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IMPACTS LEAN SIX SIGMA ON SUPPLY CHAIN PERFORMANCE IN MANUFACTURING INDUSTRY

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Abstract

Lean Six Sigma is an effective approach to reducing waste and defects in manufacturing projects that have been widely accepted by multiple manufacturing firms around the world. The absence of instruction and guidance for effective work completed has evolved into the main obstacle to the deployment of Six Sigma in small and medium-sized businesses (SMEs). This project management method only includes value-added steps in project progression for the betterment of operational efficiency in project performance. In this research, the beneficial outcome and effectiveness of using lean six sigma project management in the manufacturing industry considering its implementation techniques in this sector. Previous literature of this study has been evaluated for understanding the dynamic effectiveness of applying this technique in manufacturing projects.

Keywords – *Lean six sigma, SMEs, Project management, Value-added steps, Project performance*

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1. Introduction

The Six Sigma method has been applied in a wide range of industries in the world. The Six Sigma method has been used in the manufacturing industry for over 50 years because of its effectiveness. This Six Sigma method is also beneficial for the company because this project management tool effectively improves quality control and process improvement. This Six sigma project management tool is also helpful for the manufacturing industry in terms of developing business performance. The fact-based data-driven decision-making feature of this project management tool is also beneficial as it provides leadership in the management stage of the manufacturing project management process. The variation of the decision-making process is also effective in terms of using statistical tools and information for the betterment of the procurement process. This Six Sigma framework is a data-driven based framework that is used for maintaining the tasks as clarified by Project stakeholders. This Six Sigma project management tool is also beneficial for judging the performance of manufacturing operations in the manufacturing industry. Starting from data collection and analysing the essential data is also important at the time of training manufacturing employees considering the collected information.

2. Literature review

2.1 Factors behind implementing Six Sigma in manufacturing industry

This research has included crucial information regarding the important information regarding the effectiveness of Six Sigma in the manufacturing industry. The standard of excellence known as Six Sigma aims for near perfection and brilliance.

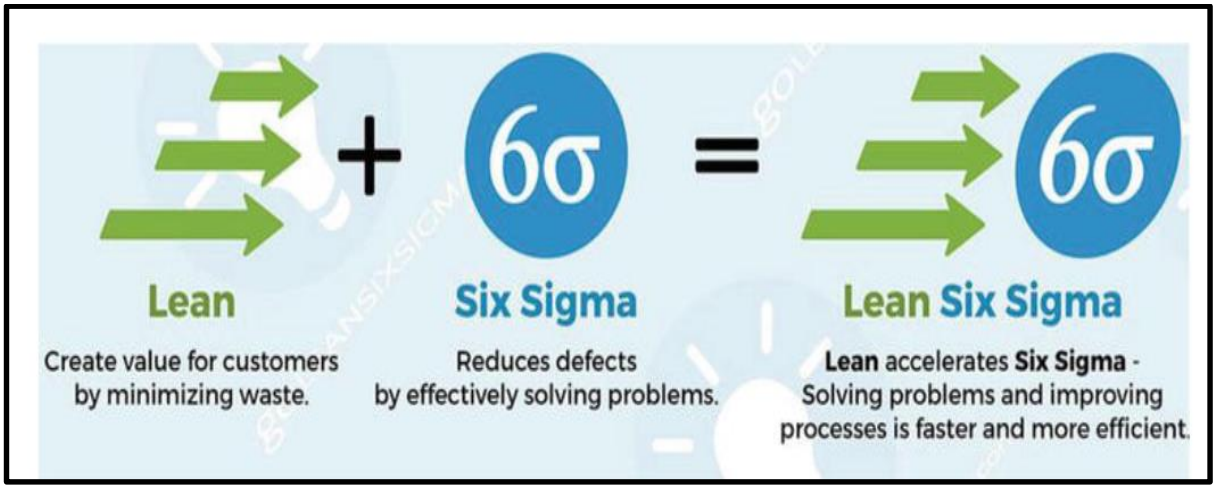

Figure 1: The concept of Lean six sigma in the context of industrial project management

(Source: Hari, 2020)

Above ***figure 1*** has outlined the essential factors behind implementation of Six Sigma in manufacturing project management. Therefore, everything that dissatisfies the buyer is referred to be a fault. The CEO and some other officials of higher leaders could provide overall alignment by deciding the strategic emphasis of both the Six Sigma programme inside this framework of the firm's philosophy and vision comprising executive leadership (Hariyani & Mishra, 2022). Leaders assume integrated accountability for Six Sigma adoption across the organisation. Champion-identified Master Black Belts serve as internal Six Sigma trainers. They give Six Sigma all of their attention. They mentor Black Belts and Green Belts in addition to helping Champions. The instance

organization opted to undertake several Six Sigma initiatives despite the fact that the staff's average educational level was not very high in order to lower operating costs, boost business results, and better compete in a more competitive market (Stankalla, Koval & Chromjakova, 2018).

A Six Sigma group was created to help with the project execution, which included setting up the necessary infrastructure, coming up with and choosing projects, reviewing the tollgates, and making judgments about rewards.

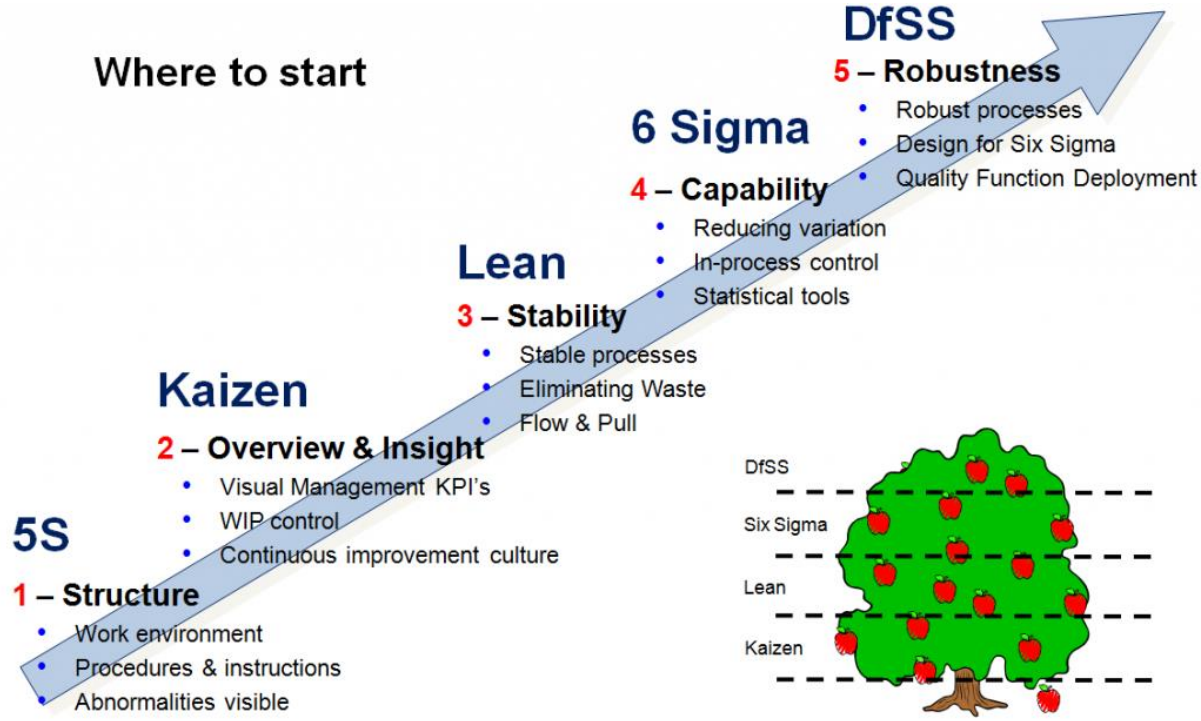

Figure 2: Manufacturing industries six-sigma process

(Source: Ali *et al.* 2020)

Numerous areas needed to be upgraded, thus the works were first thoroughly prioritised, and two were chosen during the initial year. Kaswan & Rathi (2020), stated that the responsibility for tracking the development and making certain of the success of each chosen project was then given to victors, who were often the heads of all the departments and auxiliary units. Every year, each champion was required to provide a list of potential projects for approval to the council along with a KPI (key performance indicator) for each department in the organisations where Six sigma project management method is applied.

2.2 Steps of applying Six Sigma in the manufacturing industry

When examining the problems with Six Sigma implementation in small and medium-sized businesses, it was discovered that a shortage of resource management and a lack of knowledge were the two biggest obstacles, however, the examines the characteristics also played a significant role in whether Six Sigma was successfully implemented (Gupta *et al*. 2018). As evidenced in the research, improvement in all processes and services can raise savings or boost an organization's bottom line. Businesses ought to begin skills training with each individual, but these programmes were too expensive for SMEs to afford (Singh & Rathi, 2018).

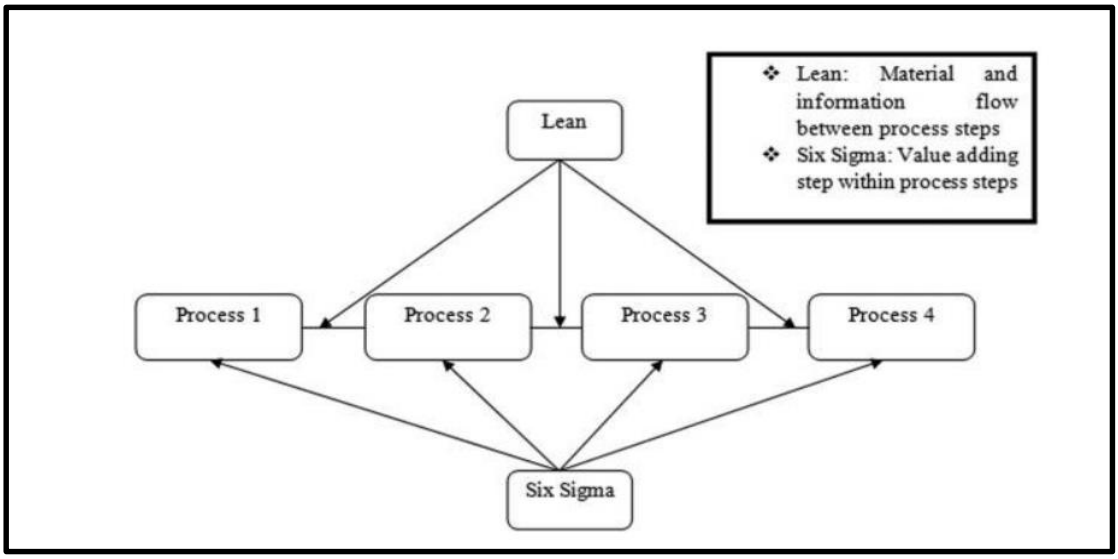

Figure 2: Implementing the concept of lean Six Sigma

(Source: Singh & Rathi, 2018)

According to a study of Six Sigma tools in manufacturing companies, the main obstacle to the adoption of Six Sigma in small and medium-sized companies is a lack of instruction and guidance for the proper completion of tasks. Businesses must begin training programmes for each contractor, but these programmes are too expensive for SMEs (Yadav, Seth & Desai, 2018). According to the survey, it is now quite simple for SMEs to obtain superior outside assets for help without incurring additional costs. According to a survey on the obstacles to Six Sigma adoption, SMEs are sceptical about the suitability of Six Sigma for them due to a lack of information, poor education, and certain false beliefs about just the methodology (Chiarini & Kumar, 2021). In addition to this, SMEs have some real technological, organisational, and budgetary constraints that serve as obstacles to Six Sigma.

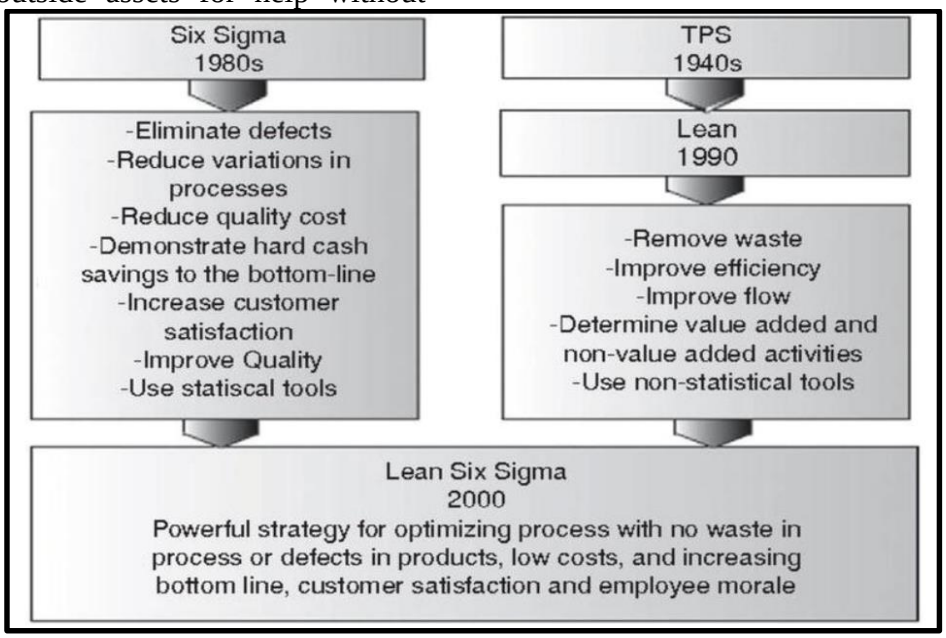

Figure 3: Evolution of Six Sigma in manufacturing project management

(Source: Hari, 2020)

Determine the clients' priorities for quality in Step 1 of Six Sigma implementation. The first features of an item are those that the buyer values the most when assessing product performance (Ahmed *et al*. 2018). These elements are mentioned in the Crucial to Quality attributes. Regularly, user surveys are done to update people's quality perceptions. A key method for gathering consumer input is the deployment of known value. At this stage, the project charter, process flowchart, and quality function deployment are the tools used. Step 2: Evaluate the processes and the defect in the final product that comes from them. For the main procedures that significantly affect the essential quality criteria, efficiency solutions are developed (Singh & Rathi, 2018). At this step, planning discussions, test, system flowcharts, and tools are used to measure or quantify the problem. Step 3: Analyze the process to pinpoint its most likely cause of errors. In order to identify and understand the fundamental causes of the errors, the technique is being meticulously reviewed. In this situation, the Ishikawa Diagram and other core implementing reforms can be used to identify the root cause of a major defect (Kaswan & Rathi, 2020). The most important and substantial flaw is given precedence after all probable vulnerabilities have been identified. The tools required used to diagnose the situation include the basic quality tools, such as histograms, Pareto charts, run charts, Control charts, scatter plots, regression analyses, fishbone diagrams, process map reviews and analyses, etc. Step 4: Improve the system' usability and eliminate the underlying reasons for the issues. For each of the key considerations, the definition restrictions are specified.

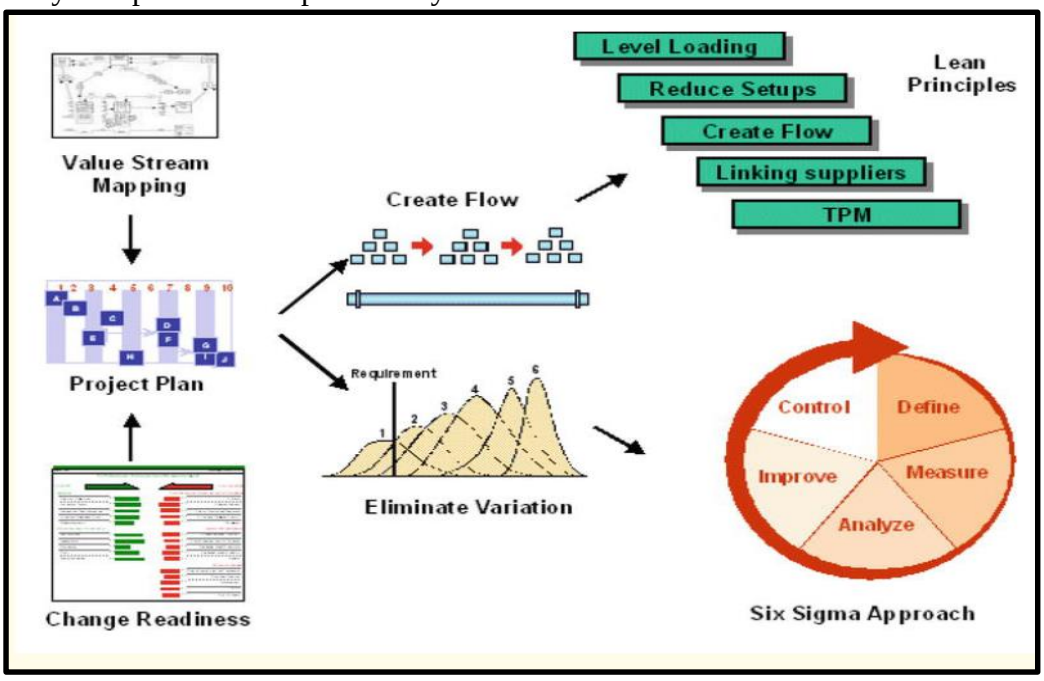

Figure 4: Integration approach of Lean Six Sigma in manufacturing

(Source: Hari, 2020)

A technique is established to assess the variations in the parameter. Processes modifications and upgrades are done to reduce variations and guarantee that the parameters fall within the predetermined range (Sodhi, 2020). During these stages, flowcharts are utilised to continuously track core support and variations. New tools used include creativity, mistake, a technique known, QFD/House of Quality, failure mode and effects analysis (FMEA), computer modelling, etc. Step 5: Use restraint to ensure that the gains are maintained over time.

Selection of Six Sigma tools and techniques is also one of the major elements behind ensuring the effectiveness of these project management tools in the manufacturing industry.

3. Research Methodology

Research methodology is an integral part of the research method that is crucial for conducting the research. Research method plays an important role in driving the research in a proper way towards the research aim and objectives. In this secondary research, an inductive research approach has been used by the researcher for the betterment of the observation pattern in this research (Walter & Ophir, 2019). This research approach has also been effective in this research for including observation theories throughout the progression of this research. Furthermore, this research approach has also been helpful in this research in terms of the development of an explanation considering the collected information. A series of hypotheses have also been included in this research considering all the research objectives in this research. Furthermore, this research approach has been focused on the elimination of all the disregarding data in this research. This inductive research approach has also been effective at the time of understanding the dynamics in this research. On the other hand, this research has also included an interpretivism research philosophy for interpreting the main element of this study (Alharahsheh & Pius, 2020). This interpretivism research philosophy is also effective in this research for integrating human interest into this research. This interpretivism research philosophy has been effective in this research for the development of social construction in this research. This research philosophy also considered and paid attention to the consciousness in this research and shared meaning as well. Another great benefit of this research methodology includes the engagement of qualitative analysis of the collected information in this research. This interpretivism research philosophy has played the role of the social actor in this research considering the research objectives (Ryan, 2018). In addition, this research has included a descriptive research design for describing all the collected information in this research. This descriptive research design has helped the researchers in describing the situation more completely throughout this research. This descriptive research design has also been effective in this research for describing different aspects of the phenomenon (Atmowardoyo, 2018). Apart from that collected data of this research has been constructed has been represented in thematic format for a better understanding of the research audience.

4. Result

A focused concentration on defining and analysing the monetary rewards of every project is one of Six Sigma's primary characteristics for industrial excellence. All of these aspects enable an organisation to precisely define the duties and functions of each team member in order to enhance the firm's production process. Making sure there are as few flaws in the industrial procedure as possible is the main objective of Six Sigma output. The eventual purpose of this system is the incidence of 3.4 defects per million probabilities (Sordan *et al*. 2020). This might appear to be an impossible endeavour, but by using this method to create high-quality products, the majority of manufacturing organisations succeed in achieving their end aim. Further, then the favourable outcomes that could be obtained, LM may statistically supervise a procedure, and 6 alone could significantly accelerate the production and lower invested capital. It is necessary to combine the two techniques. The two ideas work well together. This is where the L6 concept came into play, trying to strike a between both ideas in order to combine

their functions and add value to enterprises (Stankalla, Koval & Chromjakova, 2018). Having a clear awareness of and a priority on defining and monitoring the cash flows on a specific project is one of Six Sigma's key characteristics for progress in the industrial sector. All of these qualities will enable a company to clearly identify the duties and functions of each team member in order to enhance the firm's production methods.

As per this research, it has been determined that the aim of Six Sigma manufacturing is to precisely guarantee that there are extremely few defects during the manufacturing stages (Parmar & Desai, 2020). Even though it can appear impossible, most business organisations succeed in their end aim by using this method to make high-quality goods. Lean Six Sigma deployment can benefit from the use of Advanced Plan and Schedules (APS) Software. Modern manufacturing firms can enhance their operations through the reduction of bottlenecks and process optimization thanks to APS Software, a reducing technological solution (Park *et al*. 2020). APS is simple to implement into manufacturers that want to operate effectively and efficiently, reduce costs, and increase revenue. Additionally, APS is globally interoperable with different ERP, MRP, and MPS programmes. For firms who want to keep their edge over their competitors and advance throughout their sector, APS is crucial.

Due to consumer demands for a greater variety of products and quick delivery coupled with lower cost constraints, project scheduling and timetabling (APS) systems have become essential for modern production operations. An ERP/MRP software can be readily connected with APS to close any deficiencies in assigning reliability and adaptability (Battissacco & Espôsto, 2018). Advanced Planning and Scheduling (APS) allows for increased agility in revising constantly changing plans while saving organizers time. Researchers think it's crucial to carry out a thorough analysis of the industrial sector in order to comprehend every facet of Lean Six Sigma (Siregar *et al*. 2019). There is little work on "Lean Six Sigma in manufacture," and it claims that there is no conventional way to perform operations over such manufacturing tasks. A better comprehension of the Lean Six Sigma principles, followed by a complete, dependable devotion and focused implementation of the eight principles, can help the companies identify the main causes. Manufacture teams must concentrate on mastering the Lean manufacturing fundamentals, much like famed football coach Vince Lombardi, who had his team concentrate on mastering the fundamentals of football in order to be successful. These fundamentals necessitate proactive preparation and rigid adherence, which call for leadership above and beyond simply meeting daily responsibilities and obligations (Siregar *et al*. 2019). Some supervisors struggle to grasp the advantages of learning the fundamentals of production. Others are simply unable to make the time.

It is boring, much like when football players practise stopping and striking. To assume charge of production lines, manufacturing organisations need more than sophisticated systems. Organizations need to go over to consecutive output from the archaic storehouse system in order to deliver deliveries on time while maintaining strong profitability (Stankalla, Koval, & Chromjakova, 2018). Manufacturing leading companies have switched to continual assembly lines backed by genuine, visible adequate supply network progressive manufacturing in favour of the traditional shop order "launch and expedite" process. The idea that successive manufacturing is only effective in settings with high unit production rates is untrue.

5. Conclusion

In conclusion, combining Lean and Six Sigma, it is a potent systems integration technique. By eliminating "Waste" from a process and resolving issues brought on by a method, it lowers a company's expenditures. Lean Six Sigma (LSS) is a newly developed, incredibly potent methodology used to find and eliminate wastage while also enhancing productivity, effectiveness, and customer satisfaction in order to survive in a cutthroat production and nonmanufacturing market. This chapter's main goal was to examine each LSS use in manufacture. This methodical, thorough review strives to compile, arrange, and organise the body of information on Lean Six Sigma and the industry. In the industrial sector, the recognised lean six sigma processes and methods, techniques, theories, successful and unsuccessful factors, and tactics can be applied efficiently as a blueprint. In order to achieve perfection, the LSS has been deployed everywhere and in all kinds of manufacturing companies. They have succeeded in achieving their LSS goals. However, there are a number of difficulties and obstructions in the LSS installation. The most crucial things that every operator needs to be aware of are evaluations of lean six sigma capability and development phases. Lean six sigma principles are explored in detail in order to identify the main causes of problems.

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