

By Echem Nkem Jacob Certified Lean Six Sigma Black Belt (**CSSBB**)

Jankech® Quality Services Ltd



What is Six Sigma?

- Six Sigma is a rigorous, focused and highly effective implementation of proven quality principles and techniques.
- The word Sigma is a statistical term that measures how far a given process deviates from perfection.
- The central idea behind Six Sigma:
 - If you can measure how many "defects" you have in a process, you can systematically figure out how to eliminate them and get as close to "zero defects" as possible and specifically it means a failure rate of 3.4 parts per million or 99.9997% perfect.
- A Six Sigma defect is defined as anything outside of customer specifications, the strategic intention of the business or organizational goal.
- The fundamental objective of the Six Sigma methodology is the implementation of a measurementbased strategy that focuses on process improvement and variation reduction through the application of Six Sigma improvement projects.
- This is accomplished through the use of two Six Sigma sub-methodologies: DMAIC and DMADV.

6σ As a Goal

Goal→highest level of process performance possible.



Sweet Fruit Design for Six Sigma

Bulk of Fruit Process Characterization and Optimization

Low Hanging Fruit Basic Tools of Problem Solving

Ground Fruit Simplify and Standardize

6σ As a Philosophy

- The philosophical perspective views all work as processes that can be defined, measured, analyzed, improved and controlled.
- Processes require inputs (x) and produce outputs (y).
- If you control the inputs, you will control the outputs. This is generally expressed as y = f(x).



6σ As a Set of Tools

- The Six Sigma expert uses qualitative and quantitative techniques to drive process improvement.
- A few such tools include
 - statistical process control (SPC),
 - control charts,
 - failure mode and effects analysis,
 - process mapping.
 - Pareto diagram
 - Cause and effect evaluation
 - Affinity diagram
 - Correlation and regression analysis
- Six Sigma professionals do not totally agree as to exactly which tools constitute the set.



6σ As a Methodology

- This view of Six Sigma recognizes the underlying and rigorous approach known as DMAIC (define, measure, analyze, improve and control).
- DMAIC defines the steps a Six Sigma practitioner is expected to follow, starting with identifying the problem and ending with the implementation of long-lasting solutions.
- While DMAIC is not the only Six Sigma methodology in use, it is certainly the most widely adopted and recognized.



6σ As a Metric

In simple terms, Six Sigma quality performance means 3.4 defects per million opportunities (accounting for a 1.5sigma shift in the mean).



Sigma Levels

"Sigma Level" is:

- A statistic used to describe the performance of a process relative to the specification limits
- The number of Standard Deviations from the Mean to the closest specification limit of the process



The likelihood of a defect decreases as the number of Standard Deviations that can be fit between the Mean and the nearest spec limit increases.

Sigma calculation

• To calculate the sigma level of a process the method below is useful

No of opportunities – No of defects

No of opportunities

Example 1: A lubricant blending company produces and distributed 40,000 4 litre bottles in a week to their customers. Out of the 40,000 bottles, 1,243 were discovered to be defective by the customers who complained of the defects.

calculate the production process sigma level.

```
Sigma level = 40,000 - 1,243 \times 100 = 96.89
```

40,000

The blending plant is producing at 96.89 % error free level

Checking from the table overleaf the sigma level is btw 3.3 and 3.4

In a million opportunities the defects (DPMO) will be between 28,700 and 35,900 defects.

Six Sigma Conversion Table

Yield	DPMO	Sigma	Yield	DPMO	Sigma	Yield	DPMO	Sigma
6.6%	934,000	0	69.2%	308,000	2	99.4%	6,210	4
8.0%	920,000	0.1	72.6%	274,000	2.1	99.5%	4,660	4.1
10.0%	900,000	0.2	75.8%	242,000	2.2	99.7%	3,460	4.2
12.0%	880,000	0.3	78.8%	212,000	2.3	99.75%	2,550	4.3
14.0%	860,000	0.4	81.6%	184,000	2.4	99.81%	1,860	4.4
16.0%	840,000	0.5	84.2%	158,000	2.5	99.87%	1,350	4.5
19.0%	810,000	0.6	86.5%	135,000	2.6	99.90%	960	4.6
22.0%	780,000	0.7	88.5%	115,000	2.7	99.93%	680	4.7
25.0%	750,000	0.8	90.3%	96,800	2.8	99.95%	480	4.8
28.0%	720,000	0.9	91.9%	80,800	2.9	99.97%	330	4.9
31.0%	690,000	1	93.3%	66,800	3	99.977%	230	5
35.0%	650,000	1.1	94.5%	54,800	3.1	99.985%	150	5.1
39.0%	610,000	1.2	95.5%	44,600	3.2	99.990%	100	5.2
43.0%	570,000	1.3	96.4%	35,900	3.3	99.993%	70	5.3
46.0%	540,000	1.4	97.1%	28,700	3.4	99.996%	40	5.4
50.0%	500,000	1.5	97.7%	22,700	3.5	99.997%	30	5.5
54.0%	460,000	1.6	98.2%	17,800	3.6	99.9980%	20	5.6
58.0%	420,000	1.7	98.6%	13,900	3.7	99.9990%	10	5.7
61.8%	382,000	1.8	98.9%	10,700	3.8	99.9992%	8	5.8
65.6%	344,000	1.9	99.2%	8,190	3.9	99.9995%	5	5.9
						99.99966%	3.4	6

Common of Lean 6σ Principles



Features of Six Sigma





Design for Six Sigma: DMADV roadmap



Origin of Six Sigma

- Originated in the early 1980s at Motorola
- Championed by Bill Smith and assisted by Mikel Harry
- A collection and articulation of quality principles and tools developed by different quality gurus of all ages
- Harry and R. Schroeder of (Asea Brown Boveri)
 (ABB) measured the financial impact.
- Jack Welch of General Electric pioneered the leadership involvement



Benefits of Six Sigma

Six Sigma Benefit: Increases Revenue

Before processes were improved, 200 loans were successfully funded per month. Inefficient processes = less revenue.

- Lean Six Sigma increases your organization's revenue by streamlining processes.
- Streamlined processes result in products or services that are completed faster and more efficiently at no cost to quality.

After processes were improved, 600 loans were successfully funded per month. More funded applications = more revenue.

 Simply put, Lean Six Sigma increases revenue by enabling your organization to do more with less – Sell, manufacture and provide more products or services using fewer resources.

Benefits of Six Sigma Benefit: Decreases Costs

Before processes were improved, 2 out of 4 computers had broken screens. More defects = increased costs.

- Six Sigma decreases your organization's costs by:
- Removing "Waste" from a process. Waste is any activity within a process that isn't required to manufacture a product or provide a service that is up to specification.

After processes were improved, No computers had broken screens. Less defects = decreased costs.

• Solving problems caused by a process.

Problems are defects in a product or

service that cost your organization money.

 Basically, Six Sigma enables you to fix processes that cost your organization valuable resources.

Benefits of Six Sigma

Six Sigma Benefit: Increases Efficiency

Before processes were improved, 1 doctor could only see 4 patients successfully. Decreased efficiency = less successful patient visits.

- Six Sigma improves the efficiency of your organization by:
- Maximizing your organization's efforts toward delivering a satisfactory product or service to your customers

Allowing your organization to allocate resources/revenue produced from your newly improved processes towards growing your business

After processes were improved, 1 doctor could see 9 patients successfully. Increased efficiency = more successful patient visits.

 Simply put, Six Sigma enables you to create efficient processes so that your organization can deliver more products or services, with more satisfied customers than ever before.

Benefits of Six Sigma

Six Sigma Benefit: Develops Effective People

Basically, Six Sigma develops a sense of ownership and accountability for your employees.

Six Sigma develops effective employees within your organization by:

- Involving employees in the improvement process. This promotes active participation and results in an engaged, accountable team.
- Building trust. Transparency throughout all levels of the organization promotes a shared understanding of how each person is important to the organization's success.

This increases their effectiveness at delivering results for any improvement project they are involved in.

Quite often, this benefit is overlooked by organizations who implement Six Sigma, but it's underlying advantages dramatically increase the chances of continued success of Six Sigma, and your business.

Who Should Embrace Six Sigma

- Large Corporations
- Small Medium Enterprises
- Manufacturing Businesses
- Servicing Enterprises
- Financial Institutions
- Technology Organizations
- Healthcare Industry
- All organizations including yours.

Organizational Roles for Six Sigma Leadership

A leadership team or council defines the goals and objectives in the Six Sigma process. Just as a corporate leader sets a tone and course to achieve an objective, the Six Sigma council sets the goals to be met by the team.

Leadership Responsibilities include:

- Defines the purpose of the Six Sigma program
- Explains how the result is going to benefit the customer
- Sets a schedule for work and interim deadlines
- Develops a mean for review and oversight
- Support team members and defend established positions

Organizational Roles for Six Sigma Sponsor

- Six Sigma sponsors are high-level individuals who are committed to its success.
- Six Sigma is generally sponsored by a fulltime, high level champion, such as an Executive Vice President.
- Sponsors are often the owners of processes and systems, who help initiate and coordinate Six Sigma improvement activities in their areas of responsibilities.

Organizational Roles for Six Sigma Team Leader

- Responsible for supervising the Six Sigma team effort,
- Supports the leadership council by ensuring that the work of the team is completed in the desired manner.
- Oversees work of the team
- Ensures success of the implementation plan
- Solves problems as they arise,
- Trains team members as needed.
- Communicates with the sponsor in defining project goals and rationale
- Assisting sponsors in motivating the team
- Picking and assisting team members and other resources, keeping the project on schedule, and keeping track of steps in the process as they are completed

Organizational Roles for Six Sigma Team Members

 Execute specific Six Sigma assignments and work with other members of the team within a defined project schedule, to reach specifically identified goals.

Organizational Roles for Six Sigma

Coach

 Coach is a Six Sigma expert or consultant who sets a schedule, defines result of a project, and who mediates conflict, or deals with resistance to the program.

• He

- Provide advice and counsel to Executive Staff
- Provide training and support
 - In class training
 - On site mentoring
- Develop sustainability for the business
- Facilitate cultural change

Six Sigma has three key methodologies:

- **DMAIC:** It refers to a data-driven quality strategy for improving processes. This methodology is used to improve an existing business process.
 - **DMADV:** It refers to a data-driven quality strategy for designing products and processes. This methodology is used to create new product designs or process designs in such a way that it results in a more predictable, mature and defect free performance.
- DFSS Design For Six Sigma. DFSS is a data driven quality strategy for designing or redesigning
 a product or service from the ground up. Sometimes a DMAIC project may turn into a DFSS
 project because the process in question requires complete redesign to bring about the desired
 degree of improvement

DMAIC

This methodology consists of the following five steps.
Define -> Measure -> Analyze -> Improve -> Control

- **Define:** Define the problem or project goal that needs to be addressed.
- **Measure:** Measure the problem and process from which it was produced.
- Analyze: Analyze data and process to determine root cause of defects and opportunities.
- Improve: Improve the process by finding solutions to fix, diminish, and prevent future problems.
- Control: Implement, control, and sustain the improvement solutions to keep the process on the new course.

DMADV

Thismethodologyconsistsoffivesteps:Define -> Measure -> Analyze -> Design -> Verify

- **Define:** Define the Problem or Project Goal that needs to be addressed.
- Measure: Measure and determine customers' needs and specifications.
- Analyze: Analyze the process to meet the customer needs.
- **Design:** Design a process that will meet customers' needs.
- Verify: Verify the design performance and ability to meet customer needs.

DFSS/DIDOV

Define -> Identify -> Design -> Optimize -> Verify

- **Define:** Define what the customers want, or what they do not want.
- Identify: Identify the customer and the project.
- **Design:** Design a process that meets customers' needs
- .Optimize: Determine process capability and optimize the design.
- Verify: Test, verify, and validate the design.

Define

During the Define phase, four major tasks are undertaken.

Measure

During the Measure phase, two major tasks are undertaken.

Data Collection

Data Evaluation

Analyze

We consider five specific types of analyses that help to promote the goals of the project.

There are many tools that can be used to perform analysis like Box Plot, Cause and Effect Diagram, Progressive Analysis, Ranking, Pareto Analysis, Prioritization Matrix, Value Analysis, etc. The proper procedure is the one that works best for your team, provided that the end result is successful.

Improve

- The objective of Improve Phase is to
 - identify improvement breakthroughs and high gain alternatives,
 - select preferred approach,
 - design the future state,
 - determine the new Sigma level,
 - perform cost/benefit analysis,
 - design dashboards/scorecards,
 - create a preliminary implementation plan.

Control

The last phase of DMAIC is control, which is the phase where we ensure that the processes continues to work well, produce desired output results, and maintain quality levels. You will be concerned with four specific aspects of control, which are as follows.

- Quality Control
- Standardization
- Control Methods and Alternatives
- Responding when Defects Occur

For more engagements contact us

www.jankechquality.com Or info@jankechquality.com

Six Sigma: Statistically Visualized

