

Lean Six Sigma

Description

Lean Six Sigma is a quality management method that relies on a collaborative team effort to improve performance by systematically removing waste and reducing variation. It combines [lean manufacturing/lean enterprise](#) (focus on waste reduction) and [Six Sigma](#) (focus on reducing process variation) to eliminate the eight kinds of waste:

1. Defects
2. Over-Production
3. Waiting
4. Non-Utilized Talent
5. Transportation
6. Inventory
7. Motion
8. Extra-Processing

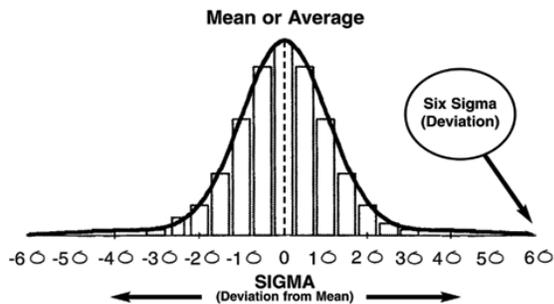
Lean aims to make processes less complicated, faster, and easier to follow. It tries to achieve continuous flow by tightening the linkages between process steps. Six Sigma is about consistency. It focuses on reducing process variation (in all its forms) for the process steps enabling a tightening of those linkages. In short, Lean exposes sources of process variation and Six Sigma aims to reduce that variation enabling a cycle of iterative improvements towards the goal of continuous flow of the process or service.

Lean Six Sigma also provides a framework for overall organizational culture change. The mindset of employees and managers changes to one focused on growth and continuous improvement through process optimization. This change maximizes the efficiency and increases profitability of the organization.

Background

The etymology of Six Sigma is based on the Greek symbol sigma or σ , a statistical term for measuring process deviation from the process mean or target. Six Sigma comes from the bell curve used in statistics, where one Sigma symbolizes a single standard deviation from the mean.

Diagram: Sigma Bell Curve



Six Sigma was introduced by American engineer Bill Smith while working at Motorola in 1986. It was developed within Motorola to compete with the Kaizen (or lean manufacturing) business model in Japan. As a result of Six Sigma, Motorola received the Malcolm Baldrige National Quality Award in the year 1988. Jack Welch then made it central to his business strategy at General Electric in 1995.

Changes Over Time

The roots of six sigma as a measurement standard can be traced back to Carl Frederick Gauss (1777-1855) who introduced the concept of the normal curve. Six Sigma as a measurement standard in product variation can be traced back to the 1920s when Walter Shewhart showed that three sigma from the mean is the point where a process requires correction. Many measurement standards (Cpk, Zero Defects, and so on) later came on the scene, but credit for coining the term "six sigma" goes to a Motorola engineer named Bill Smith. *(Note: Six sigma is a federally registered trademark of Motorola.)*

In the late 1970s, Dr. Mikel Harry, a senior staff engineer at Motorola's Government Electronics Group (GEG), began to experiment with problem solving through statistical analysis. Using his methodology, GEG began to show dramatic results -- GEG's products were being designed and produced faster and more cheaply. Subsequently, Dr. Harry began to formulate a method for applying Six Sigma throughout Motorola. His work culminated in a paper titled "The Strategic Vision for Accelerating Six Sigma Within Motorola." He was later appointed head of the Motorola Six Sigma Research Institute and became the driving force behind Six Sigma.

In the early and mid-1980s with Chairman Bob Galvin at the helm, Motorola engineers decided that the traditional quality levels of measuring defects in thousands of opportunities did not provide enough granularity. Instead, they wanted to measure the defects per million opportunities. Motorola developed this new standard and created the methodology and needed cultural change associated with it. Six Sigma helped Motorola realize powerful bottom-line results in their organization. They documented more than \$16 billion in savings as a result of Six Sigma efforts.

Since then, tens of thousands of companies around the world have adopted Six Sigma as a way of doing business. This is a direct result of many of America's leaders openly praising the benefits of Six Sigma. Leaders such as Larry Bossidy of Allied Signal (now Honeywell) and Jack Welch of General Electric Company.

Six Sigma has evolved over time. It is more than just a quality system like Total Quality Management (TQM) or International Organization for Standardization (ISO). It's a way of doing business. As Geoff Tennant describes in his book "Six Sigma: Statistical Process Control (SPC) and TQM in Manufacturing and Services," "Six Sigma is many things, and it would perhaps be easier to list all the things that Six Sigma quality is not. Six Sigma can be seen as a vision, a philosophy, a symbol, a metric, a goal, a methodology."

Purpose

Six Sigma is a data-driven approach to quality, aimed at reducing variation and the associated defects, wastes and risks in any process in order to improve performance and customer satisfaction.

How It Works

Diagram: Lean Six Sigma Cycle

Lean Six Sigma involves a five-step process (Design for Six Sigma (DFSS), or the Six Sigma DMADV process):

1. **Define:** Craft a problem statement, project charter, customer requirements, and process map.
2. **Measure:** Collect data on the current process, performance, and issues. Verify that reliability of the data.
3. **Analyze:** Examine the process and data to identify the cause of issues. Display the data, investigate, and confirm the cause.
4. **Design and Improvement:** Decide on solutions to fix issues and create process maps for the new solutions. Take steps to implement the fixes and continue to measure improvement.
5. **Control (Monitor and Verify):** Refine the new process, continue monitoring, and use finding elsewhere as appropriate for the business.



It is an improvement system used to develop new processes or products at Six Sigma quality levels. It also can be employed if a current process requires more than just incremental improvement.

Core Values, Principles and Concepts

- Focus on the customer.
- Identify and understand how the work gets done (the value stream).
- Manage, improve, and smooth the process flow.
- Remove Non-Value-Added steps and waste.
- Manage by fact and reduce variation.
- Involve and equip the people in the process.
- Undertake improvement activity in a systematic and scientific way.

Framework

A combination of tools from lean manufacturing and Six Sigma are used:

Continuous improvement (Kaizen): The concept of improving all functions of a business and involving all employees from the CEO to line workers. Kaizen literally means "change is good." (*Kai is change, Zen is good.*)

Value-stream mapping: A method for analyzing process or services using a visual tool that displays all critical steps in the process and quantifies the time and volume at each stage. It shows the flow of both materials and information as they progress through the process.

Line balancing: Leveling the workload across all processes in a cell or value stream to remove bottlenecks and excess capacity.

Visual Management: A way to visually communicate expectations, performance, standards, or warnings in a way that requires little or no prior training to interpret using visuals like colors, words, pictures, or symbols.

Application

Application of Lean Six Sigma to the public sector places emphasis on quality without waste. A White Paper written by Newton Peters from Xerox stated, "To improve the quality of its documentation and information processes, the public sector must learn to utilize Lean Six Sigma teachings so that all the processes that fall under the information and documentation functions are streamlined to better serve the public. Because of the considerable volume of information handling that goes on in the public sector, the government needs a structured approach, no less, no more. This structured approach brings about improvement."

Government programs, including VR, try to continuously improve by reducing costs, increasing customer satisfaction and creating a culture of excellence. Lean Six Sigma can be used at all levels within an organization. For Vocational Rehabilitation Agencies, it can be used to improve and streamline administrative processes as well as for improving client services.

Challenges of applying Lean Six Sigma to the public sector include the hierarchical environment, varying goals, and complexity of the structure.

Vocational Rehabilitation

Examples of VR Agencies that have used Lean:

VA – VR & E

Atlas Research is working with the VA to stabilize and streamline core processes using Lean Six Sigma and Agile.

Pennsylvania

Pennsylvania has a Lean in Government initiative; held an inaugural virtual summit in January 2021.

Ohio State Government

Ohio implemented Lean Six Sigma throughout state government in January 2011. They established a LeanOhio Team within the Department of Administrative Services that teaches Lean tools and provides training to staff in state government. Their mission is to "lead and support efforts that make government services simpler, faster, better, and less costly." Since launching, they have led and facilitated over 400 projects and done improvement projects with over 45 state agencies, boards, commissions, and elected officials.

Each state agency has a Lean Liaison.

The state offers a Lean Boot Camp.

For more information, visit <https://lean.ohio.gov>.

Ohio Rehabilitation Services

Has fully integrated Lean into the agency, including an introduction in their new employee training and offering further belt training to interested employees.

Using Lean Six Sigma tools, VR has substantially reduced the case costs and the process times for eligibility and employment outcomes.

Ohio	2011	2018
Budget	Significant and disproportionate reductions	Proportionate (or better) budget outcomes
Time to eligibility	127 days	24 days (July 2018)
Time to rehabilitation	28.5 months (FFY 2012)	17.6 months (FFY 2017)
Employment outcomes	3,373 (FFY 2011)	5,980 (FFY 2017)
Cost per emp. outcomes	\$10,190 (FFY 2012)	\$7,442 (FFY 2017)
Order of Selection	Yes (waiting list SD and D)	No (serving all categories for the first time since 1991)
Employer engagement	No formal strategy	Dedicated Business Relations Unit

Oklahoma Vocational Rehabilitation

Initially Initiated Lean Six Sigma to streamline travel requests; spread to other administrative processes.

Other Organizations

Human Service Organizations: Since its inception, Lean Six Sigma has been used extensively in human service and government organizations. In short, it has been used to make these organizations simpler, faster, better, and less costly. Agencies have used the tools to cut red tape, remove inefficiencies, improve customer service, and achieve measurable results. The benefits of Lean Six Sigma: Increasing profitability, improving customer focus, generating sustained improvement, setting direction and goals and fostering continuous learning and development apply equally well to human service as they do to manufacturing. The challenge is to define what the metrics should be and define clear measures for performance that align with customer satisfaction and the mandates of government.

Although Lean Six Sigma often involves a series of small improvements, in reality, it is a long-term strategy that is about transformation. It requires a long-term commitment from leadership to change the culture of an organization. Here's a sampling of public sector organizations that have had Lean Six Sigma initiatives:

Delaware DOL

Florida Dept of Children and Families

U.S. Dept of Housing and Urban Development

U.S. Dept of Health and Human Services

FDA

Chickasaw Nation

Cities: Baltimore, Irving, Henderson, Odessa, Phoenix, San Diego, Buffalo, San Francisco, Springfield

Public Service or Other Related Organizations

Boy Scouts

YMCA

AARP

Criticisms or Concerns

In order to align with vocational rehabilitation, different metrics need to be developed to move away from the manufacturing base. For example, instead of reducing errors, VR agencies can develop metrics around reducing time for client services.

Implementing Lean Six sigma requires a culture shift within an agency. Getting staff onboard can be challenging and works best with strong support from leadership on the initiative. Because it is a team effort, staff need to learn how to work as a team and how to focus on the process, not blaming anyone for issues and striving to make the processes work for everyone that touches it. They need to learn how to look at the data and identify where problems exist. Staff need to become accustomed to continuous change, listening to customers and field staff and analyze the data, particularly examining the outliers.

Effectiveness

In 2018, the International Journal of Lean Six Sigma published an article about a study of Lean Six Sigma in the Public sector. They conducted a literature review and did interviews of a sample of public sector officials. They concluded that Lean Six Sigma is a framework that can help the public sector maximize their tax dollars while increasing the quality of their goods and services:

https://www.researchgate.net/publication/325278543_Opportunities_for_Lean_Six_Sigma_in_public_sector_municipalities.

Ohio VR, the agency with the most use across systems, found that it substantially reduced time to eligibility, time to plan, time to rehabilitation, and the cost per outcome while increasing employment outcomes.

The VR Agencies that used Lean Six Sigma reported it takes a significant investment of time and training, but there's good return on investment.

Recommendation for Use in VR

Although Lean Six Sigma arose out of manufacturing, the core values align with those of Vocational Rehabilitation.

VR Agencies are continuously challenged to "do more with less," enhance budget and organizational performance, and identify innovative ways to increase impact and improve outcomes.

Potential Benefits to VR include the following:

- Speeding up administrative processes like purchases, travel requests
- Supports rapid engagement through eligibility and IPE development and into services
- Creates statewide consistency vs. regional/office differences
- Streamlines processes so VRCs can focus more on client interaction
- Helps VR move from a transactional to a transformational approach

With some adjustments to terminology and the metrics being used, the core values of Lean Six Sigma can be applied to support VR's values.

Lean Six Sigma Values	VR Values
Focus on the customer Providing quality	Focus on the customer satisfaction with services and outcomes High Quality competitive, integrated employment with benefits
Identify and understand how the work gets done (the value stream)	Rehabilitation process clearly outlined in Law and Regulations Reduce administrative and paperwork burden for counselors
Manage, improve, and smooth the process flow	Rapid engagement to eligibility and IPE, services, and employment
Remove Non-Value-Added steps and waste	Streamline and eliminate unnecessary assessments and approvals
Manage by fact and reduce variation	Use evidence-based practices
Undertake improvement activity in a systematic and scientific way	Use data to improve services and outcome

How to use

With some adaptations, Lean Six Sigma can be effectively applied to VR agencies both for administrative processes and client services.

Certification

Extensive training widely available

Levels: White Belt (\$199), Yellow Belt (\$499), Green Belt (\$2650), Black Belt (\$2950), Master Black Belt, (\$4975)

Lean Fundamentals (\$1300)

Cost: \$200-5,000

Training time: 1-8 days

Training is available from multiple sources, including: <https://www.6sigma.us/>; <https://Asq.org>

Resources

Websites

<https://www.isixsigma.com/new-to-six-sigma/history/history-six-sigma/>

<https://www.6sigma.us/lean-six-sigma-articles/how-the-public-sector-benefits-from-lean-six-sigma/>

<https://www.6sigma.us/>

<https://Asq.org>

Steven Jobs on Lean Six Sigma Core Principles: Quality from the perspective of customers:

<https://www.google.com/url?sa=t&rct=j&q=&esrc=s&source=web&cd=&cad=rja&uact=8&ved=2ahUKEwjLn8XXw5fvAhU0NX0KHdB6C4sQwqsBMAN6BAgEECU&url=https%3A%2F%2Fwww.youtube.com%2Fwatch%3Fv%3DgHSp-1lxolg&usg=AOvVaw0cBDqlePthA5OU8ZcZVEke>

<https://Lean.Ohio.gov>

<https://www.epa.gov/sites/production/files/2013-11/documents/leangovtprimer.pdf>

Articles

Lean Government - NOW! by [Harry Kenworthy](#)

Videos

6-Step Kaizen Process: <https://www.youtube.com/watch?v=s2HCrhNVfak>

9-minute general description of Kaizen process: <https://www.youtube.com/watch?v=gEC-81b7bdc>