



Six Sigma Method

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Abstract: Six Sigma is built on principles and methods that have proven themselves over the twentieth century. It has incorporated the most effective approaches and integrated them into a full program. It offers a management structure for organizing continuous improvement of routine tasks, such as manufacturing, service delivery, accounting, nursing, sales, and other work that is done routinely. Further, it offers a method and tools for carrying out improvement projects effectively.

1 Six Sigma in a Nutshell

From the late 1980s onward, many companies started programs aimed at quality and efficiency improvement under the name *Six Sigma*. Motorola was the first company to organize its improvement activities under this name, but it was, in particular, the program's adoption in 1995 by General Electric that gave it enormous momentum. It borrows many principles and techniques from twentieth-century quality engineering and industrial statistics, but its impact and completeness set it apart from earlier comparable initiatives. It could be seen as a successor of initiatives such as *Taguchi's methodology*, the Shainin method, and total *quality management*^[1]. An overview of relevant literature is provided by Brady and Allen^[2].

The approach is often characterized by its emphasis on decision making based on quantitative data, its focus on bottom-line results, and its customer-driven approach. From the perspective of business economics, Six Sigma is a program for organizing project-wise improvement of routine operations in companies. It offers a template organizational structure in which project leaders are named *black belts* or *green belts*, and project owners are named *champions*. To the project leader, Six Sigma offers a stepwise strategy and an extensive collection of techniques and methods; De Koning and De Mast^[3] provide a reconstruction of the method based on a multitude of sources.

A substantial part of the techniques and methods that Six Sigma prescribes for projects consist of methods borrowed from industrial statistics and quality engineering; Hoerl^[4] gives an overview of a typical curriculum of a Six Sigma black belt course. Typical methods used in Six Sigma projects are statistically *designed experiments*, *gauge R&R* studies, and process capability analysis. In addition to these statistical and quality engineering tools, the program offers techniques borrowed from marketing and *project management*.

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Six Sigma's stepwise strategy is often referred to as *DMAIC*, which stands for its main phases *define, measure, analyze, improve, and control*. The objective of these phases can be described as follows^[5]:

Define: problem selection and benefit analysis.

Measure: translation of the problem into a measurable form and measurement of the current situation.

Analyze: identification of influence factors and causes that determine the behavior of critical to quality (CTQ) characteristics.

Improve: design and implementation of adjustments to the process to improve the performance of the CTQ characteristics.

Control: empirical verification of the project's results and adjustment of the process management and control system in order that improvements are sustainable.

In many accounts, these five phases are further subdivided into steps^[5]. The program prescribes that problems are quantified and parameterized in the form of indicators called *CTQ characteristics*. Improvement actions are based on the discovery of causal influence factors, sometimes called *leverage variables* or *the X's*.

After 2000, the Six Sigma method has been integrated with the Lean approach. Lean expresses the systematic pursuit of waste reduction in organizations. Lean focuses on efficiency, aiming to provide products and services that customers want at the lowest cost and as fast as possible. Lean and Six Sigma are complementary. Lean can benefit from the management structures and the scientific method that Six Sigma offers. Six Sigma projects—especially the ones pursuing efficiency improvement and speed—can benefit from the standard solutions that Lean offers. The Lean Six Sigma method has been described by De Mast *et al.*^[5].

Related Articles

Sigma Metric (Sigma Level); Sigma Level of a Process; Process Capability, Error in Estimation of; Process Capability Plots; Process Capability Indices, Comparison of; Process Capability Indices, Alternatives to; Multivariate Process Capability Indices, Comparison of; Control Charts and Process Capability; Quality Control; Quality Assurance.

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