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SIX SIGMA IN SUPPLY CHAIN MANAGEMENT: EVALUATION AND MEASUREMENT APPROACH FOR GROWTH IN INDUSTRY

Praveen*, Dilip Kumar, Rahul Agrawal

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Abstract

This research paper is based on the effectiveness of Six Sigma project management tool implication and evaluating its effectiveness on the organizational supply chain. This research paper has also evaluated the impacts of implementing this project management tool in saving crucial time in the organizational supply chain. In this context, the Six Sigma technique gives businesses the ability to assess their current SCM procedures and direct them toward development. The core principles of Six Sigma are variation reduction, defect measurement, and quality improvement of goods, procedures, and activities. As it guarantees the delivery of the best suitable product, now at right moment, in the right location, and at the lowest expense to the customer, SCM built upon that Six Sigma methodology successfully controls common disturbance concerns in the production process. To quantify and determine the impact of Six Sigma on SCM, this study proposes a comprehensive model, a commercial benefit guideline, and a monetary pyramid.

Keyword: *Automotive, Lean Six Sigma, Cost Reduction, improve efficiency, Customer satisfaction, Removing project constraint, Track record, Distribution network.*

Mechanical Engineering Department, Sanskriti University, Mathura, (U.P.) India

*pchugh1986@gmail.com

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Introduction

This Six Sigma-based project management method is widely used global business sector. As every business follows its different strategies in business activities, therefore, the strategy of applying Six Sigma in their business process. Apart from project management, this Six Sigma tool is also used in the organizational supply chain management process. At the time of following Six Sigma project management methodology, the organization is required to engage quality control officers in supply chain management for justifying the quality of supply chain management. A rational, methodical, and procedure method is Six Sigma, which aims to continuously improve processes. In order to boost its competitiveness versus Japanese firms, Nokia created this program management approach in 1986 for its high-volume production scenario. Six Sigma is a well-organized knowledge management strategy that emphasizes minimizing variance, assessing flaws, and enhancing the calibre of goods, procedures, and services. This is a highly controlled procedure that aids businesses in determining how effective a process is executing and concentrating on creating and supplying almost flawless goods and services.

Literature Review

Importance of Six Sigma in Supply chain management

As it ought to be, distribution network efficiency is an ongoing problem. As per the current scenario, Automotive organizations are required to be intended in implementing effective and new supply chain strategies [1]. Lean Six Sigma, which combines the attention to eliminating waste and simplification afforded by Lean principles with the error avoidance objective of Six Sigma, offers a good foundation for this undertaking. Organizations all over the globe have adopted the Lean Six Sigma technique in a variety of ways to enhance supply chain management.

Decreasing the waste

One of the main goals of the Lean approach is to decrease the 8 possible wastes (imperfection, excess supply, waiting, underutilization of skills, transit, storage, mobility, and unnecessary operations) that can negatively impact a supply chain. The method distribution network analysts use to identify wasted activity that isn't essential to the operation is increasingly crucial [2]. This differentiation is formed for lean firms based on one factor: value to the consumer.

Figure 1: Six sigma rule for waste control

(Source:[22])

A leaner firm uses fewer assets as efficiently as possible to bring an item to market in order to produce the highest quality product at a lower cost. Trash is any part of the procedure that does not deliberately and immediately advance that objective. These inefficient components may be found using the Six Sigma DMAIC/DMADV technique in conjunction with the Lean methodology, maintaining costs low for the company and the client [3].

Prevention of defects

This Six Sigma approach was first created to tackle production flaws and reduce them to levels that could be tolerated. Any management of supply chains may benefit greatly from Six Sigma analyses' in-depth understanding of quality control procedures [4]. Additionally, process improvement has a part to play here. Any lengthy, laborious, or complicated procedure increases the potential for error and presents additional chances for either technological or human mistakes. The Lean technique and Six Sigma analytics may be used to optimize and simplify operations. Because there are fewer flaws, manufacturing standards are preserved and there is less waste from defective parts.

S. No.	Performance measure related questions	Factor loading value	Variance %	Cronbach value α
Leadership			91.04%	0.951
1	Insure Top Management commitment	0.952		
2	Insure LSS training and resource	0.934		
3	Review and support regularly	0.959		
Structured improvement procedure			89.74%	0.943
1	Use of Value stream map	0.934		
2	Application of Six Sigma DMAIC approach adaptation	0.930		
3	Process analysis through control chart	0.967		
Quality information and analysis			81.87%	0.889
1	Through waste elimination	0.944		
2	Through defect reduction	0.784		
3	Identification of variation in process	0.935		
Supplier relationship			90.85%	0.949
1	Don't change supplier on regularly	0.954		
2	Maintain true integration between supplier and industry	0.929		
3	Use Project charter to maintain the relationship	0.958		
Customer oriented			85.66%	0.916
1	Manage on-time delivery system	0.926		
2	Adopt just in time system in the production process	0.894		
3	Eliminate the chance of returning product or service	0.927		
Focus in LSS metrics			83.53%	0.898
1	Improvement on Overall Equipment Effectiveness	0.963		
2	Improvement on First Time Yield	0.929		
3	Reduction in cycle time	0.838		

Figure 2: Effectiveness of Six Sigma in the automotive industry value-adding process

(Source: [4])

Improving the performance

The methodologies of Lean and Six Sigma together are ideally suited for supply chain optimization. These ideologies work together just to concentrate on two essential components of production, effectiveness and quality. The DMAIC/DMADV strategy provides several opportunities to improve procedures, address issues, and save waste in the Automotive industry [4]. Distribution network executives can make certain that almost all the processes of their automotive production activities are customer-focused and defect-free by using the Lean Six Sigma methodology. Businesses may link all of their operational efficiencies to the objective of providing their clients with distinctiveness by identifying their client base and demands early on in the DMAIC/DMADV process [5]. The overall purpose of the organization, which is to ensure that clients are satisfied with their purchases, helps keep everyone motivated.

Key elements of Six Sigma

• **Define**
• **Measure**
• **Analyze**
• **Improve**
• **Control**

Table 1: Phases of Six Sigma

Application of Six Sigma in organizational supply chain management

Supply chain risk management

It's possible that Quality Management that concentrates on using that, advancements, and capacities are insufficient to lower risks. To lower supply chain risks in unpredictable circumstances, businesses must concentrate on external factors and procurement adaptability. Monitoring, regulating, and reducing internal and external hazards by building a more robust distribution network is the key to being profitable in business today [6]. Many of those in charge of managing current

supply chains are unaware of how much more vulnerable they are. Risk management by organizations, which are aware of the risks that are taken, is often effective. Organizations do not realize the dangers they are incurring, which are fast growing in quantity and severity as a result of changes. Risk has been defined by ISO 31000 as the impact of unpredictability on goals, whether this produces a good or unfavourable outcome [7]. Risk is typically defined as a circumstance with the potential to have negative effects and a specific degree of chance that it will do so. The size of the harmful impact and the corresponding incidence rate is its primary dimensions. Recognition, evaluation, and prioritizing of risks are elements of automotive risk management [8]. Then, resources are applied strategically and economically to reduce, monitor, and manage the likelihood and/or effect of occurrences. Risks frequently start at the point when the supply chain stakeholders and the response company meet, where issues including collaborative trust, cultural misalignment, and insufficient benefit communications are present [9]. Because of the inherent knowledge asymmetries that exist when working beyond business divisions and company borders, risk can develop in supply management at all levels.

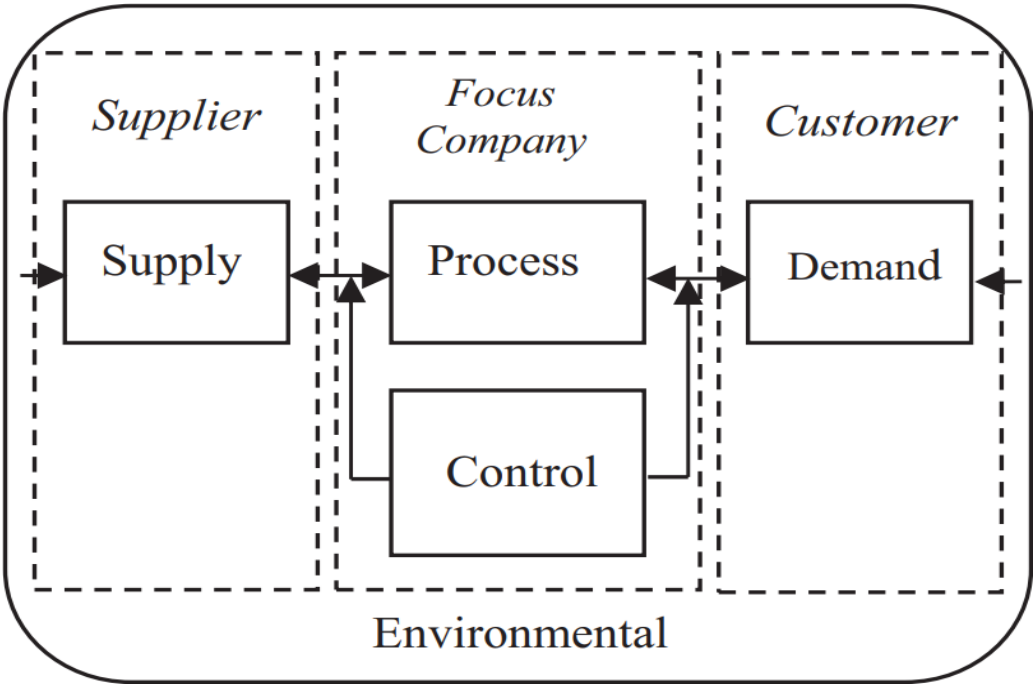

Figure 3: Main sources of supply chain risk

(Source: [6])

Each element that is unable to forecast with precision and due to which interruptions may occur is a component of inventory costs [6]. A commonly used model states that there exist three different forms of risk, which may be further split into five different supplier performance source groups. Product hazards and key to effectiveness are inside the company, whereas both supply and demand risks are outside the company yet intrinsic to the distribution networks. Environmental issues, as seen in Figure 3, are the source of the ultimate risk for the networks.

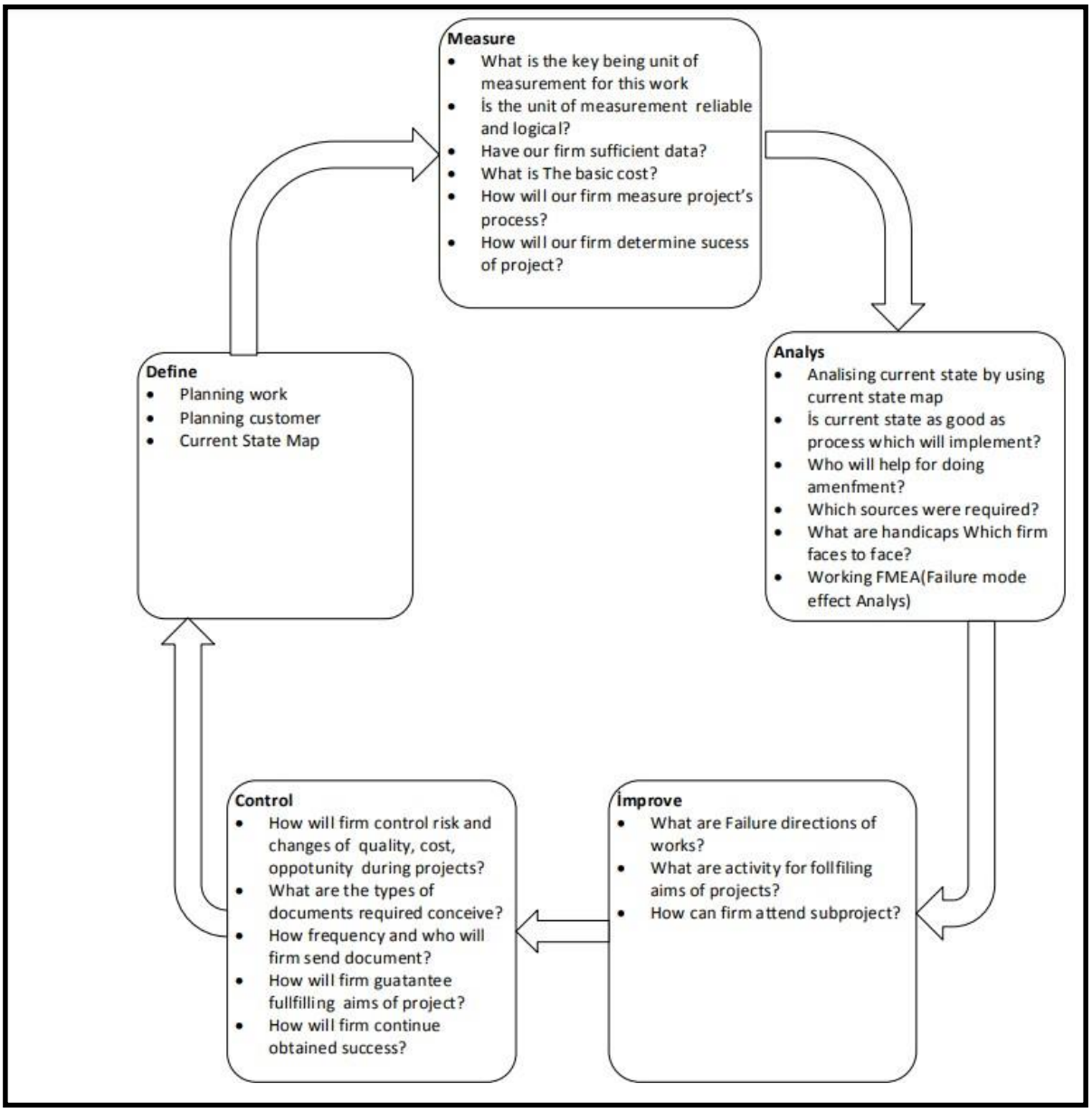

Figure 4: Factors to be considered at the time of implementing Six Sigma in supply chain management process

(Source: [10])

Supply chain is an integrated method that makes sure to provide the most suitable item to the customer at the right moment, in the correct location, across the supply chain, for the least amount of money, and while preserving the right flow of materials, natural resources, and output [10]. In logistics, the six-sigma technique is crucial for defining flaws, determining the best times to implement changes, and identifying pertinent suppliers. A production chain, which is a collection of suppliers, workshops, storage, distribution facilities, and shops via which natural resources are purchased, converted, manufactured, and supplied to clients, connects businesses to upwards parties like vendors and downward partners like customers. The movement of merchandise from raw materials to finished items supplied to the final customer is represented by the chain of activities. Therefore, the supply chain includes everyone related to meeting a client request, whether they are doing it explicitly or implicitly [11]. As a result,

supply chain encompasses all operations involving the transformation of commodities from raw materials through the point of delivery to the end consumer, as well as unified and coordinated management. Given the variety of parties and activities that make up a normal supply chain, businesses must properly manage the chain to profit from it.

Figure 5: Implementation of Lean Six Sigma in automotive manufacturing

(Source: Self-developed)

A supplier chain's operations should all be reclassified as critical steps. Due to the fact that both Six Sigma and SCM have received widespread recognition as "process techniques," they are now being integrated. Six Sigma measures have a good track record of performance appraisal across a wide range of processes and activities [12]. It is thought that various variation sources, such as market swings, supply deliveries, quality and quantity and equipment and staff discrepancies, need to be regulated or addressed in order to improve Service quality. Using Six Sigma technique, it has been previously researched how quality management may be used in SCM to improve the efficiency of numerous issues throughout the whole supply chain system. Very frequently, when SCM project managers move on to other projects, earlier accomplishments in lean manufacturing become little more than "previous" triumphs rather than a foundation for sustainable continual improvement upon which to continue process [13]. An essential challenge in SCM in general and the production management system in specific is the connection between development and coordination by feedback. By its very nature, the Six Sigma technique would encourage more use of quantification. There was a wealth of quantifiable information regarding operational functions and operations, but it was rarely used to solve issues or make decisions. With the right use of numerical data, the quantitative power of Six Sigma may identify faults in SCM procedures and further improve the quality of SCM judgments. All these Six Sigma and SCM are practiced methodologies. In Six Sigma, organizational weaknesses and organizational variation are dealt with using a systematic method called Describing, Assessing, Comparing,

Developing and Integrating (DMAIC) [14]. The procedure emphasis in the distribution network is well recognized and offers unmistakably very substantial benefits in reducing waste levels and thereby improving the distribution network. With the aid of a Samsung case study, it has also been highlighted how important Six Sigma and SCM methodologies are for both quality and process development.

Research Method

Research method is about evaluating process of conducting entire research work considering the effectiveness of applied tools and techniques. Starting from finalizing data sources and making discussions after collecting data from those sources, all these parameters depend on the research method. As this research is based on a project management tool, Six Sigma. Therefore, this research includes a secondary research method for collecting information from wide range of information from already published journal articles. This research is based on secondary sources which include Google Scholar, ProQuest, BBC, Newspaper articles and a few more official websites of organizations [15]. In this research, proper transparency has been maintained while collecting essential information from authentic sources. Accessing guidelines were maintained in this research at the time of collecting valuable information from those sources.

Discussion

The Six Sigma technique has garnered a lot of attention as a means of minimizing variation. Contrary to many industrial processes, supply management procedures are frequently evaluated in terms of time (e.g., picking rates, on-time deliveries, etc.), rather than a specific physical size or quantities (e.g., picking accuracy, product tolerances, etc.) [16]. Capturing must be the main emphasis of supply chains in order to shorten lead times and boost pipeline effectiveness. Through the use of product generation, time constraints may be utilized to increase product availability and guarantee shorter order cycles. The organization's internal processes and supply chain operations must be coordinated. Six Sigma procedures improve lead-time dependability, minimize safety stock levels in the supply chain, and assist in squeezing out time volatility [17]. Additionally, by lowering the cycle inventory level, it is possible to shorten the production time for a variety of operations or processes, increasing overall business reactivity to client demands and enhancing economic health.

As a result, the use of Six Sigma in the value chain boosts productivity (in terms of cost savings) and performance (in terms of higher customer management). SCM is characterized as the improvement of operations along the whole value chain and the synchronization of resources to gain a competitive edge [18]. SCM is a paradigm that unifies all stakeholders throughout the value chain into a single, integrated system. It includes not just logistical tasks (such order fulfilment, stock management, shipping, and storing), as well as other work procedures. Through the interconnection and harmonization of diverse business operations in the pursuit of accomplishing strategic priorities, SCM offers value to a company [19]. To manage the activities and interactions between the many partners in supply chains, SCM employs a systematic and integrated approach. SCM places a strong emphasis on supply chain procedures. The quick goals of SCM are to facilitate growth, decrease storage, and shorten lead times, whilst the lengthy goals are to grow market position for businesses and have outside integration with the supply logistics network. The discipline of SCM has developed into a crucial strategic element or tool for businesses looking to boost productivity and maintain competitiveness. It is important to emphasize that Six Sigma has something unique to offer enterprises in comparison

to the contribution of current supply chain improvement strategies. Organizations may save expenses and improve customer service with the help of a Six Sigma-based SCM that is properly planned and implemented [20].

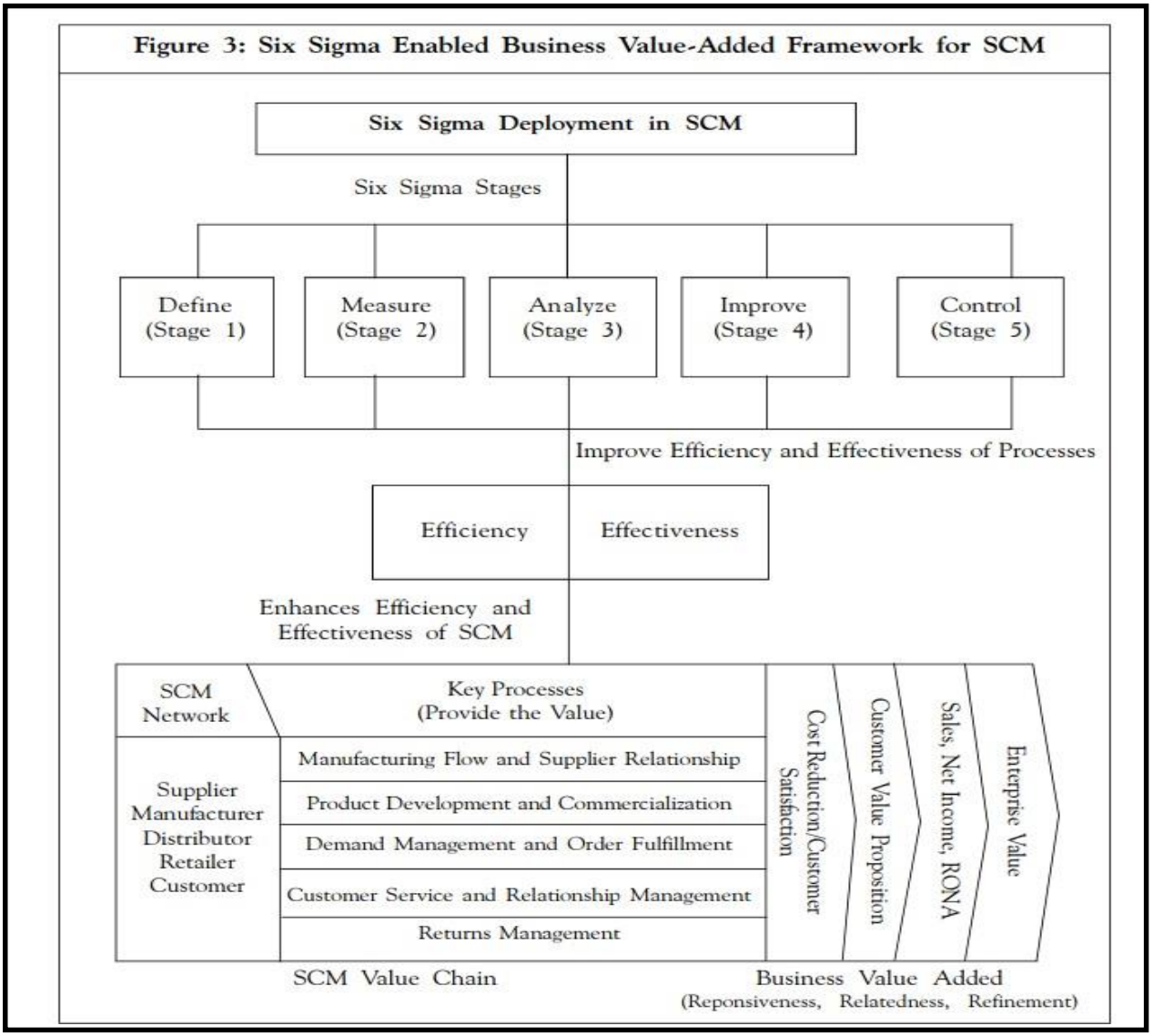

Figure 6: Effectiveness of Six Sigma for adding value to SCM

(Source: [21])

Conclusion

Six Sigma provides a way to develop supplier procedures that are more dependable, consistently generate quality results, and lower the risk of non - compliance. The goal of the information Six Sigma technique is to increase process capabilities and bring activities under greater management. Six Sigma would impose a more systematic approach to SCM initiatives and make sure they were systematically developed and carried out. Additionally, Six Sigma's analytical focus would direct quality initiatives toward identifying and addressing core causes rather than only treating the manifestations of SCM issues. A customer-centric approach to innovation is Six Sigma. The implementation of Six Sigma results in the concurrent reduction of expenses and enhanced services through the enhancement of the standard among all supply chain. Due to their complimentary nature, Six Sigma and SCM are both regarded as two cornerstones of corporate transformation.

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