



SIX SIGMA FUNDAMENTALS

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SIX SIGMA

Six Sigma (6 σ) is a set of techniques and tools for process improvement. It was introduced by American engineer Bill Smith while working at Motorola in 1986. A six sigma process is one in which 99.99966 % of all opportunities to generate some feature of a part are statistically expected to be free of defects.

METHODOLOGY (DMAIC)

The DMAIC model is very similar to the PDCA (Plan-Do-Check-Act)

Table 1.1 Mapping of PDCA with Six Sigma DMAIC model

Plan	Define
Plan	Measure
Plan	Analyze
Do/Check	Improve
Act	Control

Tool	Description
<i>Define</i>	
SIPOC (supplier-input-process-output-customer)	Tool to describe and understand a process more clearly. Supplier can also be interpreted as “source of inputs” or “who supplies the inputs,” and customer can be interpreted as the “recipient of the outputs.”
Is-is not analysis	Tool helpful in defining a problem. Oftentimes, understanding what is not a problem will help the team zero in on areas that are a problem. This saves a significant amount of time during problem solving.
Timeline of events	Tool used to understand the problem through a sequence of events (one event leads to another)
Trend chart	Tool used to understand process trends (favorable and unfavorable) from historical events of data
Run chart	Tool used to understand process patterns from historical data
Process flowchart	Graphical representation of the sequence of interrelated activities
Current state map	A value stream map that represents the current state of a process
GANTT chart	Management of schedule, resources, cost, and risk used in project management
Stakeholder analysis	Tool used to understand the people who are influential to a project and those who offer resistance coupled with their level of involvement in a project

<i>Measure</i>	
Data collection plan	Plan describing what, why, where, when, who, and how of data collection (5W1H). Prior to collecting data, having a detailed collection plan can help make collection more effective.
Measurement systems analysis (MSA)	Analysis of the capability of a measurement system (tools, methods, people, environment, etc.)
Benchmark	Start by setting the current baseline for the process
Process capability	Ability of the process to meet expected output. Often represented by indices Cp and Cpk (the higher the indices, the better).
Tool	Description
<i>Analyze</i>	
Why-why	Method of continuing to ask “why” on a problem symptom until the root cause is reached
Hypothesis tests	Statistical methods to test hypothesis on process improvement
Statistical sampling	Statistically valid sampling (e.g., power and sample size, acceptance sampling)

Improve

Design of experiments	Tool for understanding cause and effect in a process and for optimizing process variables to achieve improved performance
Future value stream map	Creates a “should be” future state value stream with non-value-added process steps removed
Theory of constraints	Tool for understanding bottlenecks
FMEA	Tool to evaluate potential risk and prioritize actions
Poka-yoke (mistake proofing)	Concept that prevents errors from happening in processes and products by “designing in” controls

<i>Control</i>	
Process behavior chart	Tool to help understand the behavior of a process by analyzing historical patterns and trends
Control plan	Document that provides basic information on what is required to manage a process during the manufacturing or service delivery
Process audit	Tool to verify compliance of a process as per the specification
Cost of quality	A measure that captures the cost of conformance and the cost of nonconformance; often represented as a ratio comparing to the revenue or cost of goods sold of an organization

REFERENCES

1. <https://sixsigmastudyguide.com/total-quality-management-and-six-sigma/>
2. <https://www.lucidchart.com/blog/8-total-quality-management-principles>