Measuring Economic Benefits of Process Improvement in CMMI Level 1 Organizations


Aldo Dagnino

**ABB Inc.
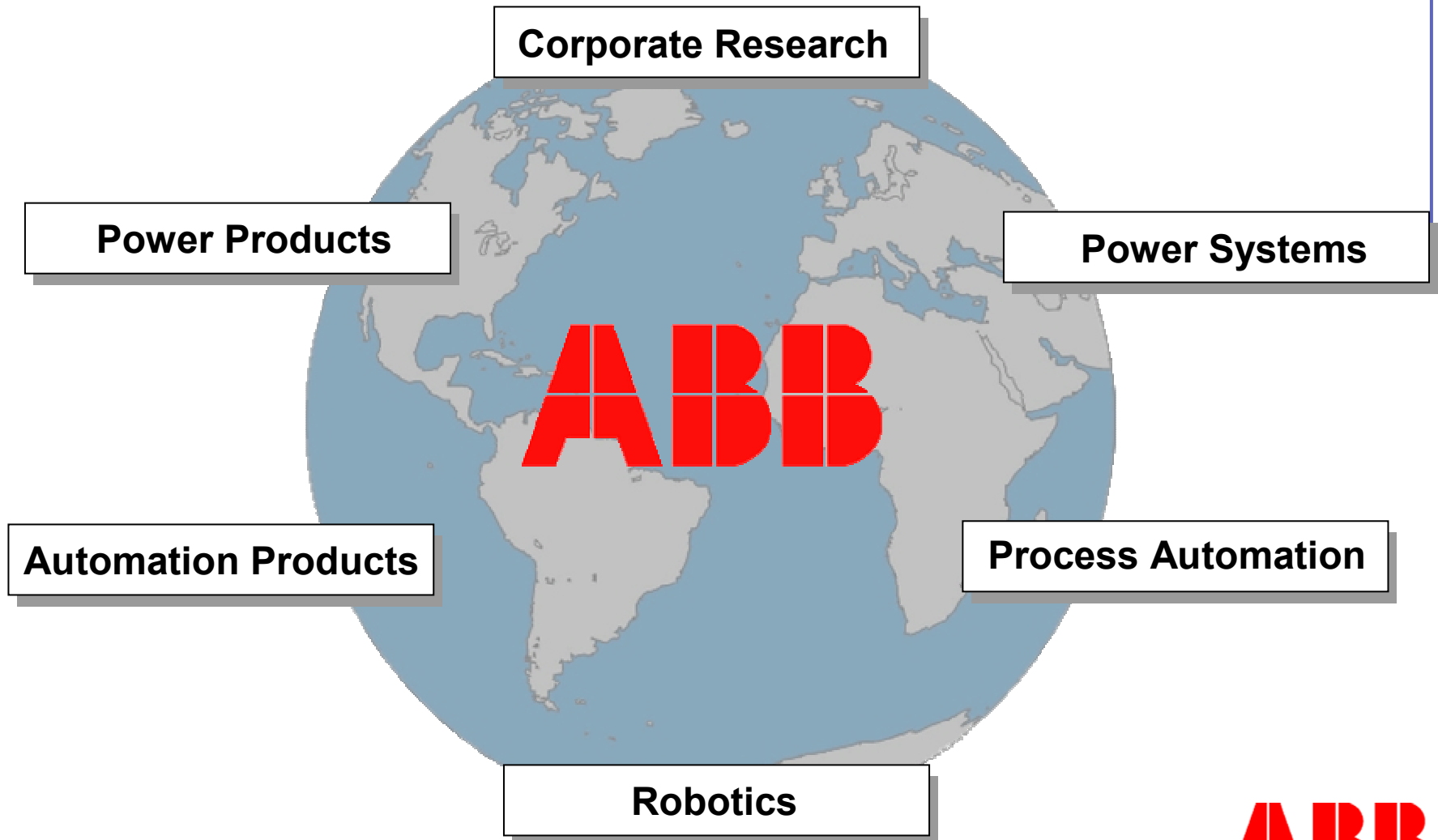US Corporate
Research Center
Raleigh, NC**

ABB Overview

- Leader in power and automation technologies

- Enable utility and industry customers to improve performance while lowering environmental impact

- ABB's products help operate Utilities, process industries, manufacturing plants, and other industries

- Present in over 120 countries and employs 110,000 people

- First company in the world to sell 100,000 robots

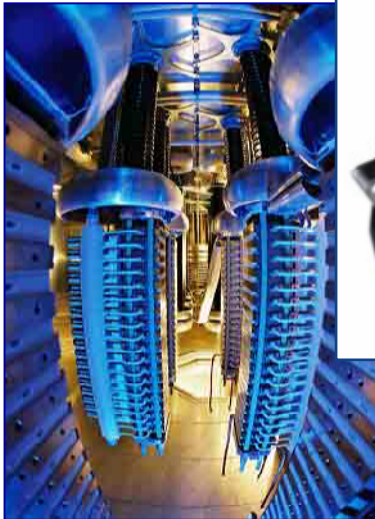- A vast majority of ABB products have software & hardware components
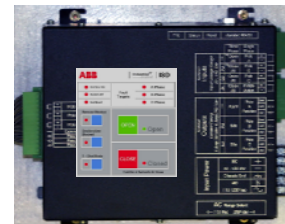
ABB's Organizational Structure
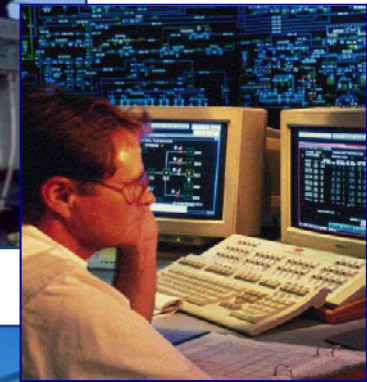
Corporate Research

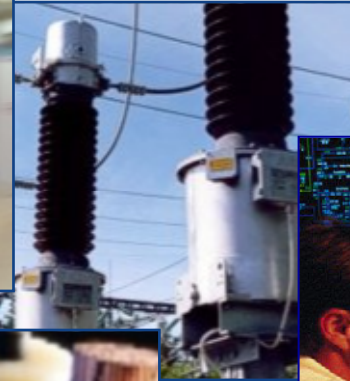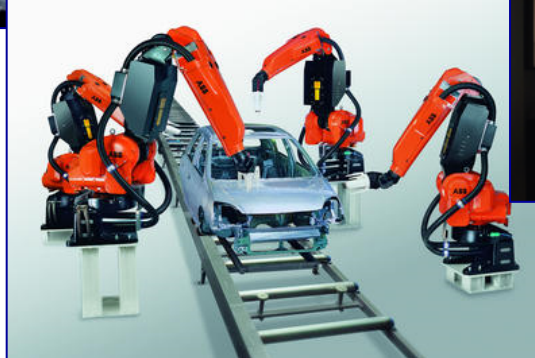Power Products

Power Systems

Automation Products

Process Automation

Robotics

ABB's Products

- Power Products
- Power Systems

ABB

ABB's Products

- Automation Products

- Process Automation

- Robotics

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- ABB Software Process Initiative (ASPI) acts as the Corporate Engineering Process Group

- ASPI is composed of members from 2 ABB Corporate Research Centers (CRCs):
  - United States: Raleigh
  - Sweden: Vasteras

- Responsible for:
  - Initiation activities
  - Performance of appraisals
  - Development of improvement methodologies,
  - Evaluation and deployment of pilots within ABB for CMMI transition, PSP/TSP, etc.
  - Assisting units in establishing improvement plans and acting
  - Collect lessons learned from process improvement activities

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ABB Corporate EPG Support

Product Development Units in ABB Globally in all Divisions

Local EPG · Local EPG · Local EPG · Local EPG · Local EPG · · ·
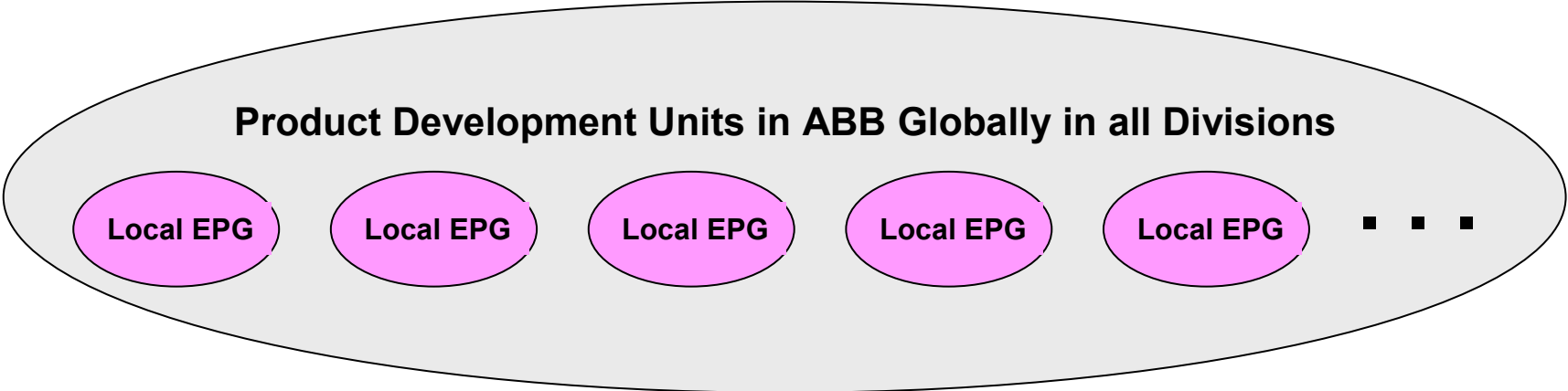
Support ABB Development Units in their Continuous Improvement Efforts to establish a culture of product development excellence

USCRC ASPI Team ⟷ SECRC ASPI Team

CEPG

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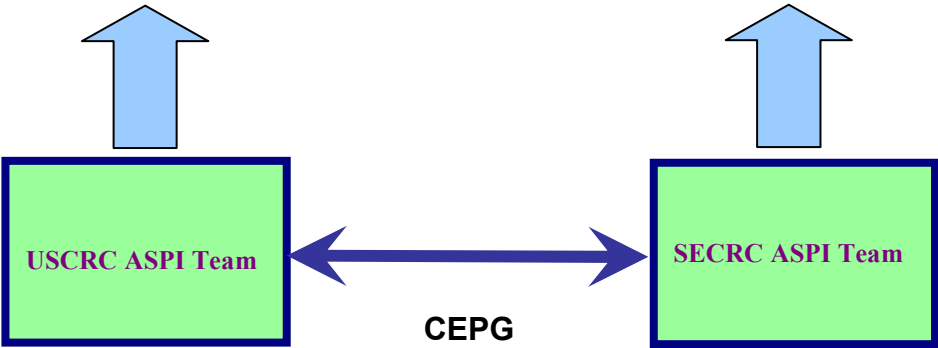
Continuous Process Improvement Cycle

- Initiate Improvement activity
    - Define Medium/Long-term Strategic Improvement Plan (SIP) and identify organization's business goals
- Conduct internal CMMI Appraisal (Class B)
- Develop Process Improvement Plan (PIP)
    - Prioritize process improvement activities using Business Objectives
- Implement PIP and monitor
- Lessons learned
- Re-Initiate

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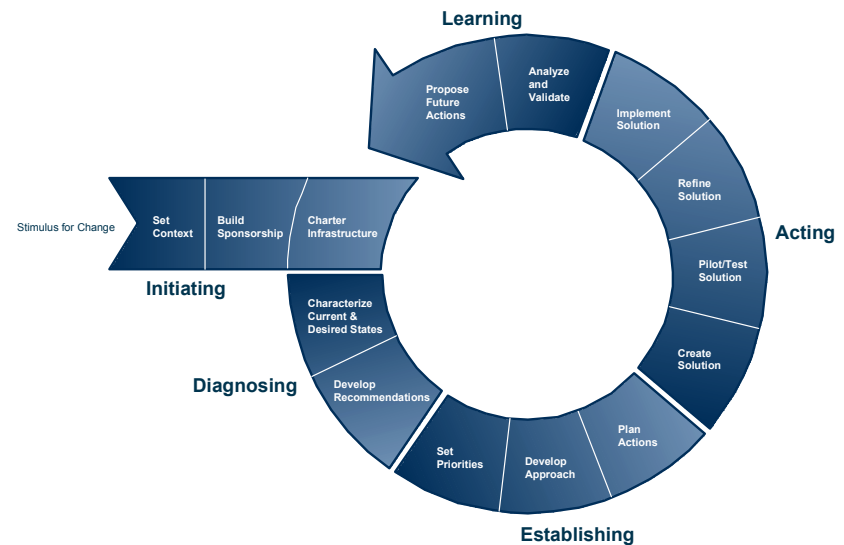
Process Improvement Driven by Competitive Advantage

- Primary customers of ABB are commercial organizations (Utilities, petrochemical industries, pharmaceutical, automotive, chemical plants, etc.)

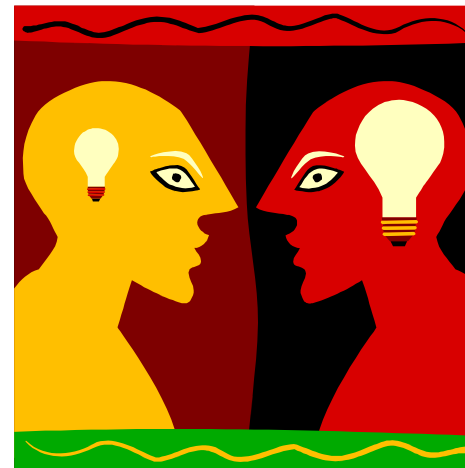- Motivation to improve is driven by business reasons

- When Maturity Level is not a business objective, prioritization of improvement activities is paramount

Process Improvement

Increase Competitive Advantage

# Results of Internal ABB Class B CMMI Appraisal

- Establishes a baseline in the organization

- Serves as a basis to identify process improvement activities

- Recommended to include the Measurement and Analysis Process Area

| Practice	RD	ReqM	PP	PMC	MA	SAM	Ver	PPQA	CM
Specific Goal 1									
SP 1.1	Medium	Medium	High	High	High	High	High	High	High
SP 1.2	High	Medium	High	High	High	High	High	High	High
SP 1.3		High	High	High	High	High	High		High
SP 1.4		High	High	High	High				
SP 1.5		High		High					
SP 1.6				High					
SP 1.7				High					
Specific Goal 2									
SP 2.1	High		Medium	Medium	High	High	High	High	High
SP 2.2	High		High	High	High	High	High	High	High
SP 2.3	High		High	High	High	High	High		
SP 2.4			High		High	High			
SP 2.5			Medium						
SP 2.6			High						
SP 2.7			High						
Specific Goal 3									
SP 3.1	Medium		High				High		High
SP 3.2	Medium		High				High		High
SP 3.3	High		High						
SP 3.4	High								
SP 3.5	Medium								
Generic Goal 2									
GP 2.1	High	Medium	High	High	High	High	High	High	High
GP 2.2	Medium	High	High	High	High	Medium	High	High	High
GP 2.3	Medium	Medium	Medium	Medium	High	Medium	High	High	Medium
GP 2.4	High	High	High	High	High	Medium	Medium	High	High
GP 2.5	Medium	Medium	Medium	Medium	High	Medium	Medium	High	High
GP 2.6	Medium	High	High	High	High	Medium	High	High	Medium
GP 2.7	Medium	Medium	Medium	Medium	High	Medium	Medium	High	Low
GP 2.8	High	High	High	High	High	High	High	High	High
GP 2.9	High	High	High	High	High	High	High	High	High
GP 2.10	Low	Low	Low	Low	High	Low	Low	High	Low

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Measurement and Analysis

- Two Types of metrics:
  - Metrics associated with the product
 - Metrics associated with the development process
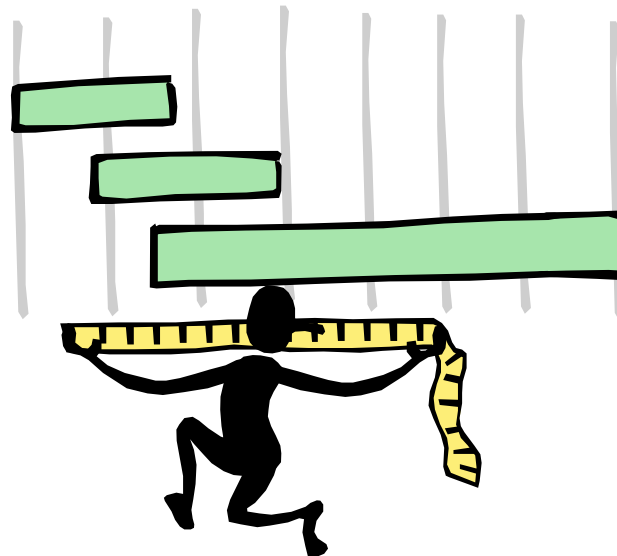
Typical Process-related MA in a CMMI Level 1 Organization

- Measurement Objectives for Process Improvement not clearly defined

    - Information needs and objectives are not consistently defined and documented

    - Measurement objectives are not consistently defined

    - Measurement objectives are not consistently aligned with information needs

- Specify Measures for Process Improvement

    - Quantifiable measures are not consistently traceable to measurement objectives

    - No clear definition between base and derived measures

- Collection and storage of specific measurement data associated with process improvement is not consistently defined

- Analysis and reporting of measurement data for process improvement is not consistently specified

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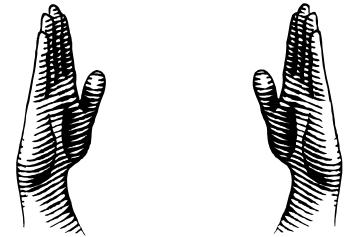
Goal-Questions-Metrics Paradigm

- *GQM presents a systematic approach for integrating goals to models of the software processes, products and quality perspectives of interest based upon the specific needs of the project and the organization. (Basili et al, 1994).*
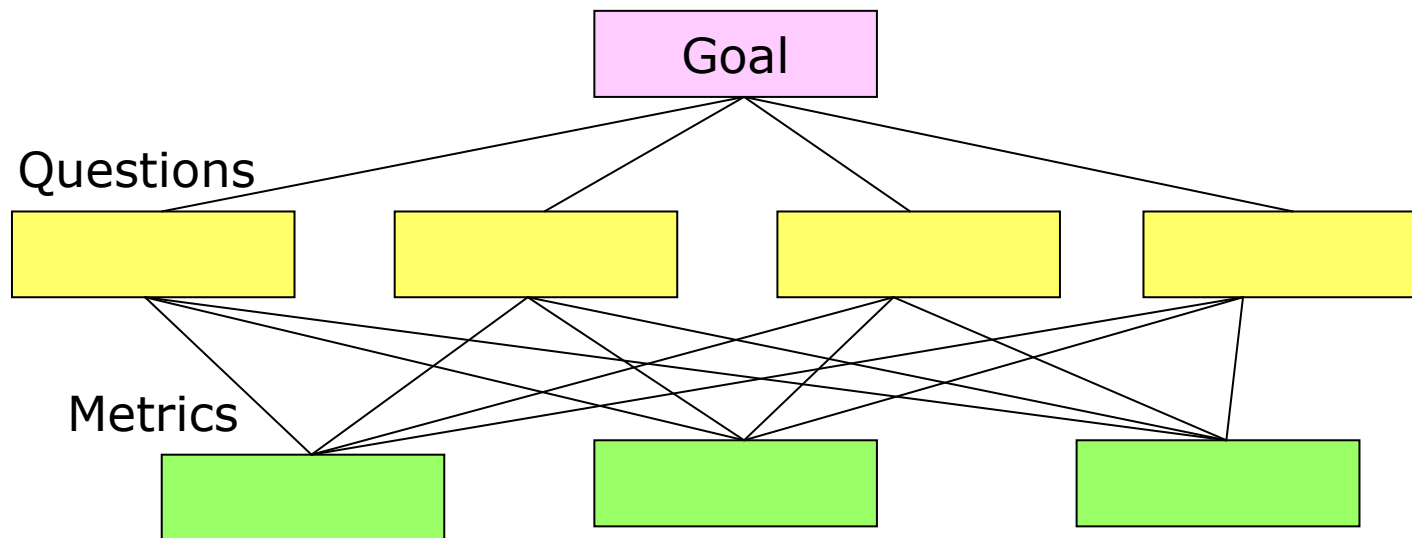
GQM Definitions

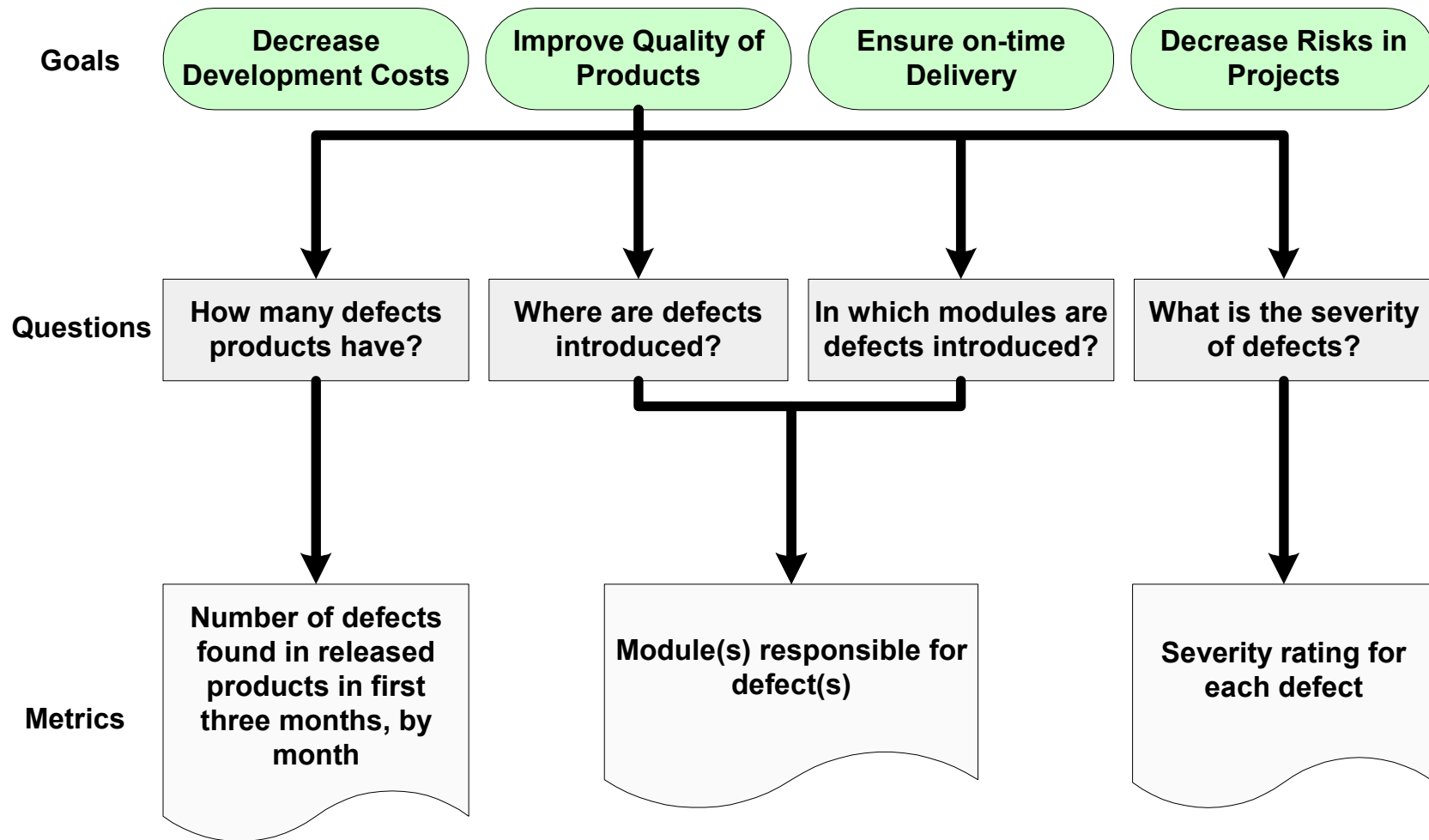- Define major goals of the process improvement activity

- Questions derived from goals that must be answered to determine if the goals are achieved

- Measurements that provide the most appropriate information for answering the identified questions

Example of GQM for Process Measurement

Goals

Decrease Development Costs	Improve Quality of Products	Ensure on-time Delivery	Decrease Risks in Projects

Questions

How many defects products have?	Where are defects introduced?	In which modules are defects introduced?	What is the severity of defects?

Metrics

Number of defects found in released products in first three months, by month

Module(s) responsible for defect(s)

Severity rating for each defect

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Product Development Process Metrics

- Typically associated with:

    - Consumption of resources during a process

    - Process control

    - Errors or faults associated with a particular process
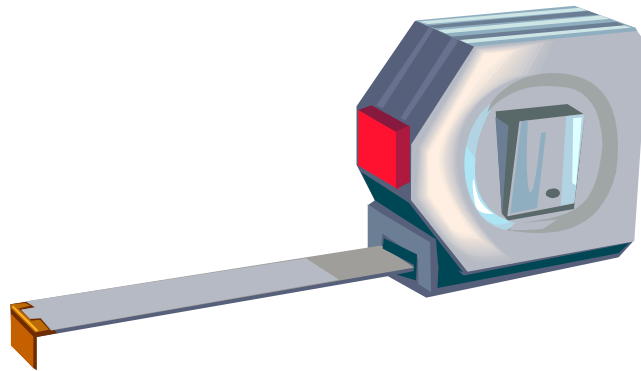
Example of Development Process Metrics

- Management control metrics
  - Deviation between actual and estimates
  - Deviation from promised final delivery
- Test coverage metrics
  - Number of defects introduced
  - Cost of reducing defects
  - Where defects are introduced
  - Error distribution by cause
- Effort
  - Person/time metrics (not elapsed but actual)
- Time
  - Time to market metrics
- Productivity
  - Software output per unit of input

Please refer to Handouts to follow specific Example discussion

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Lessons Learned

- A CMMI appraisal provides the foundation for process improvement

- Using the GQM approach is a useful way to establish a metrics program for process improvement

- Establish Goals from business objectives

- Business objectives should be employed to prioritize process improvement activities after appraisal has been conducted

- Use the CMMI Measurement and Analysis process area practices to establish metrics for process improvement

- Process improvement should include the MA process area together with any other improvement to ensure meaningful measurements are obtained

- Start small and simple

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Questions ?