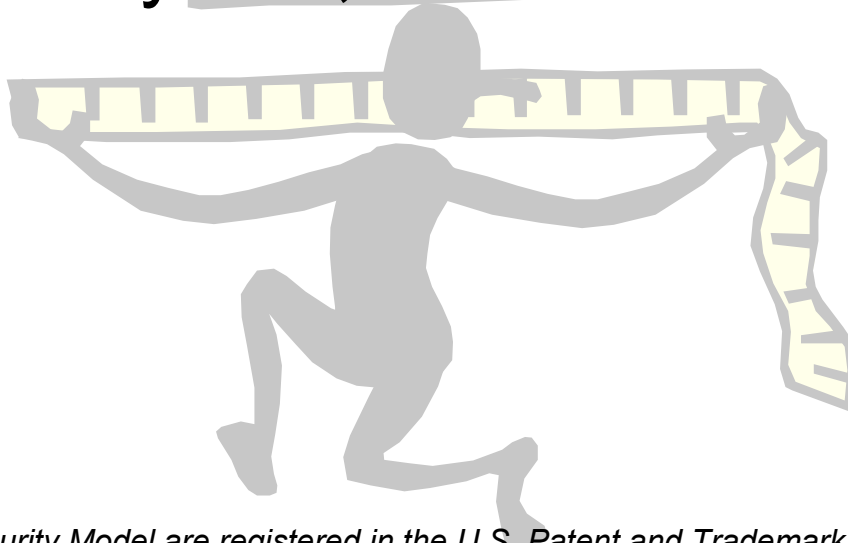




TeraQuest

Measurement and the CMMs[®][1]

Beth Layman, TeraQuest Metrics, Inc.



Objectives

Discuss CMMs and Measurement

Discuss CMM measurement requirements from an assessor's perspective

Review common measurement program problems seen during assessments

Provide a few good examples and some advice

CMMs and Measurement

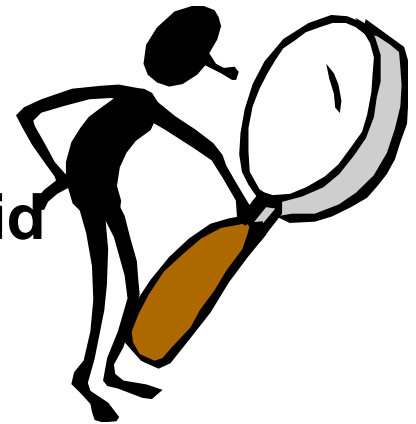
Measurement provides visibility into the process

Measurement is not a “Level 4 only” activity!

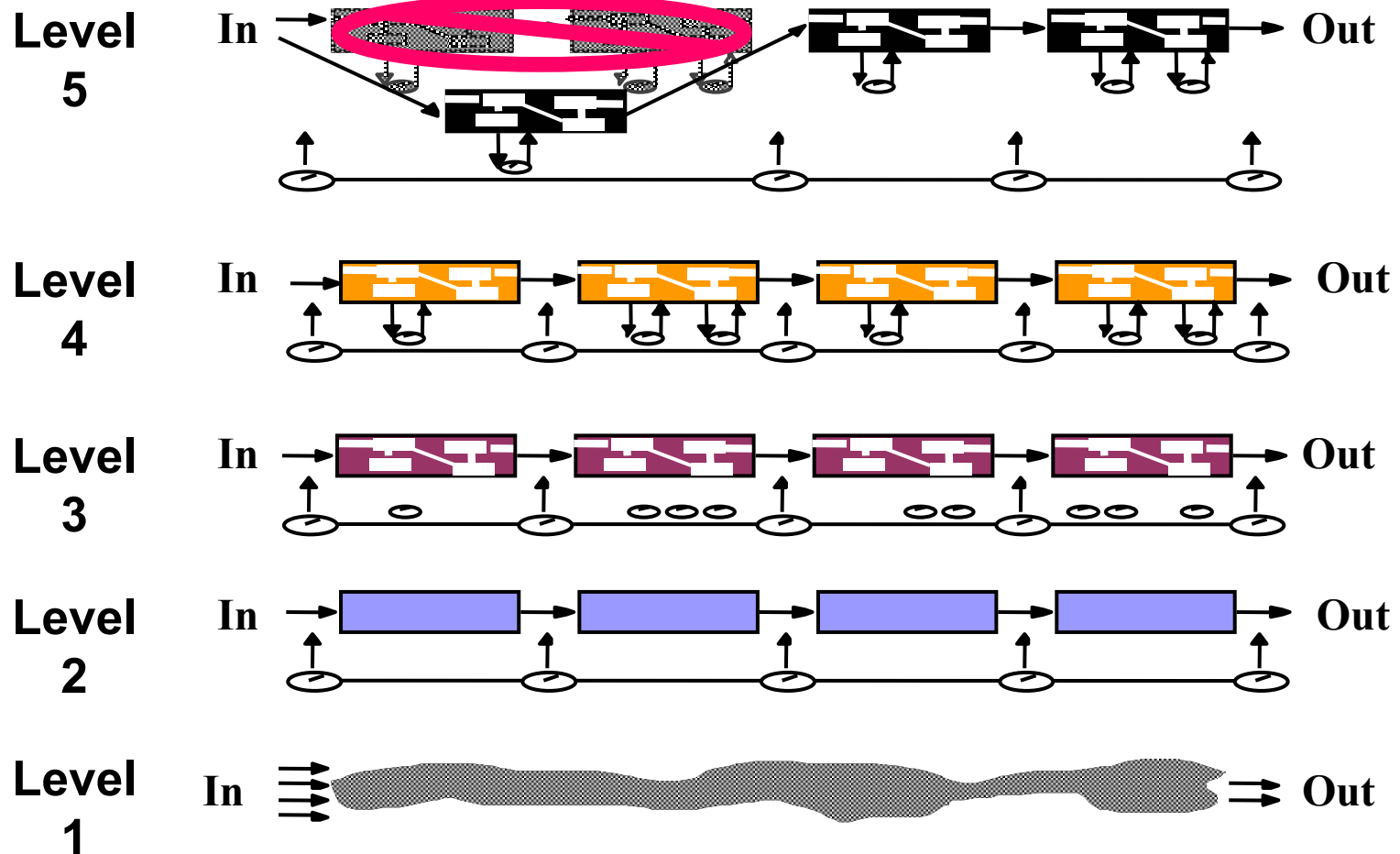
Measurement is scattered throughout SW-CMM Level 2 and Level 3

In CMMI, Measurement & Analysis becomes its own Process Area

To be ready for high maturity, must have solid measurement program (most don't!)

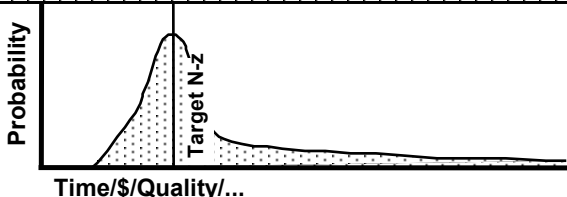
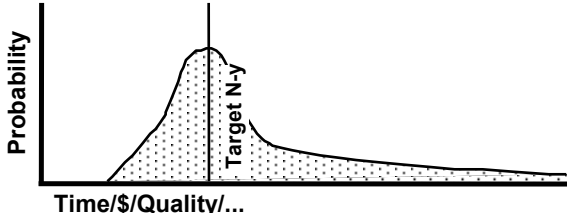
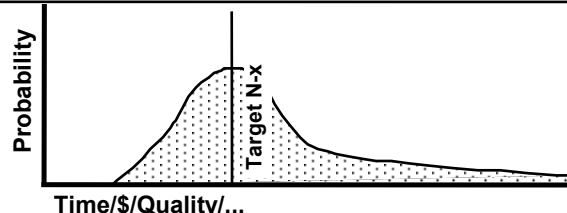
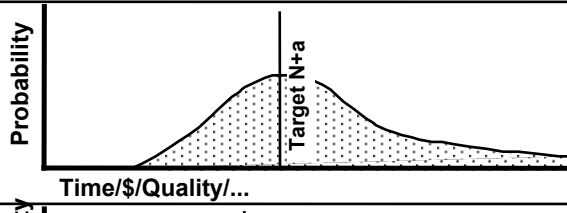
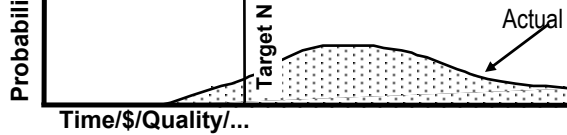


Measurement & Process Maturity



Source: [2], page 23

Measured Performance Improvement

Level	Process Characteristics	Predicted Performance
5 Optimizing	With continuous process optimization and targeted technology insertion, performance continues to improve at Level 4.	
4 Managed	With quantitative management of the process and product, performance continues to improve at Level 4.	
3 Defined	With well-defined processes, performance improves at Level 3.	
2 Repeatable	Plans are based on known past performance. Estimates/plans are more realistic and met more often.	
1 Initial	Schedule and Cost targets are typically optimistic (overruns) Performance results vary widely.	

Adapted from Source: [2], page 28

SW-CMM Measurement Requirements

Project Management Measures

- Planning and Tracking (SPP, SPTO, ISM)
 - Work Product/Software Size (SLOC, FP, Pages, Reqs)
 - Work Effort, Cost, Schedule
 - Critical Computer Resources

Product Management Measures

- Peer Review Defect Data (PR, SPE)
- Test Defect Data (SPE)
- SQM KPA at Level 4

Process Management Measures

- Process Status (ME1s - All KPAs)
- Peer Review Process Data (PR)
- SPI Progress (OPF/OPD)
- Training Quality (TR)
- QPM KPA at Level 4
- Process Improvement trends at Level 5

Measurement Infrastructure

- Organizational Database (OPF/OPD, ISM)
 - Historical Data (Size, Productivity, Effort Distribution)

CMMI Measurement Requirements

Generic Practices

- GP 2.2 Plan the Process
 - Include measurement requirements (process, product, service)
- GP 2.8 Monitor and Control the Process
 - Measure actual performance of the process, product, service; identify deviations; take correction action
- GP 3.2Collect measures to support process improvements

Measurement Program/Infrastructure

- Measurement & Analysis PA – basically **PSM**
- Measurement Repository (OPF/OPD, IPM)
- Quality and Performance Baselines and Models (OPP)

Project, Product, Process Management Measures

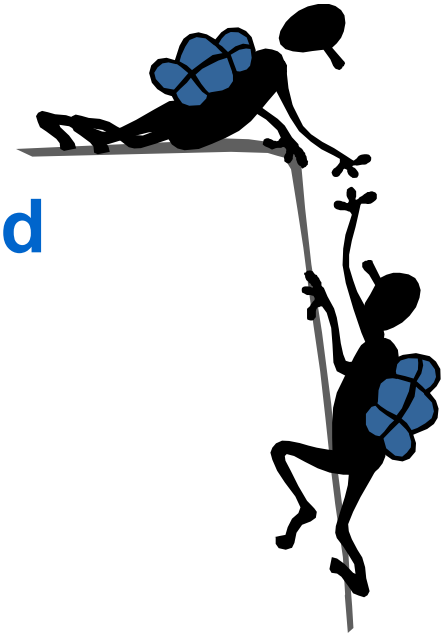
- Project Planning and Monitoring/Control (PP, PMC, IPM)
 - Work Product/Size, Effort, Cost, Schedule
- TPMs (RD), Peer Review/Test Defect Data (VER/VAL)
- Quality and Performance Baselines and Models (QPM)
- SPI Progress (OPF/OPD)
- Training Quality (TR)
- Process Improvement trends at Level 5

Common Measurement Problems

Analysis of CMM-based assessment findings shows that **ME common features** are often not met^[5].

Other/related problems:

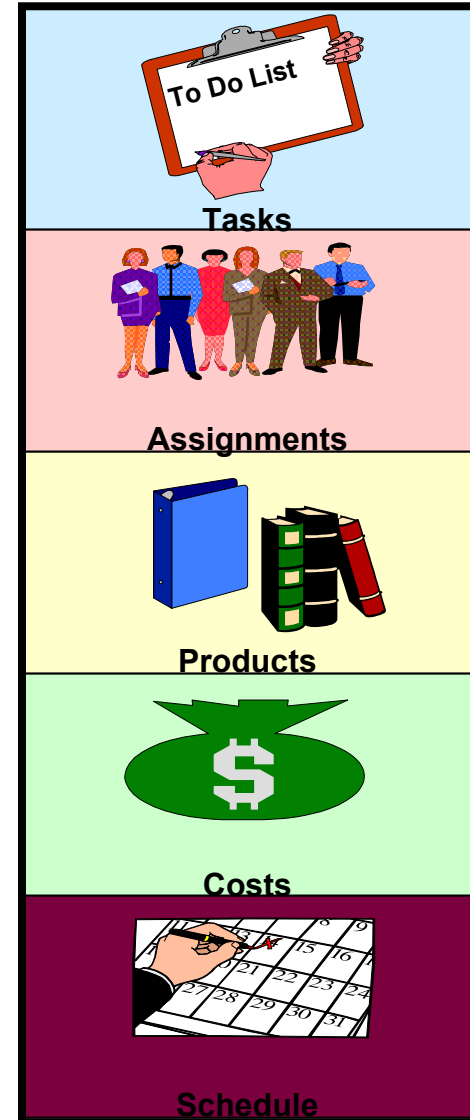
- **Measures Collected but not Used**
- **No Measurement Plan/Design**
- **Weak Measurement Repository**



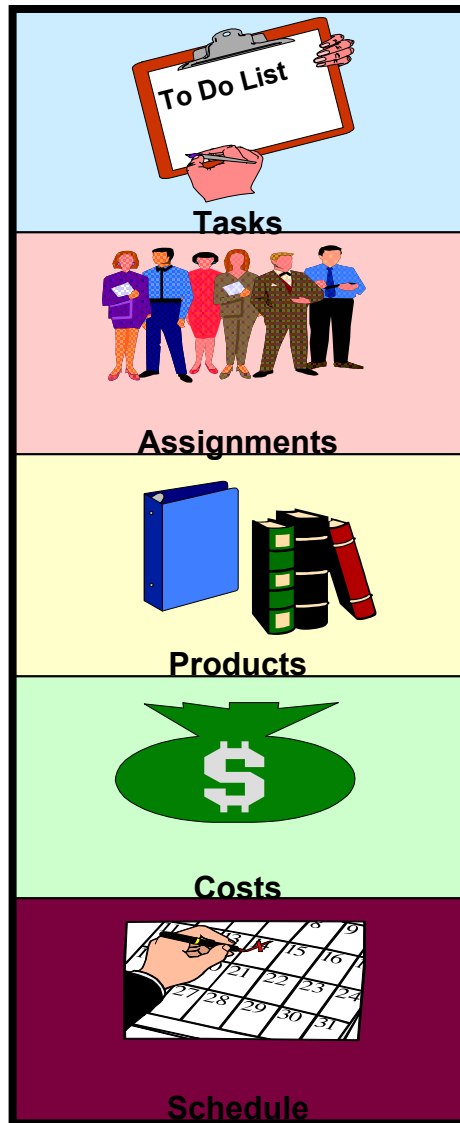
Problems with ME practices-1

Each CMM key process can be described in terms of:

- Tasks or Activities
- Assignments or Resources
- Work Products/Deliverables
- Costs/Dollars
- Schedule/Dates/Milestones



Problems with ME practices-2



ME Purpose: To provide insight into the STATUS of the Key Process Areas.

Activity Status

Tasks:

- Actual progress vs. plan
- How soon will we be done?
- Are we behind schedule?

Resources:

- Costs incurred vs. plan
- Effort Consumed vs. plan
- Are we over budget?

Product Status

- Deliverables produced vs. plan
- Deliverables complete?
- Behind schedule?

Problems with ME practices-3

Common problems/misinterpretations:

- SPP and PTO – Not insight into any/all project tasks (i.e., overall effort, overall schedule), but insight into the effort and resources required to do proper project management (planning and tracking).
- PR - Not insight into defects found, but number of reviews performed and review time spent vs. time allocated for reviews.



Measures Collected but not Used

Problem:

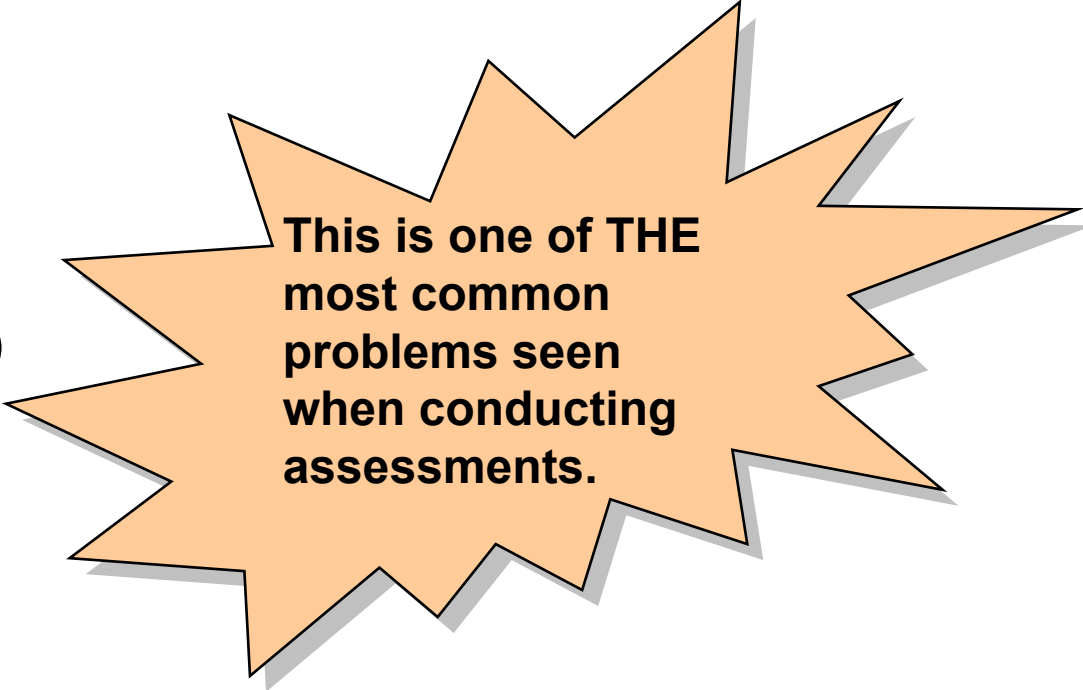
- Graphs produced, but not really analyzed by “real” project staff
- Graphs not used proactively to manage
- Graph interpretations vary and are not controlled

Statements like “Measurements are made and used to determine the status of...” means you must:

- Collect the data
- Analyze the data
- Interpret results
- Report results
- Take action (as needed)

Related Problems:

- Dirty, missing data



This is one of THE most common problems seen when conducting assessments.

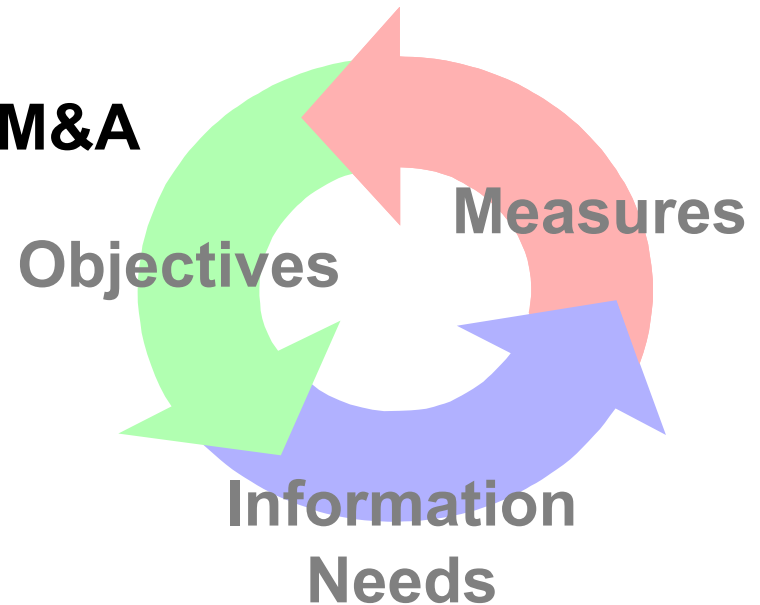
No Measurement Plan/Design

Problem:

- CMMI requires more measurement planning & design artifacts
- Many organizations transitioning to CMMI do not have these artifacts
 - Documented Information Needs, Measurement Objectives
 - Measurement specifications
 - Collection, storage, and analysis procedures

See SG 1 and associated SPs of M&A

See GP 2.x



Weak Measurement Repository

Problem:

- Repository not used by projects
- Outdated data
- Very little data available



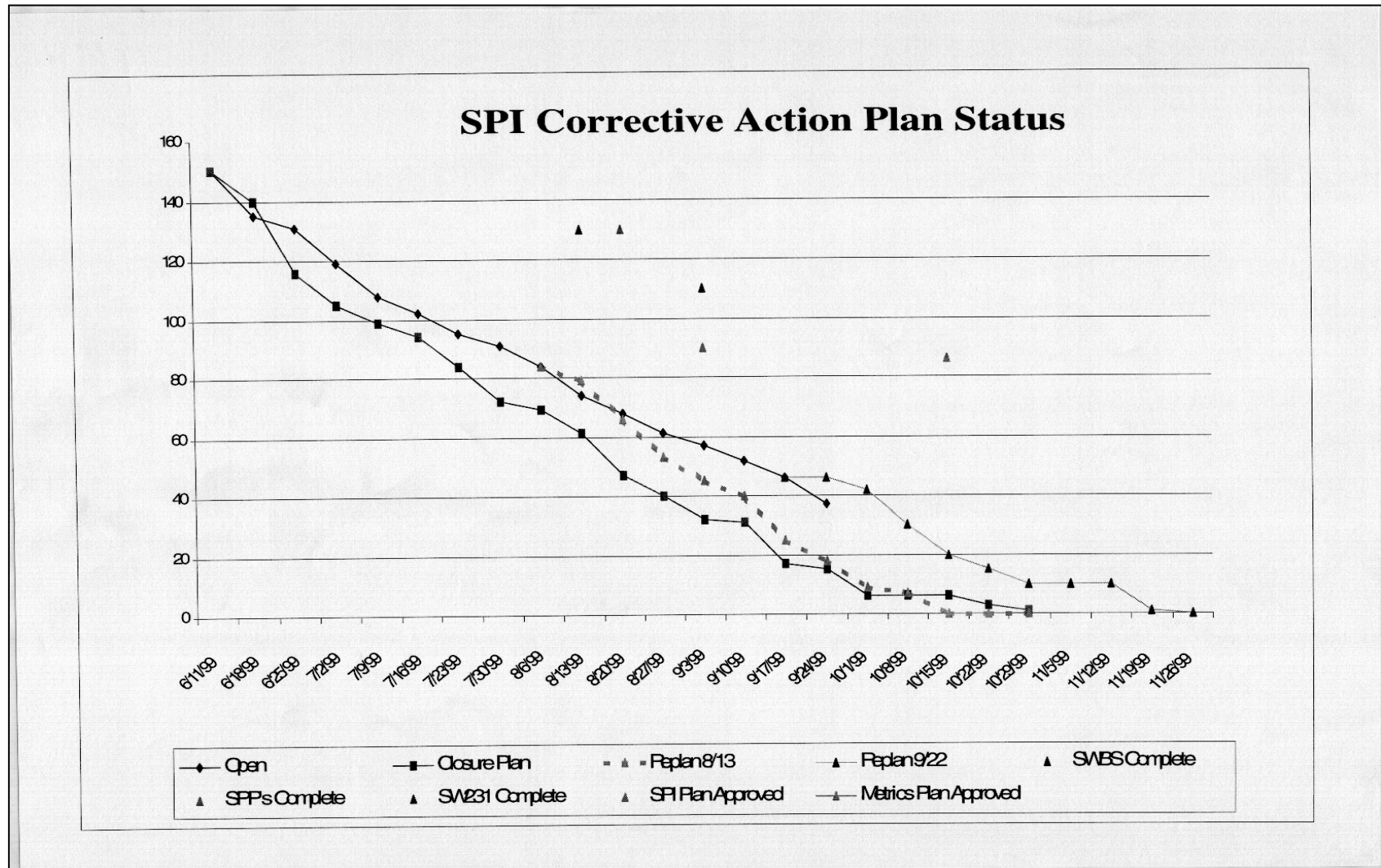
Some underlying issues:

- Metrics Group dreams them up - if it can be measured...
- Asked for (projects must submit) but never used
- Data not used is rarely accurate
- Lack of clear operational definitions
- Cumbersome/burdensome submission process
- Lack of enforcement re: project submissions
- Timeliness/granularity of submissions
- Lack of integrity checks/quality control of submissions



A Few Good Examples & Some Advice

Let Measures Evolve to Match Need



Designing Measures

Align Information Needs to Measures

- helps with big picture; *why* use measures

Identify “who” needs the information

- Example: “**Software project manager** and **software team** need to know: how much are requirements changing.... “

Include Analysis Guidance

Develop Measurement Concept (Ops Concept) first, then the Measurement Construct (Design)

How much are requirements changing and where in the project LC is it happening? Are the number of overall requirements growing? What is the rate of growth? Has the scope expanded such that the project needs to be replanned?

Information Need

Requirements Growth & Stability
See Figure 1

Decision Criteria & Indicator

If Growth > 10% OR Instability > 10%, must document analysis.
If there is any Growth or Instability in Testing Phase, must document analysis.

Analysis Model

Derived Measure(s)

Growth

Instability

Functions

$\text{Growth} = \text{Reqs Added} / \text{Total Reqs}$

$\text{Instability} = (\text{Reqs Added} + \text{Changed} + \text{Deleted}) / \text{Total Reqs}$

Base Measures

Total Requirements at time t

Reqs Added in period t

Reqs Changed in period t

Reqs Deleted in period t

Measurement Methods

Current count+ added - deleted

query SCR system for # reqts added in project in period t

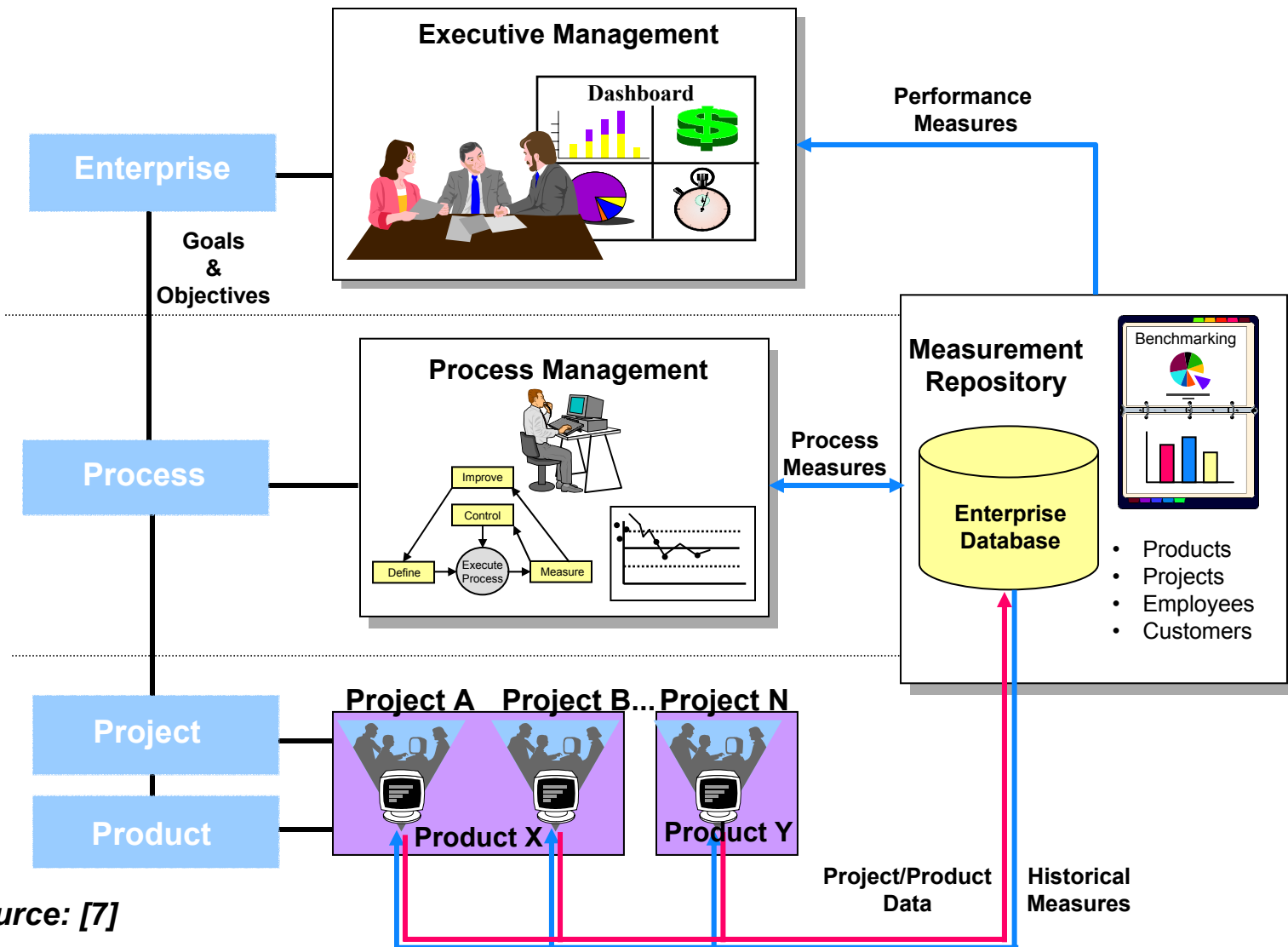
query SCR system for # reqts changed in project in period t

query SCR system for # reqts deleted in project in period t

Caliber, Requisite Pro or SRS (current count); SCRs

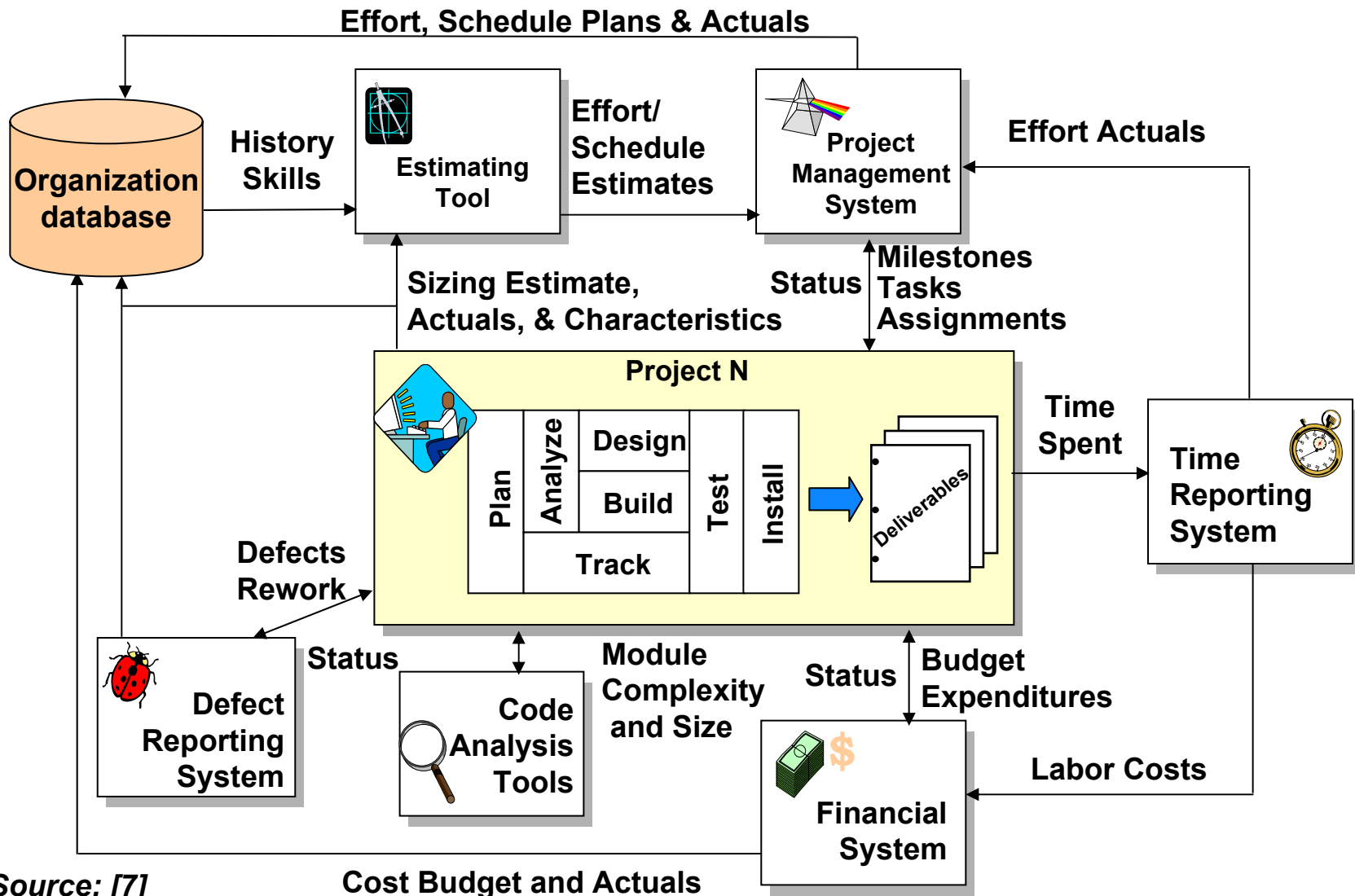
The Process (Entities & Attributes)

Draw Simple Pictures



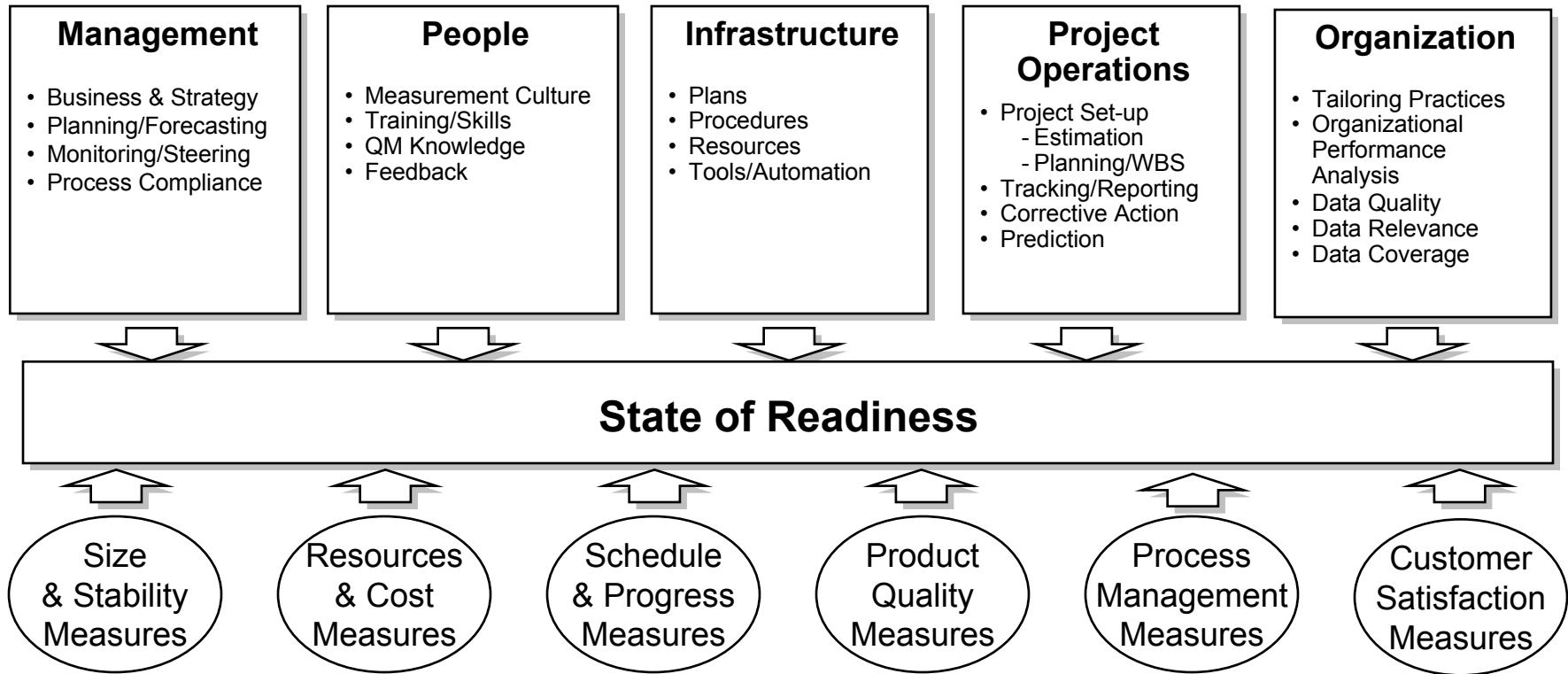
Source: [7]

Automate/Integrate Systems



Source: [7]

Evaluate Measurement Readiness



Source: [8]

References

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2. Paulk, Mark C., Charles V. Weber, Bill Curtis, Mary Beth Chrissis. *The Capability Maturity Model: Guidelines for Improving the Software Process*. Addison-Wesley, 1995.
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6. “Common Assessment Findings Report”, SPC-97031-MC, Software Productivity Consortium.
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