

**A review on productivity improvement in manufacturing industry**

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**Abstract**

This study presents a novel analysis for the control of manufacturing flaws. This investigation focuses on the tube bending process. The chosen component was generally rejected due to defects in a cross section of the tube flatness. A strategy for increasing productivity is a method for increasing the production of brake shoes. The British Department of Commerce and Industry said in its definition: Six Sigma is: "Uses data retrieval methods to obtain comparable quality. Six Sigma analysis can focus on a production or service element, with ' special emphasis on design, production, and statistical analysis of customer activity". This article gives the details of various methods of productivity improvement in manufacturing industry.

**Keywords:** Six sigma, Manufacturing industry, Productivity improvement, Zero defects.

**Introduction**

In today’s competitive world, customers want perfection, and there is no room for error. Meet the needs of today’s customers, make them happy or take new ways to exceed their expectations. Six Sigma helps to achieve this goal. Six sigma is a highly stringent method that allows us to concentrate on embryonic items or deliver almost perfect services. Six sigma can help us decrease or accept the unpredictable nature of their operations. The core assumption of Six Sigma is that if you can quantify the "faults" in a process, you can figure out how to reduce them and get as close to "zero flaws" as feasible. The term "sigma" refers to the dispersion distribution of any process or technique's mean value (mean value). Six sigma is a strong force. Leading companies such as GE, Motorola, and Ford have achieved remarkable success and improved customer satisfaction by radically changing the way they work and improving the products and services they offer. These leading companies are so satisfied with six sigma that they are willing to invest \$ 10 billion in 6 sigma to get a multi-billion dollar response disability.

Defining a “Six Sigma” management system, Motorola University said: “A Six Sigma management system can improve the understanding of a company’s strategy and the indicators that best reflect the strategy's success. Provides a priority source of information for project planning that will improve measurement and use leaders to manage work to achieve quick, lasting, and improved results. "

How to approach Six Sigma requires the use of a model to drive practice to quality issues. The most widely used model is DMAIC (definition, measurement, analysis, optimization, and control), often referred to as a five-model. The model serves as a guideline for improvement projects and guides the team. Figure 1.1 shows the procedure,



Figure 1: Six Sigma Phases

DMAIC is a way to identify the root cause of quality problems and apply controls through data analysis and improve quality. Although the implementation of DMAIC aims to improve production and manufacturing, processes such as product design and chain management are still underway. This is a company optimization strategy used to increase profits to eliminate waste in the work process and increase the efficiency of all operations in line with customer needs and expectations. DMAIC is a customer-based program in which a team works together on projects aimed at improving customer satisfaction. This is a scientific way to improve all aspects of corporate and organizational processes.

### Related Research

**Mohammad Alnadi & Patrick McLaughlin et al. (2021)** conducted a literature review on published leadership and Lean Six Sigma literature. The preceding literature used a theme analysis to assist find significant traits and relate behaviour to specific elements. This study focuses on and investigates the role of leaders, since administration has been identified as one of the critical success factors for the implementation of Lean Six Sigma. As a result, the focus of this study was on the leadership traits that allow this to happen. The writers of this study conducted a thematic analysis of the published information. Communication; a culture of continuous improvement; training and employee development; vision formulation and alignment; team member motivation; employee empowerment; and leadership commitment and support were the seven key aspects that emerged. The related behaviours were explained in terms of how they may aid in the implementation of Lean Six Sigma [1].

**Alnadi and McLaughlin et al. (2020)** Leadership styles also contain certain behaviours that leaders should take care of to make Lean Six Sigma effective [2]

**Bertha Viviana Ruales Guzmán, Alessandro Brun, Oscar Fernando Castellanos Domínguez, et al. (2019)** This paper analysed the literature that studied the relationship between Quality Management and productivity as few studies have done before. Previous revisions to this one used a mainly narrative approach. In contrast, in this systematic review, a more rigorous, well-defined, and unbiased process was adopted, in which essential indicators for companies, such as productivity, were taken into account, providing exciting and valuable findings that will guide future research and that are

a helpful guide for researchers, practitioners, managers and policy makers. The main results are summarised in the following paragraphs [3].

**Nogueira et al. (2018)** specifically address leadership behaviours and styles that may impact the effective implementation of Lean Six Sigma. The authors studied the literature and determined the leadership behaviours that support Lean Six Sigma, as well as understanding how leadership behaviours aid the Lean Six Sigma process [4].

**Rajat Ajmera et al. (2017)** consider using the six sigma DMAIC method to reduce defect rates in selected textile industries. This is a systematic approach to minimize defects through five steps in the DMAIC method (definition, measurement, analysis, optimization, and control). Six different sigma devices were used in different phases. The Pareto research was designed to identify the major types of defects. Find the root cause of these defects by analyzing the causes. And finally, there are possible solutions to overcome these factors. The results obtained after the application of the solution are significant. Improving process quality leads to reduced costs and improved service. The percentage of defects was reduced from 7.4 to 5.08, so the Sigma score increased from 2.9 to 3.2 [5].

**Nachiket Kulkarni et al. (2017)** provided the application of the DMAIC method to improve the production process of shunt shoes. The purpose of this article is to introduce the application of the DMAIC method, which identifies a reliable quality strategy for the data used to improve its processing[6].

**Santosh Subhash Chandra Dubey and Dr Arun Kumar et al. (2017)** examined the main reasons to implement effective TQM and why SMEs oppose the adoption of TQM. The results will encourage and help them to eliminate or reduce barriers for SMEs in applying TQM to achieve enterprise success in future research[7]

**Mohd khairulnizam zahari and Norhayati zakuan et al. (2016)** examined the relationship between quality management and employee performance. Three hundred fifty questions were posed to 10 manufacturing companies in Malaysia, and the sample consisted of 294 completed surveys (response rate of 84.0%). Before the pilot test, a validity test was performed to test the relevance of the question. Statistical analysis and regression are used to predict and evaluate this relationship. The models were assessed using the modelling equation modelling (SEM) based on time-lapse analysis (AMOS). The survey results show that total quality management has a significant impact on team member performance[8].

**Jyoti Prakash Majumdar et al. (2016)** learn the key reasons to achieve success in complete quality management and the reasons that lead to the hesitation of small and medium enterprises to adopt complete quality management. The results will encourage and guide future research to eliminate or reduce the difficulty of SMEs in applying TQM to achieve business success [9].

**C. Manohar & A. Balakrishna et al. (2015)** talked about improving product quality and productivity through fault analysis and the application of the Six Sigma DMAIC method (measurement-measurement-specification). -improvement-control) of a tire manufacturer, which can provide a system to identify, define and eliminate variable sources of work, improve work performance, improve and maintain efficiency, i.e., A good control plan can reduce the defects in casting production, thereby increasing the results obtained [10].

**Naisargik Patel and Sanjay Shah et al. (2015)** discussed applying Six Sigma methods in production. Six Sigma's DMAIC (definition, measurement, analysis, optimization-control) method has been used in Six Sigma in the manufacturing industry to improve the quality level of its processes. By applying this method, the level of Sigma can be improved without a significant investment. Implementing the Six Sigma approach has saved a lot of money for various manufacturing industries, thus reducing losses [11].

**S. Suresh, A.L. Moe, and A.B. Abu et al. (2015)** used the Six Sigma DMAIC method to reduce automotive piston ring fabrication defects. Using the Six Sigma method, the rejection rate is reduced to 13.2% from the current 38.1% rejection rate. In the long run, after applying all the solutions alternately, the rejection rate can be further improved [12]

**Ghazi Abu Taher & Md. Jahangir Alam et al. (2014)** offer a realistic method for enhancing the high productivity of a production line in a manufacturing firm. The goal is to recognise the company's problem and build a stronger reaction to improve production line performance [15].

**Darshan D. Patel et al. (2014)** suggested a Six Sigma initiative within the company to discover and minimise production costs and procedures [16]

**S. Arun Vijay et al. (2014)** seek to reduce download time in a multipurpose hospital by implementing the Six Sigma DMAIC version. He investigated the employment of distinguishing first-class instruments and procedures during the five phases of the Six Sigma DMAIC version. [19]

**Md. Enamul Kabir et al. (2013)** look at and examine techniques of the case enterprise to discover the current sigma level and eventually improve the current sigma stage through productiveness development. In line with the objectives, the current sigma level has been calculated and given tips for improvement. This has been achieved by way of using the six-sigma DMAIC cycle. Mainly to enhance the DMAIC cycle section, specific development tools are used like 5s, grocery store and line balancing, and so on [22].

**Deepak Mittal and Kiran Bala et al. (2013)** studied the concept of Total Quality Management (TQM) to discover the impact of numerous parameters of TQM practices in manufacturing firms. For this observe various vital parameters required for successful implementation of TQM are identified from the literature [23].

**Vikas Tayal et al. (2012)** apply DMAIC (define, measure, analysis, improve, control) technique. The emphasis became laid down closer to reducing the defects (Blush, Burn, cold flows, cold slug, contamination, peeling, and gloss) inside the injection moulding via controlling the parameters with the DMAIC technique. This technique is a mission pushed control approach to improve the employer merchandise, offerings, and approaches with the aid of continually lowering defects in the agency [24]

**Suman Rani et al. (2012)** discussed the effect of the implementation of total quality management (TQM) in the manufacturing industry (Mohindra Fasteners Ltd.). Only a few service agencies had been able to acquire complete blessings of TQM. One foremost cause for its inadequate achievement is seeking to put in force in service organizations strategies that have been a hit in manufacturing. In production, the emphasis of TQM is on "zero defects" [25]

## **Manufacturing Steps in Industry**

The transformation of raw materials into finished items to meet human needs is referred to as production. Different manufacturing processes are used to change raw materials based on their shape, size, and physical properties. Metals are produced in a variety of ways, including-

**Metal Casting:** Metal casting: casting is a manufacturing method in which a solid is melted, heated, and then distributed to a specific temperature in a hollow or a mould. The molten metal strengthens the mould and creates the required form

**Metal Shaping and Shaping:** Using plastic deformation, convert basic geometrical metal objects into complex geometrical forms. The tool or mould applies pressure to the material in order to transfer the desired form through contact between tool and substance. It encompasses rolling, forging, extrusion, drawing, sheeting, powder metallurgy, shaping, and other processes.

**Connection:** a temporary or permanent bond between two or more materials. Soldering, soldering, diffusion, adhesives, mechanical connections, and so on are all part of it.

**Treatment:** This is a metal removal method. Turning, boiling, framing, planing, shaping, broaching, grinding, and other processes are used in its treatment.

**Finishing:** This refers to improving the surface polish of the material. Molding, polishing, polishing, deburring, coating, galvanising, and other processes This includes.

**Modification process for material properties:** This process involves changing the material's properties to achieve the desired properties. This includes quenching, quenching, annealing, carburizing, etc.

**Advanced manufacturing process:** It includes non-traditional machining. It has ultrasonic machining, abrasive beam machining, chemical, electric discharge machining, electrochemical machining, and high energy beam machining.

## **Results And Analysis**

This paper describes the various manufacturing steps and a detailed literature review for productivity improvement in manufacturing industry. Out of various methods, six sigma method is one of the best method. Six Sigma analysis can focus on a production or service element, with special emphasis on design, production, and statistical analysis of customer activity.

## **Scope For Future Work**

Much of this research has been devoted to improving product quality by improving methods. But, in this study, the costs associated with improving the car were not explained anywhere. Significant investments in quality improvement will have a negative impact on productivity. With lower quality and higher prices, research will provide a lot of support. Before improving quality or production, the price should be checked. However, for many people, as a motivation for improvement, it should produce beneficial results in all aspects of the business. This may prompt Future research to be included in price analysis to improve its quality and productivity.

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