

Implementing S&OP in the automotive aftermarket supply chain: the case of Rhiag Italy

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Abstract: The academic literature is wide in the generalization of Sales and Operations Planning process. However, there is a growing need to explore specific contexts that shape the design of Sales and Operations Planning process and affect its implementation. Through the lens of contingency theory, the purpose of this research lies in exploring a specific context where the Sales and Operations Planning process is applied, with a collaborative management research conducted at an Italian leader company in the distribution of automotive aftermarket parts. The contingency factors, proposed by the literature and considered for this research, are specifically: industry, supply chain complexity (dynamic and detail complexity), firm size, hierarchical planning framework and organizational characteristics. This research outlines the ways the contingency factors affect the design of the Sales and Operations Planning process for the specific context analyzed, in terms of set-up variables (planning horizon, planning frequency, planning object) and process variables (inputs, activities, outputs). Furthermore, the research illustrates the ways the contingency factors set the desired implementation of Sales and Operations Planning process as response variable, taking in consideration the maturity model in terms of: meeting and collaboration, organization, measurements, information technology and Sales and Operations Planning process plan integration. The contribution of this research lies on the one hand in advancing the state of the art in the field of Operations Management Practice Contingency Research, mainly for the Sales and Operations Planning process practice. On the other hand, the research is relevant from the industry-related perspective because introduces detailed insights about the fit between Sales and Operations Planning process and contingency factors to reach higher level of Sales and Operations Planning process effectiveness.

Keywords: Sales and Operations Planning (S&OP); Cross-functional integration; Contingency theory; Operations Management Practice Contingency Research

I. INTRODUCTION

The increase of the competition in the markets, in a more and more dynamic and globalized economic environment (Feng et al. 2008), has led to higher product complexity, higher demand complexity, higher supply-related complexity (Ivert et al. 2015, Cigolini et al. 2022b). The visibility of the market is shorter (Affonso et al. 2008) and the companies must be increasingly flexible to comply with the needs of the customers (Bagni et al. 2022, Franceschetto et al. 2023). A possible solution is the adoption of the Sales and Operations Planning (S&OP) process. S&OP is a tactical process with a planning horizon which covers up to 18 months, at product family level (or Stock Keeping Unit, SKU) and is performed generally every month, or driven by events in case it is used as a tool to respond quickly to the uncertainty of the context (Thomé et al. 2012a; Grimson et al. 2007, Rossi et al. 2017). The concept of S&OP has evolved from aggregated production planning in the early 1950, then into manufacturing resource planning (or MRP II), in

the middle of 1980, to the current definition of business process for the alignment of supply and demand (Thomé et al. 2012b, Cigolini et al. 2022a).

II. LITERATURE REVIEW

The methodology selected, to search the literature, was the systematic literature search protocol, both for the theoretical lens (contingency theory) and the empirical context (S&OP). For the literature review, both for the theoretical lens and the empirical context, the methodology used was the conceptual review, to identify a golden thread in the investigated area. The data source selected, for the literature search, was Scopus database, both for the theoretical lens and for the empirical context, because contains the relevant papers for Management and Industrial Engineering. The keywords used for the theoretical lens were: *Contingen* Theor** AND *Operation* Management* OR *OM*. From 36 documents found, plus 2 seminal books, at the end 28 documents were eligible for full text screening. The keywords used for the search, for the empirical context,

were the following: *sale* and operation* plan** OR *sale* & operation* plan** OR *S&OP*. These keywords were used by several authors, including Thomé et al. 2012a, 2012b and Tuomikangas et al. 2014. From the 175 documents identified, filtering even by year of publication greater than 2000, due to the seminal paper of Olhager et al. (2001), 71 papers were eligible for the full screening.

III. RESEARCH FRAMEWORK

There is a growing need by academics and practitioners to have more studies about the contextualized S&OP. In general, the more the S&OP fits the contingency factors, the more is its effectiveness. Even so, in general, for the field of Operations Management, there is a growing need to figure out what are the contextual factors that make the Operations Management practices effective. From the knowledge gaps identified, the following research questions are introduced:

RQ1. How do contingency factors influence S&OP design?

RQ2. How do contingency factors are related to the desired maturity stage of S&OP implementation?

A. Contingency theory in OM

The contingency theory (CT) of the organization, developed since 1960s, is a result of fit between the organization and the contingency factors (Donaldson 1995, 2001). Depending on the considered characteristics, several CTs can be identified: structural CT, leadership CT, human resource management CT and strategic decision-making process CT. The structural CT, for example, holds that the effectiveness of the organization depends on the fit with the task uncertainty, the size of the organization, the strategy, the environmental. The universal theories of organization hold that the maximum level of performance is reachable from “one best way”, namely, via the maximum level of an organizational characteristics (Donaldson 2001, Pero et al. 2016). Instead, CT affirms that the maximum is reachable by the appropriate level of an organization characteristic related to the contingency factors (Donaldson 2001). In the recent years, there has been a growing need in Operations Management (OM) to figure out which are the contextual factors, for which, these practices are effective in the performance of organization. This part of research is called Operations Management Practice Contingency Research (OM PCR) and the CT is one of the main theoretical lenses used (Walker et al. 2015). In OM PCR, with the lens of CT, the variables used are three: contingency factors, the response variable, the performance of the organization (Sousa et al. 2008).

B. S&OP through the lens of contingency theory: the contingency factors

According to the literature (Tuomikangas et al. 2014), the basic design of S&OP does not fit for all the contexts because specific contingency factors could

affect the design in different ways. The contingency factors, so far analyzed in the literature (Olhager et al. 2001, Grimson et al. 2007, Thomé et al. 2014a, 2014b, Goh et al. 2015, Ivert et al. 2014a, 2014b, Noroozi et al. 2016, 2017, Kaipia et al. 2017, Kristensen et al. 2018) for S&OP, have been: industry, supply chain complexity (dynamic and detail complexity), firm size (large firms require more S&OP adoption), manufacturing strategies (make to stock vs make to order), manufacturing process (e.g., job shop vs continuous line process), hierarchical planning framework (integration between tactical and operations plan), organizational characteristics (human, technology and organizational). Referring to supply chain complexity (Ivert et al. 2014b, 2015, Gosling et al. 2016), the dynamic part is related to product complexity (product variety, number of SKUs, shelf life), supply uncertainty (material supply uncertainty in lead time-quality-quantity, production network complexity, supplier base complexity, see e.g., Pero et al. 2020), demand uncertainty (demand variation, customer base complexity, service level requirements), demand pattern (seasonal products, new products). On the other hand, the detail complexity concerns the entities which the S&OP process should consider in the planning process (Ivert et al. 2014b). For the organizational characteristics, Swaim et al. (2016) found that a high level of integration in the organization allows a higher standardization of S&OP. A higher level of S&OP standardization and organizational priority leads to higher engagement of the organization in the process, which in turn leads to higher effectiveness of the process. Furthermore, Oliva et al. (2011) claims that higher integration in the organization is reachable by informational, procedural and alignment quality which, in turn, are improved by higher levels of engagement of the organization in the process.

C. S&OP through the lens of contingency theory: the response variables

The response variables, by means S&OP practice fits the context, affected by contingency factors, are set-up and process parameters (Dittfeld et al. 2020). The set-up parameters (or planning parameters) are related to the: planning horizon (the period included in each S&OP cycle), the planning frequency (the length of S&OP cycle), the planning object (the level of aggregation, usually the family group or the single SKU, see Ivert et al. 2015, Dittfeld et al. 2020). The process parameters are inputs, mechanisms, and outcome (Dittfeld et al. 2020). The inputs are related to the plans coming from the different departments involved in S&OP, including constraints and goals (Thomé et al. 2012a, Dittfeld et al. 2020). The main output from S&OP is the integration of the plans (Thomé et al. 2012a). The main activities are the following ones.

1. *Meetings and collaboration* include the participants in the S&OP meeting, the degree of formalization of the meetings and regularity in the participation, the level of trust and commitment in the

participation, the degree of cross-functionality (Grimson et al. 2007, Thomé et al. 2012a, Dreyer et al. 2018).

2. *Organization* is related to the definition of a S&OP structure, the level of empowerment of the team for S&OP and executive participation, the definition of an agenda and steps to follow (Dreyer et al. 2018). The steps are mainly 5: data gathering, demand plan, supply plan, pre-meeting, and executive meeting (Wagner et al. 2014). It could be necessary the addition of a preliminary step at the beginning (event plans, Dreyer et al. 2018), and two further steps at the end of the process in case of a multinational company (global roll-up and global executive meeting, Seeling et al. 2021). It could be a critical revision step as conclusive phase of the S&OP cycle (Rota et al. 2021).
3. *Information Technology* concerns systems and software used for S&OP, the degree of sharing and consolidation of information (Dreyer et al. 2018). For early stages of S&OP, it is not so pivotal to have advanced Information Technology (IT) systems such as simulation tools, mathematical patterns, and Advanced Planning Systems (APSs, Grimson et al. 2007, Ivvert et al. 2010, Amico et al. 2023).
4. *S&OP Metrics* includes measurement of S&OP effectiveness and efficiency. (Hulthén et al. 2016).

Within the design phase, Goh et al. 2019 suggest avoiding a rigid S&OP formalization, to rapidly react in case of extraordinary events or unexpected changes.

D. *S&OP implementation through the maturity models*

The implementation pattern of S&OP is driven by the maturity model (Danese et al. 2018). Different maturity models have been proposed in literature (Grimson et al. 2007, Wagner et al. 2014, Pedroso et al. 2017), according to the type and number of dimensions (mechanisms) considered, and the type and number of evolution stages. The role of these models is threefold: descriptive for the implementation, prescriptive to understand the current and the following stage to reach, comparative to benchmark the maturity stage of the company with respect to the competitors (Danese et al. 2018). Grimson et al. 2007 propose a maturity model based on five dimensions and five stages. For the implementation of S&OP are reported several enablers in literature (Pedroso et al. 2016): the ability to learn from previous mistakes, the ability to make changes, the discipline, the presence of an S&OP department, the top management support, the cross-functionality, the performance evaluation, the information system, the training on S&OP, the commitment of participants, well assigned roles and responsibilities, impartiality in the conducting of the process.

Furthermore, to aim to a successful implementation, Tchokogué et al. (2022) suggest paying attention to the

organizational characteristics by getting the S&OP project endorsed by the top management, by training and involving the employees in the project, by changing the culture of the organization.

IV. THE CASE OF RHIAG ITALY

Rhiag is the leading Business to Business (B2B) automotive aftermarket distributor in Italy. Rhiag is part of LKQ Corporation, a Fortune-500 global leader in its industry. Rhiag Italy competes in the market by leveraging a national coverage, pursuing a differentiation of product portfolio and channels. Moreover, Rhiag has conducted a vertical integration strategy in selected areas. In the latest years, the automotive aftermarket industry has followed a similar path to other industries (Cannas et al. 2020, Rossi et al. 2021) and it has become very competitive, with many new competitors grounded on cost leadership, boosting demand variance with many sales promotions. The higher demand variance has generated many more stockouts and overstocks. This triggered the need for a collaboration with Politecnico di Milano to implement a Collaborative Management Research (CMR). CMR was motivated by the need to create a tight link between academicians and practitioners to fill the gap between rigor and relevance (Canterino et al. 2016). CMR project lasted 12 months and was divided in 3 main chunks: company investigation (2 months), CMR implementation (8 months), CMR improvement (2 months). The criteria used to conduct CMR project was suggested by Coghlan et al. (2014) in terms of rigor, reflectiveness, relevance.

The first cycle was related to the investigation of the company. The protocols for data collection were: preliminary dialogue with top management, CMR team identification (1 PhD candidate, 1 company tutor, 1 professor of Operations and Supply Chain Management, 1 representative for each department involved), definition of the purpose of CMR (the design and implementation of the practice S&OP), development and acting the interview protocol. Relating to the interview protocol, semi standardize interviews were conducted to identify: the contingency factors, their relationship with S&OP, the initial collocation in the S&OP maturity stage framework suggested by Grimson et al. (2007). For the interviews, it was done primarily the selection of who interviewing: the respondents chosen were the responsible of each department. Then, it was done the collection of archival data related to pre-existing documents from each department, informative materials about the company and the interviewees. Next, it was sent, by e-mail, general questions (broader questions) to each single interviewee, and then it was prepared the “face to face” interviews. Finally, it was sent the output of the transcription to each respondent, to have the confirmation for the disclosing of the content. The output of the interviews was corroborated by observations, participating directly and actively in the S&OP process. The mechanisms to analyze data

were based on coding the interviews through a deductive approach, data driven analysis and time series analysis.

In the second CMR cycle, the implementation, of the research project, concerning the S&OP process, took place. The third CMR cycle was related to the improvement of the project to the next stage of maturity.

V. KEY FINDINGS

In this section, the results responding to the research questions are reported.

RQ1: how do contingency factors influence S&OP design

The main challenges for Rhiag, reported in the previous paragraph, and its size (more than 300 employees) triggered the need to adopt S&OP.

Due to the high number of SKUs managed, more than 250,000 classified in around 2,000 Product Family Groups (PGSs), the CMR decided to consider the PGSs as S&OP object. Nevertheless, there were two exceptions in which the SKUs were treated as S&OP object: for new product launches, for which the initial sales forecast in input were detailed in SKUs; for sales promotions, in which the estimation of the impact on the sales forecast was given, in some cases, per SKUs. In addition, the choice to consider the SKUs, as planning object, was required by the demand which had the characteristic to be influenced, in some cases, by the presence of possible relationship between similar SKUs with different brand (for instance, a sales promotion for a SKU with a brand “x” could cannibalize a similar SKU with a brand “y” without sales promotion).

The demand, for Rhiag, was even characterized by a high variance, due to many promotional activities, which competitors adopted changing the behavior of the market. As a result, the effort for Rhiag to plan many events, required a S&OP planning horizon which did not exceed three months ahead (since beyond this boundary it was tricky to forecast possible future moves of the competitors).

In general, the products were not affected by a shelf life, but the company, with the aim to optimize its operative working capital, included the concept of “write off limit”, to avoid a high level of obsolescence during the year. This aspect impacted specifically for new product launches and seasonal products for which the sales forecast accuracy was very low. For these products It was important to have a planning horizon of 12 months with the aim to minimize the obsolescence risk. Besides, for the seasonal products, the yearly planning horizon was necessary to share in advance the annual figures with the suppliers, to avoid consistent run-out events during the seasonality.

In terms of detail complexity, Rhiag’s network was articulated according to three layers. The first layer was composed mainly of a central distribution center. In the

second layer, there were 17 regional distribution warehouses scattered on the whole Italy. In some specific areas, Rhiag also owned 12 retail branches. This part of the network was out of scope of the CMR project because, at that time, had just been added after a vertical integration (nevertheless, the aim was to include this part in the S&OP in the short-term future). Then, it was decided to run one single S&OP process with, as output, one integrated plan. In case of specific events – like sales promotions impacting one distribution warehouse – an additional output, related to the regional distribution warehouse involved, was generated.

Concerning the demand characteristics, many customers populated three main segments: aftermarket or domestic market, export market and intercompany market (which is related to the demand from the other companies of LKQ Europe). The CMR team decided to consider the aftermarket for the S&OP planning, as it accounted for about 85% of the total turnover. Customer side, very high service level was required and, as a result, there was the need to pay attention to the sales forecast accuracy (which called for the need of S&OP).

Concerning the suppliers, the service level of the domestic and European suppliers was on average about 75%, with a moderate risk of stockout. In general, 10% of the high number of suppliers were from far-east regions. To point out, though, that even mostly of the domestic/European suppliers had in turn, in their vendor list, far east suppliers. These peculiarities raised up the importance to anticipate, as soon as possible, the purchasing forecast to the suppliers, at least 3 months ahead. Additionally, due to the high supply uncertainty, there was the need to provide to the S&OP process adequate information about stockout risks per PGS, or in some cases per SKU. The distribution network complexity, and its limited inventory capacity, required a monthly alignment between purchasing forecast volume and capacity constraints. This latter was an important input to consider, necessarily, in each run of the S&OP process. To add that, due to the dynamic market and supply uncertainties, the CMR team decided to consider additional event-based runs of S&OP.

For all the above-mentioned demand and supply characteristics the CMR team defined the following activities, to run for each cycle of S&OP:

- *Event plans and data gathering.* The departments shared in input the events for the horizon planned, with a pre-meeting among sales department and product experts to collect evidence and action plan.
- *Demand plan.* Data gathered in the previous step was added to the baseline forecast crafted by the APS, to get as output the demand plan.
- *Supply plan.* The demand plan was switched to the purchasing plan, via APS, considering the inventory level, the inventory policy (target inventory level, target customer service level, stocked items), the capacity constraints in the

network, possible purchasing targets to achieve with suppliers in the period analyzed.

- *S&OP meeting* (also called balancing meeting). It is the periodical S&OP meeting, among the representants of the departments, in which the demand plan and supply plan were discussed, amended, and confirmed. A revision step was always taken in place to share thoughts and points to improve for the S&OP process.
- *Executive meeting*. Ad hoc meeting called just in case unsolved crucial points came out previously.

In Rhiag, the S&OP was the means, even, to link and integrate the corporate strategy (budget) with the operations plan (sales forecast and purchasing plan). For this part, the budget figures were given in input to the S&OP process. Furthermore, during the balancing meeting, there was a section in which the actual performance of the top 40 PGs (selected in a decreasing impact on turnover) were matched to the expected budget figures.

RQ2: how do contingency factors set the desired maturity stage of S&OP implementation

Following the maturity model proposed by Grimson et al. (2007), each dimension goes through a maturity evolution from a minimum level (stage one) to a maximum level (stage five). The dimension “meeting and collaboration” goes from a silo culture predominant, to a stage in which even the suppliers and customers are involved. The dimension “organization” starts from an absent S&OP organization up to the presence of a S&OP team with executive participation. The dimension “measurements” moves from a missing consolidation of data, among the departments, to real-time Key Performance Indicators (KPIs). The dimension “S&OP integration” steps forward from a completely missing integration, among departments, to a strong integration, thanks to a S&OP process seen as essential for the aiming of company profitability. Starting from the maturity model suggested by Grimson et al. (2007), the CMR team, within the first CRM cycle, analyzed the As-Is (i.e., actual) level of maturity for each dimension. For the dimension “meeting and collaboration”, the stage of maturity was between 1 and 2 since there was a silo culture among the departments but a periodic management meeting among the executives (mainly focused on strategic and financial goals).

For the dimension “organization”, the stage was 1 considering the lack of a S&OP organization.

For “measurements”, the stage was 2 because there were used some KPIs to highlight the effectiveness of the supply chain to fulfill the customer orders.

About the “information technology” there was a different level of evolution among the departments. For instance, in the Supply Chain department, an APS crafted the baseline sales forecast plan and the baseline

purchasing plan. Instead, in general, in the other departments, information was stored in spreadsheets and not shared.

For the dimension “S&OP plan integration”, Rhiag was in the middle between the stage 1 and 2, since the Supply Chain department struggled to meet the potential future orders, and the sales budget was drawn up neglecting the bottom-up plans.

In the second CMR cycle, the implementation started with the objective to improve each dimension by stepping up to the upper stage.

About the dimension “meeting and collaboration”, the predominant silo culture was the starting point to overcome, by playing out monthly and event-driven meetings. The demand and supply characteristics triggered both the cross-integration among the departments and the integration with some top suppliers and customers.

The same improvement was for the organization because, as reported by Swaim et al. (2016), higher level of integration leads to higher standardization of S&OP. Furthermore, they hold that higher standardization – jointly with top management endorsement – leads to higher team engagement, and in turns, to higher effectiveness of the process. Considering these suggestions from literature, the improvement, played out by CMR, was to establish an informal S&OP team with a representative from each department.

About measurements, the needs from the customers to have high service level triggered most attention to the sales forecast accuracy. About the supply uncertainty, it was very important to measure the supply service rate, mainly for top suppliers (in terms of total purchasing volume) and far east suppliers, for which the availability was pivotal to avoid rush purchasing orders placed to domestic/European suppliers (with a negative impact on the profitability).

For the information technology, the meaningful differences between the way in which the departments manage the data, pushed the CMR team to decide for a common space to gather: all the inputs from the departments, the scheduling of the process, the results of the measurements, the procedures.

Concerning the “S&OP plan integration”, the specific problem of frequent stock-out and overstock events, required to step up to the next stage of maturity. This evolution consisted in reaching an integration among the departments in the formulation of the sales forecast plan and purchasing forecast plan.

Within the third cycle, the CMR team analyzed the gaps between the current and the expected benefits, setting the further desired stage for each dimension. The actual benefits were related to a better integration among the departments (starting from a silo culture) and a correspondent improvement in the sales forecast

accuracy of around +5%. The expected benefits would be highly integration among departments, with a more significant increasing of sales forecast accuracy.

For “meeting and collaboration” the desired step of improvement was the stage 4, due to the importance of getting to a predominant share of suppliers and customers in the S&OP run, motivated by demand and supply complexity in the context.

About “organization”, the S&OP process legitimization represented an important improvement, so the next step consisted in the composition of a dedicated S&OP team fostering a better engagement and, as a result, higher informational, procedural and alignment quality (see Oliva et al. 2011).

Concerning the “information technology”, the idea was to move to stage 4 with the introduction of a tool of revenue planning that did not operate concurrently with the APS. To improve the data quality, as reported in Ohlson et al.2022, the artificial intelligence could be a support. Aligned to this evidence, the CMR decided to introduce the machine learning, to recognize patterns in the past and, consider, in the demand plan, these possible behaviors in the future. Furthermore, about the purchasing plan, the machine learning could avoid bull-whip effects and improve the capacity utilization.

For “measurements”, there was pressure to move to stage 4, where even the sales forecast of new products and the effectiveness of S&OP were measured.

About the “S&OP Plan integration” the purpose was to go to stage 4, where the plans were all highly integrated considering both bottom-up and top-down evidence.

VI. CONCLUSIONS

The topic of S&OP is widely covered by academic literature, but just a limited number of studies has aimed at exploring the ways S&OP is shaped by specific contexts. For this reason, the scope of this study is oriented at exploring a specific context where S&OP process is adopted through a CMR at an Italian leader company in the distribution of automotive aftermarket parts. From the academic viewpoint, this research is an advance in the state of the art, thanks to a new detailed and longitudinal study on OM PCR (operations management practice contingency research), specifically on how the shaping of S&OP changes in function of the characteristics of the context. For practitioners, the potential impact is meaningful for who belonging to the same specific context, due to the guide that the research wants to give, supporting the design and the implementation of S&OP. The potential detailed support of this research is thanks to a longitudinal study done with an action-research focused on actual organizational problems and grounded on scientific knowledge. For practitioners from other contexts, the research adds, however, further insights about possible correlations amid contingency factors and S&OP design/implementation. Nevertheless, this research has

limitations in terms of generalization and terms of time. About the generalization, as a matter of fact, this study is limited to a very specific context. As a result, a possible future path could be the study of more additional contexts to figure out better how the shaping of S&OP changes in function of specific contingency factors. Multiple case studies, for instance, could be an effective research methodology to underline similarities or differences between contexts, adding further robustness to the research for S&OP. In terms of limitation in time, this collaborative management research lasted around 12 months, further time was needed to explore how the contingency factors changed over time and how the improvements were actual adopted. For future longitudinal studies, a larger time horizon could be suggested to have more detailed results about the evolution over time of the S&OP process in function of possibly new company challenges. Possible other studies could cover the effect of the pair contingency factors – S&OP response to the performance of the organization, for instance in terms of impact on the company profitability. Furthermore, the study of S&OP could be enriched by considering other theoretical lenses, for instance, the “resource-based view”, which is the most used in the OM, as reported by Walker et al. (2015).

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