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Benefits of Software Process Improvement

February 6, 2001

Agenda

- **Definition: What is process improvement?**
- **Reason: Why improve the process?**
- **Method: How is the process improved?**
- **Benefits and disadvantages: What are the results of process improvement?**
- **Obstacles: Why is it so hard to improve?**
- **Bottom line: Is it all really worth it?**

What Is Process Improvement?

- **Process: a series of actions, changes, or functions that achieve an end result**
- **Improve: to make better**
  - **Increase quality**
  - **Increase productivity**
  - **Perform to plan**
  - **Higher customer satisfaction**

Why Improve?

- Assumes current conditions or results are not most desirable
  - Not meeting business goals
  - Insufficient quality
  - Inconsistent deliveries
  - Behind schedule
  - Over budget
  - Customer dissatisfaction
  - Maximize profit
  - Augment competitive posture
  - More consistent performance
- Reasons to improve vary depending on an organization's priorities
  - Short-term improvement to fulfill immediate need
  - Long-term improvement to reach a goal

Why Improve?

Continued

- **Much of $250 billion spent on software projects in the United States was wasted on late, incomplete, or canceled projects***
  - **53% ($132.5 billion): over budget, delayed, less functional than planned**
  - **31% ($77.5 billion): canceled**
  - **16% ($40 billion): on time, within budget, with all planned functions**
- **Common software issues**
  - **High cost, low quality**
  - **Unpredictable performance**
  - **Excessive maintenance costs**
  - **Dissatisfied customers**

**Source: Investor's Business Daily (Jan. 25, 1995)*

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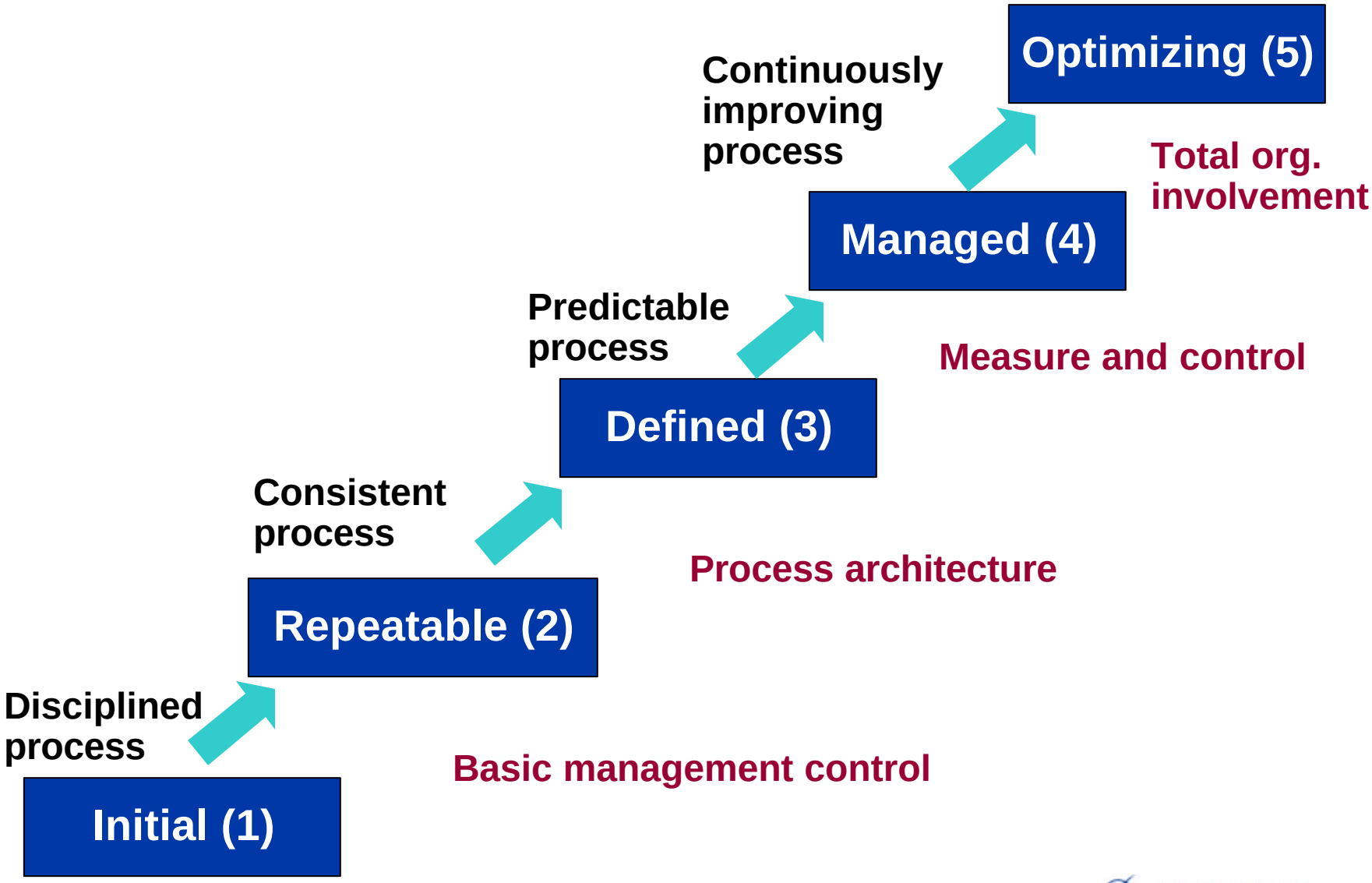
SEI and the CMM

- **Software Engineering Institute (SEI) is a federally funded research and development center**
  - **1987: Maturity Questionnaire**
  - **1991: Capability Maturity Model (CMM), Version 1.0**
- **CMM levels**
  1. **Initial: chaos, unpredictable, “hero” stage**
  2. **Repeatable: disciplined, meeting commitments**
  3. **Defined: processes shared across organization**
  4. **Managed: managed by facts and data**
  5. **Optimized: continuously improving**

Capability Maturity Model (CMM)



Capability Maturity Model (CMM)

Continued

- **Level 2**
  - **Requirements management**
  - **Project planning**
  - **Project tracking and oversight**
  - **Subcontractor management**
  - **Software quality assurance (SQA)**
  - **Software configuration management**
- **Level 3**
  - **Organization process focus**
  - **Organization process definition**
  - **Training program**
  - **Integrated software management**
  - **Software product engineering**
  - **Intergroup coordination**
  - **Peer reviews**
- **Level 4**
  - **Quantitative process management**
  - **Software quality management**
- **Level 5**
  - **Defect prevention**
  - **Technology change management**
  - **Process change management**

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How is the Process Improved?

IDEAL Model

- **Initiating: defining current process**
- **Diagnosing: identifying areas for improvement**
- **Establishing: prioritizing and planning**
- **Acting: creating, piloting, refining, and implementing the solution**
- **Learning: evaluating progress, proposing future actions**

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How We Improved Our Process

- **Initiating and diagnosing**
  - **Used SEI questionnaire and CMM to assess current state and improvement areas**
  - **Set goals for improvement (by CMM level)**

- **Establishing**
  - **Developed near-term and long-term plans**
  - **Developed process assets: procedures and standards**
  - **Established training program based on SEI materials**
  - **Developed relationships with Configuration Management and Software Quality Assurance groups**

How We Improved Our Process

Continued

- **Acting**
  - **Use**
    - **Process assets, a subset of available library**
    - **Tailor organizational process and the process assets**
  - **Measure**
    - **Defined standard set of metrics used across projects**
    - **Project metrics rolled up into Organization Metric Analysis Report**
    - **Automation of metrics through tools**
- **Learning**
  - **Quality assurance evaluations**
  - **Root cause analysis on defects**
  - **Analyze metrics at project and organizational level**
  - **Collect lessons learned in project portfolio**

Key Aspects of Our Improvement

- Management commitment
  - Senior and project management leadership
  - Dedication of resources
- Peer reviews
  - Use checklists as criteria for review
  - Root cause analysis of defects found
- Process assets library
  - Standards and procedures for software development
  - Assets are tailorable
- Metrics

Standard Set of Metrics

- Software development progress
- Cost and schedule deviation
- Software development manpower
- Product size
- Requirements changes
- Computer resource utilization
- Defects
- Training
- In-process technical reviews
- Process assessments

What Are the Results of Process Improvement?

Benefits

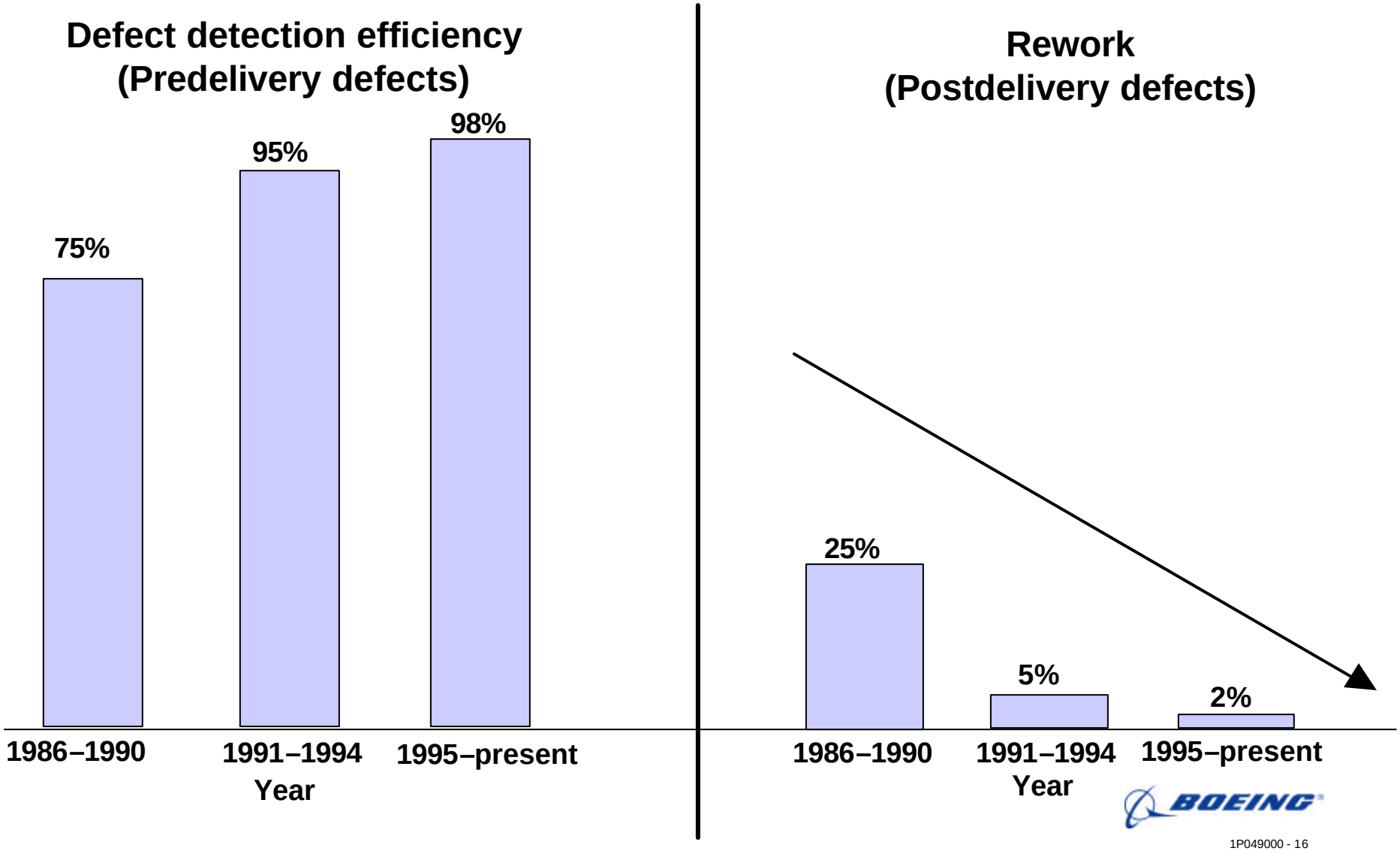
- Management commitment -> environment for improvement
- Peer reviews -> quality
- Process assets library -> productivity
- Metrics -> visibility

Benefits: Environment for Improvement

- **Ensures process improvement is related to business goals, which is necessary for long-term improvement**
- **Communicates to others importance of process improvement effort**
- **Provides support and reinforcement in difficult times; prevents abandonment of process to fight fires**
- **Produces lasting results: continuity, consistency**

Benefits: Quality

Peer reviews identify defects before they are delivered



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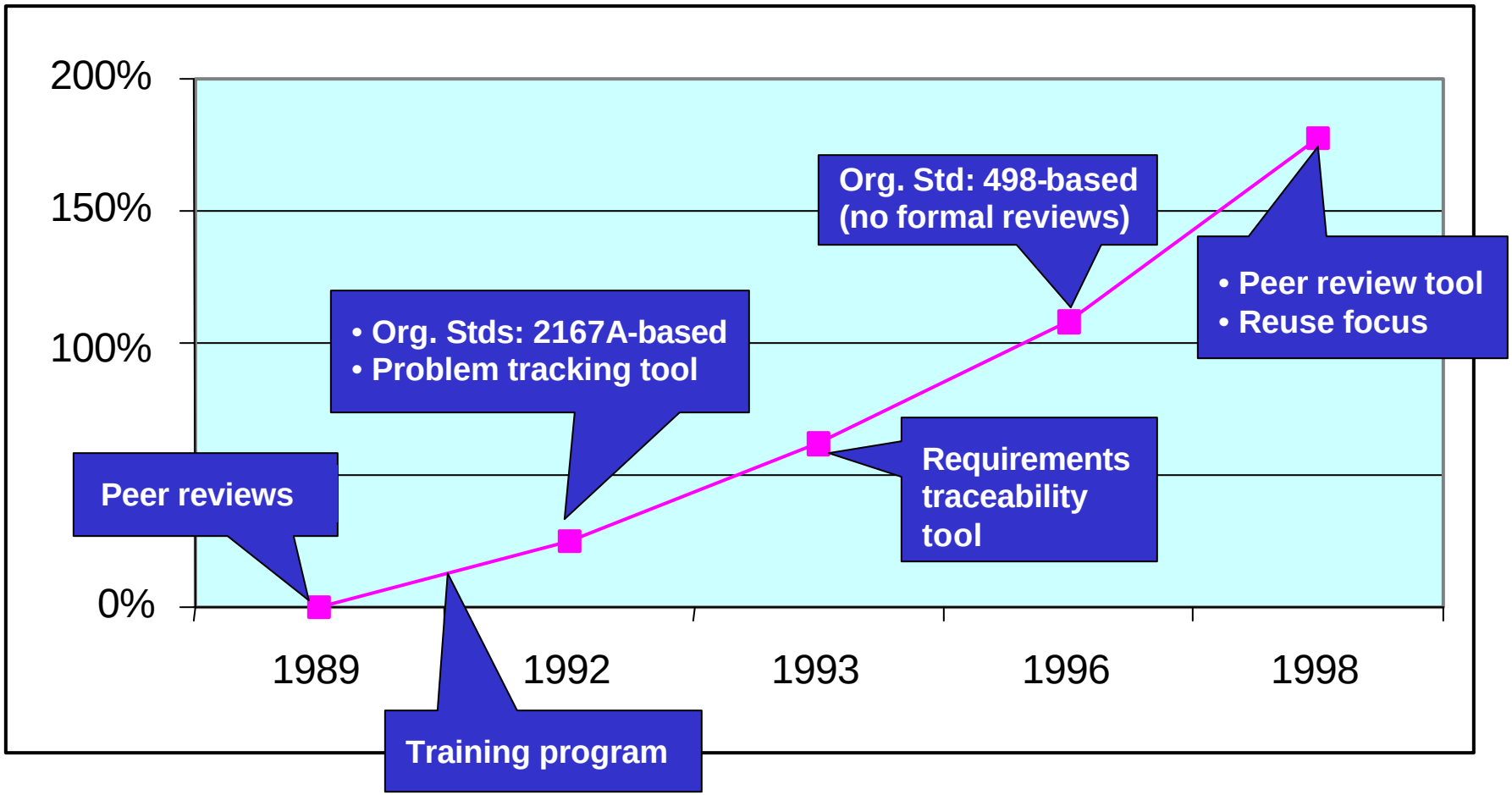
Benefits: Productivity

Organization standards help achieve productivity increase



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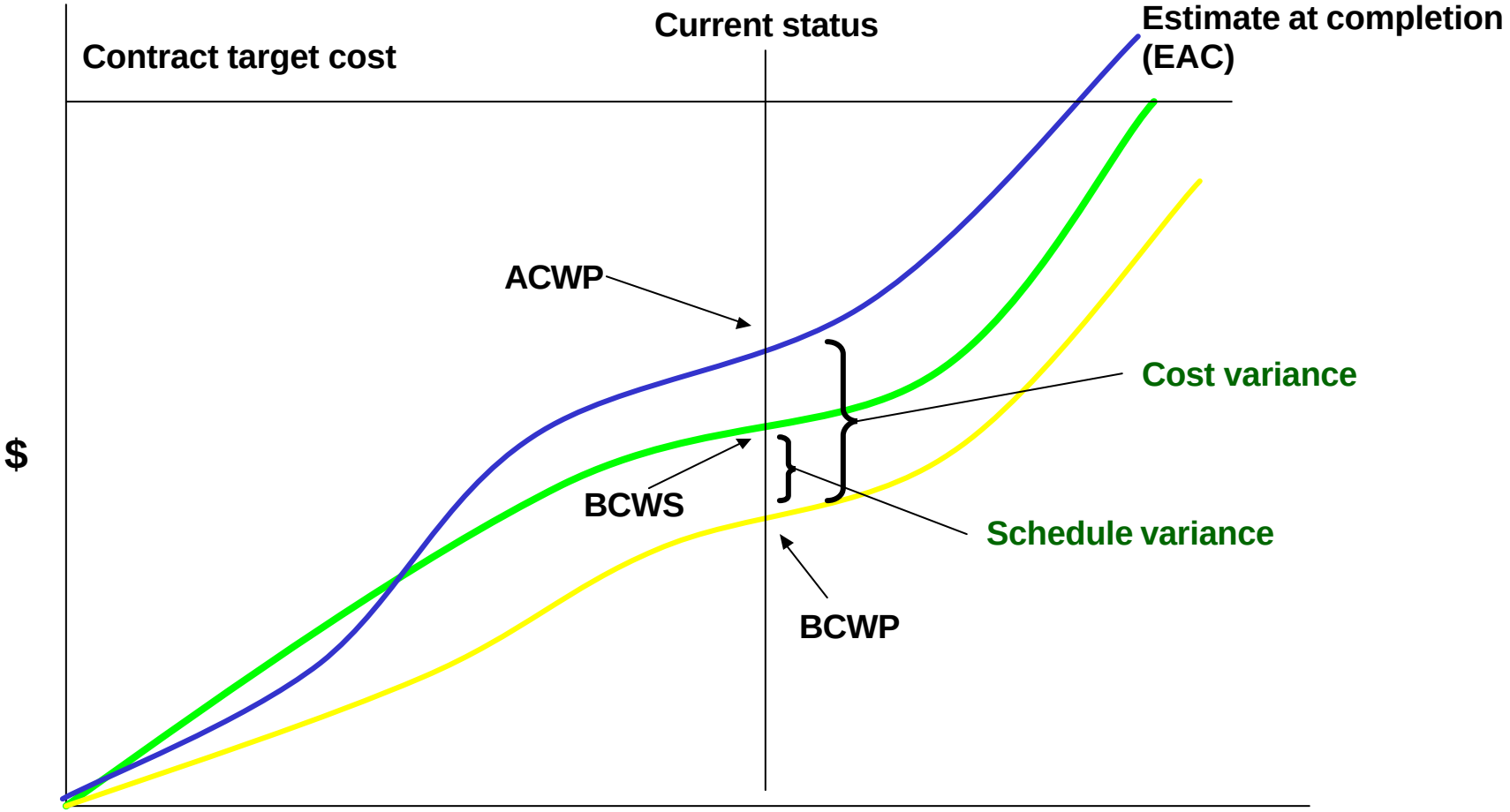
Benefits: Visibility

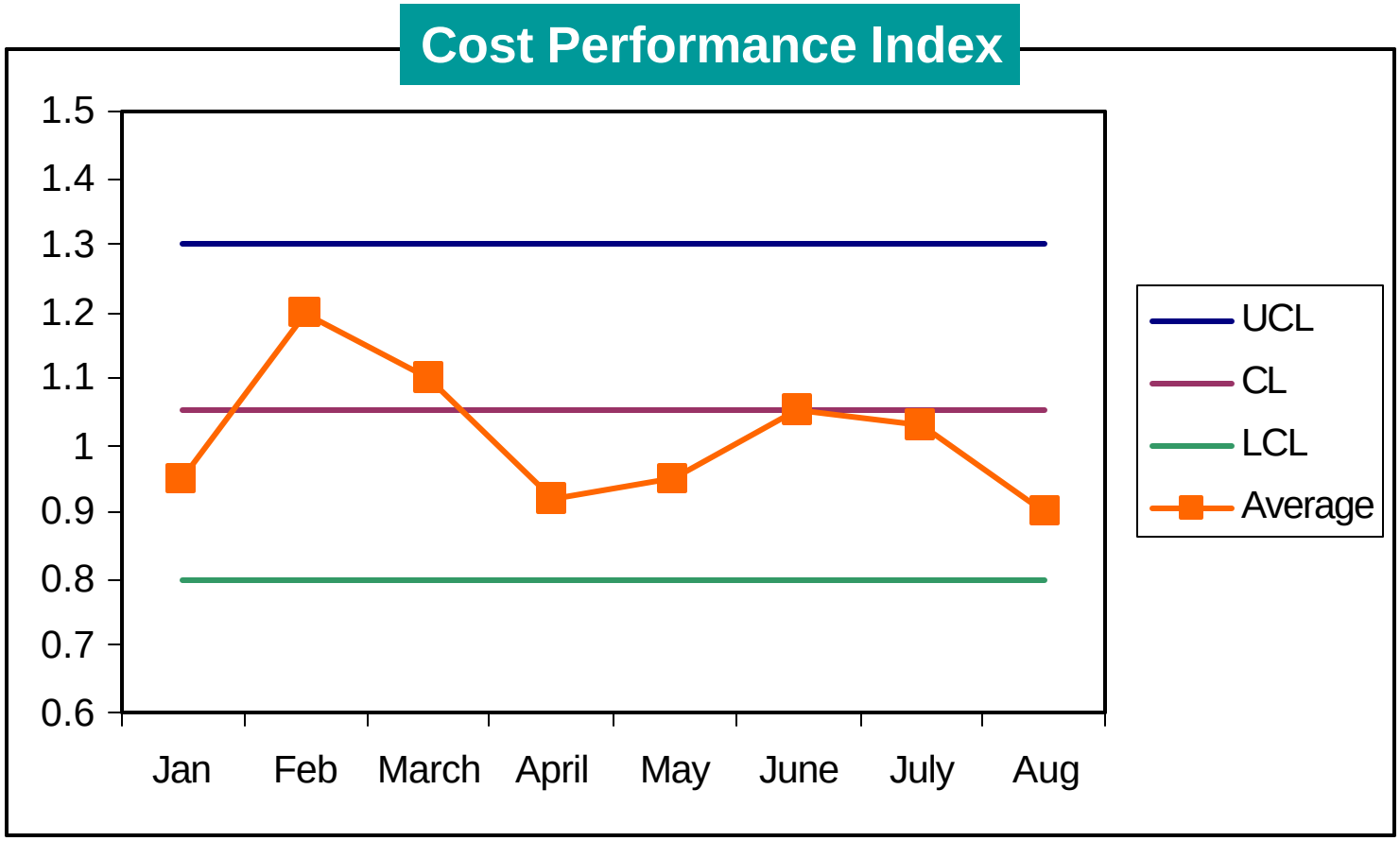
- Metrics provide timely insight into the process
  - Identify areas needing improvement
  - Identify areas deserving praise
- Metrics help managers “see” how their programs are doing
- Metrics provide defense against critics
  - Estimating cost and schedule
  - Proving the worth of process improvement
  - Preventing panic and over-management

Metrics: Earned Value



BCWS: budgeted cost of work scheduled
BCWP: budgeted cost of work performed
ACWP: actual cost of work performed

Metrics: Capability



UCL: upper control limit
CL: control limit
LCL: lower control limit

Example data only

What Are the Results of Process Improvement?

Possible disadvantages and solutions

- Lack of flexibility
- Impractical
- Costly

Disadvantages and Solutions

- **Lack of flexibility**
  - **Process is inappropriately detailed**
  - **Standards are too rigid, with no value added**
  - **Change is not easily implemented**

- **Solution**
  - **Process should be tailored by the project**
  - **Standards and procedures should be developed by those who use them (engineers and SQA)**
  - **Change and improvements should be encouraged and manageable**

Disadvantages and Solutions

Continued

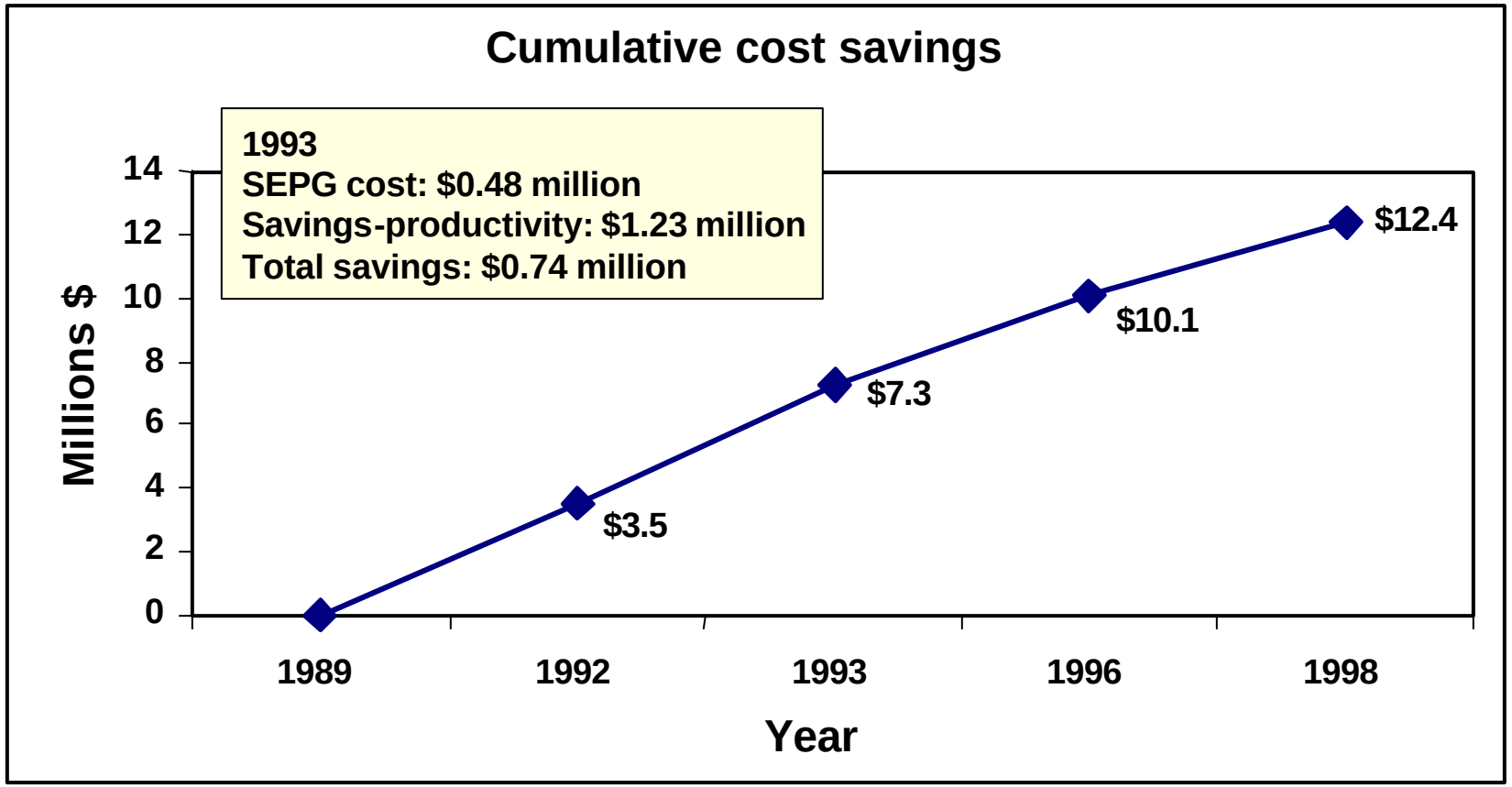
- **Impractical**
  - **Process becomes overly theoretical, not practical**
  - **Process becomes burdensome; stifles creativity and innovation**

- **Solution**
  - **Staff the organization's process group with personnel who have worked on projects**
  - **Process should be tailored by the project**
  - **Solicit and use practitioner feedback from beginning to end**

Disadvantages and Solutions

Continued

Increased productivity results in cost savings



Why Is It so Hard to Improve?

- Improvement effort becomes unfocused and disappears
- Possible causes
  - Misunderstanding the problems to be fixed
  - Trying to fix too many things at once
- Possible solutions
  - Thorough assessment and planning to prioritize areas of improvement and focus effort
  - Build consensus on areas of improvement and improvements to be implemented

Why Is It so Hard to Improve?

Continued

- Improvement effort is not maintained; process returns to former state
- Possible causes
  - "Fighting fires" mentality
  - Lack of consistent management support
  - No clear link to business need
  - Lack of visible results—no method to measure success, no communication of success
- Possible solutions
  - Management support: express importance and expected results
  - Verify process is being implemented (SQA, internal audits, and peer reviews)
  - Measure and communicate results

Why Is It so Hard to Improve?

Continued

- **Resistance to change**
  - **Fear of losing job—higher productivity requires less people to do the same job**
  - **Fear of learning something new, losing expertise**
  - **Fear of greater scrutiny (e.g., using metrics negatively)**
- **Possible solution**
  - **Training and communication: purposes of improvement and benefits**
  - **Proper use of metrics—for improvement, not for punishment**

Is It Really Worth It?

- **Improvement is needed**
- **Improvement is possible**
- **Improvement requires investment and commitment**
- **Improvement is challenging**
- **Improvement results in benefits**

The right kind of improvement, implemented in the right way, will produce the right results

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Acronyms

- ACWP: actual cost of work performed
- BCWP: budgeted cost of work performed
- BCWS: budgeted cost of work scheduled
- CL: control limit
- CM: configuration management
- CMM: capability maturity model
- EAC: estimate at completion
- LCL: lower control limit
- SEI: Software Engineering Institute
- SEPG: Software Engineering Process Group
- SQA: software quality assurance
- UPL: upper control limit