

Performance Indicators and their Role in Supply Chain Performance Measurement (SCPM) for Manufacturing & OEM Companies.

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Abstract

Supply Chain is a core of all manufacturing businesses today and therefore, companies are focusing on their supply chains deeply to enhance the efficiency & effectiveness by reducing tangible (physical) and intangible (process) wastes and innovating process & procedures. It is very important to record and monitor the current and future states of supply chains so that improvements could be quantified. To measure the performance in any field, there are certain parameters & indicators and hence supply chain is not the exception, and therefore, supply chains also have many such parameters & indicators which are normally known as “performance indicators”. It is unfortunate that many manufacturing and original equipment manufacturers (OEMs) companies are struggling to optimize their supply chains and bring down the costs & to improve the bottom-line. The objective of the review was to identify and explain key performance indicators which could help to measure the health of the supply chains and to optimize the overall value to the organization. The research found that performance indicators are much more effective and hence, the research recommend that the key performance indicators must be adopted, monitored and measured regularly according to need of the particular organization. In case, performance indicators are lagging behind then, the corrective measures to be taken immediately to recover and control the desired performance of the supply chain.

KEYWORDS: KPI, SCM, Performance Indicator, Supply Chain Performance (SCP), Manufacturing, Optimize, Supply Chain Health, Supply Chain Performance Measurement (SCPM)

LIMITATION: The main limitation of the paper is the absence of empirical data and the dependency on the literature available on open sources.

PAPER TYPE: Review Paper

Introduction

In the era of competition and fluctuating business conditions in the twenty first century, the manufacturing and original equipment manufacturers (OEMs) are facing various issues in their supply chains for example Indian automobile companies has to shift of BSI-IV engines to BSI-VI engines, demand crisis, economic slowdown and at the same time, consumer's expectations are increasing. These things have put in a lot of pressure on automobile OEMs to cater the fast and changing needs of the consumers at competitive price. In the automobile industry, normally vehicles are designed & build to keep in

mind the global demand as well to avoid creating a brand-new setup for global demand and hence its supply chains have become more complex. The recent economic slowdown in India has put pressure on manufacturing and OEM's top leadership to make right decisions about their supply chains for improved performance. During the literature review, it was found that adopting, measuring and monitoring the KPIs improves performance of the supply chain and hence accuracy, visibility, reliability, productivity, efficiency which ultimately improves the profitability. The purpose of the review was to recognize and explain key performance indicators which could help to measure the health of the supply chains and to optimize the overall value to the organization. This study found that the companies which have adopted a mechanism of monitoring performance indicators periodically and regularly have better performance than others.

Literature Review

Supply Chain Management

It is well known that supply chain management has evolved as a new dimension in the field of management. Supply chain management (SCM) is "the systematic, premeditated synchronization of the traditional commercial meanings and the tactics across these commercial meanings within a specific firm and across businesses within the supply chain network, with the objective to improve the continuing performance of the individual firms and across the supply chain network". SCM could also define as "DPECM activities (design activity, plan activity, execute activity, control activity, and monitor the activity) of the supply chains for the purpose of generating net value, construction of a competitive infrastructure, leveraging worldwide logistics, harmonizing the supply with demand and assessing the performance globally." The goal of SCM is to achieve greater profitability by adding value and creating efficiencies, thereby increasing customer satisfaction" (Stock & Boyer, 2009) and (Chopra & Meindl, 2010). An effective SCM needs several decisions connecting to the flow of information, product, and funds. Inside an organization, supply chain actions fit to the three command processes which are known as customer relationship management (CRM), internal supply chain management (ISCM), and supplier relationship management (SRM). Integration among the three macro processes is crucial for successful supply chain management us (Chopra Sunil, 2016). Aggressive rivalry, shifting market request and growing consumer necessities has led to consumer becoming extra demanding with augmented preferences (Zhang & Chen, 2006). SCM handles the outflow and inflow of materials, services and information among the producers, manufacturers and the consumers with maintaining a good relationships (Christopher, 2005) and (Samaranayake, 2005). Today, companies do not want to

leak any kind of waste and hence very much careful in innovating the processes and SOPs. SCM has a vital role in optimizing the performance of the automotive industry and OEMs. "Researchers and firms like (Gunasekaran & Negi, 2004); (Hugo, Badenhorst-Weiss, & Van Bilion, 2004)(IBM, 2009) have recognized the role of supply chain as foundation of competitive advantage to the automobile industry and OEMs". The industry has undergone significant structural and other changes in the past 10 years. The last two decades has seen that the SCM practices developed leaner in order to eradicating inefficiencies. Concepts such as just-in-time, VMI, outsourcing, 3PL/4PL, international networks, decrease of buffers in raw materials, time & capacity, and discount in the store facilities & warehouses have controlled disciplines including SCM (Sahay, Gupta, & Mohan, 2006). Today, SCM is an integral part of commerce to improve the customer satisfaction and ultimately the firm's success. Efficient & effective supply chain management ensures that the right data is in place, for right forecast, at right resources, to produce right product, in the right quantity, in the right condition, are delivered to the right place, at the right time, and the right cost. In SCM, these rights could be termed as nine rights (9Rs) (Singh Jagdeep, 2019). Now days, mostly automobile firms have become part of at least few or many supply chains and these firms should perform likewise to attain higher performance. A typical supply chain consists of supplier's supplier, supplier, manufacture, wholesaler, retailer and end consumer. The manufacturing supply chain elasticities from the producers of raw materials through the assembly of sophisticated electronic and computing technologies (Tang & Qian, 2008). Supply chain strategy formation has three foundational key principles which encounter the customer needs (Taylor, 2004); (Hines, 2006); (Fawcett, Ellram, & Ogden, 2007); (Chopra & Meindl, 2010) and these principles include the degree of uncertainty and understanding the customer, knowing the supply chain capabilities, and assessing the choices and selecting the design. (Fisher, 1997) established an outline to support managers, comprehend the nature of their product and recognized the supply chain that can best suit & satisfy the originated demand (Jacobs, Chase, & Aquilano, 2009).

Performance Measurement basis of Supply Chain Management

The performance must be measured to optimize the results and hence many researchers have worked in this area. "Measuring the performance could be illustrated as a deed of assessing an efficiency and effectiveness of the machine, man or a process etc. (Gunasekaran & Kobu, 2007) (Kazemkhan & Ahadi, January 7-9, 2014) to gauge the performance of the supply chain, the SCPM needs to be accomplished, seeing the existence of various stakeholders

or partners in the SCM network (De Sousa, Camparotti, Esposto, & Guerrini, 2014) (Kusrini, Subagyo, & Masruroh, 2016) (Kazemkhan & Ahadi, January 7-9, 2014). The SCPM empowers the stakeholders of the supply chain to succeed advantageously and uninterruptedly to attain its goals (Agami, Saleh, & Rasmy, 2012). The performance measurement of any supply chain is normally decided by the company's business goals and their respective service levels etc., it could also be judged based on individual company's strategy, the level of control, and various communications which helps to improve supply chain performance operationally. There are many challenges faced by the company's during the negotiations with service providers, suppliers, technology providers, and any other capital goods or resource providers, while creating & adopting the key KPIs but the few key performance indicators must be placed at all levels so that to monitor, judge and control the smooth supply chain functions & operations and also to communicate to the respective stakeholders where they are lagging behind. Information sharing in manufacturing business is vital and in case of lack of information sharing, it may lead to serious issues like bullwhip effect and that causes to a lose-lose situation for all supply chain partners. (Demirkan & Cheng, 2008) scrutinized the performance of the supply chain under several directions and the approaches concerning information& risk sharing. (Cheng, 2011) have illustrated the aspects of SCM performance and Information sharing & risk sharing while (Sepehri, 2011) has thrown light on order lead time and its impact on Inventory turnover ratio.

Performance Indicators and Related Theories

(Parmenter, 2019), defined four types of performance indicators as KRIs, RIs, PIs and KPIs. The theory has explained the RIs and PIs as “the result indicators (RIs) replicates that many measures are a sum of greater than one team's input and these measures are important and useful in observing the combined teamwork but it is hard to indicate which team was responsible for non-performance and performance” whereas “the performance indicators (PIs) are the measures which could be tied-up with particular team or cluster etc. for common goals. Performance and non-performance will be the responsibility of one team which provides clarity and ownership”. (Parmenter, 2019) again explained the four performance indicators in details as below:

1. Key result indicators (KRIs) provides a summary that how the company (firm) was performing.
2. Result indicators (RIs) advise the leadership that how various teams are uniting to yield desired outcomes or results.
3. Performance indicators (PIs) advise the leadership which teams are delivering the desired results.

4. Key performance indicators (KPIs) advise the leadership that how the company (firm) was performing twenty-four by seven, Half-yearly, quarterly, monthly, fortnightly, weekly or daily in their respective accomplishments. Point to be noted that the leadership is able to increase performance considerably by taking right actions.

(KPI.ORG, n.d.) defined the “Key Performance Indicators (KPIs) are the critical indicators of improvement towards a proposed result. KPIs emphasis for the strategic and operational improvements, create an analytical basis for decision making and help focus attention on what matters most”. KPIs could be used for setting up the targets (the desired level of performance) and tracking progress against that target, to improve leading indicators that will later drive lagging benefits. Leading indicators are predecessors of future success whereas lagging indicators show how successful the organization was at achieving results in the past. How to judge the good KPIs? The good KPIs provide evidence of progress towards a targeted result, compares the performance, measure what is intended to be measures for better decision, make balance between leading and lagging indicators, and the good KPIs could also help to track accuracy, quality, efficiency, effectiveness, timelines, compliance, behaviors, machine, people or process performance or resource utilization. (Tutorials point, 2020) supply chain performance (SCP) measure could be demarcated as a method to judge the performance of supply chain system. SCP measures may be divided into two classes as qualitative measures (Example: customer satisfaction and product quality and quantitative measures (Example: order-to-delivery lead time, supply chain response time, flexibility, resource utilization, delivery performance. Quantitative measures could be further classified as financial and non-financial measures. Now, let's understand both of them in details.

In SCPM, financial measures are defined as “the measures taken for gauging different fixed and operational costs related to supply chain. The eventual aim of any supply chain performance measurement (SCPM) was to maximize the profit by maintaining or reducing various supply chain related costs. The metrics of non-financial measures consists of Flexibility, quality, customer service level, cycle time (Order to delivery lead time, supply chain lead time), inventory level, personnel utilization, and more.

A Framework of Scpm

From the literature reviews and theories, supply chain performance measurement (SCPM) framework was developed as shown in Figure-1 below. It helps to decide which KPI is good or useful for their organization as per their requirements. This framework also helps to create KPIs and measure the KPIs for supply chain performance measurement. The framework has shown two indicators namely result indicators and performance indicators which

impacts SCPM and Supply Chain Performance Measurement has classified into two categories namely qualitative measurement and quantitative measurement. The quantitative measurement further classified into two metrics namely financial measurement metrics and non-financial measurement metrics. Examples of KPIs are already given in the framework itself however for more clarity, few of them are quoted here as Inventory Turnover, Inventory Accuracy, Order to Delivery Lead Time, On-Time Delivery, Order Fill Rate, Back order, Cash to Cash Cycle Time and more.

We also need to understand few common metrics which are very much useful in almost all kind of supply chains which are efficiency, accuracy, reliability, flexibility and visibility. These are explained as below:

Efficiency of any system, machine is calculated based on its utilized capacity (output) divided by maximum capacity (Input). Example: A machine has a capacity to manufacture 100 items in a given period of time and it currently manufacture 80 items in the specified time, then the efficiency of the machine would be $\{(80/100)*100\}$, which comes out to be 80%. Practically, it is always difficult to get 100% efficiency due to various factors however it could be

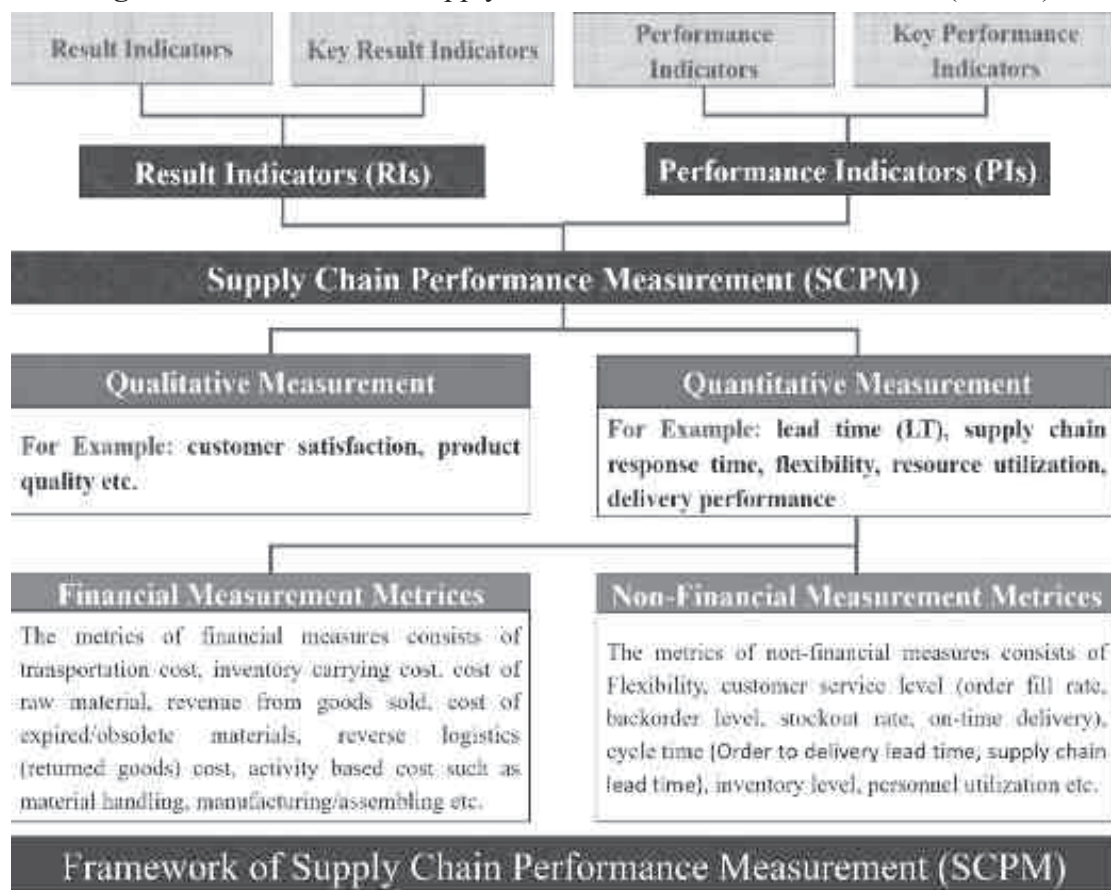
optimized always.

Accuracy: It could be defined as the degree to which the result of a measurement, calculation, or specification adapts to the correct value or a standard. The examples are forecast accuracy, order fulfillment accuracy, Inventory accuracy - System vs. physical, Documentation accuracy, Information accuracy, any other accuracies etc.). Understand with an example as “Order Accuracy Percentage = (Desired Orders Delivered to the Customer in a Given Period / Total Number of Orders Made in a Given Period)*100”

Reliability: It could be stated as “the mark to which the supply chain produces consistent performance”. Increasing supply chain reliability will result in reducing inventory levels and preparing for demand to meet customer's requirements.

Visibility: It could be defined as the capability of tracking the goods/parts/components or products in transit or in the warehouse/store in real time. The aim of supply chain visibility is to improve and strengthen the supply chains by making data readily available to all stakeholders/business partners, including customers.

Figure-1: Framework of Supply Chain Performance Measurement (SCPM)



Some KPIs and their formulae are provided here for understanding purposes.

Inventory Turnover Ratio = Cost of Goods Sold / Average Inventory value, where average inventory is calculated as $\{(\text{opening inventory in value} + \text{closing inventory value})/2\}$

Order Fill Rate (%) = (Total Number of Orders Shipped (Fulfilled) from Initial Order / Total Number of Orders Received) * 100

Cash to Cash Cycle Time (CTCCT) = (Inventory Days of Supply + Days of Sales Outstanding) - Average Payment Period for Material

How to Optimize Supply Chain Performance?

Some ideas are provided to enhance or optimize the supply chain performance. Once manufacturing and OEMs implement these ideas, it will definitely help to enhance the supply chain performance.

Localize the sourcing/procurement of the parts, raw material or work-in-progress inventory, collaborate with suppliers and share future plans so that they could support timely.

Use of ICT: automate as much process & procedures as possible, physical documentation must be eradicated wherever possible. Use hand held mobile devices for inventory mgmt.

Reduce inventory through VMI, develop new suppliers nearby etc. and inventory control – It will reduce handling cost, obsolete cost, carrying cost, investment cost, space cost etc.

Outsource non-core activities and focus on core areas of business (products)

Reduce operational costs and other energy cost by automation

Logistics Optimization: It includes warehouse optimization (Resources, space and operational costs etc.), Transport/Distribution Optimization, Inventory Optimization

Improve manufacturing quality and reduce wastes (tangible-material, intangible-process)

CONCLUSION

During the literature review, it was found that adopting, measuring and monitoring the important performance indicators improves supply chain performance and hence its efficiency, accuracy, visibility, reliability and productivity. The aim to gauge performance of the supply chain is to improve supply chain's operational effectiveness

& ultimately the operational performance. The study has given few supply chain metrics and KPIs & related formulae for understanding purposes. KPIs can be created by the firms their own based on their needs however KPIs are must to measure the supply chain performance. The objective of the study was achieved by literature reviews, understanding on the performance measurement in SCM, examples of performance indicators & related theories, framework of supply chain performance measurement and its explanation and finally provided some ideas to optimize supply chain performance. There is no doubt that the KPIs help to measure the health of the supply chains and to optimize the overall value to the organization. This study found that the companies which have adopted a mechanism of monitoring performance indicators periodically and regularly have better performance than others. Hence, the study concludes and recommended that the required performance indicators must be implemented in the manufacturing and OEM companies to monitor, control and ultimately optimize the supply chain performance.

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