



Practical Software and Systems Measurements

A measurement framework for software projects.

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Agenda

- Introduction
- Description of PSM
 - Origin
 - Measurement principles
 - Process
 - Support
- Uses for PSM
- Summary
- Questions

What is PSM?

- Practical Software and Systems Measurements is:
 - A Process for creating a project's software measurement plan.
 - A support organization, PSM Support Center
 - provides coordination, training materials and communication.
 - Cooperates with SEI and USC CSE to align processes.
 - Tools needed to use the process effectively.

PSM – Practical Software and Systems Measurements

- *A Foundation for Objective Project Management.*
- Presents a proven approach for defining and implementing an effective measurement process for software and system projects.
- The goal of Practical Software and Systems Measurement is to provide project and technical managers with the quantitative information required to make informed decisions that impact project cost, schedule, and technical performance objectives.

PSM Origin

- The DOD Office of the Joint Logistics Command published their Practical Software Measurement study in 1996.
- PSM Process and Measurement Principles were derived from studies of DoD procurements.

Reasons for measurements

- Project oversight
- Outsourcing management
- Planning accuracy
- Reliability forecasting
- Understanding of larger and more complex projects
- Process improvement
- Etc.

Measurement supports the skills of the PM

- Examples:
 - Risk management
 - Delivery of objectives
 - Financial reporting and forecasting
 - Effective communications

PSM Measurement Principles

- PSM process is built on 9 principles of measurement derived from the JLC96 study.
 - Experiences were based on both successful and unsuccessful projects.

Measurement Principles (slide 1)

- Use project issues and objectives to drive the measurement requirements.
 - The differences in projects are reflected in their measurement needs.
 - Issues are gathered from all stakeholders.
- Define and collect measures based on the technical and management processes.
 - PSM is not one-size-fits-all.
 - Lifecycle agnostic.
 - Based on the project at hand.

Measurement Principles (slide 2)

- Collect and analyze data at a level of detail sufficient to identify and isolate problems.
 - PSM planning begins at project initiation.
- Implement an independent analysis capability.
 - The whole team needs confidence in the measurement products.

Measurement Principles (slide 3)

- Use a systematic analysis process to trace the measures to the decisions.
 - PSM measures are planned (chosen) to be a part of the decision making process.
- Interpret the measurement results in the context of other project information.
 - Measures only show what they are chosen to show and do not reflect the entire environment.

Measurement Principles (slide 4)

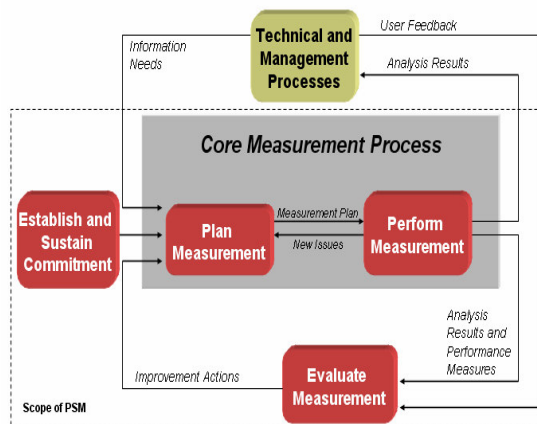
- Integrate measurement into the project management process throughout the life cycle.
 - Measurements come and go during a project.
 - Choose measurements appropriate for each phase and distribute them when they are valid.
- Use the measurement process as a basis for objective communications.
 - Trusted measurements allow a common basis for decisions.

Measurement Principles (slide 5)

- Focus initially on project-level analysis.
 - Organizations need to understand projects before attempting cross project comparisons
 - A measurement system change can have large unexpected impacts which require support for institutionalization.
 - Cross project data validation takes time to establish.
 - Keep changes within the organization's ability to accept change.

PSM Process

- Start by gathering project issues (also called Information Needs).
- Tailor measures to issues within the existing process environment in project planning.
- Perform measurement.
- Evaluate measurement.



Tailoring Measures from Issues

- Tailoring begins with Issue Identification.
- Issues flow from the project team.
- Measures are chosen in light of the project's process.

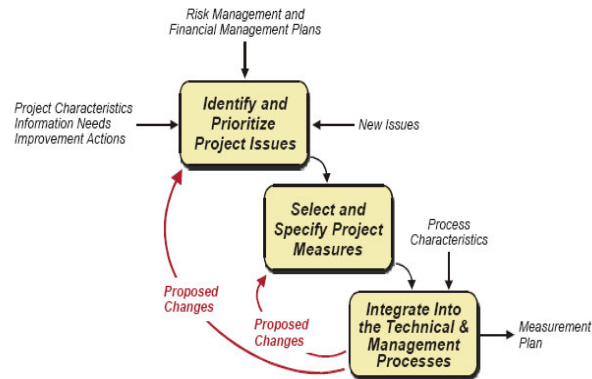
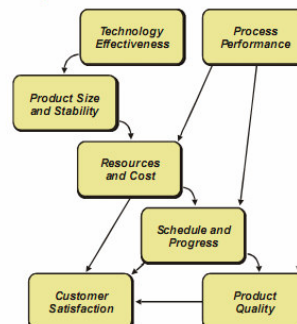


Figure 1-3. Tailor Measures Activity

Issues to Categories

- Issues (usually) fall into 7 **PSM Analysis Model** Categories
 - Schedule and Milestone Progress
 - Resources and Cost
 - Product Size and Stability
 - Product Quality
 - Process
 - Technology Effectiveness
 - Customer Satisfaction



Issue to Category to Measure

- Measures are related to issues via a category list.

Issue - Category - Measure Mapping		
Common Issue Area	Measurement Category	Measures
Schedule and Progress	Milestone Performance	Milestone Dates Critical Path Performance Requirements Status
	Work Unit Progress	Problem Report Status Review Status Change Request Status Component Status Test Status
	Incremental Capability	Action Item Status Incremental Content - Components Incremental Content - Functions
Resources and Cost	Personnel	Effort Staff Experience Staff Turnover Error Value Cost
	Financial Performance Environment and Support Resources	Resource Availability Resource Utilization
Product Size and Stability	Physical Size and Stability	Database Size Components Interfaces Lines of Code
	Functional Size and Stability	Physical Dimensions Requirements Functional Change Workload Function Points
Product Quality	Functional Correctness	Defects Technical Performance
	Supportability - Maintainability	Time to Restore Cyclostatic Complexity Maintenance Actions Utilization
	Efficiency	Throughput Timing
	Portability Usability Dependability - Reliability	Standards Compliance Operator Errors Failures Fault Tolerance
Process Performance	Process Compliance	Reference Model Rating Process Audit Findings
	Process Efficiency	Productivity Cycle Time
	Process Effectiveness	Defect Containment Rework
Technology Effectiveness	Technology Suitability Technology Volatility	Requirements Coverage Technology Impact Baseline Changes
Customer Satisfaction	Customer Feedback Customer Support	Survey Results Performance Rating Requests for Support Support Time

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Issue to Category to Measure

- Measures are related to issues via a category list.

Look at one Issue Area as an example.

Issue - Category - Measure Mapping		
Common Issue Area	Measurement Category	Measures
Schedule and Progress	Milestone Performance	Milestone Dates Critical Path Performance Requirements Status
	Work Unit Progress	Problem Report Status Review Status Change Request Status Component Status Test Status
	Incremental Capability	Action Item Status Incremental Content - Components Incremental Content - Functions
Resources and Cost	Personnel	Effort Staff Experience Staff Turnover Error Value Cost
	Financial Performance Environment and Support Resources	Resource Availability Resource Utilization
Product Size and Stability	Physical Size and Stability	Database Size Components Interfaces Lines of Code
	Functional Size and Stability	Physical Dimensions Requirements Functional Change Workload Function Points
Product Quality	Functional Correctness	Defects Technical Performance
	Supportability - Maintainability	Time to Restore Cyclostatic Complexity Maintenance Actions Utilization
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	Portability Usability Dependability - Reliability	Standards Compliance Operator Errors Failures Fault Tolerance
Process Performance	Process Compliance	Reference Model Rating Process Audit Findings
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Categories to Measures

Common Issue Areas	Measurement Categories	Measures
Schedule and Milestone Progress	Performance	Milestone Dates Critical Path Performance
	Work Unit Progress	Requirements Status Problem Report Status Review Status Change Request Status Component Status Test Status Action Item Status
	Incremental Capability	Increment Content - Components Increment Content - Functions

Selection of Measures

- Meets needs of the project.
- Appropriate for the project.
- Data availability
 - Accessibility.
 - Effort.
 - Timeliness.
 - Integrity.
- Effectiveness at identifying problems.

Measurement selection

- Select measures via a consistent process
- Document the selection

Measure	Selected	How Measured	Reason not selected
Process audit findings	Yes	Audit issue closure is required for milestone completion	
Reference model ratings (CMM, CMMI, ISO-9000)	No		Business goals, not managed by a release project.
Productivity	No		Tracked at the product level.

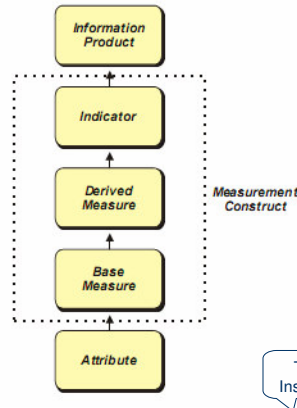
Construction of Indicators

Identifying the source and status of each measure.

Measurement Concept	Measure	Data source	Criteria	Project Phases	Status
Milestone dates	Start and Completion of Tasks	Project management tracking system	Activities complete	All	Used, auto
Requirements status	Completion of review	Review database	Critical documents	1	Used, manual
Requirements change	Number and rate of changes	Change request database	Number open per status, Number of updates per month	1, 2, 3	New, manual

Measurement Construction

- Information is the result of combining measures into appropriate Indicators.
 - Charts.
 - Tables.



Measurement Specification

Who,
What,
Where,
When,
Why &
How.

General Measurement Specification Table

Common Issue Area: All

This table provides measurement specification guidance that is applicable to all measures. It augments the specification guidance in the individual Measurement Description Tables. It helps to define overall data and implementation requirements for all sample measures in this Guide.

Specification Guidance

- Data Types** - Measurement data representing plans, changes to plans, and actual values should be collected and reported for each measure. Update plans and estimates on a regular basis.
- Measurement Definitions** - Identify the actual measurement definitions and methods used for each measure. If these change during the project, the definitions and interpretations should be updated and provided to the project office. Differences in estimation methods and the way that actuals are counted should also be identified, including the "exit" criteria for counting actuals.
- Data Dates** - For each measure, identify both the date that the measurement data was collected, and the date that it is reported. The data should be provided in a timely manner. The difference between the collection date and the delivery date should be minimized.
- Measurement Organization** - If more than one organization is involved in developing the system for a project, measurement data should be collected from each organization and identified by source. Identify different definitions for the same measures.
- Project Phase** - Measures that are selected and integrated into the project are applied to all life-cycle phases: include project planning, development, and operations and maintenance. Throughout all project phases, measurement plans and estimates should be continually updated and reported.
- Collection Periodicity** - Measurement data should be collected on a periodic basis (not event-driven). Most projects collect measurement data monthly, but the frequency can be adjusted as necessary. The periodicity for selected measures may be modified to meet process constraints.
- Data Reporting Mechanisms** - Identify the reporting mechanisms for delivering data to the project office. Every effort should be made to establish the resources necessary to transfer the data electronically on a periodic basis.

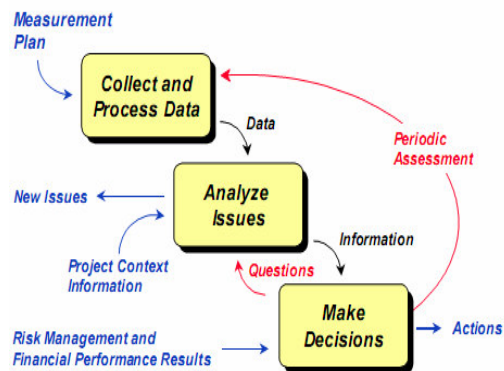
Sample Measurement Template

PSM Guidebook contains templates for the fifty measures in the ICM Table.

Review Status	Category: Issue:	Work Unit Progress Schedule and Progress
<p>The Review Status measure counts the number of reviews successfully completed, including both supplier and acquirer reviews. The measure provides an indication of progress in completing review activities.</p>		
Selection Guidance	Specification Guidance	
<p>Project Application</p> <ul style="list-style-type: none"> Used on medium to large projects. <p>Process Integration</p> <ul style="list-style-type: none"> Easy to collect if formal reviews are a part of the development process. <p>Usually Applied During</p> <ul style="list-style-type: none"> Requirements Analysis (Estimates and Actuals) Design (Estimates and Actuals) Implementation (Estimates and Actuals) Integration and Test (Estimates and Actuals) 	<p>Typical Data Items</p> <ul style="list-style-type: none"> Number of reviews Number of reviews completed successfully Cumulative time spent in reviews <p>Typical Attributes</p> <ul style="list-style-type: none"> Type of review Component being reviewed Increment <p>Typical Aggregation Structure</p> <ul style="list-style-type: none"> Component Activity <p>Typically Collected for Each</p> <ul style="list-style-type: none"> CI or equivalent Activity <p>Alternatives to Reviews Include</p> <ul style="list-style-type: none"> Inspections Walkthroughs <p>Count Actuals Based On</p> <ul style="list-style-type: none"> Completion of review Resolution of all associated action items 	
<p>This measure answers questions such as:</p> <ul style="list-style-type: none"> Are development review activities progressing as scheduled? What components have failed their review? 		

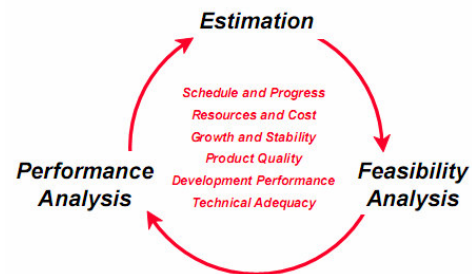
Implement the Measurements

Used during the Implementation phases of the project.



Evaluate the Measurements

Confirm that the measurements are effective.



PSM Tools

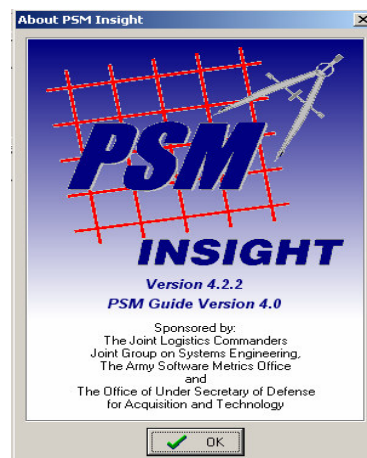
- PSM support Center offers a few tools to support process implementation:
 - Text book and Guidebook – See reference slides.
 - White Papers on Implementation, use in various domains and Experience Stories.
 - PSM Insight – Process tool for the PC.
 - RUP Plug-in - for Rational Unified Process users.

PSM Insight

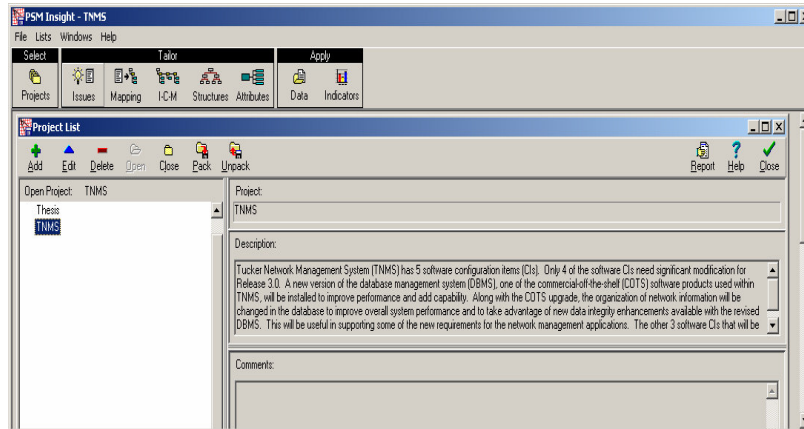
- PC based process and data management tool.
- Supports the execution of the process across the lifecycle.
- But: Insight is not required.
 - PSM can be done with pen and paper or your existing desktop applications.

Insight

- Insight is:
 - Distributed for no charge (sign-in required).
 - Supported by tutorials and full documentation.
 - a single user program that will run on a network.



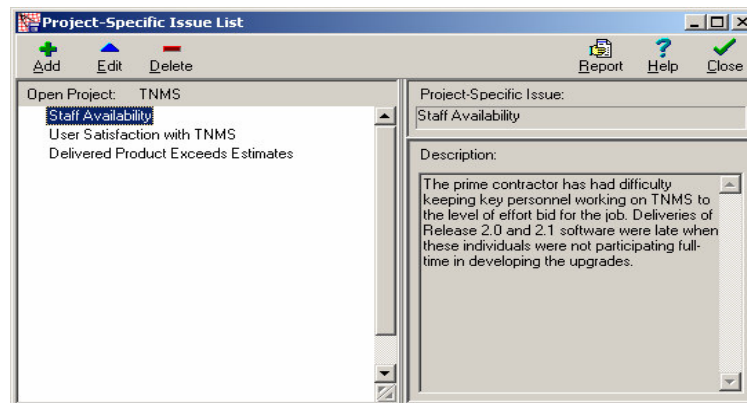
Insight main window



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Insight - Issue entry

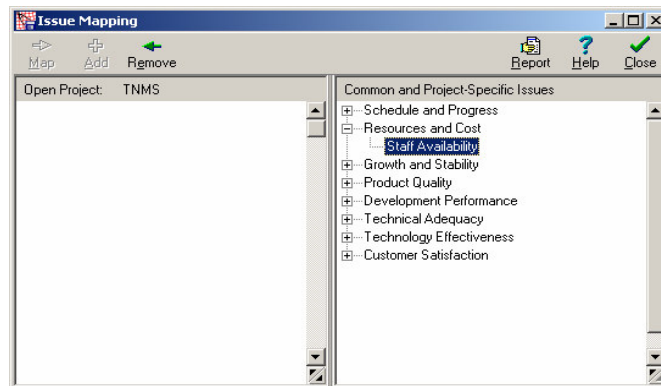


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Insight – Issue mapping

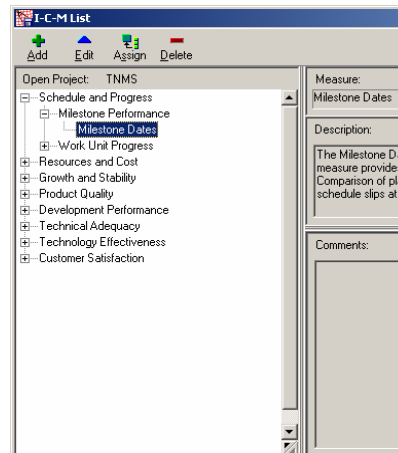
- Map Issues to the Issue Areas in the I-C-M table.



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Insight – Issue to Measure Mapping

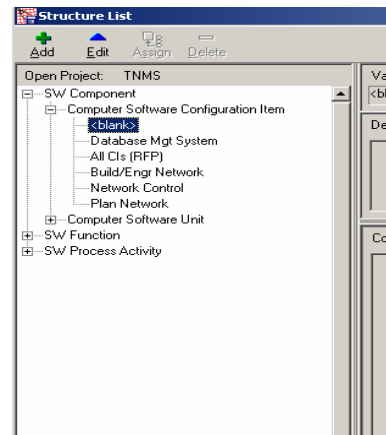
- Measure to Issue Area mapping.



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Insight - Project Functional Mapping

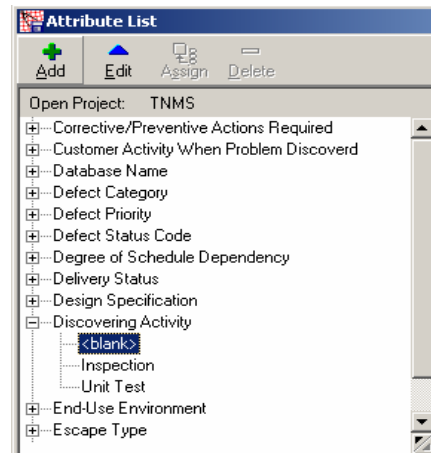
- Project characteristics and activity structure is mapped into Insight.



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Insight - Attributes

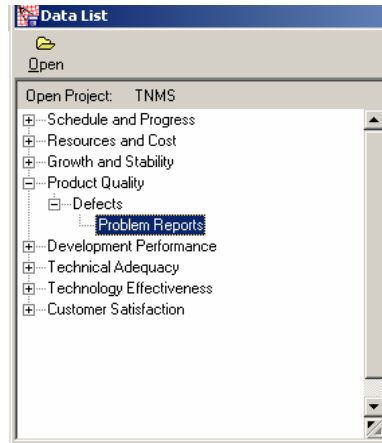
- Setting up data attributes for project tracking



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Insight – Data to Indicator Mapping

- Selecting the data indicators.
- Data can be entered or imported from text files or spreadsheets.



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Insight - Input the data for the measure

Data for Open Defects:

The screenshot shows a window titled 'Problem Reports' with a table of data. The table has the following columns: Date, Computer Software Configuration Item, Planned/Actual, Organization, Version, SPR Priority, Discovering Activity, and SW F. The data is as follows:

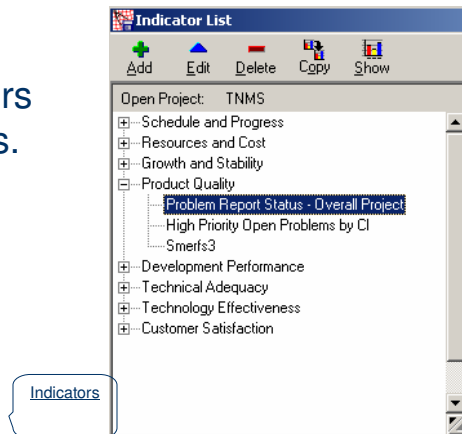
Date	Computer Software Configuration Item	Planned/Actual	Organization	Version	SPR Priority	Discovering Activity	SW F
1/14/1998	Build/Engr Network	Actual	Prime	v3.0	1-Urgent	Inspection	
1/14/1998	Build/Engr Network	Actual	Prime	v3.0	2-High	Inspection	
1/14/1998	Build/Engr Network	Actual	Prime	v3.0	3-Medium	Inspection	
1/14/1998	Build/Engr Network	Actual	Prime	v3.0	4-Low	Inspection	
1/14/1998	Database Mgt System	Actual	Sub	v3.0	1-Urgent	Inspection	
1/14/1998	Database Mgt System	Actual	Sub	v3.0	2-High	Inspection	
1/14/1998	Database Mgt System	Actual	Sub	v3.0	3-Medium	Inspection	
1/14/1998	Database Mgt System	Actual	Sub	v3.0	4-Low	Inspection	
1/14/1998	Network Control	Actual	Prime	v3.0	1-Urgent	Inspection	
1/14/1998	Network Control	Actual	Prime	v3.0	2-High	Inspection	
1/14/1998	Network Control	Actual	Prime	v3.0	3-Medium	Inspection	
1/14/1998	Network Control	Actual	Prime	v3.0	4-Low	Inspection	
1/14/1998	Plan Network	Actual	Prime	v3.0	1-Urgent	Inspection	
1/14/1998	Plan Network	Actual	Prime	v3.0	2-High	Inspection	

At the bottom of the window, it says 'Date on which measurements were taken.' and 'Records: 260'.

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Insight - Select Charts

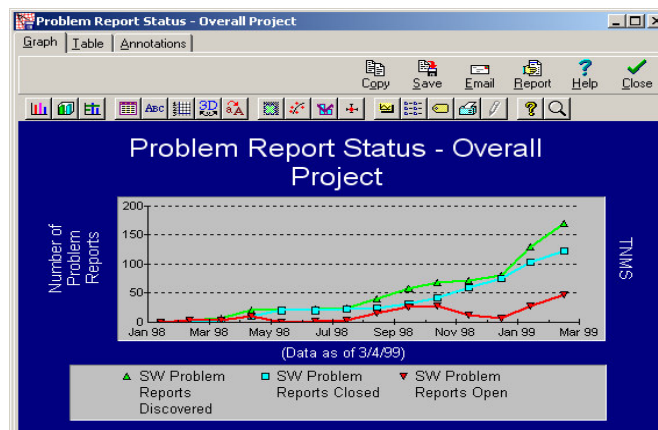
- Charts are built from the Indicators the project needs.



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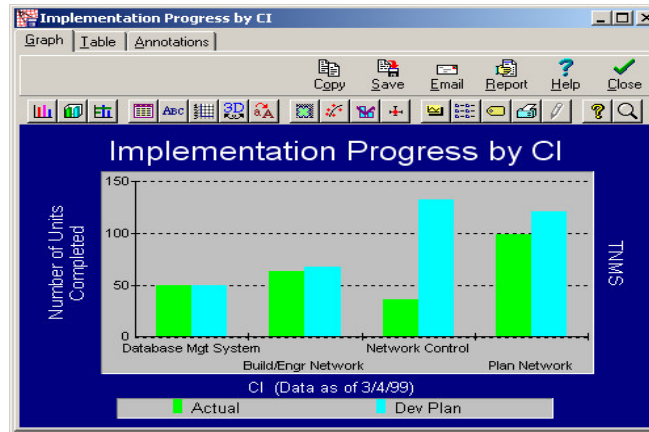
Chart display

Charts can be viewed, mailed, exported as data files, etc.



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Insight - Additional chart format



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Where PSM can be used

- The default use is to establish a new measurement plan for a project.
- PSM also works for other issues.
 - Validation of an existing plan
 - Process Improvement
 - Audit preparation

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Measurement Plan Validation

- Are existing institutionalized measures suitable?
 - PSM suggests measurement concepts opportune for the project

Process Improvement

- What measures can solve existing problems for a project or project subteam?

PSM for ISO Audit Preparation

- Processes in use need to be shown relevant and effective.
- Measurements are to be selected using a defined process.
- PSM can be used to satisfy these requirements.
- PSM data would be in the evidence book for the auditor's review.

PSM Support

- PSM support Center at <http://www.psmc.com>
- PSM Guidebook and text – see references
- PSM Insight program for planning and execution phases of the project
- PSM training and certified trainers
- PSM Conference each summer
- Documents and Technical Working Group reports on website

Questions ??

References

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References (slide 2)

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