Measurement of Measurement Project (M2P)

A Targeted Assessment of the Software Measurement Process

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About this Research

- Presented at the Seventh IEEE International Software Metrics Symposium

  Berry, Michael and Vandenbroek, Michiel. “A Targeted Assessment of the Software Measurement Process”

- A joint project of CSIRO Mathematical and Information Sciences (CMIS) and Motorola Australia Software Centre
About me: I Like to Watch.

• Measurement
  – I watch the people who do the work

• Meta-measurement
  – I watch the people who watch the people who do the work
  – Assessment of measurement

• Meta-meta-measurement
  – I watch the people who watch the people who watch the people who do the work
  – Evaluation of assessment
M2P Assessment of Software Measurement

Goal:
To successfully address the issues of assessing software measurement systems so that they may be improved
Why you might be interested

• Assessment of measurement means that:
  – measures are used to manage measurement
  – measures are used to improve measurement

• You may want to comply with
  – ISO/IEC 15939,
  – ISO/IEC 15504 and/or
  – CMMI “Measurement and Analysis”
ISO/IEC 15939 Architecture

Core Measurement Process

Establish Capability → Plan → Perform → Evaluate

Information Needs → Technical and Management Processes → User Feedback

Scope of Standard

CAESER - Centre for Advanced Software Engineering Research

3/12/01 M.Berry
The Use of Measurement in CMMI models
“Measurement and Analysis”: A CMMI Process Area

DI 3. Monitor & Control Process

Monitor and control the performing of the M&A process ……. and take corrective action

VE 1. Review Activities and Results with Mgt

Review…the implemented M&A process with management and resolve issues
The MOSMAN Project: An M2P Targeted Assessment

Targeted the Relationship of measurement with

*Project Tracking and Oversight* (PTO)

: a CMM level 2 KPA
Recommendations for Improvement

• Find a way to ensure that operational-level managers can benefit from the measures that they collect for the next management level.

• Ensure that managers understand the limitations of the measures they use and that they use them appropriately.

• Provide adequate resources and funding for data collection.

• Continually assess the level of support provided by measurement to PTO.

• Resolve conflicts and contradictions between the various indicators of a project's performance.

• Find ways to capitalise on experience through measurement.
M2P Activities

- Focus group sessions and interviews
  - With respect to the target process, collect assertions about measurement performance and “best practice” models
  - Map assertions against normative models
- Build and test the assessment instrument
- Deploy instrument using web technology
- Analyse responses to identify potential improvement opportunities
- Select opportunities
  - With reference to the “hygiene” factors assessment
Outline of the Process

1. Capture issues during focus group meeting
2. Survey Instrument
3. Capture data online via internet
4. Software Measurement Performance
5. Performance analysis
6. Improvement Opportunities
7. Goals, constraints, resources, priorities
8. Planning
9. Improvement Plan
Our Starting point: People’s Assertions

• “The experience we get from measuring actual results and performance and comparing them against project plans is never carried forward into future project planning.”

• “Tracking actual results and performance against plans is not possible without measurement.”

• “We keep our plans valid by regularly reviewing the measurements upon which the initial estimates and project plan were based.”
A Good Assertion

• Is provocative!
  – We want people to respond emotionally to the sentiment in the assertion
  – Survey respondent gets to agree or disagree with the assertion on an ordinal scale

• Has the relationship as its theme
  – Needs to link measurement (service, process and/or product) to the target process
Selecting Assertions

• Needed to ensure that the problem space is covered by a minimal set of assertions

• Mapped assertions onto two normative models and one descriptive model
  – CMM Common Features of PTO
  – ISO 15939 Software Measurement Process
  – M2P Lens model

• Dropped redundant assertions, inserted two dummy assertions to fill gaps
The Survey Instrument

• Assertions converted into *Probes*
  – Each probe covered a specific aspect of the relationship between the measurement process and the “Project Tracking and Oversight” process

• Two views of the relationship
  – *The PTO view*
  – *The Measurement view*
An M2P Probe

A web form containing a set of stimuli and a scale for responses
### Mathematical and Information Sciences

**Software Measurement Assessment**

**Respondent Id:** Test

#### FrontPage Save Results Component

**Goals of Project Tracking and Oversight - PTO**

<table>
<thead>
<tr>
<th>Goal 1</th>
<th>Actual results and performance are tracked against the software plans</th>
</tr>
</thead>
<tbody>
<tr>
<td>PTOG01-5</td>
<td>The effort of measuring actual results is wasted because we never compare them to the plan.</td>
</tr>
</tbody>
</table>

**PTO View**

<table>
<thead>
<tr>
<th>Do you agree that actual results and performance are not being compared to plans?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very strongly agree</td>
</tr>
</tbody>
</table>

**Measurement View**

<table>
<thead>
<tr>
<th>Do you agree that measuring actual results and performance is a waste of effort?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very strongly agree</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In your opinion, is it important that actual results and performance are compared against plans?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely important</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>In your opinion, is it important for effective PTO that actual results and performance are measured?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely important</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How confident are you that your view of PTO is accurate?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely confident</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>How confident are you that your view of Measurement is accurate?</th>
</tr>
</thead>
<tbody>
<tr>
<td>Extremely confident</td>
</tr>
</tbody>
</table>

**Comment:**

[Submit Response] [Skip to Next] [Jump to PTOG01-5]
Data collected

• With Probes, for PTO and for Measurement
  – Level of Performance
  – Level of Importance
  – Respondent’s confidence in their answer
  – Free text comments

• Respondent demographic

• Measurement Program Hygiene Factors
  – Context
  – Process
  – Resources
Analyses from an M2P Assessment
Little opportunity for improvement
More opportunity for improvement

PTOAP01-05 Frequency Distribution

Performance/Importance Ranking

No of Responses

PTO Performance
Measurement Performance
PTO Importance
Measurement Importance
Good opportunity for improvement

PTOAP08-06 Frequency of Responses

Performance Gap

PTO Performance
Measurement Performance
PTO Importance
Measurement Importance

Performance/Importance Ranking

No of Responses
Segmenation of Responses

PTOAB02-01 Frequency of Responses By Respondent Primary Role (Management or Technical)

Performance Ranking

- Management - PTO Performance
- Management - MES Performance
- Technical - PTO Performance
- Technical - MES Performance
Individual Response Patterns

Respondent 2 / All Questions

Performance/Importance Ranking

Percentage of Responses

PTO Performance

Measurement Performance

PTO Importance

Measurement Importance

Graph showing response patterns for Respondent 2 across PTO Performance, Measurement Performance, PTO Importance, and Measurement Importance.
Never-neutral Response Pattern

Respondent 6 / All Questions

Performance/Importance Ranking

Percentage of Responses

PTO Performance  Measurement Performance  PTO Importance  Measurement Importance
One Respondent’s Response Pattern:
Used to identify and count significant shifts in responses

<table>
<thead>
<tr>
<th></th>
<th>PTO Performance</th>
<th>Measurement Performance</th>
<th>PTO Importance</th>
<th>Measurement Importance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1&lt;sup&gt;st&lt;/sup&gt; Quartile response range</td>
<td>1-2</td>
<td>1-2</td>
<td>1</td>
<td>1</td>
</tr>
<tr>
<td>Median Response point</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>2</td>
</tr>
<tr>
<td>4&lt;sup&gt;th&lt;/sup&gt; Quartile response range</td>
<td>5-7</td>
<td>5-7</td>
<td>4-7</td>
<td>4-7</td>
</tr>
</tbody>
</table>

A response in this range is a negative shift

A response in this range is a positive shift
Descriptive Statistics

A set of indicators that collectively characterise a property of the *relationship between software measurement and PTO*
**Probe Id:** PTOAB03-0  

**Assertion**  Adequate resources and funding are never provided for collecting the data needed to track the software project properly.

### Improvement Opportunity

<table>
<thead>
<tr>
<th>Performance</th>
<th>Index</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>High numbers suggest high potential</td>
<td>1.8</td>
<td>8</td>
</tr>
<tr>
<td>Low numbers suggest low potential</td>
<td>2.6</td>
<td>2</td>
</tr>
</tbody>
</table>

### PTO View

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
<th>Median</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you agree that software projects are not being tracked properly?</td>
<td>4.8</td>
<td>5</td>
<td>1.4</td>
</tr>
</tbody>
</table>

### Measurement View

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
<th>Median</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Do you agree that data collection is not being adequately resourced?</td>
<td>5.6</td>
<td>5</td>
<td>1.1</td>
</tr>
</tbody>
</table>

### PTO View

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
<th>Median</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>In your opinion, is it important that software projects are tracked properly?</td>
<td>1.8</td>
<td>2</td>
<td>0.8</td>
</tr>
</tbody>
</table>

### Performance Gap

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
<th>Std Dev</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance minus Importance</td>
<td>3.0</td>
<td>1.65</td>
<td>4</td>
</tr>
</tbody>
</table>

### Respondents' Confidence in their Response

<table>
<thead>
<tr>
<th>Question</th>
<th>Mean</th>
<th>Std Dev</th>
</tr>
</thead>
<tbody>
<tr>
<td>Very confident = 1, Not Confident = 7</td>
<td>2.5</td>
<td>0.8</td>
</tr>
</tbody>
</table>

### Shifts in Opinion provoked by these questions

<table>
<thead>
<tr>
<th>Shift from Respondent's Median</th>
<th>Index</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance:</td>
<td>-3</td>
<td>18</td>
</tr>
<tr>
<td>Importance:</td>
<td>7</td>
<td>2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Shift into Respondent's Bottom or Top Quartile</th>
<th>Index</th>
<th>Rank</th>
</tr>
</thead>
<tbody>
<tr>
<td>Performance:</td>
<td>-4</td>
<td>19</td>
</tr>
<tr>
<td>Importance:</td>
<td>19</td>
<td>5</td>
</tr>
</tbody>
</table>
Conclusions
M2P Targeted Assessment

- Focuses on stakeholders’ wants and needs
- Is effective
  - Delivered a ranked list of opportunities to improve measurement, in order based on strength of sentiment & extent to which the sentiment is shared
  - Also identified opportunities to improve target process
- Is efficient
  - ~12x3 hours of focus group work, ~60 hours for survey coordinator, ~30x1 hour for respondents
- Provided “Cheap objectivity”
- Repeatable: survey instrument & assessment
Future Work

• Input scales
  – 7 point Likert scale insufficient for characterising individual response patterns

• Visualisation models
  – Generate 3-D cityscape images using VRML

• Replication and Improvement of M2P process
  – Same area of project management
  – Different KPAs
  – Slices across KPAs for a specific activity
  – Different reference models eg SPICE