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## Six Sigma as a Quality and Continuous Improvement Strategy.

Prajwal Jaya Naik<sup>1</sup>

<sup>(1)</sup>Department of Mechanical Engineering, VIVA Institute of Technology, India.)

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**Abstract :** As Global competition hikes, Quality become the highest priority in today manufacturing world. Competitiveness, innovation and performance are the key words that best define the goals of this business environment. Under the given circumstance concepts like quality and continuous improvement become important actors in achieving these goals. These programs were instituted within the 1980s and early 1990s as response to the “economic growth and manufacturing dominance of Japanese industries”. Most of these programs, are “Just-in-Time (JIT), Total Quality Management (TQM), KAIZEN, Poka-yoke” were based partly on the tenets and results of the Toyota Production System (TPS) that was established in an evolutionary manner since the 1950s through the work of W. Edwards Deming and Taiichi Ohno. for many years, TQM has been a dominant management concept for improving competitiveness and financial results. In recent years, however TQM seems to have lost variety of its nimbus with other concepts and approaches like Lean Enterprise and Six sigma launched and increasingly stylish. These aims of this paper is to clarify that sigma could also be alternative for its predecessor i.e. TQM and their similarities and differences to sort out whether the two ideas truly are various dishes or contain the indistinguishable fixings in various.

**Keywords** - Six sigma, TQM, Quality, Continuous Improvement.

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### I. INTRODUCTION.

“Quality” is a relatively a subjective term. Quality as an idea has been characterized and depicted differently in the writing. One of the ways, TQM and Six Sigma fluctuate by the way the two of them depict "quality. TQM defines "quality" as a calculation of how well a business that meets its consumer expectations produces the features of a product. A "good quality" product here refers to the item that is in line with customer requirements. Also, a product of "bad quality" refers to something that the customer will not be keen on putting resources into. Then again, 'quality' is determined by Six Sigma as the proportion of the quantity of deformities an item or administration may have. "Good quality" refers to something with the most outlandish (or no) imperfection, since Six Sigma expects that mistake free administrations and insignificant deformities in products produce more noteworthy shopper fulfilment Total quality management focuses primarily on maintaining current quality standards, while Six Sigma focuses primarily on making slight required improvements in processes and systems to ensure high quality standards. The Total Quality management measure, after a specific timeframe, arrives at an immersion stage. No more changes can be made in quality after hitting the saturation point. Then again, Six Sigma only from time to time moves toward the phase of immersion by beginning a quality interaction at the subsequent stage.

Six Sigma is a more up to date idea when contrasted with Total Quality Management (TQM). When it was conceptualized, however, it was not meant to be a substitute for TQM. In assorted market conditions, including assembling and administration areas, both Six Sigma and TQM have a few similitudes and are viable. By conveying a more imperfection cantered methodology focused on quality improvement and disposing of the unclearness of TQM, Six Sigma tackled the vast majority of its issues and become more dependable [3]. Although Six Sigma's consistent DMAIC approach and bottom-line commitments easily replaced TQM weaknesses such as its vagueness and difficulty in allocating financial benefits, its strengths were the emphasis on quality improvement, collaboration and participation of every individual within the organization [1].

## II. METHODOLOGY.

In a Manufacturing process most, items will be without imperfection however certain rate will be blemished. The distribution of the data ought to be relative uniform; subsequently, we endeavour to fit to the normal distribution. The standard deviation addresses the spread of the information, in other words, the "wideness" of the curve. The standard deviation is addressed by a Greek letter sigma on the X-axis. To apply real life data to the normal distribution, we have to calculate two things.

1. Mean (average)
2. Standard deviation.

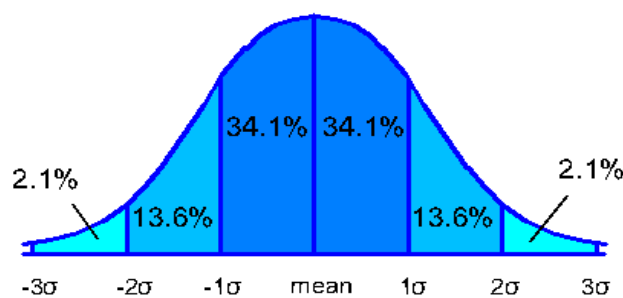


Fig: Bell curve.

The rates that fall into each standard deviation (34.1%, 13.6%, and 2.1%) are reliably the same. As such, 34.1% of the information is consistently inside 1 standard deviation above (or underneath) the mean. Simply the size of the standard deviation (x-axis) is changed to facilitate the instructive index working with. The curve gets compliment or more extensive to coordinate the information. In the event that the curve is tall and tight, the majority of the information is near the mean. In like manner, if the curve is short and wide, the information is extremely spread out and distant from the mean. In Six Sigma philosophy, the (objective) is to limit item imperfections to six standard deviations, for example six "sigma." The Upper Specification Limit (USL) is three standard deviations over the mean, and the Lower Specification Limit (LSL) is three standard deviations beneath the mean. These address the limits of worthy creation deformity rates, and they are fixed by Six Sigma procedure the total of all the rate esteems inside 3 standard deviations from the mean 73% (they have been adjusted in the above outline). Therefore, the six-sigma standard represents:

- 3.4 Defect part per million products.
- 0.00034% defective.

As should be obvious, a "six sigma process" is virtual flawlessness. Any interaction can be portrayed by the number of blemished items there are as far as standard deviations, for example: "Our automobile seat production process is achieving a 4.0 sigma level". This means that 95.45% are within specifications (two standard deviations) and 4.55% are defective [8].

Table 1: Six Sigma levels and corresponding DPMO as adapted from Sheehy et al. (2002) and Raisinghani et al. (2005)

<i>Short term</i>			<i>Long Term</i>		<i>Notes</i>
<i>σ Level</i>	<i>DPMO based on a centered process</i>	<i>Process Yield</i>	<i>σ Level</i>	<i>DPMO based on worse side</i>	
6.0	0.002	99.99966%	4.5	3.4	a 6 σ process
5.0	0.6	99.97700%	3.5	230	
4.5	6.8	99.86500%	3.0	1350	
4.0	63.5	99.37900%	2.5	6210	
3.0	2700	93.32000%	1.5	66800	most companies operate at this level (Kwak and Anbari, 2004)

Six Sigma is an information driven strategy that works exclusively on measurable information got from a wellspring of study. It aims to reduce the number of errors per million products generated in a process by 3.4 or fewer defects [4]. In the long run, Six Sigma allows companies to maximize earnings cumulatively. The Total Quality Management strategy lays down a collection of guidelines aimed at strategically improving a company's overall processes. This, in turn, helps to create a high-quality product that is valued and appreciated by clients. Originally the Six Sigma Approach was intended and based on quality assurance purposes, this methodology is one of the most common methods used today for business improvement. At the point when managers and analysts understood that there are numerous potential changes that should be possible just as numerous approaches to make measures more effective, the idea of utilizing the Six Sigma Approach in business measure improvement came to fruition.. Six Sigma Approach has many advantages in today's world as a tool and technique to solve various issues and problems. However, the main benefit of using Six Sigma is the elimination of errors that can reach consumers.

Other advantages of using this technique, however, include:

- Concentrate on consumers and clients.
- Increased and greater commitment to clients.
- Reduce time for cycles.
- Minimizing waste.
- Decisions which are based on data.
- Effective use of time.
- Permanent gains and enhancements.
- Systematic problem-solving approach.
- Maintains incentive for workers.

The adaptability of the two strategies makes it conceivable to apply them in any association. The two approaches are DMAIC and DMADV. DMAIC is the methodology utilized when the objective is to advance existing business measures. The letters of the abbreviation define the means that should be done to actualize for example (Define, Measure, Analyse, Improve, Control)

DMADV, also referred to as DFSS or Six Sigma Design, is targeted and used in projects that produce processes or product designs. A task group utilizes the Six Sigma Methodology style of DMADV when they will likely make a cycle or item that better fits the necessities of clients. Like DMAIC, by defining each of the letters in the acronym, the steps and stages of DMADV can be defined i.e. (Define, Measure, Analyse, Design, Verify).

Whereas for TQM or Total Quality Management, before Lean and Six Sigma became more commonly used in industries, another technique enjoyed its worldwide popularity. TQM concentrated primarily on building an environment where workers would constantly strengthen their practices and deliver good value to consumers with on-demand goods and services. TQM is a management theory aimed at combining all organizational functions (marketing, finance, architecture, engineering and manufacturing, customer support, etc.) to meet customer expectations and organizational goals [5][6].

TQM incorporates Edward Deming's 14 principles, sometimes referred to as TQM's father [6][7].

- Establish consistency of intent for product and service enhancement.
- Adopt the new Economic Stability Theory.
- Cease inspection dependency in order to achieve consistency.
- Stop the practice of rewarding business on price alone; instead, by partnering with a single supplier, minimize overall costs.
- Develop every method for preparation, development and service constantly and forever.
- Training at the Institute on the job.
- Adopt leadership and institute it.
- Drive out anxiety from the minds of workers.
- Break down barriers between areas of personnel.
- Eliminate workforce slogans, exhortations, and goals.
- Eliminate employee numerical quotas and management numerical priorities.
- Eliminate obstacles that deprive individuals of workmanship pride and eliminate the annual ranking or merit scheme.
- Set up a vigorous education and self-improvement program for all.
- Put everybody in the business to work to achieve the transition.

### III. COMPARISON OF SIX SIGMA AND TQM.

- Both Six Sigma and Total Quality Management are unfathomable great agency instruments, but there's a skinny line of partition among them. Although the method and cycles applied in each will in standard be very an awful lot like, there are some big varieties [2].
- Six-Sigma is a surprisingly brisker concept than Total Quality Control, but now no longer explicitly its different option. The essential difference among Total Quality Management and Six Sigma is that TQM presents synthetic merchandise of advanced great, even as six sigma, on the opposite hand, effects in higher effects. Total great manipulate refers to workers' steady exertion to make sure tremendous merchandise. The Six Sigma technique calls for many diffused modifications withinside the strategies to make sure green overall performance and improved purchaser satisfaction [2].
- Total Quality Management calls for the layout and implementation of recent strategies and structures and keeps a hit collaboration among extraordinary departments. Based on extraordinary patron remarks and analysis, new strategies are created.
- Keeping up present day great requirements is the crucial goal of Total Quality Control, even as Six Sigma basically facilities round making the vital regular upgrades to cycles and techniques to assure excessive
- Improvements in present day guidelines and strategies to make sure excessive great are a part of the Total Quality Management Process Via lowering and in the end putting off defects from the device, Six-Sigma makes a speciality of enhancing The cycle of general great control ensures that every and each component related with the agency is walking after lengthy haul great items/administrations to enhance present day cycles, projects, administrations and paintings culture. Then again, Six Sigma centres round first locating and finally wiping out numerous deformities and obstacles that could come withinside the technique of the association's Total great control in a layman's language emphasizes the enhancement of present day practices and the needful upgrades in strategies to make sure advanced great items and

In order to make sure excessive great items, groups that exercise Six Sigma are cantered on getting rid of mistakes and defects.

- A much less complicated cycle than Six Sigma is Total Quality Management. Six-Sigma calls for those who are particularly educated, even as complete great manipulate does now no longer entail rigorous education. The Six Sigma method units up remoted tiers for workers which can be simply prepared for the same usage. Depending on their skill ability level, employees certified for Six Sigma also are licensed as 'Green Belts' or 'Black Belts'. Six-Sigma calls for the involvement of most effective licensed practitioners, even as a component-time interest that doesn't require unique education can be known as whole great manipulate. Six-Sigma can be implemented through practitioners who're dedicated and well-trained.
- In comparison to general great manipulate, Six-Sigma is taken into consideration to supply higher and greater dependable overall performance. Six Sigma's interplay relies upon on contribution from clients and is greater genuine and effects-arranged. In Six Sigma, purchaser enter performs a vital component. At the appointed time of time, professionals count on that six sigma will surpass in standard great manipulate.

#### IV. CONCLUSION.

Long before Six Sigma, TQM was in operation. Too many people think of Six Sigma as a TQM substitute. Even Though the potential of Six Sigma is higher than the TQM, due to its challenges and its complexity it become difficult to apply. Although it is possible to use Six Sigma and TQM separately, they are compatible. At the appointed time of time, specialists expect that six sigma will surpass in general quality control. Each of them has a different emphasis, using them together will increase the improvement in performance. At the same time, though, it's necessary to delineate how each will be used. And how they will communicate, for that matter. There is only a slight difference between Six Sigma and TQM, since both of them are focused on improvements in efficiency and defect reduction.

#### REFERENCES

- [1] Frank.J. Wyatt “<https://medium.com/business-process-management-software-comparisons/the-demise-of-six-sigma-the-right-sizing-of-a-problem-solving-methodology-4e49b4442bf7>”.
- [2] Naomi Enterprise Deployment and tagged ASQ, Black Belt, Proofread. “<https://sixsigmastudyguide.com/total-quality-management-and-six-sigma/>”.
- [3] Prachi Juneja Reviewed by Management Study Guide Content Team “<https://www.managementstudyguide.com/six-sigma-and-total-quality-management.htm>”.
- [4] Henry Harvin “<https://www.henryharvin.com/blog/six-sigma-vs-tqm>”.
- [5] Khurram Hashmi “<https://www.isixsigma.com/methodology/total-quality-management-tqm>”.
- [6] Gilbert, G. (1992). “*Quality Improvement in a Defence Organization.*” Public Productivity and Management Review, 16(1), 65-75.
- [7] Eduonix <https://blog.eduonix.com/featured/six-sigma-vs-total-quality-management/>.
- [8] Bernie Roseke (President of Roseke Engineering) “<https://www.projectengineer.net/six-sigma-basics/>”
- [9] Souraj Salah, Juan Antonio Carretero, Abdur Rahim “Six Sigma and Total Quality Management (TQM): similarities, differences and relationship” Article in *International Journal of Six Sigma and Competitive Advantage* · January 2009 pp.,239-245.