SIX SIGMA-DMAIC APPROACH OF QUALITY IMPROVEMENT: A REVIEW

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Abstract

Six Sigma is a disciplined, project-oriented, statistically based approach for reducing variability, removing defects, and eliminating waste from products, processes, and transactions. The Six Sigma initiative is a major force in today's business world for quality and business improvement. Statistical methods and statisticians have a fundamentally critical role to play in this process. It discusses the evolution of Six Sigma and describes its major components, including how it is usually implemented in business organizations, and the role of statistics and statisticians in the process. It also discusses the implications of Six Sigma for education and training of statisticians and the potential impact on the statistics profession. This paper deals with the work done on the Six Sigma for the period 1984 to 2014.

Keywords: Defect rate, parts per million, DMAIC Approach, Deming's Philosophy, Quality control

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1. Introduction

The focus of Six Sigma is to reduce variability in key product quality characteristics around specified target values to the level at which failure or defects are extremely unlikely. The Six Sigma concept is to reduce the variability in the process, so that the specification limits are at least six standard deviations from the target. This is a Six Sigma quality level, and it results in about 3.4 parts per billion non-conforming to specifications. Table 1 shows the percentage distribution and defectives (in PPM) and Figure 1 shows it graphically.

Table 1 Percentage distributions and defectives (in PPM)

Specification Limit	Percentage inside specification	Defective (in PPM)
±1 Sigma	68.27	317300
±2 Sigma	95.45	45500
±3 Sigma	99.73	2700
±4 Sigma	99.9937	63
±5 Sigma	99.999943	0.57
±6 Sigma	99.9999998	0.002

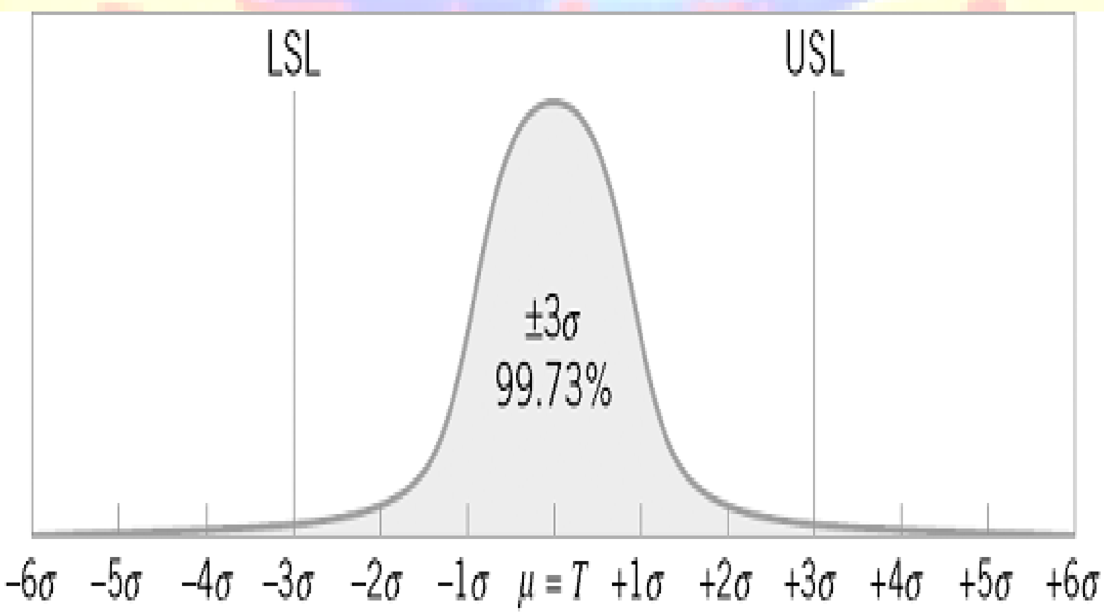

Figure 1 Normal distribution centered at the target

Under the Six Sigma concept, an assumption was made that when the process reached the Six Sigma quality level, the process mean was still subject to disturbances that could cause it to shift by as much as 1.5 standard deviations off target. This situation is shown in Figure 1.2. Under this scenario, a Six Sigma process would produce up to 3.4 parts per million (ppm) non-conforming to specifications. Table 2 shows the percentage distribution of data with ±1.5σ shift and graphical representation is shown in Figure 2.

Table 2 Percentage distributions of data with ±1.5σ shift

Specification Limit	Percentage inside Specification	Defective (in PPM)
±1 σ (Sigma)	30.23	697700
±2 Sigma	69.13	608700
±3 Sigma	93.32	66810
±4 Sigma	99.3790	6210
±5 Sigma	99.97670	233
±6 Sigma	99.999660	3.4

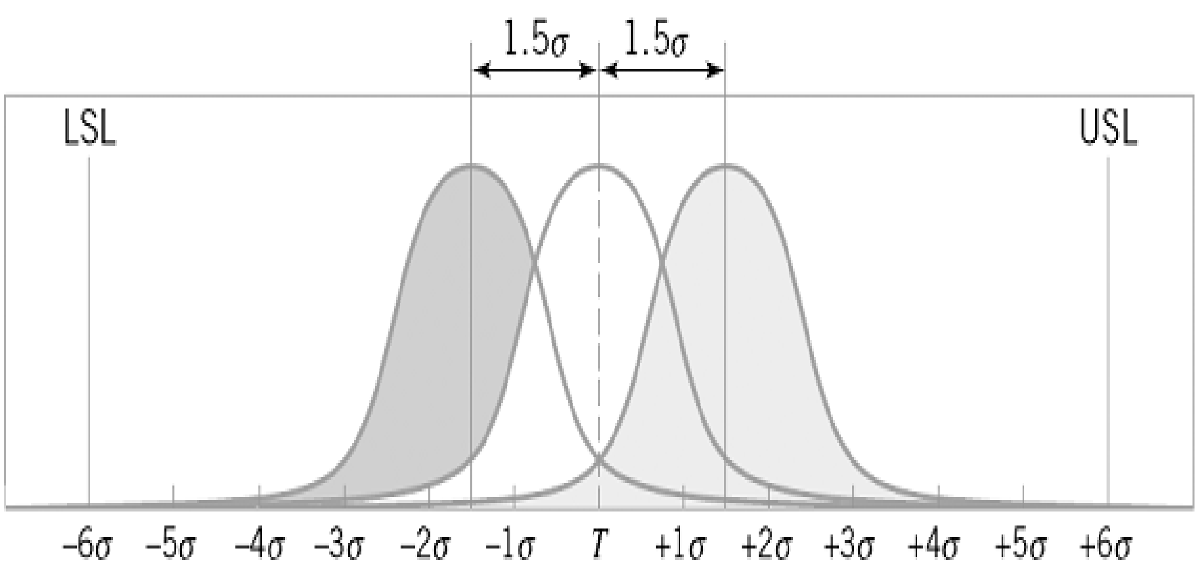

Figure 2 Normal distribution with the mean shifted by ± 1.5σ from the target

The drifting mean aspect of the Six Sigma metric has been a source of controversy. Some have argued that there is an inconsistency in that we can only make predictions about process performance when the process is stable, i.e. the mean and standard deviation are constant over time. If the mean is drifting, a prediction of up to 3.4 parts per million (ppm) non-conforming to specifications may not be very reliable, because the mean might shift by more than the "allowed" 1.5 standard deviations. Process performance is not predictable unless the process behavior is stable. Advocates of Deming's philosophy have rejected Six Sigma in some cases on the grounds that the 3.4 ppm is a "numerical goal", the 1.5 sigma shift is arbitrary, and that Six Sigma is a "slogan", supposed violations of some of Deming's 14 points. (Deming, 1986). However, no process or system is ever truly stable (this is the second law of thermodynamics at work), and even in the best of situations, disturbances and upsets occur. These disturbances can result in the process mean shifting off-target, an increase in the process standard deviation, or both. The Six Sigma process concept is one way to model this behavior. Like all models, it is at best an approximation, but it can be a useful way to think about and quantify process performance. The 3.4-ppm metric, however, is increasingly recognized as primarily a distraction; it is the focus on reduction of variability about the target and the elimination of waste and defects that is the important feature of Six Sigma.

1.2 The Evolution of Six Sigma Concept

Since its origins, there have been three generations of Six Sigma implementations. Generation I Six Sigma focused on defect elimination and basic variability reduction, primarily in manufacturing. Motorola is a classic exemplar of Generation I Six Sigma. In Generation II Six Sigma, the emphasis on variability reduction and defect elimination remained, but now there was a strong effort to tie these efforts to projects and activities that improved business performance through improved product design and cost reduction. General Electric is often cited as the leader of the Generation II phase of Six Sigma. In Generation III**,** Six Sigma has the additional focus of creating value throughout the organization and for its stakeholders (owners, employees, customers, suppliers, and society at large). Creating value can take many forms, such as increasing stock prices and dividends, job retention or expansion, expanding markets for company products/services, developing new products/ services that reach new and broader markets, and increasing the levels of customer satisfaction (perhaps by reducing cycle time or increasing) throughout the range of products and services offered.

1.3 Six Sigma Projects

Six Sigma projects are typically 4–6 months in duration and are selected for their potential impact on the business. Project selection and the DMAIC process is discussed in the following Section.

1.3.1 The DMAIC Approach

DMAIC, an acronym for Define, Measure, Analyze, Improve, and Control, is a structured problem-solving procedure widely used in quality and process improvement. Figure 3 shows DMAIC process.

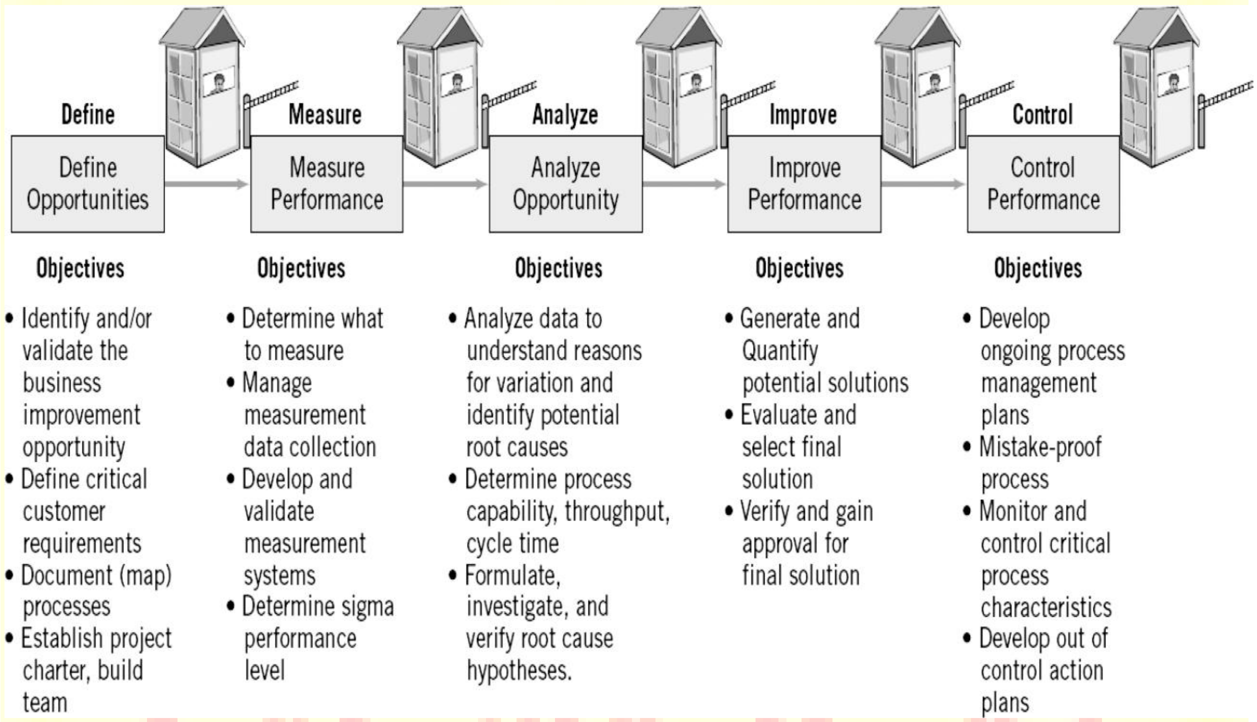

Figure 3 The DMAIC Process

It is observed that there are "tollgates" between each of the major steps in DMAIC. At a tollgate, a project team presents its work to managers and "owners" of the process. In a Six Sigma organization, the tollgate participants also would include the project Champion, MBBs, and other BBs not working directly on the project. Tollgates are where the project is reviewed to ensure that it is on track. They provide a continuing opportunity to evaluate whether the team can successfully complete the project on schedule. Tollgates also present an opportunity to provide guidance regarding the use of specific technical tools and other information about the problem. Organization problems and other barriers to success, as well as strategies for dealing with them, are often identified during tollgate reviews. Tollgates are critical to the overall problem-solving process. It is important that these reviews be conducted very soon after the team completes each step. The DMAIC structure encourages creative thinking about the problem and its solution within the definition of the original product, process, or service. When the process is operating so poorly that it is necessary to abandon the original process and start over, or if it is determined that a new product or service is required, then the improved step of DMAIC actually becomes a process design or re-design step. In a Six Sigma organization, that means that a design for Six Sigma (DFSS) effort is required. One of the reasons that DMAIC is so successful is that it focuses on the effective use of statistical tools.

1.4 Main Objective of DMAIC

The DMAIC (Define-Measure-Analyze-Improve-Control) is the classic Six Sigma problem-solving process. Traditionally, the approach is to be applied to a problem with an existing, steady-state process or product and/or service offering.

Variation is the enemy—variation from customer specifications in either a product or process is the primary problem. Variation can take on many forms. DMAIC resolves issues of defects or failures, deviation from a target, excess cost or time, and deterioration. Six Sigma reduces variation within and across the value-adding steps in a process. DMAIC identifies key requirements, deliverables, tasks, and standard tools for a project team to utilize when tackling a problem.

The DMAIC methodology uses a process-step structure. Steps generally are sequential; however, some activities from various steps may occur concurrently or may be iterative. Deliverables for a given step must be completed prior to formal gate review approval. Step Reviews do occur sequentially. The DMAIC five steps are

1.5 DMAIC Procedure

Five steps of the DMAIC methodology is discussed in this section.

Step 1 **DEFINE**

Define the problem and scope the work effort of the project team. The description of the problem should include the pain felt by the customer and/or business as well as how long the issue has existed. Hence, identify the customer(s), the project goals, and timeframe for completion. The appropriate types of problems have unlimited scope and scale, from employee problems to issues with the production process or advertising. Regardless of the type of problem, it should be systemic—part of an existing, steady-state process wherein the problem is not a one-time event, but has caused pain for a couple of cycles.

Step 2 MEASURE

Measure the current process or performance. Identify what data is available and from what source. Develop a plan to gather it. Gather the data and summarize it, telling a story to describe the problem. This usually involves utilization of graphical tools.

Step 3 ANALYZE

Analyze the current performance to isolate the problem. Through analysis (both statistical and qualitatively), begin to formulate and test hypotheses about the root cause of the problem.

Step 4 IMPROVE

Improve the problem by selecting a solution. Based on the identified root cause(s) in the prior step, directly address the cause with an improvement. Brainstorm potential solutions, prioritize them based on customer requirements, make a selection, and test to see if the solution resolves the problem.

Step 5 CONTROL

Control the improved process or product performance to ensure the target(s) are met. Once the solution has resolved the problem, the improvements must be standardized and sustained over time. The standard-operating-procedures may require revision, and a control plan should be put in place to monitor ongoing performance. The project team transitions the standardized improvements and sustaining control plan to the process players and closes out the project.

2. Literature Review

From the past literature survey, it is evident that some research on DMAIC methodology have been carried by previous researchers but still a lot of applied research in this field is required so as to explore the utilization of DMAIC methodology in the area of production, manufacturing and design.

Raouf and Ali (1984) presented a procedure to find an optimal ongoing process capability index. They used the process capability indices assess the ability of a process to meet the present specification limits. A fixed value for an ongoing process capability index is generally used. Minimization of statistical process control costs can be achieved by selecting an optimal process capability index. Cheikh and McGoldrick (1988) discussed the work, which has been carried out in the area of tolerances with cost, function and process capability the main parameters in mind. So that the resulting functional variables of the assembly can meet their respective functional tolerances requirement and cost of manufacturing all the components to their respective functional tolerances is minimized. It shows that, when manufacturing cost information and process capability information are available, functionally correct design at minimum cost can be achieved. Furthermore, they showed how statistical analyses of the manufacturing processes involved can lead to the relaxation in requirement at the same time, maintaining the desired levels of product quality and reliability.

Goh (2000) outlined the functions of statistical tools and examined the steps in which they are adopted by non-statisticians in industry. A “seven S” approach is explained, highlighting a strategy for the effective deployment of statistical quality engineering. In a manufactured product attainment of superior quality and reliability depends upon the existence of a framework integrating an organization’s capabilities in management, technology and information utilization. Chen and Ding (2001) proposed a new index S_{pmk} for any underlying distribution, which takes into account process variability, departure of process mean from the target value, and proportion of non-conformity. Ribeiro et al. (2001) presented a new procedure for quality control and quality assurance in scenarios where several variables and attributes have to be monitored. The proposed procedure, named integrated process control, begins with the definition of control stations on the production line, where a single chart that aggregates several variables and attributes is used. This procedure is complemented by using Pareto charts, which determine the quality characteristics contributing the most to the number of defectives. The integrated process control also uses traditional control charts; however, these are used selectively following the indication of the Pareto charts. The joint use of these tools facilitates the identification and solution of quality problems, allowing the improvement actions to be taken at the right time and place. The key advantages of the proposed procedure are: the ability to handle variables and attributes on a single integrated chart, the statistical approach, providing a solid basis for decision making, and the strong managerial appeal provided by the integrated charts.

Pearn and Chen (2002) developed a procedure similar to those of Cp, Cpk and Cpm for the one-sided capability indices CPU and CPL by obtaining unbiased estimators of CPU and CPL. Process capability indices have been used in the manufacturing industry to provide quantitative measures on process potential and performance. Folaron (2003) provided a comprehensive view of Six Sigma within the historical context of the development of industry and the associated impact on the quality of processes and products. In particular, since 1980, there has been a profound growth in the use of statistical methods for quality and overall business improvement in the United States and throughout the world. This has been motivated, in part, by the widespread loss of business and markets suffered by many US companies that began during the 1970s. For example, the US automobile industry was nearly destroyed by international competition during this period. One US automobile company estimated its operating losses at nearly $1 million per hour in 1980. The adoption and use of statistical methods have played a central role in the renewed competitiveness of US industry with respect to quality. Hoerl (2004) discussed that Six-Sigma had maintained momentum for over ten years now, longer than many pundits expected. This paper suggests that several emerging trends will continue, such as migration to financial services and healthcare, standardization of Design for Six-Sigma (DFSS), and further globalization. Longer term, a key challenge appears to be integration into normal operations, rather than managing Six-Sigma as a separate initiative.

Sadagopan et al. (2005) discussed about how General Electric, Motorola, and other top companies reported a substantial financial gain as a result of implementing the Six Sigma program, the momentum towards infusing it in an organizational arena started. Thereafter, researchers working on Six Sigma program have been reporting its prowess. Mahanti & Antony (2006) explained that Six Sigma body of knowledge has benefited a large number of organizations in improving product and process quality (Define, Measure, Analyze, Improve, Control) and even for developing new products (Design for Six Sigma), some work is still needed for managing software projects. The aim of their work is to present the results of semi-structured interviews conducted with software professionals in a few Indian software companies implementing Six Sigma. Prajapati and Mahapatra (2007) discussed a very simple and effective design of proposed X-bar and R charts to monitor the process mean and standard deviation. The concept of the proposed chart is based upon the sum of chi-square (χ^2) to compute and compare Average Run Length values (ARLs). They compared the performance of the proposed chart with VSS, VSI and VSSI joint schemes proposed by Costa (1999). Etienne (2008) discussed six sigma is widely accepted as a highly performing strategy for driving defects out of a company's quality system. Measurement through the Define, Measure, Analyze, Implement, Control (DMAIC) process is central to it. It shows that the quality performance data expressed as the usual percentage defect rate and based on two manufacturing industry case studies can be converted into a wide range of vital, Six Sigma metrics and that these can be used to develop insight into a company's quality system and its comparison to the Six Sigma benchmark, both at the qualitative and quantitative levels.

Thirunavukkarasu et al. (2008) presents the snapshots observed by reviewing the literature on Six Sigma. This literature review enabled to study the history of Six Sigma program and its development phases. It is found that no research on linking quality function deployment with Six Sigma program has so far been pursued. Hence, the literature snapshots were referred to design a technique named as Total Six Sigma Function Deployment (TSSFD). Aggogeri & Gentili (2008) discussed the quality standards of the output, the features of delivery and the introduction of new services are becoming the most important factors to success in business performance. In this context, the application of new methodologies is essential to increase the business performance. Six Sigma can give an important solution for those companies that intend to highlight the customer satisfaction focusing on the continuous improvement of the processes. The purpose of this paper is to show the power of the Six Sigma methodology in increasing the performance level of industrial processes and systems. The paper shows a Six Sigma case study applied to the automotive market.

Prajapati and Mahapatra (2009) discussed the limitations of CUSUM and EWMA charts and proposed a new chart and compared this chart with conventional CUSUM and EWMA charts. They found that CUSUM and EWMA schemes are ineffective to catch the process shifts when samples are not taken from same stream. Rajesh et al. (2009) implemented Six Sigma and

Design for Six Sigma (DFSS) successfully in a variety of industries (1) to improve performance, (2) to design new products, processes and services, or (3) to redesign the existing ones. Taguchi's robustness strategies are an important part of the (DFSS) approach. In this paper, we will describe how robustness strategies are used to design a radio-frequency identification system. The main objective of the design is to select a combination of design parameters that can assure good tag readability. This research takes into consideration the effect of base material, the distance between tag and base material, and the distance between tag and reader antenna on the robustness of the tag readability. Indu (2009) said that Six Sigma is not merely a quality initiative; it is a business initiative. The use of Six Sigma methodology is more valuable in financial institutions now than it has ever been and companies are now reaping true savings and revenue growth. It follows the Define-Measure-Analyze-Improve-Control (DMAIC) approach to problem solving and to identify the areas for improvement. Either the voice of the customer or voice of business acts as a source for identification of major improvement areas. This work presents an extensive review on Six Sigma, and application of Six Sigma in banking services. The study was initiated with a view to identify the feeble areas in overall transaction and improve upon those which would be of maximum benefit to the company. Gray & Anantatmula (2009) discussed Six Sigma concepts and tools, which have established proven practices and have demonstrated their worth within industry, the variation and style in which the Six Sigma projects are formulated and executed leaves much opportunity for continued development. The purpose of this paper is to propose a practical framework for integrating conventional project management process groups, as established by the Project Management Institute and Six Sigma DMAIC methodologies. Banuelas et al. (2009) investigated the status of Six Sigma implementation in supply chain in the UK. The first part of this work comprises a review of the literature of Six Sigma implementation in the supply chain. Then they report the results of a postal questionnaire survey. The results of the survey indicated that around 50% of the UK manufacturing organizations surveyed implement Six Sigma in the supply chain. However, only a small number of them include the entire supply chain in their Six Sigma projects. Simple graphical tools are preferred over more complex techniques during Six Sigma supply chain projects. Cost, quality and delivery are the main focus of Six Sigma projects. They found that lack of know-how and resources are the major constrains for companies not implementing Six Sigma in the supply chain.

Radhakrishnan & Sivakumaran (2010) concluded that 'Six Sigma is a tool used to convert management problem into a statistical problem and to find a statistical solution then it converts into a management solution'. Six Sigma is a set of practices originally developed by Motorola to systematically improve processes by eliminating non-conformities. Gnanaraj et al. (2010) discussed about recent years trends in Six Sigma. The world has been focusing on the development of Small and Medium Enterprises (SMEs). Meanwhile, the world has also been looking at the Lean Six Sigma concept as an enabler for companies to achieve prosperity. Hence, it is recommended that Lean Six Sigma be applied to SMEs. However, contemporary SMEs are suffering from certain deficiencies which make it unsuitable for them to implement the Lean Six Sigma concept immediately. This situation indicates the need for developing a model that can overcome the deficiencies existing in SMEs and enable implementation of the Lean Six Sigma concept for achieving prosperity. In order to fulfill this need, in this paper, a model named DOLADMAICS (for Deficiencies Overcoming-Lean Anchored-Define-Measure-Analyze-Improve-Control-Stabilize) is contributed. The DOLADMAICS model is designed to enable an SME to implement the Lean Six Sigma concept at five levels. The workings of DOLADMAICS model is explored by presenting a hypothetical case study. Desai & Patel (2010) highlighted a research study conducted to ascertain the implementation hurdles Indian industries are facing in Six Sigma implementation and thus failing to gain appropriate benefits from the same. It also presents two real life case studies highlighting Six Sigma implementation difficulties in Indian industries. The cases are the industries where Six Sigma was not tried before. Six Sigma was applied on to their chronic problems keeping in view the findings of the analysis of Six Sigma implementation barriers in Indian industries.

Sony & Subhash (2011) did a pilot survey in Indian service organizations. They presented some of the difficulties, implementation issues and success factors, and also, the benefits of Six Sigma in service organizations, tools and techniques of Six Sigma in service performance improvement and key criteria for the selection of winning projects, illustrated with results of a Six Sigma pilot survey in Indian service organizations. The outcome of the research illustrates that the bulk of service organizations in the India has been engaged in a Six Sigma initiative for over three years. The average sigma quality level of the organizations was around 2.9. This is a first paper on status of Six Sigma in Indian service organizations and will be immense use for academia and practitioners. Jones et al. (2011) developed an instrument for measuring Six Sigma implementation. They developed eight constructs for measuring Six Sigma implementation utilizing the PDCA cycle (plan-do-check-act). The instrument captures different aspects of Six Sigma implementation in organizations such as the role of black belts, financial responsibility and executive support. In addition, we show that there is significant difference in Six Sigma implementation among organizations, where those employing PDCA cycle for their Six Sigma initiatives achieve higher level of performance. They believe the proposed instrument can be used for measuring Six Sigma implementation in organizations. Implications for managers and future research have been provided.

Ashish et al. (2012) explained the importance of small and medium enterprises (SMEs) to the economy and the industrialized world as a whole is well known. The objectives of this paper are to get strength, barriers, enablers and possible solutions to implement Six Sigma in small and medium industries. The research methodology adopted is questionnaire-based research, followed by development of standard solution matrix for manufacturing-related problems. The concept is developed based on the theory of inventive problem solving (TRIZ). Finally, the methodology to apply Six Sigma to SMEs has been suggested. Use of contradiction matrix for problem solving gives a new line of thinking for solution; interestingly most of conventional manufacturing problems of Six Sigma can be tackled by selected standard principles. Khurshid (2012) stated that Six Sigma can be implemented in manufacturing SMEs. Moreover, this study identifies the motivation for adopting Six Sigma by Australian manufacturing SMEs. It was found that a normative isomorphic change mechanism, under institutional theory, is exclusively involved in the adoption of the Six Sigma methodology. This study also discusses various critical success factors and impeding factors involved in the implementation of quality improvement initiatives, in general, as well as of Six Sigma, in particular. This study contributes anecdotal evidence to the literature that, as in large organizations, successful Six Sigma implementation in SMEs can provide financial gains and operational excellence. This study also contributes by identifying the current status of quality management practices in Australian manufacturing SMEs. There are a few limitations of this study. First, the limited number of Six Sigma practicing SMEs restricted the generalization of the findings. Secondly, due to the unavailability of a database exclusive to Australian manufacturing SMEs, the survey was sent to all ISO 9001 certified organizations regardless of their size. Moreover, due to resource constraints, the study focused only on SMEs belonging to the manufacturing sector and the service sector was not discussed. Dibia & Onuh (2012) presented the successful deployment of Lean Six Sigma entails making a committed and coordinated effort to achieve better, easier, quicker and safer output for customers and all other stakeholders at a competitive lower cost. Thus enabling the organization to strategically simplify its processes, optimize its resources, and improve its quality thereby creating real value for its customers and stakeholders. This paper introduces the Lean leadership, people, process and outcome (LPPO) model for Lean Six Sigma deployment and carries out a comparative study of the deployment of Lean Six Sigma in two companies using the soft systems methodology. The findings underscores the importance of visible leadership commitment, right people, right organizational structure, right project and the right supporting structures in the successful deployment of Lean Six Sigma.

Khoury et al. (2013) stated that logistics managers are required to efficiently and effectively manage logistics operations. One of the tools they employ to meet this requirement is the integration of Six Sigma. This study surveyed logistics managers on the east coast of the USA to determine their level of acceptance of the integration of Six Sigma within logistics operations and to identify the components of Six Sigma that require modification for successful integration. The results of this study revealed that despite the management style (Theory X or Theory Y), 88% of managers believe Six Sigma is compatible with logistics managers' roles and responsibilities. Furthermore, adaptation of logistics processes to Six Sigma requirements proved more compatible than the adaptation of Six Sigma to logistics processes. Also, the adaptation of logistics processes to accommodate Six Sigma had a significant impact on organizational savings and on successful Six Sigma implementation. Chiarini (2013) discussed that Six Sigma is a well-consolidated model used by thousands of companies around the world and has a particular organization built on the define-measure-analyze-improve-control methodology. The International Organization for Standardization (ISO) in 2011 issued a standard named ISO 13053 with the aim of standardizing Six Sigma implementation. This research reviews, for the first time, the differences between the requirements of ISO 13053 and the actual practices followed by a sample of 107 European large companies when implementing Six Sigma. The results are also interesting because they reveal the state-of-the-art of Six Sigma organization inside companies. It seems that companies have started measuring and classifying Six Sigma savings not just using the cost of poor quality. Furthermore, there are different points of view about how long the training for Master, Black, Green and Yellow Belts should be. Even, how long a Six

Sigma project should last is not clear. Lastly, the research highlights how it is important to apply some lean production tools. Shanmugaraja et al. (2013) concluded that in the recent past, Six Sigma approach had been the methodology of choice for achieving quality and productivity through streamlined business practices that would eventually delight customers. Though Six Sigma had been expanded to several industrial sectors presently, only few research attempts have been noticed to examine the successful implementation of the method in the organizations. Despite the fact that organizations achieve benefits from Six Sigma implementations, such benefits are not sustainable until Six Sigma program gets incorporated with its critical success factors while implementing to improve product or service quality.

Singh and Bakshi (2014) followed an analytic-deductive approach to realize the issues related to present power crisis and growing demand of backup power systems (BPSs), especially in India. It not only explored the need of high cost BPSs in current scenario but also put emphasis to reduce the running cost through parametric optimizations. A Define-Measure-Analyze-Improve-Control (DMAIC) model of Six Sigma was being suggested and practiced for bringing breakthrough in efficiency or mileage of a Diesel Genset. Mishra and Sharma (2014) made an attempt to propose a conceptual framework for improving process dimensions in a supply chain network. Authors observed from the results that selection of appropriate strategies for improving process performance, based upon experiences and use of statistical tools by cross-functional teams with an effective coordination, guarantees success. Prashar (2014) demonstrated the successful application of Six Sigma DMAIC methodology in FES for driving down the field failures and improved customer satisfaction. Author showed how a leading company operating in farm equipment sector (FES) in India utilized Six Sigma statistical tools to reduce field failures of tractor assembly and thereby improved customer satisfaction.

3. CONCLUSIONS

Six Sigma is a level of performance that reflects significantly reduced defects in products and services, a statistical measurement of process capabilities as well as a benchmark for comparison. It is a set of statistical tools to help companies to measure, analyze, improve and control processes. It is also a commitment to all customers and consumers of products and services that an organization continually works on for improving its products and processes to reduce the defects. Six Sigma uses a specific five-step problem-solving approach: Define

Measure, Analyze, Improve, and Control (DMAIC). The DMAIC framework utilizes control charts, designed experiments, process capability analysis, measurement systems capability studies, and many other basic statistical tools. The DMAIC approach is an extremely effective framework for improving processes. From the literature review, it is found that DMAIC approach of Six Sigma is being presently implemented in both the manufacturing and service sectors; effectively.

Almost all implementations of Six Sigma employ DMAIC for project management and completion of process improvement projects. However, DMAIC is not necessarily formally tied to Six Sigma, and can be used regardless of an organization's use of Six Sigma. It is a general and very useful approach to management of change and improvement. DMAIC is a generalization of Walter Shewhart's Plan-Do-Check-Act cycle, which provides a roadmap to help people understand how to integrate the various tools into an overall approach to quality improvement.

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