Lean Process Design
A Concept of Process Quality

David N. Card
dca@q-labs.com
Agenda

- Background and Objectives
- Concepts of Lean
- Lean Process Design Process
- Summary
Background

- CMMI® requires the definition of processes that cover certain goals and practices
  - Requires “sufficiency”
  - Does not provide criteria for a “good” process – not an appraisal consideration
- Lean principles provide “goodness” criteria for processes
- Lean usually applied as a re-engineering technique, e.g., Kaizen

CMMI® is a registered trademark of Carnegie Mellon University
Objectives

- Identify the process “goodness” criteria implicit in Lean principles
- Explain how these can be applied during the design and initial definition of processes
- Minimize later rework and re-engineering
The Lean Misconception

- Lean is not about "light weight" processes
- "Lean" refers to reducing inventory and "work in progress"
- Lean is accomplished through robust processes
  - Simple
  - Reliable
  - Standardized
  - Enforced

*Caveat: many flavors of Lean*
Five Lean Principles

- **Value** – identify what is really important to the customer and focus on that
- **Value Stream** – ensure all activities are necessary and add value
- **Flow** – strive for continuous processing through the value stream
- **Pull** – drive production with demand
- **Perfection** – prevent defects and rework

*Value Stream = Business Process*
Views of Lean

- **Five Observed Principles**
  - Value
  - Value Stream
  - Flow
  - Pull
  - Perfection

- **Technical Practices**
  - Similar to Six Sigma (including Statistical Process Control)
  - Adds queuing theory perspective
Lean Techniques

- Realize the principles of Lean
  - Methods and tools for defining, analyzing, and improving processes
  - Criteria for efficient and effective processes
  - Dimensions of process performance subject to control

- Based on queuing theory (a process may be viewed as a system of queues)

*Lean is not just an attitude!*
Example Manufacturing Process

Parts Inventory → Assemble Wheels → Stock of Wheels

Assemble Frames → Stock of Frames

Assemble Bike

Stock of Bikes

Inventory and Work in Progress Enable Inefficient and Unreliable Processes!
Example Software Process

Waterfall model implies large WIP; Incremental and agile imply smaller WIP, but are they “robust” enough?
Limits to Performance

Continuous Improvement Increases Capacity and Reduces Variability

From P. Middleton, Lean Product Development, 2005
Implications of Queuing Theory

- Broadens concerns for managing the capacity of organizations
- Leads to design criteria for process definition
  - Queues with certain properties operate more efficiently
- Suggests candidate measures
  - Properties of queues are measurable
The Capacity Myth

- Most engineering organizations behave as if their system/software development capacity is elastic
  - Capacity expands to accommodate the need
  - Projects are planned in isolation

- Systems have limits to performance
  - Organizational performance must be managed to facilitate project success
  - Organizational performance is not simply an aggregation of individual projects
Lean Process Design

- Why – begin the process improvement journey with efficient and effective processes, not just compliant processes
- How – use Lean concepts to make decisions about the organization and composition of processes, more than human factors considerations
- When – during process design and initial definition, not just as later rework
Kaizen

- A facilitated team activity
- Focused on improving an existing process or (more commonly) subprocess
- Applies Lean principles
- Typically involves tools such as
  - Quality Function Deployment
  - Process Mapping
  - Value Stream Analysis
Process Size as a False Trail

- Lean is not about the “size” or “volume” of the process definition
- Process definition includes
  - Organizational standard process
  - Organizationally-defined alternatives
  - Project-defined alternatives
- Volume of alternatives and variations often exceed the volume of the basic organizational process – focus on these!
Process Proliferation

Organizational Standard Process

Eliminate OSP Element

Organizationally Defined Alternatives

Projects Defined Processes

Eliminate Project Variations
Lean Process Design Process

- Requires a focus on the architecture or “system design”, as well as the design of subprocesses
- Provides common and specific criteria for each level of design
- Use estimates of process performance to help make design decisions
- Incorporates traditional process definition conventions and notations
Lean Process Design Process

1. **Identify Value**
   - Customer Needs
   - Existing Process

2. **Define Architecture**
   - ISO 9001, CMMI, etc.

3. **Analyze Architecture**
   - Estimated Performance

4. **Define Subprocesses**
   - Existing Process

5. **Improve Process**
   - Performance Data
Lean Process Design Criteria

- Break work into “small” packages
- Process small packages of work continuously
- Distribute work evenly across subprocesses
- Minimize subprocess variations
- Minimize hand-offs between subprocesses
- Reuse subprocesses within the architecture
- Avoid redundant or duplicative tasks
- Eliminate “just in case” activities
- Minimize waiting and delays
- Identify and mitigate performance constraints
- Understand downstream demand
Lean Subprocess Design Criteria

- Use proven subprocesses
- Ensure subprocess are followed
- Keep subprocesses simple
- Plan for control of subprocess performance
- Build quality assurance into each subprocess
- Avoid redundant or duplicative tasks
- Eliminate “just in case” activities
- Minimize waiting and delays
- Identify and mitigate performance constraints
Human Factors Criteria

- Process definitions are intended for human users, must be
  - Understandable
  - Natural/Intuitive
  - Accessible
  - Effectively supported by tools
  - Etc.

- Process definitions are only one element of a process instantiation (also, people, tools, and input)
Lean Software Management
Case Study: Timberline Inc

Peter Middleton
Amy Flaxel
Ammon Cookson

Used with Permission
Work Balance Chart - Initial

Estimated Cycle Time

TT = 2

- Engineering Design / Develop
- QA Design Black Box Testing
- QA Design & Execute White Box Testing
- Training Development
- Tech Comm Development
- QA Smoke / Regression Testing
- QA Develop & Execute Automation
- QA Execute Black Box Testing

Middleton, Flaxel, Cookson
Work Balance Chart – Post Adjustment

Middleton, Flaxel, Cookson
Example: Cycle Time Analysis

Run Chart

Middleton, Flaxel, Cookson
Performance Dimensions

- Task size
- Work arrival rate
- Cycle time
- Effort
- Delay/Waiting
- Defects
- Rework
Summary

- Lean is not about the volume of process definitions
- Processes can be designed, up front, to be more efficient and effective with Lean principles
- Good process design requires engineering at both the system (overall process) and subprocess levels
- Lean helps identify the critical measures of performance
About Q-Labs

- Consulting, Training and Appraisals in:
  - Software Measurement
  - CMM/CMMI
  - Lean/Six Sigma
  - ISO 15504/SPICE
  - ISO (001
  - 150 employees
  - ISO 9001 Certified

- A broad international client base, e.g.
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  - AXA, BNP Paribas, Banques Populaires
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