

Measures for Success: Lessons Learned from Applying PSM



**Practical Software and
Systems Measurement**
*Objective Information for
Decision Makers*

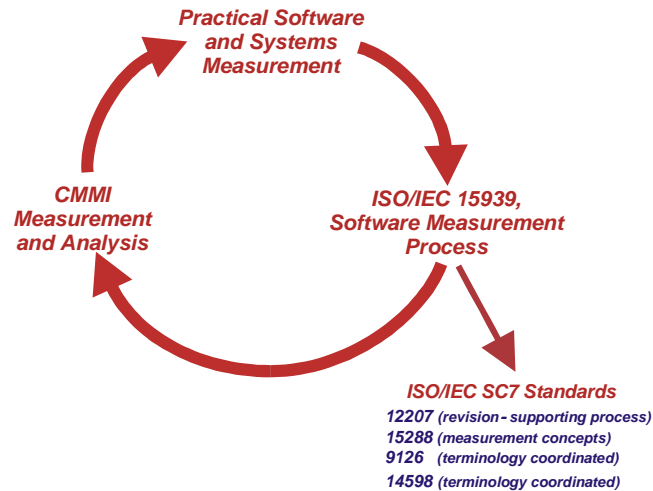
*Department of Defense
US Army*

Measurement Principles

- **Measurement Is a Consistent but Flexible Process that Must Be Tailored to the Unique Information Needs and Characteristics of the Project or Organization**
- **Decision Makers Must Understand What is Being Measured and Trust the Information**
- **Measurement Must Be Used to be Meaningful**

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PSM - ISO Standards - CMMI



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Fact-Based Management

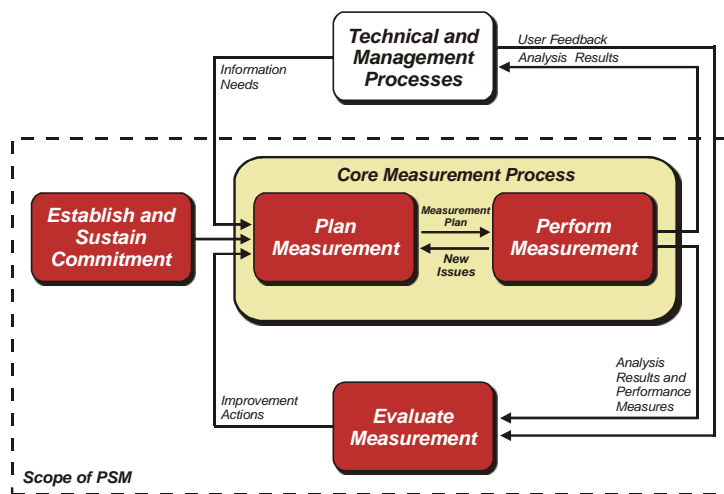
- **Requires Measurement Information to Support Critical Project and Organizational Business and Technical Decisions**
- **Measurement Results Must Be Communicated and Used Across the Entire Corporate Entity**
- **Measurement Results Must Be Incorporated with Risk Management and Context Information**

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Consistent but Flexible Process

Measurement Activities



Plan Measurement

- **Measures Are Defined to Provide Insight into a Project or Organization's Information Needs by**
 - *Identifying what the decision makers need to know*
 - *Relating these to entities that can be measured*
 - *Selecting and specifying measures based on project and organizational processes*

Information Categories

- **Schedule and Progress**
- **Resources and Cost**
- **Product Size and Stability**
- **Product Quality**
- **Process Performance**
- **Technology Effectiveness**
- **Customer Satisfaction**

Plan Measurement - Lessons Learned

- **Start by Implementing a Small Set of Measures**
 - Reduces the level of change, resources required, and impact on the workload
 - Add additional measures later, incrementally
- **The Measurement Plan Should Specify Both “What” Will be Measured and “How” the Process Will Work**

Multi-Level Measurement Requirements



Plan Measurement - Lessons Learned (cont).

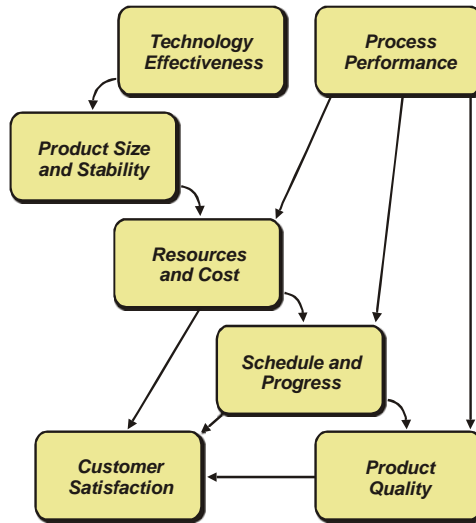
- **Workshops Are Good For Defining Information Needs**
- **Allow Tailoring of Organizational Measures**
- **Successful Measurement Programs Integrate the Needs of all Decision-Makers**
 - *This simplifies data collection and reduces duplication*

Perform Measurement

- **Collecting Measurement Data, Performing Analysis, and Presenting Results**
- **Analysis Can Include Estimation, Feasibility Analysis of Plans, and Performance Analysis of Actual Data Against Plans**

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PSM Analysis Model



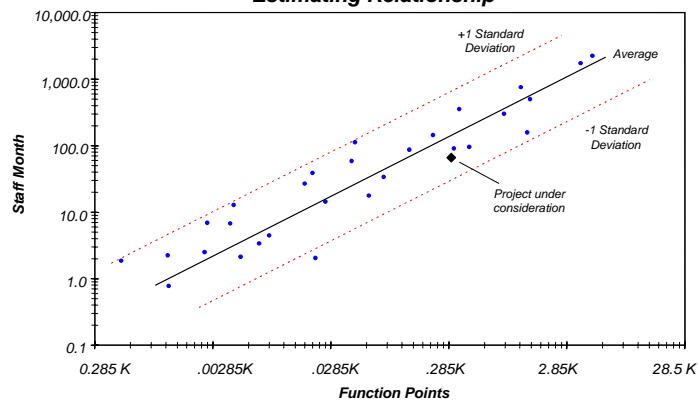
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Measurement Feasibility Analysis

Size - Effort
Estimating Relationship



Project: PSM

Data as of 31 Mar 98

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Lessons Learned - Perform Measurement

- **Automate Data Collection Whenever Possible**
- **It Take About 6 to 9 Months to Establish Measures**
 - *Initial focus is on ensuring data is provided*
 - *Next focus in on data problems*
 - *After these are resolved, focus can move to performance issues*
- **Clearly Identify the Reporting Mechanisms at Both the Project and Organizational Levels**
- **Aggregation Approaches Need to be Specified, Especially When Measures Are Tailored**

Establish and Sustain Commitment

- **Includes Establishing the Resources, Training, and Tools to Implement a Measurement Program Effectively and Ensuring Commitment to Use the Information that is Produced**
- **Need to have Commitment Reinforced and Demonstrated Regularly**
- **Need to Adopt an Action Orientation**

Gain Support for Measurement

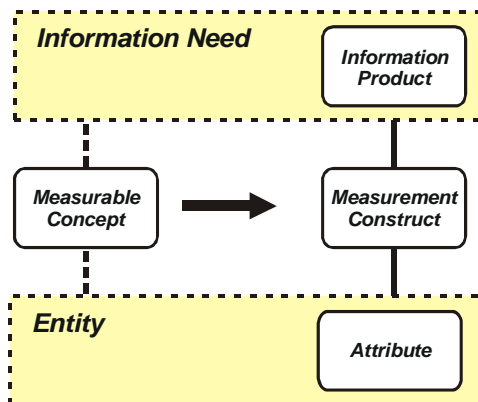
- ***The Resulting “Culture Shock” from Implementing any new Process causes a Natural Reaction of Personal Resistance***
 - *Overcome resistance to change*
- ***Provide the Participants with an Understanding of the Measurement Process and the Benefits to Their Projects***
 - *Training programs should help project representatives identify information needs and measures*
 - *Planning workshops should include representatives at all levels of the organization*

Lessons Learned - Evaluate Measurement

- ***Both the Measurement Process and the Specific Measures Should be Periodically Evaluated and Improved***
- ***Measurement is an Iterative Process: the Measures are Refined as Information Needs Change and the Organization Implements Improvement Actions***

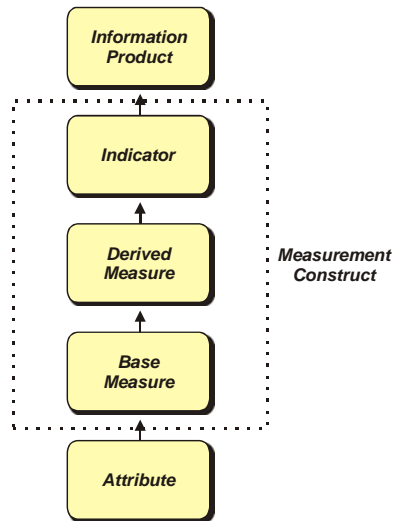
Understand and Trust Measurement Information

Information Model: High-Level View

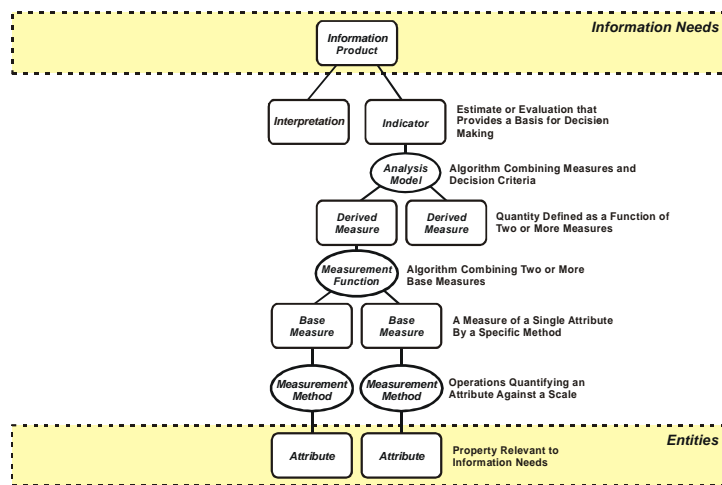


Adapted from ISO/IEC 15939 - Software Measurement Process

Measurement Construct - Levels

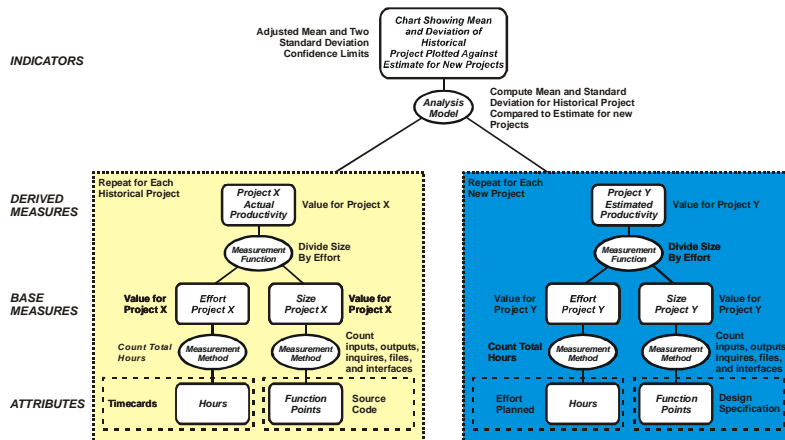


Measurement Construct



Adapted from ISO/IEC 15939 - Software Measurement Process

Measurement Construct - Productivity



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Lessons Learned

- **Provide Well Defined Base Measures to Ensure Consistency**
- **Present Information in a Format that is Understandable to the Decision Maker**
- **People Doing Measurement Aren't Generally Making the Decisions - It Is Important to Present Information Clearly and Concisely**
- **Just Because the Measurement Information is Accurate and Objective, Does Not Mean It Will be Acted On**

Measurement Must be Used

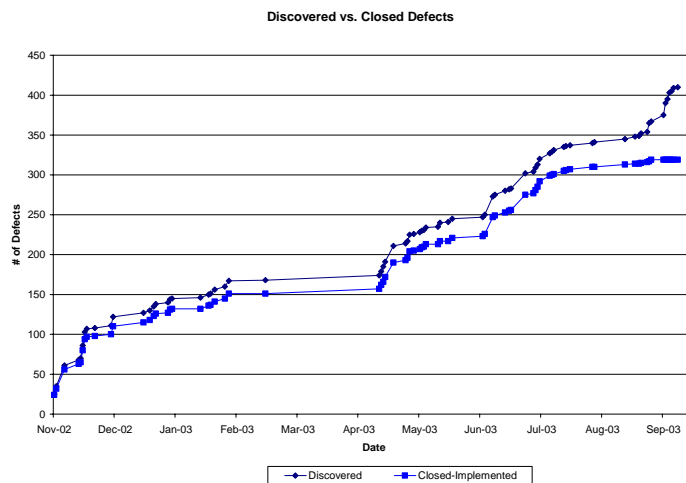
Lessons Learned

- ***The Measurement Process Should be an Integral Part of the Way Business Is Conducted***
- ***Data Must be Provided Early Enough to Allow Managers to Take Action***
- ***Results Must Be Communicated Throughout the Organization in a Timely Manner***
- ***Decisions Should Not Wait for Perfect Data, but Should be Based on Accurate Data, Augmented by Risk Management and Context Information***

Lessons Learned (cont.)

- **The Measurement Results Should Help Decision-Makers Optimize Overall Performance**
- **Most Organizations are Composed of a Portfolio of Distinct Projects, So Project-Level Information Must Be Aggregated to Appropriate Levels of the Organization to be Used Effectively**

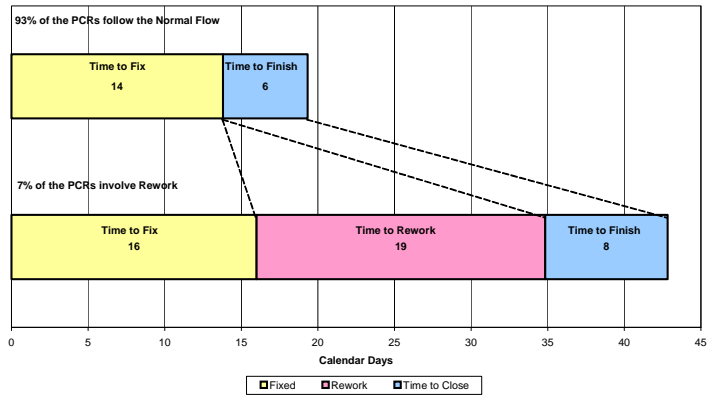
Project-Level Focus



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Aggregated Data Highlights Issues

Time to Fix vs. Time to Close
Closed Defects
As of 25 Sep 03



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Summary

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Opportunities / Threats

- **More Use/Mis-Use of Measurement**
- **Continuous Requests for the “List” of Best Measures**
- **Constrained Environments that Don’t Let You Act on the Measurement Results**
- **Changing DoD Requirements for Measurement**
 - **Greatly reduced requirements/standards (e.g. DoDI-5000)**
 - **Continued emphasis on performance requirements**

Recommendations for Improvements

- **Align Information Needs Across All Perspectives**
- **Put Your Energy into Making Sure Information Is the Best It Can Be (Versus The Most It Can Be)**
 - **Fewer but better measures**
- **Design the Measurement Process to React to Continuous Change**
- **Use the measurement results**
 - **Use the measurement results**
 - **Use the measurement results**
 - **....**

PSM Products

PSM Products Available

- **PSM Book - Version 5 - Published by Addison Wesley**
- **PSM Insight**
- **PSM Guidebook - Version 4**
- **1 and 2 day Training Sessions**
- **Measurement Workshops for Programs or Organizations**
- **Measurement Experience Reports**
- **Sample Measurement Specifications**



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PSM Products Available (cont)

- **DoD Implementation Guidance**
- **Measurement White Papers**
 - *Evolutionary Acquisition*
 - *Interoperability*
 - *Object-Oriented Design*
 - *Product Lines*
- **Applying PSM to Enterprise Measurement (PSM and the Balanced Scorecard)**
- **Rational Unified Process (RUP) Measurement Plug-In**

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PSM Products Under Development

- **Measurement White Papers**
 - *Acquisition Measurement*
 - *Safety and Security Measurement (UK/Australian collaboration)*
 - *Systems Engineering Technical Measures (INCOSE collaboration)*
 - *System of System Measurement (DAU collaboration)*
 - *Process Improvement Measurement*
 - *Organizational / Enterprise Measurement*

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For More Information

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Backup Material

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PSM Participating Organizations

DoD and Government

- US Air Force AFMC
- US Air Force SSSG
- US Air Force STRATCOM
- US Air Force STSC
- US Army AMC
- US Army CECOM
- US Army RDECOM-ARDEC
- US Army SAALT
- US Army SMDC
- USMC MCTSSA
- US Navy AEDC
- US Navy ASN RDA
- US Navy FMSO
- US Navy NAVAIR
- US Navy NAVSEA
- US Navy NAWC
- US Navy NRL
- US Navy NSWC
- US Navy NUWC
- US Navy OPTEVFOR
- OSD NII
- OSD PA&E
- ODUSD (S&T)
- Aerospace Corp.
- Dept of Homeland Security, Customs & Border Protection
- DAU-DSMC
- DCMA
- DFAS
- DISA
- DLA
- FAA
- IDA
- MITRE Corp.
- NASA
- Sandia National Lab
- Soc. Sec. Admin.
- Software Engineering Institute

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PSM Participating Organizations

Industry

- ACS GSG
- Accenture, Quality and PI
- Alion Science and Technology
- American Sys. Corp.
- Ameritrade Corporation
- Argon Engineering Associates
- Assurance Engineering
- BAE Systems
- Bloodworth Int. Tech.
- Booz Allen Hamilton
- CMIS
- CTA
- Carnegie Mellon Univ.
- Computer Sciences Corp.
- David Consulting Group
- Distributive Software
- Federal Reserve Bank
- First Line Partners
- Frunhofer Ctr. For Experimental Software Engineering
- GTE
- Galorath, Inc.
- General Dynamics
- General Scientific Corporation
- Graeme & Garland
- Hawaiian Electric
- IEEE
- IFPUG
- IITRI
- INCOSE
- ITABHI
- Independent Engineering, Inc.
- IBM
- Jacobs Sverdrup
- James Gregory Assoc.
- Kodak Health Imaging
- L3 Communications
- Lockheed Martin
- Nat. Renewable Energy Lab.
- Northrop Grumman
- OAO Corporation
- Pragma Systems Corporation
- PRICE Systems, LLC
- QSM
- Quality Plus Tech.
- Raytheon - Hughes
- Reifer Consultants
- Robbins, GIOIA
- Rockwell Collins
- SAIC
- Sallie Mae
- SETA
- Sentel
- Software Engineering Assoc., Inc.
- Software Management Solutions
- Software Metrics, Inc.
- Software Productivity Consortium
- Tecolote Research, Inc.
- TeraQuest Metrics
- Texas Guaranteed Student Loan Corporation
- Titan Corporation
- Tivoli
- United Defense
- Univ. Southern CA
- Upsart Systems, LLC
- User Trust Network
- US West
- VPI - State University
- West Virginia High Tech. Consortium
- West Virginia University
- Whittaker Group
- Wind River Systems
- Xcel Energy

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PSM Participating Organizations

International

- Liveware I.S.S.A. (Argentina)
- ADI Limited (Australia)
- Australian Defence Force Academy (Australia)
- Defence Materiel Org.-Australian DoD (Australia)
- Jacobs Sverdrup Technology (Australia)
- Motorola SOC Design Center (Australia)
- S-3 Consulting Pty. Ltd (Australia)
- Saab Systems Pty. Ltd. (Australia)
- Software Improvements Pty. Ltd. (Australia)
- Software Quality Institute (Australia)
- Tenix ESD (Australia)
- ti Metrics (Brazil)
- General Dynamics (Canada)
- NRC (Canada)
- Amdocs (Israel)
- Tangram Hi-Tech Solutions (Israel)
- Centro de Investigacion en Matematicas (Mexico)
- Ericsson Espana SA (Spain)
- Defense Science and Technology Labs (UK)
- UK Ministry of Defense (UK)
- University of York/ York Metrics Ltd. (UK)

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Transition Organizations

DoD and Government

- US Army RDECOM – ARDEC (PSM Support Center)
- US Air Force Software Technology Support Center
- US Navy NAVAIR
- Naval Undersea Warfare Center
- Aerospace Corporation
- Defense Contract Management Agency
- Defense Acquisition University - Defense Systems Management College
- Federal Aviation Administration
- MITRE Corporation
- Software Engineering Institute

Transition Organizations

Industry

- *Argon Engineering Associates*
- *Computer Sciences Corporation*
- *David Consulting Group*
- *Distributive Software*
- *INCOSE*
- *Lockheed Martin*
- *Northrop Grumman*
- *Quality Plus Technologies, Inc.*
- *Software Management Solutions*
- *Software Productivity Consortium*
- *TeraQuest Metrics*
- *Texas Guaranteed Student Loan Center*
- *Titan Corporation*

Transition Organizations

International

- *Liveware I.S.S.A (Argentina)*
- *ADI Limited (Australia)*
- *Australian Defence Force Academy (Australia)*
- *Defence Materiel Organisation - Australian DoD (Australia)*
- *Jacobs Sverdrup Technology (Australia)*
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