

# Lean Process Improvement

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and User Group  
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- 5 organizations: Jacobs and Government
- About 75 projects
- Over two years

- Technical Director, Jacobs Technology/ITSS
- Candidate SCAMPI Lead Appraiser
- (lean) Six Sigma Black Belt
- Member of the Steering Committee and Chair of the Software Committee, NDIA Systems Engineering Division
- Visiting Scientist, Software Engineering Institute
- Project Manager, Software Development
- Systems Engineer, Advanced Research Center
- Program Manager – Air Force Systems Acquisition and Development
- B.S. Aerospace Engineering
- M.S. Operations Research

- Monolithic and cumbersome
  - Process deployment cycles of 6 months to 2 years
  - Deployed processes reflect significant changes
  - Deployed processes often (certainly?) partially obsolete
- Contextually removed from development teams
  - EPG “ownership” of processes
  - “Real” work is contextually separate
  - Necessity for change
  - Frequent “push-back”
- Cost-inefficient
  - Many changes at once are difficult to “get right”
  - Latent process defects have a long(er) life
  - Training/implementation/institutionalization costs are high
  - Application to new efforts is delayed

**Do we HAVE to live with this?**

- By the end of this tutorial, you will:
  - Understand what Lean SPI is
  - Understand why fast process iterations are critical to successful improvement programs
  - Understand how to apply Lean SPI in organizations that apply lean or agile development approaches
  - Understand how to apply Lean SPI in “traditional”, systemic, plan-based development organizations

- Process improvement efforts by agile and lean development organizations are often:
  - Undocumented or only partially documented
  - Not under “appropriate” configuration management
  - Difficult (impossible?) to coordinate or learn organizationally across development teams
  - Not persistent

Therefore.....

## Lean SPI

- Follows lean construct,
- within “leaned” CMMI framework,
- with Six Sigma process controls.

- Sharp focus on customer value
- **Fast iterations?** ←
- Workflow synchronization
- Early defect removal
- Rapid learning
- Agile project management
- Vision point architecture
- Options thinking and “decide as late as possible”
- High degree of concurrency and communication
- Waste elimination
- Agile engineering support

Aren't these good things for process improvement as well?

- **Focus on the customer**
- Kaizen workflow development
- Process improvement iterations
- Lean SPI infrastructure
- Agile SPI management
- Process defect removal
- Summary of CMMI practices and compliance

Principles can be applied to Systems Engineering PI as well...

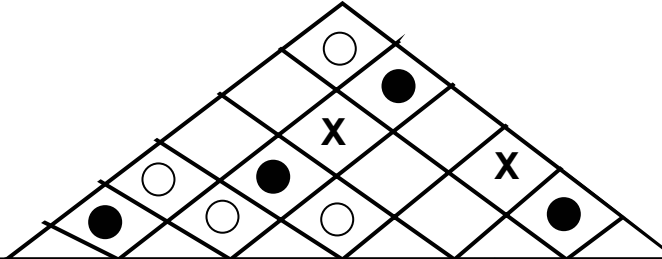


- Lean view of customer value
  - Does the activity or product have DIRECT value in the eyes of the customer?
    - Configuration management?
    - Quality assurance?
    - Defect tracking/management?
- Lean focus on customer needs
  - Quality function deployment
  - Continuous relationship and listening to customer
  - Fast response to customer needs

- Lean/Six Sigma mechanism
- Proven, high value method for understanding customer needs
- Visual mapping to derived technical requirements
- Opportunity to address process quality attributes
  - Speed (of development cycle)
  - Defect profiles
  - Technical domains
  - Deployment of new projects
  - Learning and training constructs

**RELATIONSHIPS:**  
 Strong ●  
 Moderate ○

**INTERACTIONS:**  
 ● Strong Positive  
 ○ Mild Positive  
 XX Strong negative  
 X Mild negative



Process Requirements \ Customer Needs	Priority	SW Architect	Lean SW Dev.	Strong RSKM	Six σ SPC	Web-base Dev	Agile Proj Mgt	Competitive Evaluation
≤ 6 mo. life cycle	1		●	○	●		●	
No delivered def.	2		○		●			
EA compliant	3	●			○		○	
CMMI compliant	5			○	○			
100% on line	4					●		
Spiral dev. cycles	1	●	●	●	○		●	


<i>Technical Difficulty (1-10)</i>	2	9	2	9	5	4
<i>Importance Rating (1-10)</i>	10	10	9	9	9	9

(1 – 10)

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- **Kaizen workflow development**
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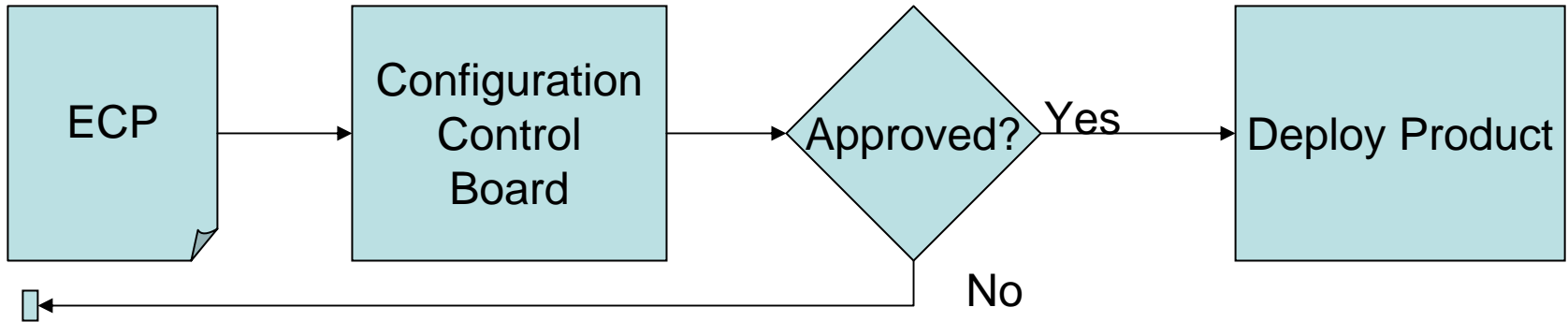
Principles can be applied to Systems Engineering PI as well...

- What is a Kaizen team?
- Workflow vs. process
- Definition of current state
- Waste identification
- Definition of ideal state
- Definition of future state
- Lean projects and tasks
- Configuration management and communications

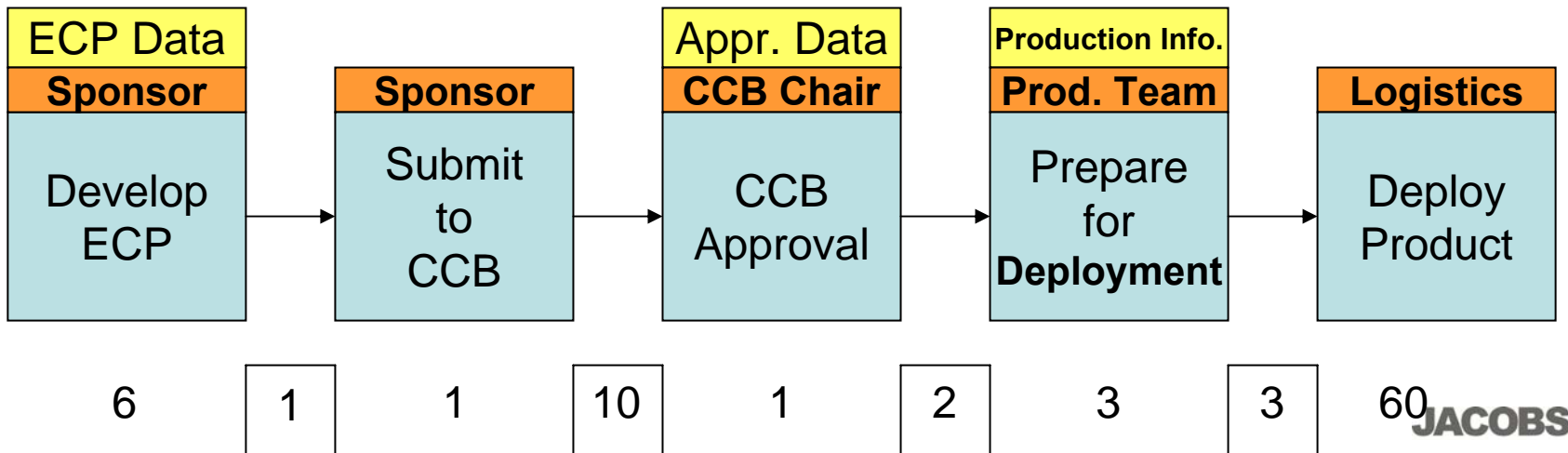
- Kaizen is Japanese for “a change for better”
- Team composition  **Process Owners**
  - Principal stakeholders
    - Those who will use process
    - Those who will be directly affected by process
- Team charter
  - Chartered by senior management
  - Authority to “do what is needed”
  - Own the process..... forever
  - Resources to do job
- Trained and led/facilitated

- **Workflow:**
  - operational aspect of a work procedure
  - describes how tasks are structured
  - who performs tasks
  - what their relative order is
  - how they are synchronized
  - how information flows to support the tasks
  - how tasks are being tracked
  - considers "throughput" as a distinct measure
- **Process:**
  - sequence in which properties or attributes of a system or object are changed
  - sequence of operations and involved events, taking up time, space, expertise or other resources, leading to the production of some outcome

## Process :



## Workflow



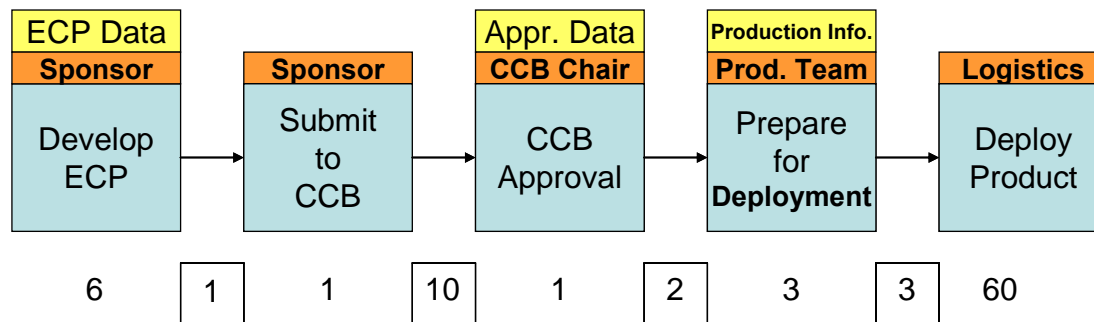


- Workflow of how it's being done now
- Don't worry about warts or things that are broken
- Don't worry about who's “at fault”
- Starting from “the right hand side” often useful
  - Start with end product or task and work backward
  - “How did we get this?”
- Discovery:
  - May be the first time the workflow has been defined
  - May be the first time workflow participants know who really does what
- Fully define workflow
  - Who does each task
  - Resources and information used
  - Products produced
  - Performance measures
  - Time to complete (measured or estimated)
  - Takt time (calculated, not measured)
    - German for “rhythm” or “beat”
    - Takt time = Net available time in a day / customer demand per day

- Will often represent a completion time that is (much) longer than the takt time
- Development (and discussion) will reveal some intuitively obvious opportunities for improvement
- Discussion of takt time induces focus on customer needs
- Discussion of information flow is typically revealing
- Early revelations of needs for synchronization

How to you identify “waste” in the workflow?

- Anything that is not of value to the customer **CM and QA**
- Partially done work
- Extra processes
- Extra features **Which ones might be “waste” – but still necessary?**
- Task switching **This information will be used in the definition of the Ideal State**
- Waiting
- Motion
- Defects
- Management activities **Lean oversight and approval**



# JE JACOBS Kaizen Workflow Development

- What is a Kaizen team?
- Workflow vs. process
- Definition of current state
- Waste identification
- **Definition of ideal state**
- Definition of future state
- Lean projects and tasks
- Configuration management and communications

The thumbnail shows a slide with the JE JACOBS logo and the title 'Lean SPI – An Outline'. It contains a bulleted list of topics: 'Focus on the customer', 'Kaizen workflow development' (highlighted with a black box), 'Process improvement iterations', 'Lean SPI infrastructure', 'Agile SPI management', 'Process defect removal', and 'Summary of CMMI practices and compliance'. A small blue box at the bottom left of the slide contains the text 'Principles can be applied to Systems Engineering PI as well...'. The JACOBS logo is in the bottom right corner of the slide.

- Conceptually remove all constraints:
  - Assume authority to “make it the way it should be”
  - No tool or technology constraints
  - Assumes processes are fully developed and stable
  - Assumes information systems are in place and operate with no time delay
- Often requires (re)negotiation of who does what
- All identified waste should be eliminated
  - Anything that is not of value to the customer
  - Partially done work
  - Extra processes
  - Extra features ←
  - Task switching ←
  - Waiting
  - Motion
  - Defects ←
  - Management activities ←
- Takt time should be met

Which ones would be difficult for programmers?

Which ones would be difficult for managers?

- Real-world constraints
  - Some things cannot be assumed away
  - Some tools and mechanisms take time to develop
  - Somewhere between current and ideal states
- Aim for real improvement in the near future
  - Improve key performance measures
  - Pay attention to takt time
  - Accept waste with great “regret”
- Fully define future state
- Re-estimate performance measures
- Get absolute commitment of Kaizen team members
- Define tasks, activities, and “projects” needed to put in place
- Kaizen TEAM briefs management for approval

# JE JACOBS Kaizen Workflow Development

- What is a Kaizen team?
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- **Lean projects and tasks**
- Configuration management and communications

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- Things to accomplish to achieve Future State
- Workflows are transformed into processes
- Lean Projects
  - Duration greater than perhaps a few weeks
  - Require significant resources/coordination
  - Complex in nature
    - Tool instantiation for the workforce
    - Definition of kanban visualization metrics
- Lean tasks
  - Simple “to-dos”
  - Track and complete
- All projects and tasks tracked to completion



- Kaizen events do not occur in a vacuum
- Kaizen events:
  - Depend on the output products from other Kaizens
  - Produce products that will be used by other Kaizens
- Process configuration management is key
  - Kaizen teams provided authority to work on workflows and processes
  - Respect for CM boundaries crucial
- Communication among Kaizen teams is key:
  - Clarify timing of Kaizen events
  - Understand and manage input/output relationships
  - Respect Kaizen boundaries and “ownership”

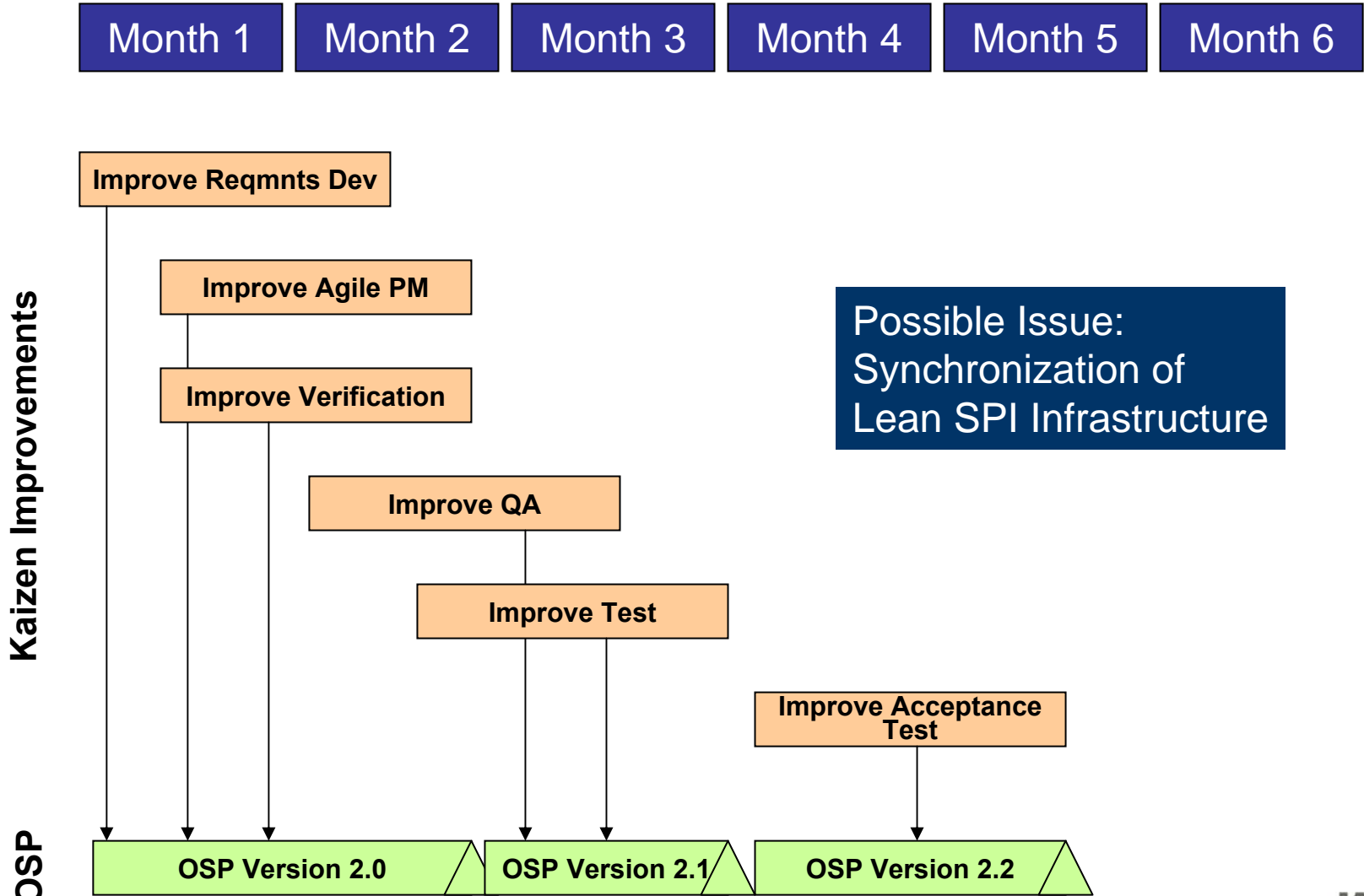
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- Kaizen workflow development
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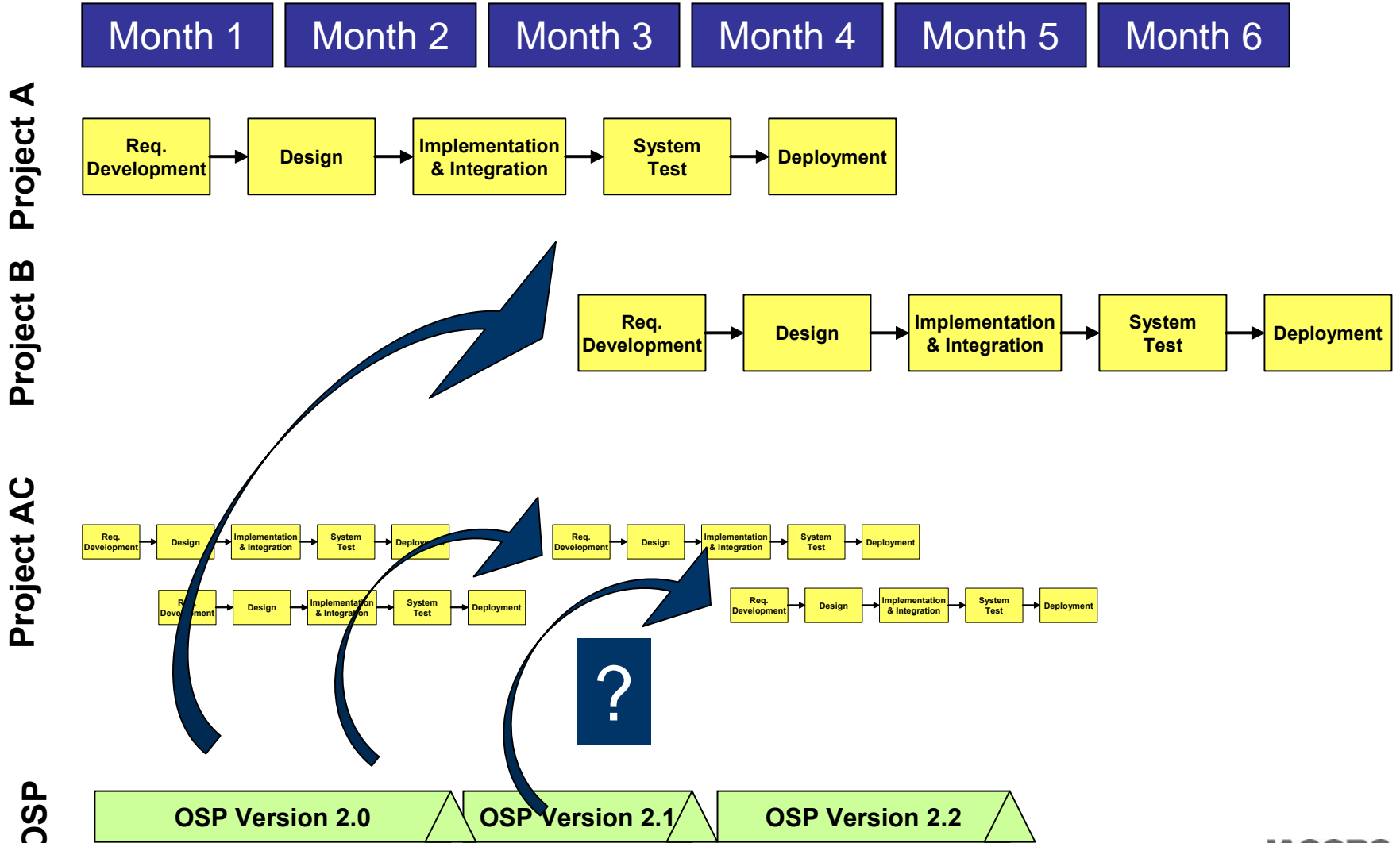
- What IS a “process improvement iteration”?
  - A deployment of a standard organizational or define process or subprocess
  - Possible timelines (use flipchart)
    - 3 years
    - 2 years
    - 1 year
    - 6 months
    - 3 months
    - 1 month
  - Includes:
    - tools/mechanisms
    - processes/subprocesses
    - training
    - deployment instructions
- Aren't frequent process iterations a really bad idea?
  - Don't project personnel dislike constant change?
  - Aren't stable processes a good idea?

Lean SPI: SYNCHRONIZE process improvements  
with lean software development iterations

- The “layperson’s” view
  - Processes should not change, except once in a great while, and we’re not so sure about that”
  - “If processes change all the time, how do I know what to do?”
  - “Doesn’t constant change cause a lot of inefficiency, and indicate we don’t know what we’re doing?”
- The Six Sigma (and CMMI) view:
  - Process stability = removal of special causes of variation
    - (Causes that are external to and beyond the scope of the process)
  - Stable process are controlled, but there are degrees of control, e.g.:
    - Variance in defect rates
    - Variance in completion times
- The lean view:
  - Continuous, immediate, piece-meal improvement, by the process owners, is key to success

- Education
  - From top to bottom in the organization
  - Continuous
  - Sometimes even works
- Change the expectation:
  - Off-load onerous “training” requirements for @ process iteration
    - On line, JIT training or point-of-use instructions
    - Shared knowledge mechanisms
  - Simple, absolute, unequivocal clarity on who/when will use new process/ subprocess
  - Successes and “lessons learned” in small, quick, improvements
    - Lean improvements, so buy-in is not a problem
    - Implement quickly
    - Institutionalize quickly
    - Advertise the successes
- Let the project or iteration complete the cycle with the process they started with
  - Exceptions MAY occur



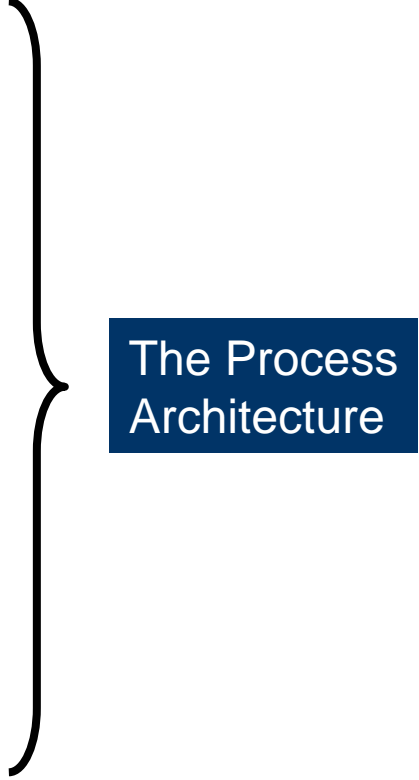


- Focus on the customer
- Kaizen workflow development
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- Why do I care about an infrastructure?
- (Organizational) process architecture
- Agile process support
- Concurrency and communications
- Organizational Learning

- I shouldn't care if...
  - I want to re-accomplish my rapid improvements
  - I want Kaizen teams to operate without the benefit of knowledge of other teams' work
  - I don't worry too much about confounding other parts of the process when I fix or improve something
  - I like to do things the hard way....
- I should care if...
  - I want improvements to “click in” to place
  - I want improvements to persist
  - I don't want to confuse the workforce

- Processes
    - Processes
    - Subprocesses
    - Relationships
  - Map to technologies
    - Requirements definition and management
    - Design
    - Code construction
    - Test
    - Metrics
    - Oversight.....
  - Map to mechanisms
  - Rapid improvement efforts
    - Use to charge Kaizen teams and focus their work
    - Use to migrate input/output of Kaizen teams to the right places
    - Use to conduct process configuration audits
- 
- The Process Architecture

- What is agile process support?

- “Pulled” by kanban visualization
- Fully prepared to act when “pulled”
  - “Pull the trigger”

- Get
- Cap
- acti

Who leads and executes lean SPI efforts (e.g. Kaizens)?

Who “owns the process”?

or take

- What

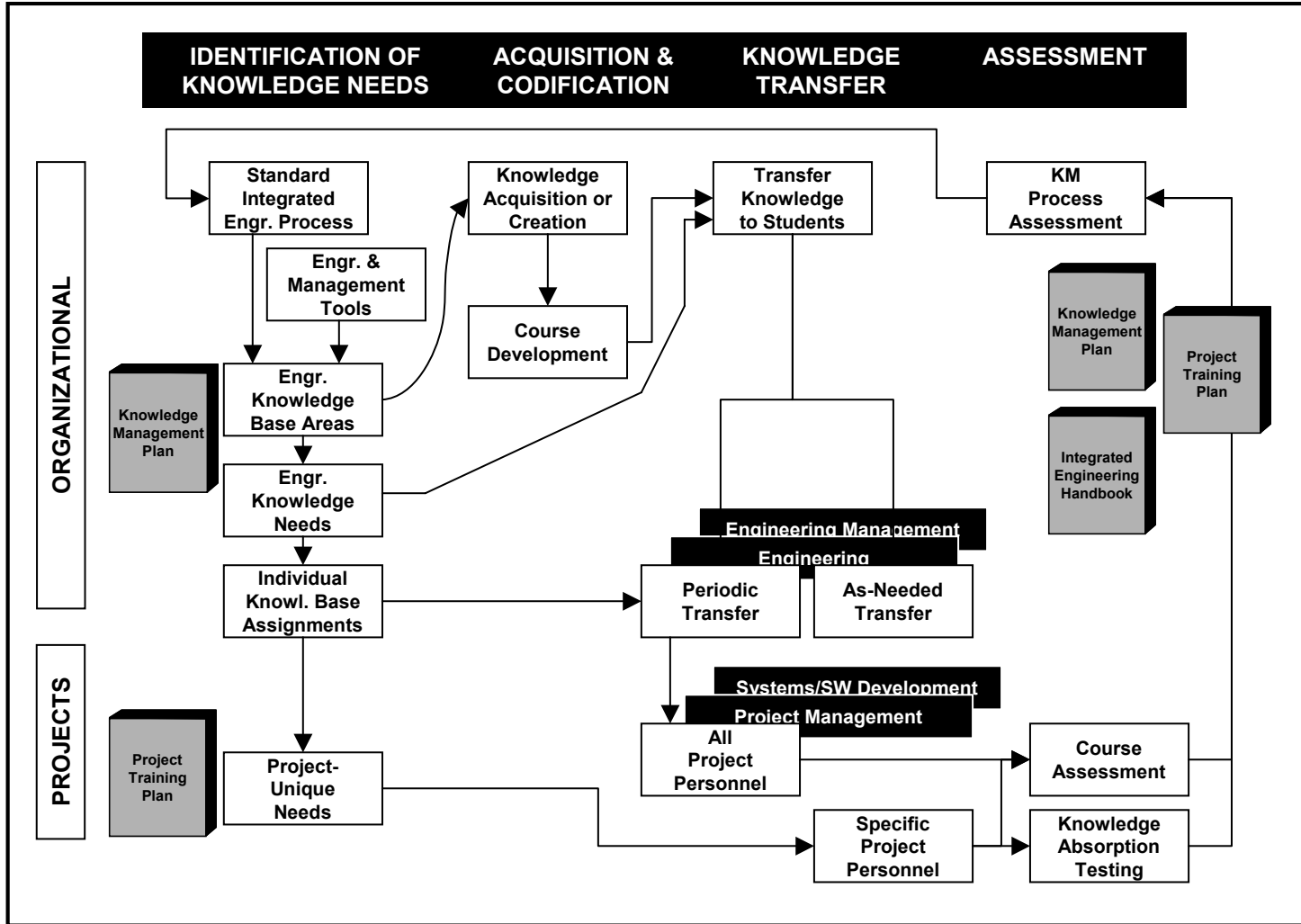
- **Kaizen events**
- Improvement task or activity support
- Strategy sessions
- **Process configuration management actions**
- **Process QA actions**
- Process verification and validation actions

- Kaizen events
  - Instantiate (respond) quickly to the problem
  - Conduct in an orderly, well-prepared manner
    - (Kaizen process, mechanisms, tools, are in place)
  - Build out-brief quickly (hours) and get full consensus
  - Provide output products quickly (a day or less)
- Process configuration management actions
  - Kanban pulled trigger to accomplish configuration audit
  - Immediate reporting of CM audit results to stakeholders
  - Mechanisms and oversight to close CM defects in hours or days
- Process QA actions
  - Kanban pull process and work product audits]
  - Audit quickly, targeting planned audit items and using criteria
  - Report audit results on the spot to all affected stakeholders & mgt
  - Provide mechanisms and oversight to close defects in hours or days

- Lean SPI invokes a higher standard
- Relevant stakeholders are aware of events and activities (and their roles) in minutes or hours
- Communications are pushed whenever possible
  - Supports rapid decision making
  - Enables immediate instantiation of follow-on activities
- Examples:
  - Electronic status boards
  - Email trigger for desk top notification
  - Cellular notification
- Kaizen events mandate buy-in (and support) of team members for Kaizen decision and products

- Classroom learning is an anti-pattern to lean learning constructs
  - Relatively long preparation times
  - Relatively inefficient knowledge transfer/assimilation
    - Difficult to get attention and engagement
    - Cost inefficient
  - Relatively disruptive to the flow of work
    - Let's stop and learn(!!)
- What other (faster and more continuous) ways are there to learn?
  - Learn during Kaizen events
  - Team members investigation and knowledge-sharing
  - Knowledge base development/ knowledge mgt.
  - Lessons learned sharing and implementation in process
  - Immediate sharing of quality audit results across organization
  - Immediate sharing of CM audit results across organization

# An Example





- Why do I care about an infrastructure?
- Process architecture
- Agile process support
- Concurrency and communications
- Organizational Learning

This completes discussion  
of Lean SPI Infrastructure



**JE JACOBS** Lean SPI – An Outline

- Focus on the customer
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- Seeing waste
- Value stream mapping
- Feedback
- Iteration leadership/management
- Options thinking
- Last responsible moment decision making
- Pull/Kanban systems and measurements
- Cost of delay awareness
- Self determination/team empowerment
- Motivation and leadership
- Technical expertise
- Refactoring (design against more stable architecture)

How would  
these apply to  
SPI management?

- Remain sharply focused on the needs of the customer(s)
  - Reassess customer needs continuously
  - May (will probably) change over time
    - Sometimes quickly
  - Understanding of customer needs will get better
- Ensure development “heroes” are in lean leadership positions
- Listen to the software development workforce
  - Kaizen improvements should be initiated within the workforce
  - Support workforce resolution of problems and implementation of improvements (agile support)
- Improve and continuously tune the process architecture
- Make “last responsible moment” investment decisions
  - In Kaizens or other improvement efforts
  - In technologies

- Focus on the customer
- Kaizen workflow development
- Process improvement iterations
- Lean SPI infrastructure
- Agile SPI management
- **Process defect removal**
- Summary of CMMI practices and compliance

- Lean focuses sharply on identification and removal of defects at the earliest possible moment
- Fast, “immediate” removal of defects is the goal
  - Ver/val of process elements prior to deployment
  - QA and CM audits yield defects
  - Process simulation can reveal defects
- Rapid, continuous improvement provides continuous opportunities to remove defects
- Six Sigma defect elimination 
  - DMAIC cycle
  - Process control (reduction in variation = fewer defects)
- Poka Yoke (mistake proof) – mechanisms to eliminate the possibility of defects
  - Well constructed checklists
  - Coding rules
- Muda - waste elimination

- Lean SPI processes are Managed processes
  - Process relationships are tracked
  - Voice of the customer and stakeholders are key
- Lean SPI processes under six sigma control are quantitatively managed processes
- CMMI-DEV process areas most germane to this discussion:
  - OPF
  - OPD
  - OT
  - OID

## Purpose

The purpose of Organizational Process Focus (OPF) is to plan, implement, and deploy organizational process improvements based on a thorough understanding of the current strengths and weaknesses of the organization's processes and process assets.

### SP 1.3 Identify the Organization's Process Improvements

*Identify improvements to the organization's processes and process assets.*

**Improvements identified primarily by customers and process owners**

### SP 2.1 Establish Process Action Plans

*Establish and maintain process action plans to address improvements to the organization's processes and process assets.*

**Kaizen team charters/plans and six sigma project plans**

### SP 3.4 Incorporate Process-Related Experiences into the Organizational Process Assets

*Incorporate process-related work products, measures, and improvement information derived from planning and performing the process into the organizational process assets.*

**Near real time, thru metrics, Kaizen events, lessons learned**

## Purpose

The purpose of Organizational Process Definition (OPD) is to establish and maintain a usable set of organizational process assets and work environment standards.

## SP 1.5 Establish the Organization's Process Asset Library

*Establish and maintain the organization's process asset library.*

**The PAL is responsive and supports rapid improvement**

## SP 2.1 Establish Empowerment Mechanisms

*Establish and maintain empowerment mechanisms to enable timely decision making.*

**Kaizen teams, kanban visualization, poka yoke, muda**



## Purpose

The purpose of Organizational Training (OT) is to develop the skills and knowledge of people so they can perform their roles effectively and efficiently.

## An informative element:

Certain skills may be effectively and efficiently imparted through vehicles other than in-class training experiences (e.g., informal mentoring). Other skills require more formalized training vehicles, such as in a classroom, by Web-based training, through guided self-study, or via a formalized on-the-job training program. The formal or informal training vehicles employed for each situation should be based on an assessment of the need for training and the performance gap to be addressed. **The term “training” used throughout this process area is used broadly to include all of these learning options.**



## Purpose

The purpose of Organizational Innovation and Deployment (OID) is to select and deploy incremental and innovative improvements that measurably improve the organization's processes and technologies. The improvements support the organization's quality and process performance objectives as derived from the organization's business objectives.

### SP 1.1 Collect and Analyze Improvement Proposals

*Collect and analyze process- and technology-improvement proposals.*

**“Collect” – some over time, most perhaps near-real-time**

### SP 1.2 Identify and Analyze Innovations

*Identify and analyze innovative improvements that could increase the organization's quality and process performance.*

**But keep it Lean – focused on customer value and fast**

### SP 1.3 Pilot Improvements

*Pilot process and technology improvements to select which ones to implement.*

**High risk improvements or technologies, Design of Experiments process control**

- Focus on the customer
- Kaizen workflow development
- Process i
- Lean SPI
- Agile SPI
- Process c
- Summary of CMMI practices and compliance

We are done!

Questions?

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