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Six Sigma: Literature Review and Implications for Future Research

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ABSTRACT

There has been significant number of papers distributed identified with Six Sigma applications in assembling and administration associations. Be that as it may, not many examinations are done on auditing the writing of Six Sigma in every one of the regions including fabricating, development, instruction, money related help and so on. Thinking about the commitment of Six Sigma in late time, an increasingly extensive survey is exhibited in this paper. The creators have checked on Six Sigma written works in the manner that would help examine academicians and professionals to investigate the development, improvement, and uses of this method.

1. Introduction and Overview of SIX SIGMA

Six Sigma is a procedure that furnishes organizations with the devices to improve the ability of their business forms. For Six Sigma, a procedure is the fundamental unit for development. Aprocess could be an item or an assistance procedure that an organization gives to outside clients, or it could be an interior procedure inside the organization, for example, a charging or creation process. In Six Sigma, the reason for process improvement is to build execution and lessening execution variety. This expansion in execution and lessening in process variety will prompt imperfection decrease and improvement in benefits, to worker confidence and nature of item, and inevitably to business greatness. Six Sigma is the quickest developing business the board framework in industry today. It has been credited with sparing billions of dollars for organizations since the mid 1990s. Created by Motorola in the mid1980s, the procedure turned out to be notable simply after Jack Welch from GE made it a focal point of his business system in 1995. The name "Six Sigma" gets from factual wording; Sigma implies standard deviation. For typical circulation, the likelihood of falling inside a ±6 sigma run around the mean is 0.9999966. In a creation procedure, the "Six Sigma standard" implies that the defectivity pace of the procedure will be 3.4 deformities per million units. Unmistakably Six Sigma demonstrates a level of very high consistency and amazingly low fluctuation. In measurable terms, the motivation behind Six Sigma is to diminish variety to accomplish little standard deviations[14].

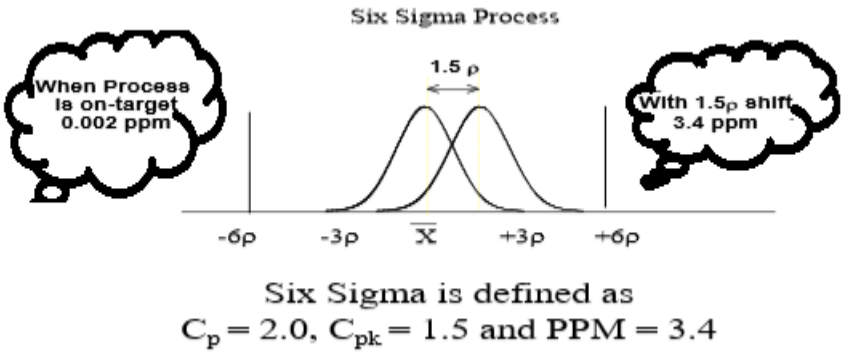

Figure 1. Six Sigma

2. Objective of Six Sigma

Six Sigma's aim is to eliminate waste and inefficiency, thereby increasing customer satisfaction by delivering what the customer is expecting. Six Sigma follows an organized system, and has characterized jobs for the members. Six Sigma is an information driven procedure, and requires exact information assortment for the procedures being broke down.

3. Key Concepts of Six Sigma

At its core, Six Sigma revolves around a few key concepts[30].

- **Critical to Quality:** Attributes generally imperative to the client.
- **Defect:** Failing to convey what the client needs.
- **Process Capability:** What your procedure can convey.
- **Variation:** What the client sees and feels.
- **Stable Operations**: Ensuring reliable, unsurprising procedures to improve what the client sees and feels.
- **Design for Six Sigma:** Designing to address client issues and procedure ability.

Our Customers Feel the Variance, Not the Mean. So Six Sigma concentrates first on lessening process variety and afterward on improving the procedure capacity.

4. Myths about SIX SIGMA

There are several myths and misconceptions encompassing Six Sigma. Some of them are given below[30]:

- Six Sigma is just worried about diminishing deformities.
- Six Sigma is a procedure for creation or designing.
- Six Sigma can't be applied to building exercises.
- Six Sigma utilizes hard to-get insights.
- Six Sigma is simply preparing.

5. SIX SIGMA – Organization

Under a Six Sigma program, the individuals from an association are allocated explicit tasks to carry out, each with a title. This profoundly organized configuration is essential so as to execute Six Sigma all through the association.

There are seven specific responsibilities or "role areas" in a Six Sigma program, which are as follows[30].

- **Leadership**
- **Sponsor**
- **Implementation Leader**
- **Coach /Expert**
- **Team Leader and Team Member**
- **Process Owner**.

6. Literature Review

At the point when a Japanese firm assumed control over a Motorola processing plant that produced Quasar TVs in the United States during the 1970s, they expeditiously set about rolling out exceptional improvements in the manner the plant worked. Under Japanese administration, the manufacturing plant was before long creating TV sets with 1/twentieth the same number of imperfections as they had delivered under Motorola's administration. They did this utilizing a similar workforce, innovation, and structures, and did it while bringing down costs, clarifying that the issue was Motorola's administration. It took some time at the same time, in the long run, even Motorola's own administrators at last conceded "Our quality smells" (Main, 1994). It took until almost the mid-1980s before Motorola made sense of what to do about it. Weave Galvin, Motorola's CEO at the time, began the organization on the quality way known as Six Sigma and turned into a business symbol to a great extent because of what he achieved in quality at Motorola. Utilizing Six Sigma Motorola got known as a quality chief and a benefit head. After Motorola won the Malcolm Baldrige National Quality Award in 1988 the mystery of their prosperity became open information and the Six Sigma transformation was on. Today it's more smoking than at any other time. Despite the fact that Motorola has been battling for as long as scarcely any years, organizations, for example, GE and AlliedSignal have taken up the Six Sigma pennant and utilized it to lead themselves higher than ever of client support and efficiency. It would be a slip-up to believe that Six Sigma is about quality in the conventional sense. Quality, characterized generally as conformance to interior prerequisites, has little to do with Six Sigma. Six Sigma centers around helping the association make more cash by improving client worth and proficiency. To connect this goal of Six Sigma with quality requires another meaning of value: the worth included by a beneficial undertaking. This quality might be communicated as potential quality and genuine quality. Potential quality is the realized most extreme conceivable worth included per unit of information. Real quality is the present worth included per unit of information. The distinction among potential and real quality is squander. Six Sigma centers around improving quality (i.e., lessening waste) by helping associations produce items and administrations better, quicker, and less expensive. There is an immediate correspondence between quality levels and "sigma levels" of execution. For instance, a procedure working at Six Sigma will neglect to meet prerequisites around multiple times per million exchanges. The run of the mill organization works at around four sigma, identical to roughly 6,210 mistakes for every million exchanges. Six Sigma centers around client prerequisites, imperfection anticipation, process duration decrease, and cost reserve funds. Along these lines, the advantages from Six Sigma go directly to the main concern. Not at all like thoughtless cost-cutting projects which likewise decrease worth and quality, Six Sigma distinguishes and dispenses with costs which give no an incentive to clients: squander costs[14].

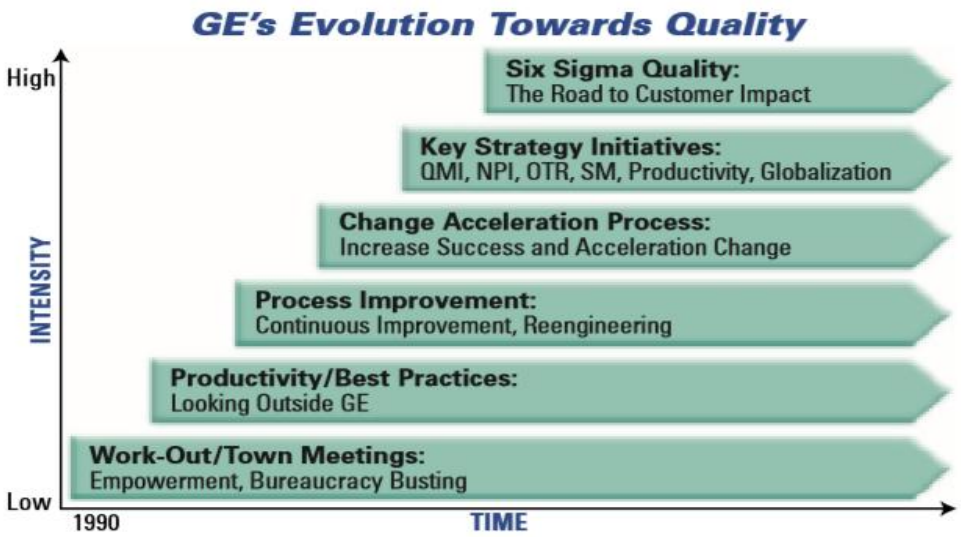

Figure 2: GE's Evolution Towards Quality[12]

The creators have surveyed different research papers from different global diaries and have made. The primary stream characterizes Six Sigma as a lot of measurable devices received inside the quality administration to develop a structure for process improvement (Goh and Xie, 2004[1]; McAdam and Evans, 2004[2]).This authoritative perspective is additionally appeared in crafted by Pheng and Hui (2004[3]), who characterize Six Sigma as a 'social and conviction' framework which manages the association in repositioning itself towards world class business execution by upgrading true basic leadership. Darshak A. Desai (2006) [6] has utilized Six Sigma DMAIC strategy to Improve client conveyance responsibilities in an Indian little scale industry. It was discovered that by virtue of improved conveyance the firm announced around 25% expansion in their turnover by fulfilling existing clients and growing new business. The subsequent stream characterizes Six Sigma as an operational way of thinking of the executives which can be shared gainfully by clients, investors, workers and providers (Chakrabarty and Tan, 2007[7]). Al-Mishari and Suliman (2008)[8] recommend three potential 'entrance ramps' or approaches an association can take to actualize Six Sigma.This regard, a significant number of the productions propose the DMAIC and DFSS techniques as the two most regular strategies to execute Six Sigma, albeit as indicated by Edgeman and Dugan (2008)[9], the primary objectivesof the twotechniquesare very extraordinary. While DMAIC is a critical thinking technique which focuses on process improvement, DFSS is characterized by Watson and DeYong (2010)[16] as "a procedure to characterize, plan and convey imaginative items give aggressively appealing an incentive to clients in a way that accomplishes the basic to-quality attributes for all the huge capacities". Numerous apparatuses and methods that can be applied to Six Sigma ventures are accessible both in the writing and open space, for example Halliday (2005)[5]. Essential devices of DMAIC, commonly utilized at the Yellow-Belt level of capability incorporate flowcharts, check sheets, Pareto graphs, cause/impact outlines, dissipate charts, histograms and Statistical Process Control (Ferrin et al,2005[4]). Comparative definition is given by Schroeder et al (2008[10]) who consider Six Sigma as a sorted out structure utilizing process improvement experts with the point of accomplishing key targets. Albeit the vast majority of these instruments are as of now surely understood and applied in different settings, Six Sigma gives a client concentrated, very much characterized system bolstered by a reasonable arrangement of thorough devices for process improvement (van Iwaarden et al, 2008)[11]. Further developed instruments, for example, relapse investigation (for example with marker factors, curvilinear relapse and calculated relapse), theory testing, control graphs and Design of Experiments regularly highlight at the Black-Belt level. This additionally implies Six Sigma might be seen as a mix of existing devices and strategies accessible well before Motorola built up this methodology (van Iwaarden etal, 2008[11]).Reduce high imperfection rate related with it.[17]. DMAIC methodolgy in certain Serbian metal handling fabricating company[18]. The creators solidly guaranteed that the Six Sigma approach proposed in the paper guarantees quality in instruction, wanted positions in presumed organizations, chance of higher examinations, creating planned business visionaries and higher level of pass outs[19]. A contextual analysis of imperfections decrease in an elastic gloves producing process by applying Six Sigma standards and DMAIC critical thinking methodology[20]. The procedure is executed on one of item gathering for cutting down deformities level which are basic to clients and its usage has had a huge monetary wound up in a real predicament line of the enterprise[21]. At first the Six Sigma DMAIC strategy is examined to sum things up alongside its applications and, points of interest. Additionally the Six Sigma devices are talked about in brief[22]. A diagram of Six Sigma, trailed by exhaustive writing audit on Six Sigma DMAIC stages, utilization of Six Sigma in little medium scale ventures and furthermore in huge assembling industries[23]. Six Sigma DMAIC system to improve a generation procedure of a laser PC Mouse. By working under these subsequent conditions, yield of the utilitarian test methodology increments from 96.2 to 98.6 %[24]. The profitability of the name printing segment shows an expansion by 584 impressions/hour, which is an expansion of 21.93% of the present generation output[25].Various improvement methodologies to decrease the process duration of Patients release process and after its usage; there is a 61% decrease in the process duration of the Patients release process. Likewise, a control plan check sheet has been created to continue the Improvements obtained[26].The idea of coordinating Lean and Six Sigma was supported throughout the years inside associations that picked Lean and Six Sigma to work in solidarity as opposed to autonomously. This is upheld by Ndaita et al. (2015:[27]), Nunes (2015:[28]) and Snee (2010:[13]) and accordingly prompts the accompanying speculation: H0: A relationship exists between the reconciliation of Lean and Six Sigma and an expansion in process execution. H1: A relationship doesn't exist between the reconciliation of Lean and Six Sigma and an expansion in process execution. Utilizing the Six Sigma technique, the dismissal rate is diminished by 13.2% from the current 38.1% of rejection[29].

7. SIX SIGMA has two key Methodologies [30]

DMAIC: It alludes to an information driven quality procedure for improving procedures. This philosophy is utilized to improve a current business process.

DMADV: It alludes to an information driven quality procedure for planning items and procedures. This strategy is utilized to make new item structures or procedure plans so that it brings about an increasingly unsurprising, develop and deformity free execution.

There is one more methodology called **DFSS** - Design For Six Sigma. DFSS is a data-driven quality strategy for designing or redesigning a product or service from the ground up.

Sometimes a DMAIC project may turn into a DFSS project because the process in question requires complete redesign to bring about the desired degree of improvement.

DMAIC Methodology This methodology consists of the following five steps.

Define --> Measure --> Analyze --> Improve --> Control

- **Define:** Define the problem or project goal that needs to be addressed.

- **Measure**: Measure the problem and process from which it was produced.
- **Analyze:** Analyze data and process to determine root cause of defects and opportunities.
- **Improve:** Improve the process by finding solutions to fix, diminish, and prevent future problems.
- **Control**: Implement, control, and sustain the improvement solutions to keep the process on the new course.

We will discuss more on DMAIC Methodology in the subsequent chapters.

DMADV Methodology :This methodology consists of five steps:

Define --> Measure --> Analyze --> Design -->Verify

- **Define**: Define the Problem or Project Goal that needs to be addressed.
- **Measure**: Measure and determine customers' needs and specifications.
- **Analyze**: Analyze the process to meet the customer needs.
- **Design:** Design a process that will meet customers' needs.
- **Verify:** Verify the design performance and ability to meet customer needs.

DFSS Methodology : DFSS is a different and developing order identified with Six Sigma quality procedures. This is a methodical approach using apparatuses, preparing, and estimations to empower us to structure items and procedures that meet client desires and can be created at Six Sigma Quality levels[30].

This methodology can have the following five steps.

Define --> Identify --> Design --> Optimize --> Verify

- **Define**: Define what the customers want, or what they do not want.
- **Identify:** Identify the customer and the project.
- **Design:** Design a process that meets customers' needs.
- **Optimize:** Determine process capability and optimize the design.
- **Verify**: Test, verify, and validate the design.

Six Sigma Goes Upstream: Design for Six Sigma (DFSS)

It is the Six Sigma methodology chipping away at beginning times of the procedure life cycle. It's anything but a technique to improve a present procedure with no principal change in process structure. It will begin at the absolute starting point of the procedure life cycle and use the most integral assets and strategies known today for creating upgraded plans. These apparatuses and techniques are prepared to plug straightforwardly into your present item improvement procedure, or configuration/overhaul of an assistance procedure or interior business process[30].

Design for Six Sigma (DFSS)

Phases Design for Six Sigma has the following four phases[30]:

- Identify requirements
- Characterize the design
- Optimize the design
- Verify the design

8. Six Sigma Belts

These belts are based on level of competence in understanding and applying related tools.

Green Belt : This green belt is a basic analytical tools, it will be works on less complex projects

Black Belt : In this black belt emphasis on application and analysis, work projects with help from green belts.

Master Black Belt: It is mainly used to understand applications and statistical theory behind applications, trains other belts, and leads project reviews.

9. The SIX SIGMA Philosophy

Six Sigma is the use of the logical technique to the plan and activity of the executives frameworks and business forms which empower representatives to convey the best an incentive to clients and proprietors. The logical strategy functions as follows[14]:

1. Observe some significant part of the commercial center or your business.
2. Build up a speculative clarification, or theory, predictable with your perceptions.
3. In view of your speculation, make forecasts.
4. Test your forecasts by leading investigations or mentioning further cautious objective facts. Record your perceptions. Alter your theory dependent on the new realities. In the event that variety exists, utilize factual devices to assist you with isolating sign from clamor.
5. Repeat steps 3 and 4 until there are no discrepancies between the hypothesis and the results from experiments or observations.

10. Six Sigma Process Improvement

In a Six Sigma project, if the Six Sigma team selects the regular Six Sigma process improvement strategy, then a five-stage process will be used to improve an existing process. These five stages are

- Define the problem and customer requirements
- Measure the defects and process operation
- Analyze the data and discover causes of the problem
- Improve the process to remove causes of defects
- Control the process to make sure defects don't recur

This five-step strategy is also called DMAIC (define-measure-analyze-improve-control). We will briefly describe the five steps. Here we assume that the process follows a SIPOC model.

Six sigma and TQM: Six Sigma isn't only a factual way to deal with measure difference; it is a procedure and culture to accomplish greatness. Following its prosperity, especially in Japan, TQM appeared to be famous in associations which lectured quality as qualification for reason, taking a stab at zero deformities with client focus[15]. Despite the fact that TQM was the administration device during the 1980s, by 1990s it was viewed as disappointment and it was discounted as an idea that guaranteed a lot yet neglected to convey. Research by

Turner (1993) has demonstrated that any quality activity should be rethought at customary interims to keep the energy level high. Against this foundation, Six Sigma developed to supplant the 'exhausted' TQM theory. The key achievement factors separating Six Sigma from TQM are: 1. Six Sigma underscores on Statistical Science and estimation. 2. Six Sigma was executed with organized preparing plans at various levels (Champions, Master Belt, Black belt, and Green belt). 3. The task focussed methodology with single lot of Problem Solving Techniques (DMAIC). 4. The Six Sigma usage impacts are evaluated in substantial reserve funds (instead of TQM where the advantages can't be estimated). Evaluation of unmistakable reserve funds is a significant selling point for Six Sigma.

Lean: Lean Thinking was an another quality and profitability improvement technique presented in Toyota Production Systems (TPS) which depends on the idea of disposal of waste in forms which had brought about efficiency increase and improvement of speed and stream in the worth stream. The standard of Lean can be expressed as a persevering quest for the ideal procedure through wastage end in the worth stream. Lean distinguishes three various types of squanders, utilizing Japanese phrasing from the Toyota Production System where lean began: muda (exercise in futility and materials), mura (lopsidedness/variety), and muri (the overburdening of laborers or frameworks). Each worker in a lean assembling condition is relied upon to ponder their activity and make proposals to wipe out waste and to take part in kaizen, a procedure of consistent improvement including meetings to generate new ideas to fix problems [15].

Six sigma vs lean: Both methodologies focus on business processes and process metrics while striving to increase customer satisfaction by providing quality, on time products and services. Lean takes a more holistic view. It uses tools such as value-stream mapping, balancing of workflow, or kanban pull signaling systems to trigger work, streamline and improve the efficiency of processes, and increase the speed of delivery. Six Sigma takes a more data-based and analytical approach by using tools to deliver errorfree products and services, such as the following examples: Voice Of the Customer (VOC) Measurement Systems Analysis (MSA) Statistical hypothesis testing Design of Experiments (DoE) Failure Modes and Effects Analysis (FMEA) Six Sigma uses an iterative five-phase method to improve existing processes. This method is known as Define, Measure, Analyze, Improve, Control (DMAIC), and normally underpins Lean Six Sigma (LSS)[15].

Both procedures center around business procedures and procedure measurements while endeavoring to expand consumer loyalty by giving quality, on time items and administrations. Lean takes an increasingly comprehensive view. It utilizes instruments, for example, esteem stream mapping, adjusting of work process, or kanban pull flagging frameworks to trigger work, streamline and improve the proficiency of procedures, and speed up conveyance. Six Sigma takes an additional information based and systematic methodology by utilizing devices to convey errorfree items and administrations.

11. SIX SIGMA and LEAN Tools

Some of the important Six Sigma tools used for easy reference. Pareto analysis, Control charts and Failure Mode Effect Analysis are explained in detail with examples[15].

Six Sigma Tools	Advanced Tools
Pareto Analysis	Failure Mode Effect Analysis (FMEA)
Flow Process Chart	Design of Experiments (DoE)
Upper Control Limit (UCL) /	Design For Six Sigma (DFSS)
Lower Control Limit (LCL) Control Chart	
Cause and Effect Diagram	
Input-Process-Output Diagrams	
Brain Storming	
Scatter Diagram	
Histogram	
The Seven Wastes	
The Five Ss	

Pareto Analysis : Pareto Analysis is a factual system in basic leadership that is utilized for the determination of a set number of errands that produce critical by and large impact. It utilizes the Pareto Principle (likewise know as the 80/20 standard) the possibility that a vast larger part of issues (80%) are created by a couple of key causes (20%). The Pareto Principle has numerous applications in quality control. It is the reason for the Pareto outline, one of the key devices utilized in absolute quality control and Six Sigma. Seven stages to recognizing the significant causes utilizing Pareto Analysis : 1. Structure a table posting the causes and their recurrence as a rate. 2. Orchestrate the lines in the diminishing request of significance of the causes, for example the most significant reason first. 3. Add an aggregate rate section to the table. 4. Plot with causes on x-hub and combined rate on y-pivot. 5. Join the above focuses to shape a bend. 6. Plot (on a similar chart) a structured presentation with causes on x-pivot and percent recurrence on yaxis. 7. Draw a line at 80% on y-hub parallel to x-hub. At that point drop the line at the purpose of crossing point with the bend on x-hub. This point on the x-pivot isolates the significant causes on the left and less significant causes on the right[15].

Control charts: A control outline is a factual apparatus used to recognize variety in a procedure coming about because of normal causes and variety coming about because

of uncommon causes. It introduces a realistic showcase of procedure soundness or unsteadiness after some time as appeared in Fig. 10. Each procedure has variety. Some variety might be the consequence of causes which are not ordinarily display all the while. This could be extraordinary reason variety. Some variety is essentially the consequence of various, ever-present contrasts simultaneously. This is basic reason variety. Control Charts separate between these two kinds of variety. One objective of utilizing a Control Chart is to accomplish and keep up process soundness. Procedure dependability is characterized as a state where a procedure has shown a specific level of consistency previously and is required to keep on doing as such later on. This consistency is described by a surge of information falling inside control limits dependent on give or take 3 standard deviations (3 sigma) of the centerline. A steady procedure is one that is reliable after some time as for the middle and the spread of the information. Control Charts assist you with observing the conduct of your procedure to decide if it is steady. Like Run Charts, they show information in the time arrangement in which they happened. Nonetheless, Control Charts are increasingly effective that Run Charts in surveying and accomplishing process soundness. Your group will profit by utilizing a Control Chart when you need to screen process variety after some time. 1. Separate between exceptional reason and basic reason variety. 2. Survey the adequacy of changes to improve a procedure. 3. Convey how a procedure performed during a particular period[15].

Failure mode and effects analysis (FMEA): It is a model used to organize potential imperfections dependent on their seriousness, anticipated recurrence, and probability of location. A FMEA can be performed on a plan or a procedure, and is utilized to provoke activities to improve structure or procedure power. The FMEA features shortcomings in the present plan or procedure as far as the client, and is an astounding vehicle to organize and sort out constant improvement endeavors on regions which offer the best return. The subsequent stage is to relegate an incentive on a 1-10 scale for the seriousness, likelihood of event, and likelihood of location for every one of the potential disappointment modes. In the wake of doling out a worth, the three numbers for every disappointment mode are increased together to yield a Risk Priority Number (RPN). The RPN turns into a need an incentive to rank the disappointment modes, with the most elevated number requesting the most dire improvement movement. Mistake sealing, or pokayoke activities are frequently a compelling reaction to high RPN's. Following is a case of a disentangled FMEA for a safety belt establishment process at a car gathering plant[15].

12. Implementing Six Sigma

After nearly two decades of Six Sigma experience, there is currently a strong assemblage of logical research that fruitful organization includes concentrating on few high-influence things. The exercises and frameworks required to effectively actualize Six Sigma are well documented[14].

1. **Leadership**. Leadership's primary role is to create a clear vision for Six Sigma success and to communicate their vision clearly, consistently, and repeatedly throughout the organization. In other words, leadership must lead the effort.
2. **Infrastructure**. Using their newly acquired knowledge, senior leaders direct the development and training of an infrastructure to manage and support Six Sigma.
3. **Communication and awareness.** Simultaneously, steps are taken to "soft-wire" the organization and to cultivate a change-capable environment where innovation and creativity can flourish. A top-level DMAIC project is focused on the change initiative and the communication required to build buy-in of the initiative, as outlined later in this chapter.
4. **Stakeholder feedback systems.** Systems are developed for establishing close communication with customers, employees, and suppliers. This includes developing rigorous methods of obtaining and evaluating customer, owner, employee, and supplier input. Baseline studies are conducted to determine the starting point and to identify cultural, policy, and procedural obstacles to success. These systems are discussed in more detail later in this chapter.
5. **Process feedback systems.** A framework for continuous process improvement is developed, along with a system of indicators for monitoring progress and success. Six Sigma metrics focus on the organization's strategic goals, drivers, and key business processes.
6. **Project selection.** Six Sigma projects are proposed for improving business processes by people with process knowledge at various levels of the organization. Six Sigma projects are selected based on established protocol by senior management to achieve business performance objectives linked to measurable financial results.
7. **Project deployment.** Six Sigma projects are conducted by project teams lead by Black Belts (or by Green Belts with the technical assistance of Black Belts).

13. Impact of SIX SIGMA

Before, nonexclusive and low-end skills, for example, the assembling of printed circuit sheets were redistributed. With Six Sigma Plus, center capabilities were reclassified and control plans set up. By and by, Aerospace Electronics System, Singapore centers around center skills that are exceptional to itself, for example, last get together and test and last arrangement. This balanced out the workforce for the association, which once experienced high turnover for its front-end and low-ability occupations. Squander has additionally been decreased from key business processes[15

Benefits of Six Sigma

Six Sigma offers six major benefits that attract companies:

- Generates sustained success
- Sets a performance goal for everyone
- Enhances value to customers
- Accelerates the rate of improvement
- Promotes learning and cross-pollination
- Executes strategic change

14. Conclusion

1. Six Sigma is a strategy that gives organizations the apparatuses to improve the capacities of their

business forms. Contrasted and other quality activities, the key distinction of Six Sigma is that it applies not exclusively to item quality yet additionally to all parts of business activity. Six Sigma is a strategy for business greatness.

2. Procedure is the essential unit for a Six Sigma improvement venture. Procedure could be an item itself, a help/fabricating process, or an interior business process. Procedure mapping, esteem stream mapping, and procedure the board are successful devices for improving generally speaking execution. Six Sigma process improvement endeavors to improve both procedure execution and procedure ability.
3. Procedure capacity is a proportion of procedure consistency in conveying process execution. Six Sigma capacity is a world-class ability.
4. Six Sigma process improvement is a strategy for improving procedure execution and ability without process update.

References

1. Goh, T. N. and Xie, M. (2004), "Improving on the Six Sigma paradigm", TQM magazine, vol. 16,no. 4, pp.235-240
2. Mcadam, R.and Evans,A. (2004), "Challenges to Six Sigma in a high technology mass manufacturing environments", TotalQualityManagement, vol.15,no.5-6, pp.699-706
3. Pheng,L.S.and Hui,M. S. (2004), "Implementing and Applying SixSigma in Construction", Journal of Construction Engineering and Management,vol.130,no. 4,pp.482-489
4. Ferrin, D.,Miller, M. and Muthler,D. (2005), "Lean sigma and simulation, so what'sthe correlation? V2", in: Proceedingsof the 2005Winter Simulation Conference,4-7 December 2005,Orlando, Florida,pp.2011-2015.
5. Halliday,S. (2005),"Application of Toolsin Six Sigma", http://www.wdpc.co.uk/articles/tools6sig.pdf,lastaccessed 25 November2009.
6. Darshak A. Desai, (2006), ―Improving Customer Delivery Commitments the Six Sigma Way: Case Study of an Indian Small Scale Industry‖ Int. J. Six Sigma and Competitive Advantage, Vol. 2, No. 1, 2006
7. Chakrabarty, A. and Tan,K. C.(2007),"The current state of SixSigma application in services", Managing Service Quality,vol.17,no.2, pp.194-208
8. Al-Mishari, S.T.and Suliman, S. (2008), "Integrating Six-Sigma with other reliability improvement methods in equipment reliability andmaintenance applications", Journal of Qualityin Maintenance Engineering, vol. 14,no.1,pp.59-70
9. Edgeman, R. L. and Dugan, J. P.(2008), "SixSigma fromproductsto pollution to people",Total QualityManagement,vol.19,no. 1-2,pp.1-9
10. Schroeder, R.G.,Linderman,K., Liedtke,C.and Choo, A. S. (2008),"SixSigma: Definition and Underlying theory", Journalof operations management,no.26,pp. 536-554
11. van Iwaarden, J., van DerWiele, T., Dale,B.,Williams, R.and Bertsch,B. (2008), "The Six Sigma improvementapproach: a transnationalcomparison",International Journal of Production Research,vol.46,no.23,pp.6739-6758
12. What Is Six Sigma?The Roadmap to Customer Impact 6σ: file:///C:/Users/user/Desktop/six%20sigma%202020/SixSigma.pdf
13. Snee, R.D., 2010, 'Lean Six Sigma – Getting better all the time', International Journal of Lean Six Sigma 1(1), 9–29. https://doi.org/10.1108/20401461011033130
14. Thomas Pyzdek and Paul A. Keller(2010),"The Six Sigma Handbook A Complete Guide for Green Belts, Black Belts, and Managers at All Levels"Mc Graw Hill; New York Chicago San Francisco Lisbon London Madrid Mexico City Milan New Delhi San Juan Seoul Singapore Sydney Toronto;,pp.1-548.
15. Vivekananthamoorthy N and Sankar S(2010), "Lean Six Sigma ", KCG College of Technology, Chennai Indiaon uploaded 27 May 2014. : https://www.researchgate.net/publication/255910300
16. Watson,G.H.and DeYong, C.F.(2010), "Design for SixSigma: caveatemptor", International Journalof Lean Six Sigma,vol.1,No. 1,pp.66-84
17. Hsiang-Chin Hung and Ming-Hsien Sung, (2011), ―Applying Six Sigma to Manufacturing Processes in the Food Industry to Reduce Quality‖ Scientific Research and Essays Vol. 6(3), pp. 580-591
18. Prof. Dr. Vidosav Majstorović 1, M.Sc. Tatjana Sibalija 1, ―Application of Six Sigma Methodology in Serbian Industry‖
19. K.G.Durga Prasad, K.Venkata Subbaiah, G.Padmavathi, (2012), ―Application of Six Sigma Methodology in an Engineering Educational Institution‖, International Journal Emerging Science, 2(2), June 2012 Issn: 2222-4254, pp222-237
20. Ploytip Jirasukprasert et. Al (2012), ―A Case Study of Defects Reduction in a Rubber Gloves Manufacturing Process by Applying Six Sigma Principles and DMAIC problem Solving Methodology‖, Proceedings of the 2012 International Conference on Industrial Engineering and Operations Management Istanbul, Turkey, July 3 – 6, 2012, pp 472-481
21. Dr. Rajeshkumar U. Sambhe, (2012), ―Six Sigma Practice for Quality Improvement – A Case Study of Indian Auto Ancillary Unit‖, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684 Volume 4, Issue 4 (Nov-Dec. 2012), PP 26-42
22. S.N.Teli, Dr.V.S.Majali, Dr.U.M.Bhushi, Sanjay Patil (2012),―Automotive Product Development Process (APDP) Strategy by Integrating Six Sigma to Reduce the Cost of Quality‖, IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN: 2278-1684 Volume 4, Issue 3 (Nov. - Dec. 2012), PP 40-48
23. Mohit Taneja1, Arpan Manchanda2, (2013), ―Six Sigma an Approach to Improve Productivity in Manufacturing Industry‖ International Journal of Engineering Trends and Technology (IJETT) – Volume 5 Number 6- Nov 2013, pp281-286
24. S. Pimsakul, N. Somsuk, W. Junboon, and T. Laosirihongthong, (2013), ―Production Process Improvement Using the Six Sigma DMAIC Methodology: A Case Study of a Laser Computer Mouse Production Process‖ The 19th International Conference on Industrial Engineering and Engineering Management, DOI 10.1007/978-3-642-37270-4 13, © Springer-Verlag Berlin Heidelberg, pp133-146
25. Joshua Chan Ren Jie, Shahrul Kamaruddin and Ishak Abd Azid (2014), ―Implementing the Lean Six Sigma Framework in a Small Medium Enterprise (SME) – A Case Study in a Printing Company‖, Proceedings of the 2014 International Conference on Industrial Engineering and Operations Management Bali, Indonesia, January 7 – 9, 2014, pp 387396

26. S. Arun vijay (2014), —Reducing and Optimizing the Cycle Time of Patients Discharge Process in a Hospital Using Six Sigma DMAIC Approachǁ, International Journal for Quality Research 8(2), pp 169–182
27. Ndaita, P.M., Gachie, T. & Kiveu, C.W., 2015, 'The implementation of Lean Six Sigma concept at national bank of Kenya – Operation division', The TQM Journal 27(6), 683–690. https://doi.org/10.1108/TQM-06-2015-0078
28. Nunes, I.L., 2015, 'Integration of ergonomics and Lean Six Sigma. A model proposal', Procedia Manufacturing 3, 890–897. https://doi.org/10.1016/j.promfg. 2015. 07.124
29. S. Suresh, a. L. Moe and a. B. Abu (2015), —Defects Reduction in Manufacturing of Automobile Piston Ring Using Six Sigmaǁ, Journal Of Industrial And Intelligent Information Vol. 3, No. 1, March 2015 , pp 32-38
30. Six Sigma :Process improvement approach;tutorials point(2018)p.1-11.

