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Significance of Sigma Team in Implementing Six Sigma Strategy in Industry :A Review

Ajay Krishnarao Madhale
Asst.Prof., Department of Production Engineering,
KIT's College of Engineering, Kolhapur.

***Abstract*:- To compete in today's world, every business needs to improve. Improvement can include better design of goods and services, reduction of manufacturing defects and service errors, more streamlined and efficient operations, faster customer response, better employee skills—clearly the list can go on and on. And the all goals can be achieved by the Six Sigma Technique. Six Sigma is one of the most popular approaches embraced by companies all over the world during the last two decades to achieve business excellence. The Six Sigma approach was first introduced and developed at Motorola in the late 1980s. This concept was brought in by engineer Bill Smith while working at Motorola in 1986, it is continuous quality improvement process. The main objective of this paper is to review and examine the steps in implementing Six Sigma in industries and key tools of each step in implementing Six Sigma project execution. In this paper the roles of Six Sigma team members are examined through the case study. The case study includes the information and statistical data of the Ford Company and General Electrics (GE), in addition to that the team members and their roles in the project and the training given to the employees to achieve desired Six Sigma Goals followed by what they learned from Six Sigma Technique. The Six Sigma Technique is best technique to improve industries, business, organizations, etc.**

Keywords*:- *Six Sigma Technique, Motorola, Bill Smith, reduction of manufacturing defect, Six Sigma Goals

I. INTRODUCTION

Global information society improves quality of life, but puts a lot of pressure on the manufacturing and service organizations to cut costs, improve productivity, reduce cycle time, reduce defects, reduce inventories, floor space, etc. Six sigma is the result of culmination of quality concepts. Various quality management strategies have been applied for continuously quality improvement for the customer's satisfaction. There are several different Quality Concept and many different opinions of what should be encompassed in the concept of product quality. "The quality of a product is its ability to full fill the customer's needs and expectations." Quality needs to be defined firstly in terms of parameters or characteristics, which vary from product to product. Quality is a necessary characteristic for Industrial Engineers to observe, study, and understand. Process improvements often begin at an analysis of the level of quality in a system or organization.

Six Sigma was created at Motorola in the 1980s. As a result, Motorola became the first recipient of America's Malcolm Baldrige National Quality Award in 1988. Six Sigma is one of the last additions in the field of quality improvement methods and (or) business process improvements methods. Six sigma became popular because of the involvement of many leading organizations. Although Motorola initiated six sigma, GE embraced six sigma in 1995. Six sigma resulted in better GE products. Many organizations are entering into six sigma and launching six sigma initiatives by using Black Belt, Green Belt, etc. American Society for Quality (ASQ) has been very active and supportive of six sigma. Six Sigma, is a quality strategy, based on customer focus and driven by data rather than assumptions and experience. Today six sigma is considered to be one of the enablers of prosperity for every sector of industry including IT, automobiles, etc.

II. DEFINITION OF SIX SIGMA

Six sigma can be defined as *"A business process that allows organizations to drastically improve their bottom line by designing and monitoring everyday business activities in ways that minimize waste and resources while increasing customer satisfaction"*.

Six sigma is defined by GE as *"A vision of quality which equates with only 3.4 defects per million opportunities for each product or service transaction and strives for perfection"*.

III. SIX SIGMA PROCESS MODELS

Six sigma is a disciplined process, which helps the companies to focus on developing and delivering nearly perfect products and services by avoiding variations in the process. There are a few six sigma models for process improvement.

1. DMAIC:

The first one is DMAIC. It is a five step process improvement model as explained in Fig.1

Fig.1DMAIC Model

Define: This is the first phase of the process improvement effort. During this phase, the six sigma project is defined. In this specially the voice of customer & their requirements and project goals.

Measure: This step involves measurement of performance, data collection, comparing the data to customer survey, etc.

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Analyze: The team discovers the causes for defects. They identify the key variables which cause the defect or which are mostly likely to cause or create a process variation. For this purpose, a cause and defect diagram can be used.
Improve: Improve the process performance by eliminate root cause of variation. Develop creative plans and implement the plan.
Control: in this phase, tools are put in place to ensure that the key variables remain within the maximum permissible ranges continuously**.**

2. DMADV:
The second method for process improvement is DNADV. DMAIC is used for improving existing process, whereas the DMADV is employed for design of new products, which aim at achieving six sigma quality. It is defined in the following Fig.2

Fig.2 DMADV Model

Define: Define phase is similar to DMAIC. Six sigma team gets a charter for the new design.
Measure: During this step, the organization may need to use Quality Function Deployment or House of Quality. They should also define the performance standards, i.e. the expected performance of the new product or process.
Analyze: The team has to design the concept or top level design for the new project. They should generate various design options. They should evaluate and finally select the right option.
Design: At this stage, the detailed design of the product or process is carried out. Detailed design involves identifying the finer details and identifying all the required steps. Finally it is the system integration that take place.
Verify: The last step is verification. At this stage, the functionality of the process or product is verified.

IV. SIX SIGMA IMPLEMENTATION

Six sigma implementation varies from organization to organization. In larger organization, six sigma is implemented in three levels as given below;

- **Business level**
- **Operations level**
- **Process level**

This indicates the hierarchy of activities in the organization. Six sigma should be implemented in a seamless manner at all the three levels.
To achieve six sigma, at the business level, it may take a few years. At the operation level it may take about 12-18 months and in the process level, the black belt may take 6-8 weeks to complete the project. *The ultimate objective of six sigma is to achieve business success through defect free operations by controlling variations at the process.*

After nearly two decades of Six Sigma experience, there is now a solid body of scientific research that successful deployment involves focusing on a small number of high-leverage items. The activities and systems required to successfully implement Six Sigma are well documented.
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. Their primary responsibility is to ensure that Six Sigma goals, objectives, and progress are properly aligned with those of the enterprise as a whole. This senior leadership training in the philosophy, is done by modifying the organization such that personnel naturally pursue Six Sigma as part of their normal routine. This requires the creation of new positions and departments, and modified reward, recognition, incentive, and compensation systems. The Six Sigma deployment will begin with principles, and tools they need to prepare their organization for success.
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.
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.

V. ROLES OF TEAM MEMBERS (CHAMPIONS, MBB, BB, GB HOLDERS)

TABLE 1: COMPARISON OF ROLES OF CHAMPIONS, MASTER BLACK BELTS, BLACK BELTS, & GREEN BELTS

	Champion	**Master black belt (MBB)**	**Black belt (BB)**	**Green belt (GB)**
Qualification	Senior executive and managers	Should have technical degree. MBB may	Technical degree or orientation. BB might be	Technical and sound support backgroun

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	such as VP or director of manufacturing or marketing. Familiarity with basic and advanced statistical tools is required	be a chief engineer or head of customer relations service. Mastery of basic and advanced statistical tools is required	an engineer or a billing administrator. Mastery of basic statistical tools is essential	d. Their current positions should be associated with the problem needed to be solved. Familiarity with basic statistical tools is a must
Training	One week of champion training	One-to-two-week training session. BB training is highly recommended	One-to-four-week sessions with three weeks between sessions to apply strategy to the assigned projects. project revive is made in second, third and fourth sessions	Two-to-three-day sessions with three weeks between sessions to apply strategy to the assigned projects. Projects review are made in the second session
Number of employees trained	One champion per business group or manufacturing site	One MBB per 30 BBs. MBBs do not have to be onsite. They can represent a division	One BB per 100 employees 100,000 would require 1,000 BBs	One GB per 20 employees

VI. SIX SIGMA AT FORD

Ford Motor Company entered into six sigma in the late 1990s. They called it *Consumer Driven 6-Sigma.* Soon after launching Consumer Driven 6-Sigma, Black belt teams worked to define the "Top 25" customer concerns across all vehicle lines. Top customer concerns were identified within business processes as well. Since its inception at Ford about $1 billion in reduced waste. In 2002, it saved Ford $359 million world-wide, including $186 million in North America operations. Most projects follow the DMAIC model. There are also Design for Six Sigma (DFSS) projects underway.

Ford currently maintains a pool of 2200 Black Belts from all areas of Ford Motor Company. Black belts serve two-year assignments, full time before they move back into the mainstream positions within the company. So far more than 40,000 Green Belts have been trained world-wide.it is expected that all salaried and many hourly employees will be trained as Green Belts by 2004. More than 6000 consumer driven Six Sigma projects have been completed to date.

TABLE 3: TEAM MEMBERS AND THEIR ROLES IN THE PROJECT

Team	Function	Team Role	Task and Involvement
M. Fischer	Engineer	Black Belt	Lead the project Data pla n Tools and methods
A. Eisele	Master Black Belt	Master Black Belt	Input of experience Coaching by tools and methods
R. Höfner	Area Manager	Project Champion	Provide resources for project
R. Schmitt	Maintenance	Process Owner	Provide resources for project
H. Nagel	Engineer	Production, subject matter expert	Test trials from production side
W. Kretschmer	Engineer	Engineering subject matter expert	Consumption recording Research for automatic equipment
S. Schmidt	Foreman	Maintenance, subject matter expert	Test trials and research
J. Buchholz	Foreman	Maintenance, subject matter expert	Test trial s and research
F. Scholtes	Foreman	Maintenance, subject matter expert	Test trials and research
U. Michelbach	Foreman	Maintenance, subject matter expert	Test trials and research
S. Bronder	Financial Analyst	Financial analys t	Cost-benefit analysis
J. Pink	Superintendent (responsible manager) supplier	Product Expert	Test trails material properties

VII. RESULTS ACHIEVED BY FORD

Because of the project's results, Ford's global Six Sigma organization nominated the team to compete in ASQ's International Team Excellence Awards (ITEA) process. The project earned finalist honors, and team members had the opportunity to present their project at the 2011 World Conference on Quality and Improvement.

Eisele says this project was a strong candidate for the competition because it was a cross-functional team that included members from production, maintenance, quality, manufacturing engineering, and the supplier*: "They worked together as a team in an excellent way, proving the power of a team and the sum of competencies in a team."*

VIII. SIX SIGMA AT GE

GE started its quality initiative in late 1980s. They claim that the Six Sigma is embedding quality thinking, process thinking across every level and in every operation of their company around the globe. There are three key elements of quality for GE as explained below:

i. The customers – Delighting Customers

Customers are the GE's universe, they define quality. They expect performance, reliability, competitive prices, on-time delivery, service, clear and correct

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transaction processing and more. Delighting customers is the necessity, because if don't do it, someone else will.

ii. The Process – Outside-In Thinking

Quality requires them to look at their business from the customer's perspective and not from their own perspective. In other words, they look at process from outside-in. By understanding the transaction life cycle from the customer's need and processes, they can discover what the customer is seeing and feeling. With this knowledge, GE identified areas where they can add value or improvement from the customer's perspective.

iii. The Employee – Leadership Commitment

They believe that people create results. Involving all employees is essential to GE's quality approach. GE is committed to provide opportunities and incentives for employees to focus their talents and energies on satisfying the customer. All GE employees are trained in the strategy and statistical tools and technique of six sigma quality. Employees are provided with the following trainings:

- Basic Six Sigma awareness
- Team Training – basic tool introduction to equip employees to participate on Six Sigma teams
- Master Black Belt, Black Belt and Green Belt training
- Design for Six Sigma Training: to prepare the teams for the use of statistical tools to design the product and processes right the first time.

They believe that quality is the responsibility of every employee. Every employee must be involved, motivated and knowledgeable if the organization has to succeed .Six Sigma focuses on reducing process variation and then on improving the process capability.

There are considerable savings claimed through the practicing of Six Sigma. Motorola, the initial champions of Six Sigma, credited it with over $4 billion manufacturing cost saving and a doubling of productivity over a period of 6 years. General Electric has claimed the following benefits from the application of Six Sigma:

- Reduced quality cost from 20% to less than 10% of sales;
- Saved $300 million in the first year of Six Sigma, raising to $2 billion in the third year;
- Operating margins stuck at about 10% for decades soared to 16.7% in less than three year.

The initial results were a 50% reduction in in time to bring product from inception to market, whilst adding 6% to its bottom line each year. With Six Sigma resulted in a 68% reduction in fault levels and a 30% reduction in product costs, which led to a near $9000 million savings per year.

IX. CONCLUSION

From the study done on the manufacturing industries in 21st century we conclude that Six Sigma is indeed an organization strategy that can provide a continuous improvement in this competitive area. The key strategy for successful implementation of Six Sigma is that the industry applying it should follow a correct methodology and use the correct tools and techniques. Hence for this Six Sigma Team is very crucial for identifying correct methodology and correct tools and techniques. Which gives an effective and great benefits to the organizations. This study will help manufacturing industries to motivate and form Six Sigma Teams at their organization. The results achieved by the FORD and GE are mentioned below;

TABLE 2: TEAM EXCEEDED ALL PROJECT GOALS (FORD)

Goals	Target	Result
Reduce costs	$1.5 million annually	$2 million annually
Improve customer satisfaction	127.000 ppm reduction	129.000 ppm reduction
Reduce environmental impact	Lower VOCs by 50.000 kg annually	VOCs reduced 70.000 kg annually

TABLE 4: RESULTS AFTER SIX SIGMA PROJECT AT GE

Item	Initial situation	After Six Sigma project
Sales	£10 m	£10 m
Cost of sales	£9m	£8.65 m
Waste	£0.7m	£0.35 m
Profit	£1m	£1.35 m
profit	10%	13.5%

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