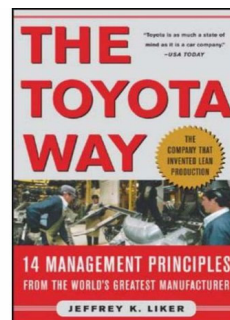
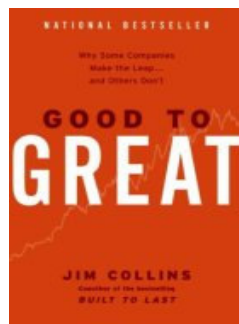
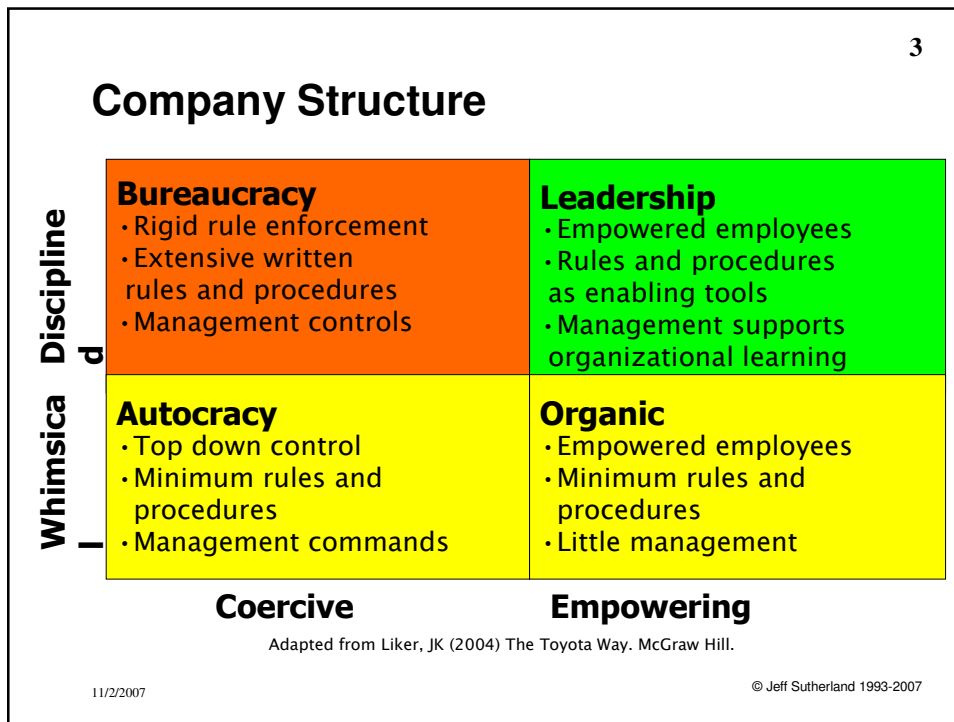




## Scrum and Lean



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- ## Toyota Motor Manufacturing Value Based Mission Statement
1. As an American company, contribute to the economic growth of the **community** and the United States.
  2. As an independent company, contribute to the **stability and well-being of team members**.
  3. As a Toyota group company, contribute to the overall growth of Toyota by **adding value to our customers**.
- © Jeff Sutherland 1993-2007

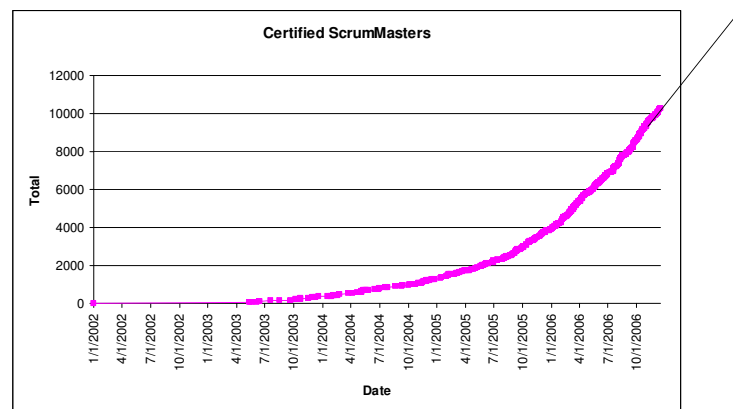
## Scrum Mission Statement

- Build communities of stakeholders (customers, companies, development teams) that increase the economic well-being of all concerned.
- Enhance development team work environments by empowering people to work together in more creative, innovative, and productive ways.
- Deliver the highest possible customer value in the shortest possible time to improve the customers work experience. Make systems easier to use, more helpful to the user, and more fun to experience.

**Yahoo Chief Product Owner – “Scrum is faster, better, cooler! It’s the way we first built software at Yahoo, yet is scalable to large, distributed, and outsourced teams.”**

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## Scrum Community of Practice



Computerworld estimates that over 2/3 of Internet projects in the U.S. use Agile methods, about 167,000 projects. (Sliwa, 2002)

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**Theory: Scrum Origins**  
**Project Management Styles**

Requirements    Analysis    Design    Implementation    Testing

**Type A – Isolated cycles of work**      **NASA Waterfall**

**Type B – Overlapping work**      **Fuji-Xerox Scrum**

**Type C – All at once**      **Honda Scrum**

*The overlapping of phases does away with traditional notions about division of labor. Takeuchi and Nonaka (1986)*

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**Rugby Scrum**

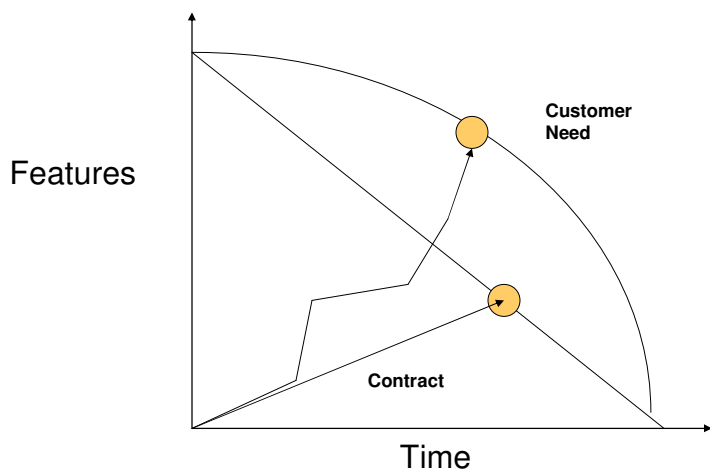
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## Toyota synthesis of constraints

- Historical assumption is that high quality, product variety, and low cost cannot be achieved simultaneously.
- Toyota production system is based on totally different way of thinking.
- Through knowledge creation by synthesis of contradictions, Toyota pushes the envelope.
- High quality, high variety, and low cost all at once.

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## Prioritize and reprioritize Product Backlog to deliver business value



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## FASTER means BETTER with Scrum

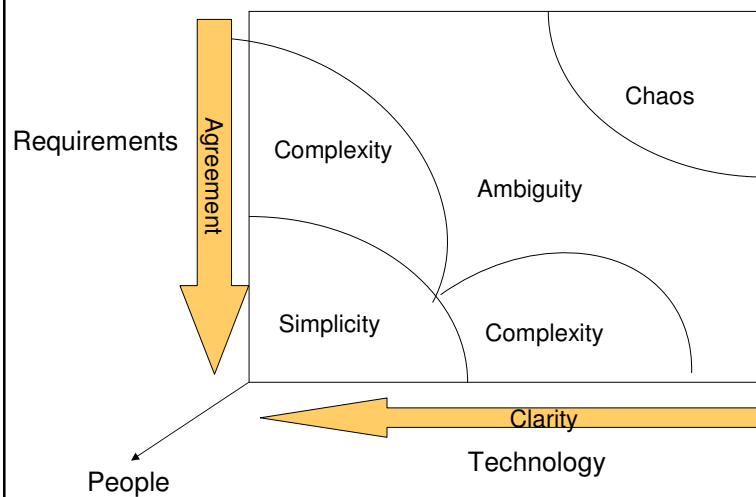
- Productivity – product backlog requirements completed per 100,000 investment

Months since Type B Scrum implemented	3	12	24
Productivity	4.5	9.0	12.2
Quality	100+	100	5

Source: Primavera

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## Better Velocity, Quality, Usability all at once because Scrum is designed for complexity



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**A "10X" Force**

When a change in how some element of one's business is conducted becomes an order of magnitude larger than what that business is accustomed to, then all bets are off. There's wind and then there's a typhoon, there are waves and then there's a tsunami. There are competitive forces and then there are supercompetitive forces. I'll call such a very large change in one of these six forces a "10X" change, suggesting that the force has become ten times what it was just recently. This is illustrated in the following diagram.

**Andy Grove. Only the Paranoid Survive: How to Exploit the Crisis Points That Challenge Every Company: 1st Currency Paperback, 1999.**

**Six Forces Diagram—With a "10X" Force**

The diagram illustrates the Six Forces Diagram with a central box labeled "The Business". Six arrows point towards this central box from the following sources:

- Top-left: Power, vigor and competence of existing competitors
- Top-center: Power, vigor and competence of complements
- Top-right: Power, vigor and competence of customers
- Bottom-left: Power, vigor and competence of suppliers
- Bottom-right: Power, vigor and competence of potential competitors
- Bottom-center: A large upward-pointing arrow labeled "Possibility that what your business is doing can be done in a different way"

What such a transition does to a business is profound, and how the business manages this transition determines its future. I like to describe this phenomenon as an inflection point.

**The Strategic Inflection Point**

What is an inflection point? Mathematically, we encounter an inflection point when the rate of change of the slope of the curve (referred to as its "second derivative") changes sign, for instance, going from negative to positive. In physical terms, it's where a curve changes from convex to concave, or vice versa. As shown in the diagram, it's the point at which a curve stops curving one way and starts curving the other way.

**Andy Grove. Only the Paranoid Survive: How to Exploit the Crisis Points That Challenge Every Company: 1st Currency Paperback, 1999.**

**The Inflection Curve**

The diagram shows a curve that starts as a dashed line curving downwards, labeled "Business declines". At a point marked with an upward arrow and labeled "Inflection Point", the curve becomes a solid line curving upwards, labeled "Business goes on to new heights".

## Cultural Change – Japanese style

<i>Old Organization</i>	<i>New Organization</i>
Centralized	Distributed
Unified perspective	Diversified perspective
Original meaning	Emergent meaning
Analytical	Creative
Analysis to action	Learning by doing
Rational	Redundant
Certain	Uncertain
Strategy concept	Local action
Authoritative	Participative
Hierarchical	Flat

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## Breaking down command and control

- Intended strategy is developed centrally. Emergent strategy self-organizes through local actions.
  - Distributed cognition and actions
- Scrum team must be allowed to self-organize
  - Autonomous
  - Transcendent
  - Cross-fertilization
- Team chooses own work
  - Individuals manage their own work
  - Management gets out of the way and helps by building clear business vision and removing impediments

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## **Diversified perspective**

- Cross-functional teams
- Scrum team has product knowledge, business analysts, user interface design, software engineers, QA
- Type C Scrum pulls in all stakeholders – management, customers, installation, and support.

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## **Toyota Prius – emergent strategy**

- Revolution in product, technologies, and process
  - Does not fit any product line. Designed for new perspective.
- Uses many technologies
  - Engine, motor, battery, braking combine into hybrid system
- Developed in record time
  - 15 months instead of four years
- Overlapping phases
  - Research, development, design, production
- Leaders built, utilized, and energized “*ba*”

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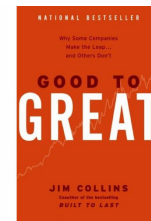
## The concept of *ba*

- Dynamic interaction of individuals and organization creates a synthesis in the form of a self-organizing team.
- It provides a shared context in which individuals can interact with each other.
- Team members create new points of view and resolve contradictions through dialogue.
- *Ba* is shared context in motion where knowledge as a stream of meaning emerges.
- *Emergent knowledge codified into working software self-organizes into a product.*

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## Prus project team managed “*Ba*”

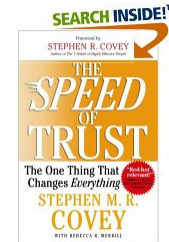
- Leaders can “find” and utilize spontaneously formed *ba*
- Leaders can build *ba* by providing space for interactions
  - Physical space such as meeting rooms
  - Cyberspace such as computer network
  - Mental space such as common goals
- Fostering love, care, trust, and commitment forms the foundation of knowledge creation (self-organization)
- *Scrum is based on TRUTH, TRANSPARENCY, COMMITMENT, and TRUST*



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## Energy of ba is given by its self-organizing nature

- *Ba* needs to be “energized” with its own intention, direction, interest, or mission to be effective.
- Leaders provide autonomy, creative chaos, redundancy, requisite variety, love, care, trust and commitment.
- Prius creative chaos was generated by demanding goals. Uchiyamada demanded that his team question every norm on new car development.
- Top management put Prius project team under great time pressure which caused extreme use of simultaneous engineering
- Equal access to information at all levels was critical
- *ScrumMaster and management must “energize” ba through facilitating colocation, dynamic interaction, face to face communication, transparency, and audacious goals.*



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## Lean Principles

- Muri
  - Smooth out flow
- Mura
  - Never overstress a person, system, or process
- Mudah
  - Aggressively eliminate waste
- Key concepts that simultaneously eliminate muri, mura, and mudah
  - Value stream mapping
  - Pull system
  - Work in progress
  - Stop the line
  - Kaizen mind, mutual ownership of problems, genchi genbutsu

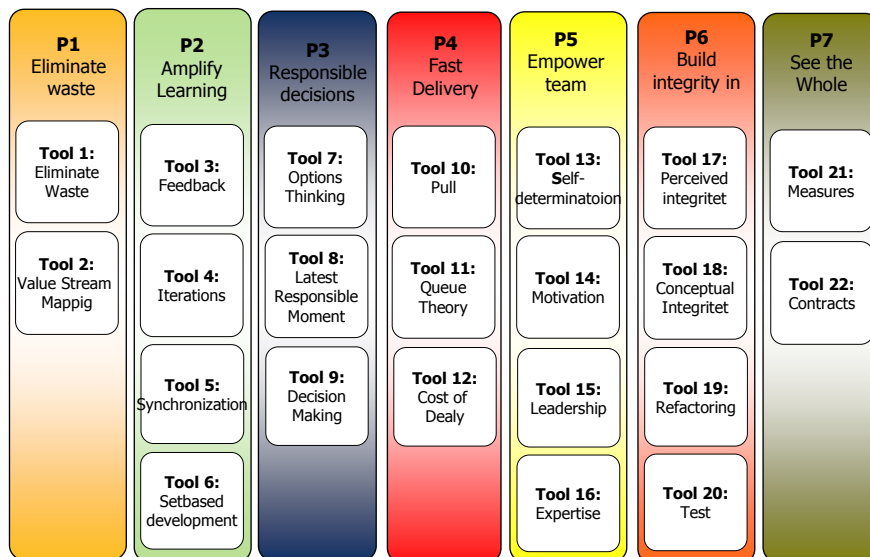
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## Scrum

- Simple framework
  - Self-organizing system
  - Inspect and adapt
- Continuous improvement
  - Daily Meeting, Impediment List, Sprint Review, Sprint Retrospective
- Key strategies for simultaneously eliminating muri, mura, mudah
  - Product backlog ready
  - Working software done - extending the definition of done
  - Information radiators
  - Workers choose work
  - Just enough, just in time
- Scrum done right is lean

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## Lean tools



Source: Mary and Tom Poppendieck

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## For those of you doing Scrum well ...

- You deliver fully tested working software in fixed length iterations based on an Agile specification
- You have a product owner with a product backlog prioritized by business value and estimated by the team
- The team generates burndown charts and knows their velocity
- There are no project managers (or anyone else) disrupting the work of the team



Kniberg, Henrik. *Scrum and XP from the Trenches: How We Do Scrum. Version 2.1, Crisp, 5 Apr 2007.*

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## Why are these critical issues?

- If testing flows over into a second iteration you have 100% work in progress which lowers quality, increases risk, and delays delivery leading to loss of revenue.
- Excess specification inflates estimates, inflates actual work (reduces flow), and produces code that is not used (waste).
- No product owner means conflicting priorities reducing flow, stressing systems, and inflating waste.
- Lack of prioritized Product Backlog reduces value flow, delays delivery which induces stress, and generates huge amounts of waste.
- Failure to have team estimate Product Backlog stresses system, slowing delivery, reducing quality, and generating waste.
- Team not tracking burndown causes flow disruption, systemic stress, and failure to deliver.
- Not knowing velocity makes it impossible to plan, introduces delays, stresses systems, and disrupts continuous improvement.

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## **Lean requires continuous incremental improvement**

- If it is broken you fix it.
- You fix it now not later.
- For serious problems you stop the line to fix it.
- You do a root cause analysis of process flaw that allowed it to break in the first place.
- You change the process so it can never happen again.
- You expect to do this every day – it never stops!
- When you achieve this discipline you have Kaizen mind ...

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## **Lean requires global optimization**

- Management by objectives can create incentives for competition and generate isolated silos of work.
- Local efficiency is bad if it suboptimizes global performance.
- Edward Deming views American management as totally broken. The American personal incentive system at the expense of team performance has caused unbelievable and unmeasurable damage. (How much does the loss of GM, Chrysler, and Ford cost the Americans?)
- Professor Senge views American management as focused on mediocrity. They force people to work harder and harder to get less and less done. This is a losing strategy.
- Lean fixes this!

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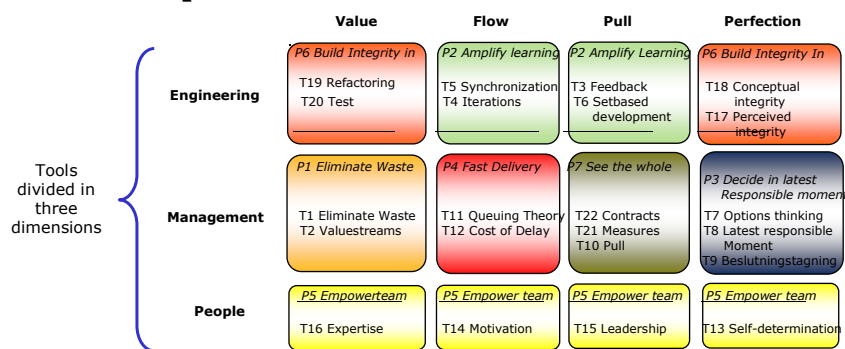
## Continuous Improvement with Lean



Directive from Strategic Planning Session in summer 2005:  
Future Improvements should be primarily based on Lean

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## Systematic's model for Lean development



Management needs to understand "The Toyota Way"

Source: Systematic Software Engineering

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## Improvement Opportunities

**Quantitative Thinking driven by Business Objectives, Process Performance, and Cost Benefit Analysis was used to identify key improvements:**

- **Defect Containment**  
Analysis shows that cost of fixing defects in later phases than coding increases significantly.
- **Lean Thinking Tool**  
Refactoring / Test
- **Suggested resolution**  
Early Test
- **Cycle Time**  
Focus on high quality has gradually increased time spent on final test and thereby cycle time.
- **Lean Thinking Tool**  
Synchronization and Iterations
- **Suggested resolution**  
Deliver often in small iterations

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## Improvement Plan and Pilots - 1

- Four pilot projects in a period of 4-6 months
  - Early testing:
    - Enhanced story-based (early testing) development
    - Colocation of tester and developer
    - Features subdivided into stories
    - Checklist driving implementation of stories
  - Synchronization and iterations:
    - Plan with many small iterations of 2-4 weeks and ensure high communication within team and to customer
- Period: December 2005 – June 2006

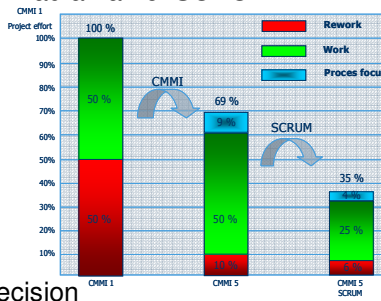


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## Improvement Plan and Pilots - 2

### Results

- Large projects doubled productivity
- Early testing: Defects in final test reduced by 40%.
- It was realized that what we trying to pilot already had a name: **SCRUM**.



### Decision

- Scrum and Story Based Development to be the new default choice for future projects within Systematic

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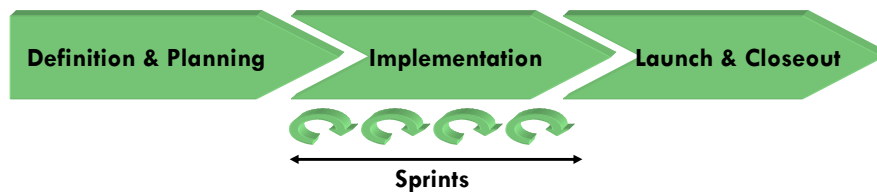
## Scrum in a Project's Lifecycle

### CMMI: *Project Planning*

- SG1: Establish Estimates
- SG2: Develop a Project Plan
- SG3: Obtain Commitment to the Plan

### CMMI: *Project Monitor and Control*

- SG1: Monitor Project Against Plan
- SG2: Manage Corrective Actions to Closure



### Scrum: *Create Product Backlog*

- Define backlog items
- Establish Estimates
- Prioritize backlog items
- Identify dependencies

### Scrum: *Create Sprint Backlog*

- Monitor progress against sprint plan
- Remove impediments

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The CMMI Model says  
*what to do*, but not  
*how to do it!*

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## **Systematic CMMI 5 Analysis First six months of Scrum**

- 80% reduction in planning and documentation costs (still under discussion)
- 40% reduction in defects
- 50% reduction in rework
- 100% increase in overall productivity
- Systematic decided to change CMMI Level 5 process to make Scrum the default mode of project management
- When waterfall project management is required, they are now need to be contracted for twice the price of Scrum projects
  - Required by some defense and healthcare agencies
  - Results are lower business value
  - Lower customer satisfaction
  - Lower quality
  - Twice the cost

Sutherland, J., C. Jacobson, et al. (2007). Scrum and CMMI Level 5: A Magic Potion for Code Warriors! Agile 2007, Washington, D.C., IEEE.  
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## CMMI/Agile Lessons Learned



- Key to achieve more agility with the CMMI is to realize that the practices are primarily advisory or indication only.
- Practices don't need to be the ones described in the CMMI specification. You have the freedom to choose other evidence.
- The core issue is not whether CMMI-like or Agile-like practices are best, the core issue is building an organizational culture with a balance of discipline and adaptability.

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## Numbers are accurate, unbiased, and conservative

- We simultaneously achieved
  - Lower cost
  - More features
  - Faster delivery
  - Higher customer satisfaction
  - Higher employee satisfaction
- All at once! This is a feature of lean and demonstrates a successful implementation.
- **We expect to improve on this as we are just beginners with Scrum.**

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## Summary

- Lean Software Development is a successful operational tool to identify improvement opportunities in a CMMI Level 5 company.
- Using CMMI and Scrum together results in significantly improved performance
  - Scrum pilot projects showed significant gains in productivity and quality over traditional methods.
  - Pilots show reduction in every category of work (defects, rework, total work required, and process overhead) by almost 50%.
- CMMI Generic Practices can be used to institutionalize and strengthen agile practices. Implementing these practices can help establish needed discipline for any Agile Method.

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## Recommendations

- Companies requiring high maturity processes should consider introducing Agile practices
  - The cost of implementing CMMI may be significantly reduced with Scrum.
  - Time to implement CMMI may not be reduced as significant cultural changes are required.
- The Agile community should use the CMMI generic practices to amplify the benefits from Agile methods.
  - The concepts of institutionalization, standardization, training, communication, and management responsibilities embedded in CMMI practice can enhance a Scrum implementation.
- The key is to build an organizational culture with a balance between discipline and change readiness.

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## Questions?



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