

# CMMI\* v1.2: The Good, The Bad, and The Ugly



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# Agenda

- **Failures in Software Development. Why? Now what?**
- **CMMI v1.2 A Template for Organizational Improvement**
- **The Good: How CMMI v1.2 Improved CMMI v1.1**
- **The Bad : The CMMI -- Continuing Confusions**
- **The Ugly: How the CMMI Obscures Some of its Basic Quality Management Principles**
- **CMMI: The Role of Appraisals (SCAMPIS)**
- **SCAMPIS: The Good**
- **SCAMPIS: The Bad**
- **SCAMPIS: The UGLY**
- **Why Do Process Improvement? The Bottom Line**

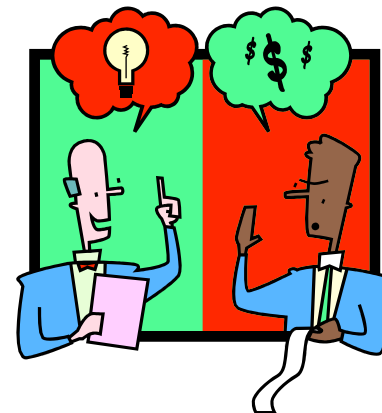
# Why We Need a Better Approach to Software Development

- **£6.2bn IT scheme for NHS “is not working and is not going to work”**
  - **“What we are trying to do is run an enormous programme with the techniques that we are absolutely familiar with for running small projects. AND IT ISN'T WORKING”**  
*Andrew Rollerson responsible for Fujitsu delivery of healthcare services*
  - **Total Cost expected to rise to £12.4bn.**
- **Britain's child-support project**
  - **a year late**
  - **\$844 M**
  - **didn't pay 50% of cases**
- **The US IRS system – finally started to be used in 2005**
  - **5 years of delays**
  - **costs exploded to \$2 B**
- **FBI system killed**
  - **3 years of work**
  - **\$150 M**
  - **5 CIOs, 9 program managers**



# There is no Secret to Meeting Cost and Schedule Commitments

- In every field, four things are required:
  - Developers must estimate and plan their own work.
  - Everyone should precisely and regularly track and report status and progress.
  - Schedule delays must be addressed every day.
  - When requirements change, everyone should
    - Revise plans
    - Renegotiate commitments



# The Basic Principles of Successful Quality Software Development Management

- No test can find more than a fraction of the defects in a product.
- To get a high-quality product you have to find more defects before test.
- The longer a defect remains in a product, the more it costs to find and fix it.

- 1 defect found early in development costs \$100 to fix
- 1 defect found during testing costs \$1,000 to fix
- 1 defect found during operations costs \$10,000 to \$20,000 to fix

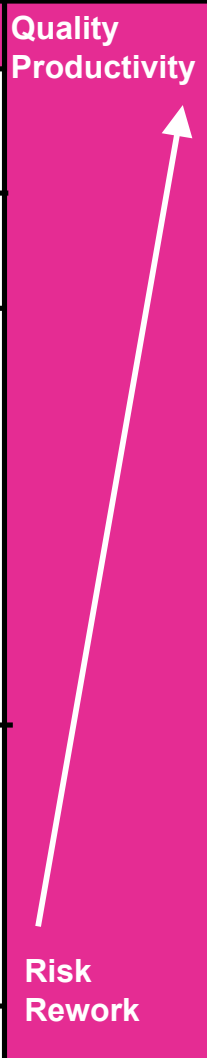


# To Find and Fix Defects before Test, a Quality Process Must:

- Have multiple early defect-removal steps
- Measure product quality at every step
- Measure process quality at every step
- Make and follow personal and team quality plans
- Regularly track product and process quality
- Use testing to:
  - verify product quality
  - gather quality data:
    - record and analyze defects to improve the process
- Promptly correct quality deviations from plan

# The CMMIv1.2: A Template for Organizational Improvement


# Staged Representation: PAs by Maturity Level

Level	Focus	Process Areas	Quality Productivity
5 Optimizing	<i>Continuous Process Improvement</i>	Organizational Innovation and Deployment Causal Analysis and Resolution	
4 Quantitatively Managed	<i>Quantitative Management</i>	Organizational Process Performance Quantitative Project Management	
3 Defined	<i>Process Standardization</i>	Requirements Development Technical Solution Product Integration Verification Validation Organizational Process Focus Organizational Process Definition +IPPD Organizational Training Integrated Project Management +IPPD Risk Management Decision Analysis and Resolution	
2 Managed	<i>Basic Project Management</i>	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management	
1 Initial			

# Continuous Representation: PAs by Category

Category	Process Areas
<b>Process Management</b>	<ul style="list-style-type: none"> <li>Organizational Process Focus</li> <li>Organizational Process Definition +IPPD</li> <li>Organizational Training</li> <li>Organizational Process Performance</li> <li>Organizational Innovation and Deployment</li> </ul>
<b>Project Management</b>	<ul style="list-style-type: none"> <li>Project Planning</li> <li>Project Monitoring and Control</li> <li>Supplier Agreement Management</li> <li>Integrated Project Management +IPPD</li> <li>Risk Management</li> <li>Quantitative Project Management</li> </ul>
<b>Engineering</b>	<ul style="list-style-type: none"> <li>Requirements Management</li> <li>Requirements Development</li> <li>Technical Solution</li> <li>Product Integration</li> <li>Verification</li> <li>Validation</li> </ul>
<b>Support</b>	<ul style="list-style-type: none"> <li>Configuration Management</li> <li>Process and Product Quality Assurance</li> <li>Measurement and Analysis</li> <li>Decision Analysis and Resolution</li> <li>Causal Analysis and Resolution</li> </ul>

# CMMI v1.1 and v1.2: The Good Remains

- **The CMMI continues to provide the most comprehensive roadmap for process improvement.** 
- **CMMI Process Areas encompass the basic process principles for managing quality software development:**
  - **Issues of how to plan and track schedule and cost are addressed in the process areas of: Project Planning, Project Monitoring and Control, Integrated Project Management, Quantitative Project Management**
  - **Issues of Quality Management are addressed in the process areas of: Process and Product Quality Assurance, Verification, Validation, Quantitative Project Management, Organizational Process Performance, Causal Analysis and Resolution**

# The Better: How CMMI v1.2 Improved CMMI v1.1



- **Reduced Model Complexity and Size**
  - **Number of Process Areas have been reduced from 25 to 22**
    - One PA again for Supplier Agreement Management (Level 2) Integrated Supplier Management Level 3 PA in v1.1 practices now in SAM
    - Separate PAs for Integrated Product and Process Development eliminated and information now incorporated into Organization Process Definition and Integrated Project Management
  - **Distinctions between basic and advanced practices for engineering process areas have been eliminated**
  - **Improved Glossary and overview material**
- **Expanded Model Coverage**
  - **Added hardware application examples**
- **Increased confidence in and usefulness of SCAMPI appraisal results**
  - **Questionnaires no longer required**
  - **Appraisal Reports (Appraisal Disclosure Statements) more comprehensive**
  - **Appraisal results valid for only 3 years.**

# Some Bad Also Remains

## Problems in both CMMI v1.1 and v.1.2



- **Continuous Representation Can be Oversold**
  - **Continuous level – “enabling an organization to incrementally improve processes corresponding to an individual process area (or set of process areas) selected by the organization”**
  - **In reality, certain process areas rely on other process areas being completed and do not stand alone.**
- **Underemphasises Management PAs**
  - **Only 6 out of 22 Process Areas devoted to Project Management**
- **Hides Importance of the Role of Senior Management**
  - **Primary reference found in Generic Practice 2.10: Review Status with Higher Level Management. Which itself is ambiguous.**

# The Ugly: CMMI Obscures Some Basic Quality Management Principles

## Problems with v1.1 and v.1.2 CMMI



- Implicitly assumes but does not emphasise the importance of frequent and early defect detection prior to test. Peer Reviews (Fagan Inspections) are key to finding as many defects before test
  - Buried in the Verification Process Area: Goal 2 -- Perform Peer Reviews.
- Overemphasises the “Testing” stage of Software Development.
  - “To get a high-quality product out of test, you must put a high-quality product into test”.
  - An overemphasis on the Test phase obscures the importance of pre-test quality process. Difference between Verification and Validation is muddled.
  - The operation of the Testing Phase itself is confused by breaking down its operations into 3 overlapping PAs: Verification (Goals 1 and 3), Validation, and Product Integration (SG3).

# Role of Appraisals (SCAMPIs)



# Major Role of Appraisals Methods and Goals

- **Mirroring organization by getting everyone to speak**
- **Assembling evidence of what people were unaware of**
- **Results are collected from the organization**
  - **They are not the conclusions about the organization**
- **A way for the whole organization to see itself**



# The Four Primary Functions of Appraisals

- **Serve as analytical tools.**
- **Function as fulcrums of positive change.**
- **Help transform organizations.**
- **Educate by giving people in organizations a broader knowledge of their own organization and by encouraging organizations to contemplate industry's best practices and compare them to their own.**



# Outcome Of Appraisals



- **Appraisals are not audits**
  - A company does not pass or fail
  - There are no certificates
  - Opportunity for everyone in organization to work together
- **Appraisals help:**
  - communication within organizations
  - to focus projects and organization on what has been improved
  - to discover what still needs to be improved
- **Organizations which perform appraisals every 6 months tend to improve more quickly**

# What Should Happen After An Appraisal

- An appraisal is a trigger
- People (at all levels) need to take proper responsibility
- Projects need to articulate processes they are presently using
  - They have to internalize what and why they are doing things
- Quickly projects talk about what they are not doing
- Prioritise which actions they will work on first and develop and follow plan to implement actions

# SCAMPIs: The Good

## SEI SCAMPI v1.2 Improvements

- **Attempts to increase confidence in and usefulness of SCAMPI appraisal results**
  - **Appraisal Disclosure Statement reporting requirements required more information**
  - **Appraisal results only valid for a maximum of 3 years.**
  - **Questionnaires no longer required**



# SCAMPIs: The Bad

## Problems with v1.1 and v.1.2 SCAMPIs



- **Examples of severe misunderstandings**
  - Confusions about criteria mean that high maturity practices are not understood and are not rated consistently ( In reality confusion about Level 2 and Level 3 practices exist and are also not rated consistently.)
  - Appraisal method allows for ‘aggressive tailoring’ and consequent inconsistent reporting.
  - Too many Lead Appraisers are being SEI certified who lack the knowledge and skill required. Many do not understand the intent of the model and try to use it as a rule book
- **SEI increasingly concerned about quality of appraisals**
  - Appraisers inconsistencies have become more apparent
  - **Consequently, the SEI has started to audit unusual appraisals**
    - 60 follow-up audits initiated
    - 42 ‘first-time appraisals’ reporting ML4 or ML5
    - 18 unusually short time to move to ML4 or ML5

# Why SCAMPI Inconsistencies Happen

- **The CMMI vocabulary is confusing:**
  - Some parts were written by software engineers, other parts by systems engineers
  - Depending on your background, some parts will be easier to read and interpret than others
- **Despite SEI requirements regarding engineering and management experience, lead appraisers have varying levels of knowledge and expertise in each process area**
- **There is too much room for Lead Appraisers bias:**
  - **Personal experience**
    - Career path and profession
    - Own organization's implementation experience
    - May or may not have seen best-in-class implementations
- **Organizations also insert bias**
  - Limited understanding of the model
  - Convenient/minimalist interpretation of the model

• Source: SEI Lead Appraiser Presentation

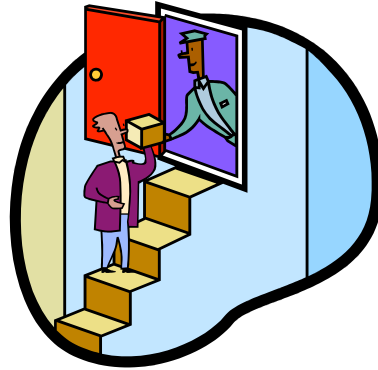
# SCAMPI: The UGLY

## Problems with v1.1 and v.1.2 SCAMPIs



- **SEI SCAMPI A appraisals:**
  - Overemphasise the role of documents and underemphasise the importance of the interviewing process.
  - Encourage both organizations and Lead Appraisers to treat appraisals as audits and not (as originally intended) to educate organizations in state of the art practices.
- To compensate, the SEI has initiated SCAMPI B and C appraisals which do not supply a rating.

# Payoff of Process Improvement



## Bottom Line Numbers

# The Payoff Of Process Maturity

Process Maturity Concerns the Discipline to Find and Fix Defects Early and Ultimately an Ability to Prevent Them.

1 defect found early in development costs \$100 to fix

1 defect found during operations costs \$10,000 to \$20,000 to fix

Today's development expectations involve at least 3-6 operational defects in a level one organization per thousand lines of code. This means a cost of between \$30,000 and \$120,00 per thousand lines of code

A Level-3 Organization Is Able to Find 50% of all defects before testing. A Level-5 Organization 80%. A Level-3 Organization can thus save between \$15,000 and \$60,000 per thousand lines of code.

Many projects now consist of 250,000 to one million lines of code, and programs are getting more complex

*Quality translates into **Hundreds of Millions of Dollars** of preventable costs*

# Organization Z Bottom Line Numbers

	Time of 1st assessment	Time of 2nd assessment (2 years after 1st)	Time of 3rd assessment (4 years after 1st)
% projects delivered on time and on budget	72%	91%	96%
% of defects detected prior to testing	50%	63%	75%
% of defect found in testing	49%	36%	24%
Productivity		11.5% per year (23% for 2 years)	24% for 2 years

# Organization Z's Savings in Dollars

- **Saved \$4,542,000 in development costs over 4 years and not including positive ripple effect into other departments**
- **Spent \$3,138,000 which includes:**
  - **\$1,956,000 for cost of Fagan Inspections**
  - **\$237,000 for cost of assessments**
- **A return of 44.6% per year or \$1,404,000 over four years**
- **Overall net increase in profit for the software development of 2.5% per year**

