Review of Supply Chain Metrics to Support Performance Excellence

Alper Senol
Ahmed A. Bakhsh
Ahmad K. Elshennawy

1Department of Industrial Engineering & Management Systems, University of Central Florida, Orlando, FL 32816 USA, +1(757)814-4949, senolalper@knight.ucf.edu
2Department of Industrial Engineering, King Abdulaziz University, Jeddah, 21589 Saudi Arabia, aabakhsh@kau.edu.sa
3Department of Industrial Engineering & Management Systems, University of Central Florida, Orlando, FL 32816 USA, ahmad.elshennawy@ucf.edu

Abstract

The supply chain industry is one of the fast pace and technology-driven industries. The dynamic supply chain concept expresses how significant is the adaption to immediate changes in the industry. Many organizations strive to manage their operations with high visibility to adopt changes for performance excellence.

This study identifies the metrics of supply chain performance that affect the performance excellence of supply chain operations. It investigates categories of performance metrics in terms of time, cost, and quality. Likewise, it discovers the characteristics of performance metrics through measuring working capital in the supply chain. In addition, it defines the key performance indicators (KPIs) and its core calculations for the end-to-end supply chain to measure the practicality of operations’ efficiency. The supply chain operations with respect to critical KPIs are determined as plan, source, make, delivery, and return.

The proposed performance metrics- KPIs presented as the milestones of dynamic supply chain models. Moreover, the change in the supply chain was reviewed due to the Covid-19 pandemic along with performance metrics.

Keywords: Supply chain management, Performance metrics, Key performance indicators, Quality metrics, Covid-19.

1. Introduction

The concept of global supply chain management (GSCM) is largely dependent on the size of the organizations and the types of products and services provided. According to Wu (2016), the main purpose of a supply chain is to make products available within planned time, quantity, place, and condition for the customer (Wu et al.2016). However, organizations face common challenges due to the complexity of the supply chain systems. Controlling and monitoring supply chain operations become imperative in the industry regardless of the size of the companies as well as
The types of products and services they provide. So that, supply chain management (SCM) performance metrics as known as key performance indicators (KPIs) are needed for evaluating and monitoring the current progress of the operations. According to Gunasekran et al. (2001), performance metrics and measurement for the supply chain are needed to monitor the material, information, and cash flow, as well as providing feedback for the decision-making process, and help with non-value items elimination in the supply chain operation.

GSCM metrics and measurements can give management a better understanding of how the organization is operating within a certain period. Along with the help of technology, tracking the metrics would be much easier and accurate. In addition, it boosts performance excellence in the areas of sourcing, manufacturing, warehousing, inventory control, transportation & distribution, and customer service. As Ananda and Grover stated in their article; even if supply chain performance metrics have significant importance, implementation, and integration of these metrics in the organization are always a very challenging subject. It is mentioned to add certain KPIs in place could be a complicated process and very challenging for companies, which do not have incentive programs, support from the upper management and company culture that is willing to adopt any kind of implementation for a performance measurement system (Anand & Grover, 2015). Nevertheless, this paper aims to bring practical solutions for the organizations to set up essential operational metrics in terms of time, cost, and quality perspective.

1.1. Fundamentals of Global Supply Chain Management

Global Supply Chains Management (GSCM) incorporates the suppliers, the manufacturers, the vendors, the logistics and transportation channels, and most importantly the customers. Management of the operations covers product or raw material procurement, manufacturing of the products, and distribution of final product to the end customer effectively. Supply chain organization manages the planning, evaluation, improvement, and optimization of their operations to be more efficient and proactive within a certain period (A. Jayaram, 2016).

Managing the supply chain involves many activities such as material planning & product development, manufacturing procurement, transportation, warehouse & fulfillment, and distribution. Organizations perform the entire physical and informational supply chain activities to deliver the products to end customers. Handfield & Nichols (2002) summarized the definition of the supply chain as "activities within the supply chain operation includes mainly physical and informational flow that cover procurement of the raw material to the delivery of the final product to the end-customer." To be able to manage all the supply chain operations, companies focus on various systems integration channels to share the information. It is essential to share correct and accurate information among the related parties within the supply chain to make business and operational decisions correctly and effectively. Shuangqin Liu & Bo Wu (2010) proposed two core principles of supply chain management that organizations follow: system principles and information-sharing principles. They stated that the supply chain is considered as a system that includes subjects related to different functions and their integration with each other. The core of the organization aims to integrate and connect the functions such as the supplier, manufacturer, distributor, retailer, and end-user by managing and monitoring information and capital flow. Also, in terms of information sharing, the accuracy of the operational information helps the enterprise make more effective and correct decisions. (Shuangqin Liu & Bo Wu, 2010). However, companies struggle to understand how to determine and use the information gathered to develop supply chain metrics. Choosing the essential KPIs is quite tedious to study. It is important to evaluate operational processes in the supply chain to set the correct number of the most effective metrics to quantify
its performance. Based on the proposed framework, GSCM consists of planning, sourcing, making, delivering, and accepting returns. Figure 1 shows a diagram of GSCM flow. On the other hand, integration of the set of correct KPIs is necessary to monitor such operations. Most importantly, companies would have the opportunity to target their strategic goals in terms of time, cost, and quality perspective by having the selected KPIs. In Figure 2, the paper proposes a framework in the theoretical aspect for the relationship between supply chain operations and related KPIs to be able to achieve the equilibrium point of time, cost, and quality constraints.

Figure 1. GSCM flow
2. Supply Chain Performance Metrics

The success of supply chain management is measured by its performance in three main areas such as time, cost, and quality. These metrics help organizations to recognize strengths and weaknesses in operations and can provide a simplistic approach for business decisions. Hausman (2004) points out that to be able to see success in changing supply chain environments, continuous improvement methodologies should be adapted. To accomplish the integrated continuous improvement culture, performance measures, or "metrics," should be used as global Supply Chain Performance improvements tools instead of narrow company-specific or function-specific (silo) metrics that potentially prevent improvements in the organization. In addition, Chae (2009) stated in his research paper that, supply chain companies could evaluate potential issues and areas for continuous improvement by monitoring performance metrics. Measuring metrics allows organizations to eliminate any gap between the planning to execution stages of the operations (Chae, 2009). On the other hand, Angerhofer and Angelides (2006) confirmed that the primary goal of performance excellence in the supply chain is achieved by the collective effort of each member of the organization (Angerhofer and Angelides, 2006). Moreover, performance metrics along with robust supply chain dashboards provide visibility to businesses in the supply chain industry to make timely and effective decision-making in such a highly volatile environment. Organizations rely on visual presentations of their supply chain operational performance throughout the chain of operational locations, business units, warehouses, production factories, product categories, and brands. Standardized KPIs can be compared to actual operational performance systematically. Supply chain dashboards reflect a precise view of the operations that help management to discern the problematic areas in the operation and act promptly before these problems turn out to be major issues for the operations. According to Sandra Durcevic (2021), existing software models in use for the supply chain management process are Supply Chain management dashboards and Supply Chain Costs Dashboard. Supply Chain Management Dashboard targets to pinpoint inventory metrics such as inventory-to-sales ratio, inventory turnover time, inventory accuracy, to reduce the unnecessary cost along with increasing customer retention and business stability. On the other hand, Supply Chain Costs dashboards reflect the metrics related to the cost of the operations such as average cash-to-cash cycle, net sales, inventory carrying cost, warehouse operational cost, transportation cost. (Durcevic, 2021)

Overall, three main constraints cover the supply chain operational metrics. Also, the collaboration and the individual performance of time, cost, and quality metrics measure operational efficiency and risk/return ratio.

2.1 Time

Supply chain management heavily relies on managing the time concept effectively from procurement to delivery of the goods to the customer. According to researchers in the supply chain subject matter; time performance has a direct impact on embedded strategic processes within value delivery systems and has introduced various measurements to assess the time-related supply chain performance (Tersine and Hummingbird, 1995; Naylor et al., 1999; Mason-Jones and Towill, 1999). Companies practically monitor their operations from sourcing to shipping the final product to the end customer. Time has always significant impact on cost and quality. For example, outsource inventory should be delivered on a planned date to keep the operations and inventory management costs minimal. In addition, it increases customer satisfaction when products are delivered to the end customer. So that, time-related KPIs play an essential part in performance excellence to stay highly competitive. The most useful metrics are Supplier Lead Time in sourcing perspective, On-Time
Production in terms of making/production aspects, and finally On-Time Shipping for monitoring delivery efficiency.

2.2 Cost

Supply chain organizations strive to increase operational performance and customer satisfaction by reducing overall costs. According to Randall and Theodore, the focus on supply chain management has limitations because of intra-firm collaboration in the classical logistics functions such as transportation, warehouse, and inventory management. However, the success started when a collaborative approach initiated on these functions between trading partners in an inter-firm aspect (Randall & Theodore, 2009). Consequently, nowadays supply chain management shifts to controlling the flow of the processes such as products, information, and cash.

Due to the highly complex structure of the global supply chain operation, the concept of managing operational costs is complicated. Major supply chain cost drivers are listed as start-up costs such as warehouse space, and material handling equipment is also known as initial investment cost as well as inventory cost, production/manufacturing cost, transportation cost, and procurement cost. Most importantly, companies need to know how and what has to be measured to run overall effective supply chain operations. Therefore, it is essential to monitor certain KPIs such as Forecasting accuracy rate, and Inventory turnover rate that have a direct impact on procurement cost. In addition, the distribution cost rate over the product sold affects the transportation cost. Effective supply chain network planning, and routing; and getting better shipping rates and packaging utilization are practical approaches to manage distribution costs.

2.3 Quality

Measuring and managing success in customer service practice and customer satisfaction are the essential parts of supply chain management for competitive advantage in the global market. Organizations in the supply chain industry use various quality metrics to assure that they are doing the most possible interactions with customers and manage the operation effectively and satisfy their customers at a manageable and suitable cost. Carmignani said the customer expectations increase tremendously for the product with level customer service and delivery time. This creates quite a bit of concern in the industry to be able to become competitive in the global market. (Carmignani, 2009). On the other hand, the quality discussed in Guangshu Chang's article for supply chain management focuses on a customer that has strong leadership, involving people, managing processes and systems, initiating continuous improvement, having a factual approach for the decision-making, and considering long term relationship with the supplier. It is also considered the eighth modern quality application in global supply chain management (Chang, 2009).

Defining the measurement metrics is the initial step to making sure a company's strategic goal aligns with the action taking with the progress. The quality factor has a significant impact on the relationship between suppliers and customers. Performance metrics such as supplier defect rate help to assess the strength of that relationship. Customers may lose interest in suppliers that have higher defect rates. Due to the defective products have a direct impact on production, they potentially have negative effects upon process cycle time, order fill rate, on-time delivery, rework, and return. Consequently, results in low satisfaction levels over the customer end. Order fill rate, product return rate, and product damage rate are the key KPIs to monitor the synchronization of the operations to meet the quality standards.
3. **GSCM operations with proposed KPIs**

Based on the literature review for the existing SCM KPIs, there are around twenty KPIs effectively used in SCM. To support the validations of the most effective KPIs, Bressoles and Lang (2020) prepared a survey questionnaire and sent it out to hundred companies to identify the most relevant SCM KPIs. There was a predetermined 30 KPIs in the questionnaire. As a result of the survey, 13 most relevant KPIs are identified within different criteria. In terms of the SCM operational aspect, inventory cycle time, safety stock, rate of obsolete inventory, order to delivery time, and out of stock rate are highly used by the companies to monitor stock and inventory efficiency. In addition, shipping accuracy, cost per shipment, invoice accuracy are used to evaluate picking and order efficiency. Lastly, the percentage of shipment arrived in good condition, and the number of damage claims is used to understand the causes of return items (Bressoles & Lang, 2020). In this paper, SCM operations are grouped into five categories; plan, source, make, deliver, and return. Proposed KPIs are distributed and organized within relevant categories to present a logical and convincing approach.

### 3.1. Plan

Planning is the process performed by the company that acquires the final product. The company decides the type and quantity of the product for manufacturing. It also includes the activities of demand forecasting, planning, and scheduling manufacturing operations, material requirement planning, and distribution requirement planning. Software programs such as Oracle, SAP, and i2 can compute large amounts of data used for predictive modeling and decision-making.

#### 3.1.1. Proposed KPIs and related Constraint

**Forecasting accuracy.** Accurate forecasting data plays a very important role in achieving successful management goals in the supply chain. It supports reducing the cost of inventory that does not need it within a given period. Lee and Aviv summarized the concept of forecasting accuracy that collaborative forecasting methods have been studying with the majority of the companies in the supply chain industry to eliminate excess inventory and avoid the bullwhip effect (Lee et al., 1997; Aviv, 2007). In a larger perspective, forecasting accuracy lowers the supply chain operation cost. The main constraints for performance excellence in the supply chain are cost-related which helps shorten lead times and enhances customer satisfaction. Moreover, accurate data and transactions between manufacturer and buyer reduce the error for the forecasting model. The collaborated supply chain performance metrics demand is informational support from the buyer’s-ends than the supplier’s that may improve the results of predictive analysis and forecasting accuracy. It can eliminate excessive on-hand inventory and achieve better operational performance in the supply chain (Lorentz et al., 2011).

Forecasting accuracy formulated as follows;

$$Forecasting \text{ Accuracy} = \frac{Predictive \text{ Analysis}}{Actual \text{ Data from Operations (sales & inventory)}}$$

**Inventory Turnover Rate.** It is a numerical output of the inventory cycles in the company each year. Inventory management is considered one of the core operating performance metrics in the supply chain industry. As Ronald H. Ballou stated, the cost of carrying inventory is the top priority
of the upper management since inventories consume a noticeable investment by many companies. Usually, the cost of carrying inventory changes between 20% - 40% of the inventory value itself (Ballou, 2000). Inventory turn around rate is an essential indicator for production companies to compete in the market according to Bahl and Ritzman (1984). On the other hand, this indicator is affected by manufacturing companies' lot sizes and capacity decisions, as recognized by Bahl and Ritzman (1984) and Bishop (1979). A higher and faster inventory turnover increases the profitability of the enterprise. Consequently, the main constraints for the performance excellence of inventory turnover rate would be cost-related and it formulated as follow;

\[
\text{Inventory Turnover Rate} = \frac{\text{Total Cost of Goods Sold}}{\text{Average On-Hand Inventory}}
\]

3.2. Source

Sourcing is a procurement process controlled by an institution that performs purchasing activities. According to Ben-Daya et al. statement sourcing process is where products or services are acquired by the company. Accurate forecasting and planning help sourcing for the supply chain organizations Making-insourcing versus buying outsourcing, selecting the supplier, and cost of purchase is the strategic decisions of the enterprises in the industry (M. Ben-Daya et. Al, 2017). Effective sourcing process rests on two pillars of supplier delivery performance and product quality. Verdouw, Beulens, and van der Vorst (2013) argue that quality control and planning are enhanced by virtual control systems. It allows buyers and suppliers to manage and track the progress of the operation in the supply chain such as tracing goods as they move through in each stage. To support the importance of the communication between supplier and buyer, organizations integrating various technological systems. For example, an electronic data interchange (EDI) system was built to increase the speed and accuracy of delivering and processing business documents. In terms of vendor-customer relationship, EDI adds so many values to any organization such as improving customer service (Tan, Kannan, & Handfield, 1998).

3.2.1. Proposed KPIs and related Constraint

**Supplier Lead Time.** It is the total amount of time between the received order from the buyer and the time the supplier ships the requested order quantities. Ideally, suppliers aim to provide shorter lead times, but it is quite challenging to get shorter lead-time due to the variability in the process. As Bandaly stated, variability in lead-time is extremely important in supply chain management and is controlled by managing uncertainty. Various risk management factors are used to manage this uncertainty since lead-time is considered an internal factor to the supply chain. (Bandaly et al., 2012). In addition, longer lead times cause and higher on-hand and in-transit inventory that increases operational cost. Main constraints for the performance excellence of supplier lead-time would be time-related and affect the cost indirectly and it formulated as follow;

\[
\text{Supplier lead time} = \text{Time for delivery of the goods to destination} – \text{Time when PO created}
\]

**Supplier Defect Rate.** Supplier defect rate is the measurement that checks the final product quality received from the manufacturer or supplier. It helps to measure a supplier’s production quality and calculates the percentage of the received product that does not comply with the requested quality specification of the buyer. Shivasankari B. points out the procurement KPIs that enterprises cannot ignore. He mentioned that to measure defect rates of suppliers,
defect types need to be broken down with reason codes. This provides insight information about your supplier’s strengths and weaknesses. Defect rates can be measured in defects per million (Bhuvaneswaran, 2019). The main constraints for the performance excellence of supplier defect rate would be quality-related and it formulated as follow;

\[
\text{Supplier defect rate} = \frac{\text{Number of defective items received}}{\text{Total number of items tested}}
\]

3.3. Make

Sourced raw materials process by the manufacturer to be able to make the final product. Jaraham re-phrases the "make" component of GSCM in his article; enterprises such as suppliers and manufacturers work with raw materials to be able to produce finished goods. Usual operation includes; logistics flow, marketing, finance, R&D, manufacturing, and sourcing. Every department and team members communicate among them during the manufacturing process (Jaraham, 2016). There are several production-related KPIs to monitor how well manufacturing processes are performed.

3.3.1. Proposed KPIs and related Constraint

**On-Time Production Rate.** This metric evaluates planned production versus actual production times on a daily, weekly, and monthly basis. Weak On-Time Production performance affects directly the end customers, and it indicates poor production efficiency and materials handling procedures. The term "takt time" calculates planned product time. In theory, this time determines what quantity of the items the manufacturer should produce within the day to meet the planned throughput (Duanmu, J., & Taaffe, K., 2007). The main constraints for the performance excellence of on-time production rate would be time-related and it formulated as follow;

\[
\text{On-Time Production Rate} = (1 - \frac{(\text{Planned Production} - \text{Actual Production})}{\text{Planned items}}) \times 100
\]

**Order Fill Rate.** Order fill rate is a measurement of delivery performance and is expressed as a percentage. It is also known as DIFOT (Delivery In Full On time). This metric evaluates the percentage of an order completed and shipped on time in the first shipment. Measuring order fill rate or DIFOT explains if the company meets the customer expectation. Zinn defines order fill rate as "orders filled completely as a fraction of the total number of orders" (Zinn et al., 2002) Higher-order fill rate equate to better customer service and satisfaction. The main constraints for the performance excellence of order fill rate would be quality-related and it formulated as follow;

\[
\text{Order Fill Rate} = (1 - \frac{(\text{full order quantity} - \text{shipped quantity})}{\text{full order quantity}}) \times 100
\]

3.4. Deliver

The delivery function is one of the most important tasks of logistics. Making precise planning and controlling product and service flow as well as storing the goods are the steps of the logistic process Lummus, et al said. (Lummus, et. Al 2001). The delivery concept is not only involved with transportation but also includes warehouse operations, inventory management, and order
management. Warehouse management systems are broadly used in the delivery process to increase productivity.

### 3.4.1. Proposed KPIs and related Constraint

**On-time Shipping Rate.** It is the percentage of orders/items completed before or at the requested ship date. According to Chae, customer service and sales can be improved by on-time and consistent delivery. However, organizations that are moving into the global market face challenges and complexity of the fast product delivery more overwhelmingly (Chae, 2009). Higher rates of on-time shipping increase customer satisfaction. The main constraints for the performance excellence of on-time shipping rate would be time-related and it formulated as follow:

\[
\text{On Time Shipping Rate} = \left( \frac{\text{Total on time orders}}{\text{Total orders}} \right) \times 100
\]

**Distribution Cost.** Total distribution cost includes inbound transportation cost, outbound freight cost, and material/packaging cost. Figure 3 shows the visual relation between three cost factors.

The main constraints for the performance excellence of distribution cost would be time-related and it is formulated as follows.

\[
\text{Inbound transportation cost per piece} = \frac{\text{total transportation cost}}{\text{number of pieces received}}
\]

or

\[
\text{Outbound freight cost per piece} = \frac{\text{total freight cost}}{\text{number of pieces shipped}}.
\]

In supply chain management, the typical cost of performed distribution and transportation, operation costs can range from 6% to 8% of overall revenues for consumer-packaged-goods (Ruffing, Shehorn, & Banerjee, 2018) as shown in Figure 4.
3.5. Return

Customers could return purchased goods because of various reasons such as receiving incorrect items, damaged goods, customers do not want items anymore, the wrong size, etc. Managing the return process and inventory is called reverse supply chain or reverse logistics. The reverse supply chain also includes the flow of products, information, and cash from the customer end to the manufacturer. It is a challenging process for the supply chain companies to manage the distribution and handling of the return products at a low cost. (Hildago et. Al 2019). As soon as the returned product arrives back at the warehouse, inventory carrying cost and warehouse space are affected negatively. It also consumes the warehouse labor force that causes inefficiency in the operations. Companies need to leave room in the operations to process the return products and monitor the progress and uncertainty with the following KPIs to make predictions for upcoming events.

3.5.1. Proposed KPIs and related Constraint

Product Return Rate. This metric offers insight information about why shipped items are returned and what is the percentages of the return items over the total shipped products. This metric provides the breakdown of the reasons why the customer returns items. Specifically, e-commerce and online retail stores are facing the challenge of handling return product and cost associated subject matters, Richey said (Richey et al., 2005). In addition, as Mollenkopf et al., stated, “The significance of product returns in internet retailing is derived from its contributions to customer satisfaction and long-term customer value “(Mollenkopf et al., 2011). A less product return rate increase customer satisfaction, boost profits and improve cash flow as a result. The main constraints for the performance excellence of product return rate would be quality-related and it formulated as follow;

\[
\text{Product Return Rate} = \frac{\text{Total Number of Items Return}}{\text{Total number of Items Sold}}
\]
**Product Damage Rate.** This metric identifies quality issues within categories that are potentially caused by either, supplier, production, or packaging. This needs to be broken down into three categorical reason codes such as received damage from suppliers, poor manufacturing, or inappropriate packaging. Data collection is crucial to identify the root cause of the damaged products. Supply chain analytics must study which items have the most significant damage rate, what are the average quantities, how do they pack, etc. To pinpoint the issues, constraints for the product damage rate would be quality-related and it can be formulated as follow;

\[
\text{Product Damage Rate} = \frac{\text{Total Number of Items Damage}}{\text{Total number of Items Sold}}
\]

4. **Business Units Responsibility Distribution**

Overall, proposed performance metrics are evaluated, reviewed, and communicated on regular basis between the responsible business units to execute successful supply chain operations. As Chae mentioned in his article on developing key performance indicators for supply chains; companies must set the KPI targets and adjust according to the improvement. In addition, designated team members such as Operation Strategy or S&OP team need to set up meetings to evaluate overall operations in the supply chain including demand planning to supply network designs (Chae, 2009). Closely monitored KPIs help each business unit to identify problematic or low-performance areas of the supply chain operations. It also supports the team to find the real cause of the identified problems and communicate effectively with the responsible business unit and department within the whole supply chain enterprise. Table 1 and Figure 5 Summarize the corresponding business units' distribution between related KPI as well as the impact of each KPI in terms of cost, time, and quality that support performance excellence of the organizations.

**Table 1.** KPI responsibility distribution.

<table>
<thead>
<tr>
<th>Supply Chain Management KPIs</th>
<th>Responsible Business Units/Departments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Forecasting Accuracy</td>
<td>Strategic Planning</td>
</tr>
<tr>
<td>Inventory Turnover Rate</td>
<td>Sales and Marketing</td>
</tr>
<tr>
<td>Supplier Lead Time</td>
<td>Purchasing</td>
</tr>
<tr>
<td>Supplier Defect Rate</td>
<td>Purchasing</td>
</tr>
<tr>
<td>On-Time Production Rate</td>
<td>Production</td>
</tr>
<tr>
<td>Order Fill Rate</td>
<td>Production</td>
</tr>
<tr>
<td>On-time Shipping Rate</td>
<td>Production</td>
</tr>
<tr>
<td>Distribution Cost</td>
<td>Strategic Planning</td>
</tr>
<tr>
<td>Product Return Rate</td>
<td>Purchasing-Production</td>
</tr>
<tr>
<td>Product Damage Rate</td>
<td>Production</td>
</tr>
</tbody>
</table>
5. Adapting Immediate Changes- Dynamic Supply Chain

Proposed performance metrics- KPIs presented in this paper are the milestones of dynamic supply chain concepts. Nowadays, change and agility are inevitable in the industry. Companies with high flexibility and are open to innovative mindsets advance in the competitive market. Monitoring supply chain operations diligently helps the companies assessing critical situations and adapt to the immediate changes that are needed in the process. Especially, the latest urge for the change in the supply chain due to the pandemic caused by Covid-19 is becoming imperative for the companies and put a big spotlight on their operations to be more effective. Companies such as Home Depot, Target, Walmart, Kohl’s, Best Buy, Bed Bath & Beyond, and Dick’s Sporting Goods have initiated curve-side pickup operations to meet their customer demand. According to Adobe analytics result that is reported on CNBC news, numbers of online orders placed by customers to pick up at stores went up 208% between April 1st, 2020, and April 20th, 2020, compared to last year's sales. (Lauran, 2020). The curbside pickup concept helps most of the big players in the supply chain and retail business to reach out to their customers in a short period with low prices by eliminating shipping costs. In addition, the idea helped prevent thousands of customers exposed to the Covid-19 virus. Consequently, factors like having a diverse supplier portfolio, keeping safety stock, taking advantage of innovation, effective collaboration between business units, and being flexible become game-changer subject matters in the decision-making process. So that, using innovative tools, and techniques, as well as monitoring performance metrics, are becoming the center of interest to increase the effectiveness of these factors.
On the other hand, the next biggest challenge would be the distribution of the supply chain due to the pandemic. Customer demand for low-cost products continues to grow. Strategically assessed centralized warehouses, distribution centers, and storage spaces aim to meet this demand. Plan, source, and delivery elements of the supply chain management get the majority of the impact through these uncertain times. The biggest logistics and transportation companies such as FedEx, UPS, and DHL are preparing their operations accordingly. Recently, Covid-19 vaccine distribution has become the hottest subject for these organizations and challenge their existing shipping strategies to ship vaccines safely wherever needed in the world. Such as cold chain distribution, packaging utilization, inventory management, traceability, and technology integration are the major subject of these distributions. In this regard, UPS has started to build centralized warehouses in Louisville, Kentucky, and Venlo, the Netherlands for their cold chain distribution. In addition, FedEx has already added 10 and DHL has 8 cold chain facilities to meet the need of the covid-19 vaccine distribution. The U.S. Department of Health & Human Services Secretary Alex Azar said, "As part of Operation Warp Speed, we have been laying the groundwork for months to distribute and administer a safe and effective COVID-19 vaccine as soon as it meets FDA's gold standard." He mentioned also, "This in-depth, round-the-clock planning work with our state and local partners and trusted community organizations, especially through CDC, ensure that Americans can receive a safe and effective vaccine in record time." (HHS, 2020). According to his brief, supply chain constraints such as Time, Cost, and Quality take essential place for the distribution of the Covid-19 vaccine. Consequently, companies such as FedEx, UPS, and DHL who signed distribution contracts with the government must monitor their operations with essential key performance metrics and communicate outcomes accordingly to conduct effective vaccine distribution.

6. Conclusions

This paper represented essential measurable supply chain operational metrics, which are considered as key milestones to support performance excellence. Measurable metrics are reviewed in terms of time, cost, and quality for each global supply chain key components/processes; plan, source, make, deliver and return.

Clearly identified performance metrics contribute to the organization's strategic goals by synchronizing business units and departments together within the supply chain organization. Sharing essential and accurate KPIs eliminates miscommunication between business units, increases visibility and accessibility of the information, and eliminates the gaps between operations in the supply chain. It provides instant feedback for the current situation of the existing operations and helps the team to identify potential problems before they cause a larger negative impact in terms of time, cost, and quality for the company. The collaboration of time, cost, and quality metrics are considered to improve operational efficiency and risk/return ratio. From a practical perspective, proposed performance metrics are assigned to the related business units/department to keep them responsible and accountable for their performance. Weaknesses and strengths in the operation's output provide a simplistic approach to make business decisions.

Overall, supply chain metrics are crucially important tools and need to be monitored
against the organization's strategic goal as well as industry needs between business units and team members to support performance excellence. Successful controlled supply chain operations provide positive metrics, KPIs, and organization with the right item in the right quantity at the right time at the right place for the right price in the right condition to the right customer.

7. References


