Implementing a Plan for Controlling Program ROI for CMMI® Process Improvement

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Objectives

Use ‘ROI’ as a measure for

– Understanding and quantifying the benefits/losses of Process Improvement (PI) and Process (P) performance for the Program

• Support decisions in planning and performing PI and P
• Increase efficiency of Process Improvement (PI) and Process (P)
Process Milestones

- CMM Level x Activity
- CMMI Updates to Division Processes
- CMMI Software Level x+1 PI
- CMMI Engineering Level x-2 PI

Timeline:
- 2003: CMM Appraisal
- 2004: CMM Appraisal, CMMI Readiness Appraisal
- 2005: CMM Appraisal, CMMI Readiness Appraisal
- Today: CMM Appraisal
- 2006: CMM Appraisal
Manage ROI

Cost & Benefit Estimates/objective

Actual Costs
- Management
- Process Development
- Training
- Compliance
- Appraisals
- Execution

Actual Benefits
- productivity gain
- effort decrease
- cycle time decrease
- rework decrease
- quality gain

Data → Control
Approach

• Benefits of the CMMI
  – Aggregate benefits at the process element level from CMMI-based improvements
    • Define ‘goodness’ measure for a process element
    • Measurements before, during, after the improvements
Process Improvement Costs (Hours)

<table>
<thead>
<tr>
<th>Year</th>
<th>Software</th>
<th>Engineering including Software</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2003</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2004</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2005</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Examples of element level process
Process Element Example

- Peer reviews
- ‘Goodness’
  - Early identification of defects
  - Number of defects missed
  - Time to close defects
  - Predictability
Data Categories for Defects

• Defects (Peer Review)
• Change requests
  – Developmental (CUT)
  – Formal (Test)
• Issues
Defect Origin

![Diagram showing defect origin by year and process phase]

- Sys Req Analysis
- Sys Arch Design
- SW Arch Design
- SW Req Analysis
- SW Prelim Design
- SW Detail Design
- Code & Unit Test
- SW Integration
- Software Quality Test

Bar chart with years 2001 to 2005, showing defect origin across various phases of software development.
Severity Occurrence

Severity Occurrence

2001  2002  2003  2004  2005

Severity 1
Severity 2
Severity 3
Severity 4
Severity 5
Peer Review Defect Data
Formal SPCR & Test

Note: Scale is approx. 30 x smaller than previous charts
Peer Review Defect Data


Baseline: 2001
CMM Appraisal: 2002 (1.2), 2003
CMMI Appraisal: 2004, 2005 (.6)
# Sweep Peak (T) Value

<table>
<thead>
<tr>
<th>Build</th>
<th>Peak Location (T-Value)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>1.8</td>
</tr>
<tr>
<td>1B.1</td>
<td>1.66</td>
</tr>
<tr>
<td>1B.2</td>
<td>1.6</td>
</tr>
<tr>
<td>1C</td>
<td>1.4</td>
</tr>
<tr>
<td>2 (Estimated)</td>
<td>1.3</td>
</tr>
</tbody>
</table>
Estimated Total Errors: 848.6
Projected Latent Errors: 211.6004
Selected Peak Location: 3
Error Discovery Efficiency: 75.06%

Bar chart showing the projected errors in different phases of software development:
- Software Requirements Analysis
- Preliminary Design
- Detailed Design
- Code and Unit Test
- Software Integration

The bars are color-coded:
- Actual
- Estimated

Close button is present.
Estimated Total Errors: 493.05
Projected Latent Errors: 299.0499
Selected Peak Location: 5
Error Discovery Efficiency: 39.35%
Benefits / ROI

• Earlier detection of defects
  – 1.2 defects per ksloc to .6 defects per ksloc at Software Integration and Test
• Time to close defects decreasing
• Number of issues declining
• ROI using cost of all Process Improvement and only defect related benefits (ignoring all other benefits) = 1.6
Summary

• Single program
• Trend data from 2002 to 2005
  – CMMI Level 5 (2005-)
• Examined defect data
• Defect benefit / Total PI cost = 1.6