



Measuring your Measures

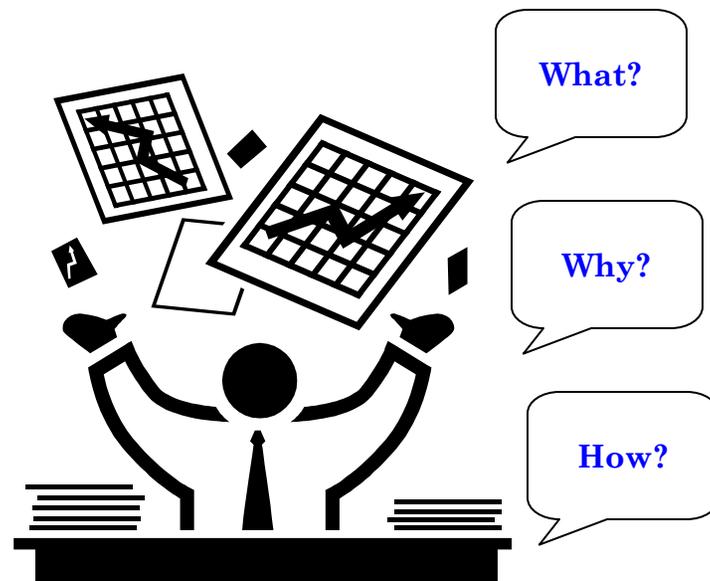
Mechanisms to Gauge the Effectiveness of a Measurement Program

ASQ Section 509
February 2009

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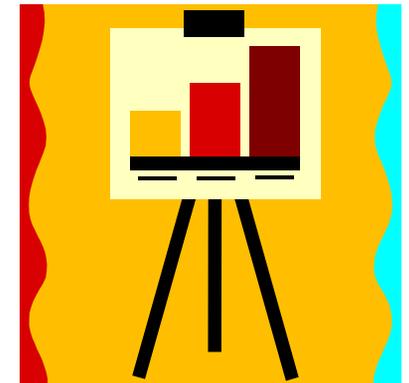
- ▶ Introduction
- ▶ Goals and Challenges of Measurement
- ▶ Alignment of Measures to Goals
- ▶ Cost of the Measurement Program
- ▶ Ease of Implementation
- ▶ Improvement of Measurement Processes

Goals and Challenges of Measurement



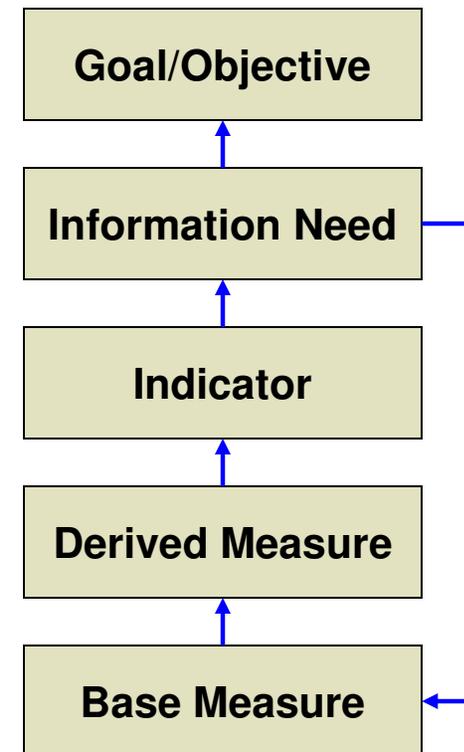
Quantitative measurement and analysis is a basic and integral function of our work

- ▶ Regardless of the degree of formality, most important decisions are based on the analysis of some data points.
 - Do we need to continue testing before delivery?
 - Are our project milestones going to be met?
 - Do we need to buy more hardware?
- ▶ Learning lessons from previous successes and failures is difficult without an audit trail that contains quantitative data.
- ▶ As organizations implement more mature measurement processes, quantitative models should become more stable and predictive.



Organizational buy in for a measurement program is *not enough*, if formal methods are not implemented.

- ▶ Process improvement specialists or management may enforce collection of a set of measures without alignment to goals or information needs.
 - “Starting next week, all projects will report Defect Leakage, CPI, SPI,....”
- ▶ Measurement processes are not always properly piloted
- ▶ User community responsible for collection and usage is not always trained.
 - Engineering experience to understand data
 - Process for collection
 - Definition of algorithms
 - Statistical methods
- ▶ ***The result is a significant amount of money spent on an ineffective measurement program.***

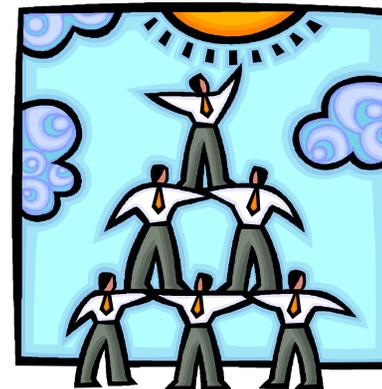
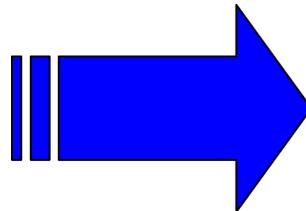


In order to receive a positive return on investment for our measurement program, four areas must be examined for efficacy.

▶ **Foundation of Effectiveness**

- 1. *Alignment of Measures to Objectives and Goals***
 - 2. *Cost of the Measurement Program***
 - 3. *Implementation of Measurement Processes***
 - 4. *Improvement of Measurement Processes***
- ▶ Each area presents an opportunity to gauge effectiveness if best practice measurement techniques are implemented.

Aligning Measures to Goals and Objectives



There is no “silver bullet” set of measurement constructs

- ▶ Some engineers and managers will try to implement a set of measures that have been successful on previous tasks.
- ▶ A measurement program developed without significant collaboration with the projects, or organization has a reduced chance for success.
 - Practical Software Measurement
 - Goal-Question-Metric
 - Interactive analysis meetings
- ▶ Industry best practices should be used as guides when developing constructs, but only after proper information needs have been established.
- ▶ Once information needs and measures are aligned, how best to tell if these are the right measures?
 - Determine value to the stakeholders



Solution: Where possible, integrate information regarding use of measures with other transactional data capture mechanisms

- ▶ A collection mechanism can be established to gauge what measures are being used, and what, if any, additional analysis needs to take place.
- ▶ Most effective in an environment where automated data collection can be implemented.
- ▶ Link measures to transactional databases
 - Risks
 - Lessons Learned
 - Action Items
- ▶ Data is then used to support indicators and analysis models.

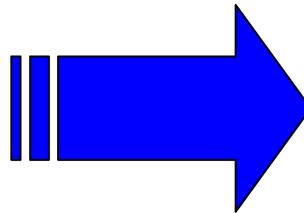
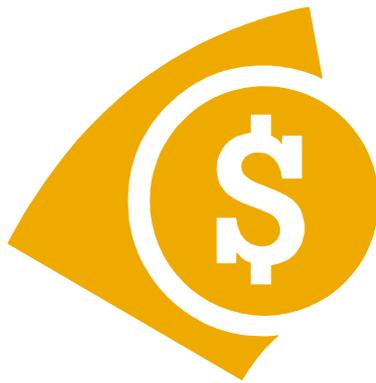
							Risk Matrix		
1	Risk ID	Risk Area	Category	Source	Measure	Risk	Consequence	Rank (Probability/Impact)	Status
2									
26	20050909-1	Management	Resource	Measures	CPI	CPI remained at less than 0.85 for two consecutive weeks. Potential for exceeding planned budget model at time of delivery	Run over budget	M/M	Open
27	20051013-1	Product	Technology	Internal - Infrastructure Team	None	PD 2.4 Testing on Dev Server	If testing brings the dev server down there could be a 4-8 hour window of downtime in bringing dev back up.	L/M	Open
28	20051025-1	Product	Technology	Measures	SPI	SPI remained at less than 0.85 for two consecutive weeks. Potential for exceeding planned budget model at time of delivery	Schedule milestones may not be met. Client satisfaction issues.	M/M	Open
29	20051025-2	Product	Technology	Measures	Defect Density	Defect Density reflected in Design phase represented as a statistical outlier. All data may not be accurately collected. Further analysis necessary	If standard rates associated with defect discovery and correction remain constant, budget plan made be exceeded due to high level of unexpected rework.	M/H	Open
						CPI remained at less than 0.85 for two consecutive weeks			

Result: A usage measure allows organizations or projects to know how often or effectively measurement constructs are being used

- ▶ Allows projects and the larger organization to see what measures are most often triggering:
 - Action Items
 - Risks
 - Lessons Learned
- ▶ Measurement constructs that generate little or no resulting activity from analysis *may* be candidates for modification.
- ▶ Identification of training needs often result from analysis of models similar to the example.
- ▶ We do not want to collect, store, and analyze data that is not providing insight into progress towards our goals

Question	Overall	Data Quality	Indicator Answer	Analysis	Action
Are we expending effort according to our original and updated estimates?		Green	Yellow	Yellow	Green
Are we spending our budget according to our original and updated estimates?		Green	Yellow	Yellow	Red
Are we on track to meet our milestones and deliverables?		Green	Yellow	Green	Yellow
To what degree is the project reporting organizational standard measures to the Booz Allen Process Improvement Organization?		Green	Yellow	Yellow	Green
Is a scheduled portion of the application ready for release?		Green	Yellow	Green	Yellow
To what degree are risks being managed?		Yellow	N/A	Yellow	Yellow
To what degree are issues being tracked and resolved?		Green	Yellow	Green	Yellow
To what degree are action items being used effectively to track short-term tasks?		Green	N/A	N/A	N/A
To what degree are peer reviews being conducted using best review practices?		Green	Yellow	Yellow	Red
To what degree are the requirements being added, deleted or modified after baseline?		Yellow	N/A	Yellow	Green

Cost of the Measurement Program

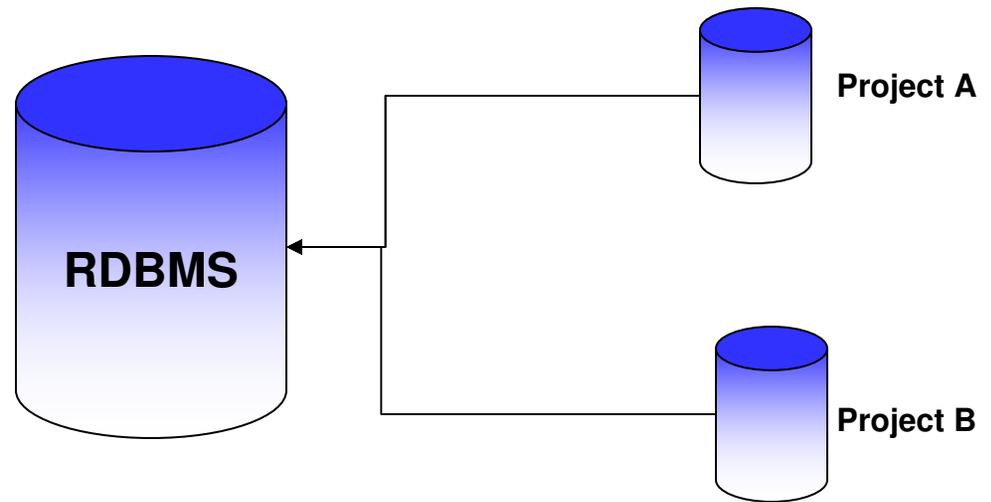


The true cost of a measurement program can be deceiving

- ▶ Mature projects and organizations are aware that the expense of measurement activities must be captured. Typically these measures include:
 - Estimated and actual labor hours for data collection
 - Estimated and actual labor hours for data analysis
 - Capital cost of any tools used to facilitate data capture and analysis
- ▶ Some projects and organizations shy away from more powerful COTS or customized data analysis tools in favor of spreadsheets, or other one dimensional collection methods.
 - “We don’t have the money for a new tool”
 - “We don’t have time for training”
 - “We already have too many tools”
- ▶ The result is ongoing expenditure of funds to maintain a repository of data with reduced flexibility
 - In order to meet changing needs, the initial “simple” repository is often expanded in attempts to mimic a multi-dimensional, or database, solution

Solution: Implement a scalable architecture when designing a collection and analysis toolset

- ▶ Automated collection driven from transactional databases assists in standardizing base measure attributes.
- ▶ No need to employ a “Data Collection Cop”
- ▶ Allows for greater flexibility of constructs
 - Modification of attributes
 - Easier to report across projects
 - No need to modify spreadsheet templates
- ▶ Greater timeliness and accuracy of data
- ▶ Easier to mine historical data that was not previously analyzed

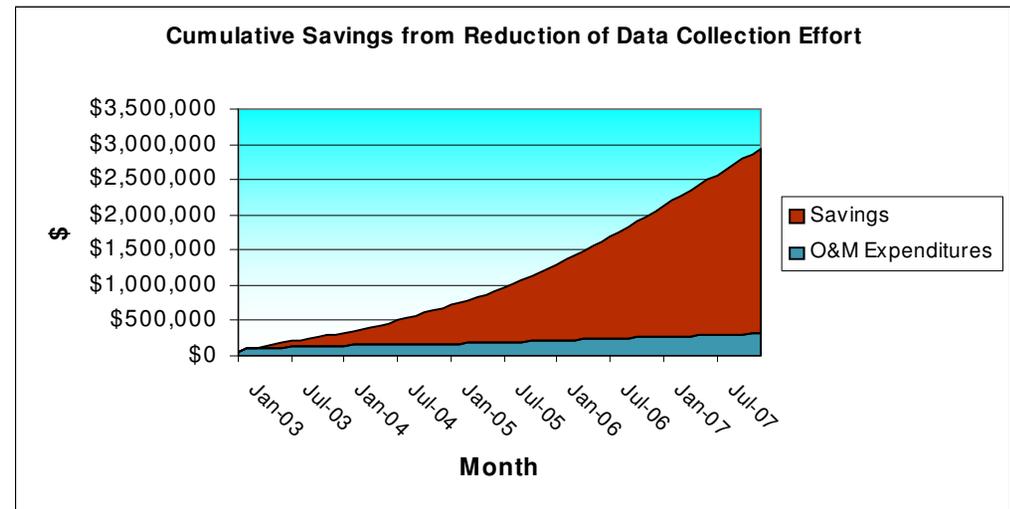


Vs.

<i>Project</i>	<i>SPI</i>	<i>CPI</i>	<i>CV</i>
A	1.0	1.1	\$250
B	.98	1.01	\$300
C	1.01	1.02	\$125
D	.88	.975	-\$100

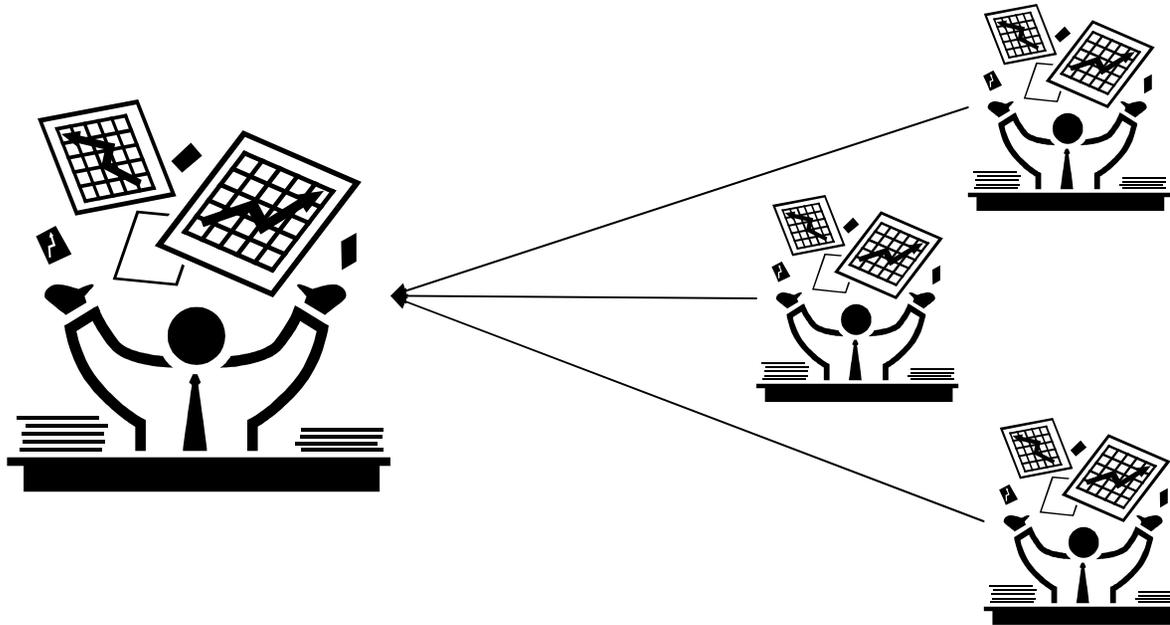
Result: Ability to reflect return on investment against a manual data collection model

- ▶ Data from one business unit that implemented a completely manual collection process resulted in an average of 15 hrs/month per project just for data collection.
- ▶ Multiplying this effort times the average labor rate, and number of projects in the pilot resulted in a cost of \$16,500/month for data collection.
- ▶ Capital costs of tool development and maintenance for pilot projects were recouped in 9 months.
- ▶ As process became institutionalized, savings have increased with each subsequent month.



Cumulative net savings after O&M expenditures since January 2003 : \$2.9 M. Compiled from effort to manually collect required measures, institutionalization rate, avg. labor rates, and O&M costs for analysis tool.

Ease of Implementation



Implementation challenges are natural with any newly defined process

- ▶ Process Definition
 - Parties responsible for process definition should have both domain experience (e.g. engineering), as well as measurement experience.
- ▶ Training
 - If those responsible for measurement and analysis activities on a project are not properly trained, implementation will fail.
 - In order to best identify process compliance issues, Quality Assurance personnel should also participate in measurement training.
- ▶ Management Support
 - Implementation of processes without enforcement mechanisms can often be difficult.
- ▶ Feedback
 - Assuming processes and constructs have been piloted, it is important to elicit and incorporate feedback. Must respond to the requests of the stakeholders.

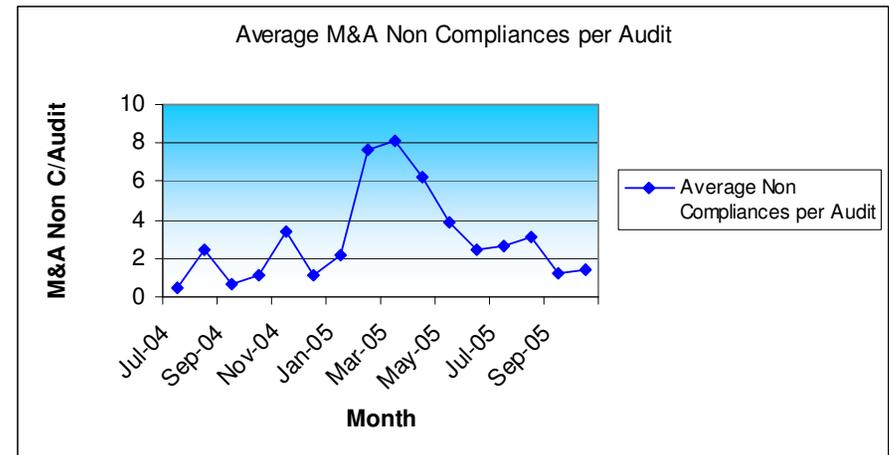
Solution: Integrate M&A activities when capturing data regarding process implementation

- ▶ Training
 - It can be beneficial to capture data on who is required to take M&A related training.
 - Similarly, who has taken M&A training?
- ▶ Quality Assurance
 - Incorporate data capture mechanisms that allow QA professionals to identify opportunities to improve M&A implementation on projects.
 - Identify issues of procedural non compliance
 - Identify strengths
- ▶ *Again: Automate and Integrate, where possible*

SQA Audit	EPPM - M & A Process Audit
Title	MEASUREMENT PLAN & CONSTRUCT DEFINITION DOCUMENT
Description	Several issues with the Measurement Plan and the Construct Definition Document were noted during the audit. Below is a list of items and the corresponding
Project	EPPM
Date Submitted	10/25/2005 3:50:01 PM
Date Closed	11/18/2005
Owner	Varghese, Mariamma
Submitter	Reisch, Troy
Severity	1 - High (5 Days)
Area of Finding	Measurements
Finding Type	Process
Corrective Action Type	Update Product Documentation

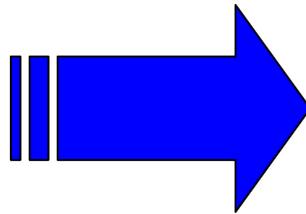
Result: Measures related to M&A implementation issues can alert management or the process group of possible focus areas

- ▶ Reviewing trends on the average number of non compliance issues in the M&A area per audit have been helpful in identification of implementation issues.
 - Number of audits
 - Number of projects
 - Number of M&A Non Compliances
- ▶ M&A Non Compliances vs. Other Functional Areas
- ▶ Measuring M&A training readiness has assisted the organizational training group with the scheduling of courses, as well as the development of new course materials.
- ▶ MAID methodology (Measurement and Analysis Infrastructure Diagnostic)



As new projects integrated into the organization trained M&A resources were not readily available, resulting in a spike in the avg. number of QA findings in the measurement and analysis area.

Improvement of M&A Processes



The goal of an engineering process group should be to continuously improve the set of processes. M&A is no exception

- ▶ Too often, organizations become married to a set of processes or constructs, regardless of their worth.
 - Are the constructs truly predictive?
 - Have our goals and objectives remained stagnant?

- ▶ Has the definition of M&A processes and constructs been respectful of project classification?
 - Software Development
 - Hardware Development
 - COTS integration
 - Project Management Tasks

- ▶ Is the current tool set used for M&A activities responsive and cost effective?

Solution: Collect data related to process improvement proposals in the M&A functional area.

- ▶ It is beneficial for the group responsible for process definition to know in what functional areas the organization wishes to see improvements
- ▶ Best practices for M&A can assist other projects of similar classification with implementation of their M&A process.
- ▶ It is important for the engineering process group to know what type of improvement proposals are being submitted for the M&A process
 - Process Modifications
 - Tool Modifications
 - New Process Enhancements
 - New Pilots
 - Best Practices

[CMMI_PIP] Submit PIP

General | Notes | Attached Files

Issue # _____ SUBMIT _____

✔ Title:

Description:

✔ PIP Type: ✔ PIP Source:

Priority: Associated QA Finding #:

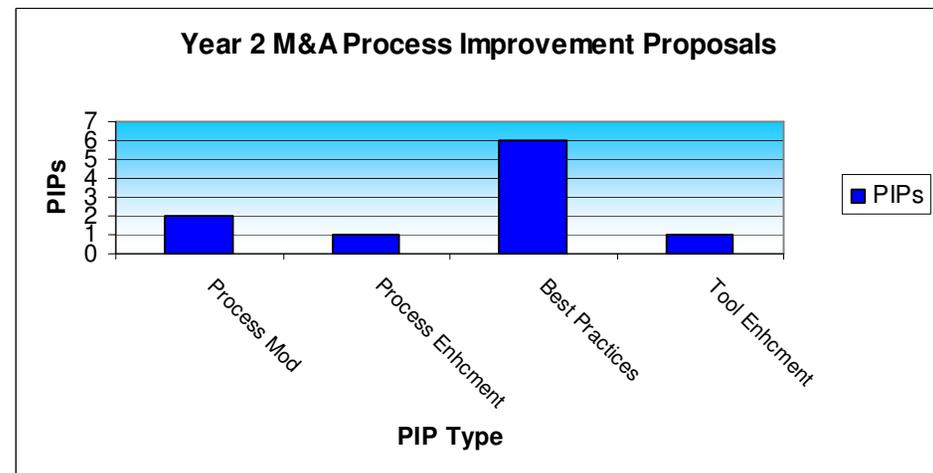
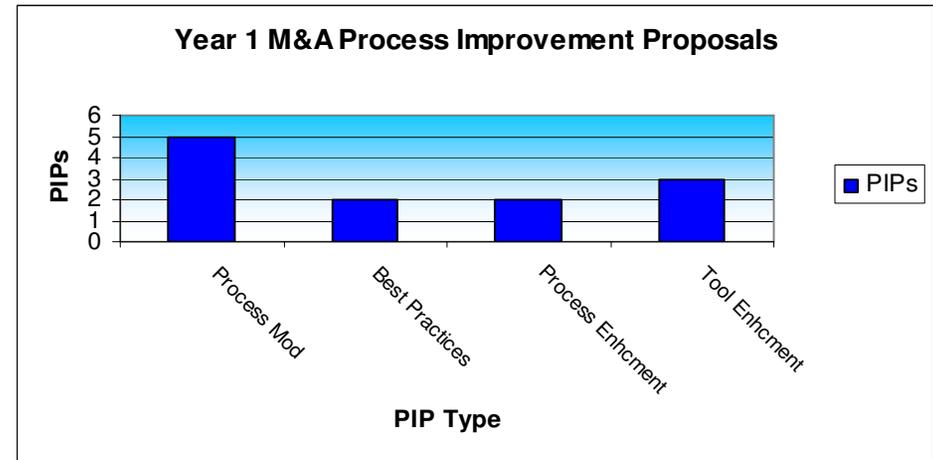
Affected Processes:

Affected Products:

• PIP Submitter Last Name: • PIP Submitter First Name:

Result: Powerful indicators reflecting M&A process definition activity can be derived from the described collection

- ▶ Examples to the right allowed the engineering process group to determine that while processes are stabilizing in 2007, more projects are discovering and sharing best practices.
- ▶ Engineering process group also measures effort spent on improving M&A processes versus other functional areas.
- ▶ Additional measures to review open M&A proposals by project classification as well as priority have been useful to determine if the correct stakeholders were involved with definition activities for M&A processes.



Summary

- ▶ Four areas of measurement to determine the effectiveness of your organization's measurement process:
 - Alignment of Measures to Goals
 - Cost of Your Measurement Program
 - Ease of Implementation Across the Organization
 - Improvement Trends for M&A Processes
- ▶ Where possible, automate your data collection process.
 - Assists the cost associated with data collection, allowing experts to spend more time on analysis.
 - Helps to improve integrity of the data. Reduces mistakes with data entry. Less need for collection police.
- ▶ **Bad Indicators = Bad Decisions**

For More Information

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