



Six Sigma for Project Managers

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PMI Wine Country Chapter

Agenda

- Personal Introduction
- What is Six Sigma
- How it has helped various organizations
- Six Sigma Certification and development opportunities
- Six Sigma DMAIC process
- Example project

What is Six Sigma?

- Six Sigma at many organizations simply means a measure of quality that strives for near perfection.
- Six Sigma is a disciplined, data-driven approach and methodology for eliminating defects (driving towards six standard deviations between the mean and the nearest specification limit) in any process -- from manufacturing to transactional and from product to service.
- The fundamental objective of the Six Sigma methodology is the implementation of a measurement-based strategy that focuses on process improvement and variation reduction through the application of Six Sigma improvement projects.

Some Six Sigma Statistics



W. Edward Deming



- Emphasizes measureable financial results
- According to the Six Sigma Academy, Black Belts save companies approximately \$230,000 per project and can complete four to 6 projects per year.
- General Electric, one of the most successful companies implementing Six Sigma, has estimated benefits on the order of \$10 billion during the first five years of implementation.
- Expected savings after one year > 2% of gross revenue.
- Motorola reduced manufacturing costs by \$1.4 billion from 1987-1994.
- Six Sigma reportedly saved Motorola \$15 billion over the last 11 years.

Some Six Sigma History



Bill Smith
Father of Six Sigma

- Carl Frederick Gauss (1777-1855) introduces the concept of the normal curve.
- Walter Shewhart in the 1920's showed that three sigma from the mean is the point where a process requires correction.
- Many measurement standards (Cpk, Zero Defects, etc.) later came on the scene but credit for coining the term "Six Sigma" goes to a Motorola engineer named Bill Smith. (Incidentally, "Six Sigma" is a federally registered trademark of Motorola).

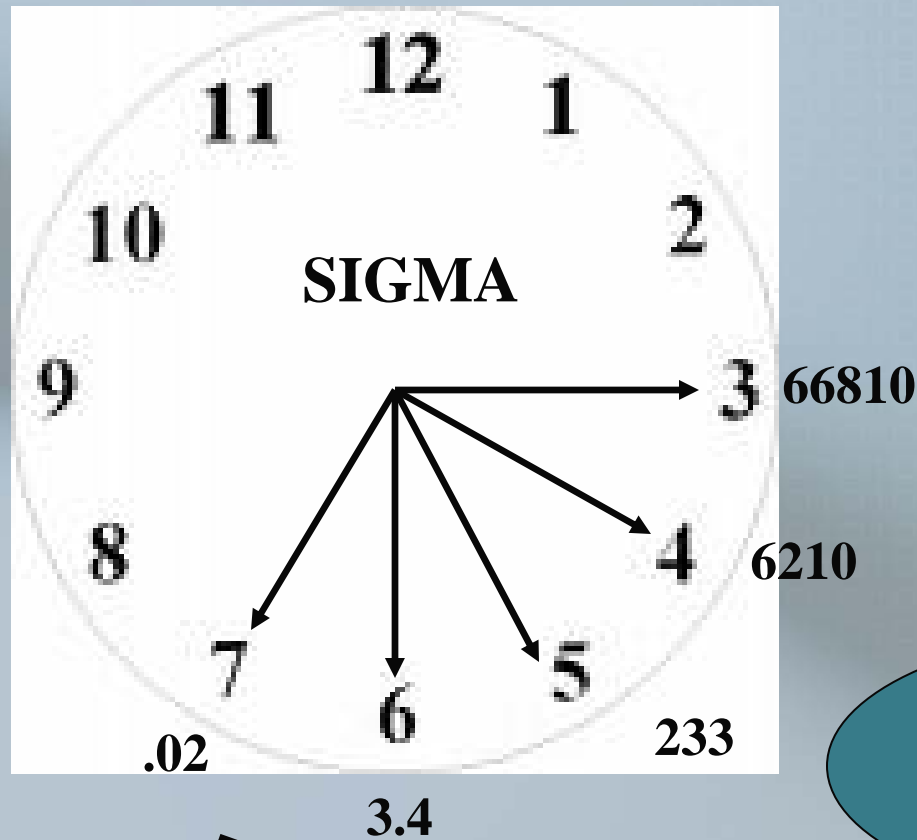
Some Six Sigma Companies



Six Sigma or TQM or ISO

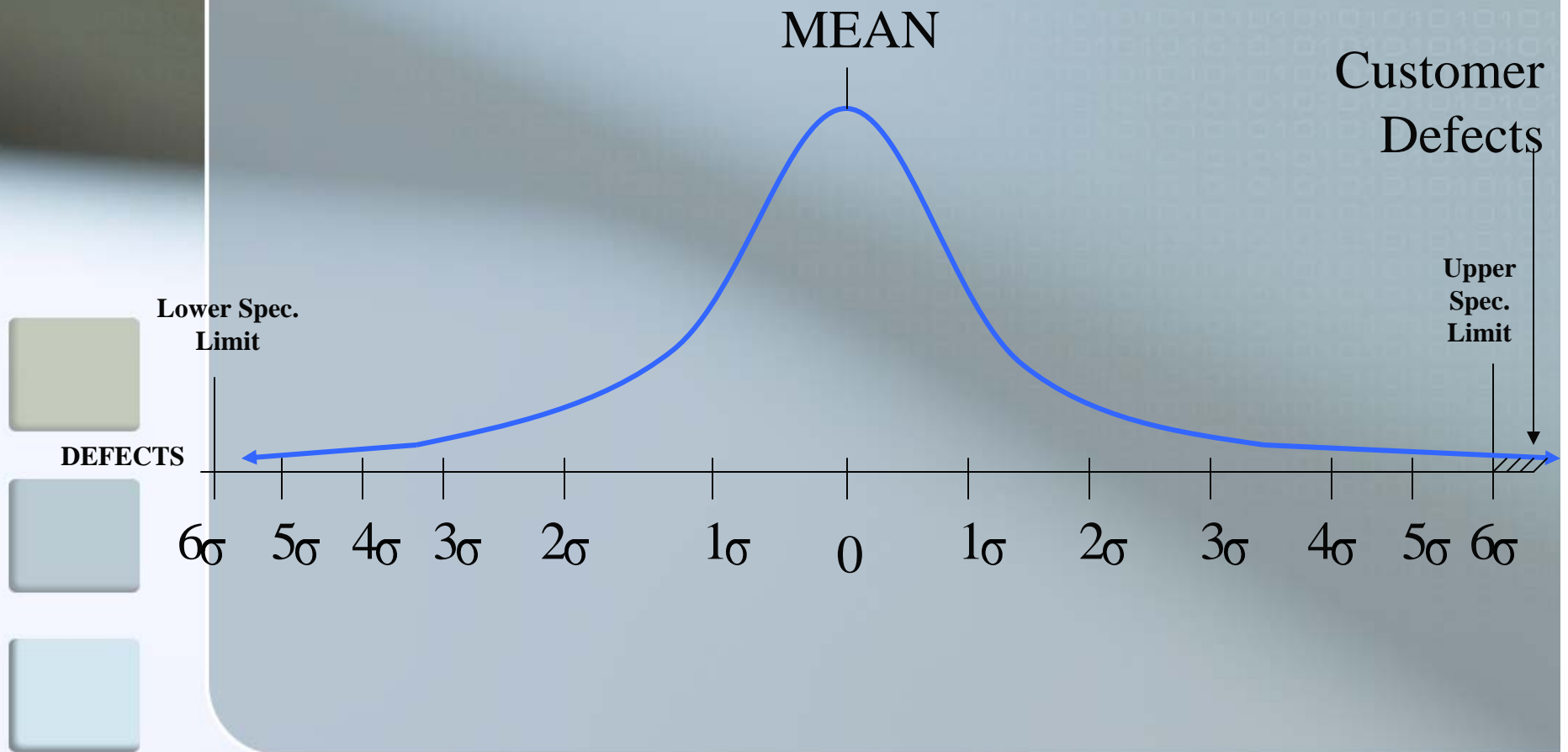
- Six Sigma is more than just a quality system like TQM
- Six Sigma is a Business Strategy
- Six Sigma is built upon a company structure with leaderships Team/Sponsors, Champions, Green Belts and Black Belts
- A cross functional strategy that includes transactional and service areas
- ROI is tied directly to projects and training

What are the Definitions of Sigma?



DPMO (Defects per million opportunities)

Six Sigma Statistical View



Motorola Green Belt Certification

- Green Belts Learn:
 - A structured problem-solving methodology for addressing business improvement projects
 - Intermediate-level quality tools within that methodology
 - How to generate bottom-line financial results
- Required:
 - Green Belt 5 day course
 - Examination
 - Green Belt Project
- <http://www.motorola.com/content.jsp?globalObjectId=3055>

Motorola Black Belt Certification

- Black Belt candidates learn to use:
 - The DMAIC model for process improvement and
 - Statistical tools and techniques to make fact-based decisions
- Required:
 - Four weeks delivered over a Four month time frame
 - Rigorous examination
 - Demonstrate results on two improvement projects
- <http://www.motorola.com/content.jsp?globalObjectId=3054>

American Society for Quality (ASQ)

- How to get there:
 - Proof of Professionalism
 - Examination
 - Proof of experience



Adobe Acrobat
7.0 Document

Six Sigma is a Disciplined Methodology

- DMAIC
 - Define
 - Measure
 - Analyze
 - Improve
 - Control

Define (DMIAC)

- Define the Customer, their Critical to Quality (CTQ) issues, and the Core Business Process involved.
 - Define who customers are, what their requirements are for products and services, and what their expectations are
 - Define project boundaries - the stop and start of the process
 - Define the process to be improved by mapping the process flow

Definition Phase

■ Goals

- Define Customers and Requirements (CTQs)
- Develop Problem Statement, Goals and Benefits
- Identify Champion, Process Owner and Team
- Define Resources
- Evaluate Key Organizational Support
- Develop Project Plan and Milestones
- Develop High Level Process Map

■ Tools

- Project Charter
- Process Flowchart
- SIPOC Diagram
- Stakeholder Analysis
- DMAIC Work Breakdown Structure
- CTQ Definitions
- Voice of the Customer Gathering

Project: Enter Project Name Here

Project Information

Leader: Enter Information Here
Master Black Belt: Enter Information Here
Project Start: Enter Information Here
Project End: Enter Information Here
Cost of Poor Quality: Enter Information Here

Team Members

Sponsor: Enter Information Here
Black Belt: Enter Information Here
Master Black Belt: Enter Information Here
Subject Matter Experts:
Enter Information Here Enter Information Here
Enter Information Here Enter Information Here
Enter Information Here Enter Information Here
Enter Information Here Enter Information Here

Process Start/Stop

Start Point: Enter Information Here
Enter Information Here
Stop Point: Enter Information Here
Enter Information Here

Project Time-Frame

Milestone Enter Here Enter Here Enter Here Enter Here Enter Here Enter Here Enter Here
Date: Enter Here Enter Here Enter Here Enter Here Enter Here Enter Here Enter Here

Process Importance

Enter Information Here
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Process Problem

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Project Goals

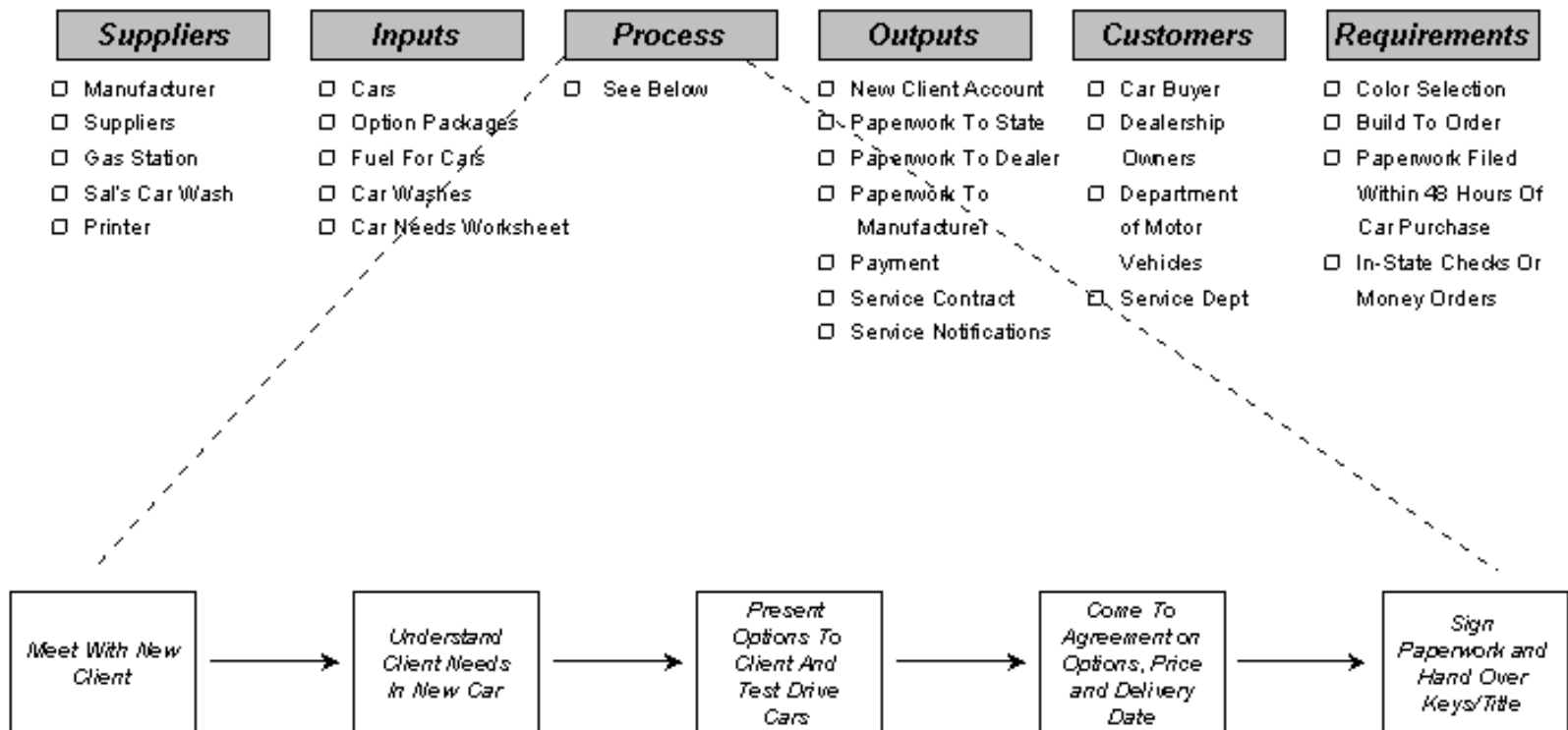
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Process Measurements

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SIPOC Diagram

Fictitious Car Dealer Example



Measure (DMAIC)

- **Measure** the performance of the Core Business Process involved.
 - Develop a data collection plan for the process
 - Collect data from many sources to determine types of defects and metrics
 - Compare to customer survey results to determine shortfall

Measure Phase

■ Goals

- Define Defect, Opportunity, Unit and Metrics
- Detailed Process Map of Appropriate Areas
- Develop Data Collection Plan
- Validate the Measurement System
- Collect the Data
- Begin Developing $Y=f(x)$ Relationship
- Determine Process Capability and Sigma Baseline

■ Tools

- Process Flowchart
- Data Collection Plan/Example
- Benchmarking
- Measurement System Analysis/Gage R&R
- Voice of the Customer Gathering
- Process Sigma Calculation

Voice of the Customer Gathering

- Customer Needs
 - Market Research Studies and Reports
 - Current and Lost Customer Interviews
 - Focus Groups
 - Surveys (Person, Telephone, Mail, Online)
 - 'Be Your Own Customer'
 - Customer Feedback and Complaint Logs
 - Customer Observation

Analyze (DMAIC)

- **Analyze** the data collected and process map to determine root causes of defects and opportunities for improvement.
 - Identify gaps between current performance and goal performance
 - Prioritize opportunities to improve
 - Identify sources of variation

Analyze Phase

■ Goal

- Define Performance Objectives
- Identify Value/Non-Value Added Process Steps
- Identify Sources of Variation
- Determine Root Cause(s)
- Determine Vital Few x 's, $Y=f(x)$ Relationship

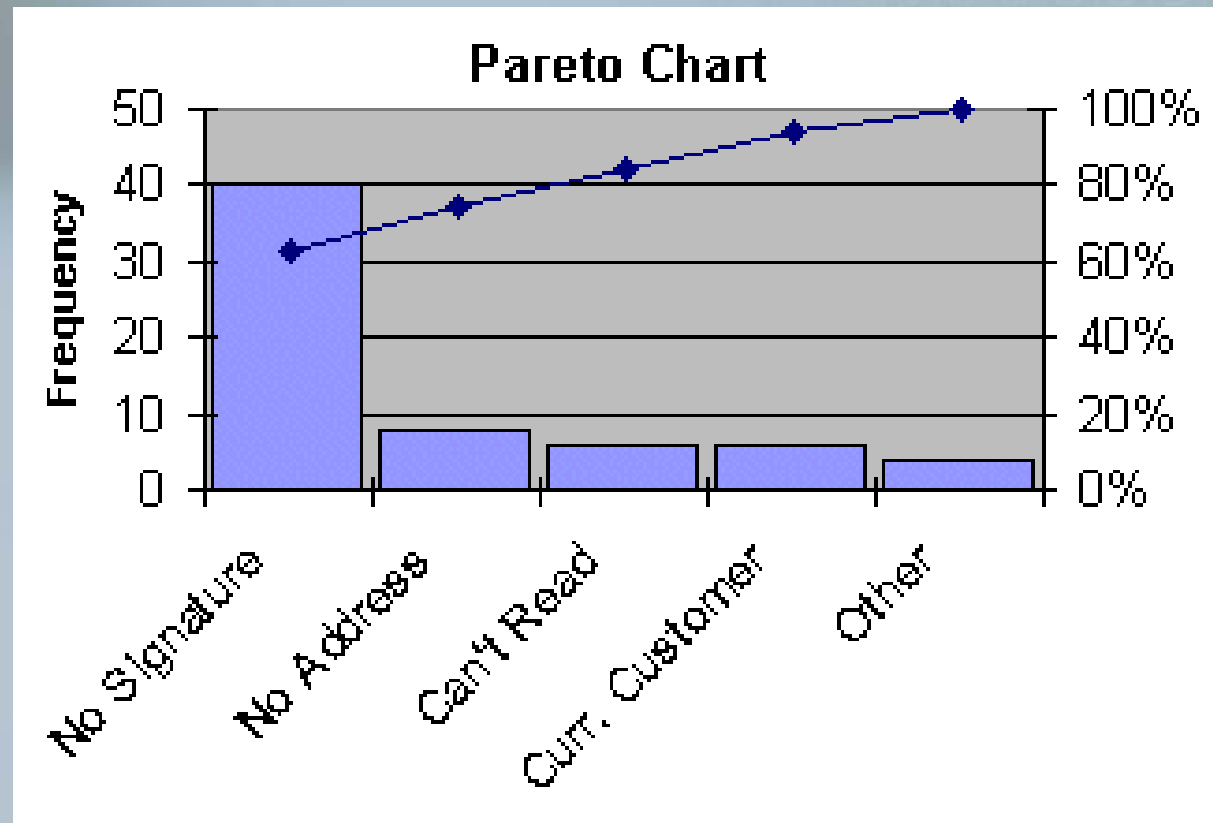
■ Tools

- Histogram
- Pareto Chart
- Time Series/Run Chart
- Scatter Plot
- Regression Analysis
- Cause and Effect/Fishbone Diagram
- 5 Whys
- Process Map Review and Analysis
- Statistical Analysis
- Hypothesis Testing (Continuous and Discrete)
- Non-Normal Data Analysis

Pareto Chart

■ Purpose Of A Pareto Chart

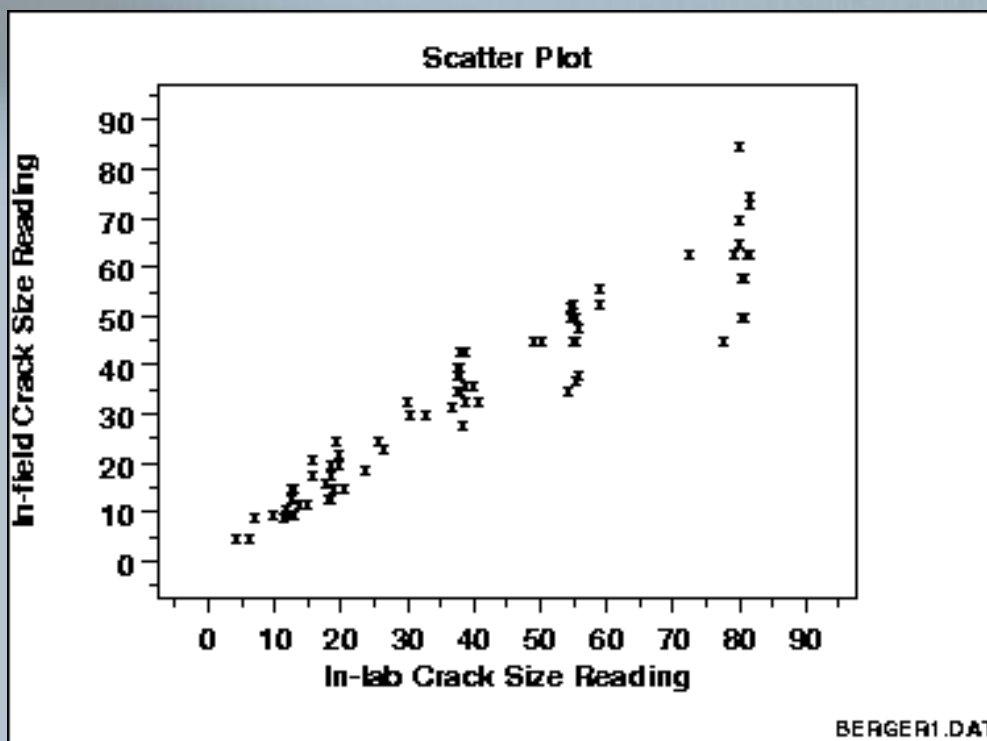
- A Pareto chart is used to graphically summarize and display the relative importance of the differences between groups of data.



Regression Analysis & Scatter Plot

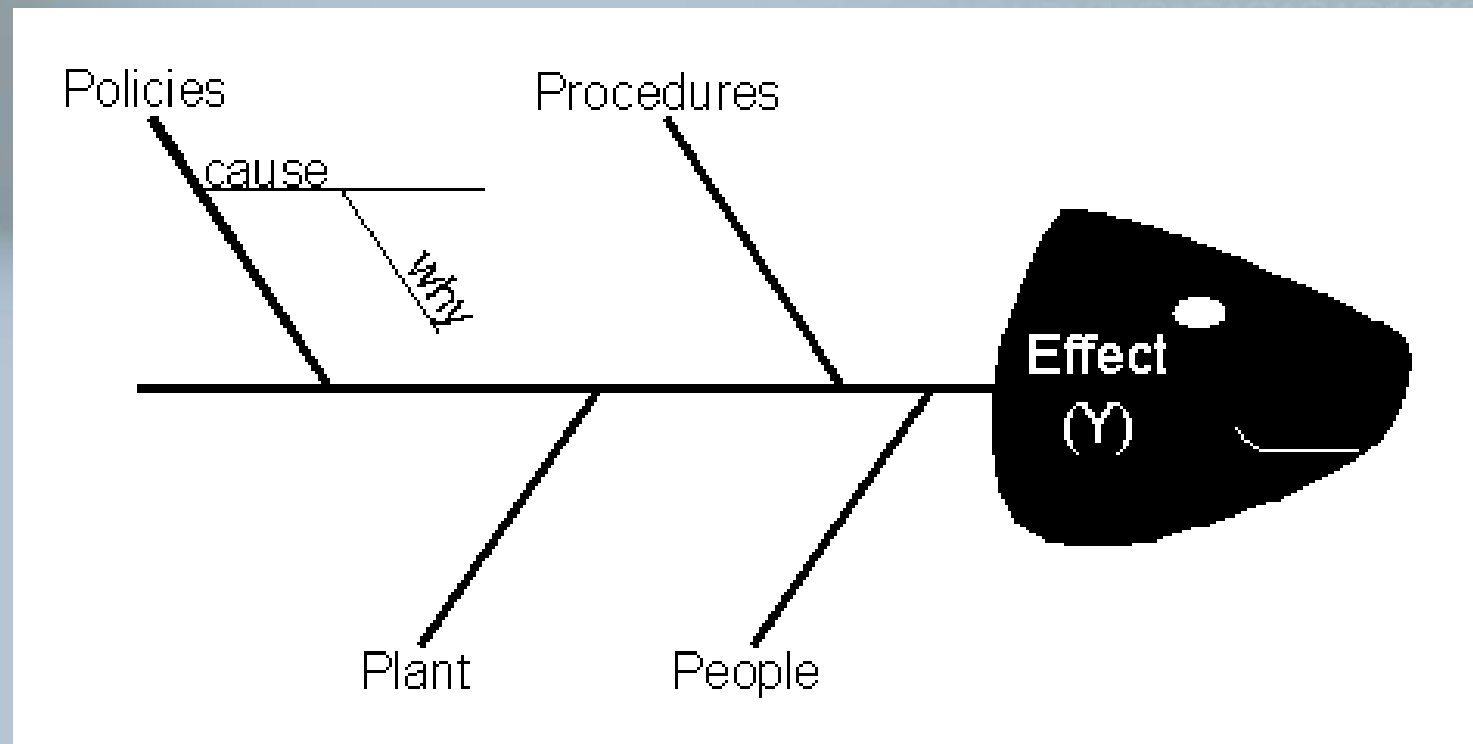
■ Regression Analysis

- A technique used for modeling and analysis of data where there is a dependent variable and one or more independent variables and an error term. The error term is treated as the random variable. It represents unexplained variation in the dependent variable.



Fishbone Diagram

- aka Ishikawa Diagram



Improve (DMAIC)

- **Improve** the target process by designing creative solutions to fix and prevent problems.
 - Create innovate solutions using technology and discipline
 - Develop and deploy implementation plan

Improve Phase

■ Goal

- Perform Design of Experiments
- Develop Potential Solutions
- Define Operating Tolerances of Potential System
- Assess Failure Modes of Potential Solutions
- Validate Potential Improvement by Pilot Studies
- Correct/Re-Evaluate Potential Solution

■ Tools

- Brainstorming
- Mistake Proofing
- Design of Experiments
- Pugh Matrix
- House of Quality
- Failure Modes and Effects Analysis (FMEA)
- Simulation Software

Control (DMAIC)

- **Control** the improvements to keep the process on the new course.
 - Prevent reverting back to the "old way"
 - Require the development, documentation and implementation of an ongoing monitoring plan
 - Institutionalize the improvements through the modification of systems and structures (staffing, training, incentives)

Control Phase

■ Goal

- Define and Validate Monitoring and Control System
- Develop Standards and Procedures
- Implement Statistical Process Control
- Determine Process Capability
- Develop Transfer Plan, Handoff to Process Owner
- Verify Benefits, Cost Savings/Avoidance, Profit Growth
- Close Project, Finalize Documentation
- Communicate to Business, Celebrate

■ Tool

- Process Sigma Calculation
- Control Charts (Variable and Attribute)
- Cost Savings Calculations
- Control Plan

Lean Six Sigma Books

- Lean Six Sigma for Service: How to Use Lean Speed & Six Sigma Quality to Improve Services and Transactions, by Michael L. George

A top recommendation. Uses compelling case studies in the provision of services (as opposed to manufacturing). More focused on theory than practical application and specific tools. Best accompanied by a tools guide.

- Lean Sigma: A Practitioner's Guide, by Ian D. Wedgwood

A technical (and rather dense) approach to lean and six sigma from a practical, step-by-step standpoint. Starts with descriptions of a variety of generic problems (e.g., on-time delivery issues, capacity too low, too many defects, uptime too low, intermittent failures, etc.), and gives "roadmaps" of methodology and tools applicable to each kind of process issue. The remaining 75% of the book is detailed descriptions of 55 specific tools referenced in the roadmaps. Here's a book review I presented in the IT SS Forum in

Lean Six Sigma Books cont.

- The Lean Six Sigma Pocket Toolbook: A Quick Reference Guide to 100 Tools for Improving Quality and Speed, by Michael L. George, John Maxey, David T. Rowlands, David Rowlands, Mark Price
Quick reference to a wide variety of tools. Similar to the Memory Jogger you got in GB training (you ARE using that, aren't you???), and including a bunch of Lean tools. I have this one on order for myself.
- Lean Thinking: Banish Waste and Create Wealth in Your Corporation, by James P. Womack & Daniel Jones
This book has heavily influenced the Lean implementation in Agilent's LSCA business. *From a reader review:* Reports on a long study of the theory of customer-driven value thinking. The elimination of waste in accomplishing customer driven trade is the main goal of this theory. Their views are spread over a period of many years, giving them the benefit of tracking case study performance over the long term. Companies both large and small have been studied and tracked to determine the benefits of these theories.
- What is Lean Six Sigma? by Michael L. George, David Rowlands, Bill Kastle
From a reader review: A conceptual-level primer for people considering instituting the Lean Six Sigma process within their company. It is an easy and quick read. We have used multiple copies to introduce the process to our employees.

Additional Citation:

Much of the content came from the iSixSigma website which is a collaboration of Six Sigma professionals. This is an excellent source for Six Sigma data and they provide a great magazine subscription:

<http://www.isixsigma.com/>