

# Six Sigma: Another Statistical Technique or a Business Improvement Approach?

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Andres E. Diaz, P. Eng., MBA, PMP  
Hunter Business Group Inc.  
[www.hunter-inc.com](http://www.hunter-inc.com)

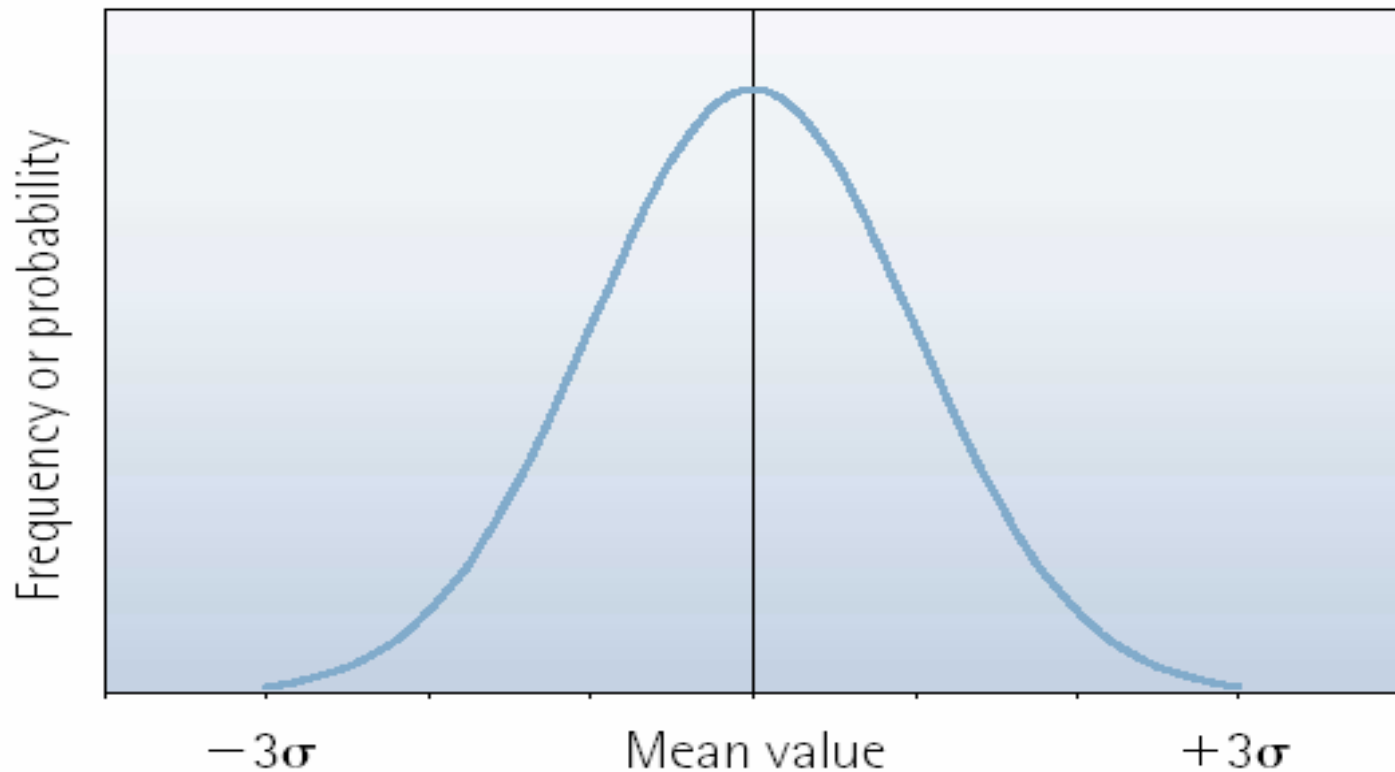
# Sigma: A measure of variation of a set of data around the mean



- Sigma: Greek alphabet letter used in statistics represent the standard deviation of a group of outcomes.
- Standard deviation: Variation from the average in a group of outcomes.

# Sigma: A measure of variation of a set of data around the mean

Figure 27.4 Shape of the normal distribution



# Sigma: A measure of variation of a set of data around the mean



- Within one standard deviation (+/-) of the mean value 68% of all outcomes occur.
- Within two standard deviations (+/-) of the mean value 95% of all outcomes occur.
- Within three standard deviations (+/-) of the mean value 99.7% of all outcomes occur.
- Within six standard deviations (+/-) of the mean value 99.9997% of all outcomes occur.

# The meaning of Six Sigma



- The term "Six Sigma" refers to the ability of highly capable processes to produce output within specifications.
  - In particular, processes that operate with six sigma quality produce at defect levels below 3.4 defects per one million opportunities (DPMO) or a yield of 99.9997%.
  - Six Sigma's implicit goal is to improve all processes to that level of quality or better.

# The meaning of Six Sigma



- Let us assume that you have a process that is performing at 99% yield.
  - When the process performs and delivers 400,000 outcomes, 4,000 will be defective.
  
- Let us know assume that your yield is 99.9997 %
  - When the process performs and delivers 400,000 outcomes, 1.2 will be defective.
  - **So?**

# The meaning of Six Sigma



- A dissatisfied customer will tell 9 to 10 people about an unhappy experience.
- The same customer will tell only five people if a problem has been solved and handled satisfactorily.
- 31% of customers who experience service problems never register complaints.
- Of that 31%, about 9% will do repeat business with the company.
- And who installs and delivers technology to support business processes? **IT does!**

# The evolution of Six Sigma



- In 1987, the United States government introduced the Malcolm Baldrige National Quality Award.
  - This award is presented annually by the president and is designed to provide an operational definition of business excellence.
- Two key aspects of the Baldrige Award are the promotion of best practice sharing and the establishment of a benchmark for quality systems that focused on customer satisfaction as a primary driver of business design and execution.

# The evolution of Six Sigma



- The first company to win the Baldrige was Motorola.
  - It recognized the need for focused quality improvement, and the award simply confirmed it had an approach and deployment of metric based, customer focused quality that would lead to the current Six Sigma.

# The evolution of Six Sigma



- **Six Sigma**, as a set of improvement practices, originally began in the 1980s in Motorola to systematically improve processes by eliminating defects.
- A few years later (1995) General Electric and Allied Signal, under the helm of CEO Jack Welch, decided to implement Six Sigma throughout the organization. The reported improvements and cost savings were about \$ 320 million within two years.

# The evolution of Six Sigma



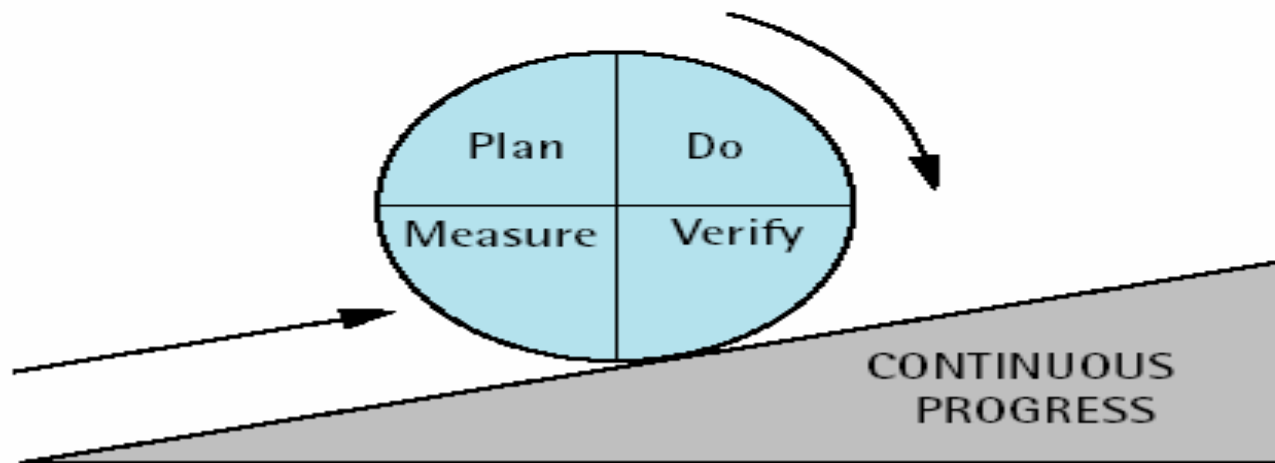
Like its predecessors, Six Sigma asserts the following:

- Continuous efforts to reduce variation in process outputs is key to business success
- Manufacturing and business processes can be measured, analyzed, improved and controlled
- Succeeding at achieving sustained quality improvement requires commitment from the entire organization, particularly from top-level management.

# The evolution of Six Sigma

Figure 4.5 Deming's quality wheel: A continuous circular process

**Plan:** Organize everything that needs to be done  
**Do:** Take action on those things that have been planned  
**Verify:** Check that all the work has been done  
**Measure:** Analyze the results  
Are there any anomalies? Improve



# Six Sigma as a management approach

## ■ The Six Sigma difference:

- Data and facts driven approach.
- Processes: where the action is.
- Committed and proactive management.
- “Boundaryless” collaboration.
- Well defined set of methodologies and analytical tools.

# Six Sigma as a management approach



## ■ Methodologies.

- Six Sigma has two key methodologies: DMAIC and DMADV, both inspired by W. Edwards Deming's Plan-Do-Check-Act Cycle.
- DMAIC is used to improve an existing business process.
- DMADV is used to create new product or process designs for predictable, defect-free performance.

## ■ DMAIC

- Basic methodology consists of the following five steps:
  - 📄 **Define** the process improvement goals that are consistent with customer demands and enterprise strategy.
  - 📄 **Measure** the current process and collect relevant data for future comparison.
  - 📄 **Analyze** to verify relationship and causality of factors. Determine what the relationship is, and attempt to ensure that all factors have been considered.
  - 📄 **Improve** or optimize the process based upon the analysis using techniques like Design of Experiments.
  - 📄 **Control** to ensure that any variances are corrected before they result in defects. Set up pilot runs to establish process capability, transition to production and thereafter continuously measure the process and institute control mechanisms.

## DMADV

- Basic methodology consists of the following five steps:
  - 📁 **Define** the goals of the design activity that are consistent with customer demands and enterprise strategy.
  - 📁 **Measure** and identify CTQs (critical to quality), product capabilities, production process capability, and risk assessments.
  - 📁 **Analyze** to develop and design alternatives, create high-level design and evaluate design capability to select the best design.
  - 📁 **Design** details, optimize the design, and plan for design verification. This phase may require simulations.
  - 📁 **Verify** the design, set up pilot runs, implement production process and handover to process owners.

# The new roles



- **Belts, Executives and Champions – What Does It All Mean?**
  - Six Sigma professionals exist at every level – each with a different role to play. While implementations and roles may vary, here is a basic guide to who does what.
  - At the **project** level, there are black belts, master black belts, green belts, yellow belts and white belts. These people conduct projects and implement improvements.

# The new roles



## ■ Black Belt:

- Leads problem-solving **projects**. Trains and coaches project teams.

## ■ Green Belt:

- Assists with data collection and analysis for Black Belt **projects**. Leads Green Belt projects or teams.

## ■ Master Black Belt:

- Trains and coaches Black Belts and Green Belts. Functions more at the Six Sigma **program** level by developing key metrics and the strategic direction. Acts as an organization's Six Sigma technologist and internal consultant.

# The new roles



## ■ Yellow Belt:

- Participates as a project team member. Reviews **process** improvements that support the project.

## ■ White Belt:

- Can work on local problem-solving teams that support overall projects, but may not be part of a Six Sigma project team. Understands basic Six Sigma concepts from an awareness perspective.

📄 Source ASQ definitions

# The new roles



Every project needs **organizational** support. Six Sigma executives and champions set the direction for selecting and deploying projects. They ensure, at a high level, that projects succeed, add value and fit within the organizational plan.

- **Champions/Sponsors:** Translate the company's vision, mission, goals and metrics to create an organizational deployment plan and identify individual projects. Identify resources and remove roadblocks.
- **Executives (Leadership Council):** Provide overall alignment by establishing the strategic focus of the Six Sigma program within the context of the organization's culture and vision.

# Six Sigma as a management approach

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# Process View of Organizations



- A process is a transformation of inputs into outputs and can be represented, at the highest level of abstraction, as a “black box”.
  
- Process architecture/structure
  - Inputs, outputs and process boundaries
  - Flow units
  - A network of activities and buffers
  - Resources (capital and labour)
  - Information structure

# Process View of Organizations



- Activity is the simplest form of transformation to be considered
  - Pure transformation activities
  - Auditing/inspection activities
  - Represented by boxes
- The Network describes the specific precedence relationships
  - Represented by solid arrows
- Buffers represent storage point between activities
  - Represented by triangles
  - “Sink” is a buffer with no exit or return network

# Process View of Organizations: Process attributes



## ■ Process cost

- Total cost incurred in producing and delivering the outputs

- Cost drivers?

## ■ Process flow time

- Total time needed to transform a flow unit from input into output

# Process View of Organizations: Process attributes



- Process flexibility
  - Ability of the process to produce and deliver desired product variety
  
- Process quality (CTQs)
  - Ability of the process to produce and deliver quality products

# Process View of Organizations: Process attributes



- Process performance
  - Efficiency or internal performance: Ability of the process to develop, produce and deliver products or services at the lowest possible cost/effort
  
  - Effectiveness or external performance: Ability of the process to meet customers' demand in terms of their exact quality, quantity, time, and location requirements

# Implementation Approaches



- Revolutionary
  - Company wide ‘way of thinking’ change (i.e. Jack Welch)
  - Long Term Effort
  - Significant Long Term Benefits
  - Top Management Support
  - World Class Organization
  - Strategic Competitive Advantage

# Implementation Approaches



- Evolutionary
  - ‘Low Hanging Fruit’
  - Individual Processes
  - Quick Benefits limited to certain areas
  - Limited Bureaucratic hurdles
  - Low Cost of implementation
  - Sense of Ownership
- Combination
  - Revolutionary Analysis
  - Evolutionary Implementation

# Any questions?

## Thanks GT ISLIG

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