Supply Chain Collaboration during Disruption through Sales & Operations Planning: A Study in a Manufacturing Industry

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Abstract

The study is based on primary and secondary data which unlocks a sequential supply chain disruption that occurred due to the pandemic and subsequent occurrences, including geopolitical tensions involving Ukraine and Russia, as well as Palestine and Israel. The geopolitical landscape is contingent upon the comprehensive strategic choices made by global leaders representing the United States, Russia, Turkey, India, the European Union, and Middle Eastern countries. There are several attempts made by researchers and industry practitioners to appropriately synchronize the demand and supply during this disruption. Substantial research has been conducted and literature is available in the field of supply chain collaboration.

However, collaboration can’t be ensured unless the end-to-end SCM is synchronized through the Sales & Operations (S&OP) planning.

Achieving smooth collaboration poses a formidable challenge, particularly amid disruptions and volatile conditions as seen today. This study undertakes a comprehensive examination by conducting a systematic literature review on various facets of sales and operations planning (S&OP), coupled with a survey utilizing a self-administered questionnaire across 24 manufacturing industries in Bangladesh. The primary aim of this paper is to assess S&OP best practices by evaluating different aspects applied in the industry, to ensure seamless connectivity, collaboration, and establishing criteria for
measuring performance in the S&OP process.

The study underscores the significance of integrating S&OP and provides a novel approach by recommending an innovative method that integrates 10 attributes of supply chain performance measurement (SCPM) to fortify the S&OP process, enhancing its overall performance and effectiveness. This study not only contributes to the researchers and academia to investigate deeper into collaboration and risk management within supply chain management (SCM) operations during disruptions but also recommends industry practitioners an innovative concept to enhance overall efficiency and provide substantial visibility into business operations.

**Keywords** - Disruption, Ukraine & Russia tension, Pandemic, Sales and Operations Planning (S&OP), Integrated Business Planning (IBP), and Supply Chain Performance Measurement (SCPM).

1. Introduction

Disparity within the societal value chain system initially ripples through the overall supply chain management (SCM), affecting every stage from upstream to downstream, spanning from suppliers to end consumers. This disruption creates chaos and a bullwhip effect, influencing both the top line and the bottom line of the business, including cash flow, profit and loss, and the balance sheet. [53,14]

The current disruption has brought to light the crucial role of supply chain operations and their seamless integration within our society [45]. Undeniably, SCM practitioners, regardless of borders, would unanimously acknowledge that the present supply chain operation is exceptionally challenging, given the multitude of uncertainties arising from changes in social, political, environmental, and economic circumstances.

Presently, all parameters within the realm of supply chain management (SCM) are characterized by volatility and exceptionally high fluctuations, resulting in an unparalleled level of unpredictability. Consumer psychology and purchasing patterns are constantly shifting, exacerbated by the recent collapses of Silicon Valley Bank and Signature Bank in the US, with several others in the pipeline in recent weeks [58]. The crisis at the US Federal Reserve and the sudden plunge of the US dollar are anticipated to have cascading effects on the global economy. [33, 58]

The impacts are expected to be particularly severe in countries like Bangladesh, India, Vietnam, etc., where heavy reliance on exports and earning foreign currency, especially from North America, particularly the US, is prevalent. [15,56]

The enduring tension in Bangladesh's ties with the United States is anticipated to intensify due to recent limitations on US visas, particularly targeting political leaders, bureaucrats, and business figures [57]. This is expected to have significant consequences for businesses, amplifying uncertainty.

The restrictions on US visas may disturb the balance of supply and demand, considering the involvement of financial transactions
within the country. Consequently, this could curtail fresh investment prospects as entrepreneurs exercise caution, meticulously observing economic trends, future relationships, and the potential impact on overall business activities. [35, 54, 57]

Concurrently, geopolitical tensions among the USA, Saudi Arabia, Russia, and Europe are poised to influence oil prices in the global market. The dynamics of oil demand and supply, along with its global price, will trigger freight costs worldwide [57]. Inflation over the past few years and the upward trend in the Cost of Goods Sold (COGS) have reached an all-time high, significantly impacting the top and bottom lines of businesses across industries. [4,56]

Global companies are compelled to resort to mass employee terminations to survive this critical economic moment, leading to unbearable impacts on every aspect of society. Despite ongoing efforts, the world has yet to fully recover from the outbreak of COVID-19, with subsequent waves and different variations continuing to impact daily lives. As a result, the world is not operating at the full pace of its economic activities as before. [31, 45]

In summary, supply chain practitioners are currently facing challenges at an unprecedented level, requiring them to manage numerous uncontrollable factors to synchronize and bring demand and supply to a possible optimized level, ensuring profitability and the availability of goods and services [33]. This task is undeniably rebellious, necessitating the highest level of collaboration across all SCM components, including planning, procurement, manufacturing, and distribution. Safeguarding SCM operations through risk management and risk mitigation during disruptions is imperative.

Achieving these challenging tasks is not possible unless the supply chain is seamlessly synchronized at its highest level and well-planned, embedded through sales & operations planning (S&OP) from upstream to downstream, with day-to-day performance monitored, reviewed, and adjusted. [3, 32]

The study aims to systematically review the literature on supply chain operations amidst disruptions, evaluate existing sales and operations planning (S&OP) approaches along with their associated challenges, suggest best practices for S&OP to facilitate smooth collaboration, and propose ten attributes for measuring supply chain management (SCM) performance within the S&OP process [34,46]. The objective is to enhance overall efficiency during disruptions.

2. Literature Review

The former leading authority in Supply Chain Management (SCM), the American Production and Inventory Control Society (APICS), now known as the Association of Supply Chain Management (ASCM), defined SCM as a comprehensive process overseeing the flow from raw materials to the consumption of end products by consumers. [13,31,56]
This definition emphasizes that SCM is a process that orchestrates the coordination of internal and external entities within a firm, spanning from the upstream to the downstream [32]. Traditionally, SCM encompasses supply base, production, distribution and warehouse operations, retail, and customers, with a primary focus on and significance placed on the customer, as illustrated in Figure 1. The integration concept in SCM implies monitoring all operational stages in business and ensuring value-added activities through collaborative efforts from both logistics providers and manufacturers. [7,48]

![Figure 1. The flow of SCM [40]](image)

2.1 Supply Chain Management in Production

The core of the SCM operation is the production process, wherein multiple steps are meticulously coordinated to sequentially add value to raw materials, meeting specific demands [2,14]. A robust and effective collaboration between manufacturers and consumers is essential for sustaining the practical realization of production. Furthermore, the essence of SCM lies in ensuring quality, optimizing costs, and managing time efficiently in the process of adding value to raw materials and delivering end products to consumers. The production process's flow involves adding value to raw materials through various steps, transforming raw materials into end products, and ultimately meeting consumer demand. SCM seamlessly operates from upstream to downstream in the production process [31]. Throughout this entire process, numerous activities take place, including technology and innovation, waste management, lean practices, total quality management, customer service, compliance with stakeholder regulations, inventory control, efficiency management, and overall Key Performance Indicators, among others.

2.2 Sales and Operations Planning

Sales and operations planning (S&OP) encompasses a synchronized process and a collective series of activities that harmonize demand and supply with financial management plans, particularly those concerning cash inflow and outflow. It intricately interconnects with inventory, inbound raw materials, factory production processes, and the distribution of finished goods through diverse channel management systems [57].

In essence, the products are sold, generating revenue that circulates back into the financial system, crisscrossing through various sequential channels [30]. The sequential
nature of the S&OP process mirrors the liquidity of a company (cash flow), resembling the circulation of blood throughout the vessels in the entire human body. [29]

Thus, S&OP is intricately linked to demand, supply, procurement, production, distribution, and sales, all aligned with the annual business plan (ABP), as depicted in Figure 2. Demand is entangled with marketing, sales, and new product development, while supply is embedded in supply chain management (SCM) and production. Overall, the ABP is directly aligned with the company’s strategic plan, ensuring business profitability and sustainability. [28]

This S&OP functions as an integrated conceptual framework intended to aid business managers in decision-making related to sales projections, procurement, manufacturing, production, distribution, and sales. Any deviation from the ABP directly impacts profitability, positioning S&OP as the central focal point in any business, navigating its course at any given point. [49]

Illustrated in Figure 2, as part of the S&OP process, it commences with the aggregate demand for any product, comparing this expected demand to the available supply in terms of manpower, machinery, and materials. This process analyzes both strategic and tactical factors, delving into material resource planning, production capacity planning, and material requirement planning. The S&OP process considers a planning horizon ranging
from eighteen (18) to thirty-six months (36), with planning cascading down every week. Master Production Scheduling (MPS) provides a detailed weekly and monthly plan connected to the month, quarter, and year, ultimately aligning with the Annual Business Plan (ABP). [3, 57]

2.3 S&OP Best Practices

Currently, there is no singular stand-alone handbook that can assert itself as the definitive best practice guide for Sales and Operations Planning (S&OP). Nevertheless, a handful of industry practitioners have developed S&OP processes that have been adopted by top global companies through customization to suit their specific needs [27]. Among these, the name Oliver Wight stands out, with Oliver Wight having passed away in 1983 at the age of 53. Throughout his tenure, he authored books, articles, and presentations on S&OP. According to Oliver Wight Education Associates, they emphasize several best practices for S&OP [29,30]:

i) Regular S&OP meetings are crucial for achieving significant outcomes. ii) Discussions and debates within these meetings should be data-driven and substantiated, avoiding reliance on opinions due to potential variations in perspectives and self-perceptions. iii) All data presented during the meetings must be validated by involved finance personnel, fostering transparency and accountability. iv) Attendance at S&OP meetings should be mandatory for all key stakeholders, while individuals lacking meaningful contributions should be excluded. v) Senior representatives from Finance, Marketing, and Production should actively engage in the S&OP process, with final approval from the CFO and CEO before execution. vi) The use of software and integrated technologies, such as Enterprise Resource Planning (ERP), is encouraged for data extraction and preparation of essential components like Production Planning (PP), Master Production Schedule (MPS), and Material Requirement Plan (MRP), among others Oliver Wight outlined six stages of the S&OP process as detailed below [29,30]:

2.3.1 Product Review Stage: In this phase, planners engaged in research, product development, and new product launches evaluate the market health of products. They compare these products with industry counterparts and make decisions related to product planning [15,25]. These decisions may involve setting production launch dates, prioritizing new projects, and allocating resources. Additionally, the impact of introducing a new product on existing products, along with the future outlook and strategic framework, is considered [9,57].

2.3.2 Demand Review Stage: This stage aims to achieve consensus and collaborative demand planning through a bottom-up approach, presenting a comprehensive picture of the overall market.

Planners analyze aggregate demand by considering factors such as dependent and independent demand, business growth, market competition, inflation, new product launches, promotions, price adjustments, quality factors, consumer trends, and production factors. The demand plan is then measured in units and revenue, periodically monitored, and compared to finance review results to identify any revenue or demand gaps. [29,30].
2.3.3 Supply Review Stage: The objective at this stage is to develop a supply plan that aligns with the demand plan. Ideally, these plans work in parallel. The supply plan ensures product availability, optimizes inventory, and manages operating costs. Factors include production planning based on machine capacity, alternate supply plans accounting for capacity and demand variations, considerations for "What-ifs," associated risks, inventory optimization, lead time, alternate sources, man-machine-materials-power consumption, line balancing, capacity constraints, and unforeseen activities. [29,30].

2.3.4 Finance Review Stage: Finance professionals intervene in this stage, engaging in debates and providing financial analysis and opinions to adjust numbers [13]. Their input covers sales, supply, machine capacity, bottom-line, and top-line figures [14]. All cost components are calculated and analyzed, and finance consolidates data and numbers, comparing them with budgeted and actual figures. If everything aligns, finance locks the numbers, preparing them for presentation to top management [5,29].

2.3.5 Pre-S&OP Stage: In this pre-S&OP stage, leaders from finance, marketing, MD, and CEO conduct meetings to understand product, demand, supply, utilization, efficiency, and financial performance. They aim to identify and address gaps, reviewing the plan versus actual performance and variations from the budget [29,47].

2.3.6 Executive S&OP Stage: At the final executive S&OP stage, all data and plans are compiled and presented with a What-if scenario level. Risk factors are discussed, and any unresolved decisions are escalated to top management for review and resolution. [29,46,50].

3. Research Methodology

This study applied both primary and secondary data sources. A comprehensive examination of journal papers related to supply chain management, risk management, collaboration, and the Sales & Operations (S&OP) process was conducted [11]. The study focused on the manufacturing industry in Bangladesh, encompassing twenty-four manufacturing sectors. Additionally, secondary data was sourced from various journal papers such as Emerald, IJSCM, IGI, and Nova publishers, etc. [11,12].

4. Discussion

4.1 Urgency of S&OP for Collaboration in Disruption

The recent disruption has laid bare the intricate nature of global supply chain operations, which have become multi-dimensional and, in many instances, appear challenging to control. Each day, the evolving market dynamics and circumstances are worsening progressively [8,9]. Unprecedented occurrences, such as countries undergoing months-long lockdowns, have resulted in significant disruptions in the supply chain, causing supplies to be halved. [1,29,51]

Export orders from around the world destined for Bangladesh are facing delays or suspensions due to various reasons, including i) a severe impact on the ware of Russia and Ukraine, ii) a surge in living costs in major export destinations, and iii) unsold stocks in retail
stores. Consequently, several emerging concepts are gaining traction, such as small-batch production, a focus on digitalization to bridge the gap in the buyer-supplier relationship, and the implementation of unmanned operations [18, 24]. It is strongly recommended that supply chain operations in any company be synchronized through the Sales & Operations Planning (S&OP) process. This facilitates the monitoring and adjustment of demand and supply in response to changes in market dynamics. The primary objective of the Sales & Operations Planning (S&OP) process is to smoothly guide the overall company operation, ensuring the seamless synchronization of demand and supply during disruptions.

Additionally, it aims to enable prompt responses to the dynamic market, considering the ongoing pandemic and political tensions among continents. Therefore, a well-functioning S&OP process empowers an organization to respond promptly to these challenges. [45]

4.2 Benefits of the S&OP Process During Disruption

When an organization has a functional Sales and Operations Planning (S&OP) system in place, it serves as a comprehensive tool for monitoring overall performance. This includes assessing how resources are managed, synchronizing the flow of demand and supply, meeting customer demands, responding to market changes, anticipating business needs well in advance, and quickly understanding and anticipating competitor activities [7, 23]. In the event of a sudden drop in demand, the efficiency of the organization's response, such as promptly adjusting production plans and halting pipeline inventory to mitigate unforeseen losses due to abrupt market changes or vice versa, is crucial. [43, 52]

The summarized benefits of a successful S&OP process include increased profitability, enhanced customer service, reduced inventory levels, minimized waste, achievement of financial targets, improved decision-making, and the facilitation of what-if analysis for better decision-making. It also contributes to improved accuracy, yields superior results, shortens the overall S&OP cycle, promotes enhanced collaboration across departments, improves communication, eradicates departmental silos, and allows teams to promptly address any misalignments between departments, fostering continuous improvement in operational and strategic plans. [44]

4.3 The Challenges of the S&OP Process

The Sales and Operations Plan (S&OP) is a collaborative and collective approach that requires consistent and regular practice, involving participants from finance, marketing, production, sales, SCM, and other relevant areas [19]. Throughout this planning cycle, which involves coordination and communication among diverse groups within the organization, several hurdles have been encountered: i) Accuracy in demand planning numbers, ii) Discussions based on subjective opinions lacking solid evidence, iii) Non-participation and limited involvement of core stakeholders in the S&OP process, iv) Lack of ownership from the finance department, v) Precise projection of supply planning and supply schedule, vi) Failure to ensure the timely arrival of raw materials at the factory, vii) Unsynchronized factory planning and lack
of coordination regarding inventory, spares, capacity, power failure, and unplanned machine breakdowns, viii) Financial cash inflow and outflow planning integrated with the S&OP, ix) Cash inflow disruption due to inaccurate demand planning, x) Financial constraints causing delays in opening Letters of Credit (LC), xi) Customs clearance delays and port congestion, xii) Necessity for top management approval, and so forth. [30,42,47] Research indicates that addressing these issues can significantly strengthen the S&OP process, making it more meaningful by ensuring seamless connectivity and enhanced collaboration.

4.4 S&OP Performance Measurement

There has been considerable research on supply chain performance measurement (SCPM) within the manufacturing industry, and many corporations have struggled to implement effective performance measurement methods in their operations [10].

Organizations are increasingly recognizing the significance of incorporating risk management into their Supply Chain Management (SCM) operations to address internal and external disruptions, along with a heightened vulnerability, as evidenced by studies [9,10, 41].

This challenge is compounded by the lack of established supply chain attributes and a performance measurement index that directly correlates with the bottom-line impacts of an organization [9,41]. As a result, companies have faced difficulties in adopting integrated SCM performance measurement models to assess their overall performance.

![Figure 3: Integrated Supply Chain Performance Measurement Model (ISCPM) [44]](image-url)
Several tools and methods are available for measuring supply chain performance, each with its own merits and criticisms [22]. A vast array of articles and models have been explored in the literature review on supply chain performance measurement (SCPM). The ISCPM model, depicted in Figure 3, delineates supplier relationship management (SRM), international supply chain management (ISCM), and customer relationship management (CRM). [10, 40]

The ISCPM model articulates ten supply chain performance measurement attributes specific to the manufacturing industry, namely Financial Health (FH), Collaboration (CL), Velocity (VC), Resilience (RE), Reliability (RL), Continuous Improvement (CI), Visibility (VS), Work People Health (WPH), Sustainability (SS), and Service Excellence (SE). [34, 39]

Presently, many organizations employ either the Balanced Scorecard (BSC) model or the Supply Chain Operations Reference (SCOR) model to assess supply chain performance [5, 16]. However, in the context of current market dynamics, companies are urged to adopt the ISCPM model. [6,15,35]

5. Conclusion
The primary aim of the study was to conduct a comprehensive review of supply chain operations during disruptions, addressing the escalating challenges in managing risk and cultivating a resilient supply chain in an increasingly borderless economy [21,22].

The study investigates the complexities arising from uncertainties in demand and supply, shorter product lifecycles, outsourcing, and various other factors. [21,34]. In the current business landscape, numerous factors, such as financial volatility, mergers and acquisitions, technological innovations, e-business, shortened time-to-market, natural disasters, pandemics, terrorist activities, and shipping accidents, significantly impact businesses [19,23]. These factors necessitate organizations to adopt smarter business approaches. With internal and external interruptions leading to exponential vulnerability, effective risk management has become crucial for supply chain management (SCM) operations. Macro factors like globalization, open internet access, and e-commerce present opportunities for supply chain diversification but also introduce intricate vulnerabilities. [7,8,24,33]

Efficiency and operating cost optimization have become urgent priorities, driving firms toward lean manufacturing, low-cost sourcing, just-in-time inventory, reduced product lifecycles, centralized distribution centers, and supplier rationalization. [16,27,32]

The second objective of the study was to evaluate current Sales and Operations Planning (S&OP) and practices along with their challenges. The authors have outlined S&OP best practices and explained the six stages of the S&OP currently being implemented. [37, 16]

The third objective was to recommend S&OP best practices to ensure seamless collaboration and propose supply chain management (SCM) performance attributes to measure the S&OP process and foster
collaboration during disruptions [28]. The authors have also discussed the challenges of implementing the S&OP process. Addressing these challenges could facilitate a smoother and more successful S&OP implementation [25,26]. The authors have further recommended ten supply chain performance measurement attributes and introduced an Integrated Supply Chain Performance Measurement (ISCPM) model [20,38].

Presently, companies are grappling with multifaceted issues such as cost optimization, time constraints, investment challenges, service level concerns, natural catastrophes, demand shocks, systemic vulnerabilities like oil dependence and information fragmentation, cyber risks, rising insurance costs, and trade finance challenges. Aligning the ISCPM model with the six stages of the S&OP process could numerically measure seamless connectivity and collaboration levels with the help of the ten attributes, providing valuable insights into various situations. [5,17]

5.1 Recommendation and Future Research

This paper presents ten attributes for measuring supply chain performance in the manufacturing industry: Financial Health (FH), Collaboration (CL), Velocity (VC), Resilience (RE), Reliability (RL), Continuous Improvement (CI), Visibility (VS), Work People Health (WPH), Sustainability (SS), and Service Excellence (SE). [36,18]

The application and implementation of the Integrated Supply Chain Performance Measurement (ISCPM) model can surpass previously utilized models, providing organizations with the means to assess their overall performance. [29,30]

It enables organizations to take precautionary measures and establish connections between day-to-day activities and financial statements such as the balance sheet, income statement, and cash flow statements to gain insights into their operational performance [31]. However, this study does not delve into the ISCPM in intricate detail, including its ten attributes and other performance measurement indices. This study presents a path for future research, particularly in the context of manufacturing and its application in the service industry, particularly concerning disruption management [30].

References


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