

Optimization in Supply Chain Components to Design a Strategic Model and Research Opportunities to Enable Profitability

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Abstract

To overcome the increasing price and various operational issues, the 'Benefit-Sharing Model' can be an ideal solution as it improves resource optimization and maximizes cost efficiency. In particular, a Japan-Bangladesh joint venture medical device manufacturing company had been making loss since its inception. It reported an annual net profit for the first time after the introduction of the 'Benefit-Sharing Model' in the supply chain operations of the organization. Price fluctuations, limited supplier sources, below-par planning process and less supplier collaboration were resulting in continuous business losses which the company needed to solve to ensure profitability. Here we discuss the utilization of a strategic model to improve process parameters and resource optimization with ideal EOQ which was adjusted with supplier MOQ ensuring perpetual shipments. Furthermore, shipment optimization to achieve cost effectiveness, research opportunities for slow moving material and Covid impact minimization are reported in this paper. Utilizing this overall approach, raw-material price reduced 6% and a smooth order trend was achieved which reduced 41% inventory holding cost, 24% lead time, 67% port demurrage cost and increased capacity utilization by 25%. In addition, R&D development to utilize slow-moving quantity reduced purchase by 7% and new source development reduced cost 45%. Moreover, during Covid period, future risk assessment and strategic business negotiation helped to secure business from high freight and price hike up to 9 months and increased order by 20%. Overall, this model and the strategic approach helped the company to achieve annual net profit for the first time in 8 years.

Keywords

Supply chain strategic practices, risk mitigation strategies, benefit-sharing model, win-win opportunities, supply chain components optimization

1. Introduction

In modern practices, Supply Chain Management (SCM) starts with customer and ends with customer. It has been defined as a set of approaches utilized to efficiently integrate suppliers, manufacturers, warehouses, and stores, so that merchandise is produced and distributed at the right quantities, to the right locations, and at the right time, in order to minimize system wide costs while satisfying service level requirements (Levi and et al. 2000).

It is the systemic, strategic coordination of the traditional business functions and tactics across these functions within a particular organization for the purpose of improving the long-term performance of the individual functions and the supply chain as a whole (Marinagi and Trivellas 2014).

Supply Chain (SC) components spread out through various departments generally work as different entities where integrated effort is missing. Information flow is hampered across departments and as a result, price fluctuations, limited supplier resources, below-par planning process and less supplier collaboration impacts business performance negatively.

Here we have proposed a modernized supply chain process in Fig. 1 and discussed all its vital stages including the core functions/activities (Rasi and et al. 2016). The performance of these stages can be impacted via various supply chain components. Moreover, based on those components a conceptual framework and hypotheses has been developed through which we designed a model to ensure operational advantage to enable positive business performance.

In addition to that, we also covered how this approach can help to tackle different internal (single supplier source, capacity limitation) or external (Covid-19) challenges to optimize the overall result of a company.

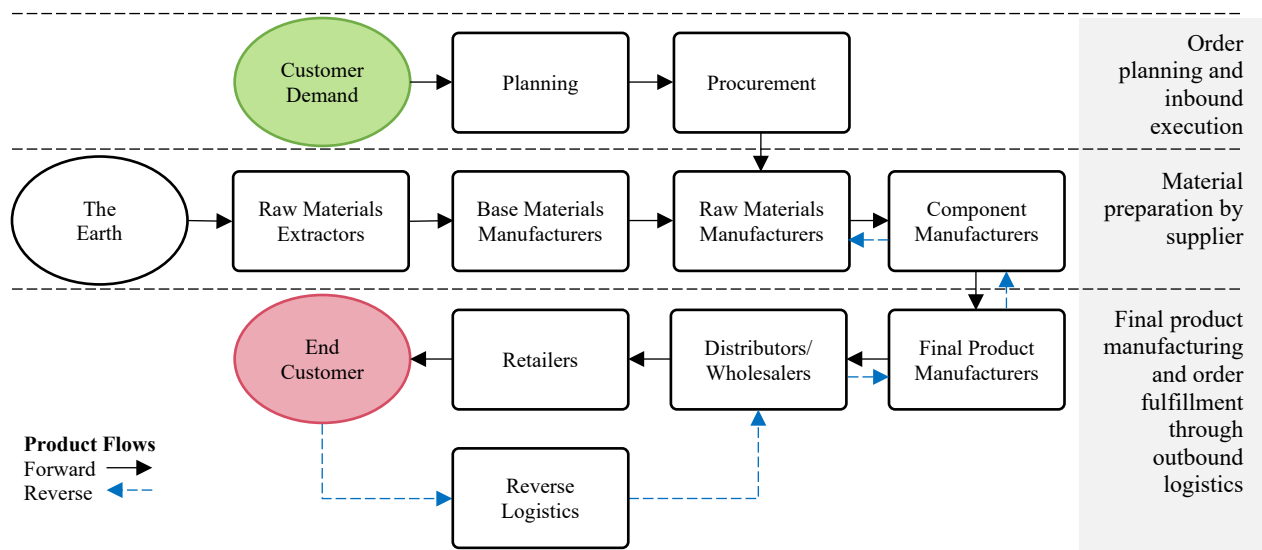


Figure 1. The Supply Chain Process

Through different stages of this standardized supply chain process, there is a major scope of optimizing multiple process and components. This research paper attempts to review the scope of optimization in supply chain components with a view to design a strategic model and explore further research opportunities to warrant profitability.

2. Literature Review

The reviewed literatures are ranging from different fields to some different research streams: different techniques or strategies used in the area of supply chain. The key focus was to find a strategic or win-win connection between buyer and supplier to develop a sustainable supply chain relationship or optimize the supply chain components. This paper also compared with other parameters like hypothesis development, strategic model development and risk mitigation strategies. It is observed that the most of the papers developed a strategic model based on some hypothesis but they did not suggest any risk management strategies to support those models. Below Table 1 shows the summary of the contributions of different papers (where ‘Y’ denotes ‘yes’, ‘N’ denotes ‘no’).

Table 1: The contributions of different papers

Paper Title	Author(s)	Summary	Hypothesis Development	Strategic Model Development	Risk Mitigation Strategies	Strategic Supplier-Buyer Partnership to Optimize SC Components
Negotiation Strategies in Supply Chain Management	Frederik Zachariassen	The influence of various negotiation strategies in diverse buyer-supplier relationships.	N	Y	N	N
Managing inventory systems of slow-moving items	G.J. Hahn, A. Leucht	The applicability and advantages of proposed approaches for managing inventory systems of slow-moving items.	N	Y	Y	N
Strategic planning and design of supply chains: A literature review	A Lambiase, E. Mastrocinque	Identifying trends, issues, key elements such as strategic decisions, economic parameters, constraints, and model features.	N	Y	N	N
Multi-objective optimization for sustainable supply chain and logistics: a review	Jayarathna, C.P., Agdas, D., Dawes L. and Yigitcanlar, T	Research gaps in Multi-Objective Optimization for Sustainable SC and Logistics Management.	N	Y	Y	N
The impact of supply chain management practices on supply chain performance in Jordan: The moderating effect of competitive intensity	Abdallah, A.B., Obaidat, B.Y. and Aqqad, N.O.	The influence of SCM practices on supply chain performance and assesses the impact of competitive intensity on this relationship.	Y	Y	N	N
The effect of an ambidextrous supply chain strategy on combinative competitive capabilities and business performance	Kristal, M.M., Huang, X. and Roth, A.V.	How an ambidextrous SC strategy affects manufacturers' competitive capabilities and, subsequently, business performance.	Y	Y	N	N
Supply chain innovation and organizational performance in the healthcare industry	Lee, S.M., Lee, D. and Schntederjans, M.J.	To investigate the impact of SC innovation on enhancing organizational performance within the healthcare industry.	Y	Y	N	N
Green Supply Chain Management: Do They Improve Operational Efficiency and Operational Performance	Rasi, R.Z., Ahmad, M.F. and Omar, S.S.	Literature review on Green SCM and its relationship toward operational efficiency and performance.	Y	N	N	N
The Influence of Supply Chain Strategy and Supply Chain Design on Supply Chain Resilience under Uncertain Circumstances: A Review of the Literature	T. Phengsuk, K. Worasan, and K. Saenchaiyathon	The study explores the factors that influence the SC resilience of businesses uncertain circumstances.	N	Y	Y	N
Unveiling Supply Chain Nervousness: A Strategic Framework for Disruption Management under Fuzzy Environment	M. Z. Mistarhi and G. M. Magableh	Introducing a strategic framework for SC nervousness management that prioritizes factors according to the relative importance.	N	Y	Y	N
The impact of supply chain management practices on competitive advantage and organizational performance	S. Lia,*, B. Nathamb, T.S. R. Nathamb, S. Subba Raob	The study formulates dimensions of SCM practices, the associations between competitive advantage and organizational performance.	Y	Y	N	N
This Paper	K. M. S. Ahmed, J. B. Shuvro	This study focuses on optimizing SC components to formulate a strategic model, while identifying research opportunities to enhance profitability.	Y	Y	Y	Y

3. Conceptual framework and hypotheses

Fig. 2 below depicts the conceptual framework of this study. The framework suggests that in total six SCM Strategic Practices will influence organizational performance both directly and indirectly via operational advantages. The six strategic practices are strategic planning, strategic negotiation, sharing information or forecast, customer satisfaction, logistical optimization and waste/slow-moving Stock Management. (Rasi and et al. 2016) (Li and et al. 2006)

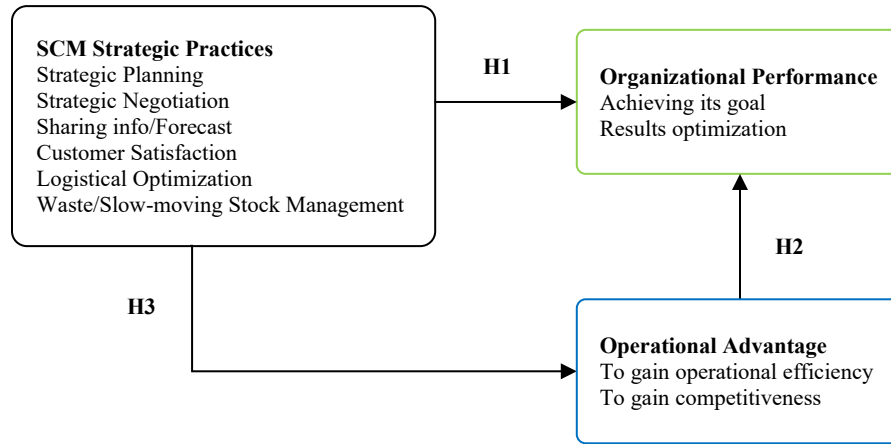


Figure 2. Research framework.

The hypotheses developed for this study are as follows:

H1: SCM Strategic Practices directly and positively affects organizational performance of the company.

H2: Operational advantage is positively related to organizational performance of the company.

H3: SCM Strategic Practices directly and positively affects operational advantage of the company

SCM strategic practices can be defined as the set of activities in an organization to ensure effective supply chain management. Different type of SCM strategic practices are discussed in details in the following paragraphs.

3.1 SCM strategic practices

Strategic planning: According to (Manzini and Bindi 2009), strategic planning refers to a long-term horizon (3-5 years) and has the objective of identifying strategic decisions for a production network and defining the optimal configuration of a supply chain. The decisions involved in this kind of planning include vertical integration policies, capacity sizing, technology selection, sourcing, facility location, production allocation and transfer pricing policies. This is the first general strategic practice needed to ensure operational advantage and also superior organizational performance.

Strategic negotiation: The act of negotiating can be defined as a process by which two or more people make a joint decision with regard to an issue about which there are initial differences in preference (Ariyanti and Salsabilla 2021). A negotiation situation is created when a disagreement or dispute arises between two opposite parties, in this case between firms in a supply chain network. Negotiators normally meet face-to-face in order to settle any disputes or problems. And a proper negotiation put into practice helps any organization to attain the desired level of performance.

Sharing info/forecast: Many researchers are of the opinion that the key to a seamless supply chain is making undistorted and up-to-date data available at every point within the supply chain (Turner 1993). By making the relevant data available and sharing it with other parties within the supply chain, information can be used as a source of competitive advantage (Jones 1998).

Although organizations are generally reluctant to share anything more than the minimal information as information disclosure is perceived as a loss of power (Towill 1994). In these circumstances, ensuring the quality of the shared information becomes a vital part of effective supply chain management (Feldmann and Muller 2003). Organizations need to consider all the internal information as a strategic asset and ensure that it flows with minimum distortion. Sharing of the right data at the right time can solve a lot of problems well in advance and benefit all involved parties.

Customer satisfaction: Customer satisfaction means keeping customers happy both in day-to-day interactions and from a more global, long-term perspective (Carnevale and Isen 1986). In recent years, many organizations have placed more and more emphasis on listening to the customers in order to customize their product and service offerings as per the customers' requirements. Through proper planning and regular business deals, an organization can ensure that all the stakeholders of its supply chain are satisfied. This can lead to more operational advantage for all parties.

Logistical Optimization: Logistics optimization is a strategy widely implemented by companies to tackle the ever growing demand for agile and efficient supply chain operations. This strategy focuses on various aspects of the supply chain and identifies opportunities for optimization of different supply chain stages. Logistics optimization is required to reduce expense across the supply chain, minimize lead times, and ensure customer satisfaction. This is a very important strategic practice to ensure superior organizational performance.

Waste/Slow-moving Stock Management: Items in decentralized retail supply chains frequently exhibit slow-moving demand patterns, i.e. rather low but highly fluctuating demand sizes and a high fraction of zero-demand periods. Slow-moving inventory can be a major threat to any companies' resources and might lead to cash flow problems. Through properly planned steps, these slow moving stocks and some wasted materials can be turned into a profitable asset for any business. The first step in dealing with slow-moving inventory is to identify it. Slow-moving inventory is inventory that has a low turnover rate i.e. it takes longer to sell than other products in your inventory. Once slow-moving inventory has been identified, and some waste material has been spotted which can be useful, the company should use strategic utilization plan to use them to gain operational efficiency. A proper selling plan for the slow-moving stocks and a reusability planning for the waste material will be effective for the organization in the long term. (Hahn and Leucht 2015). (Goh and Lim 2014), (Nawawi and Salim 2018)

4. Research Procedure

To generate a strategic model this study followed a combination of several research outcomes (Anass and et al. 2009), (Ariyanti and Salsabilla 2021). This includes literature review, lessons from conference papers, books, case study and real life experiences. The total procedure is depicted in the Fig: 3, which comprises the following steps: prior studies of research findings to select key SC drivers which will operate within well-defined boundaries to overcome SC challenges and finally to learn lessons for SC optimization. Then gathering data and information to analyze gap in SC components which will lead to generate opportunities to develop a strategic model. After negotiation and implementation of the strategic model with all channel partners, the process outcomes will be recorded in two categories; success factors and risk factors for further improvements. Review again and again until the sustainable model achieved through the agreement of all internal and external stakeholders.

This methodology was applied in a 100% export oriented Japan-Bangladesh joint venture which is a medical device manufacturing enterprise. They are only conducting manufacturing operation in Bangladesh, therefore, SCM is a very critical part to its business. For fully functioning SCM, procurement, planning (demand and material), inbound logistics and warehouse were selected to form a group. Key tasks and sub-tasks were enlisted in the SOP and cross-functional flowchart was also inserted in all the necessary departments for better visibility and practice.

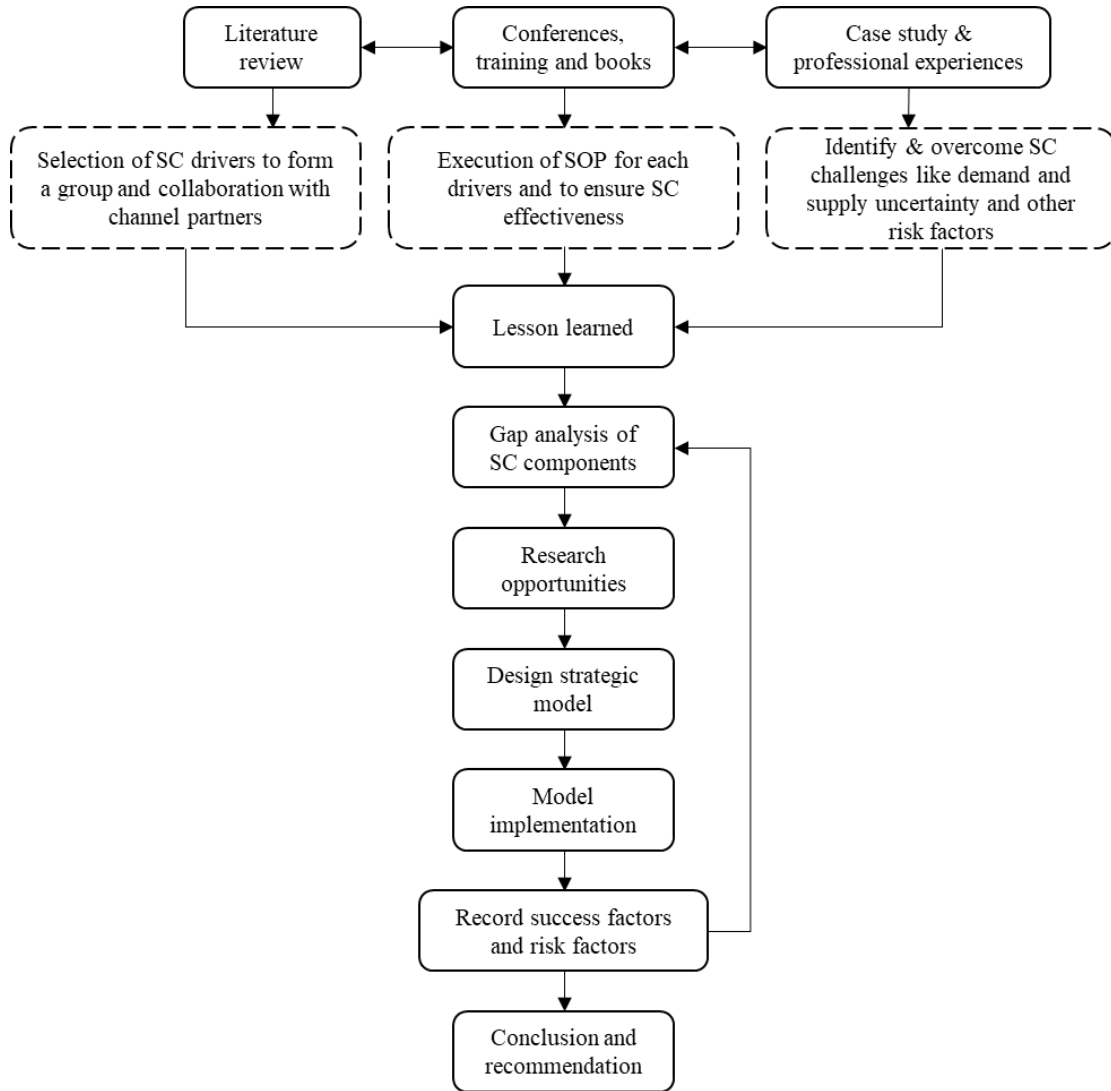


Figure 3: Research methodology

5. Risks Categorization and Mitigation Strategies

In recent times, supply chain risks and uncertainties have emerged as a significant topics of interest within researchers and practitioners. A groundbreaking work by Lee in 2002 has contributed a pioneering framework that revolves around the uncertainties based on supplier risk and demand risk, particularly within the context of that are functional or innovative, stable or evolving. He argues that supply chain strategies need to be aligned with the right level of demand and supply risks encountered. (Lee H. 2022)

In this paper, we followed the framework proposed by (Norrman and Jansson 2004) to prepare a risk matrix in Fig. 4 and also adopted the framework by (Oke and Mohan 2008), the risk classification was established in Table 2, after conducting a thorough analysis in a company record. (Norrman and Jansson 2004)

The risks are classified as supply risks, demand risks and miscellaneous risks. (Lee H. 2022), (Ariyanti and Andika 2006)

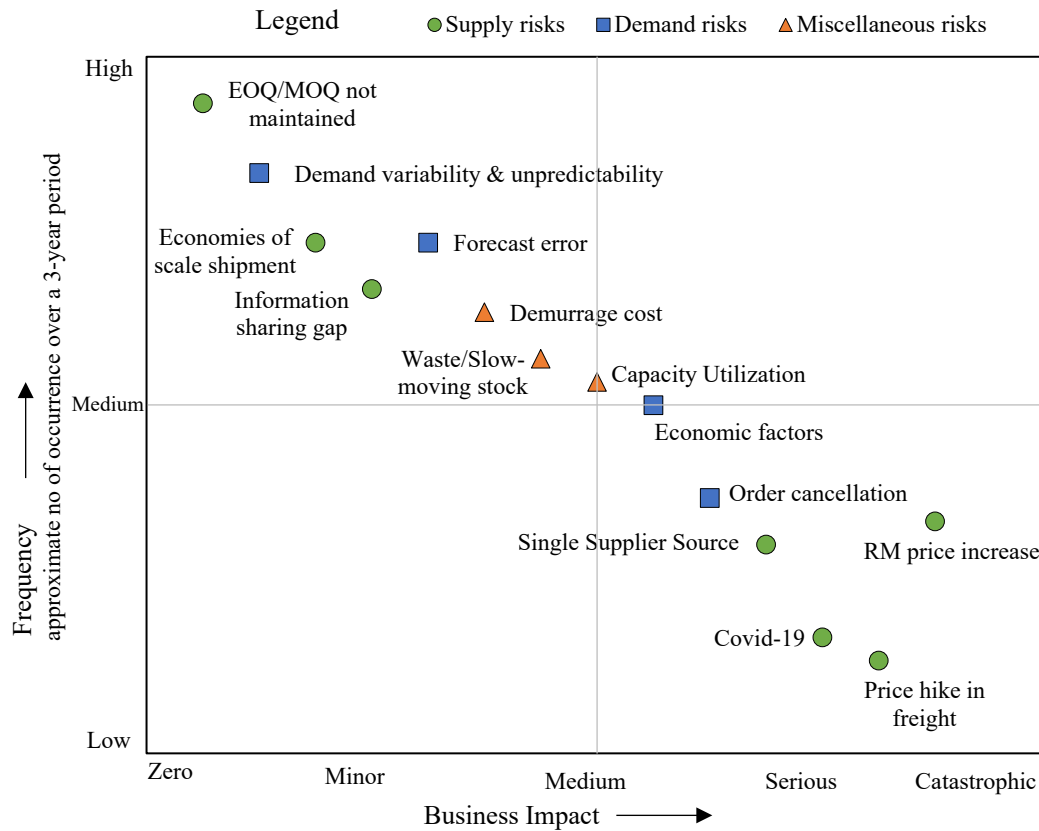


Figure 4: Risk Matrix

5.1 Supply Risks:

Supply risk can be defined as the potential disruptions and uncertainties associated with the purchasing and sourcing of materials and services essential to support operations.

RM Price Increase: The surge in raw material prices can highly impact the global supply chain, acting as a major disruptor. When the cost of essential inputs like metals, energy, or agricultural products rises, it undoubtedly has a domino effect on production costs for various industries. Manufacturers often find themselves struggling with higher expenses, leading to either reduced profit margins or the transfer of the burden to consumers via increased prices. This escalation can trigger a chain reaction on the overall supply chain as the companies belonging further downstream in the supply chain face heightened input costs, potentially resulting in a strain on their competitiveness. Moreover, the interconnectedness of the global economy means that a spike in raw material prices in one region can reverberate globally, impacting trade balances and economic stability on a broader scale.

Price hike in freight: An increase in freight prices can result in significant influence over the intricate network of the global supply chain. As transportation costs escalate, the repercussions echo throughout multiple industries, eventually increasing overall production expenses. As a result, businesses reliant on efficient and cost-effective logistics find themselves grappling with diminished profit margins or, in turn, passing the burden onto consumers through increased prices. The impact extends beyond individual companies, affecting the broader dynamics of international trade and supply chain. Elevated freight prices can disrupt the delicate balance of supply and demand, leading to potential delays, shortages, and increased complexity in managing inventory. The interdependence of global trade means that any increase in transportation costs can create a ripple effect across borders, underscoring the vulnerability and adaptability required in the contemporary supply chain world.

Covid-19: The emergence of the Covid-19 pandemic has been a massive shock to the global supply chain, exposing vulnerabilities and testing resilience on an unprecedented scale. Lockdowns, restrictions, and disruptions in workforce

availability have disrupted manufacturing processes and distribution channels worldwide across all the industries. The pandemic has exposed all the risks associated with overreliance on specific regions for production, as supply chains faced interruptions due to factory closures and transportation restrictions. Additionally, fluctuations in demand for various goods and the sudden shift in consumer behavior have created huge challenges in inventory management. Companies are now compelled to reevaluate and enhance their supply chain strategies, with a renewed focus on flexibility, diversification, and digitalization to better navigate uncertainties that may arise in the wake of any future global crises. The enduring impact of Covid-19 on the supply chain serves as a strong catalyst for transformative changes in how businesses approach and adapt to the ever-evolving landscape of global commerce and trade.

Single supplier source: Relying on a single supplier source can be a double-edged sword in the global supply chain as it might initially streamline operations and result in reduced costs, but in the long run, it exposes businesses to significant risks. Any disruption, be it due to geopolitical events, natural disasters or unforeseen circumstances like a pandemic, can cause a cascading effect on the entire supply chain. The vulnerability of depending on a single supplier becomes evident when that source encounters challenges, leading to potential shortages, production delays, and increased costs. Diversifying supplier networks becomes mandatory for business resilience, as it reduces the impact of disruptions and provides security against unforeseen events. So, a more diversified and flexible approach to sourcing is a must for the long-term stability and sustainability of the global supply chain.

Info sharing gap: In the global supply chain, the information exchange gap is a serious issue that can hinder responsiveness and efficiency. Effectively anticipating and addressing interruptions is hampered when there is a lack of clear, real-time communication across various supply chain organizations. A healthy supply chain depends on timely and reliable information sharing to help stakeholders make choices, manage inventory, and coordinate operations with ease. The absence of robust information sharing systems can lead to inefficiencies, longer lead times, and misalignments. It will need teamwork to close this gap, utilizing data-sharing platforms and technology to improve supply chain visibility. In the end, building resilience and flexibility in the information-sharing ecosystem requires a more open and linked ecology.

Economies of scale shipment: One of the main tactics for streamlining the global supply chain is to take advantage of economies of scale in shipping. Businesses can take advantage of lower per-unit transportation costs by combining bigger quantities of items into single shipments, which lowers the total cost of transporting goods over long distances. Reduced carbon emissions per unit of goods means fewer shipments, which further supports environmental sustainability through economies of scale in shipping. This strategy, however, requires effective synchronization and coordination throughout the supply chain. Companies can attain cost reductions, improve their competitiveness, and sustain price competitiveness in the global market by engaging in large-scale exports. Therefore, adopting economies of scale in shipping plays a crucial role in determining the overall profitability and cost-effectiveness of the contemporary global supply chain.

EOQ/MOQ not maintained: The failure to maintain an optimal Economic Order Quantity (EOQ) or Minimum Order Quantity (MOQ) can significantly disrupt the global supply chain dynamics. When companies deviate from these established quantity benchmarks, it often leads to suboptimal inventory management, increased holding costs, and logistical inefficiencies. Inconsistencies in order quantities may result in frequent and smaller shipments, leading to higher transportation expenses and elevated risks of stock-outs or excess inventory. The lack of adherence to EOQ/MOQ principles can also strain relationships with suppliers, as it may affect their production planning and overall efficiency. Achieving the right balance in order quantities is crucial for sustaining a cost-effective and streamlined global supply chain, emphasizing the importance of aligning procurement strategies with optimal inventory management practices.

5.2 Demand Risks:

Demand risk can be defined as the potential uncertainty and variability associated with fluctuations in demand for a product or service, impacting overall operations and business planning.

Order cancellation: Order cancellations have the power to cause havoc throughout the complex global supply chain, causing ripple effects that affect different manufacturing and distribution stages. Manufacturers have to deal with surplus inventory, overcapacity manufacturing, and possible financial losses when orders are cancelled. In turn, suppliers could experience messed-up production schedules and strained relationships with other suppliers. The effect is not limited to specific businesses; it also affects the market's overall supply and demand equilibrium. This

interruption may result in lower productivity, higher expenses, and difficulties controlling inventory levels. Furthermore, because of the interconnectedness of the global supply chain, order cancellations in one area of the world can have a significant influence elsewhere, emphasizing the necessity for flexibility, agility, and efficient communication to lessen the effects of such situation.

Economic factors: Economic factors have a profound influence on the global supply chain, shaping its dynamics in multiple ways. Fluctuations in currency values, interest rates, and overall economic stability directly affect production costs, pricing strategies, and consumer demand. Economic downturns can lead to reduced consumer spending, altering the patterns of global trade and requiring agile adjustments in supply chain strategies. Moreover, geopolitical economic shifts, such as trade policies and tariffs, introduce uncertainties and reshape the landscape of international commerce. The economic health of nations affects the financial viability of businesses along the supply chain, influencing investment decisions, production levels, and overall market competitiveness. Adapting to economic variables is essential for the resilience and sustainability of the global supply chain, emphasizing the need for proactive strategies that navigate the complexities of the ever-changing economic landscape.

Forecast error: Forecast errors can majorly impact the global supply chain, disrupting the delicate balance between supply and demand. When predictions about consumer preferences, market trends, or production needs deviate even slightly from reality, it can lead to misalignment in inventory levels and production schedules. Overestimating demand may result in excess inventory and increased holding costs, while underestimating demand can lead to stock-outs and missed opportunities. The impact of forecast errors is amplified in a global context, as it can trigger a chain reaction affecting suppliers, manufacturers, and distributors across borders. The inefficiencies introduced by inaccurate forecasts can impact at various stages through the supply chain, causing delays and increased costs. Adaptable forecasting methods and real-time data analysis become mandatory to minimize these errors, resulting in a more agile and responsive global supply chain.

Demand variability & unpredictability: Demand variability and unpredictability is another of the major challenges to the global supply chain, injecting a level of uncertainty that requires constant adaptation. Sudden shifts in consumer preferences, market trends, or external factors like geopolitical events which can lead to fluctuations in demand that are difficult to anticipate. This variability can result in excess inventory or stock-outs, both of which have cascading effects throughout the supply chain. Suppliers may struggle to align production with unpredictable demand, while manufacturers and distributors may find it challenging to maintain optimal inventory levels. The interconnected nature of global trade exacerbates these challenges, as disruptions in one region can reverberate globally. Navigating demand variability requires agile supply chain strategies, robust data analytics, and collaborative relationships that can swiftly respond to the unpredictable global market.

5.3 Miscellaneous risks:

Capacity utilization: Capacity utilization is a key factor influencing the efficiency and competitiveness of global supply chains. Optimal capacity utilization maximizes resource utilization, minimizes production costs, and allows businesses to meet demand without creating unnecessary bottlenecks. However, both underutilization and overutilization of capacity can have significant consequences. Low utilization can lead to higher production costs per unit and lower competitiveness. On the other hand, too high utilization can strain resources, affect product quality, and lead to delays. Global supply chains rely on synchronized functions at each stage, from raw material extraction to manufacturing and distribution. Variations in capacity utilization at any point in this complex network can lead to inefficiencies, requiring careful planning and coordination to maintain a balanced and responsive global supply chain.

Waste/Slow moving stock: The presence of waste and slow-moving inventory within global supply chains can impact efficiency and profitability. Excess inventory or slow-moving inventory ties up valuable capital, takes up storage space, and increases storage costs. This situation is further exacerbated in a global context where the interconnectedness of supply chain partners can amplify spillover effects. Manufacturers may face difficulty adjusting production schedules, and retailers may struggle to manage excess inventory. Suppliers may also be affected, potentially delaying orders and disrupting their own production cycles. Addressing waste and slow-moving inventory requires proactive inventory management, accurate demand forecasting, and optimized communication throughout the supply chain. Minimizing these inefficiencies makes global supply chains more responsive, cost-effective, and better manages the evolving dynamics of international trade.

Demurrage cost: Demurrage costs represent a significant challenge in the global supply chain, affecting the timely movement of goods and adding financial burdens. Demurrage occurs when cargo remains at a port or terminal beyond the allotted free storage or unloading period. This delay can be caused by various factors, including customs clearance issues, transportation bottlenecks, or unexpected disruptions. The financial implications of demurrage costs extend beyond the immediate fees incurred, as they can lead to cascading effects such as delayed deliveries, increased transportation expenses, and strained relationships with suppliers and customers. In the interconnected world of global trade, the impact of demurrage costs resonates throughout the supply chain, emphasizing the need for effective logistics planning, streamlined processes, and proactive measures to mitigate the challenges posed by these additional expenses.

Table 2: Risk classification and management strategies based on findings.

Risk Category	Risk Type	Frequency	Business Impact	Risk Management Strategies
Supply risks	RM price increase	Low to medium occurrence	Very high business impact	- Source more cost effective suppliers, negotiate with higher order volume which is in line with EOQ.
	Price hike in freight	Very low occurrence	High business impact	- Negotiate with the most process efficient supplier. - If necessary, make a business deal to secure supply for next few quarters to survive the sudden price hike.
	Covid-19	Very low occurrence	High business impact	- Focus on flexibility, diversification, and digitalization in order to tackle uncertainties. - To avoid all the risks associated with over dependency on a single source or region.
	Single supplier source	Low to medium occurrence	Medium to high business impact	- New suppliers inclusion who are in line with the competitive strategy after supplier scoring model.
	Info sharing gap	Medium to high occurrence	Low business impact	- Improve the planning process and share info with your supplier in advance to secure supply and reduce lead time. - This will also help to develop buyer-supplier relationship.
	Economies of scale shipment	High occurrence	Low business impact	- Always order on FCL basis/optimum quantity to keep shipment cost per unit at a minimum.
	EOQ/MOQ not maintained	Very high occurrence	Very low business impact	- Negotiate with EOQ to optimize inventory holding cost. - If $EOQ \approx MOQ$, negotiate with MOQ for better unit price. - If $MOQ > EOQ$, a long term business strategy can ensure more business and stronger Buyer-Supplier relationship. - If $MOQ \gg \gg EOQ$, follow EOQ, otherwise find suitable supplier.

Demand risks	Order cancellation	Low to medium occurrence	Medium to high business impact	- If market demand falls drastically, supplier-buyer can renegotiate the profit margin to rejuvenate the market demand. - Right market forecast and proper demand planning to ensure win-win situation for all parties.
	Economic factors	Medium occurrence	Medium business impact	- Identify fast moving SKUs and secure business. - Offer discount for slow moving SKUs to keep the demand.
	Forecast error	High occurrence	Low business impact	- Use statistical tools for better forecasting using past years data and better demographic factors.
	Demand variability & unpredictability	High occurrence	Very low business impact	- Ensure strong relationship with customers with better price, product and on-time delivery.
Miscellaneous risk	Capacity utilization	Medium occurrence	Medium business impact	- Better market analysis before investment. - Seasonality analysis, proper demand planning and co-ordination of supply.
	Waste/Slow moving stock	Medium occurrence	Medium business impact	- Reduce, Reuse, Recycle. - R&D development for better waste management. - Proper focus on each SKUs to avoid slow-moving stock.
	Demurrage cost	Medium to high occurrence	Medium business impact	- Follow customs rules and regulations properly. - Prepare necessary documents on time to avoid customs release delay. - Tack consumption and order/schedule shipments as per WH capacity.

6. Case Study

The developed framework was implemented in the Japan-Bangladesh medical device manufacturing company to activate its SC drivers to optimize the components largely. As it is a 100% export-oriented company which allowed to import raw materials with duty free facility but at the same time has a storage limitation. That's why it is called bonded warehouse which yearly storage capacity (can be increased based on the export performance) and at a time stock holding quantity were limited (not more than 650MT) by the government. They had more than 20 suppliers and shipment from more than 10 different countries. They were handling around 20 types of raw materials. During the study, the record showed that the company never achieved annual net profit since its inception and raw material price had been increasing, on time delivery was often not ensured etc. As a result, they were losing orders day by day specially in Latin American market. Considering the situation, the proposed framework was implemented to increase the supply chain surplus significantly.

6.1 Strategic Model Design: Benefit Sharing Model

At the beginning of the year, company faced several challenges in their business, such as increasing material prices and a decline in customer orders. Addressing these critical issues required a thorough analysis of the supply chain components to develop a well-tailored model that would enable the company to achieve its objectives while maintaining a win-win relationship with its partners. Upon analyzing the components, several issues emerged:

- Company heavily relied on a single supplier source for its most consumed PVC material. This dependency came from the supplier's nomination for producing medical-grade PVC using a patented recipe provided by parent corporation.
- Limited collaboration meetings with the supplier resulted in fewer discussions on future opportunities.
- The high material price led to losing orders from regular customers, and most importantly, they lost a Latin American order entirely.

In response to these challenges, "The Benefit-Sharing Model" was introduced in quarter one of the next year to mitigate the identified threats.

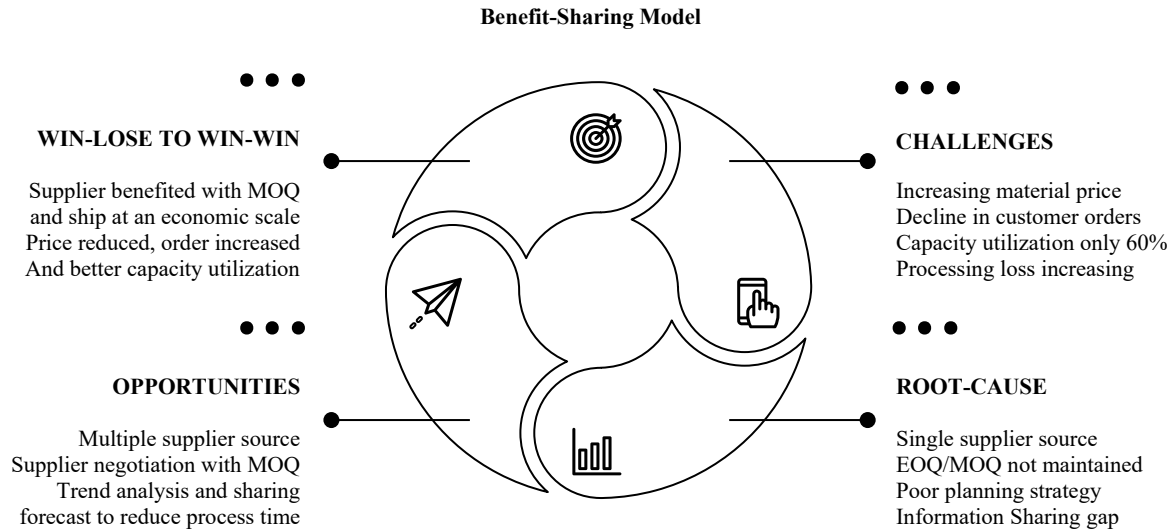


Figure 5: Benefit-Sharing Model

6.2 An aggressive improvement goal for resource optimization

From record, it was evident that there were significant fluctuations in purchases, ranging from 0 to 550 tons, as illustrated in Fig. 6. This fluctuation led to delays in material in-housing, inconsistencies in lead times, demurrage issues, and higher inventory holding costs among other challenges. To address such demand fluctuations, prioritizing a robust material planning strategy became essential. By combining the outcomes of forecasting with the Reorder and safety stock model, the original monthly requirement was predicted, denoted as x^* , within a specific time interval.

x^* = EOQ to support regular demand

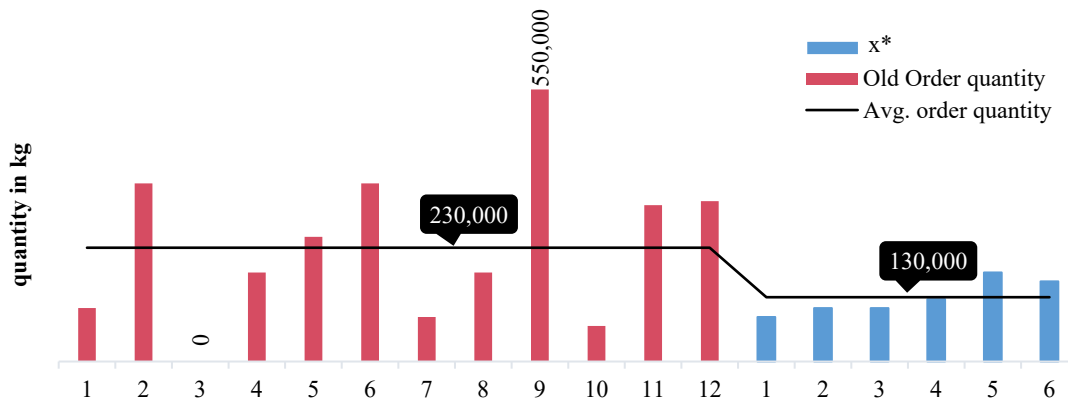


Figure 6: Order Flow Status

6.3 Supplier Negotiation to Implement Benefit Sharing Model

According to ABC analysis, there was one specific grade of PVC compound which was required in significant quantities (more than 50%), that was exclusively sourced from a single supplier along with other PVC grades due to their offering of the lowest price at that time. Due to the dependency on the same supplier for a longer time, supplier took the opportunity to increase the price by 5% for all grades which resulted in increase of product unit price. Within next few months, company started losing orders and notably they lost Latin American orders completely.

However, there was another enlisted supplier, who had the capability to provide the same. Unfortunately, this supplier was not securing orders due to their higher pricing compared to the competing supplier. The record showed that planners only ordered 1 FCL few times and never had any meeting for better negotiation. Later after several meetings, negotiations were conducted with the second supplier, resulting in a successful agreement to lower their prices even below the established rate by the first supplier. It was found that supplier MOQ was less than EOQ for that particular grade, which helped them for economies of scale production/shipment and reduced their overall production cost. As a result, a better price, less than 6% from the previous price was achieved.

Surprisingly, approximately two months after losing the order, the first supplier extended an offer matching the unit price of the aforesaid PVC Compound, aligning with the pricing structure of the second supplier. This marked an unprecedented decrease in pricing since the inception of the company.

Due to the positive outcome of the model implementation, similar approach followed for other key materials or suppliers. As the higher order volume helped the supplier to increase production efficiency and reduce production and shipment cost, they shared a portion of that savings by reducing the material cost. This resulted in significant cost savings for other key raw materials and the cost reduction was 20% monthly.

There were other fixed single source suppliers for which the MOQ was very high. For those suppliers, company communicated with the parent company, to negotiate a special discount through mother corporation for all the sister concerns. And it was executed accordingly for more price benefit.

6.4 Customer satisfaction generates more order and the recovery of market share lost earlier

In conclusion, the implementation of the analyzed strategies and negotiation techniques, notably the implementation of the "Benefit-Sharing Model," had successfully led to a reduction of raw material prices, increase of orders and the recovery of previously lost markets. Specifically, in the Latin American market, where after six months of absence, they have returned with three times more order than previous. As a result, customer order increased by 25%.

6.5 Process and cost improvements

The implementation of the "Benefit-Sharing Model" had brought significant improvements in various areas of supply chain operations. Firstly, alternative supplier development with the same unit price for the most critical material grade. This also enables flexibility during rapid change in market, faster replenishment of stock to avoid stock-out, cash flow increase due to more order fulfillment etc. Secondly, as order volume increased and demand fluctuation reduced, a consistent monthly order flow was maintained and order forecast was shared on regular basis. As a result, suppliers can more accurately anticipate future demands to start production earlier which results in reduction of lead time by 24% Fig.7. This way company was also sharing a portion of their inventory at supplier's end or in pipeline. Thirdly, as lead time reduced and EOQ was maintained during material ordering, inventory holding cost reduced by 41% Fig.7. Fourthly, ordering at multiple suppliers simultaneously with different shipment schedule helped to accommodate increased order volume with the same warehouse capacity.

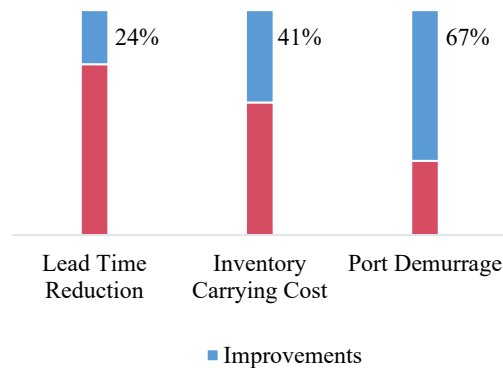


Figure 7: Process and cost improvements

This also helped making material supply process more secure and reduced port demurrage by 67% Fig.7. Finally, due to more demand and through implementing a stable monthly order to supplier and a more seamless supply schedule, on time material arrival was achieved, thereby increasing overall production efficiency. As a result, capacity utilization increased by 15% (from 60% to 75%).

6.6 Shipment optimization and selecting appropriate incoterms to achieve cost effectiveness

Initially the primary cost reduction focus was on the A and B category items as per consumption. After a satisfactory result in those categories, team put an interest on C category items and found something interesting. One of the PP grade suppliers who was shipping on CFR at port basis, was charging transportation cost which was nearly half of the material cost. That was quite unusual. Upon reviewing data from the last five years, the analysis indicated that, during the initial three-year period, the charge was 26% of the material price. Subsequently, without notifying the SC team, there was a sudden surge to 40-50% in the following two years and it remained unnoticed Fig. 8. After reviewing the enlisted freight forwarders, the cost analysis showed a potential to decrease the transportation expenses by 71%. After the meeting with the supplier, it was found that they were using their own shipping line and charging more for more profit and shipment was not at an economic scale (they were unnecessarily using more containers where actual requirement is less). That's why the charge was so high and SC team fixed that issue selecting the Ex-work shipment from next purchase. Also per order commission was high and fixed which was reduced by 67% by reducing the no. of order per year from 6 to 2 as material shelf-life and lead time both was high.



Figure 8: Year-over-year transport charge% vs Unit Price

6.7 R&D development to consume slow-moving materials and waste management

For few components, the production process generates more scrap material than actual consumption. As a result, slow moving quantity was increasing day by day. With the help of product development team and production team BOM was adjusted to reduce the stock. As a result, monthly purchase was reduced by 7%.

For drain bag preparation, PVC film was purchased as a raw material. But assembly section did only cutting and sealing for drain bag preparation, so film wastage could not be reprocessed again. So a suitable supplier was sourced who will directly supply drain bag as supplier has the facility to reuse the film wastage. And there were 32 operators engaged in assembly section for this, later allocated for different tasks. So overall cost savings was 45%.

6.8 COVID-19 pandemic impact: 2020 and 2021

In 2020, as company had to purchase materials from 10 different countries except China, SC team got the view of the pandemic situation. Based on future crisis analysis and strategic/advance purchase helped to increase order by 20%. Because when few suppliers were affected and their production was slowed down/shut down, the order from other sister concerns from 4 different countries started to come in Bangladesh. As a result, capacity utilization was increased again by 13% and overall it was 85%, which was the highest ever Fig. 9.

From early 2021, due to global pandemic situation, the shipment freight was increased significantly and most of the suppliers' shipment term was CFR. As a result, supplier proposed higher CFR unit price. As discussed earlier, for the most consumed materials grade PVC, SC team already developed an alternative supplier. One of them proposed 6%(Supplier-A) additional rate and another one 30%(Supplier-B). As Supplier-B was unable to reduce price, SC team did last 5 years' business analysis for Supplier-A and during the meeting, all the company order was negotiated with Supplier-A with same old price. Supplier was happy with the bigger order volume in each month and SC saved the company from high freight/price hike up to nine months.

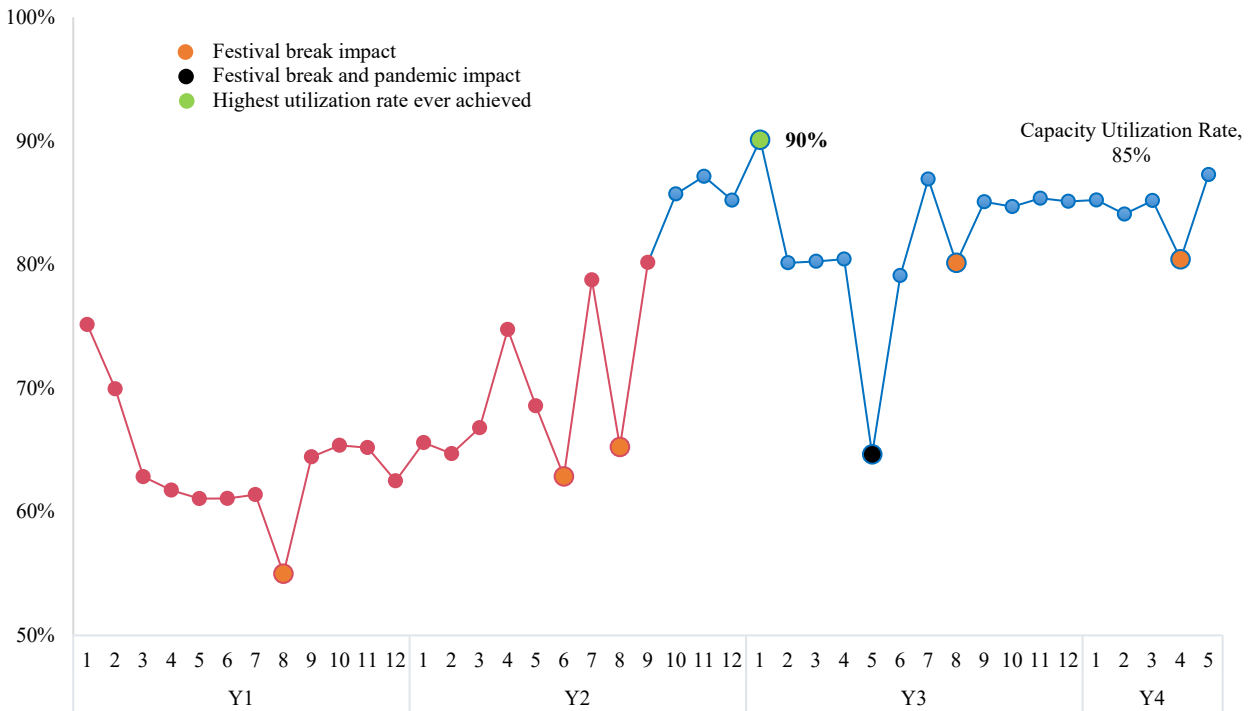


Figure 9: Year-over-year capacity utilization rate

7. Results and discussion:

In summary, the 'Benefit-Sharing Model' and the associated strategic approach not only addressed the persistent losses but also propelled the company to achieve an annual net profit for the first time in years. This success underscores the efficacy of strategic supply chain management in fostering resilience and profitability amid complex operational challenges. Below Table 3, summaries all the components and its limitations where different strategies as per opportunities were set to gain operational performance. By prioritizing mutual benefits for both the company and its suppliers, a long-term sustainable business model was achieved to gain competitive advantages.

Table 3: Organizational performance through SCM strategic practices and operational advantage

The win-lose situation turned into win-win opportunities with the right benefit-sharing model						
SC components	Limitations	Opportunity	Strategy	Company Benefit	Suppliers Benefit	Result
Planning	- No strategic planning	- Establish smooth order trend	- Calculate original monthly requirement	- Lead time reduced by 24% - Faster replenishment to avoid stock-out	- Anticipation of future demand to prepare earlier	- Company achieved annual net profit for the first time since its inception where direct SC contribution was 34%.
Source	- Single Supplier	- Alternative supplier inclusion - High RM volume	- Negotiation with both parties with EOQ \approx MOQ	- Best unit price	- Production efficiency	- Among 5 affiliated companies, Bangladesh unit ranked top position for the lowest RM unit price and secured the third position for the lowest final product unit price.
Information	- Info sharing gap - Less collaboration meeting	- More synergy - Improved performance	- Forecast sharing - Order visibility - Business transparency - Regular collaboration meeting	- Secure material supply - Faster supply support	- Stronger cooperation with stakeholders	
Inventory	- Higher holding cost - Waste/Slow-moving Stock	- Resource optimization	- Maintain EOQ - R&D Development and product sourcing	- Holding cost reduced by 41% - Monthly RM purchase reduced by 7% - Cost savings by 45% and 32 manpower requirement reduced	- New business	
Warehouse	- Limited capacity	- Maximize capacity utilization	- Perpetual shipments	- Higher inventory management in same WH capacity	- Continuous production and shipments	
Inbound operation	- High demurrage cost	- Cost reduction	- Buyer supplier collaboration regarding planning, doc. sharing and monitoring	- Demurrage cost reduced by 67%	- Less hassle regarding document correction and penalty.	
Customer	- Demand variability & unpredictability	- Customer satisfaction	- Lower product price - Ability to adapt rapid shifts in market/demand	- More Business	- More Business	
Manufacturing	- Low capacity utilization rate	- Higher order management	- RM cost minimization - Resource optimization - Future risk analysis to secure inventory	- Due to RM and resource optimization, capacity utilization increased 15%. - Due to strategic purchase during pandemic, capacity utilization increased 10%. - Overall capacity utilization rate increased 25% (from 60% to 85%).	- Secure business partner	

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