



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”

Proceedings of the Seventh International Software Metrics Symposium; London. April 2001 IEEE Computer Society Los Alamos, California 2001.

- A joint project of CSIRO Mathematical and Information Sciences (CMIS) and Motorola Australia Software Centre

CAESER - Centre for Advanced Software Engineering Research



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

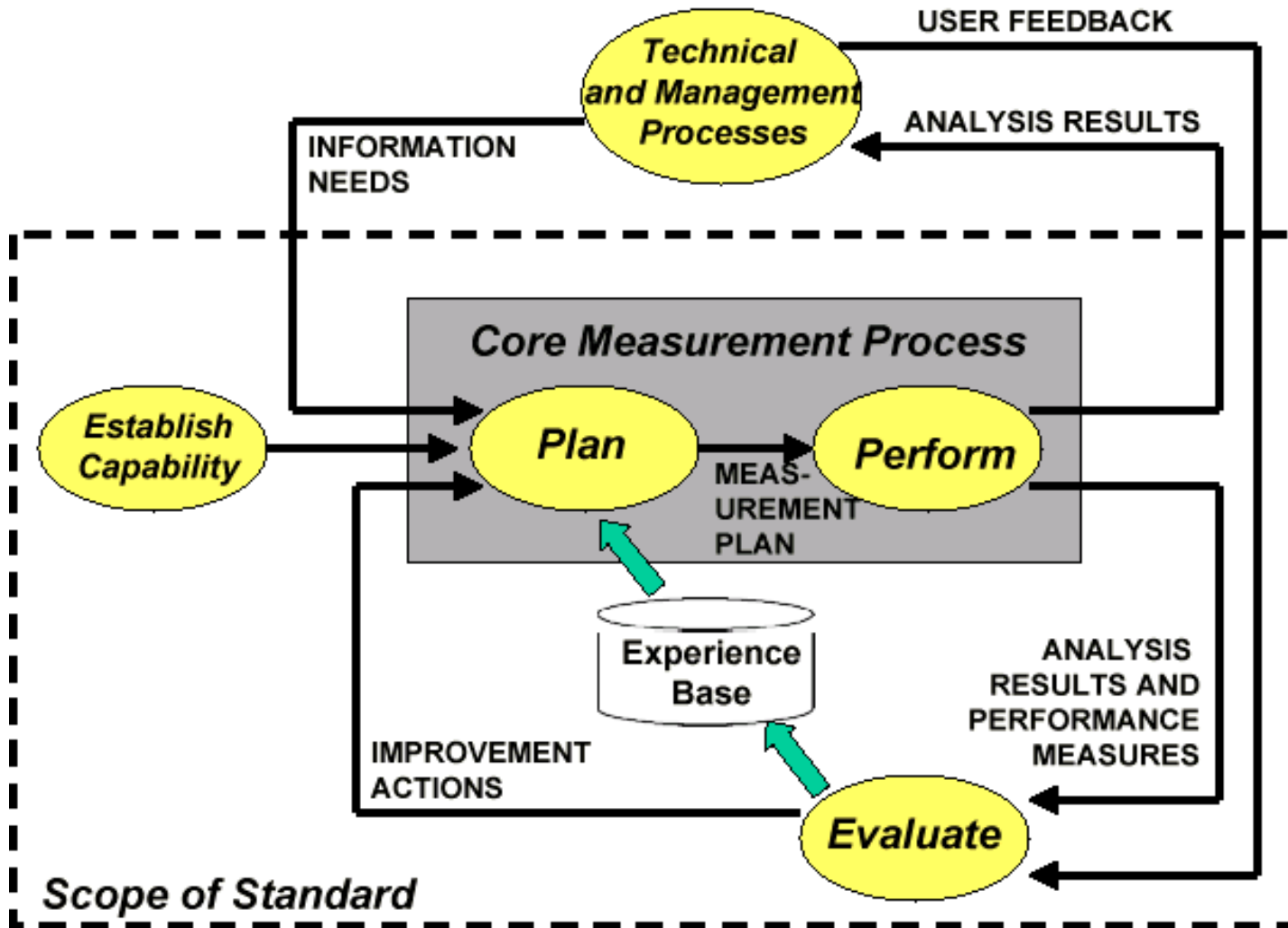


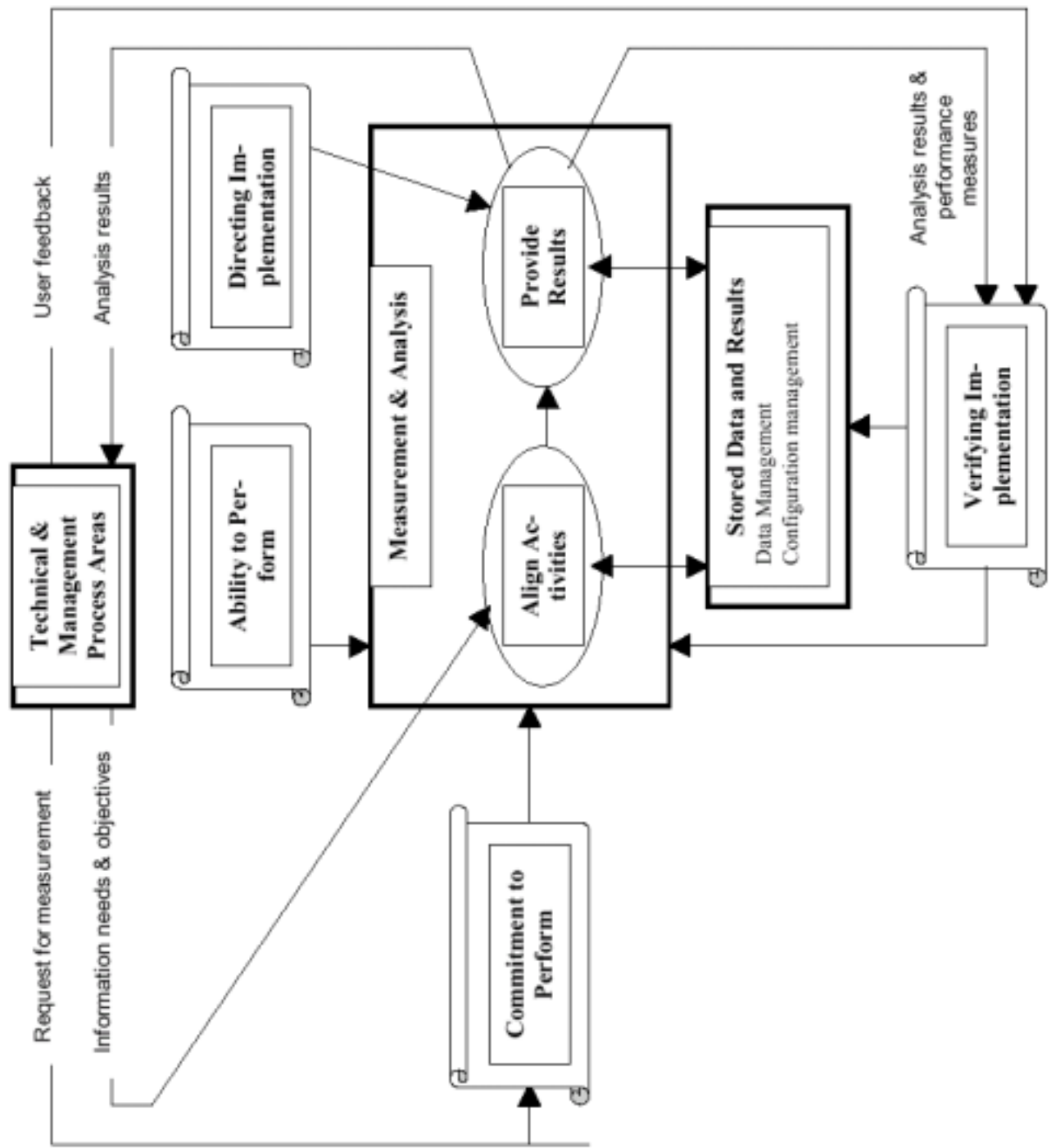
Why you might be interested

- 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





The Use of Measurement in CMMI models [Vol 1 V0.2b Figure 4 p52]



“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

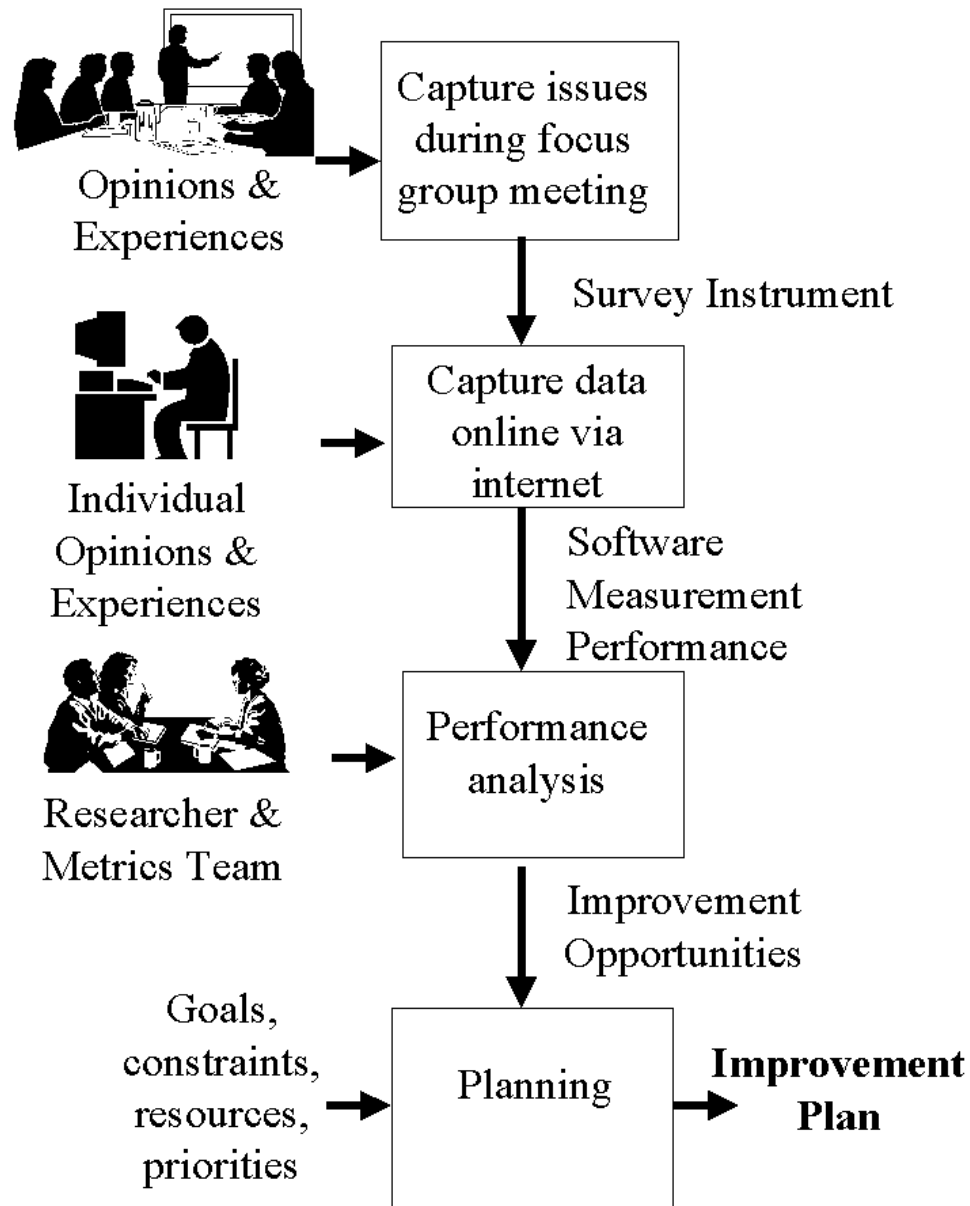
- **Find a way to ensure that operational-level managers can benefit from the measures that they collect for the next management level.**
- **Ensure that managers understand the limitations of the measures they use and that they use them appropriately.**
- **Provide adequate resources and funding for 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





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:

Table of Contents

[Project Tracking and Oversight](#)

Click on a button to go directly to a PTO common feature.

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- [Commitment](#)
- [Ability](#)
- [Activities](#)
- [Measurement](#)
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[CLOSE](#)

[FrontPage Save Results Component]

Goals of Project Tracking and Oversight - PTO

Goal 1 *Actual results and performance are tracked against the software plans*

PTOG01-5 The effort of measuring actual results is wasted because we never compare them to the plan.

PTO View

Measurement View

Do you agree that actual results and performance are not being compared to plans?

Do you agree that measuring actual results and performance is a waste of effort?

Very strongly agree	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Very strongly disagree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Very strongly agree	Strongly agree	Agree	Neutral	Disagree	Strongly disagree	Very strongly disagree
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

In your opinion, is it important that actual results and performance are compared against plans?

In your opinion, is it important for effective PTO that actual results and performance are measured?

Extremely important	Very important	Important	Neutral	Not important	Very unimportant	Extremely unimportant
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Extremely important	Very important	Important	Neutral	Not important	Very unimportant	Extremely unimportant
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

How confident are you that your view of PTO is accurate?

How confident are you that your view of Measurement is accurate?

Extremely confident	Very confident	Confident	Neutral	Not confident	Very unconfident	Extremely unconfident
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Extremely confident	Very confident	Confident	Neutral	Not confident	Very unconfident	Extremely unconfident
<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Comment

Submit Response Skip to Next Jump to



Data collected

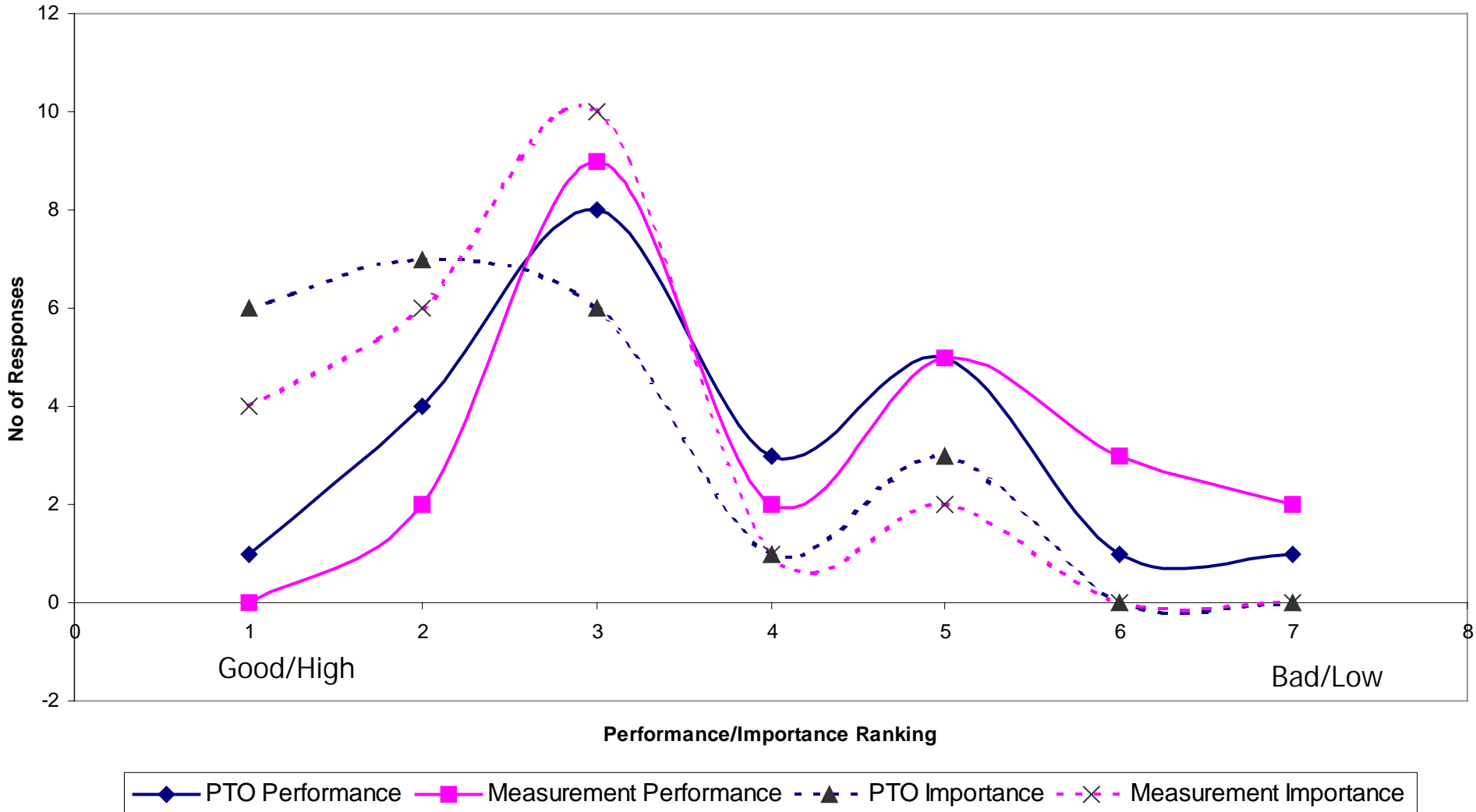
- With Probes, for PTO and for Measurement
 - Level of Performance
 - Level of Importance
 - Respondent's confidence in their answer
 - Free text comments
- Respondent demographic
- Measurement Program Hygiene Factors
 - Context
 - Process
 - Resources



Analyses from an M2P Assessment

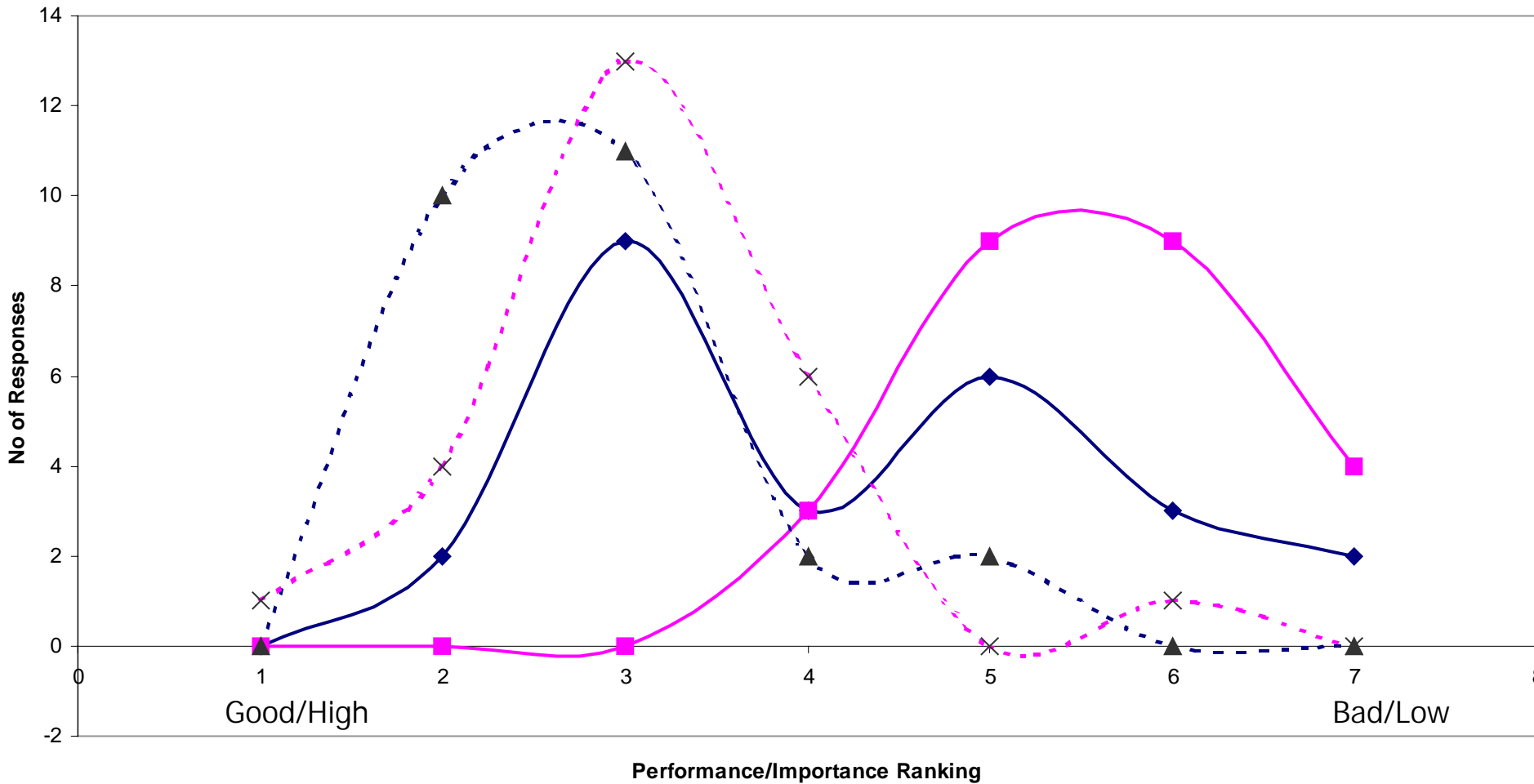
Little opportunity for improvement

PTOAP02-04 Frequency of Responses



More opportunity for improvement

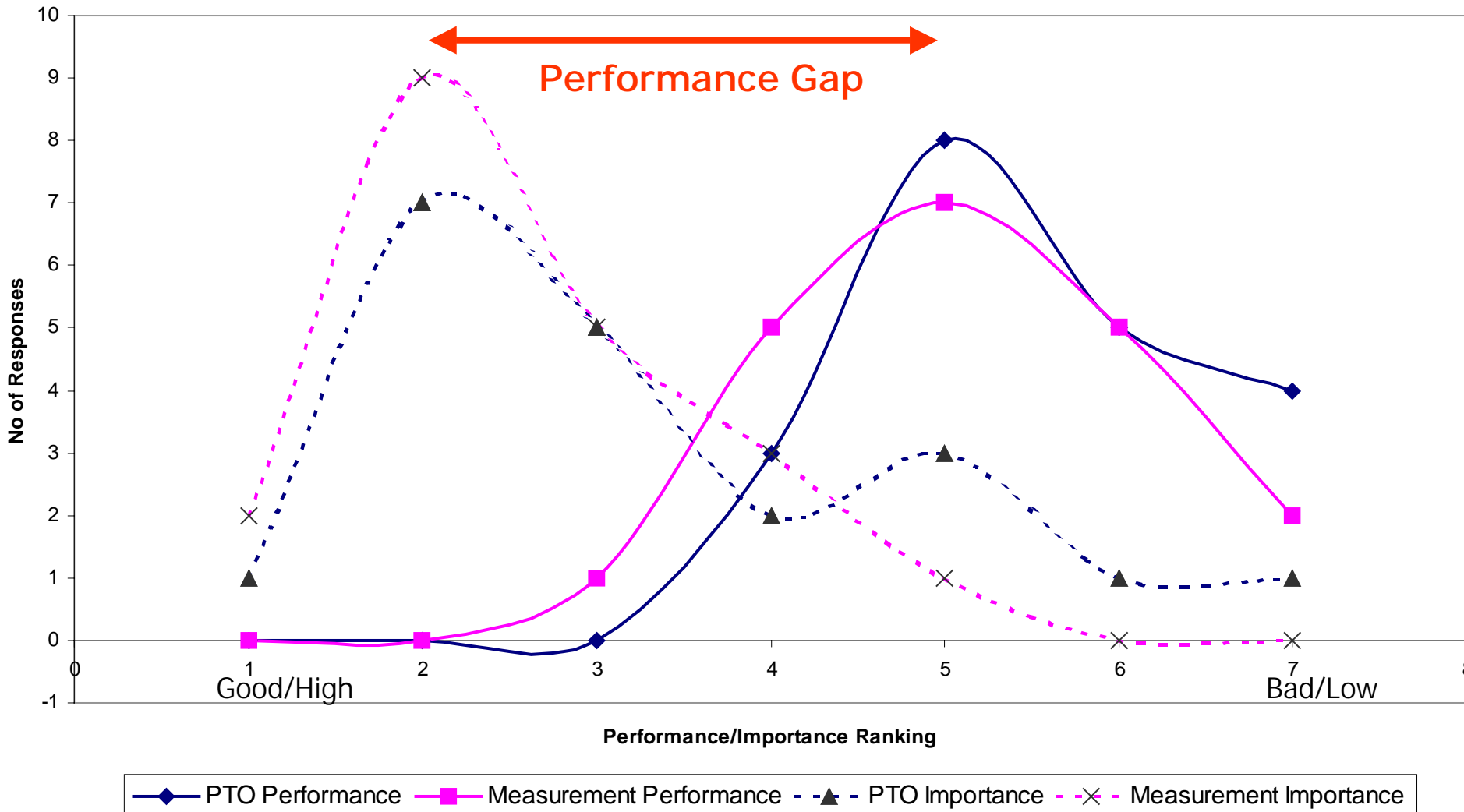
PTOAP01-05 Frequency Distribution



—◆— PTO Performance —■— Measurement Performance - -▲- - PTO Importance - -×- - Measurement Importance

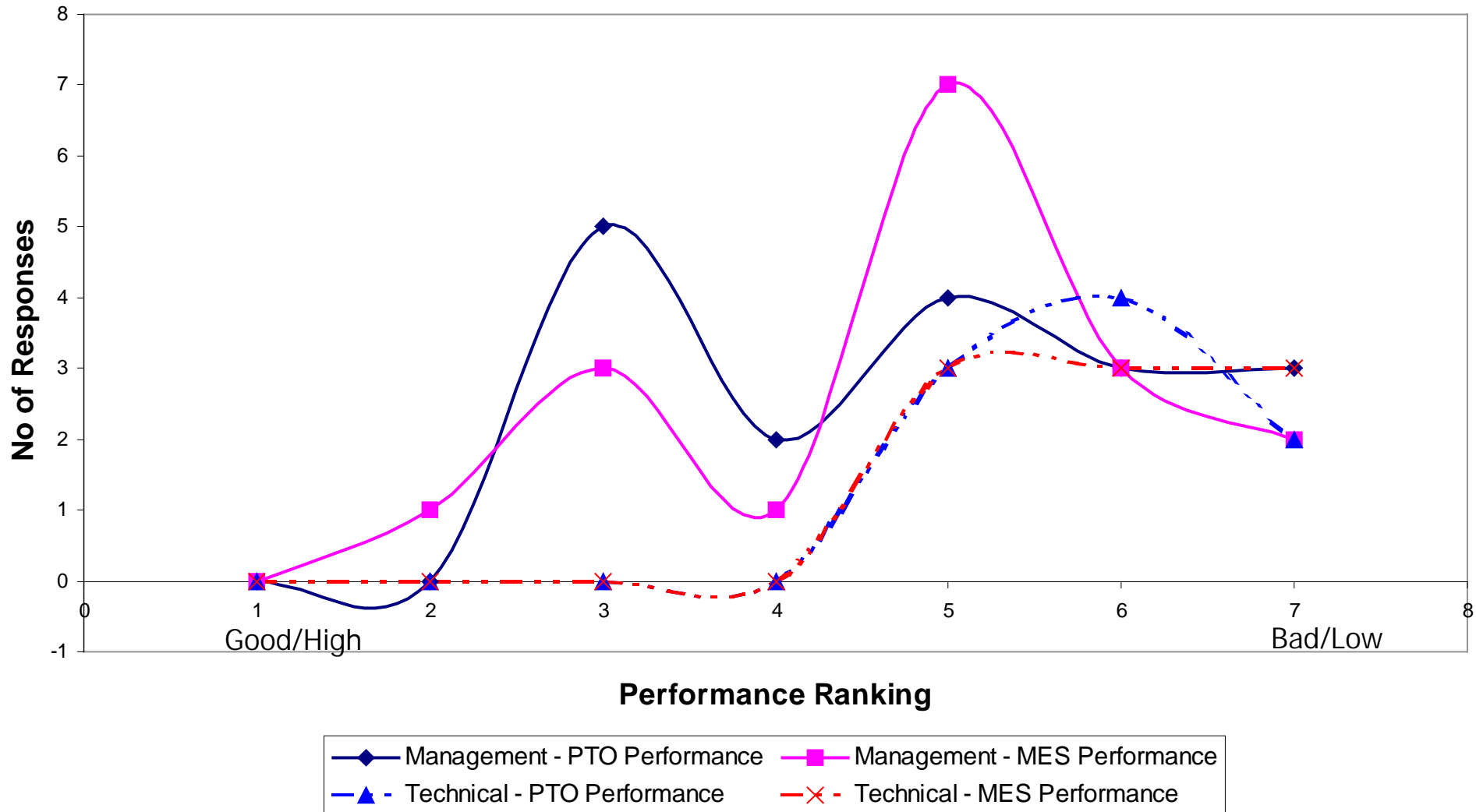
Good opportunity for improvement

PTOAP08-06 Frequency of Responses



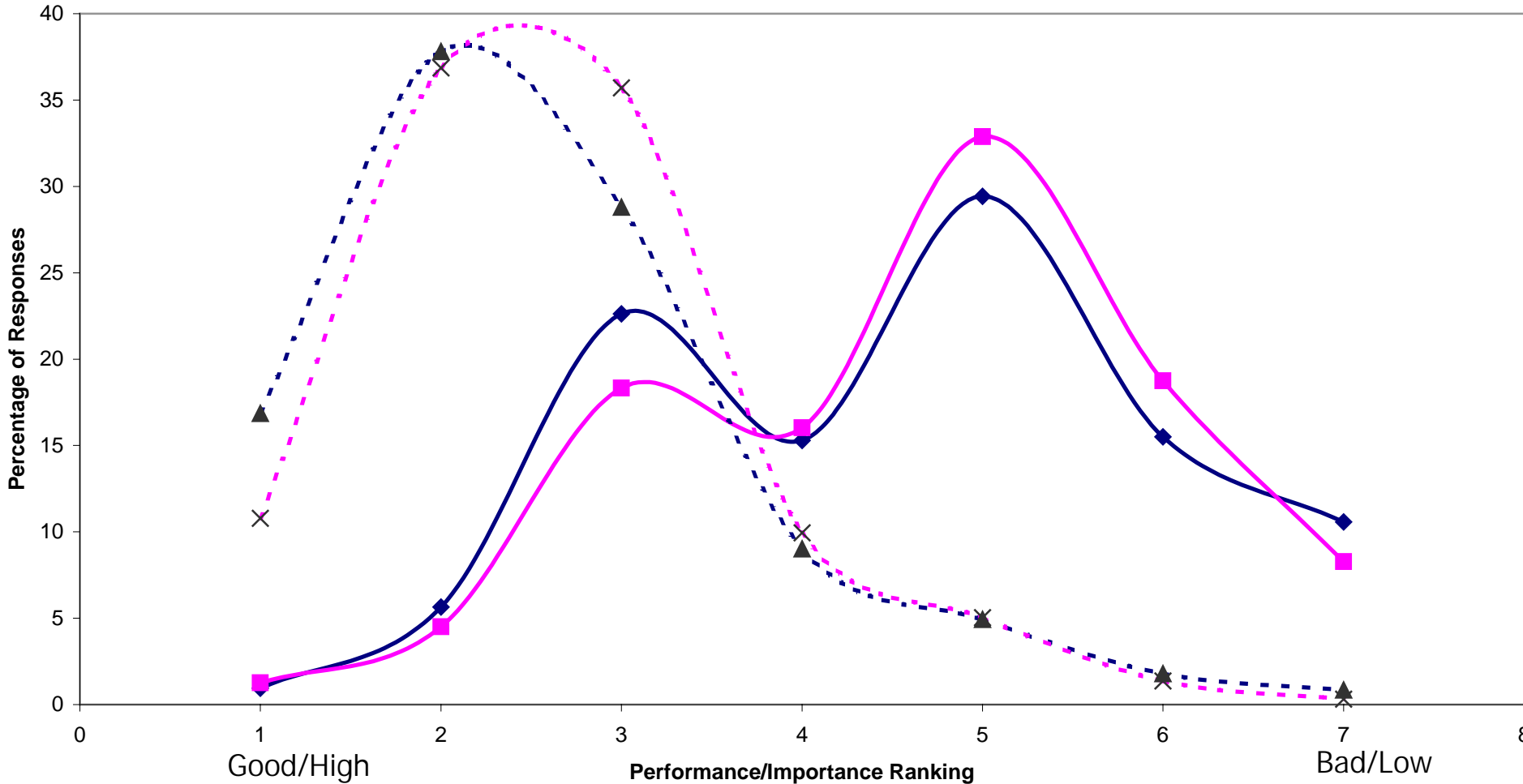
Segmentation of Responses

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



Overall Impression

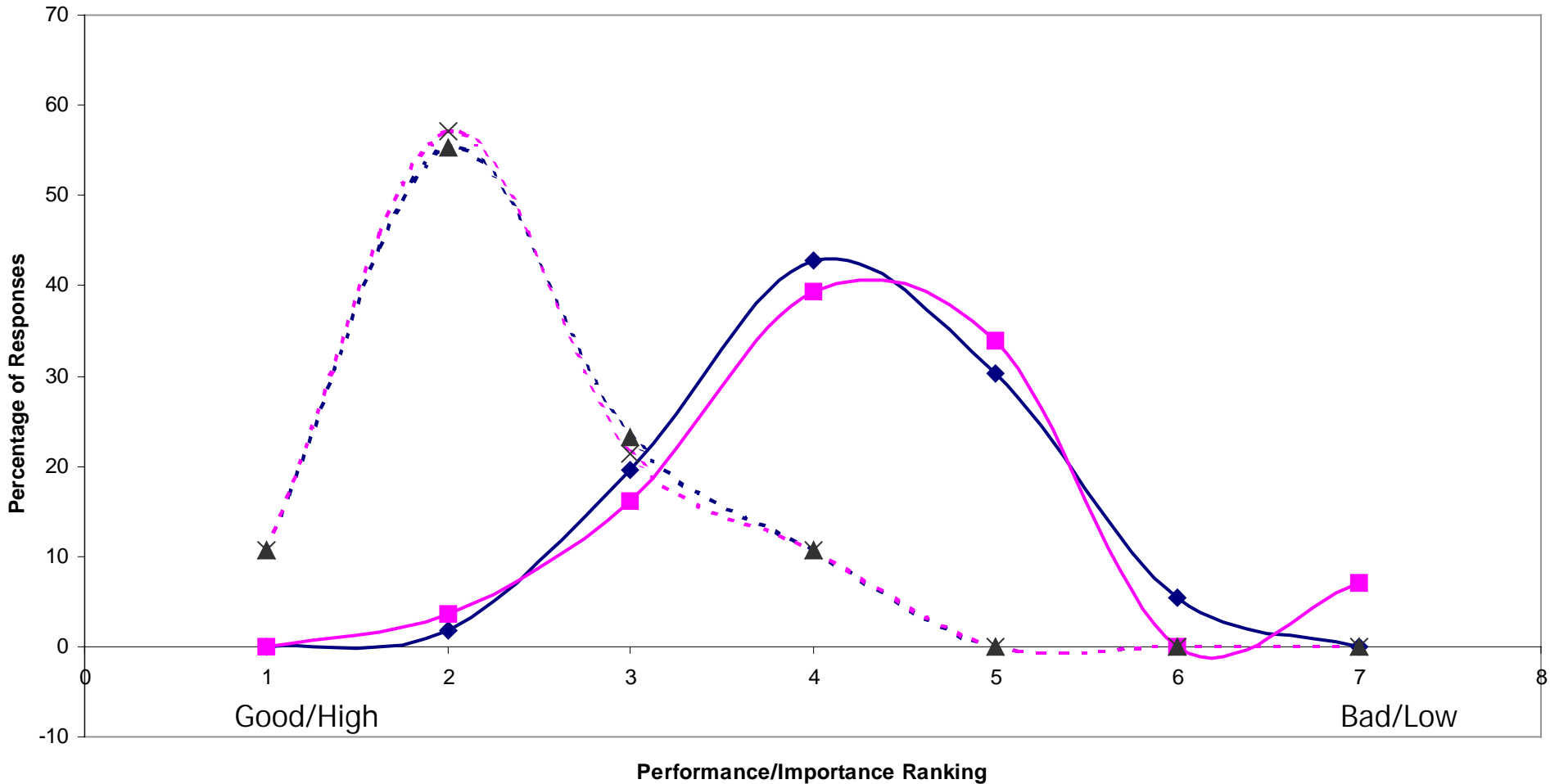
All Respondents/All Questions



Legend: PTO Performance (solid blue line with diamond markers), MES Performance (solid magenta line with square markers), PTO Importance (dashed blue line with triangle markers), MES Importance (dashed magenta line with 'x' markers)

Individual Response Patterns

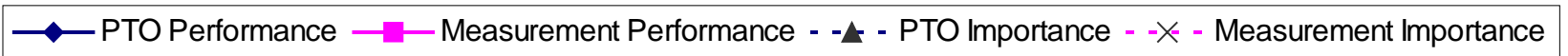
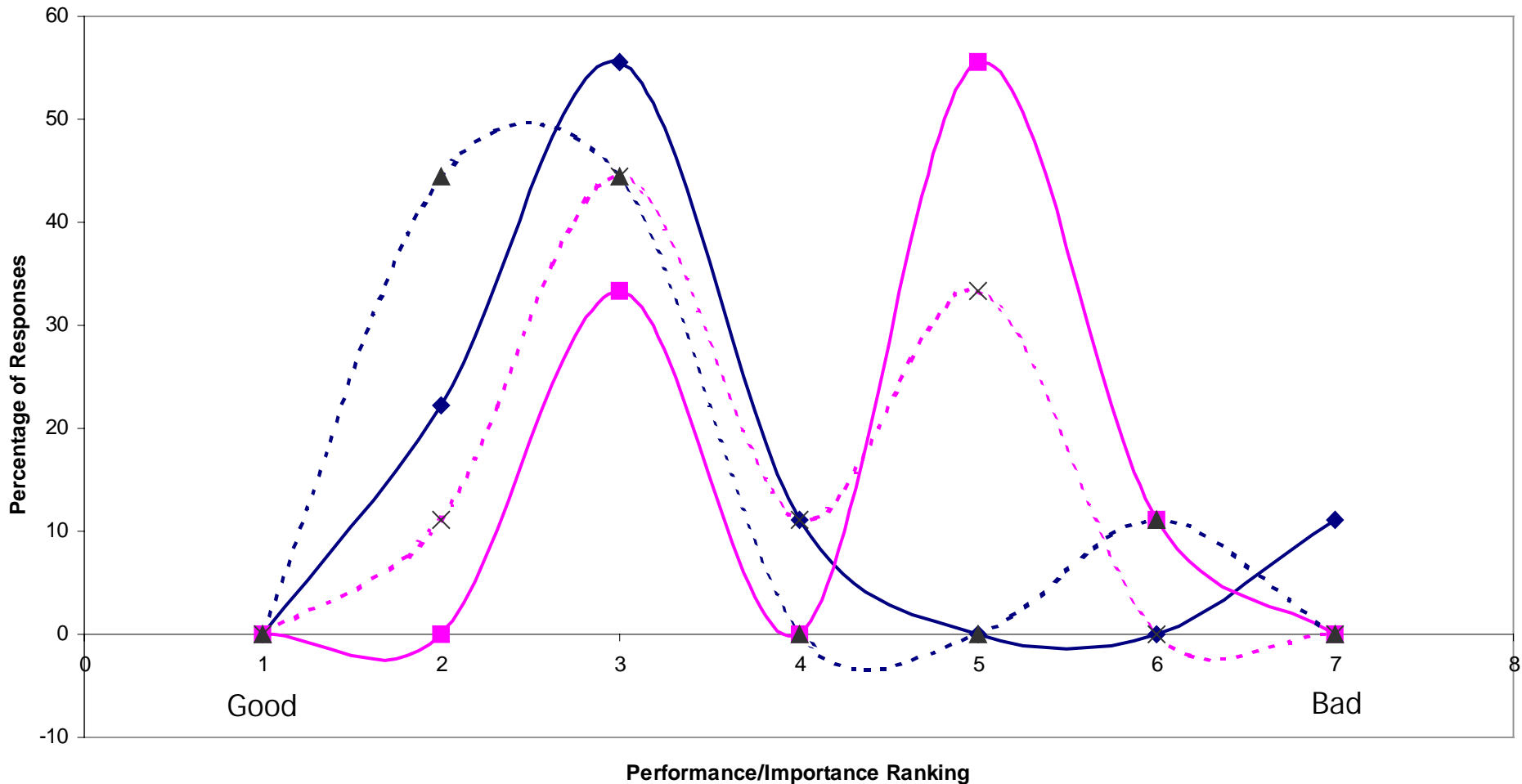
Respondent 2 /All Questions



Legend: PTO Performance (solid blue line with diamonds), Measurement Performance (solid magenta line with squares), PTO Importance (dashed black line with triangles), Measurement Importance (dashed magenta line with crosses)

Never-neutral Response Pattern

Respondent 6 /All Questions





One Respondent's Response Pattern: Used to identify and count significant shifts in responses

	PTO Performance	Measurement Performance	PTO Importance	Measurement Importance
1 st Quartile response range	1-2	1-2	1	1
Median Response point	3	3	2	2
4 th Quartile response range	5-7	5-7	4-7	4-7

↑ A response in this range is a positive shift

↓ A response in this range is a negative shift



Descriptive Statistics

A set of indicators that collectively characterise a property of the *relationship between software measurement and PTO*

Probe Id: PTOAB03-0*No of Responses:* 26

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

Improvement OpportunityIndex Rank

*High numbers suggest high potential
Low numbers suggest low potential*

1.8

8

2.6

2

Mean Median Std DevMeasurement ViewStd DevMean Median

Do you agree that software projects are not being tracked properly?

4.8

5

1.4

5.6

5

1.1

Do you agree that data collection is not being adequately resourced?

In your opinion, is it important that software projects are tracked properly?

1.8

2

0.8

2.1

2

0.8

In your opinion, is it important that data collection is adequately resourced?

Performance GapMean StdDev Rank*Performance minus Importance*

3.0

1.65

4

Mean StdDev Rank

3.5

1.4

1

Respondents' Confidence in their Response*Very confident = 1, Not Confident = 7*

2.5

0.8

2.7

0.9

Shifts in Opinion provoked by these questionsIndex Rank**Shift from Respondent's Median**

-3

18

Index Rank

-10

1

Importance:

7

2

7.5

1

Shift into Respondent's Bottom or Top Quartile**Performance:**

-4

19

-30

2

Importance:

19

5

19

5



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