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Module One: Getting Started

Welcome to the Six Sigma workshop.

The last couple of decades small, mid-sized and Fortune 500 companies have embraced Six Sigma to generate more profit and greater savings. So what is Six Sigma?

Six Sigma is a data-driven approach for eliminating defects and waste in any business process.

You can compare Six Sigma with turning your water faucet and experiencing the flow of clean, clear water. Reliable systems are in place to purify, treat and pressure the water through the faucet. That is what Six Sigma does to business: treats the processes in business so that they deliver their intended result.

What is "Sigma"? The word is a statistical term that measures how far a given process deviates from perfection. Sigma is a way to measure quality and performance.

The central idea behind Six Sigma is that 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.

“Quality means doing it right when no one is looking.”

Henry Ford
This workshop will give participants an overview of the Six Sigma methodology, and some of the tools required to deploy Six Sigma in their own organizations.
Workshop Objectives

Research has consistently demonstrated that when clear goals are associated with learning, it occurs more easily and rapidly. The objectives of this Workshop are:

- Develop a 360 degree view of Six Sigma and how it can be implemented in any organization.
- Identify the fundamentals of lean manufacturing, lean enterprise and lean principles.
- Describe the key dimensions of quality – product features and freedom from deficiencies.
- Develop attributes and value according to the Kano Model.
- Understand how products and services that have the right features and are free from deficiencies can promote customer satisfaction and attract and retain new customers.
- Describe what is required to regulate a process.
- Give examples of how poor quality affects operating expenses in the areas of appraisal/inspection costs, internal failure costs and external failure costs.
- Using basic techniques such as DMAIC and how to identify Six Sigma Projects.
- Use specific criteria to evaluate a project.
- Discover root causes of a problem.
- Design and install new controls to hold the gains and to prevent the problem from returning.
Module Two: Understanding Lean

Lean and Six Sigma are like buzz-words we hear in business all of the time. Before we get started, let’s make sure we all understand just what we mean by “Lean” and “Six Sigma”.

“Six Sigma is the most important training thing we have ever had. It’s better than going to Harvard Business School.”

Jack Welch, GE
About Six Sigma

Six Sigma is a structured, data-driven process of solving critical issues from a business perspective that we haven’t been able to solve with current methodology.

Six Sigma is the single most effective problem-solving methodology for improving business and organizational performance.

The common measurement scale is called the Sigma capability or Z and is a universal scale. It is a scale like a yardstick measuring inches or a thermometer measuring temperature.

The scale allows us to compare business processes in terms of the capability to stay within the quality limits established for that process.

The Sigma scale measures Defects Per Million Opportunities (DPMO).
Six Sigma equates to 3.4 defects per million opportunities.
What Six Sigma is and is not

- Six Sigma is not an add-on to normal business activities.
- It is an integrated part of the improvement process.
- Six Sigma is management methodology driven by data.
- Six Sigma focuses on projects that will produce measurable business results.
- Six Sigma is not a standard, a certification or a metric like percentage.

The central idea behind Six Sigma is that if you can measure how many “defects” you have in a process, you can systematically determine how to eliminate those and approach “zero defects”.

- Sigma is a value from 1 to 6 that signifies the maximum number of defects per million:
  - 1 Sigma = 690,000 defects/million = 31% accurate
  - 2 Sigma = 308,537 defects/million = 69.1463% accurate
  - 3 Sigma = 66,807 defects/million = 93.3193% accurate
  - 4 Sigma = 6,210 defects/million = 99.3790% accurate
  - 5 Sigma = 233 defects/million = 99.9767% accurate
  - 6 Sigma = 3.4 defects/million = 99.999997% accurate

- Six Sigma is about reducing variation

- Six Sigma find out the facts before acting
About Lean

“Lean” means continuously improving towards the ideal and achieving the shortest possible cycle time through the tireless reduction of waste.

- It is focused on eliminating waste in all processes
- It is about expanding capacity by reducing costs and shortening cycle times
- It is about understanding what is important to the customer (e.g. value)
- It is not about eliminating people

Examples of Lean Projects

- Reduced inventory
- Reduced floor space
- Quicker response times and shorter lead times
- Decreased defects, rework, scrap
- Increased overall productivity
**History behind Lean**

The phrase “lean manufacturing” was coined in the 1980’s and has its roots in the *Toyota Production System*. (See later in this module)

Most of the basic goals of lean manufacturing are common sense, and some fundamental thoughts have been traced back to the writings of Benjamin Franklin.

Henry Ford cited Franklin as a major influence on his lean business practices, which included *Just-in-time* manufacturing.

The founders of Toyota designed a process with inspiration from Henry Ford and their visits to the United States to observe the assembly line and mass production that had made Ford rich. The process is called the *Toyota Production System*, and is the fundamental principle of lean manufacturing.

Two books have since shaped the ideologies of Lean: “The machine that changed the world” (1990) and “Lean Thinking” (1996).
**Toyota Production Systems**

The *Toyota Production System* (TPS) is a mindset and management system that embraces continuous improvement.

TPS organizes manufacturing and logistics, including interaction with suppliers and customers.

Originally called "Just In Time Production," it builds on the approach created by the founders of Toyota.

TPS revolves around 5 simple steps:
1. Define Value of your product > Make it according to Customer needs and Customer Defined
2. Identify Value Stream of your product > Follow the product and identify unnecessary actions
3. Study the Flow your product > Eliminate All Waste
4. Make only what the customer orders > Produce Just In Time for Demand
5. Strive for Perfection > Continuous Improvement. Good enough is never enough.
The Toyota Precepts

The 5 methods defined by Toyota contain some basic principles:

1. **CHALLENGE**
   Form a long-term vision, meeting challenge with courage and creativity to realize your dreams.
   - Create Value through Manufacturing and Delivery of Products and Services
   - Nurture a spirit of Challenge
   - Always have a Long Range Perspective
   - Thorough Consideration in Decision Making

2. **KAIZEN**
   Improve your business operations continuously, always driving for innovation and evolution.
   - Have a Kaizen Mind and Innovative Thinking (See later this module)
   - Build Lean Systems and Structure
   - Promote Organizational Thinking

3. **GENCHI GENBUTSU (Go and see)**
   Go to the source to find the facts to make correct decisions, build consensus, and achieve goals at our best speed.
   - Genchi Genbutsu (Go and See)
   - Lead with Consensus Building
   - Create Commitment to Achievement

4. **RESPECT**
   Respect others, make every effort to understand each other, take responsibility and do your best to build mutual trust.
   - Respect for Stakeholders and community
   - Develop Mutual Trust and Mutual Responsibility
   - Be Sincere, transparent and open in all Communication
5. TEAMWORK
Stimulate personal and professional growth, share the opportunities of development, and maximize individual and team performance.

- Have Commitment to Education and Development
- Have Respect for the Individual; Realizing Consolidated Power as a Team

CHECK POINT

- Does your MIP proposal consider a long range perspective?
- Does it eliminate waste?
- Have you involved all the stakeholders?
Module Three: Liker’s Toyota Way

In this module we will look closer at Toyota’s philosophies that have become a spiritual pinnacle of modern manufacturing.

“The Toyota Way” is a book about the 14 principles that drive Toyota’s culture.

The book was written by Dr. Jeffery Liker, a leading author on lean practices and an expert on U.S. and Japanese differences in manufacturing.

“Do you value practices, or do you practice values?”

Unknown
Philosophy

Have a Long-Term Philosophy

**Principle 1:** Base your management decisions on a long-term philosophy, even at the expense of short-term financial goals.

In Toyota’s vision, the purpose is to work, grow, and align the organization toward a common purpose that is bigger than making money.

The vision instills the importance of generating value for the customer, society, and the economy. The business and its people must accept responsibility for its conduct and continuously improve its skills.
Process

Principle 2: Most Business Processes are 90% Waste and 10% Value-Added Work.

Create continuous Flow and a process flow to bring problems to the surface.

Work processes are redesigned to eliminate waste (Muda).
Strive to cut back to zero the amount of time that any project is sitting idle or waiting for someone to work on it.

“Flow” means that when your customer places an order, this triggers the process of obtaining raw materials needed just for that customer’s order. The raw material then flows immediately to supplier plants, where workers immediately fill the order with components, which flow immediately to a plant, where workers assemble the order, and then the completed order flows immediately to the customer.

The Heart of One-Piece Flow is called Takt Time (Rhythm in German) – The rate of Customer Demand -

Principle 3: Use “pull” systems to avoid overproduction.

Provide your customers with what they want, when they want it, and in the amount they want. Minimize your work in process and warehousing of inventory by stocking small amounts of each product and frequently restocking based on what the customer actually takes away.

The Toyota Way is not about Managing Inventory, it is about Eliminating It.

Principle 4: Level out the workload (Heijunka).
Work like the tortoise, not the hare. This helps achieve the goal of minimizing waste (Muda), not overburdening people or the equipment (Muri), and not creating uneven production levels (Mura).

Level out the workload as an alternative to the stop/start approach of working on projects in batches that is typical at most companies.

**Principle 5: Build a culture of stopping to fix problems, to get quality right the first time.**

Build into your equipment the capability of detecting problems and stopping itself. Any employee in the Toyota Production System has the authority to stop the process to signal a quality issue.

It is OK to stop or slow down to get quality right the first time to enhance productivity in the long run.

**Principle 6: Standardized tasks and processes are the foundation for continuous improvement and employee empowerment.**

Although Toyota has a bureaucratic system, the way that it is implemented allows for continuous improvement (Kaizen) from the people affected by that system.

**Principle 7: Use visual control so no problems are hidden.**

Included in this principle is the 5S Program - steps that are used to make all work spaces efficient and productive, help people share work stations, reduce time looking for needed tools and improve the work environment:

<table>
<thead>
<tr>
<th>Sort:</th>
<th>Sort out unneeded items</th>
</tr>
</thead>
<tbody>
<tr>
<td>Straighten:</td>
<td>Have a place for everything</td>
</tr>
<tr>
<td>Shine:</td>
<td>Keep the area clean</td>
</tr>
<tr>
<td>Standardize:</td>
<td>Create rules and standard operating procedures</td>
</tr>
<tr>
<td>Sustain:</td>
<td>Maintain the system and continue to improve it</td>
</tr>
</tbody>
</table>

**Notes**
Principle 8: Use only reliable, thoroughly tested technology that serves your people and processes.

Use technology to support people, not to replace people. Often it is best to work out a process manually before adding technology to support the process.

New technology is often unreliable and difficult to standardize. A proven process that works generally takes precedence over new and untested technology.

Conduct actual tests before adopting new technology in business processes, manufacturing systems, or products.

Reject or modify technologies that conflict with your culture or that might disrupt stability, reliability, and predictability.
People and Partners

**Principle 9: Grow leaders who thoroughly understand the work, live the philosophy, and teach it to others.**

The principles have to be engrained; it must be the way one thinks. Employees must be educated and trained: they have to maintain a learning organization.

Grow leaders and develop role models from within, rather than buying them from outside the organization.

A good leader must understand the daily work in great detail so he or she can be the best teacher of your company’s philosophy.

**Principle 10: Develop exceptional people and teams who follow your company’s philosophy.**

Success is based on the team, not the individual. Teamwork is something that has to be learned.

**Principle 11: Respect your extended network of partners and suppliers by challenging them and helping them improve.**

Toyota treats suppliers much like they treat their employees, challenging them to do better and helping them to achieve it.

Have respect for your partners and suppliers and treat them as an extension of your business.

Challenge your outside business partners to grow and develop. It shows that you value them. Set challenging targets and assist your partners in achieving them.
Problem Solving

Principle 12: Go and see for yourself to thoroughly understand the situation (*Genchi Genbutsu*).

Principle 13: Make decisions slowly by consensus, thoroughly considering all options; implement decisions rapidly (*Nemawashi*).

The following are decision parameters:

1. Find what is really going on (go-and-see) to test
2. Determine the root cause
3. Consider a broad range of alternatives
4. Build consensus on the resolution
5. Use efficient communication tools

Do not pick a single direction and go down that one path until you have thoroughly considered alternatives. When you have picked, move quickly and continuously down the path.

Principle 14: Become a learning organization through relentless reflection (*Hansei*) and continuous improvement (*Kaizen*).

The general problem solving technique to determine the root cause of a problem includes:

1. Initial problem perception
2. Clarify the problem
3. Locate area/point of cause
4. Investigate root cause (5 whys)
5. Countermeasure
6. Evaluate
7. Standardize

Once you have established a stable process, use continuous improvement tools to determine the root cause of inefficiencies and apply effective countermeasures.
Module Four: The TPS House

If TPS is a mindset, then what’s holding it all together, is the TPS House.

In this module we look at the TPS house, the Blueprint for a Lean Enterprise that has become one of the most recognizable symbols of modern manufacturing.

The house represents a structural system of how to view our business and organization: The house is strong if the roof, the pillars and the foundations are strong. A weak link weakens the whole system.

It starts with the goals of best quality, lowest cost and shortest lead time – the roof.
There are two main pillars holding the roof up: Just-in-Time (JIT) and Jidoka.

JIT and Jidoka mean never letting a defect pass into the next station and freeing people from machines – automation without a human touch.

In the center of the system are people.
The Goals of TPS

The Main goals of the Toyota Production System are to eliminate three types of waste:

Overburden or stress in the system (Muri)

Inconsistency (Mura)

Waste (Muda)

The elimination of waste (Muda) is the most common way to look at the effects of TPS. We will look at Waste in greater detail in Module Seven.

There are four rules to TPS:

Rule 1: All work shall be highly specified

Rule 2: Every customer-supplier connection must be direct

Rule 3: The flow of products and services must be simple and direct.

Rule 4: Any improvement must be made according to the scientific method at the lowest possible level in the organization.
The First Pillar: Just In Time (JIT)

JIT is the left pillar and means to make what the customer needs, when it is needed, in the right amount.

Ideally nothing is produced unless a customer is identified and the product is ordered. This helps in reducing inventories, warehousing and other holding costs.

JIT is not about automation. JIT involves controlling the flow of materials and manpower so that adequate resources are on hand when needed.
The Second Pillar: Jidoka (Error-Free Production)

Jidoka is the right pillar of the house.

It means that when an operator detects an error on an assembly line, they will try solving it themselves. If they cannot correct it themselves, they will call their supervisor. If the supervisor cannot complete the job within the given amount of time, the line will be stopped. The error will be fixed and the line will be re-started.

If you have no solution to the problem, you will not be able to continue with manufacturing. So solving problems becomes a must.

Traditionally, stopping the manufacturing line is treated as a crime, something you should not do at all.

The TPS view is that if you are not shutting down the line, you have no problems. All manufacturing plants have problems. So you must be hiding problems. TPS wants the problems to surface so that the process can be improved. Changing the mentality is the key to implementing Jidoka in an organization.
Kaizen (Continuous improvement)

Kaizen is a Japanese term that means continuous improvement. With Kaizen, good enough is never enough. No process is ever perfect.

Kaizen aims to eliminate waste in all systems of an organization through improving standardized activities and processes.

The continuous cycle of Kaizen activity has seven phases:

1. Identify an opportunity
2. Analyze the process
3. Develop an optimal solution
4. Implement the solution
5. Study the results
6. Standardize the solution
7. Plan for the future

The following are some basic tips for doing Kaizen:

- Replace conventional fixed ideas with fresh ones.
- Start by questioning current practices and standards.
- Seek the advice of many associates before starting a Kaizen activity.
- Think of how to do something, not why it cannot be done.
• Don’t make excuses. Make execution happen.
• Do not seek perfection. Implement a solution right away, even if it covers only 50 percent of the target.
• Correct something right away if a mistake is made.