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Measuring Acquisition Processes

What, You Mean I have to Measure?

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Purpose of Briefing

Discuss measurements of **acquisition** processes

Provide insight on the types of indicators and measurements that can be used for these processes



Why Measure Acquisition Processes?

Provide management visibility into software acquisition processes and practices

Identifies process improvement opportunities

Helps establish problem priorities

Provides a basis for orderly improvement efforts



What Acquisition Processes Should be Measured?

Successful application of (software) measurement depends on having well-established measurement goals.

“The data collection process must be driven by the . . . questions that we formulate based on our needs. In short, know what question is to be answered before collecting the data.”

—*Juran*



Topics



Background Information

- Trends in software acquisition
- What's the problem?
- One solution – SA-CMM

SA-CMM® and Measurements

- Structure
- Template for Measurement & Analysis
- What should be measured
- Example Process and Product measures

Measures at an Organizational Level

- Balanced scorecard
- Methodology
- Example indicators

Summary



Trends ₁

Software is pervasive throughout our society.

Demand for software-intensive systems has been growing consistently and steadily.

2000 Defense Science Board Study:

- There is tremendous growth in software content in both manned and unmanned systems.
- Software requirements now amount to the bulk of the overall specification requirements (65% for the B-2, 80% for the F-22).



Trends ₂

However, there are widespread problems in projects involving software.

2000 Defense Science Board Study reported that:

53% of projects were late and over budget
16% were on time
31% were canceled before completion



What's the Problem? ₁

Studies indicate many problems are in *managing* the (software) acquisitions.

Software acquirers and software suppliers have a closely linked relationship.

“By regularly putting the development process under extreme time pressure and then accepting poor-quality products, the software user community has shown its true quality standard.”

[DeMarco 87]

What's the Problem? 2

The studies have shown that:

The Acquirer 's management processes and practices and resultant decisions can negatively impact the software development processes of the Suppliers.



What Can Be Done?

Focus on improving the processes of the Acquirer

A process management maxim states that

The quality of a system is highly influenced by the quality of the process used to acquire, develop, and maintain it.

Under this maxim we could improve the processes and practices of the Acquirer by using a CMM-Based Process Improvement approach.

That is, develop and apply a CMM that focuses on improving software acquisition processes.

The SA-CMM is intended to fulfill this role



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⇒ SA-CMM® and Measurements

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SA-CMM Overview

The SA-CMM[®] is:

- a Capability Maturity Model (CMM) whose intended use, along with its associated training and appraisal methodology, is to help improve an organization's software acquisition process
- a yardstick to benchmark an organization's current process capability and performance
- focused inward to process and acquisition management
- applicable to systems and Information Technology (IT) acquisitions or any acquisition involving products and services



SA-CMM

The SA-CMM was developed to

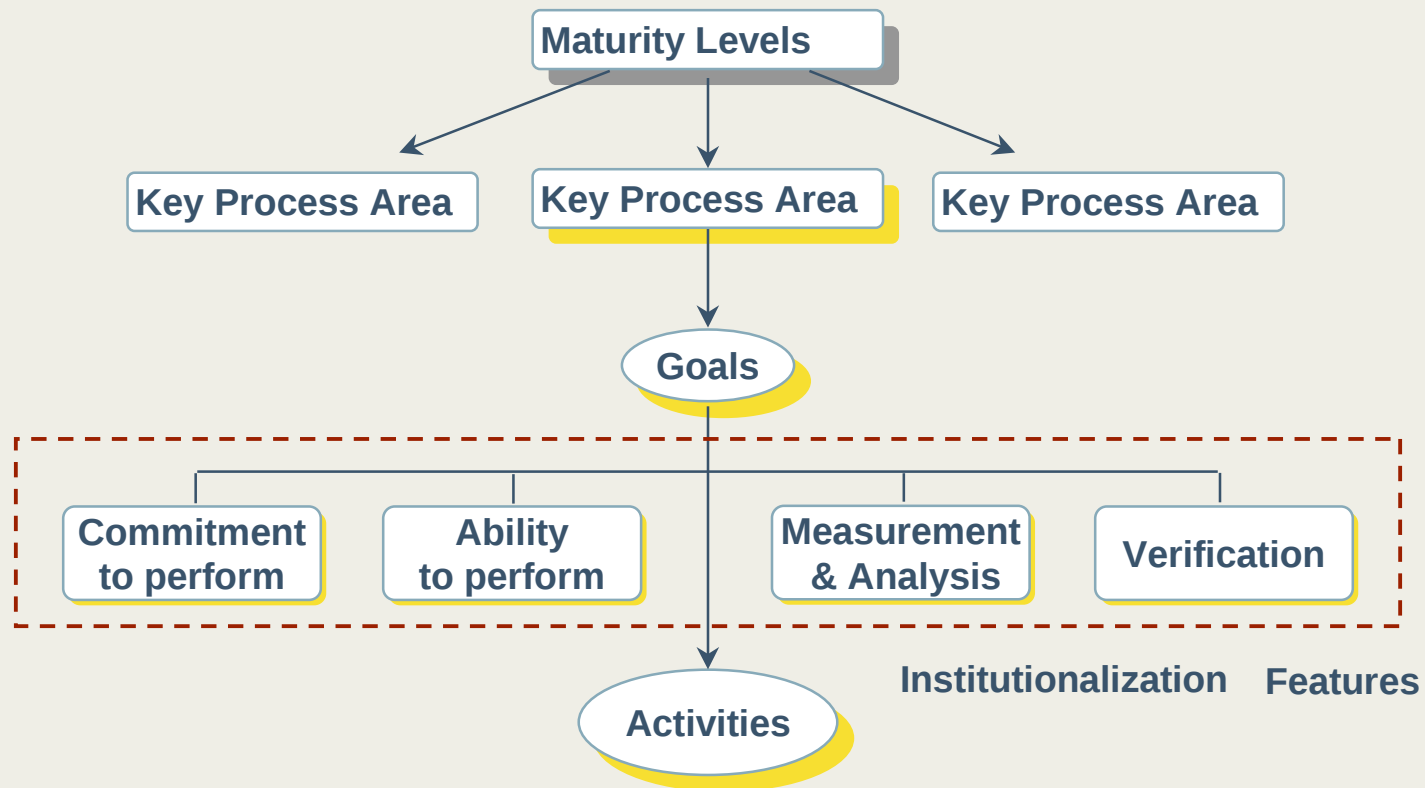
- increase awareness of the criticality of software in an acquisition
- provide a model of key features for the process of acquiring software products and services

The SA-CMM is

- reflective of “best” processes in software acquisition
- able to provide quantifiable indication of capability based on maturity level.



SA-CMM Structure





SA-CMM Key Process Areas

Level	Focus	Key Process Areas	
5 Optimizing	<i>Continuous process improvement</i>	Acquisition Innovation Management Continuous Process Improvement	Higher Quality Productivity Lower Risk
4 Quantitative	<i>Quantitative management</i>	Quantitative Acquisition Management Quantitative Process Management	
3 Defined	<i>Process standardization</i>	Training Program Acquisition Risk Management Contract Performance Management Project Performance Management Process Definition and Maintenance	
2 Repeatable	<i>Basic project management</i>	Transition to Support Evaluation Contract Tracking and Oversight Project Management Requirements Development and Mgt. Solicitation Software Acquisition Planning	Higher Risk Rework
1 Initial	<i>Competent people and heroics</i>		

Standard Template for Measurement and Analysis

Measurement 1: Measurements are made and used to determine the **status** of the activities for <x> and the resultant products.

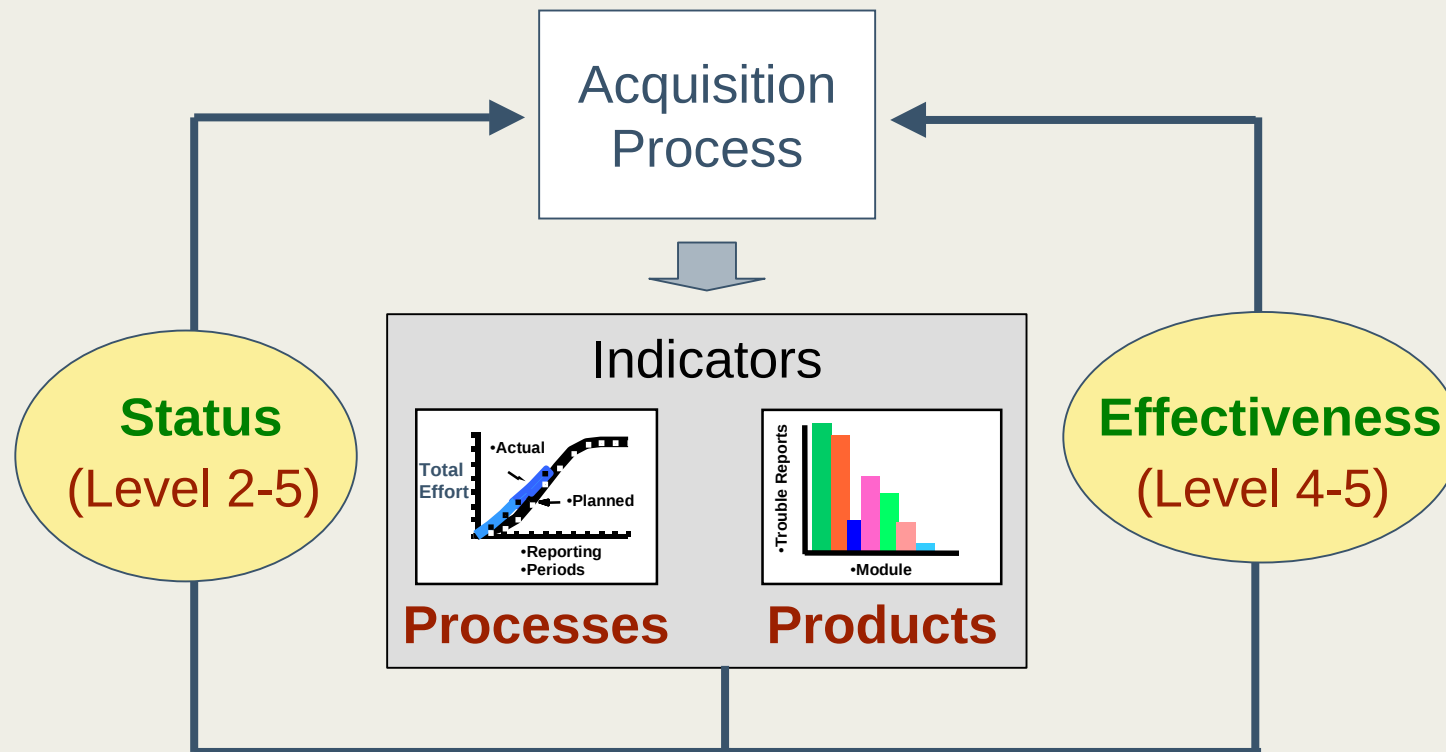
Measurement 2: Measurements are made and used to determine the **effectiveness** of the <x> activities and resultant products.

(This measurement template is in Levels 4 and 5 only.)

<x> represents the appropriate KPA oriented process.



What Should be Measured?



SA-CMM Key Process Areas

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**Requirements
Development and
Mgt.**



Requirements Development and Management (RDM) - Example

Purpose: To establish a common understanding of the software requirements by the acquisition project team, the end user, and the contractor.

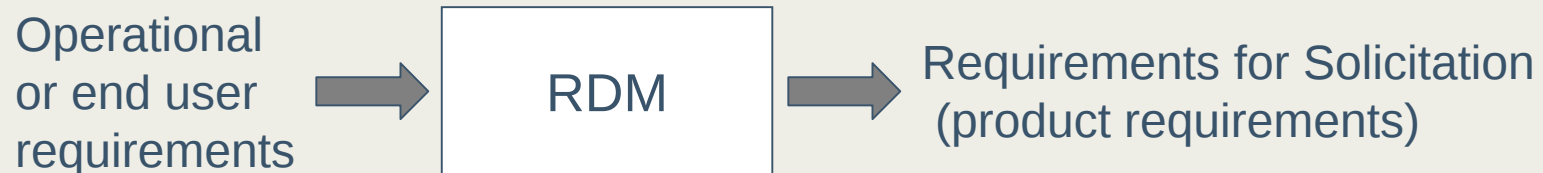
Includes both technical and non-technical requirements.

Involves development of the requirements and management of any changes.

Starts with description of an operational need and ends with transfer of responsibility to the maintainer.



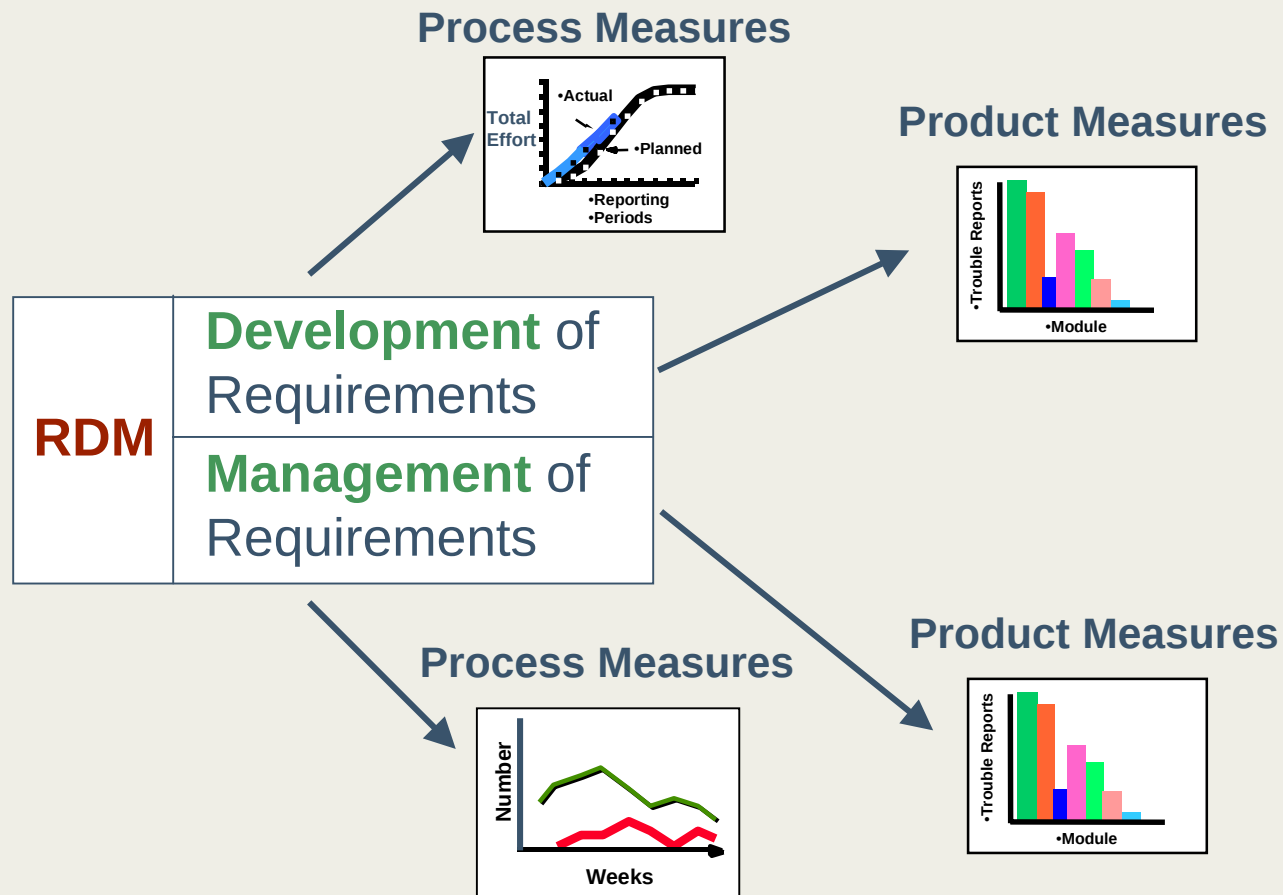
RDM Example



Typical Process Activities

- Translation of operational or end user requirements into solicitation documentation (specifications)
- Baselining SW requirements
- Controlling all subsequent requirement changes

RDM - Measurement Opportunities





RDM - Process Measures - Status

RDM Sub-Process

- development of software related contractual requirements
- management of requirements

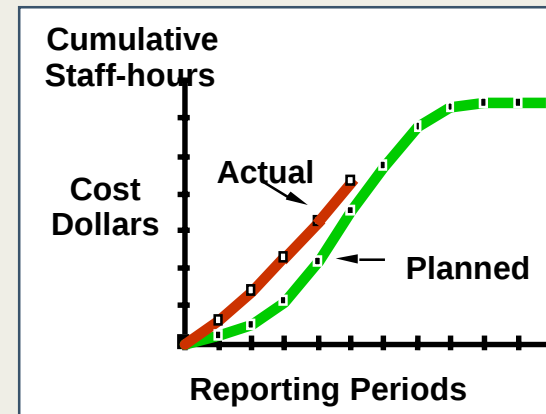
Typical Measures

- effort expended
- funds expended
- progress toward completion
- number of change requests appraised
- completion of milestones



RDM - Process Status Indicators

Effort Expenditure



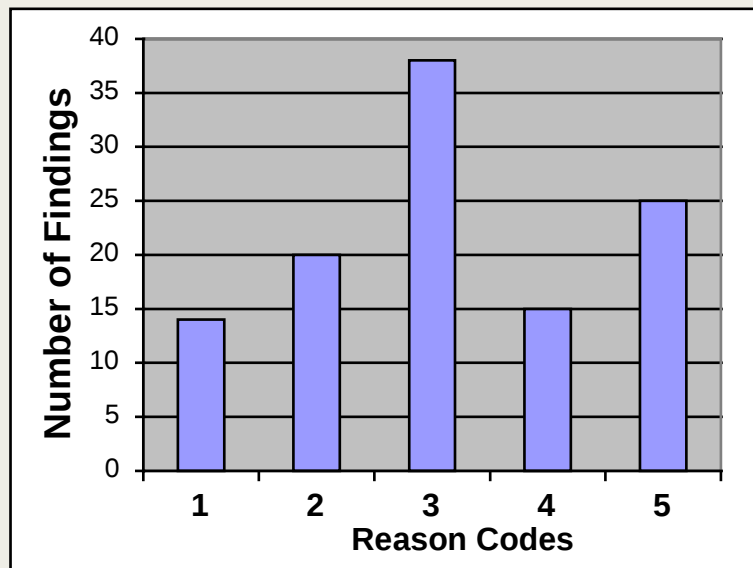
Staff Availability

		Req.	Avail	Recruitment
Staff Type 1	Entry			
	Journeyman			
	High Grade			
Staff Type 2	Entry			
	Journeyman			
	High Grade			
Staff Type n	Entry			
	Journeyman			
	High Grade			



RDM - Process Compliance

Process Audit Results



Reason Codes

- 1 Documentation is missing, incomplete, ambiguous or erroneous.
- 2 Inadequate tools, facilities, or equipment to support the process.
- 3 Inadequate process training.
- 4 Required data is missing, incomplete, ambiguous or erroneous.
- 5 Process quality control gates do not exist or are not enforced.



RDM - Product Measures

Products

- requirements baseline
- RDM activities' work products
- operational requirements documents (ORD)
- system specification
- change requests

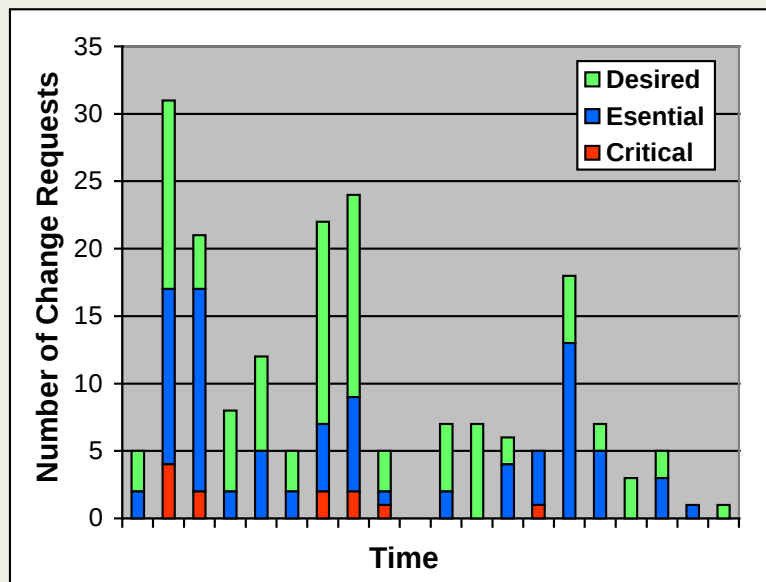
Measures (used for tracking status)

- requirements added, deleted, modified
- changes to ORD
- severity and priority of defects in documents

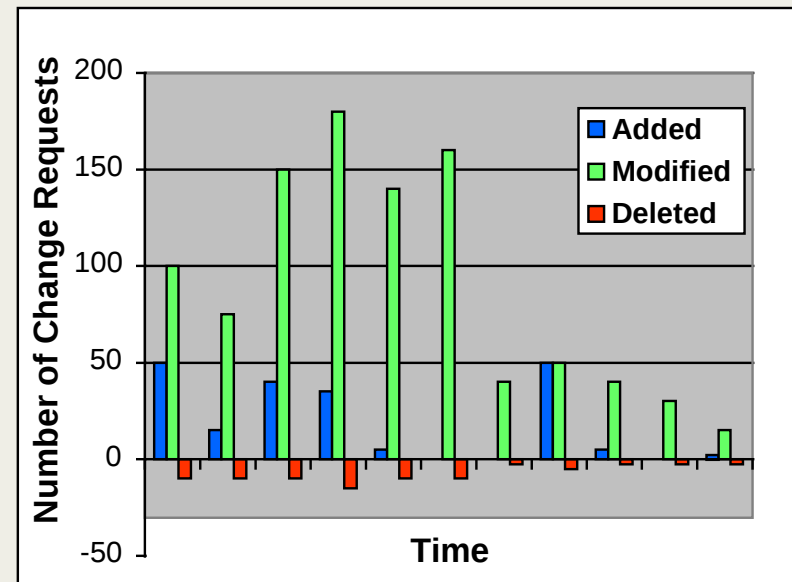


RDM - Status of Requirements 1

Change requests by priority



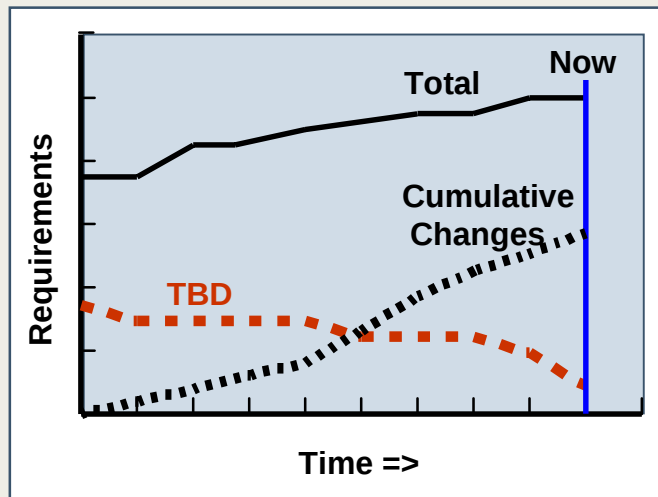
Requirement stability
by type of change



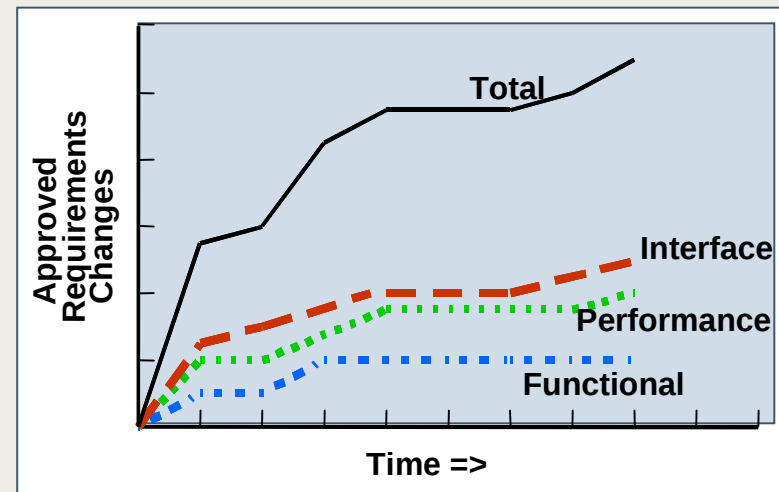


RDM - Status of Requirements 2

Status of “TBDs”



Type of Changes



Choice of indicators depends upon what you want to know.



RDM - Product Status Indicators

Quality of products

Open and Closed Deficiencies							
		PRIORITY					
		1		2		3	
		Open	Closed	Open	Closed	Open	Closed
SEVERITY	1						
	2						
	3						
	4						
	5						

Severity Levels	Number of Deficiencies That Have Been Open x Days				Totals
	$x < 30$	$30 < x \leq 60$	$60 < x \leq 90$	$x > 90$	
Severity 1	2	1			3
Severity 2	3	1	1		5
Severity 3	3	2	1	1	7
Severity 4	4	3	3	2	12
Severity 5	8	6	3	3	20
Totals	20	13	8	6	47



SA-CMM Key Process Areas

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SA-CMM Measurement Summary

The choice of measures and indicators for the SA-CMM key process areas depend upon what you must know to give the acquisition manager insight into the related process activities.

Two useful measures for each KPA that can provide this insight are:

- compliance with defined processes
- status of activities against original plan



Topics

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- One solution – SA-CMM

SA-CMM® and Measurements

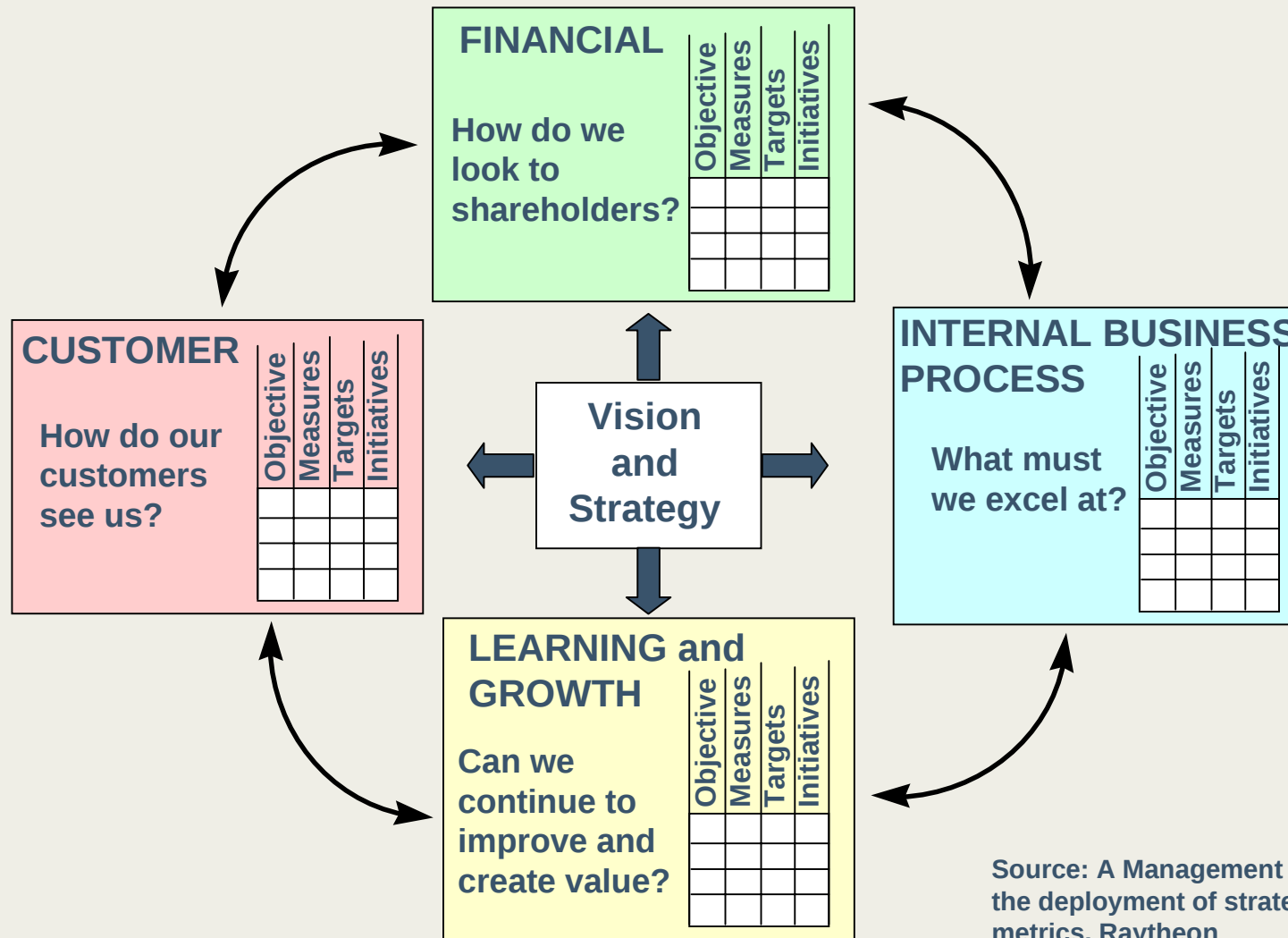
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⇒ Measures at Organizational Level

- Balanced scorecard
- Methodology
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Summary

A Balanced Scorecard Perspective on Performance



What Measures Should Be Taken?

Successful application of software measurement depends on having well-established measurement goals.

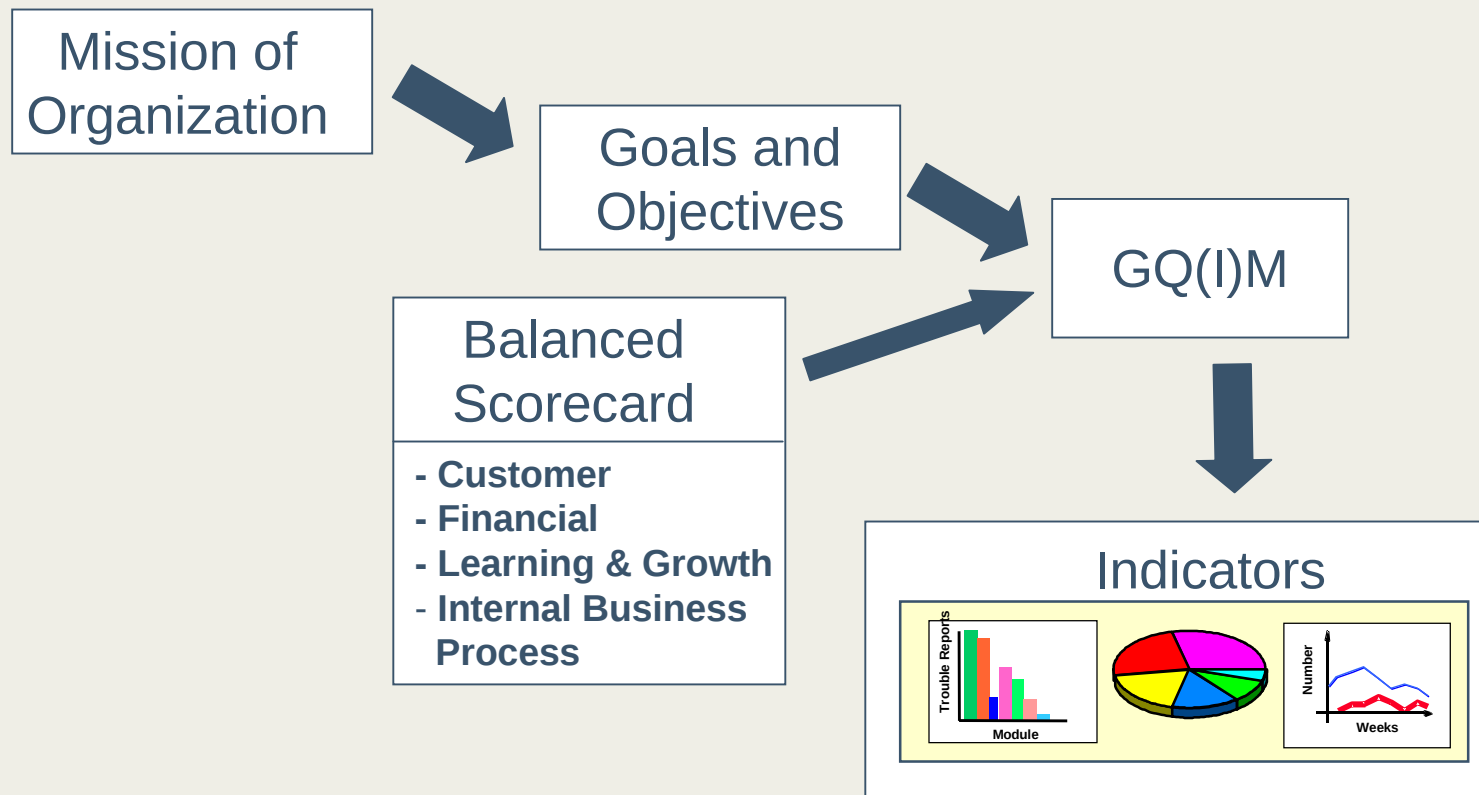
“The data collection process must be driven by the . . . questions that we formulate based on our needs. In short, know what question is to be answered before collecting the data.”

—*Juran*

[Rozum 92]



Methodology





Example Results

Balanced Scorecard Dimension	Measurement Areas
Internal Business	• Availability and capability of resources • Quality (deficiencies) • Timeliness (on-time delivery, cycle time) • Productivity • Compliance with customer requirements
Innovation and Learning	• Improve quality (process, products, services) • Improve communication • Trend in employee satisfaction • Enhance staff capability
Customer	• Quality of products • Timeliness (% products delivered on time) • Responsiveness (% compliant with req.) • Communication • Financial Control • Resource availability and capability
Financial	• Effective financial controls



Internal Business - Example 1

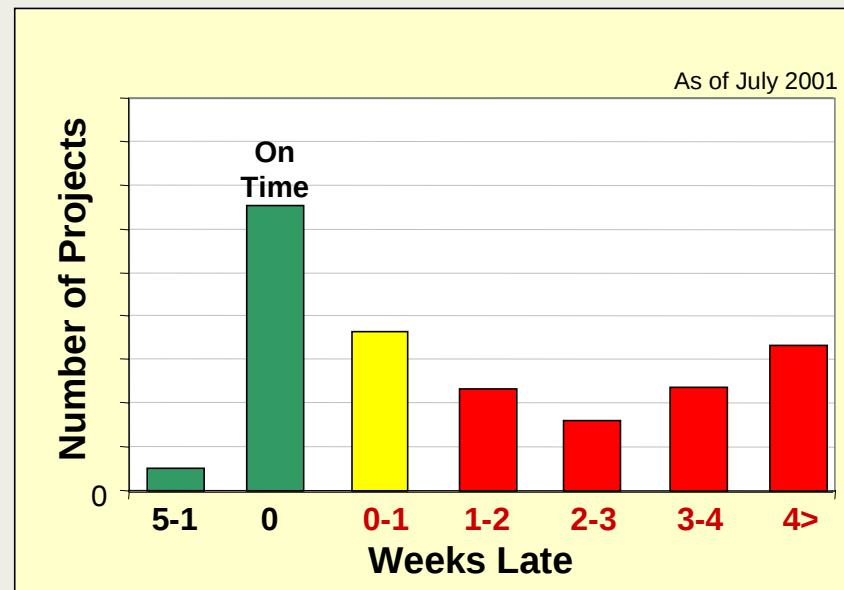
Open and Closed Deficiencies

		PRIORITY					
		1		2		3	
		Open	Closed	Open	Closed	Open	Closed
SEVERITY	1						
	2						
	3						
	4						
	5						



Internal Business – Example 2

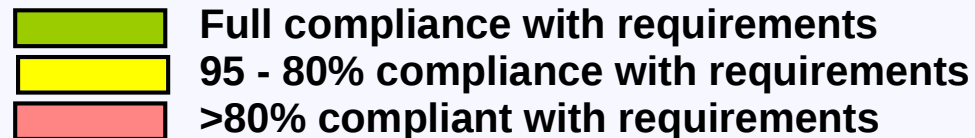
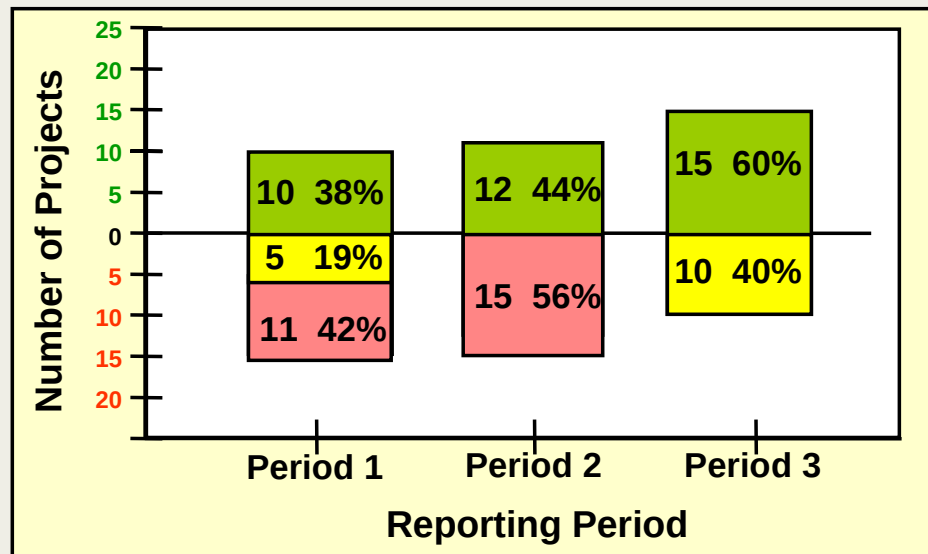
On Time Delivery





Innovation and Learning - Example

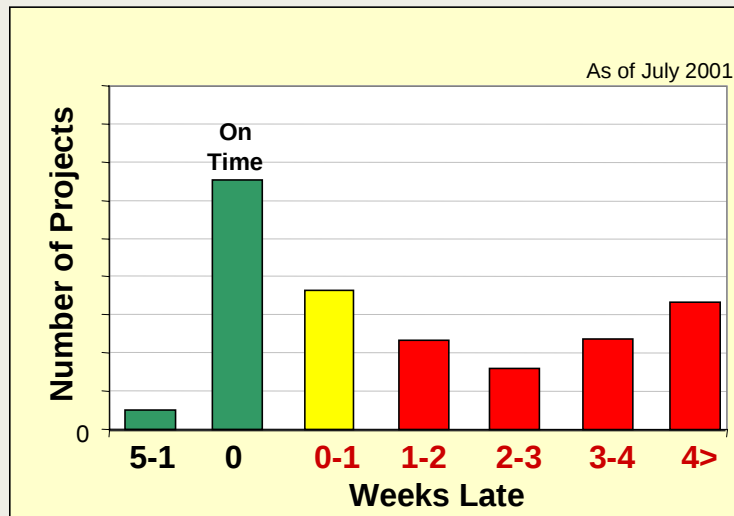
Compliance with Requirements



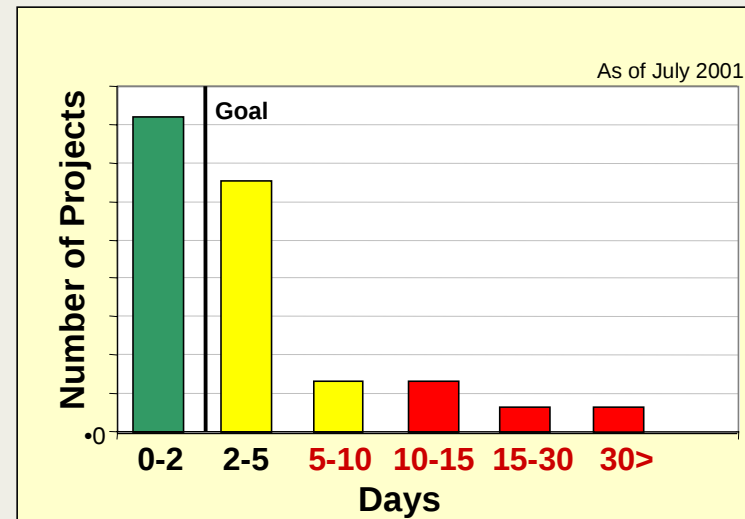


Customer - Example

Delivery Dates

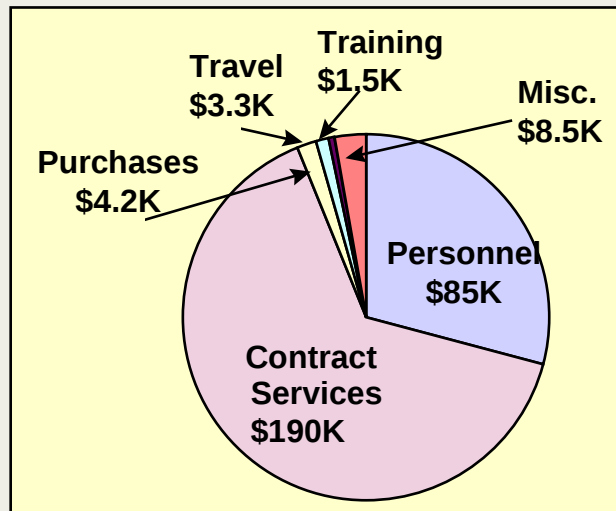


Time to Fix “Show-Stopper”



Financial - Example

Expenses



Area	Dollars
Personnel	85
Contract Services	190
Purchases	4.2
Travel	3.3
Training	1.5
Misc.	8.5



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⇒ Summary

Summary ₁

Reliance on software to provide system functionality is increasing.

Projects involving software acquisitions typically experience cost overruns, schedule slippage, and failure to achieve performance goals

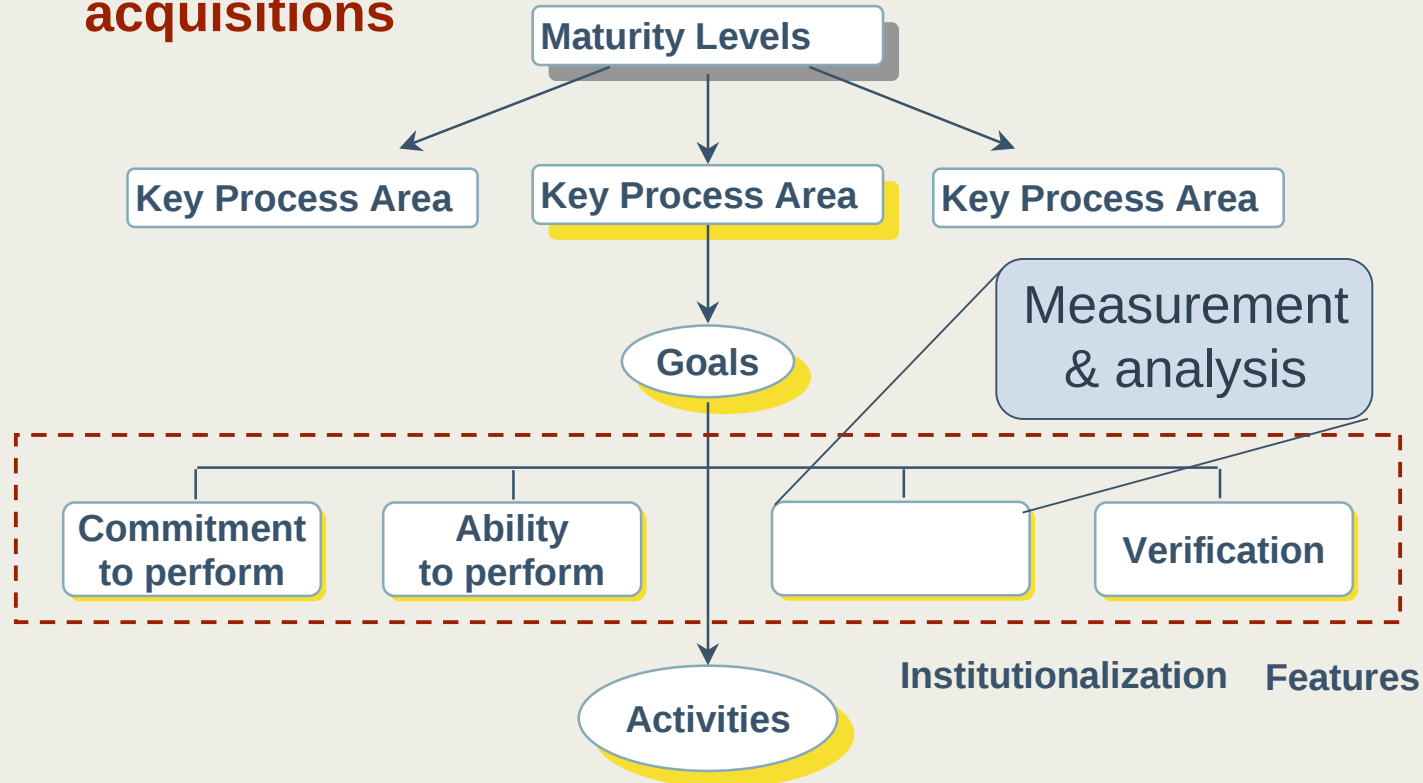
Studies show these problems result in part from the Acquirer's **management** of the acquisition

The **SA-CMM** was developed to

- increase awareness of the criticality of software in system acquisitions
- provide a model of features for the process of acquiring (software) products and services
- provide a model to instill discipline in the acquisition process.
- help process improvement

Summary ₂

The SA-CMM calls for measurement of key acquisition activities to aid the management of acquisitions





Summary ³

At the project level:

The choice of measures and indicators for the SA-CMM key process areas depend upon what you must know to give the acquisition manager insight into the related process activities.

Two useful measures for each KPA that can provide this insight are:

- compliance with defined processes for the KPA
- status of activities against original plan for the KPA



Summary ⁴

At the acquisition organizational level:

A balanced score card approach can provide additional measures and indicators to support meeting the enterprise business needs.

Work is underway in applying the balanced score card approach to acquisition organizations



Summary ⁵

Successful application of (software) measurement depends on having well-established measurement goals.

“The data collection process must be driven by the . . . questions that we formulate based on our needs. In short, know what question is to be answered before collecting the data.”

—Juran

Bottom Line

Make it simple and usable for acquisition project manager and the acquisition organization



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