Measurement and the CMMs®

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Objectives

Discuss CMMs and Measurement

Discuss CMM measurement requirements from an assessor’s perspective

Review common measurement program problems seen during assessments

Provide a few good examples and some advice
CMMs and Measurement

Measurement provides visibility into the process

Measurement is not a “Level 4 only” activity!

Measurement is scattered throughout SW-CMM Level 2 and Level 3

In CMMI, Measurement & Analysis becomes its own Process Area

To be ready for high maturity, must have solid measurement program (most don’t!)
Measurement & Process Maturity

Level 5

Level 4

Level 3

Level 2

Level 1

Source: [2], page 23
## Measured Performance Improvement

<table>
<thead>
<tr>
<th>Level</th>
<th>Process Characteristics</th>
<th>Predicted Performance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>5</strong></td>
<td>Optimizing With continuous process optimization and targeted technology insertion, performance continues to improve at Level 4.</td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td><strong>4</strong></td>
<td>Managed With quantitative management of the process and product, performance continues to improve at Level 4.</td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td><strong>3</strong></td>
<td>Defined With well-defined processes, performance improves at Level 3.</td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td><strong>2</strong></td>
<td>Repeatable Plans are based on known past performance. Estimates/plans are more realistic and met more often.</td>
<td><img src="image" alt="Graph" /></td>
</tr>
<tr>
<td><strong>1</strong></td>
<td>Initial Schedule and Cost targets are typically optimistic (overruns) Performance results vary widely.</td>
<td><img src="image" alt="Graph" /></td>
</tr>
</tbody>
</table>

*Adapted from Source: [2], page 28*
SW-CMM Measurement Requirements

Project Management Measures
- Planning and Tracking (SPP, SPTO, ISM)
  - Work Product/Software Size (SLOC, FP, Pages, Reqs)
  - Work Effort, Cost, Schedule
  - Critical Computer Resources

Product Management Measures
- Peer Review Defect Data (PR, SPE)
- Test Defect Data (SPE)
- SQM KPA at Level 4

Process Management Measures
- Process Status (ME1s - All KPAs)
- Peer Review Process Data (PR)
- SPI Progress (OPF/OPD)
- Training Quality (TR)
- QPM KPA at Level 4
- Process Improvement trends at Level 5

Measurement Infrastructure
- Organizational Database (OPF/OPD, ISM)
  - Historical Data (Size, Productivity, Effort Distribution)
CMMI Measurement Requirements

Generic Practices

• GP 2.2 Plan the Process
  – Include measurement requirements (process, product, service)
• GP 2.8 Monitor and Control the Process
  – Measure actual performance of the process, product, service; identify deviations; take correction action
• GP 3.2 …..Collect measures to support process improvements

Measurement Program/Infrastructure

• Measurement & Analysis PA – basically PSM
• Measurement Repository (OPF/OPD, IPM)
• Quality and Performance Baselines and Models (OPP)

Project, Product, Process Management Measures

• Project Planning and Monitoring/Control (PP, PMC, IPM)
  – Work Product/Size, Effort, Cost, Schedule
• TPMs (RD), Peer Review/Test Defect Data (VER/VAL)
• Quality and Performance Baselines and Models (QPM)
• SPI Progress (OPF/OPD)
• Training Quality (TR)
• Process Improvement trends at Level 5
Common Measurement Problems

Analysis of CMM-based assessment findings shows that ME common features are often not met\(^5\).

Other/related problems:

- Measures Collected but not Used
- No Measurement Plan/Design
- Weak Measurement Repository
Problems with ME practices-1

Each CMM key process can be described in terms of:

• Tasks or Activities
• Assignments or Resources
• Work Products/Deliverables
• Costs/Dollars
• Schedule/Dates/Milestones
Problems with ME practices-2

ME Purpose: To provide insight into the STATUS of the Key Process Areas.

Activity Status

Tasks:
• Actual progress vs. plan
• How soon will we be done?
• Are we behind schedule?

Resources:
• Costs incurred vs. plan
• Effort Consumed vs. plan
• Are we over budget?

Product Status

• Deliverables produced vs. plan
• Deliverables complete?
• Behind schedule?
Problems with ME practices-3

Common problems/misinterpretations:

• SPP and PTO – Not insight into any/all project tasks (i.e., overall effort, overall schedule), but insight into the effort and resources required to do proper project management (planning and tracking).

• PR - Not insight into defects found, but number of reviews performed and review time spent vs. time allocated for reviews.
Measures Collected but not Used

Problem:

- Graphs produced, but not really analyzed by “real” project staff
- Graphs not used proactively to manage
- Graph interpretations vary and are not controlled

Statements like “Measurements are made and used to determine the status of….” means you must:

- Collect the data
- Analyze the data
- Interpret results
- Report results
- Take action (as needed)

Related Problems:

- Dirty, missing data

This is one of THE most common problems seen when conducting assessments.
No Measurement Plan/Design

Problem:

- CMMI requires more measurement planning & design artifacts
- Many organizations transitioning to CMMI do not have these artifacts
  - Documented Information Needs, Measurement Objectives
  - Measurement specifications
  - Collection, storage, and analysis procedures

See SG 1 and associated SPs of M&A
See GP 2.x
Weak Measurement Repository

Problem:
- Repository not used by projects
- Outdated data
- Very little data available

Some underlying issues:
- Metrics Group dreams them up - if it can be measured...
- Asked for (projects must submit) but never used
- Data not used is rarely accurate
- Lack of clear operational definitions
- Cumbersome/burdensome submission process
- Lack of enforcement re: project submissions
- Timeliness/granularity of submissions
- Lack of integrity checks/quality control of submissions
A Few Good Examples & Some Advice
Let Measures Evolve to Match Need
Designing Measures

Align Information Needs to Measures
  • helps with big picture; why use measures

Identify “who” needs the information
  • Example: “Software project manager and software team need to know: how much are requirements changing…. “

Include Analysis Guidance

Develop Measurement Concept (Ops Concept) first, then the Measurement Construct (Design)
How much are requirements changing and where in the project LC is it happening? Are the number of overall requirements growing? What is the rate of growth? Has the scope expanded such that the project needs to be replanned?

Requirements Growth & Stability
See Figure 1

If Growth > 10% OR Instability > 10%, must document analysis. If there is any Growth or Instability in Testing Phase, must document analysis.

Growth = Reqs Added/Total Reqs

Instability = (Reqs Added + Changed + Deleted)/Total Reqs

Total Requirements at time t

Reqts Added in period t

Reqts Changed in period t

Reqts Deleted in period t

Caliber, Requisite Pro or SRS (current count); SCRs

Base Measures

Function

Analysis Model

Decision Criteria & Indicator

Information Need
Draw Simple Pictures

Source: [7]
Automate/Integrate Systems

Effort, Schedule Plans & Actuals

Organization database

History Skills

Estimating Tool

Effort/Schedule Estimates

Project Management System

Effort Actuals

Milestones Tasks Assignments

Project N

Plan
Analyze
Design
Build
Test
Install

Deliverables

Status

Time Spent

Time Reporting System

Cost Budget and Actuals

Budget Expenditures

Labor Costs

Code Analysis Tools

Module Complexity and Size

Status

Defect Rework

Defect Reporting System

Defects

Organization database

Defect Reporting System

Status

Effort Actuals

Financial System

Source: [7]
Evaluate Measurement Readiness

Management
- Business & Strategy
- Planning/Forecasting
- Monitoring/Steering
- Process Compliance

People
- Measurement Culture
- Training/Skills
- QM Knowledge
- Feedback

Infrastructure
- Plans
- Procedures
- Resources
- Tools/Automation

Project Operations
- Project Set-up
  - Estimation
  - Planning/WBS
- Tracking/Reporting
- Corrective Action
- Prediction

Organization
- Tailoring Practices
- Organizational Performance Analysis
- Data Quality
- Data Relevance
- Data Coverage

State of Readiness

Size & Stability Measures
Resources & Cost Measures
Schedule & Progress Measures
Product Quality Measures
Process Management Measures
Customer Satisfaction Measures

Source: [8]
References

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