Six Sigma – Lessons Learnt at GE

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Introduction

Six Sigma is highly disciplined process that help us focus on developing near-perfect products and services and also allow us to improve the existing ones.

Why "Sigma"? The word is a statistical term that measures how far a given process deviates from perfection/expectation. The central idea behind Six Sigma is that if you can measure how many "defects" you have in a process, you can systematically figure out how to eliminate them and get as close to "zero defects" as possible. To achieve Six Sigma Quality, a process must produce no more than 3.4 defects per million opportunities. An "opportunity" is defined as a chance for nonconformance, or not meeting the required specifications. This means we need to be nearly flawless in executing our key processes.

A key difference between Six Sigma and other approaches is the integration of a highly disciplined process (such as DMAIC for **D**efine, **M**easure, **A**nalyze, **I**mprove, **C**ontrol or DMADOV for **D**efine, **M**easure, **A**nalyze, **D**esign, **O**ptimize, **V**erify) with one that is very quantitative and data oriented. The concepts underlying Six Sigma have always made sense. Even Six Sigma becomes more important today because of the following:

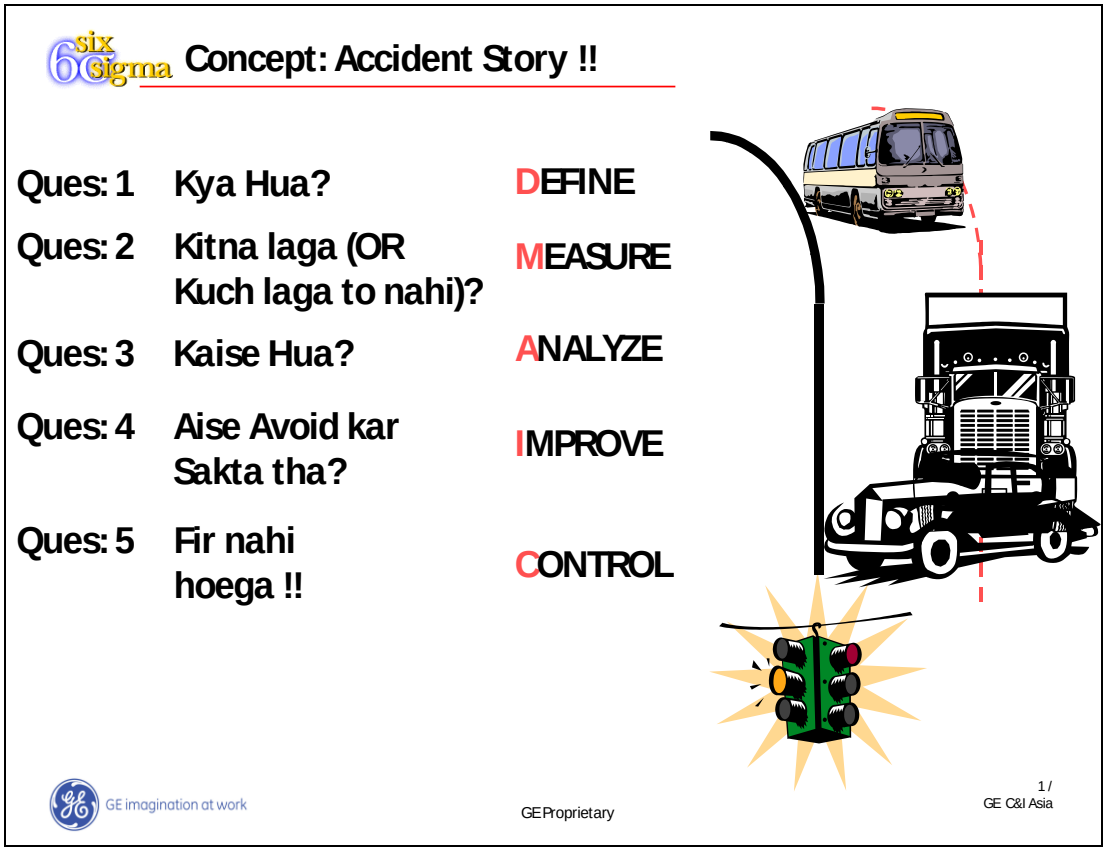
- Extensive globally localized competition.
- Consumer demand for best quality products and organizational recognition of the cost of poor quality.
- Easily available databases for logical conclusions/inferences.

In our regular day-today life, unknowingly we follow Six Sigma methodology- DMAIC. Just to explain the same, consider a common road accident scenario in a typical Indian context.

- Suppose we are riding in a bus as shown in the picture and reach a traffic light where we suddenly see a big truck has bumped into a car from the back. As the picture depicts, the truck is not on the lane it should be whereas there is no clear idea about the car though.

[*] NOTE- Author has not directly referred to any existing papers/articles in writing this paper. If it matches with the views expressed in any existing articles, it is purely coincidental.

- Assume that our bus stops near the accident spot, we get down from the bus and rush to the spot. Typically we will ask the following questions, also, in sequence. We typically look around and ask the questions to the crowd/folks who were there before we reached.



These questions/comments typically explain DMAIC approach for any problem solving. Following explains it in a broader sense-

- In Define phase, one needs to first understand what is the problem, why the problem needs to be solved i.e. to understand the business impact, who all are going to work on it, what's the time frame, etc..
- Measure phase looks for clear measurement metrics and method for the output. If a high level output is not clear, it needs to be drilled to measurable level. Also, need to identify in the first glance, what are the input parameters, and again with their operating ranges. In this step one need to also establish the validity of the output measurement technique/methodology.
- In analyze phase, we first baseline the level of the problem as it is today. In this phase, we typically convert a practical problem into a statistical one. We also test various hypothesis and filter out the relevant inputs, which is impacting your current process.

- As the team starts working together, they suggest some changes to improve the "As Is" process. In Improve phase this is converted again to Statistical measurement. The earlier and today's Statistical indices i.e. Z-score are compared. Also an attempt is made to differentiate both the processes/techniques Statistically.
- Improvement obtained needs to be sustained. Also, the improvement shall not be person/team dependent. In Control phase, procedures for sustaining the improvement are documented. Also, documentation of whole efforts is also a typical activity carried out in this phase.

Lessons:

In 1995, Jack Welch introduced Six Sigma to General Electric (GE). He mentioned we would build on the successful experiences of other organizations such as Motorola and Allied Signal. Since then, many organizations have introduced or improved Six Sigma by adapting best practices from GE and elsewhere.

Any list of Six Sigma lessons learned is a work in progress. It will evolve as we continue to learn. This article is again one more drop in the ocean. While much of what I say will be agreed/not-agreed by Six Sigma practitioners, I welcome your comments. There are many articles on what are the key lessons learned about Six Sigma. My list builds on my own experiences during my 7-year career with GE.

1: Business Management Commitment

First and most important point is the enthusiastic commitment and support of Top management. This approach if it is driven by top down approach which yields good alignment of expectations to efforts.

It is unlikely Six Sigma would have succeeded at GE without CEO Jack Welch's (and now Jeff Immelt's) leadership. What are needed are both an up-front investment in funding and a system that actively rewards successful implementation and implementers.

At each business level, if Business Leader is made responsible of the initiative then she/he establishes the whole team and implementation becomes smooth.

2: Infrastructural support

A formal supporting infrastructure is required to execute this activity. Management's commitment includes establishing and supporting such an infrastructure. This basically means setting up the formal organization e.g. Quality Leader, MBB, BBs, etc. defining roles and responsibilities, a budget for the process and clear measurement matrix. This process needs to be closely integrated with the existing system.

3: Career path for Six Sigma Team

When we select best suited for Six Sigma job, there is a need to show a clear career path for BBs and MBBs. They should not only excel technically but also be imaginative and persuasive leaders. These jobs demands more people oriented personalities rather than

knowledgeable not open-minded. At GE, for example, MBBs are likely candidates for subsequent upward management positions. Six Sigma roles really becomes a jumping pad where the work focus is more horizontal than vertical. This gives ample area to choose next assignment.

4: Trainings

Once the organization decides to implement Six Sigma in their operations, first milestone is the Training and the related training material, tools, etc. Some organizations outsource training. It's also advisable to build the internal team as Train-the-Trainer so that organizational flavor can be added easily. A few points to be considered are-

- Trainers need to be knowledgeable and fantastic communicators. They need to keep the class live by bringing in a lot of relevant and generic examples. Organizational examples or areas where it can be applicable are always good to refer.
- Identify a set of trainers and maintain a pool of trainers. In-rotation trainers are a good suggestion though in the beginning it becomes difficult.
- Training material needs to be customized along with the case studies or examples. This often requires deviations from and extensions to previously developed materials. As the emphasis is on the training material, it continues to be on the associated tools. Both need to be Inc.
- Do not forget to take a feedback from the class on Trainers as well on contents of the course.
- Common vocabulary of Six Sigma i.e. in teaching, communication and across group/business presentations.
- Decide the right training matrixes for each Six Sigma stage i.e. for GB, BB and MBB.
- Encourage the Six Sigma team to attend/present in conferences and similar forums.

Generic trainings are good but many times different functional needs to be recognized in keeping training fully relevant as Six Sigma moves from the manufacturing to other functions.

5: Tool Library

Trainings without sufficient tools are like facing a war bare handed. Statistical and other tools form the backbone of Six Sigma. Generic tools like Minitab surely helps analyze many things. But for various other concepts e.g. Quality Function Deployment (QFD), Failure mode and effect Analysis (FMEA), Design of Experiments (DOE)—specific tools are found useful because they are usually not covered in our regular educational curriculum, so needs extra efforts.

Basically Six Sigma becomes powerful if the tools are rooted into a process and immediately put to practical use. Six Sigma is therefore much more than a toolbox. With experience, some tools have been found to be more important than others.
One caution in tools usage- output of every tool needs to be analyzed practically. Never Statistics out Engineering/Technical understanding.

The basic concepts of Six Sigma, such as a highly disciplined data oriented approach to quality improvement, are directly applicable to all operations, but the relative importance of specific tools varies from one operation and one business to another.

6: Curriculum

In Six Sigma team, organization can structure their champions as master black belts, black belts, and green belts—each with designated responsibilities. As Six Sigma implementation progresses, revisiting the responsibilities are advisable. For GB/BB/MBB, decide on the depth of the training contents as well project expectations. For additional learning, organization can go for tollgates as the project progresses and final presentation to experts/management. GE has designed online tests for refreshing the learning's.

7: Project Selection and Execution

All the above steps and investment does not make sense if the learnings are not applied to right problem and of course at right time. Project shall not be force fit of the Six Sigma concepts. Even in the beginning stages, project selection needs to be tighter exercise. Project broad definition approval matrix must be designed for the same. Many organizations define "x" amount monetary benefit out of the project as a minimum criteria. Also, it can be mapped from Cycle Time, manpower savings, etc. Overall, a clear organizational expectations needs to be set before giving go-ahead for the project execution. Team composition also plays an important role in the overall project execution cycle. Each team members role and responsibilities in the project execution must be defined clearly alogwith the timelines. Total management commitment, appropriate infrastructure, involvement of top people and the right training set the stage for success and result in high expectations. All Six Sigma projects need be selected judiciously. This is particularly critical for start-up projects.
Early bird projects can be of small duration e.g. 3 months, etc so as to catch the low-hanging fruit. In the beginning, DMAIC methodology based projects are advisable rather than directly jumping into DFSS.

Once the project is complete, share the same with the bigger team. This creates interest in the team members. A successful start, built on accepted and highly demonstrable successes, will expedite the path forward.

8: "Big Picture" Approach: Focus on the Entire System

Before initiating any action, it is a must to understand the Big Picture, though the project aims at solving a small portion of it. Once a big picture is clear, bigger problems

can be divided into small individual problems with clear critical to quality characteristics (CTQs).

Many times these CTQs are frequently closely related, so there is a need to evaluate the impact and associated cost of any action on all other important CTQs. Basically, the focus needs to be on overall system improvement rather than on the improvement of any individual CTQ.

9: Focus on Customer CTQ's than internal Improvements

As the project execution progresses, there are chances that the focus in on internal improvements rather than a significant impact on the bottom-line. In overall Six Sigma implementation and project execution, customer shall not feel left out.
A few examples of direct customer CTQs are time to delivery, waiting time to respond to customer enquiries, customer service, etc.

GE extended these concepts through its ACFC (at the customer, for the customer) initiative. Its purpose is to train customers in Six Sigma and help them in the start-up process, including mentoring them on specific projects.

10: Encompass Commercial Quality

While addressing customer CTQs, many times an internal improvement comes in limelight e.g. need to design a pricing or discount mechanism, strategy on collections, vendor developments, etc. This shall be immediately addressed which really helps the backroom operations as well as to customers, adding to other project improvements/deliverables.

11: Data Collection

Six Sigma calls for a disciplined customer-focused approach to quality improvement, resting on the principle "In God we trust, all else bring data." Also, it's commonly said, "data never lies". Unfortunately, the data that are readily available, even though sometimes voluminous, are often insufficient for the task at hand. This is because the data were obtained for reasons other than analysis or data was recorded/noted not considering the relevant information. So, it becomes necessary to obtain the additional information again. Also, data on every unit or every part isn't available or can't be obtained. In experimental analysis, it's also possible that each reaction takes days/months for the output. In such cases its advisable to select a sample and collect for the set. This is because it is the quality rather than the quantity of the data that counts.

12: Data Analysis

Given two sets of data, usually we just look at the average i.e. Mean of both the data sets and comment on the process. In Six Sigma approach, its said that customer not only look at the Mean i.e. how well you are on Target but also Variance i.e. how many times you are consistent? So, focus needs to be on reducing variability, and not just improving the mean. All natural processes follow normal distributions. So, if data obtained is non-

normal then the analysis needs to be done accordingly. Sampling also plays a crucial role in this phase. Also, it's commonly said that the same data can be looked/analyzed in many ways. This fact also shall be kept in mind while concluding or while taking inferences.

13: Reliability

Each product design has both short- and long-term functioning. Short-term quality is reflected by customer delight in on-time delivery. For major products (e.g. washing machines, bearings, automobiles, rail engines, aircraft engines) demand is sustaince of effective functioning i.e. reliability for such products, quality is reflected by high reliability (error free operation) over many years.

Thus, a key goal in a Six Sigma program is to design products for long life and high reliability.

14: Don't force fit tools

In every Six Sigma project execution, the goal shall be to improve the performance but not to show off usage of concepts/tools. Many tools are very powerful and have much applicability, but they are not equally relevant for all situations and need be used judiciously.

Avoid showing off the Six Sigma terminologies than the real usage.

15: Recognize Business Impact

"Every problem has a solution"….. question is how to quantify the solution achieved. Many times the solution is reduction of cycle time or reduction of defects, manpower efficiency improvement, etc. These are easy to quantify in terms of per hour increase in production, increase in sales or rework reduction, savings on input efforts, respectively.

A significant element of Six Sigma is the quantifying of hard number savings i.e. achieved Business impact. It's a bit complicated task to quantify in terms of currency e.g. because of ACFC efforts, increase in immediate sales. One of the suggestions here is to involve Finance section from the start of the project.

16. Conclusions/Communications/Documentation

All Six Sigma projects needs to be closed with a conclusion or action items with owners and timeline. It must be communicated to entire team. This really helps take down the outcome of the project to all functions.

As the Six Sigma project execution penetrates various functions, one of the important steps is to document the efforts in terms of internal reports. This helps share best practices and the document can be referred in anytime in future for reference. Dedicated intranet website for Six Sigma is suggested to have this done effectively.

17: DFSS Introduction and Implementation

Always it's good to aim at low hanging fruits by first implementing DMAIC. As the organizational acceptability of the concepts progresses, it's always good to look beyond. Next step on this is to bring in Design for Six Sigma (DFSS) concepts. Both in a way are complimentary to each other e.g. if there is a existing product and you are getting number of complaints then we just look at the complaint feature and fix it or improve on it. Clearly this is DMAIC. Next step to this is to come out with a totally new product. This is DFSS. One may call it a New Product Introduction or New Technology Introduction. Thus, DFSS becomes an integral element of Six Sigma, with long-term payoffs. For DFSS, different set of trainings needs to plan on DMADOV process. Thus, the basic implementation process is DMADOV, with its emphasis on design, in place of the closely related DMAIC, which emphasizes improvement.

18. Innovation

As DMAIC and DFSS focuses on improvement and coming out with new products, Innovation needs to be emphasized. Many times we take few abnormal outcomes as obvious. The output needs to be digested for the reason. Organization must look at each and every new business opportunity in a systematic way so that innovativeness also brings in business in the long term.

19. Celebrations

In the introduction of Six Sigma every success, small or big, needs to be celebrated with cross-functional teams. This needs to be rapidly followed by solid evidence of successful applications resulting in important quality improvements. Every celebration needs talking about and referred to in the beginning phase. One of the suggestions on this is to distribute visible mementos to the celebrating team members.

20: Cultural Change

In GE, Six Sigma is used as a culture change. This brings-in boundaryless working and teams across the globe together. Sometimes people say that Six Sigma brings in bureaucracy but it's the other way. Once processes are established, it hardly matters who is working i.e. focus shifts from person to process. Yes, people might think putting up process as a bureaucracy. In real sense, it's not!!

This indeed, is a price one pays for a highly disciplined process (such as DMAIC, project tollgates). It has, however, resulted in criticism, especially from those in the trenches who perhaps experience some frustration in the added work or possible delay that might result from Six Sigma.

21: Everyone needs to get into the Game !!

Once credibility for Six Sigma is established, you need to leverage the momentum. The goal should be to make Six Sigma all pervasive within the organization and beyond i.e. for vendors, suppliers, customers, etc. The initial distinction between Six Sigma projects

and other projects should disappear, as Six Sigma becomes “the way we work and the way we lead.”

22: Six Sigma: Everytime, Everywhere - Everything !!

As Six Sigma gets implemented in every function within an organization and also extended to suppliers, vendors and customers, it may no longer be every time in the lime light news. This should not come as a surprise and certainly should not imply that now it has become irrelevant. It shall be taken as way to work. The momentum can be retained by continued successful and broader applications. Best practices need to be sought and implemented, as Six Sigma truly becomes the way we work.

Closure:

So what will Six Sigma look like in, say, next two, five or ten years from now? Six Sigma calls for a disciplined customer-focused approach to quality improvement. The above-mentioned concepts will be as important in the future as they are today.

Global competition and customer demands will continue to call for continuous quality improvement, coupled with cost reduction. Thus the pressures that lead to Six Sigma in the first place are unlikely to abate, and will in all likelihood, increase. A disciplined and proactive approach to quality improvement that puts the customer first continues to make great sense and will ensure that we move forward in an organized manner.

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