix definition with financial objectives and not for constraining demand.

In process step 4 (4. Executive Meeting) the objective is to have upper management decision-making approval on the region level. This happens in the second week of the month, where this process step is similar to step 5 in Wallace and Stahl (2008) and Seeling (2021) propositions. The difference lies on the meeting outcome that is twofold: a sales plan based on supply constraints and an unconstrained demand plan.

Process step 5 (5.Global consolidation) effectively adds up the requirements from all of the regions and identifies the amount of goods available in each of the warehouse in the chain considering its respective inventory strategy and reorder points/quantities. The main objective is to have a global netted demand and to distribute it to each manufacturing plant / supplier.

Process step 6 (6.Capacity preview) allows the plants and suppliers to identify if the demand plans, now called net requirements, can be met according to their material, man-power, and machines availability. All figures are updated in a systematically way and discussed in process step 7 (7. Supply review) with upper management according to scenario propositions – This step is where the first signal for investments in manufacturing and infrastructure capacities are given.

A global roll-up (8.Global roll-up) happens with very similar characteristics when comparing with Seeling (2008), nevertheless it aggregates all demand and manufacturing plans, demonstrating risks and opportunities and where attention is required from upper management. It is not only based on a set of KPI's, but it contains strategic information and required action plans.

In process step 9 (9.Global executive meeting) has different objectives than proposed by Seeling (2008). Due to its strategic nature, it happens three times per year and it is intended for global executives to provide their strategic guidance and sign off on sales plans, infrastructure, launches, and overall business direction in order that structure can follow strategy, as proposed by Chandler (1962) Therefore, the whole process becomes more focused on strategy rather than tactics.

The final process step (10. Feedback loop) was uniquely present in company A and it is also included as one of the proposed steps. It provides a feedback on a monthly basis to all local and regional organizations about the outputs that were decided during the S&OP process with the mainly objective to show the gaps and risks from the supply side to serve as input for the demand planning. It can be inferred that the process exhibits cyclical behaviour, as it was observed in the course of the investigation.

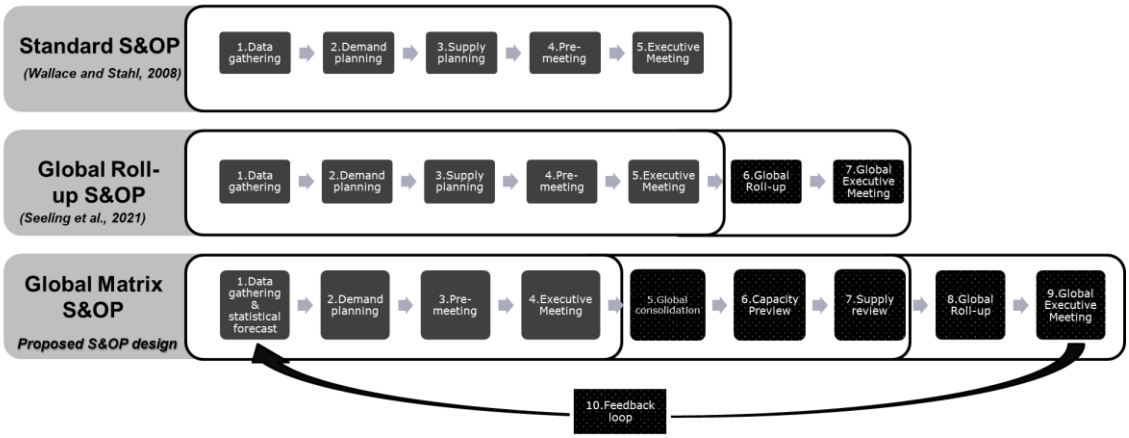


Figure 5 – Global S&OP comparison

With the demonstrated gaps between the literature and interviews, it is possible to offer a novel approach to global S&OP in multinational corporations, especially the ones within a global matrix set-up. It is proposed that an innovative 10-step S&OP process will enable global firms to successfully plan sales and operations (Figure 4 and Figure 5).

Conclusion

A new S&OP design process step is proposed with a different framework from other authors present in the current literature (Seeling *et al.*, 2021; Wallace and Stahl, 2008). It concentrates not only in subsidiaries, but it gives a headquarter perspective of the full process. In addition to its theoretical contributions, this research provides applications that can assist executives, especially those from multinational manufacturing companies, in their efforts to expedite global planning and to implement the most fit S&OP process according to their company set up.

This research contributes to the theory building of S&OP by combining both scientific knowledge and organizational practice while building new perspectives about S&OP designs that better fit global manufacturing companies, going beyond the unique two existing 5-step or 7-step frameworks identified in the literature (Kristensen and Jonsson, 2018; Seeling *et al.*, 2021). It thus expands it to a more complete, more robust, more multifaceted and more global S&OP design, while mapping and combining designs proposed in the literature with designs employed and/or aimed by real global manufacturing companies. The foreseen research benefits thus include establishing a link between real-world practice and academia knowledge breaking the barrier of having scientific research in highly complex firms despite the difficulties when researching S&OP(Goh and Eldridge, 2019; Pedroso *et al.*, 2016).

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