Lean 3P (Production Preparation Process) Training
Ground Rules

This is a learning environment, make the most of it

• Ask questions at any time
• Keep an open mind to change
• Respect each others views
• Never leave in a silent disagreement
• If you disagree with something/someone – say so, but prepare to be challenged
• Practice mutual respect every day
• Treat others as you want to be treated
• One person, one voice—no position or rank
• There’s no such thing as a dumb question
• Be prepared to work!
• Understand the process and Just Do It!
Week’s Agenda

Day 1
- 3P / Design Training
- Evaluate VOC
- Prioritize Customer requirements

Day 2
- Define impact of Requirements
- Brainstorm Alternatives

Day 3
- Evaluate design alternatives
- Gap Analysis
- Develop KPI’s
- Business Plan Draft

Day 4
- Develop Project plans
- Resource Planning
- Communication Plan for customers
Lean 3P (Production Preparation Process) Training

3P Introduction

June 2013
Lean 3P (Production Preparation Process) is an event driven process for developing a new product / service concurrently with the operation that will produce it and by the people that will interact with it.

Results in better products that require less initial capital and lowers ongoing unit costs.

Uses Lean Six Sigma principles as part of the design – focused on customer.

3P enables the development of great products:
- The right features
- The right price
- The right cost
- The highest user Satisfaction
3P allows for more reliable innovation...

Lean 3P

- Improve performance of new and existing products and processes
- Design products and processes right the first time
- Develop alternatives to meet core customer needs
- Done right first time

Traditional Innovation

- Over the wall
- Late to market
- Rework pre-launch and post launch
- High Developmental costs
- No optimized for Lean

Concept Generation
Product Planning
Product Engineering
Process Engineering
Production Process

Generate Product Concept
Repeat
Expose Customer to Product
Conversation with Customer about Product
Why Does 3P work

- Intense cross functional collaboration
- Product Development concurrently with Process
- Rapid Learning and Try-Storming
- Process that moves quickly through a series of steps
- Activate our thinking and help us gain understanding
- Evaluate and converge upon optimum solutions
When to use 3P?

- New Product
- Design Changes
- Change in capacity
- Change in Demand
- Recovery / Turn Around
- New Client
3P Key Components

- **VOC – Planning & Preparation**
  - Customer – Market research plan

- **VOC – Interpret Customer Requirements**
  - CTXs : CTQs, Business Requirements (BR)

- **Conceptual Design**
  - 1-3 Alternatives – “At a Glance”

- **Detailed Design**
  - Process/Product Design

- **Pilot and Full Scale Implementation**
  - Detailed Pilot layout, Ramp up plan
3P Cycle

New product / service

VOC – Planning & Preparation

Product/Service Innovation

VOC – Interpret
Customer Requirements

3P Cycle

Pilot and Full Scale Implementation

Detailed Design

Conceptual Design

RFI or RFP

Process Innovation

Reengineering
### 3P Session Overview

<table>
<thead>
<tr>
<th>Inputs</th>
<th>Session</th>
<th>Outputs</th>
</tr>
</thead>
<tbody>
<tr>
<td>Customers, Proposal, Product/service concept, Preliminary CTQ’s</td>
<td>VOC – Planning &amp; Preparation days</td>
<td>Research data plan, Targeted customers, Customer segmentation, Benchmarking plan,</td>
</tr>
<tr>
<td>Research data, Benchmark data, Competitive analysis</td>
<td>VOC – Interpret Customer Requirements</td>
<td>CTQ/P’s, SLA’s, Preliminary specifications, House of Quality, Weighted CTQ elements, Business requirements, Competitive analysis plan</td>
</tr>
<tr>
<td>CTQ’s, SLA’s, Specifications, HOQ, Lean Design Principles,</td>
<td>Conceptual Design</td>
<td>Hi-level process steps/map, Relationship of process steps to CTQ, 1 to 3 best alternative designs, Hi-level layout, Targeted technology &amp; equipment</td>
</tr>
<tr>
<td>Skunk works, 1-3 best alternatives, Lean concepts, “Process/Product Glance”</td>
<td>Detailed Design</td>
<td>Detailed process, Layout, Staffing, Quality Checks, Standard Ops, High level implementation plan, Final technology &amp; equipment, Metrics, supplies/materials, Pilot plan, FMEA, Control plan, Training docs</td>
</tr>
<tr>
<td>Outputs from Detailed Design</td>
<td>Pilot and Full Scale Implementation</td>
<td>Validated design/process, Detailed implementation plan, Sign offs &amp; approvals, Revised: Standard Ops, Staffing plan, Control plan, FMEA</td>
</tr>
</tbody>
</table>

Diagram:
- **Concept – Features & SLA’s**
- **Conceptual Design**
- **Detailed Design**
- **Outputs from Detailed Design**
- **Pilot and Full Scale Implementation**
- **inputs**
- **Session**
- **Outputs**
- **Project Timeline**
Lean 3P (Production Preparation Process) Training

3P - VOC – Planning & Preparation

June 2013
Identifying Customers

Who Are Our Customers?
What Do They Need?
What Do They Want?
Are All Customers The Same?

How do we find out?
Identifying Customers

Review Engagement Proposal

Whose needs must be met for this product/process to be successful?

Are all customers equally important?

Are there other potential key customers (either external or internal)?
Identifying Customers

High-Level Process Mapping

 Suppliers  Inputs  Process  Outputs  Customers

CTQs  CTQs

Measures  Measures

Process Map
# Gather Customer Needs

<table>
<thead>
<tr>
<th>Method</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Interview</strong></td>
<td>Learn about a specific customer's needs and requirements, customer values, and point-of-view on service issues, product/service attributes, and performance indicators/measures; supports development of hypotheses about customer values.</td>
</tr>
<tr>
<td><strong>Focus Group</strong></td>
<td>Organize information from the collective point of view of a group of customers that represent a segment; helps define a segment and prioritize customer values.</td>
</tr>
<tr>
<td><strong>Survey</strong></td>
<td>Measure the needs and customer values for—or the importance and performance of—a product, service, or attribute across an entire segment or group of segments; furnishes “hard” evidence to support decision-making.</td>
</tr>
<tr>
<td><strong>Internal Research &amp; Listening Posts</strong></td>
<td>Search for customer needs and requirements, product/service attributes, customer values, and performance indicators/measures from secondary sources.</td>
</tr>
</tbody>
</table>

**Select customer research method(s)**
What Questions Do We Ask Our Customers?

*Kano Model:*

Which characteristics drive customer satisfaction?

*Product Function* vs. *Customer Satisfaction*:
- *Excitement*
- *Performance*
- *Absent*
- *Threshold*
- *Fully Implemented*
Drivers of Customer Satisfaction

Threshold Attributes:

Expected attributes – “musts” of a product

Increasing performance of these attributes provides diminishing returns

Absence (or poor performance) of these attributes results in extreme customer dissatisfaction

Example – brakes on a car
Drivers of Customer Satisfaction

*Performance Attributes:*

More is generally better – customers will typically pay more for these attributes.

Increasing performance of these attributes improves customer satisfaction.

Absence (or poor performance) of these attributes results in lower customer satisfaction.

These attributes form weighted needs upon which product concepts will be evaluated.

*Example – fuel economy in a car*
Drivers of Customer Satisfaction

*Excitement Attributes:*

Unspoken and unexpected by customers
Increasing performance of these attributes results in high levels of customer satisfaction
Absence (or poor performance) of these attributes does not result in lower customer satisfaction
Identifying and providing these attributes provides a competitive advantage (until they morph into Performance Attributes)

*Example – rear video camera in a car for backing up*
Segment Customers

Define Customer Segments

Segmentation is recommended to focus customer research on the most important customers:

- First, determine logical customer segments (Region, Type Of Business, Size, etc.)
- Then, write a definition of each customer segment
Prioritize Customers / Segments

Who are the critical customers/customer groups for the product or service?

All customers/segments are not of equal importance

Identify the “Vital Few” and “Useful Many” customers

Example: Personal computer leasing service

- **Vital Few:** Large companies who lease > 500 computers for long-term (> 1 Year)

- **Useful Many:** Small companies who lease 1-10 computers for 6 months-1 year
Lean 3P (Production Preparation Process) Training

3P - VOC – Interpret Customer Requirements

June 2013
Understand Customer Requirements

Utilize the voice of the customer as an input to product expectations.
Identifying Customers

Who are our customers?

What do they need?

What do they want?

Are all customers the same?

How do we find out?
Are you connected to your Customers?

- How the customer explained it
- How the Project Leader understood it
- How the Analyst designed it
- How the Programmer wrote it
- How the Business Consultant described it
- How the project was documented
- What operations installed
- How the customer was billed
- How it was supported
- What the customer really needed
Lean Six Sigma Starts with the Customer

Customer focus begins by linking business strategy and customer wants and needs.

There are two major types of customers, with differing needs:

- Internal Customers (partners)
- External Customers

Customers wants and needs can be determined in many ways:

- Surveys
- Interviews
- Focus groups, etc.
Voice of the Customer Context

Organizational Objectives & Goals

Voice of Business (VOB)

Voice of Process (VOP)

Voice of Customer (VOC)

Client Expectations

Improvement Projects
If the customer requirements are not explicit, clarify and quantify them

<table>
<thead>
<tr>
<th>Voice of the Customer (VOC)</th>
<th>Voice of the Customer theme</th>
<th>Critical to Quality (CTQ) Characteristic</th>
</tr>
</thead>
<tbody>
<tr>
<td>The support for this system is lousy! Nobody is dealing with the problems we report</td>
<td>Customer needs product problems to be dealt with promptly</td>
<td>Support staff will respond within 30 minutes of a problem being reported</td>
</tr>
<tr>
<td>The new release of product is full of problems</td>
<td>Customer needs product to be delivered error free</td>
<td>Product will be delivered right first time</td>
</tr>
<tr>
<td>The procurement process takes too long We may not get the hardware in time</td>
<td>Customer needs a quicker turnaround time on orders</td>
<td>Customer orders will be approved internally within 1 day of the initial request</td>
</tr>
</tbody>
</table>
Lean Six Sigma starts with the Customer

- Customer information is translated to the business as customer requirements, or critical to quality (CTQ) requirements
- Excelling at fulfilling customer CTQs can drive differentiation
- Differentiation can give a competitive advantage in products and services
What Satisfies the Customer?

Kano Model:

- **Service Element**
- **Customer Satisfaction**

- **High**
  - **DELIGHTERS**
    - Breakthrough Customer Needs/Features
  - **SATISFIERS**
    - Core Competitive Requirements
  - **DISSATISFIERS**
    - Basic Requirements

- **Low**
  - **Excitement**
  - **Performance**

- **Absent**
  - **Fully Implemented**
  - **Threshold**

Understand which service elements drive customer satisfaction

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Kano Analysis

Generate a list of customer requirements (CTQs)
Review the Kano Analysis
Identify the appropriate category for each requirement.

Work through the list of requirements one by one. Mark each as to whether it is a:
Dissatisfier – Basic Requirement
Delighter
Satisfier – More Is Better

Determine priorities
Turn high priorities into objectives and take forward
Reactive and Proactive Data

**Reactive data comes to you**

**Proactive data is gathered by reaching out to the customer**
“Voice of the Customer” sample survey results

### Client Survey Results by Performance Category For <customer A>

<table>
<thead>
<tr>
<th>Performance Category *</th>
<th>Response Composite</th>
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<tbody>
<tr>
<td>Overall</td>
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<tr>
<td>Referenceability</td>
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<tr>
<td>Renewability</td>
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<td>Value</td>
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<td>Competitive Advantage</td>
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<tr>
<td>Innovation</td>
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<tr>
<td>Thought Leadership</td>
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<tr>
<td>Overall Evaluation Composite</td>
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<tr>
<td>Performance to Commitments Composite</td>
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<tr>
<td>Applied Innovation Composite</td>
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<tr>
<td>Collaboration &amp; Alignment Composite</td>
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</tbody>
</table>
Reactive Data

Reactive data reflects past performance, is often related to customer dissatisfaction and can be reflected through:

Customer Complaints
  Help Desk calls or emails
Sales Data
  Credits due to contested payments
Warranty claims
Product returns
Proactive Data

Proactive data requires more effort to collect, but can provide more current and specific information.

Examples include:
- Interviews
- Focus groups
- Surveys
- Comment cards
- Sales calls
- Customer visits
- Market research
- Competitive Analysis
Surveys and Sampling

• Surveys are used to find out more about customers:
  – Opinions
  – Attitudes
  – Preferences

• Sampling is a method of gathering information about populations from a cross section of individuals

What are some ways to survey and the potential pitfalls of each? And for your project?
VOC and Customer Expectations

Process Capability compares the Voice of the Customer (VOC) to the Voice of the Process (VOP) assessing a process to see if it meets customer requirements

- VOC = specifications given by the Customer for the product
- VOP = the distribution of the data obtained from the process
Customers Experience Variation, not Averages

Pilot A

End of runway!

Pilot B

Avg. distance to stop

Avg. deviation from center of runway

Which pilot would you want to fly with?
Define CTQ’s (output measures)

We measure improvements in process/service performance by monitoring the process outputs.

You should have identified the highest priority goals for your project and now you need to create a measure for them.

This output measure is frequently called a CTQ – Critical to Quality characteristic.

CTQ’s are the high level process measures that will tell you and the customer whether the improvements that you make have had an effect on the area the customer needs.
CTQ Trees
A Tool to Help Derive CTQs

What does a Tree diagram do?
Converts general customer goal statements into more detailed Critical To Quality Characteristics (CTQs)
  • From general “WHAT” to specific “HOW”
Takes input from all the sources identified in previous VOC activities i.e. Kano
Maintains an iterative process until you end up with things that are meaningful, measurable and actionable
CTQ Trees – Example

- **Needs**: Good Service
  - System Avail.
    - Fast response times
    - Minimal downtime
  - Flexible response to overtime requests
- **Drivers**: Good Support
  - Calls answered promptly
  - Trouble tickets actioned quickly
  - Files sent to 3rd parties on time
- **CTQs**
  - Max response time < 0.2 secs
  - System available Mon-Sat 07:00
  - Severity Level 1 tickets < 4 hrs
  - Password resets < 2 hrs

Max response time < 0.2 secs
System available Mon-Sat 07:00
Severity Level 1 tickets < 4 hrs
Password resets < 2 hrs
CTQ Tree – Exercise

Split into groups
One of you should act as the customer and express a general service requirement for the simulation exercise or your project.
The others should work with you to translate the general requirement into a series of concise specifications using the CTQ Tree method.
Aim to record 2-3 detailed specifications.
Lean 3P (Production Preparation Process) Training

3P - Conceptual Design

June 2013
Develop Alternatives

**Why**
- Discover potential improvement
- Force new look at product/process

**Who**
- Key stakeholders and SMEs

**When**
- Dramatic change in product/process: volume, requirements, technology
- New product/process
- Relocation/consolidation or Recovery
- Respond to RFP
Develop Alternatives

What - Deliverables

- Multiple: Product visual, process map, layout, Quality plan, accessories, equipment plan, FTE plan, etc
- High level: “At a glance”

How

- Managed Creativity exercises
- Structured Approach
- Brainstorming
- Documentation of ideas
Steps to Develop Alternatives

Time Base Strategy / Lean Concept and Training

Managing creativity
  • Rules of creativity
  • Recognizing barriers to creativity
  • Exercises in creativity

Reviewing current product / process
  • What are the outputs
  • What are the true customer and business requirements
  • Identify Value Add

Brainstorming

Map alternatives

Document alternatives

Deliverable: processes at a glance
Design Principles

- Minimize wasted motions by the operators.
- Facilitate operator flexibility, not process order.
- Enable minimal staffing.
- Don’t disrupt operator flow with material flow.
- Each process must ensure quality before passing the product to the next process.
- Quality assurance methods must be consistent with the process.
- Place in coming items entrance & finished item exit points together.
- Consider an “open room” arrangement.
- Avoid isolated islands
Design Principles cont.

- Use highly-visible management to facilitate rapid response to abnormalities
- Minimize transport distances
- Minimize workstation size
- Ensure that work is “belly high” and “forearm deep”
- Standard operations
- Segregate complexity
- Flow process
- Common tempo
- Quality at the source
- Minimize waste
- Feedback – HPC Ecosystem
Design Principles cont.

- Ensure that work is “belly high” and “forearm deep”
- Standard operations
- Segregate complexity
- Standard operations
- Flow process
- Common tempo
- Link processes
- Quality at the source
- Minimize waste
- Feedback – HPC Ecosystem
- Engineered loading
Managing Creativity

Acknowledge need for “change”
Review barriers to creativity
Review rules of creativity
Exercises to stimulate new ideas
Brainstorming
Rules of Managed Creativity

I will not judge another person’s idea

I will overcome hurdles in my own thinking and generate creative ideas

I will make every effort to look at each situation and problem from many angles

I will express my ideas openly and not fear the opinion of others

I will return to my 12 year old mindset
Rules of Managed Creativity

Blank page (no preconceived ideas)

Creativity before capital

Multifunctional team (stakeholders)

Short time frame to concept

Lots of ideas

No money
Barriers to Creativity

1. The right answer
2. Follow the rules
3. Be practical
4. Play is frivolous
5. That’s not my area
6. Don’t be foolish
7. Avoid ambiguity
8. To err is wrong
1. The Right Answer

_Quote:_ “Nothing is more dangerous than an idea when it’s the only one you have.” French Philosopher Emile Chartier

_Approach:_

- Look for the second right answer
- Get a lot of good ideas
- Change the question

_Techniques:_

- What if?
- Play the fool
- Reverse the problem
- Break the rules
- Ask for plural answers
2. Follow the Rules

**Quote:** “If you don’t ask “why this?” often enough, somebody will ask “why you?””
*Physicist Tom Hirshfield.*

**Approach:**
- Challenge the normal patterns
- Suspend all rules
- Start with a “white board”.

**Techniques:**
- Rules exist for a reason determined at one time. That time has passed – should the rules?
- Gather the rules, and then throw them all out.
- Examine one by one, only accept back rules that are still absolutely necessary.
- Find a Sacred Cow – slay and grill it
3. Be Practical

**Quote**: “Every child is an artist. The problem is how to remain an artist after growing up.”  
*Pablo Picasso*

**Approach**: 
- Ask “what if?” questions.  
- Imagine how others would do it.  
- Use as stepping stones, extrapolate from ideas

**Techniques**: 
- Avoid “premature evaluations”  
- Exercise the “creative no”  
- Imagine you are the idea
4. Play is frivolous

**Quote:** “Play is what I do for a living. The work comes in organizing the results of the play.” System Architect

**Approach:**
- When do you normally get new ideas?
- Pause for a bit
- Use incubation
- One O’clock should mean something new

**Technique:**
- When you have a problem, play with it
- Pause, incubate, “play”
- Revisit
- If you don’t have a problem, play anyway
5. That’s not my Area

_Quote:_ “Make it a point to be on the lookout for novel and interesting ideas that others have used successfully in the past. Your idea has to be original only in its adaptation to the problem you are currently working on.”  

_Thomas Edison_

**Approach:**

- Forget specialization
- Use cross fertilization
- Be an Explorer

**Technique:**

- Steal shamelessly
- Change roles titles
- Look outside your discipline or industry
6. Don’t be foolish

**Quote:** “We all know your idea is crazy. The question is, whether it is crazy enough.” — Niels Bohr

**Approach:**

- Don’t just “go along” — avoid groupthink.
- Consult a fool – think like one
- Put on your fools cap

**Technique:**

- Reverse assumptions
- Be irreverent
- Make jokes – laugh at it
- Reverse you viewpoint, do the opposite of what is expected
7. Avoid Ambiguity

Quote: “The little I know I owe to my ignorance.” Anonymous

Approach:

• Look for ambiguity – specificity destroys ideas
• Find paradoxes
• Let random information stimulate thought

Techniques:

• How else can this be interpreted?
• Listen to your dreams.
• Ask an Oracle
8. To err is wrong

**Quote:** “If you are not failing every now and again, it is a sign you are not trying anything very innovative.” Woody Allen

**Approach:**

- Try something new
- Produce new ideas first, not right ideas
- See failure is a learning experience.
- Use it to produce something new

**Technique:**

- Use an error to stimulate thinking – stepping stone to new idea
- Ask what bad things can happen if I do this?
Managed Creativity: Summary

Give yourself a license to be creative

Become an:

**Explorer** – search for new information and resources

**Artist** – new resources and information into new ideas

**Judge** – evaluate merits of ideas and what to do with it

**Warrior** – convert ideas into action
Creative Exercise

1. Below is the Roman numeral seven. Add a single line to make it 8.
   VII

2. Below is Roman numeral nine. Add a single line to make it 6.
   IX

3. A king is to give his throne to one of 2 sons. He will have his sons compete in a horse race in order to determine the successor of the throne. Whoever owns the slower horse gets the throne. The sons – fearing each other will cheat by slowing down their horse – ask the court jester how to ensure a fair race. The jester answers with 2 words.
   What are those 2 words?
Review Process - Product

What are the customer requirements? (CTQs, CTP)
  • List or review SIPOC

What are the business requirements?

How are requirements met?

Map the current process at a high Level
  • Physical flow
  • Information/data flow
  • Value add vs. non-Value Add

Review barriers of Creativity
  • Which Techniques can you apply to your product or process
  • Try at 2-3 techniques

Brainstorm on Alternatives to deliver CTQs, CTPs, BRs
Brainstorming

1. Generate ideas: Structured or non-structure
2. Document
3. Everyone Participates
4. No criticism
5. Exhaust ideas
6. Review and Clarify
7. Discard duplicate
8. Organize common themes
   - Use affinity mapping if needed
9. Common themes become basis for alternatives
10. High level evaluation to judge alternatives
    - See Appendix : Lean, Design Principles
Document Alternatives

High Level “sketch” or Design of Alternatives

Include key components of product / process

- Visual of product
- Process flow: physical, information
- Report layouts
- Information flow
- Quality assurance method
- Accessories
- Equipment
- Technology
- FTEs
- Work Methods
- Etc.
Design Principles

Just-In-Time Is...

A business system which produces:

- What the customer wants
- In the quantity the customer wants
- When the customer wants it

While using minimum resources:

- People
- Space
- Materials
- Equipment
Design Principles cont.

...By Focusing and Eliminating Waste of:

- Defects
- Excess motion
- Over Production
- Over Processing
- Excess Material / Information / Inventory
- Transportation
- Waiting
Pugh Matrix

There are a variety of methods for selecting a best design concept from among alternatives. With a Pugh Matrix, concepts are compared to a base case and the best features of concepts are combined to develop a superior concept.

The basic Pugh Selection process is as follows:

1. Generate a number of design concepts.
2. Develop evaluation criteria (10-20 at most, highest priority CTQs).
3. Pick the best current concept as the baseline.
4. Score each alternative as better (+), same (S) or worse (-) against the baseline for all criteria.
5. Attempt to combine superior features of different concepts.
6. Continue until the “best” concepts appear.
# Pugh Matrix: Evaluate 7 Alternatives

## Key Criteria

<table>
<thead>
<tr>
<th>Key Criteria</th>
<th>Concept 1 Baseline Design</th>
<th>Concept 2 New Design</th>
<th>Concept 3 New Design</th>
<th>Concept 4</th>
<th>Concept 5</th>
<th>Concept 6</th>
<th>Concept 7</th>
<th>Importance Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to provide loan amount</td>
<td>S</td>
<td>S</td>
<td>-</td>
<td></td>
<td></td>
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<tr>
<td>Follows design principles</td>
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<td>+</td>
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<td></td>
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</tr>
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<td>0</td>
<td>4</td>
<td>2</td>
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<td>4</td>
<td>1</td>
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<tr>
<td><strong>Weighted Sum of Positives</strong></td>
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<td>23</td>
<td></td>
<td></td>
<td></td>
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<td></td>
</tr>
</tbody>
</table>

### Analysis:
- Concept 3's negatives outweigh its positives and should be dropped from further consideration.
- Concept 2 has a slight edge over the others but is not a clear winner. More thought should go into refining/improving this concept.
Lean 3P (Production Preparation Process) Training

3P - Detailed Design

June 2013
Simulation Steps

For the best concepts:

Create high-level process map (if not already completed)

Determine the Critical To Process steps/variables

Determine design elements for simulation

Simulate the process
  • Simulate equipment and operators
  • Use workstation tools
  • Use actual material or make prototypes
  • Build the product & the production areas
  • Get into the details of the process
  • Simplify the process steps for the operator
  • Observe the process
  • Continue to simulate & eliminate waste
  • Collect data as you go

Review the alternative concepts and select best one
Simulation Steps

For complex processes:

- Start with the critical process steps
- Break into teams to cover more ground
Review: Pugh Matrix Analysis

Best 3 Alternatives

<table>
<thead>
<tr>
<th>Key Criteria</th>
<th>Concept 1</th>
<th>Concept 2</th>
<th>Concept 3</th>
<th>Concept 4</th>
<th>Concept 5</th>
<th>Concept 6</th>
<th>Concept 7</th>
<th>Importance Ranking</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ability to provide loan amount</td>
<td>S</td>
<td>S</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>3</td>
</tr>
<tr>
<td>Application time</td>
<td>S</td>
<td>S</td>
<td>-</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>Knowledgeable representatives</td>
<td>S</td>
<td>S</td>
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<td>5</td>
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<tr>
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<td>S</td>
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<td>1</td>
</tr>
<tr>
<td>Information requirements</td>
<td>S</td>
<td>+</td>
<td>-</td>
<td></td>
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<td></td>
<td></td>
<td>4</td>
</tr>
<tr>
<td>Processing time</td>
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<td>+</td>
<td>-</td>
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<td></td>
<td>3</td>
</tr>
<tr>
<td>Cost/Transaction</td>
<td>S</td>
<td>-</td>
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</tr>
<tr>
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<td>+</td>
<td>-</td>
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<td></td>
<td>3</td>
</tr>
<tr>
<td>Development budget</td>
<td>S</td>
<td>S</td>
<td>-</td>
<td></td>
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<td></td>
<td>3</td>
</tr>
<tr>
<td>Follows design principles</td>
<td>S</td>
<td>-</td>
<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

| Sum of Positives                          | 0         | 4         | 2         |           |           |           |           |                   |
| Sum of Negatives                          | 0         | 2         | 7         |           |           |           |           |                   |
| Sum of Sames                              | 10        | 4         | 1         |           |           |           |           |                   |
| Weighted Sum of Positives                 | 0         | 11        | 6         |           |           |           |           |                   |
| Weighted Sum of Negatives                 | 0         | 10        | 23        |           |           |           |           |                   |
High-Level Process Map

Create a process map complete with:
- Process steps
- Process step outputs – “Y”
- Process step inputs – “X”
Design Elements

The Total Design Concept: Elements

- Depending On The Product/Service (Or Function) To Be Designed, The Following Design Concept Elements Will Be Included:

  - Equipment
  - Facilities
  - Materials/Supplies
  - Product/Service
  - Human System
  - Information System
  - “Production” Process
  - Lean Six Sigma Service

Specific Design Methods for Different Disciplines (i.e. Information Technology) are Employed to Develop Concepts and Further Details
Design Elements Example

Equipment
- Equipment
- Tools
- Transport
- Education/Training
- Attitude & Morale
- Performance Feedback
- Ergonomics

Facilities
- Electrical
- HVAC
- Arrangement
- Telecommunication
- Space
- Furniture
- Storage
- Forms

Materials/Supplies
- Supplies
- Materials
- Hardware
- Software
- Data Flows
- Data Process
- Data Sources
- Data Needs

Product/Service
- Cost
- Features
- Delivery
- Safety
- Control Plan
- Customers
- Supplies
- Materials
- Equipment
- Process

Human System

Information System

“Production” Process

Lean Six Sigma Service
### Critical To Process Steps

#### Which Functions Or Processes Impact The CTQs?

<table>
<thead>
<tr>
<th>Small Business Loan Service</th>
<th>Function/Process</th>
<th>Loan Servicing</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>CTQ</strong></td>
<td>Loan Application</td>
<td></td>
</tr>
<tr>
<td>Loan Application Time</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Knowledge Representatives</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Available Representative</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Payment Due Same Day Each Month</td>
<td>●</td>
<td>○</td>
</tr>
<tr>
<td>Interest Rate</td>
<td>●</td>
<td>○</td>
</tr>
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</table>

**Key:**
- ● Strong Relationship
- ○ Moderate Relationship
- △ Weak Relationship
High-Level Process Map

Relate critical to quality areas to the process map. These are the key areas to simulate.
Simulate & Collect Data

What simulation data can be collected to determine to what extent each design concept will meet customer expectations?
Simulation: Select the Best Design

Review the Pugh Matrix.

Which of your three simulated concepts tested the best?
Does the best concept exceed the voice of the customer expectations?

<table>
<thead>
<tr>
<th>Key Criteria</th>
<th>Concept 1 Baseline Design</th>
<th>Concept 2 New Design</th>
<th>Concept 3 New Design</th>
<th>Concept 4</th>
<th>Concept 5</th>
<th>Concept 6</th>
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<td>1</td>
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<td>4</td>
</tr>
<tr>
<td>Processing time</td>
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<td>+</td>
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<td>+</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>5</td>
</tr>
</tbody>
</table>

Concept Selection Legend
Better +
Same S
Worse -
Simulation Output Checklist

- Preliminary Process Map
- Detailed Design Elements Identified
- Process Specifications
- Staffing Estimate
- Preliminary Equipment Planning
- Standard Operations Sheets
- Preliminary Layout/Facilities
- Models/Prototypes
- Preliminary Budget Estimate
- Action Item List
“The Devil Is In The Details”

Adm. H. Rickover

– Commentary on Designing, Building And Operating Safe Naval Nuclear Propulsion Systems (From an old German saying)
Design Integration

- Design integration is the process of “assembling” the design elements into a whole

- Design integration also considers how the new design fits into existing company systems and processes

- The Design

  - Product/Service Design
  - Process Design
  - Facility/Site Design
  - Equipment/Tool Design
  - Materials/Supplies Design
  - Information System Design
  - Human Systems Design
### Design – Dividing the Effort

#### High-Level Design, Design Requirements
- Product/service
- Processes
- Facilities
- Equipment
- Materials/supplies
- Information
- Human

#### Truck Leasing Design Project Plan

<table>
<thead>
<tr>
<th>What</th>
<th>Who</th>
</tr>
</thead>
<tbody>
<tr>
<td>Design Leasing Agreement</td>
<td>Bill</td>
</tr>
<tr>
<td>Design Marketing Processes</td>
<td>Marge</td>
</tr>
<tr>
<td>Design Order Fulfillment Process</td>
<td>Steve</td>
</tr>
<tr>
<td>Design Service Process</td>
<td>John</td>
</tr>
<tr>
<td>Develop Truck Specifications</td>
<td>Hilly</td>
</tr>
<tr>
<td>Design Lease Training For Staff</td>
<td>Mike</td>
</tr>
<tr>
<td>Design Information System</td>
<td>Eric</td>
</tr>
</tbody>
</table>
Design Output

- Final process map
- Detailed design elements
- Design requirements and process specifications
- Standard operations
- Staffing requirements
- Human systems design
- Layout/facilities
- Equipment planning
- Models/prototypes
- Budget estimate
Final Process Map

Design – Develop Detailed Design
Deployment Or Cross-Functional Map

1. Calls To Apply For Loan
   - Answers Call, Greets Customer

2. Provides “Needs” Info
   - Inquires About Customer’s Loan Needs

3. Selects Best Option
   - Describes Loan Options

4. Provides Info
   - Requests Application Info
   - Enters On Computer
   - Provides Loan Decision Data, Closes Call

(1) Customer Needs Checklist Required
(2) Loan Options Checklist Required
(3) If Customer Is Bank Member, Access Existing Data
(4) Output Of Process Goes To Loan Processing Process

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### Critical To Process Variables

#### Credit Check Design

<table>
<thead>
<tr>
<th>Credit Check Design</th>
<th>E-Link To Credit Bureau</th>
<th>Credit Report Screen</th>
<th>Credit Bureau Reports</th>
<th>Credit Report Request SW Module</th>
<th>Loan Processor</th>
<th>Credit Check Training Module</th>
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</thead>
<tbody>
<tr>
<td>Turnaround Time (&lt;5 Min)</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<tr>
<td>Correct Credit Report</td>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Up-To-Date Credit Report</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
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<td>Late Payments Flagged</td>
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<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Credit Data Displayed</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
<tr>
<td>Correct Analysis</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
<td>●</td>
</tr>
</tbody>
</table>

#### Key:
- ● Strong Relationship
- ○ Moderate Relationship
- ▲ Weak Relationship

- CTPs – Critical to process variables
- Design requirements are deployed to CTPs
Total Design Concept: Elements

Depending on the product/service (or function) to be designed, the following design concept elements will be included:

- Equipment
- Facilities
- Materials/Supplies
- Product/Service

Different disciplines (i.e., Information Technology) specific design methods are employed to develop concepts and further details.
Design Elements Example

- **Equipment**
  - Equipment
  - Electrical
  - HVAC
  - Arrangement
  - Transport

- **Facilities**
  - Tele-communication
  - Space
  - Furniture
  - Storage

- **Materials/Supplies**
  - Supplies
  - Forms
  - Materials
  - Delivery
  - Safety

- **Product/Service**
  - Cost
  - Features

- **Human System**
  - Education/Training
  - Attitude & Morale
  - Performance Feedback
  - Ergonomics

- **Information System**
  - Management Structure
    - Leadership
    - Tasks & Jobs
    - Roles & Responsibility
    - Moment Of Truth
  - Data Flows
  - Data Process

- **Production Process**
  - Hardware
    - Control Plan
    - Supplies
    - Materials
  - Software
    - Data Needs
    - Data Sources
  - Process
  - Equipment
    - Delivery
    - Safety

# Design Requirements

## Small Business Loan Service

Functional to design requirement matrix

<table>
<thead>
<tr>
<th>Function/Process</th>
<th>Functional Requirement</th>
<th>Design Element</th>
<th>Design Requirement(s)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Loan Application</td>
<td>Application Time</td>
<td>Telephone System</td>
<td>1 Line Per Officer</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Volume Of 30 Calls/Hour</td>
</tr>
<tr>
<td></td>
<td>Target: 30 Minutes</td>
<td>Application Process</td>
<td>Target: 30 Minutes</td>
</tr>
<tr>
<td></td>
<td>Upper Spec: 60 Minutes</td>
<td></td>
<td>Upper Spec: 60 Minutes</td>
</tr>
<tr>
<td>Loan Officers</td>
<td></td>
<td>Loan Officers</td>
<td>Volume of 30 Calls/Hr.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Trained In Appl. Process</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Trained In Phone System</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>Knowledge Of Available Loan Types</td>
</tr>
</tbody>
</table>
Layout/Facilities

Develop High-Level Design

- Layout diagrams are used to design where the work will be performed.

- Combine process map with layout diagram to minimize transport, storage, waiting, delays, etc.

- Consider how facilities “interact” with people doing work (lighting, traffic patterns, availability of needed resources, etc.)
Draft Lockbox Layout Diagrams
Draft Loan Office Layout Diagram
Processing Work Cell Layout

- Simple and flexible workflows
- Waste elimination
- Work cells
- Work station design
- First time quality
- Mistake proofing
Lean 3P (Production Preparation Process) Training

3P - Pilot and Full Scale Implementation

June 2013
Piloting

- **Piloting Defined:** To test the capabilities of the new process, where critical functions defined in the Detailed Design phase are operational, but on a limited scale.

- **Why Pilot**
  - Improved Solution
  - Improved Implementation
  - Lower Risk Of Failure
  - Confirm Expected Results And Relationships
  - Ability To Better Predict $ Savings From Proposed Solution
  - Increased Opportunity For Feedback
  - Increased Buy-In
  - Get Early Version Of A Solution Out Quickly to A Particular Segment
When To Pilot

In General, There Is A Way To Pilot All Or Some Part Of Every New Design. It Is Almost Always Worth The Extra Effort To Pilot.

You Certainly Need To Pilot When:

• The Scope Of The Design Is Large
• The New Product/Service Could Cause Far-Reaching, Unintended Consequences
• Implementing The Design Will Be A Costly Process
• The Design Would Be Difficult To Reverse
• When Designing New Processes, Piloting Is Almost Always A MUST!!
Types Of Pilots

Products

- Test Markets
- Product Mock-Ups, Scale Models
- Focus Groups Use Product
- Offer To “Favored” Customers
- Alpha, Beta Tests

Processes

- Walk-Throughs, Dry Runs
- Test Locations
- Subset Of Items To Process
- Particular Customers
- Simulations
- “Hand-Offs”
Pilot Lessons Learned

Freeze Your Design Specifications

- Use A Phased Approach For Changes
- Don’t Design To A Moving Target

K.I.S.S.

- Minimize Hand-Offs
- Standardize Process Steps (Technology Can Help)

Only Plan Controllable Process Steps

- Only Consider Outsourcing If It Can Be Controlled

Simulation Tools Are Helpful And Timesaving

- But… Only As Good As You Make Them

Start Thinking Seriously About Implementation

- Roles, Tasks, Change Management…
Pilot “Build” – Objectives

Build “Enough” Of The Detailed Design To Support The Needs Of Pilot Test Plan

Limit Capital And Other Resource Expenditures (Managing Risk)

Examples:

- Hospital Redesign – Four Demonstration Nursing Units “Built” To Test New Patient Care Model
- Auto Leasing Processes “Built” In One State To Test New Leasing Product
- Logistics Information Management System “Built” To Test New Supply Chain Management System
Pilot Build & Test

Act | Plan
--- | ---
Check | Do
Measure Performance And Analyze Results

- Develop Form: 1/5
- Test Form: 2/4
- Revise Form: 2/10
- Roll-Out: 3/5

Before
- Time To Process In Days

After
- Time To Process In Days
Evaluate Detailed Design Capability

Tollgate: Production Readiness Review

Inputs

TRANSFER FUNCTIONS

SIGMA PREDICTIONS

FMEA/ERRORPROOFING

RESIDUAL FAILURE RISK

SIMULATIONS/CAPABILITY PREDICTIONS

SPEC LIMIT

Review

Outputs

GO TO PRODUCTION

YES

REDESIGN OR EXIT

NO

Table:

<table>
<thead>
<tr>
<th>Item/Process Step</th>
<th>Potential Failure Mode</th>
<th>Potential Effect(s) Of Failure</th>
<th>Severity</th>
<th>Potential Cause(s) Of Failure Occurrence</th>
<th>Detection</th>
<th>Recommended Action</th>
<th>Responsibility And Target Completion Date</th>
</tr>
</thead>
</table>

Action Taken

Total Risk Priority Number Resulting Risk Priority Number

Tollgate: Production Readiness Review

TRANSFER FUNCTIONS

SIGMA PREDICTIONS

FMEA/ERRORPROOFING

RESIDUAL FAILURE RISK

SIMULATIONS/CAPABILITY PREDICTIONS

SPEC LIMIT

GO TO PRODUCTION

REDESIGN OR EXIT
Pilot Output Checklist

- Critical process variables meet specifications
- CTQ's verified
- IT systems verified
- Standard work sheets adjusted
- SLAs met (or capable)
- Resource plan adjustments
- Equipment capability verified
- Cycle & lead times verified
- Final materials, supplies ID'ed
- Information flows finalized
- Facility needs/layout adjustments
- T-charts/Gap analysis/Action plans