

# The Basics of Six Sigma

**Six Sigma's pedigree can be traced to the concept of Total Quality Management (TQM), but it is different from approaches like TQM, Business Process Reengineering (BPR), Benchmarking or Business Excellence, in terms of the bottomline focus and intensity of application. Industry experience has shown that Six Sigma does work. If applied correctly, it can be the key to enhancing customer experience by adding to the bottomline.**

**W**hile conducting an audit of a Public Sector Undertaking, an auditor has to give a separate Report under section 619(3)(a) of the Companies Act, 1956, on the accounts of auditee company to the Comptroller and Auditor General of India, New Delhi. In the recently amended format of such report, in Annexure I, under the head 'Productivity', auditors have to answer one important question, which is:

What type of process improvement and variation reduction measures are being used by the management? Is the management applying programmes such as Six Sigma in this connection?

What exactly is Six Sigma? Let us find out.

## Origin of Six Sigma

During the 1970s, Japanese electronic goods attracted American customers because they were cheaper and of better quality. This became a real economic threat to the US. Bob Galvin, CEO of Motorola, asked his workers in 1981 for a tenfold improvement in product failure over the previous five years. Another Motorola Engineer, Bill Smith, carried out an in-depth study of the problem and concluded that defects should be eliminated from both the process and the final product, at design and production stage itself, to avoid detection and rejection/rework. It was an engineer called

Mikel Harry who, along with Bill Smith, introduced the concept of Six Sigma at Motorola during the 1980s. Richard Schroeder helped Harry popularise the concept, and it began to be actively used from the mid-1990s.

## Meaning of Six Sigma

Six Sigma is a business strategy that gives a definite competitive edge if rightly implemented. It is a proven methodology that delights customers with 'cheaper, better and faster' products/services and generates profits to keep the owners and workers of the organisation inspired and motivated. It seeks to identify and eliminate causes of errors or defects in business processes by focusing on outputs that are critical to customers. The vital point in Six Sigma is 'Measurement'. It is a measure of quality that strives for near-elimination of defects using the application of statistical methods. A defect is defined as anything that could lead to customer dissatisfaction. The defect has to be reduced in a measured way and not through subjective descriptions such as 'we have drastically reduced the defects'. The following quotation on Numerical Representation by Mikel Harry and Richard Schroeder in Six Sigma, the Breakthrough Management Strategy may be of interest here:

*"We don't know what we don't know*

*We can't do what we don't know*

*We don't know until we measure*

*We don't measure what we don't value*

*We don't value what we don't measure."*



— CA. Jayant M. Ranade

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The fundamental objective in the Six Sigma methodology is the implementation of a measurement-based strategy that focuses on process improvement and variation reduction. Sigma is a standard deviation indicating the measure of deviation from the mean; it is the measure of any variation or defect in a process/activity. Six Sigma deals with strategies of continuous improvement and defect reduction to achieve a quality standard of not more than 3.4 defects per million opportunities (DPMO). In today's business environment, the Six Sigma standard is synonymous with excellence.

**Example 1:**

- Precision Tool: Grade 'A' has 2000-2100 rounds per minute (rpm)
- Any tool having less than the above rpm is a defective supply
- Such defects/disputes lead to enormous financial loss

One	Sigma means defects in	70	consignments out of	100
Two	Sigma means defects in	309	consignments out of	1000
Three	Sigma means defects in	668	consignments out of	10000
Four	Sigma means defects in	621	consignments out of	100000
Five	Sigma means defects in	223	consignments out of	1 million
Six	Sigma means defects in	3.4	consignments out of	1 million

- One Sigma Quality Standard means 30% (100 – 70)
- Two Sigma Quality Standard means 69.1% (1000 – 309/10)
- Three Sigma Quality Standard means 93.3% (10000-668/100)
- Four Sigma Quality Standard means 99.4% (100000-621/1000)

- Five Sigma Quality Standard means 99.9767% (1 million – 223/10000)
- Six Sigma Quality Standard means 99.99966% (1 million – 3.4/10000)

**Example 2:**

- A purchase order/contract should be issued within sixty days of tender opening.
- Any supply order/contract issued after sixty days is a defect.
- Such defects lead to delays/financial loss/disputes.

One Sigma means 70 defects out of 100

Three Sigma means 688 defects out of 10000

Six Sigma means 3.4 defects out of 1 million

**Example 3:**

- Supply of filters for equipment.
- Minimum performance requirements: 2000 hours.

● A filter that fails before 2000 hours is defective

Two Sigma means 309 defectives out of 1000

Six Sigma means 3.4 defectives out of 1 million

Generally Sigma is expressed as PPM (parts per million) or DPMO (defects per million opportunities).

**Importance of Six Sigma**

India is one of the most favoured destinations for outsourcing because of factors like availability of talent pool, good telecom infrastructure, favourable government policies, stable economic environment and, above all, cost arbitrage benefits. However, other countries like Australia, China, the Philippines and Ireland are also fast emerging as close competitors in the ITES/BPO sector. Hence, to sustain its competitive advantage, India needs to move up the value chain by offering the twin advantage of

superior quality along with cost arbitrage. Many multinational companies such as GE, Motorola, FedEx, Sony, DuPont, Texas Instruments, Citibank, etc. already implement Six Sigma. Wipro became the first Indian Company to implement the program in May 1997.

### Applicability of Six Sigma

- Wherever people work
- Production, Manufacturing, Service
- Purchasing, Inventory Management, Maintenance, Finance, Marketing, Safety, HRM
- In a nutshell, to all processes and products of all organisations/institutions.

It is worth noting that the 'dabbawallas' of Mumbai excel in Six Sigma.

### Terms Used in Six Sigma

#### (a) 'Champion'

- A manager/leader of senior rank
- Has a positive outlook.
- Oversees and supports Projects done by 'Black Belts' and 'Green Belts'.
- Breaks down barriers and rigidity
- Helps to select the Project.
- Helps provide funds and benchmarking wherever needed.

#### (b) 'Master Black Belts' (MBB)

An MBB should be expert in Six Sigma implementation with a proven track record. Initially, an MBB should be an outsider. With the development of Six Sigma culture, outstanding Black Belts who have sound knowledge of statistics related to Six Sigma could be promoted as MBBs.

#### Here's what an MBB does:

- Helps Champions select Projects and people to run it.

- Provides full training to Black Belts and the people who do Six Sigma projects.
- Brings about a radical change in work culture of the organisation and changes human resource into appreciating human capital.

#### (c) 'Black Belts'

They are from within the company. People selected for Black Belt training should have a positive outlook. They are trained by a Master Black Belt. A Black Belt is in charge of a Project, and works full-time on it till it's completed successfully.

#### Qualities a Black Belt Should Have:

- An open mind with leadership and functional skills. He should be proactive.
- Fully dedicated to the Project. He should have faith in making the impossible possible, and always change for the better.
- Full faith in the innovativeness of his people.

Black Belt Training: Classroom training is for four weeks (160 hours). After each training week, three weeks' practical work on the training project is done at the workplace. So the total period for a project is 4-5 months. MBBs can be consulted during practical work if needed. A Black Belt should preferably be computer-friendly.

#### (d) 'Green Belts'

- Normally one week of classroom training.
- They work with Black Belts to complete the project.
- On excellent performance they can be promoted as Black Belts.

People love to work on Six Sigma projects with dedication as their value goes up after the certification.

### Other Terms:

DMAIC	:	Define, Measure, Analyse, Improve, Control
DFSS	:	Design For Six Sigma
R&R	:	Repeatability & Reproducibility
DOE	:	Design Of Experiments
PONC	:	Price Of Non-Conformance
COPQ	:	Cost Of Poor Quality
PFMEA	:	Process Failure Mode And Effect Analysis
OFAT	:	One Factor At A Time
SPC	:	Statistical Process Control
DPU	:	Defects Per Unit
CTQ	:	Critical To Quality
DPMO	:	Defects Per Million Opportunities
UCL	:	Upper Control Limits
LCL	:	Lower Control Limits

### Environment for Six Sigma

It is necessary that an environment conducive to Six Sigma training and implementation is created in the organisation or unit. Initiative can be taken by the TQM head or HRD head to make a brief presentation before top executives regarding the benefits of Six Sigma. Thereafter, at the instance of the top executives, a one-day programme may be organised for all the departmental heads or sectional heads of the organisation or the unit respectively as the case may be.

Top executives must also attend this meeting, which is conducted by a Master Black Belt. This meeting will highlight the experiences of various organisations that have implemented Six Sigma and succeeded in delighting customers and enhancing profits to the benefit of the organisation and its people. The 'high price of non-conformance' and 'cost of poor quality' is explained with real examples. The methodology of Six Sigma is then explained in detail.

The most important aspect, the power of the people, has to be emphasised. The leader must 'own' the team. A mechanic or operator can be the best change agent if an environment of innovativeness is created by the leader. An open mind and transparency are prerequisites. People

must be convinced that the new technique will bring benefits to them. The Master Black Belt must clarify any doubts that executives might have.

The training should tune up the minds of the executives to prepare and inspire people in their departments and sections to come forward enthusiastically in implementing Six Sigma.

### Implementation of Six Sigma

The five steps of implementation of Six Sigma are:

*DMAIC: Define & Measure, Analyse, Improve, Control*

#### Define & Measure:

- One-week classroom Black Belt training on 'Define & Measure', followed by three weeks practical at workplace. Practical work will be done based on the classroom training received.
- The team at the workplace should consist of people actually involved in the work. The

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Champion and the Black Belt will play their roles as mentioned above.

- The leader of the team should fully own the team and his role should be clearly defined.
- Full involvement of the team, particularly frontline, and also the help of customer/internal customer is needed in selection of

problems.

- The process whose problems are affecting the customer the most may be selected for bringing improvement. Thus the project for the team will be to improve the selected process continuously till Six Sigma is achieved. This should be within a reasonable time frame. The objective of the project should be well understood by all team members.
- A flowchart is prepared giving details of all the activities of the process under consideration. The help of the frontline should be taken in preparing the flowchart. The input and output variables of the process should be indicated in details. 20% of key variables may be selected which are causing 80% of the problems (known as Pareto Law).
- The team should bring out elements such as 'critical-to-quality' which have maximum

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impact on the result—and therefore on the customer/internal customer.

- Right measurement data is key to the success of Six Sigma project. Frequency of defects and number of opportunities should be measured. DPMO should be worked out.

### Analyse:

- Black Belt classroom training for one week followed by three weeks actual practice on the project at the workplace. Statistics

training is also given to the Black Belt during this phase.

- Statistical training must include the basic seven quality tools: Flowchart, Run (Trend) Chart, Pareto Chart, Scatter Diagram, Cause & Effect Diagram, Histogram, and Control Chart.
- Statistical analysis in detail is done at this stage. Various statistical tools (including the seven basic quality tools) root cause analysis, brainstorming, etc. are used for analyzing the vital variables, particularly areas relating to customer-driven CTQ.
- Current performance measures should be compared with the best in class, and the gap analysed. As an interim measure, benchmarking may be done for the key performance measures with the best-in-class, wherever the gap is wide.
- At this stage there should be a clear picture of when and where the defects occur, and what the root causes are.

### Improve:

- Training one week plus on job three weeks.
- DOE or 'design of experiment' when done properly is key to improvement phase. Here it can be worked how change in input variables affect the output variables.
- Action plan for improvement is prepared and implemented.

### Control:

- Training one week plus on job three weeks.
- 'Walk the talk' needed.
- SPC is an important tool for the control phase of the process/project.
- Monitoring and control of the modified process to continue and corrective actions to be taken so that Six Sigma level is attained and sustained. □