World-Class Quality

Using Lean Principles and Process Models to Achieve Measurable Results

NDIA Systems Engineering Conference - October 2008

Tim Olson, President
Lean Solutions Institute, Inc. (LSI)
(760) 804-1405 (Office)
Tim.Olson@lsi-inc.com
www.lsi-inc.com

World-Class Quality

"I have made this letter longer than usual because I lack the time to make it shorter"

Blaise Pascal

World-Class Quality

Presentation Objectives

Present an overview of lean and lean principles.

Discuss how to define lean processes using process models.

Present some lean metrics.

Describe some lean measurable results.

World-Class Quality

Outline

Introduction

Lean Principles

Lean Process Models

Lean Metrics

Some Lean Success Stories

Summary

World-Class Quality

The Quality Crisis

The cost of poor quality:

- **"In most companies the costs of poor quality run at 20 to 40 percent... In other words, about 20 to 40 percent of the companies' efforts are spent in redoing things that went wrong because of poor quality" (*Juran on Planning for Quality*, 1988, pg. 1)**

- **Crosby's Quality Management Maturity Grid states that if an organization doesn't know it's cost of quality, it's probably at least 20%. (Crosby, *Quality is Free*, 1979, pg. 38-39)**

World-Class Quality

Lean Problems

Most organizations have too much waste (e.g., non-value added).

Most processes have too many "non-value added" steps.

How can organizations focus on "value added" and remove waste?

Lean is a recent quality approach to help organizations focus on "value" and remove "non-value".

World-Class Quality

What is Lean?

Lean has its roots in quality and manufacturing, and is a recent popular movement in quality.

"Lean Production" is the name for the Toyota Lean Production System.

The following are major lean references (see references in back of presentation for full references):

- "The Machine That Changed The World"
- "Learning to See"
- "The Toyota Way"
- "The Toyota Product Development System"
- "Lean Thinking"

World-Class Quality

Quality Maturity

STAGE	SUMMARY	COQ	BA	DCF	SEI
Prevention	"We know why we have happy customers."	5%	800	20%	5
Wellness	"Quality planning, control, and improvement are routine."	10%	700	40%	4
Progressive Care	"Management commitment and continuous improvement resolve quality problems."	18%	600	60%	3
Intensive Care	"We don't know why we have quality problems, but they hurt."	25%	400	80%	2
Comatose	"What quality problems?"	33%	200	100%	1

- Acronyms are (COQ=Cost of Quality; BA=Baldrige Award; DCF=Dilbert Correlation Factor; SEI=SEI CMMI/CMM)
- Based on "The Eternally Successful Organization", by Crosby, the SEI, the Baldrige Award, & Dilbert Comics

World-Class Quality

Outline

Introduction

Lean Principles

Lean Process Models

Lean Metrics

Some Lean Success Stories

Summary

World-Class Quality

Some Lean Principles - (1)

Establish customer defined value (i.e., identify the "value stream"). Process = "value".

Continuously eliminate non-value added activities (e.g., waste, rework, defects).

Use leadership and standardization to create a lean culture.

Align your organization through visual communication.

Create an optimized process flow (e.g., "Flow", "Pull", "Just-In-Time", "Leveled").

World-Class Quality

Some Lean Principles - (2)

Use lean metrics to manage the value stream.

Front-Load the process for maximum design space.

Build a learning organization to achieve lean and continuous improvement.

Adapt technology to fit your people and processes.

Strive for perfection through continuous improvement.

World-Class Quality

Outline

Introduction

Lean Principles

Lean Process Models

Lean Metrics

Some Lean Success Stories

Summary

World-Class Quality

Common Process Problems

Too Big: Processes become too large and complex

Poor Usability: Not "fit for use" by process users. Many processes contain mixed information types

Poor Design: Process documentation usually violates good definition and writing principles

Not Visual: Processes need to be defined by well thought out diagrams, pictures, or models

Defined Sequentially: Processes are not novels

Shelfware or Unused Webware: Unused processes

World-Class Quality

Why Lean Process Models?

Reduce Size: Lean processes are precise, concise, and more usable.

Better Usability: Lean processes require defining "chunks" and labeling them for use.

Better Designs: Lean processes require good process definition and writing principles.

Visual Diagrams: Processes need to be defined by well thought out diagrams or "process models".

Defined Non-Linearly: Processes are dynamic, parallel, and concurrent.

World-Class Quality

Guidelines for Lean Processes

Chunk steps (7 plus or minus 2) into usage scenarios (e.g., plan, control, improve, engineer).

Use process modeling and best practices (e.g., procedures, standards) to select the best chunks.

Question every step of the process.

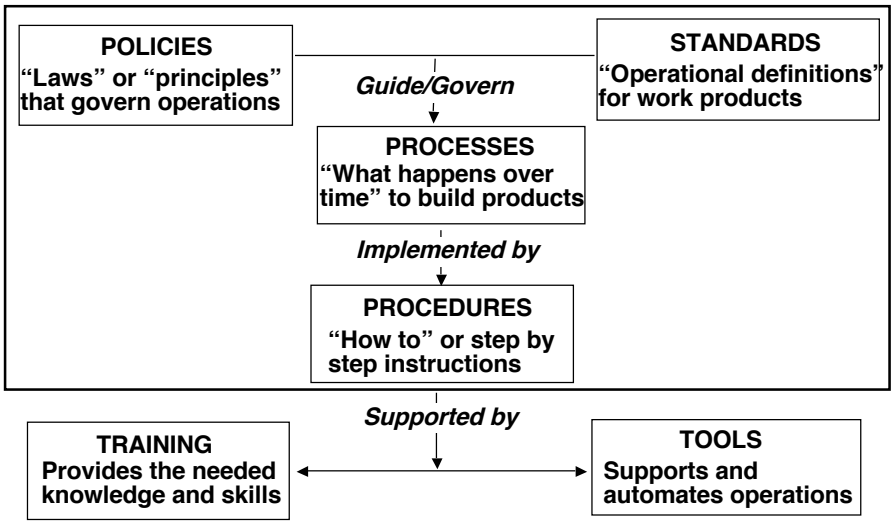
Remove "non-value added" steps.

Combine similar steps.

Refine steps to be short and usable.

World-Class Quality

Documentation Framework



• Slide adapted from"A Software Process Framework for the SEI Capability Maturity Model", Olson, Timothy G., et al, CMU/SEI-94-HB-01

World-Class Quality

Key Process Questions

Key Process Question	Process Element
Why is the activity performed?	1. Purpose
Who does what activity?	2. Role(s)
What work products are used?	3. Input(s)
What work products are produced?	4. Output(s)
When does the activity begin?	5. Entry criteria
When does the activity end?	6. Exit criteria
Where is activity performed?	7. Context (e.g., hierarchy)
What activities are performed?	8. Activities
How is the activity implemented?	9. Procedure

• Slide adapted from"A Software Process Framework for the SEI Capability Maturity Model", Olson, Timothy G., et al, CMU/SEI-94-HB-01

World-Class Quality

Process Definition Modes

Beginner Mode:

- **Assumes user has little or no experience**
- **Includes training material**
- **Includes process guidance and lessons learned**

Intermediate Mode:

- **Assumes user has some experience with process**
- **Includes process guidance and lessons learned**

Expert Mode:

- **Assumes user is very experienced**
- **Concise and precise as possible**

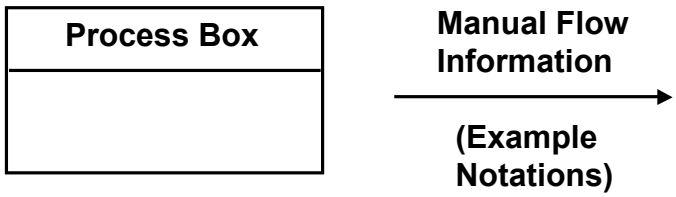
All Modes should be "Chunked" and Include:

- **Process models, checklists, forms, and tables**
- **Pointers to detailed explanations**

World-Class Quality

Value Stream Mapping

1. Define the product/service process to map.
2. Define the current value stream map.
3. Define the future value stream map
4. Implement the work plan (i.e., future state)



• Adapted from Keyte, Beau, and Locher, Drew. *The Complete Lean Enterprise: Value Stream Mapping for Administrative and Office Processes*, Productivity Press, New York, NY, 2004.

World-Class Quality

Process Models

Value Stream Mapping (VSM) is a lean best practice (primarily in manufacturing).

However, VSM currently lacks tool support and does not scale up to complex systems.

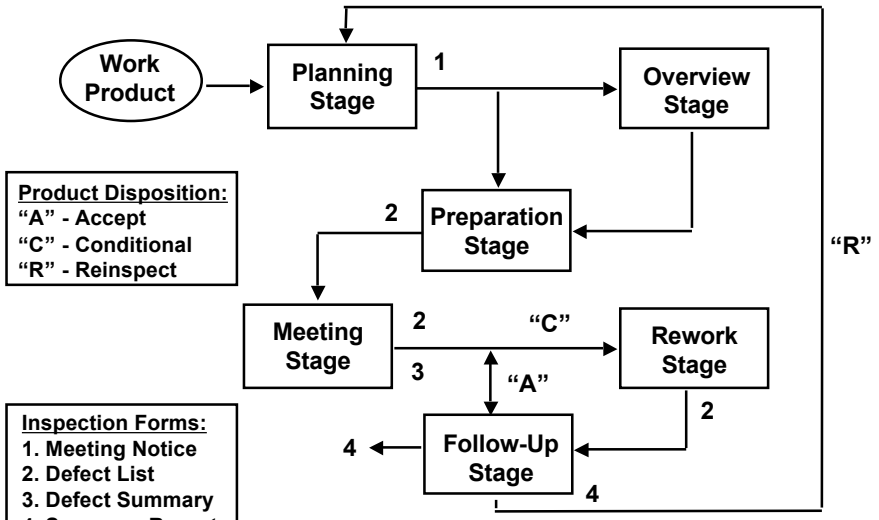
Process Modeling can implement VSM, scales up to complex systems, and has automated tool support.

LSI has a lean process modeling approach that puts the 5 W's on one page in a diagram.

Please see handout for example process models and success stories at NASA.

World-Class Quality

Inspection Process Model



•Adapted from Ebenau, *Software Inspection Process*, McGraw Hill, 1994

World-Class Quality

Example ETVX: Planning Stage

Purpose: Organize and plan resources for inspection

Inputs	Entry	Task	eXit	Outputs
• Final Draft of work product • Supporting materials for work product → • Inspection data (estimated or actual)	• Work product is completed (Final Draft) AND • Work product meets entry criteria	1. Verify entry criteria 2. Select inspection team 3. Need an overview? 4. Schedule inspection 5. Complete and distribute inspection work package **Measurements** • Preparation rate • Inspection rate • Defect density	• Team Selected AND <Overview Planned> AND Inspection Scheduled AND Work Package Distributed	• Inspection work package →

Roles: Moderator; Author

• Reference: " Best-In-Class Software Inspection Process Guide", by Olson, Timothy G., 1994

World-Class Quality

Outline

Introduction

Lean Principles

Lean Process Models

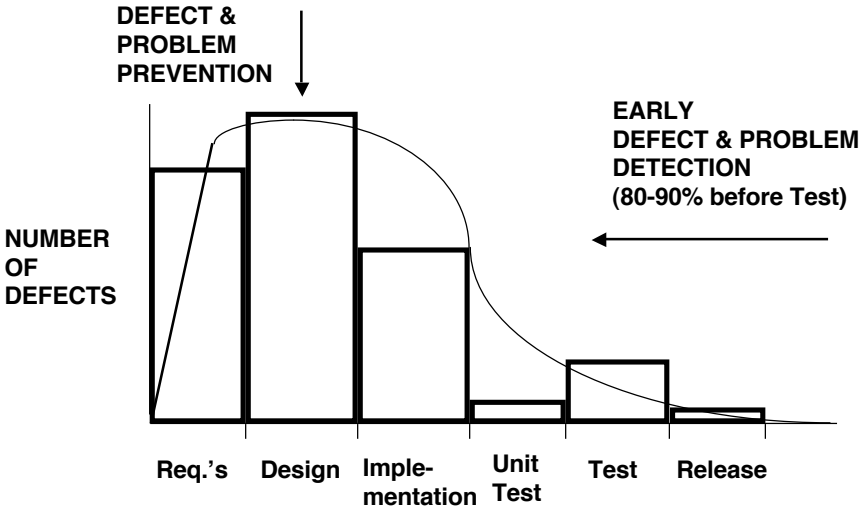
Lean Metrics

Some Lean Success Stories

Summary

World-Class Quality

Best-In-Class Defect Strategies

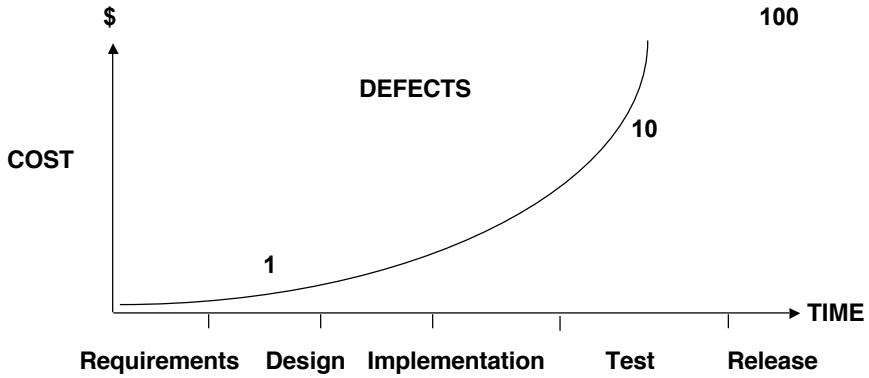


- Slide adapted from Olson, "A Software Quality Strategy for Demonstrating Early ROI", SSQ Journal, May 1995.

World-Class Quality

Industry Standard Cost Ratio to Fix a Defect

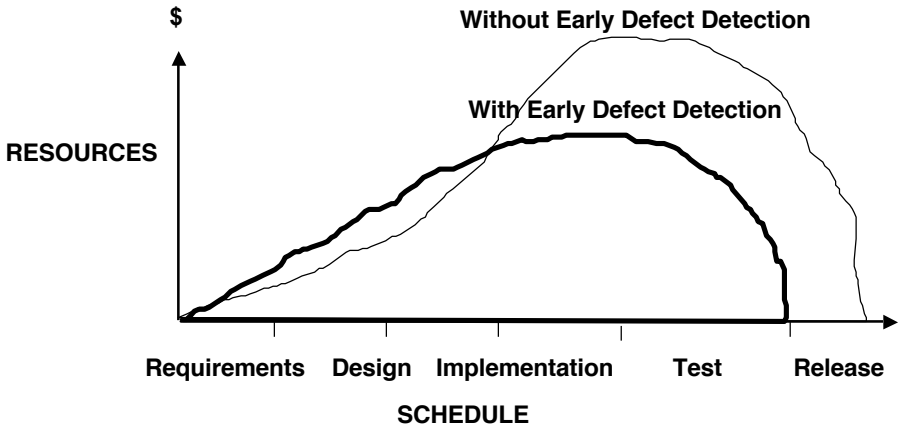
Defects cost less to fix when detected earlier in the process



- Data from Gilb, T. and Graham, D. *Software Inspection.* Addison-Wesley, 1993.

World-Class Quality

Early Defect Detection (EDD) Shortens the Schedule



- Adapted from Fagan, M. "Advances in Software Inspections", IEEE Transactions on Software Engineering, July 1986

Lean Measurement Framework^{SM}

GOALS	KEY QUESTIONS	METRICS	DC	DS
PLAN		Cost, defects, effort, size, schedule, etc.		
CONTROL		Cost, defects, effort, size, schedule, etc.		
IMPROVE		Cost, defects, effort, size, schedule, etc.		

- DC = Data Collection; DS = Data Storage

Outline

Introduction

Lean Principles

Lean Process Models

Lean Metrics

Some Lean Success Stories

Summary

World-Class Quality

Some Lean Success Stories

Toyota - Best lean documented success story in industry (from manufacturing - see references). Number 1 automobile manufacturer.

Hewlett Packard - a CMMI success story of a software service. 25% of the size of a typical CMMI implementation!!!

Lean Early Defect Detection - Averages 7:1 ROI!

World-Class Quality

HP Lean CMMI Process

The Capability Maturity Model Integrated (CMMI®) is an industry systems engineering model used in engineering, service, software, automotive, etc.

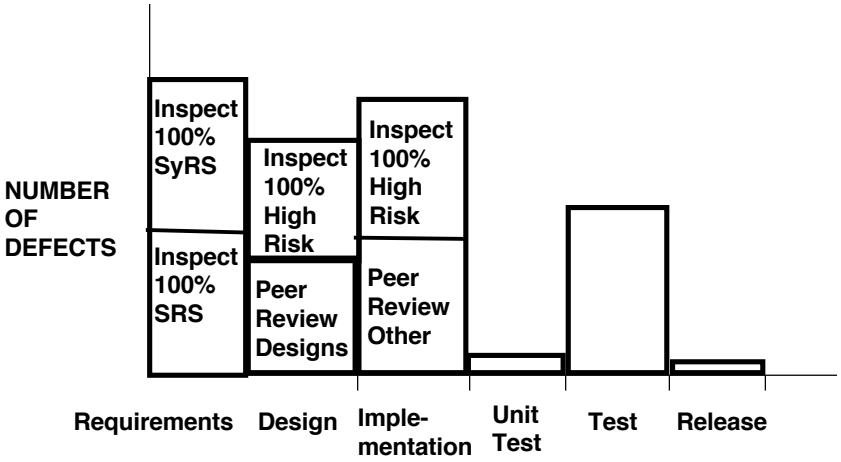
A small unit of HP implemented CMMI Maturity Level 3 in about 7 months (an average 4 year effort).

The lean HP Maturity Level 3 process is about 25% of the size of the HP India Process (or a typical CMMI Maturity Level 3 process).

• Olson, Timothy G., Kellum, Julie, and Tufail,Zia., "Rapidly Defining a Lean CMMI Maturity Level 3 Process", Presentation, NDIA CMMI Conference, 2006.

World-Class Quality

EDD Strategy: Defect Removal Efficiency (DRE)



- Slide adapted from Olson, "A Software Quality Strategy for Demonstrating Early ROI", SSQ Journal, May 1995.

World-Class Quality

Best-In-Class EDD Benchmarks

MEASUREMENT	WORLD-CLASS BENCHMARK
Costs of Poor Quality (COPQ)	Reduced from ~33% to ~15% (e.g., cut COPQ in half)
Defect Removal Efficiency	70-90% defect removal before test
Post-Release Defect Rate	Six Sigma (i.e., 3.4 Defects Per Million)
Productivity	Doubled (e.g., in 5 years at ~20% a year)
Return on Investment	7:1 - 12:1 ROI
Schedule / Cycle Time	Reduced by 10-15% (e.g., per year)

World-Class Quality

Outline

Introduction

Lean Principles

Lean Process Models

Lean Metrics

Some Lean Success Stories

Summary

World-Class Quality

Summary

Lean Organizations:

- Achieve measurable results (e.g., 7:1 ROI)
- Define customer value (i.e., the "value stream")
- Process = "Value Added"
- Remove non-value added (i.e., waste)
- Visualize the process
- Optimize process flow
- Manage the process with lean metrics
- Create and sustain a lean culture
- Build a lean learning organization
- Adapt technology to fit people and processes
- Strive for perfection through continuous improvement

World-Class Quality

Some Lean References

- Keyte, Beau, and Locher, Drew. *The Complete Lean Enterprise: Value Stream Mapping for Administrative and Office Processes*, Productivity Press, New York, NY, 2004.
- Liker, Jeffrey K. *The Toyota Way: 14 Management Principles from the World's Greatest Manufacturer*, McGraw-Hill, New York, NY, 2004.
- Liker, Jeffrey K and Meier, David. *The Toyota Way Fieldbook: A practical Guide for Implementing Toyota's 4Ps*, McGraw-Hill, New York, NY, 2006.
- Mann, David, *Creating a Lean Culture: Tools to Sustain Lean Conversions*, Productivity Press, New York, NY, 2005.
- Morgan, James M., and Liker, Jeffrey K., The Toyota Product Development System: Integrating People, Process, and Technology, Productivity Press, NY, NY, 2006.
- Olson, Timothy G., "Best-In-Class Early Defect Detection and Defect Prevention", Tutorial, NDIA CMMI Conference, 2007.
- Olson, Timothy G., "Defining Lean Systems Engineering Processes", Paper and Presentation, INCOSE International Systems Engineering Conference, 2007.
- Olson, Timothy G., "How to Define Lean Processes that are CMMI Compliant", Tutorial, NDIA CMMI Conference, 2006.
- Olson, Timothy G., Kellum, Julie, and Tufail, Zia., "Rapidly Defining a Lean CMMI Maturity Level 3 Process", Presentation, NDIA CMMI Conference, 2006.
- Olson, Timothy G., "Using Best Practices to Define a Lean Decision Analysis Process", Presentation, INCOSE Systems Engineering Conference, 2007.
- Rother, Mike and Shok, John. Learning to See, Brookline, Mass.:Lean Enterprise Institute, 1998.
- Womack, James P., and Jones, Daniel T., Lean Thinking: Banish *Waste and Create Wealth in Your Corporation*, Free Press, New York, NY, 2003.
- Womack, James P., Jones, Daniel T., and Roos, Daniel., *The Machine That Changed the World*, Rawson Macmillan, New York, NY, 1990.

World-Class Quality

Using Lean Principles and Process Models to Achieve Measurable Results

NDIA Systems Engineering Conference - October 2008

Tim Olson, President
Lean Solutions Institute, Inc. (LSI)
(760) 804-1405 (Office)
Tim.Olson@lsi-inc.com
www.lsi-inc.com