All Others Bring Data

CMMI® and Goal-Driven Measurement

Software Engineering Institute
Carnegie Mellon University
Pittsburgh, PA 15213

Charlene Gross and Wolf Goethert
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In God We Trust, All Others Bring

Benefit and Value of Measurement

The benefit and value of measurement comes from the decisions and actions taken in response to analysis of the data, not from the collection of the data.

Objectives

Review basic concepts of CMMI® and Goal-Driven Measurement

Provide examples of relationships between CMMI® and Goal-Driven Measurement

Describe application of measurement throughout CMMI®

Definition – CMMI-DEV, Version 1.2 (CMMI)

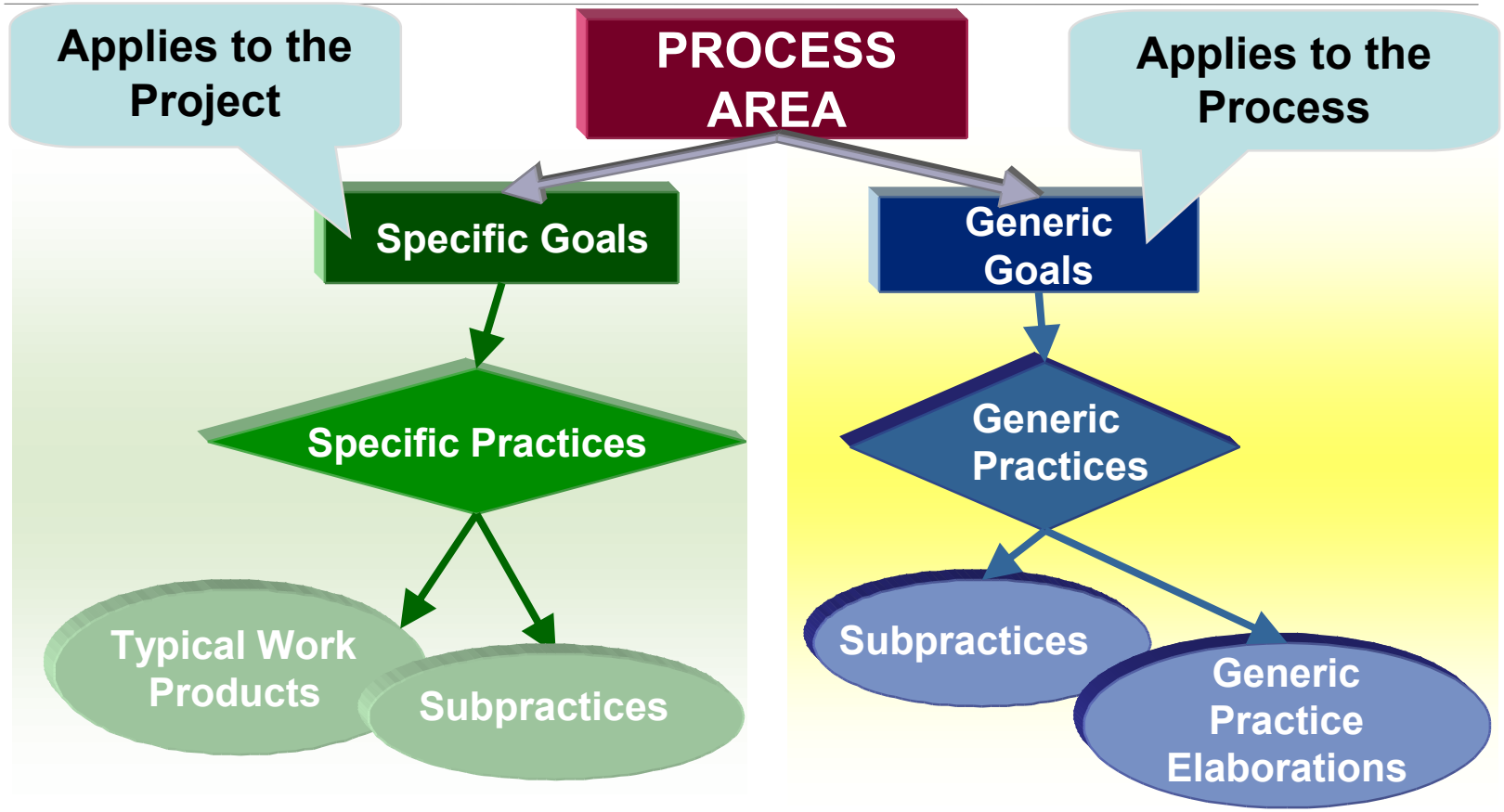
Non-prescriptive best practices

Infuse quality into products through the use of better processes

Focuses on improving processes from ad hoc, immature processes to disciplined, mature processes

If you can't describe what you are doing as a process, you don't know what you're doing. ---W. Edwards Deming

ts - CMMI® Model Components



Measurement and Analysis Process Area Specific Goals

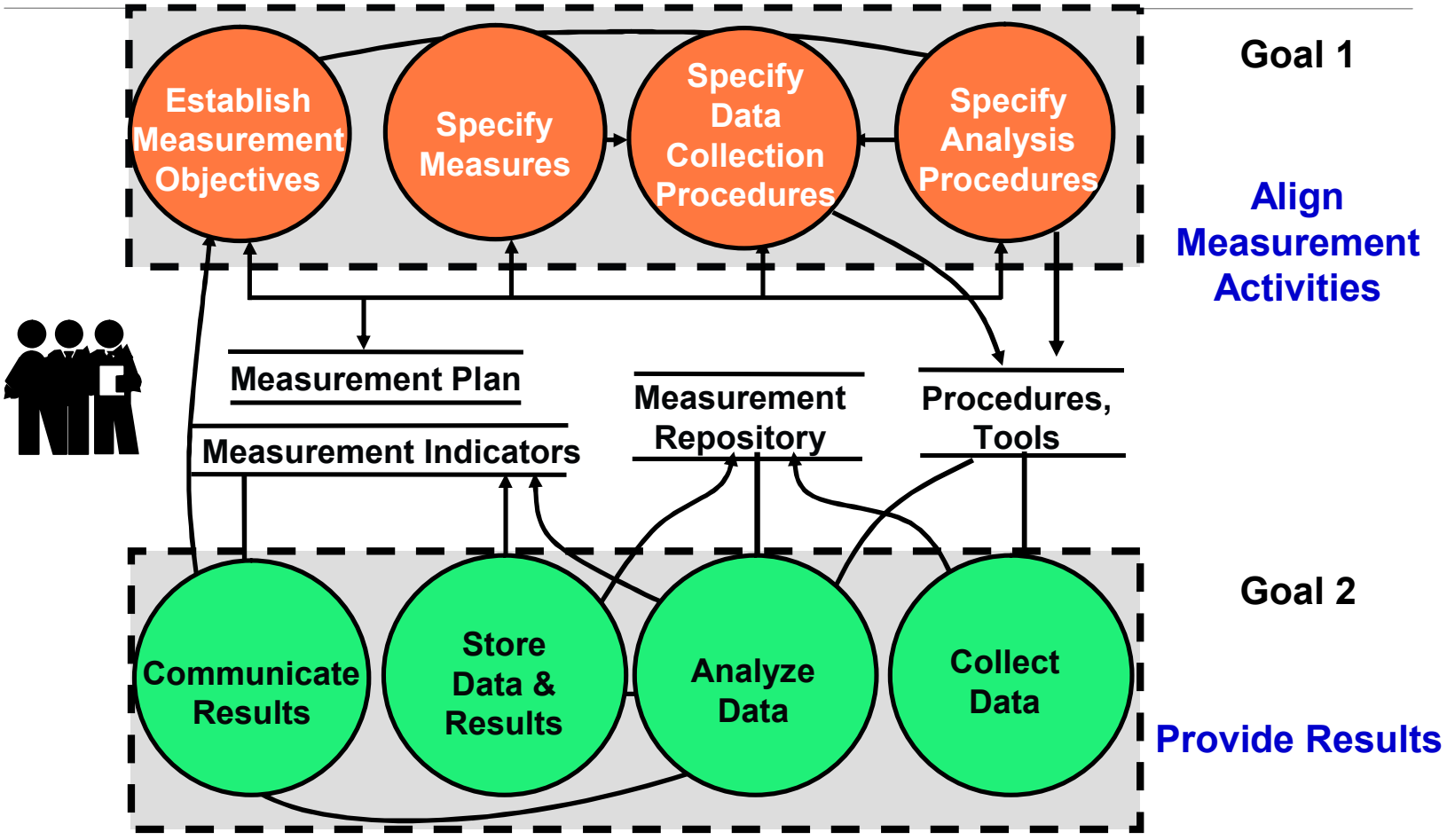
SG 1: Align Measurement and Analysis Activities

- Measurement objectives and activities are aligned with identified information needs and objectives.

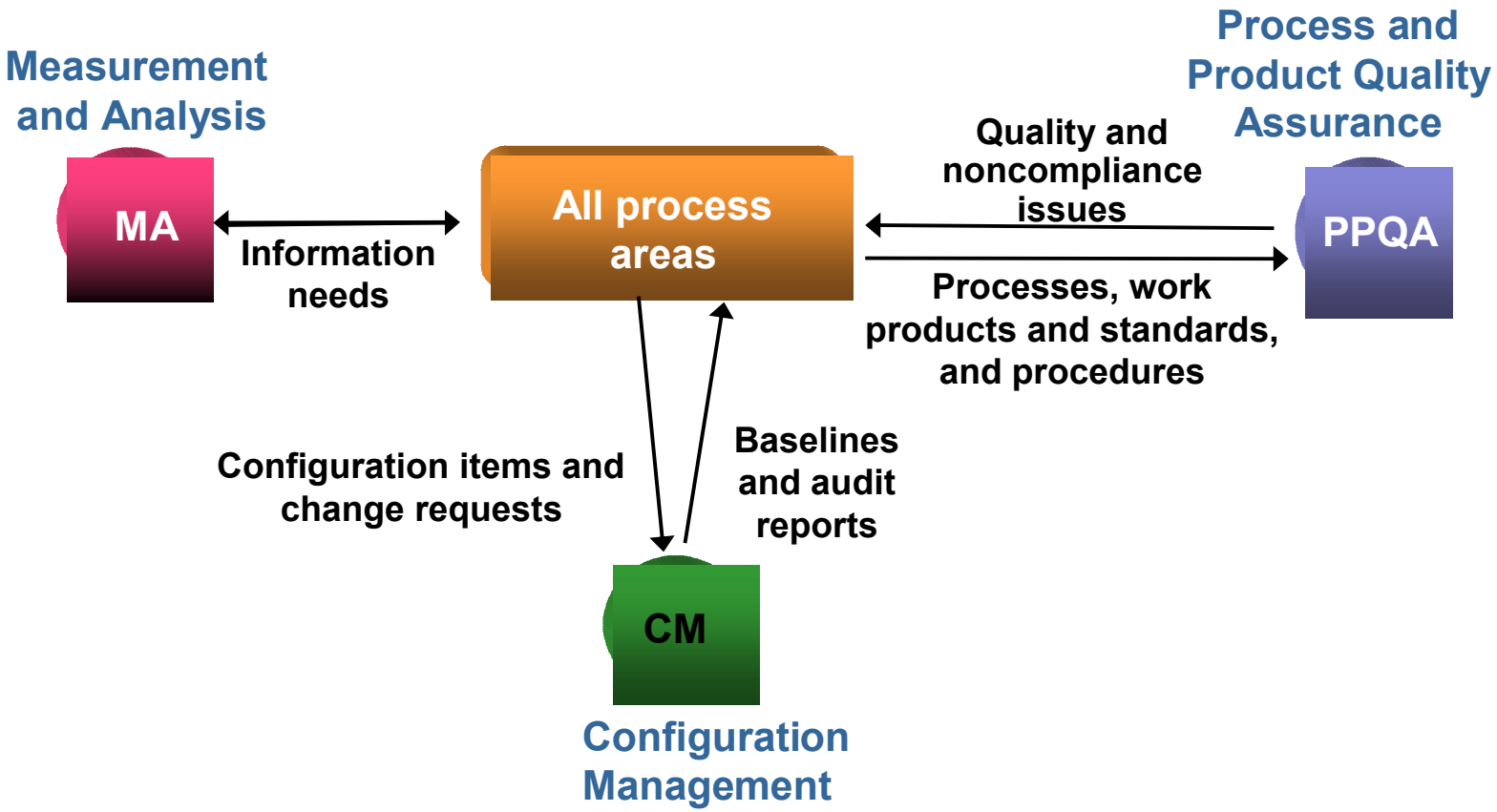
SG 2: Provide Measurement Results

- Measurement results that address identified information needs and objectives are provided.

MA Specific Practices



Measurement and Analysis Supports All Other CMMI Process Areas



[CMMI-DEV Version 1.2, Relationships Among Process Areas p. 63]

Goal-Driven Measurement

First Law of Blissful Ignorance

"What you don't know will always hurt you."

[Robbins and Finley, 1996]

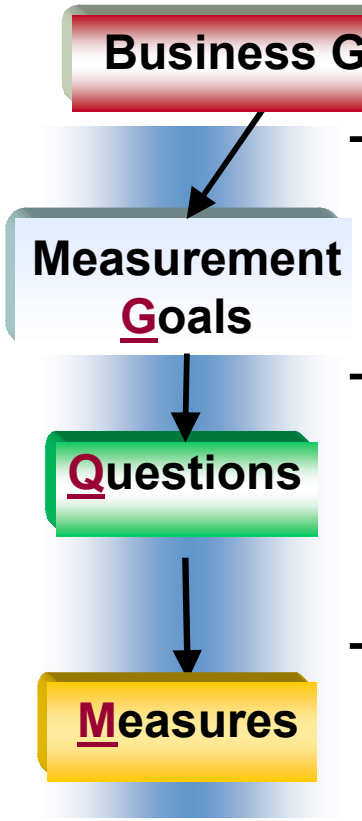
Goal Driven Measurement – Definition

Adaptable process to identify and define measures

Begins with identifying business goals and breaking them down into manageable subgoals

Ends with a plan for implementing well-defined measures and indicators that support the goals

oal-Question-Metric (GQM)



What are our business goals?

Å **Improve customer satisfaction by reducing defects**

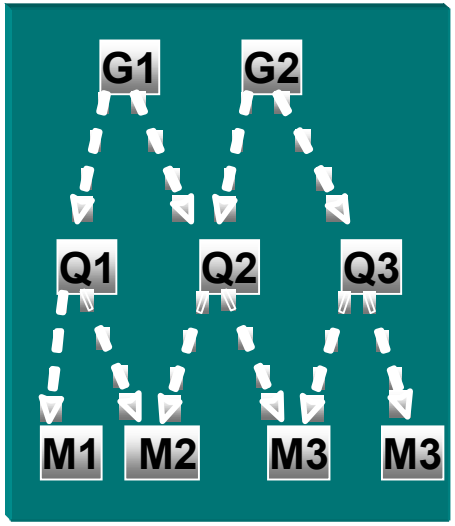
What do we want to achieve in order to satisfy our business goals?

Å **Reduce post-delivery defects to "N" per KLOC**

What questions will help us plan & manage progress toward our goal?

Å **Where are defects introduced & removed?**

Å **How effective are peer reviews?**



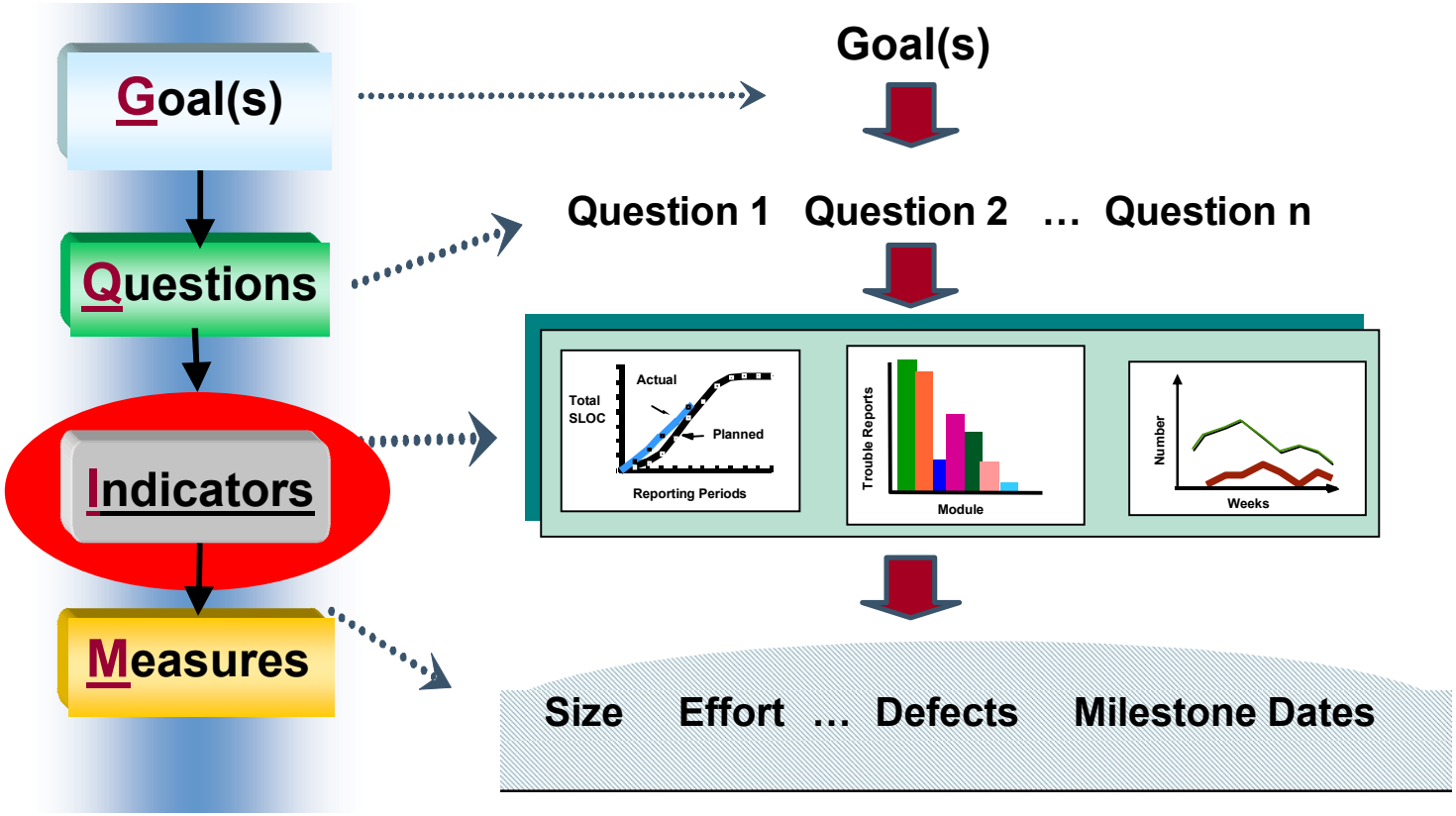
What measures are necessary to answer these questions?

Å **Defects detected in peer review, testing ...**

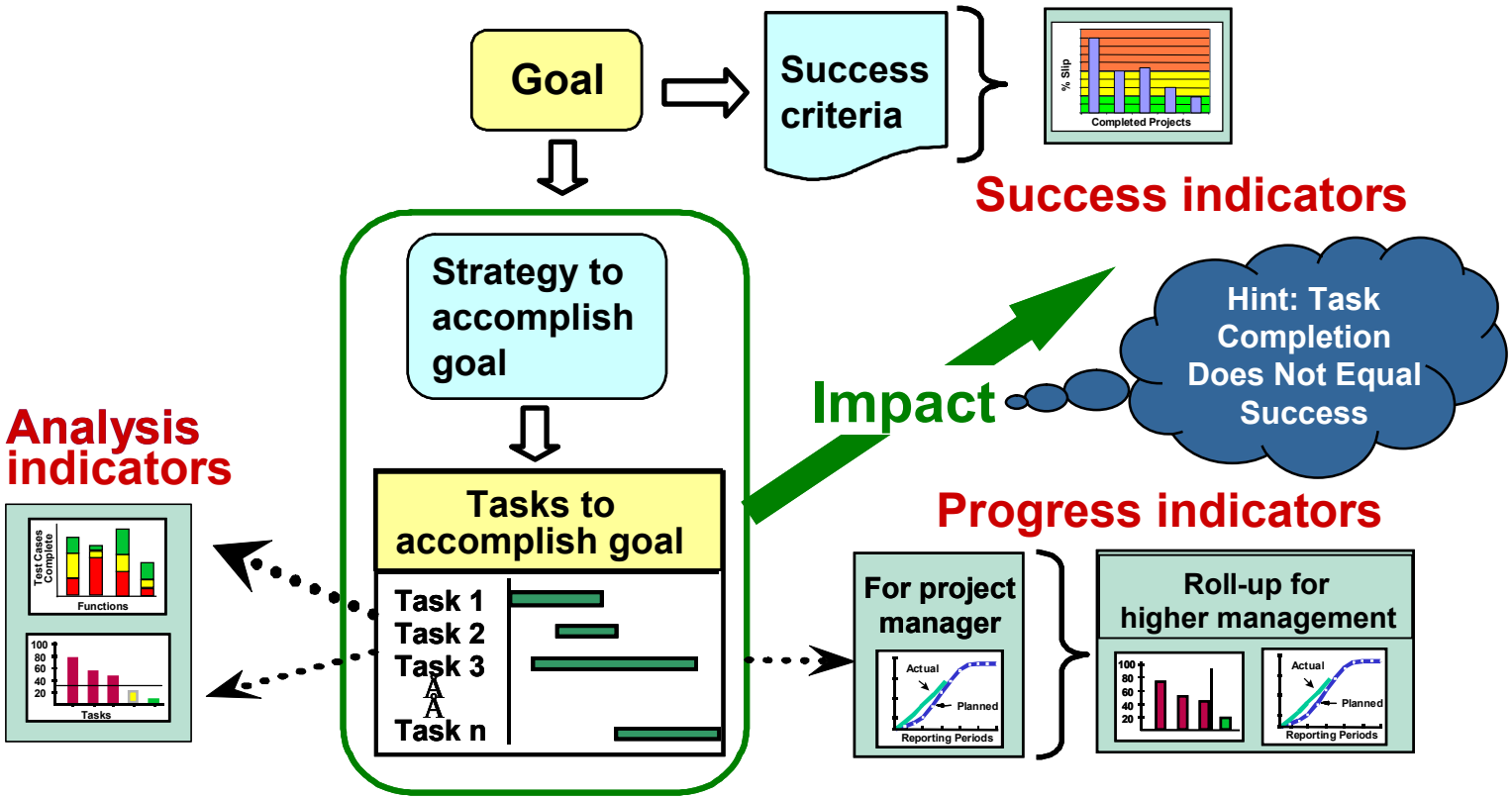
Å **Defect categorization, rework time ...**

[Basili 88, Basili 89, Rombach 89]

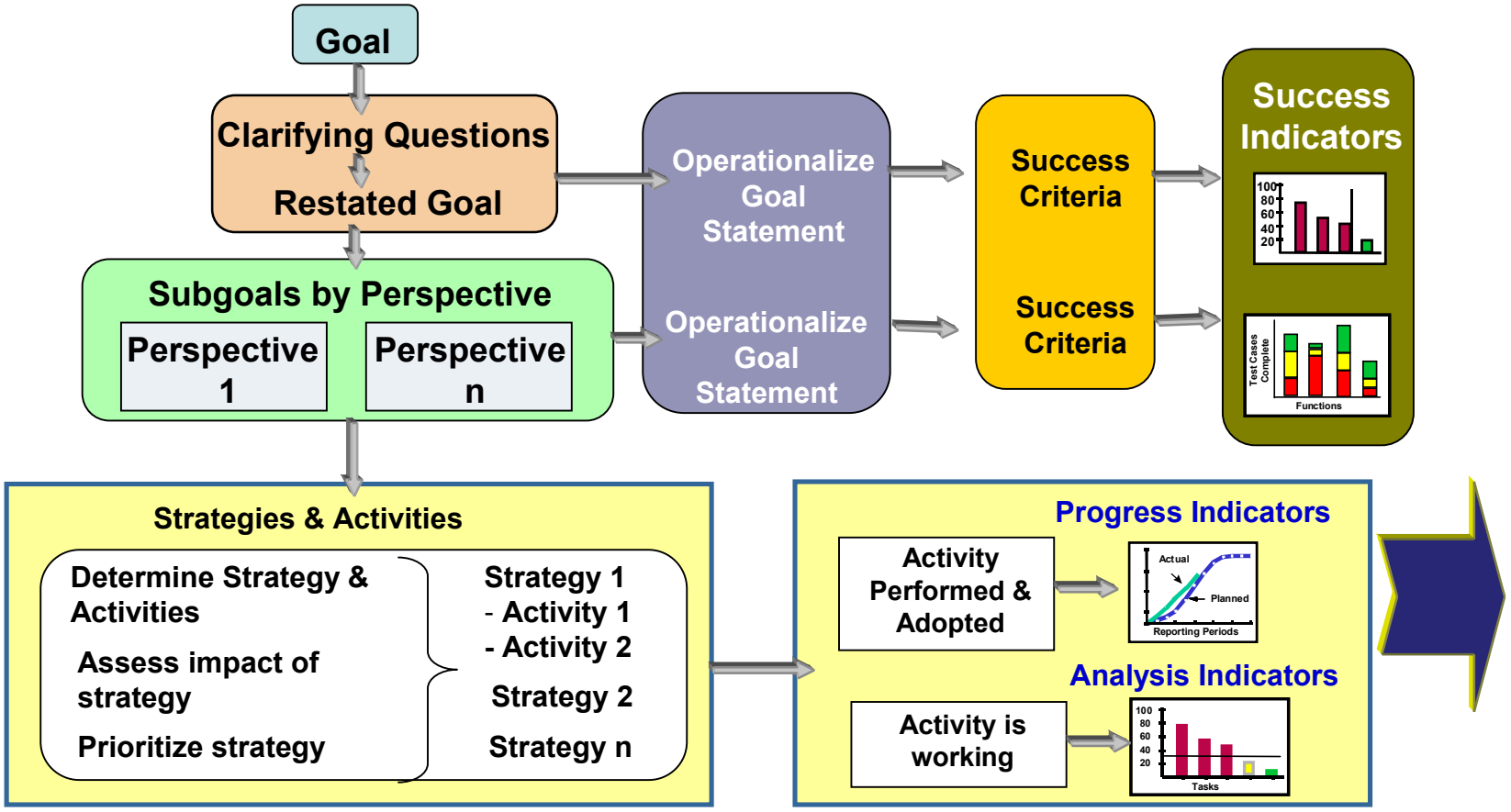
Goal Driven Measurement Process Model



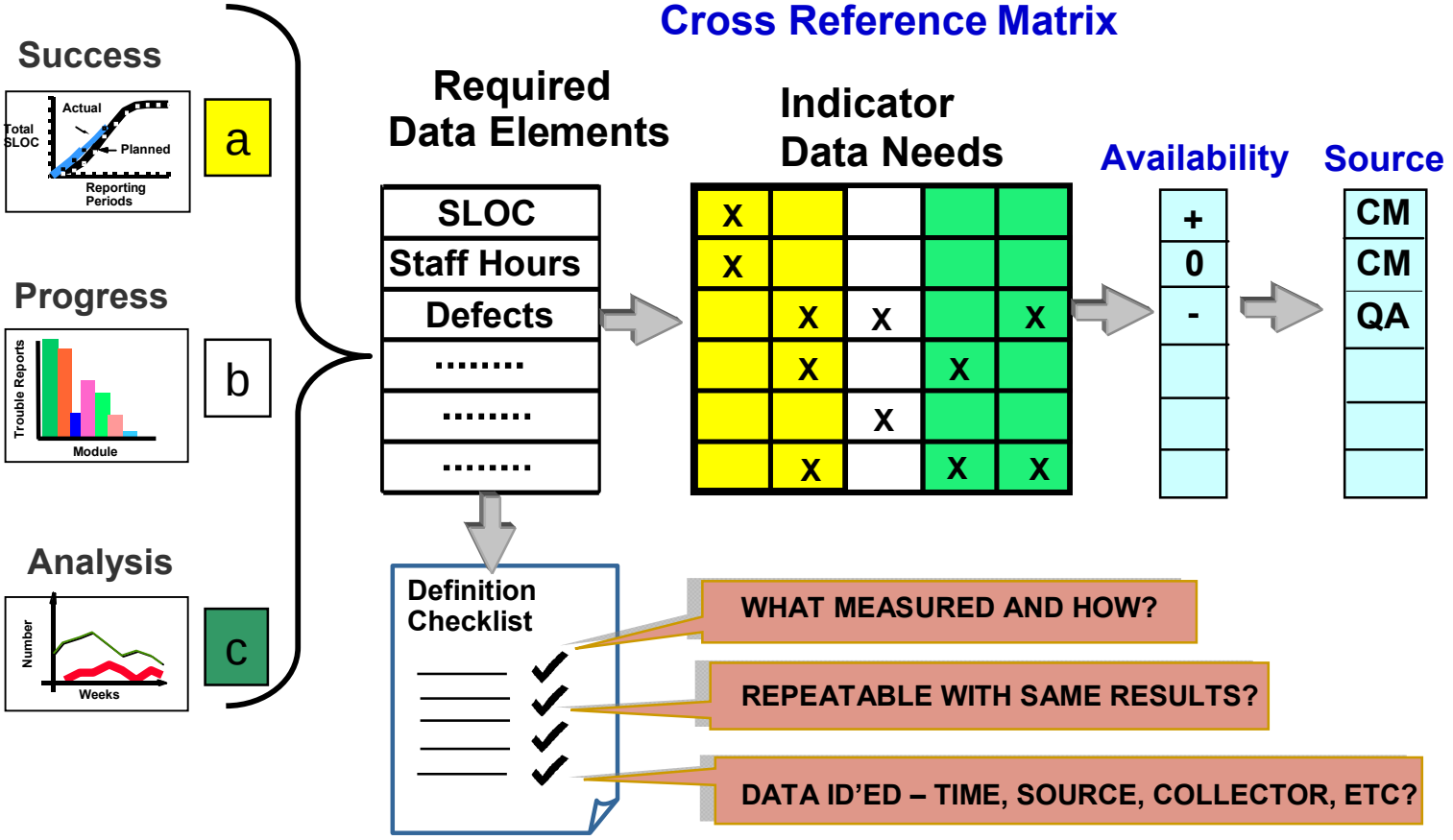
Types of Indicators



oal-Driven Measurement – GQ(I)M Steps



Applying Goal-Driven Measurement – GQ(I)M Steps -2



Applying Goal-Driven Measurement – GQ(I)M Steps -3

Identify Actions Needed to Implement Your Measures

List of data elements

1
2
3
4
5
6

Available source

Typical Planning tasks

	Data element 1	2	3	4
Data elements defined	Y	N	60%	Not Doc'd
Data collection procedure defined	50%	N	60%	Not Doc'd
How data are to be stored and accessed defined	N	N	30%	Not Doc'd
Data collection forms defined	N	N	N	N
Process guide for Collecting the data prepared	N	N		

Verification

Data Elements
Size
Defects

Avail	Source
+	QA
0	CM
-	?
0	Etc.
+	Å
- -	Å

Planning Tasks	Data Elements 1	2	3	4	5
Task 1		50	N		Y
Task 2		Y		Y	Y
Task 3	Y		Y		
Task n		N		Y	

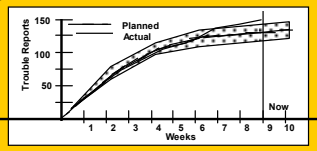
Analysis & Diagnosis

Action Plans

Q(?) Indicator Template

1 Indicator Template

- Date
- Indicator Name/Title
- Objective
- Questions
- Visual Display



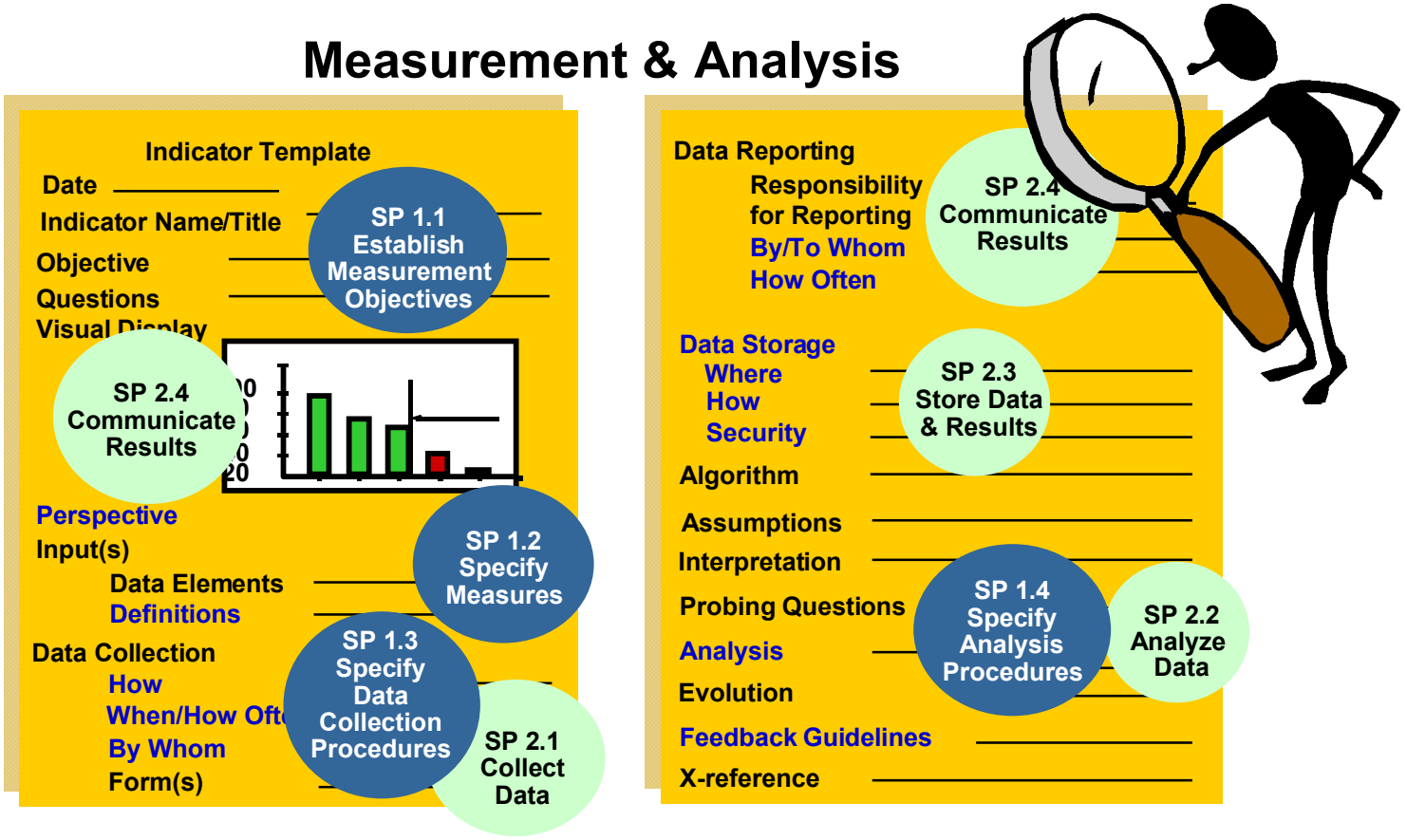
- Perspective Input(s)
  - Data Elements
  - Definitions
- Data Collection
  - How
  - When/How Often
  - By Whom
  - Form(s)

2

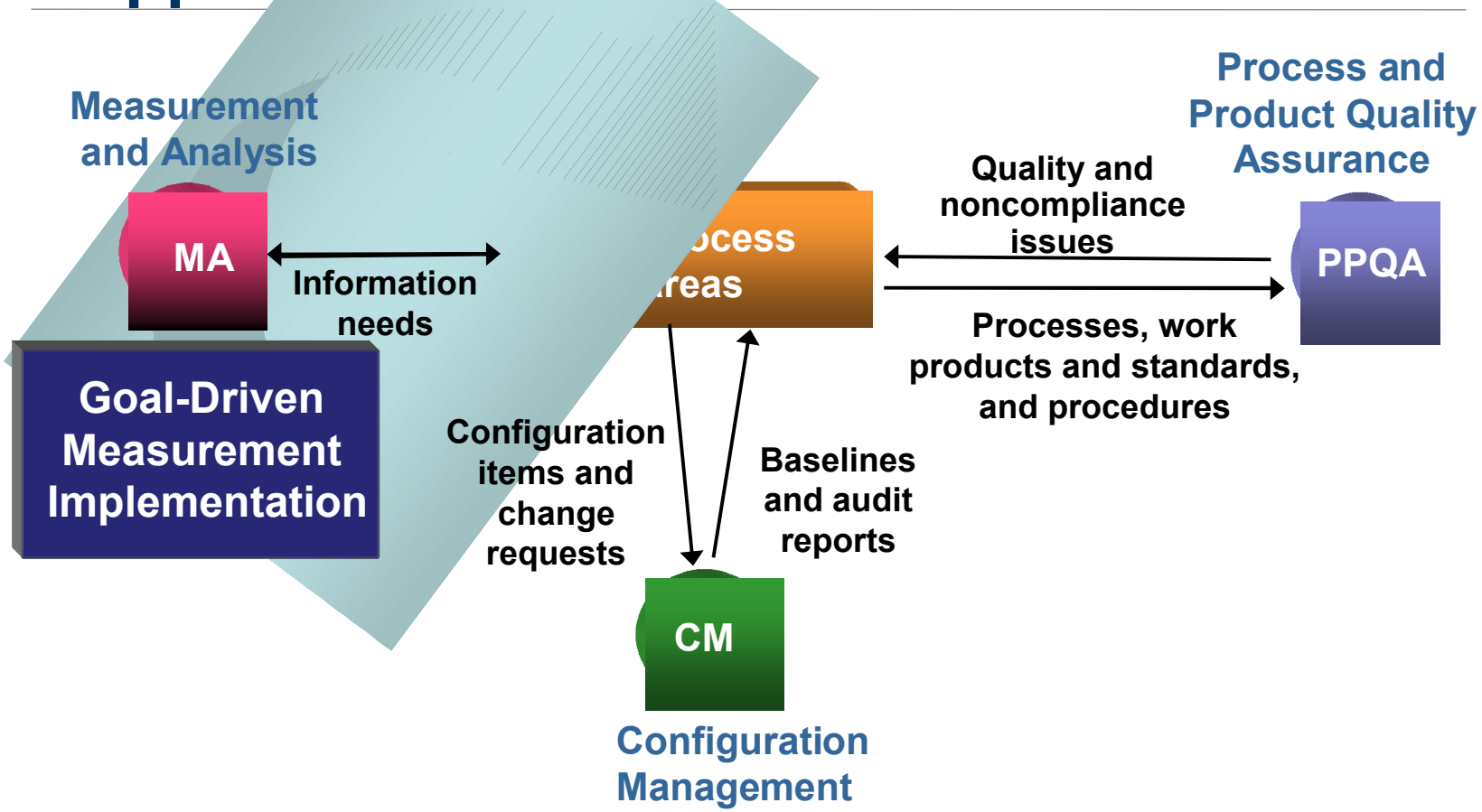
- Data Reporting
  - Responsibility for Reporting
  - By/To Whom
  - How Often
- Data Storage
  - Where
  - How
  - Security
- Algorithm
- Assumptions
- Interpretation
- Probing Questions
- Analysis
- Evolution
- Feedback Guidelines
- X-reference

One accurate measurement is worth a thousand expert opinions. ---Admiral Grace Hopper

Mapping CMMI Measurement and Analysis to Indicator Template

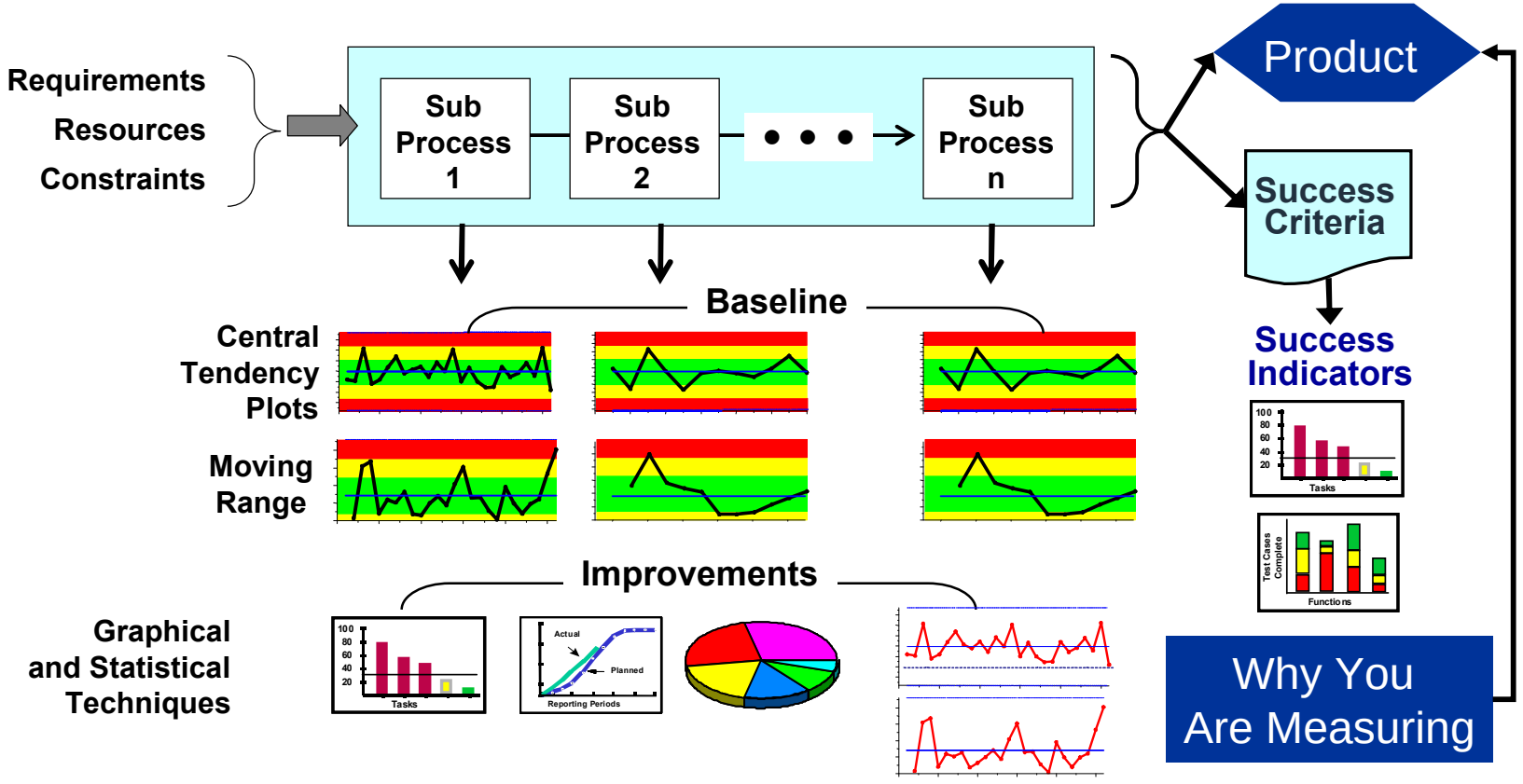


Goal-Driven Measurement Implementation Supports All CMMI Process Areas



[CMMI-DEV Version 1.2, Relationships Among Process Areas p. 63]

How Goal Driven Measurement Supports CMMI – High Maturity Organizations



...ne Ways That Goal-Driven Measurement Supports PAs At All Levels - 1

The following samples are drawn from the informative material of the PAs.

Color coding for PAs is by Maturity Level and solely for illustration of the broad application of Goal-Driven Measurement.

Yellow = Maturity Level 2 PAs

Green = Maturity Level 3 PAs

Blue = Maturity Level 4 PAs

Orange = Maturity Level 5 PAs

White = Generic Practices

Backup slides provide more detail for each PA, as well as the complete name of the PA represented.

Sampling The Ways That Goal-Driven Measurement Supports PAs At All Levels - 2

Measurement assumptions, definitions, what counts, what doesn't

- Project Monitoring and Control ML2
- Organizational Process Performance ML4
- Quantitative Project Management ML4

Description of approach for measuring and analyzing performance data

- Project Monitoring and Control ML2
- Organizational Process Focus ML3
- Integrated Project Management + IPPD ML3
- Quantitative Project Management ML4
- Causal Analysis and Resolution ML5
- Organizational Innovation and Deployment ML5
- Generic Practice 2.2 Plan the Process

Defined requirements for collection

- Verification ML3
- Organizational Process Performance ML4
- Quantitative Project Management ML4
- Causal Analysis and Resolution ML5
- Organizational Innovation and Deployment ML5

Sampling The Ways That Goal-driven Measurement Supports PAs At All Levels -3

Documentation of organizational and measurement objectives

- Organizational Process Focus ML3
- Causal Analysis and Resolution ML5
- Organizational Innovation and Deployment ML5
- Generic Practice 4.2 Stabilize Sub process Performance
- Generic Practice 5.1 Ensure Continuous Process Improvement

Information and descriptions to understand and interpret measures

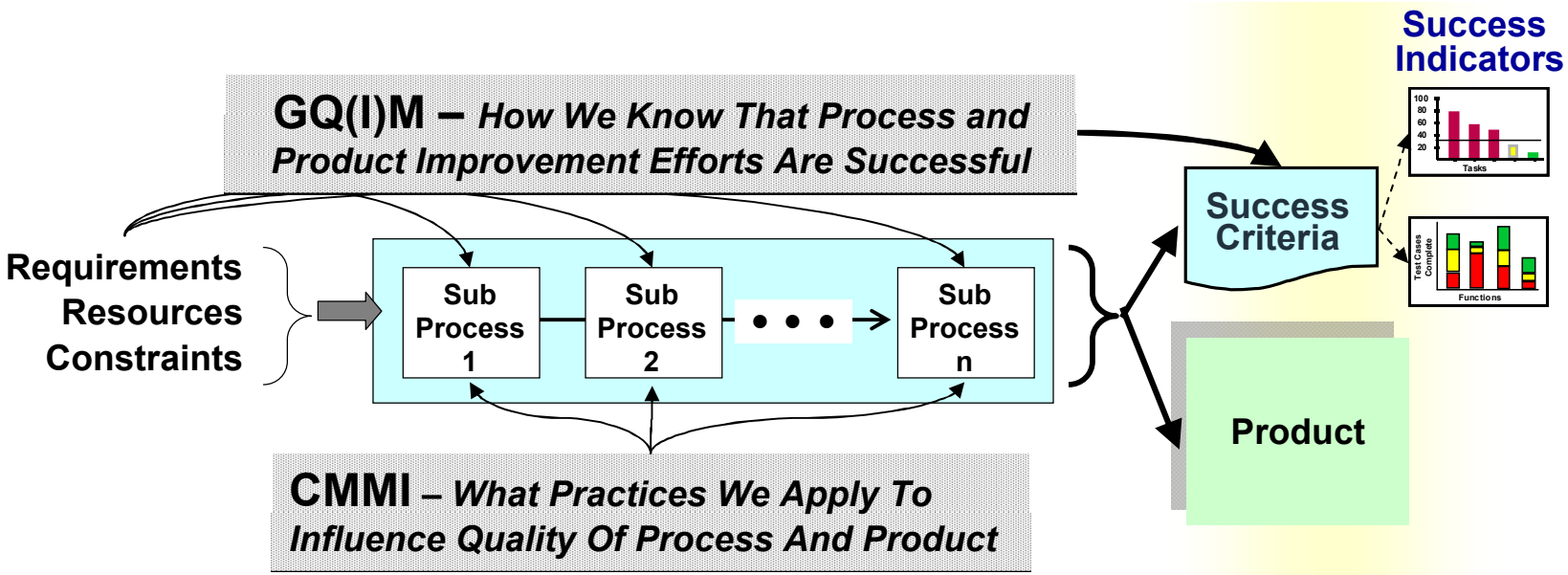
- Organizational Process Definition + IPPD ML3
- Quantitative Project Management ML4
- Generic Practice 2.8 Monitor and Control the Process
- Generic Practice 3.2 Collect Improvement Information

Definitions of measures and measurement activities

- Verification ML3
- Organizational Process Performance ML4
- Quantitative Project Management ML4
- Causal Analysis and Resolution ML5
- Organizational Innovation and Deployment ML5

Conclusion

The Quality Of The Product Is Highly Influenced By The Quality Of The Process"



Were we successful?

Customer perspective (final product)
Organizational perspective (processes)

- On time
- Within budget
- Of acceptable quality
- Does what its supposed to do
- Customers like it

Basic Concepts Summary

CMMI Version 1.2 Model Structure

Measurement and Analysis Process Area

SG 1 Align Measurement and Analysis Activities

SP 1.1 Establish Measurement Objectives

SP 1.2 Specify Measures

SP 1.3 Specify Data Collection and Storage Procedures

SP 1.4 Specify Analysis Procedures

SG 2 Provide Measurement Results

SP 2.1 Collect Measurement Data

SP 2.2 Analyze Measurement Data

SP 2.3 Store Data and Results

SP 2.4 Communicate Results

Goal-Driven Measurement Process

Step 1: Identify you business goals

Step 2: Identify what you want to know or learn

Step 3: Identify your subgoals

Step 4: Identify the entities and attributes

Step 5: Formalize your measurement goals

Step 6: Identify your measurement questions & indicators

Step 7: Identify the data elements

Step 8: Define and document measures and indicators

Step 9: Identify the actions needed to implement your measures

Step 10: Prepare a plan

Finding Additional Goal-Driven Measurement Information . . .

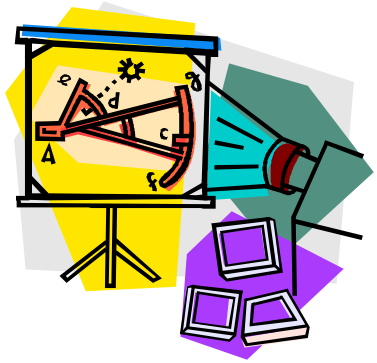
Organizational – Dave Zubrow, Director SEMA; Wolf Goethert, Bob Ferguson, Jeanine Siviy,

Selected Publications –

- Goal-Driven Software Measurement--A Guidebook. Robert E. Park, Wolfhart B. Goethert, William A. Florac. CMU/SEI-96-HB-002. http://www.sei.cmu.edu/pub/documents/96.reports/pdf/hb002.96.pdf
- Applications of the Indicator Template for Measurement and Analysis. Wolfhart Goethert and Jeannine Siviy. CMU/SEI-2004-TN-024. http://www.sei.cmu.edu/pub/documents/04.reports/pdf/04tn024.pdf
- Experiences in Implementing Measurement Programs. Wolfhart Goethert and Will Hayes. CMU/SEI-2001-TN-026. http://www.sei.cmu.edu/pub/documents/01.reports/pdf/01tn026.pdf

Questions

Backup Slides



PMC - Project Monitoring & Control

SP 1.1 Monitor Project Planning Parameters

Monitor the actual values of the project planning parameters against the project plan.

GQ(I)M Process and Indicator Supports:

- Recording associated contextual information (e.g. assumptions, definitions, what counts and what doesn't) to help understand the measures.

PMC - Project Monitoring & Control -2

SP 1.6 Conduct Progress Reviews

Periodically review the project's progress, performance, and issues.

GQ(I)M Process and Indicator Supports:

- Description of approach for measuring and analyzing project performance data

Ver- Verification

SP 2.1 Prepare for Peer Reviews

Prepare for peer reviews of selected work products.

GQ(I)M Process and Indicator Supports:

- Record of defined requirements for collecting data during the peer review

SP 3.2 Analyze Verification Results

Analyze the results of all verification activities.

GQ(I)M Process and Indicator Supports:

- Documentation of technical performance parameters as part of measurement definition.

OPF – Organizational Process Focus

SP 1.1 Establish Organizational Process Needs

Establish and maintain the description of the process needs and objectives for the organization.

GQ(I)M Process and Indicator Supports:

- Documentation of measurement objectives established by tying organizational objectives to the picture of success and what we need to know

OPF – Organizational Process Focus -2

SP 3.4 Incorporate Process-Related Experiences into the Organizational Process Assets

Incorporate process-related work products, measures, and improvement information derived from planning and performing the process into the organizational process assets.

GQ(I)M Process and Indicator Supports:

- Documentation of how the organization's common set of measures will be analyzed

SP 1.4 Establish the Organization's Measurement Repository

Establish and maintain the organization's measurement repository.

GQ(I)M Process and Indicator Supports:

- Information and descriptions needed to understand and interpret the measures and assess them for reasonableness and applicability.

Integrated Project Management + IPPD

SP 1.4 Integrate Plans

Integrate the project plan and the other plans that affect the project to describe the project's defined process.

GQ(I)M Process and Indicator Supports:

- Definitions of measures and measurement activities for managing the project

Integrated Project Management + IPPD -2

SP 1.5 Manage the Project Using the Integrated Plans

Manage the project using the project plan, the other plans that affect the project, and the project's defined process.

GQ(I)M Process and Indicator Supports:

- Documentation of approach to obtaining and analyzing the selected measures to manage the project and support the organizationôs needs.

OPP – Organizational Process Performance

SP 1.2 Establish Process-Performance Measures

Establish and maintain definitions of the measures that are to be included in the organization's process-performance analyses.

GQ(I)M Process and Indicator Supports:

- Selection of measures and definitions for appropriate insight into the organizationôs quality and process performance

OPP – Organizational Process Performance -2

SP 1.4 Establish Process-Performance Baselines

Establish and maintain the organization's process-performance baselines.

GQ(I)M Process and Indicator Supports:

Å Documentation of collection information for measures

SP 2.1 Select Measures and Analytic Techniques

Select the measures and analytic techniques to be used in statistically managing the selected sub-processes

GQ(I)M Process and Indicator Supports:

- Development of definitions of the measures and analytic techniques to be used in (or proposed for) statistically managing the sub-processes; operational definitions of the measures, their collection points in the sub-processes, and how the integrity of the measures will be determined

CAR - Causal Analysis And Resolution

SP 1.1 Select Defect Data for Analysis

Select the defects and other problems for analysis.

GQ(I)M Process and Indicator Supports:

- Documentation of objectives established for measurement and analysis, specifying the measures and analyses to be performed, obtaining and analyzing measures, and reporting results

OID – Organizational Innovation and Deployment

SP 2.1 Plan the Deployment

Establish and maintain the plans for deploying the selected process and technology improvements.

GQ(I)M Process and Indicator Supports:

- Establishment of measures and objectives for determining the value of each process and technology improvement with respect to the organizationôs quality and process-performance objectives

OID – Organizational Innovation and Deployment -2

SP 2.3 Measure Improvement Effects

Measure the effects of the deployed process and technology improvements.

GQ(I)M Process and Indicator Supports:

- Establishing objectives for measurement and analysis, specifying the measures and analyses to be performed, obtaining and analyzing measures, and reporting results.

Generic Goal (GG) 2

GP 2.2 Plan the Process

Establish and maintain the plan for performing the process.

GQ(I)M Process and Indicator Supports:

- Identification and documentation of measurement requirements to be included in the plan for performing the process

Generic Goal (GG) 2

GP 2.8 Monitor and Control the Process

Monitor and control the process against the plan for performing the process and take appropriate corrective action.

GQ(I)M Process and Indicator Supports:

- Documentation of established measures for monitoring actual performance of the process.

Generic Goal (GG) 3

GP 3.2 Collect Improvement Information

Collect work products, measures, measurement results, and improvement information derived from planning and performing the process to support the future use and improvement of the organization's processes and process assets.

GQ(I)M Process and Indicator Supports:

- Selection of appropriate measures to support future use and improvement of processes and process assets

Generic Goal 4

GP 4.2 Stabilize sub-process Performance

Stabilize the performance of one or more sub-processes to determine the ability of the process to achieve the established quantitative quality and process-performance objectives.

GQ(I)M Process and Indicator Supports:

- Selection of process and product measures to be incorporated into the organizationôs measurement repository to support process-performance analysis and future fact-based decision making

General Goal 5

GP 5.1 Ensure Continuous Process Improvement

Ensure continuous improvement of the process in fulfilling the relevant business objectives of the organization.

GQ(I)M Process and Indicator Supports:

- Identification of process improvements that would result in measurable improvements to process performance.