Demand Planning and Sales and Operations Planning: Aligning Supply with Demand

Jonas Bergström
KTH Royal Institute of Technology, Sweden

ABSTRACT

This paper studies the role of demand planning and Sales and Operations Planning (S&OP) in matching market demand and supply chain strength. In paper, there are main formulas such as statistical methods, machine learning, Collaborative Planning, forecasting, and Replenishment (CPFR). In addition, we also talked about that S&OP has developed into Integrated Business Planning (IBP). IBP links site planning with long-term strategic financial objectives. It also introduces the importance of forecast accuracy, and how to modify the deviation, use causal variables, product segmentation and demand sensing to reduce forecast error. The conclusion of this study is that strengthening cross-departmental cooperation or using AI for forecast will improve the balance between supply and demand, resource allocation and the overall role of the supply chain.

Keywords: Demand Planning; S&OP; Integrated Business Planning; Forecast Accuracy; Collaborative Planning; CPFR; Consensus Forecast; IBP

1. INTRODUCTION

Demand planning-this is a mechanism to predict customers' future demand, which makes it easier to plan, adjust supply chain inventory and plan production-and Sales and Operations Planning (S&OP)-this is a kind of supply chain that will have too much inventory (when the forecast is too high) or not (when the forecast is too low), which will bring financial burden to the company and customers. The structure of S&OP has developed from the monthly operational confirmation meeting to the Integrated Business Planning (IBP), which is an important planning structure that connects the operational supply chain plan with the money plan and strategic decision.

2. DEMAND FORECASTING METHODS

2.1 Statistical Forecasting

There are many methods of statistical demand forecasting (using past data to predict future demand), ranging from simple moving average to complex mechanical learning model. Exponential smoothing (Simple, Holt's double, Holt-Winters triple) uses fewer parameters, and the parameters are simple to calculate and update. The stable demand pattern and trend AutoRegressive Integrated Moving Average (ARIMA) model can predict the time series more freely by modeling the autocorrelation mechanism of past demand data. The methods of machine learning (gradient boosting (XGBoost, LightGBM), LSTM of neural networks, transformer model and ensemble method) are sufficient training data. If the relationship between variables (such as social media) and demand is complicated and nonlinear, the results are much better in academic competitions (M4, M5 forecasting competitions) and practical business.

2.2 Collaborative Forecasting

Collaborative Planning, Forecasting, and Replenishment (CPFR)—the sharing of demand forecasts and inventory data between retailers and suppliers to create jointly agreed demand plans—enables more accurate forecasting than either party can achieve independently. Retailers have point-of-sale data visibility that manufacturers lack; manufacturers have marketing program knowledge and production capacity information that retailers need for inventory planning. The Voluntary Interindustry Commerce Standards (VICS) CPFR model provides a standardized process framework for retailer-supplier collaboration that has been implemented by Walmart, Target, and other major retailers with their key suppliers.

Table 1. S&OP process steps, purposes, and key participants.

S&OP Process Step	Purpose	Key Participants
Demand review	Review statistical forecast; incorporate commercial intelligence	Sales; marketing; demand planning
Supply review	Assess supply capability against demand plan; identify gaps	Operations; procurement; logistics
Pre-S&OP	Reconcile demand and supply gaps; develop options for resolution	Supply chain; finance; functional leaders
Executive S&OP	Resolve trade-offs; make resource allocation decisions; approve plan	Senior leadership; CFO; COO; CCO
Financial integration	Translate operational plan to financial forecast; update P&L	Finance; FP&A; supply chain

3. S&OP TO INTEGRATED BUSINESS PLANNING

Integrated Business Planning (IBP)—developed by Oliver Wight and implemented by companies including Unilever, P&G, and Colgate—extends S&OP's cross-functional operational coordination into a strategic management process that connects 18-24 months operational planning with 3-5 years strategic planning and monthly financial forecasting. IBP's distinctive contribution is connecting supply chain planning to strategic resource allocation: capacity investment decisions, new product launch planning, market entry and exit decisions, and financial commitment management are integrated into the monthly planning cycle rather than being treated as separate strategic planning exercises disconnected from operational reality. Lapide's (2005) 'Sales and Operations Planning Part I: The Process' in the Journal of Business Forecasting documented S&OP's evolution from monthly production planning meetings to integrated cross-functional management processes.

4. FORECAST ERROR AND IMPROVEMENT

Forecast accuracy—the degree to which forecasts match actual demand—is the primary driver of supply chain performance: high forecast error leads to either excess inventory (when forecasts are too high) or stockouts (when too low), imposing costs on both sides of the error. Mean Absolute Percentage Error (MAPE) is the most widely used forecast accuracy metric despite its known limitations (undefined for zero-demand periods; asymmetric penalty for over-and under-forecasting). Improving forecast accuracy requires: identifying and eliminating bias (systematic over-or under-forecasting); incorporating causal variables (promotional activities, economic indicators, competitive actions) that explain demand variation; segmenting products by forecastability (A items with stable demand vs. C items with erratic demand warrant different forecasting approaches); and improving demand sensing (using more current sell-through data rather than lagged historical shipments).

5. CONCLUSION

Demand planning and S&OP are the cooperation mechanisms of various departments. Now, supply chain can convert the signal of market demand into the actual work plan, so as to better allocate production, inventory and logistics resources. From the state of planning separately according to functions (sales forecasting and operation capacity planning are done separately) to comprehensive S&OP, and finally to IBP, it is impossible for departments to communicate with each other only by two people. Thanks to machine learning, the accuracy of demand forecasting is improved, especially when sales promotion, seasons and various factors lead to products with complex demand mode. The work of --demand planning is changing. Manual judgment required for statistical prediction is reduced, and more complex factor models can be established. In the following research, the use of AI's Demand Sensing-things that use real-time sales data, social media signals and economic indicators in order to update the forecast all the time instead of every month-is the reason for the inefficiency of supply chain.

REFERENCES

[1] Bower, P. (2005). How the sales and operations planning process creates value. Journal of Business Forecasting, 24(1), 18–23.
[2] Makridakis, S., Spiliotis, E., & Assimakopoulos, V. (2018). The M4 competition: Results, findings, conclusion and way forward. International Journal of Forecasting, 34(4), 802–808.
[3] Wallace, T. F., & Stahl, R. A. (2008). Sales and operations planning: The how-to handbook (3rd ed.). T. F. Wallace & Company.
[4] Lapide, L. (2005). Sales and operations planning part I: The process. Journal of Business Forecasting, 24(3), 17–19.