CMM®/CMMI® Level 4: Quantitative Measurement versus Quantitative Management

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Level 3 Measurement

Purpose of measurement in is to provide information that improves decision making in time to affect the business or mission outcome

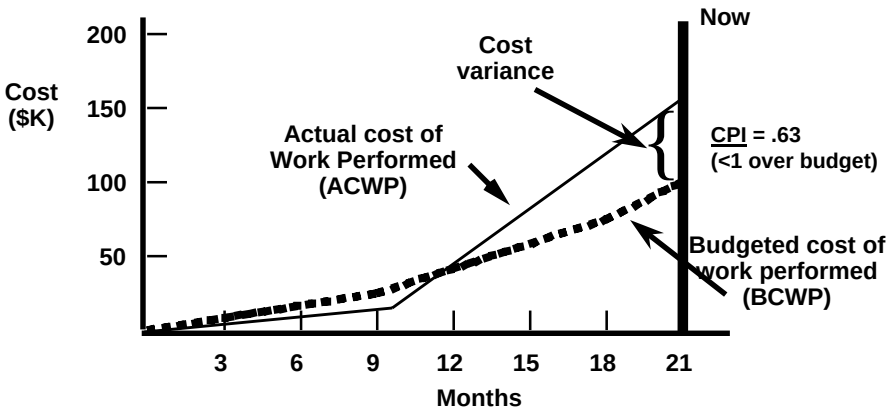
Organization standardization drives the characteristics of Level 3 measurement activities

- **based on the standard processes, defined processes, and life cycle models**
- **cover the significant attributes of all life cycle phases**
- **includes standard set of measures**
- **stored in organization's measurement repository**

Corrective action is proactive, using objective action triggers

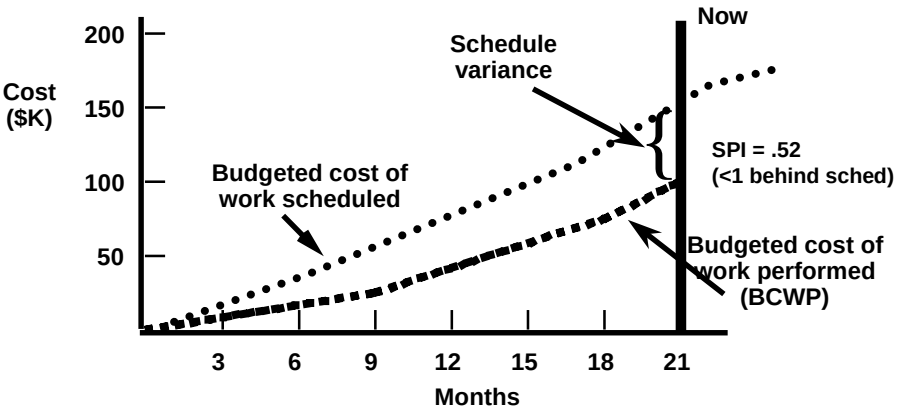
Level 3 - Earned Value - 1

Cost Variance (CV) is the difference between actual and budgeted costs (BCWP - ACWP)



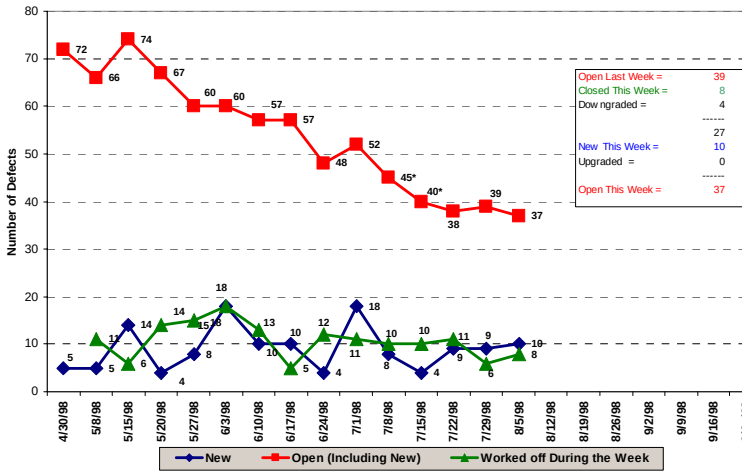
Level 3 - Earned Value - 2

Schedule Variance (SV) is the difference between budgeted cost for work performed and work scheduled (BCWP- BCWS)



Level 3 - Defect Trends

Status of Severity 1 Defects



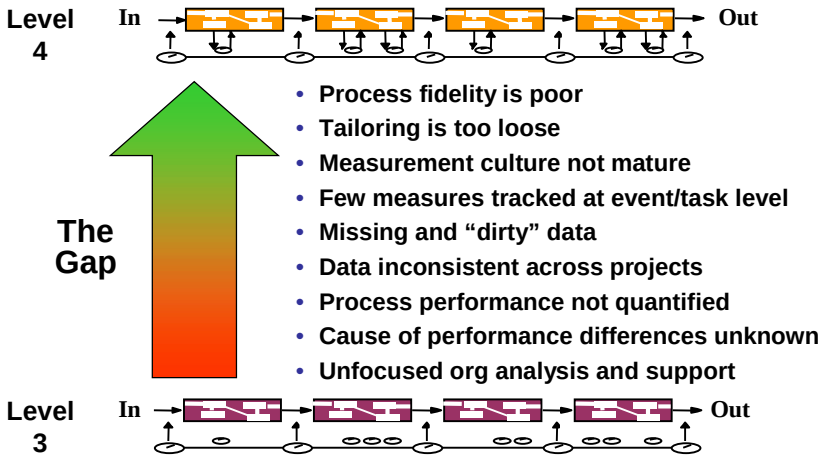
Level 3 - Defect Densities

Defect Density

CI	*Size (KSLOC)*	*Defects*	*Defect Density (Defects/KSLOC)*
A	44	48	1.1
B	32	60	1.9
C	36	36	1.0
D	28	33	1.2
E	34	42	1.2
F	15	46	3.1
G	9	30	3.3
Total	***198***	***295***	***1.5***

Project: PSM ***Data as of 30 June 95***

Gap Between Levels 3 and 4



- Process fidelity is poor
- Tailoring is too loose
- Measurement culture not mature
- Few measures tracked at event/task level
- Missing and "dirty" data
- Data inconsistent across projects
- Process performance not quantified
- Cause of performance differences unknown
- Unfocused org analysis and support

Source: Adapted from *Perdue in (Paulk et al., 1995)*

Characteristics of Level 4

Establish achievable quantitative project goals for performance and product and service quality

Establish defined processes and plans that have the capability to achieve the goals

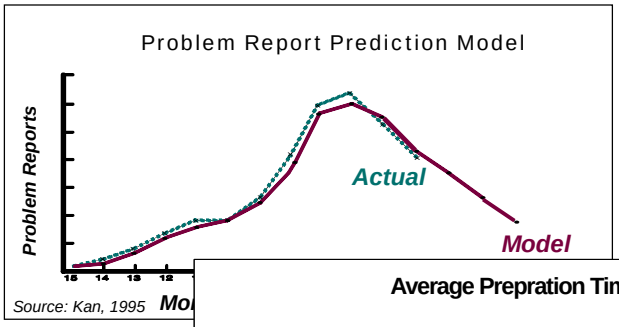
Understand, reduce, and control process variation

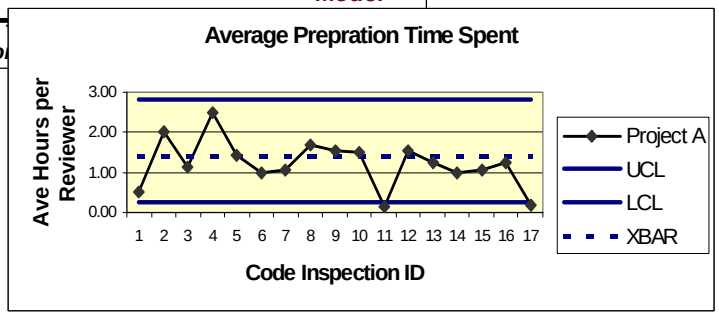
Statistically predict the results of primary work efforts (their process) on a regular basis

Statistically predict the project results against the goals on a regular basis

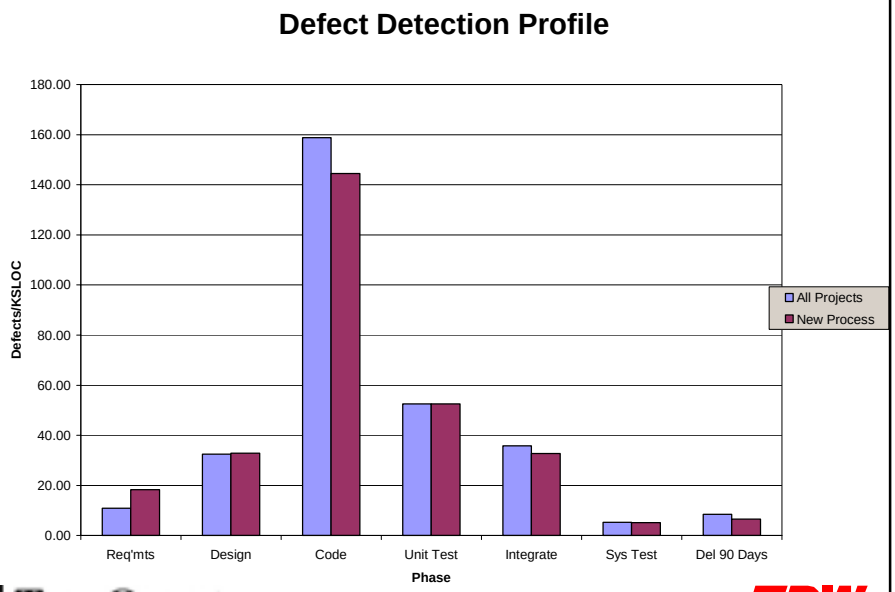
Perform corrective actions so that the goals are achieved

Level 4 Measures





Level 4 - Detection/Removal Profiles



Goals – Stepping Stone or Stumbling Block?

Goals need to include specification of measures and analyses that will be used to judge whether the goals will be / are achieved

Goals need to be expressed quantitatively or objectively

- not all goals are quantifiable

Goals need to cover a unified set of measures

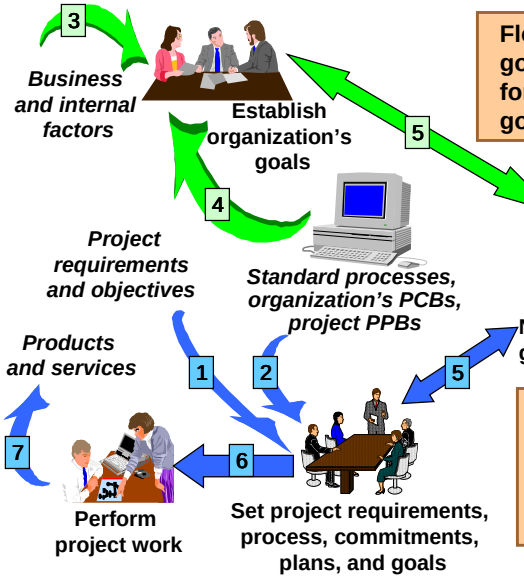
Goals need to be negotiated with the stakeholders

- fact-based and data-based negotiations
- what the project will achieve

Goals represent an agreement with the stakeholders on the measured result that will be achieved

- a commitment!

Setting Level 4 Goals



Flow-down of organizational goals to projects is <u>not required</u> for Level 4, but project quality goals are required

Project quality goals should measure in same dimensions as the organization's goals, but they do not have to satisfy the organizational values

Characteristics of Level 5

Organization understands its critical business issues or areas of concern

Organization establishes the quantitative performance and quality improvement goals

Organization establishes the infrastructure and defines the strategy for systematically pursuing improvements

Improvements are pursued, identified, evaluated, piloted, and deployed to achieve the improvement goals

Three categories of process improvements

- **defect and problem prevention improvements**
- **continuous capability improvements (individual and team)**
- **planned innovations**

Level 4 versus Level 5 Goals

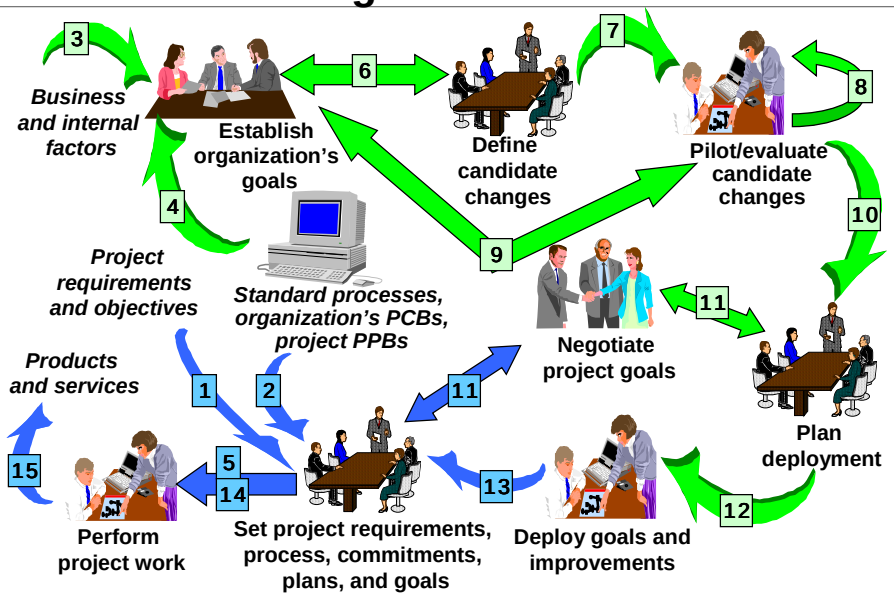
Level 4 and 5 projects need a stable base to succeed

- **requirements, process, budget, schedule, staff, resources, commitments, and performance and quality goals**
- **credible analyses that show these are consistent**

Achieving organizational improvement ("stretch") goals is the responsibility of those who set them

- **goal "flow-down" to projects can be a dangerous strategy**
- **the organization determines how to achieve the goals, then …**
- **changes to project goals are negotiated based on facts and data**

Setting Level 5 Goals



TRW Systems

A leading global integrator of complex systems

- based on information technology and systems engineering expertise
- integrated solutions: architecture, development and sustainment

Many customers and markets in transformation

Six Sigma – a cornerstone of our transformation

Treasury Communications System

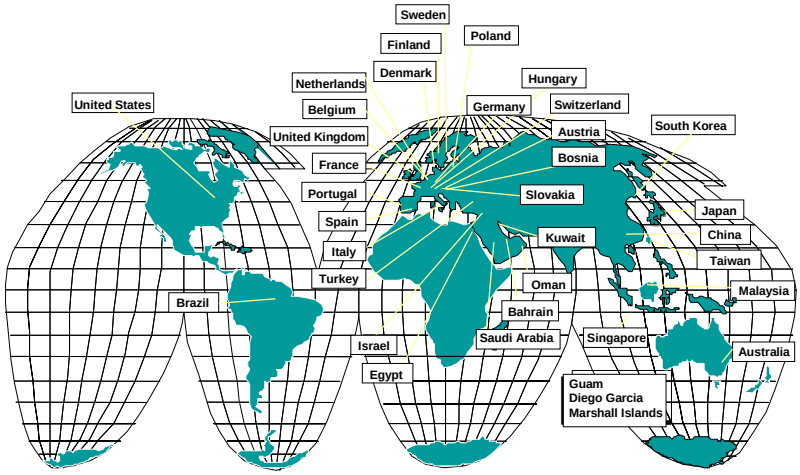
Intercontinental Ballistic Missile program

Ohio MARCS

Global Business Presence

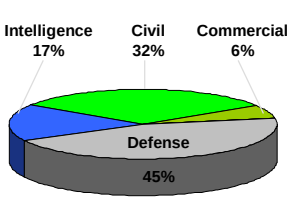
50 States
34 Countries

15,000 Employees
2001 sales of $3.1B

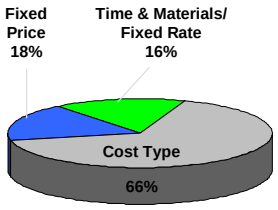


TRW Systems Business Mix

Markets

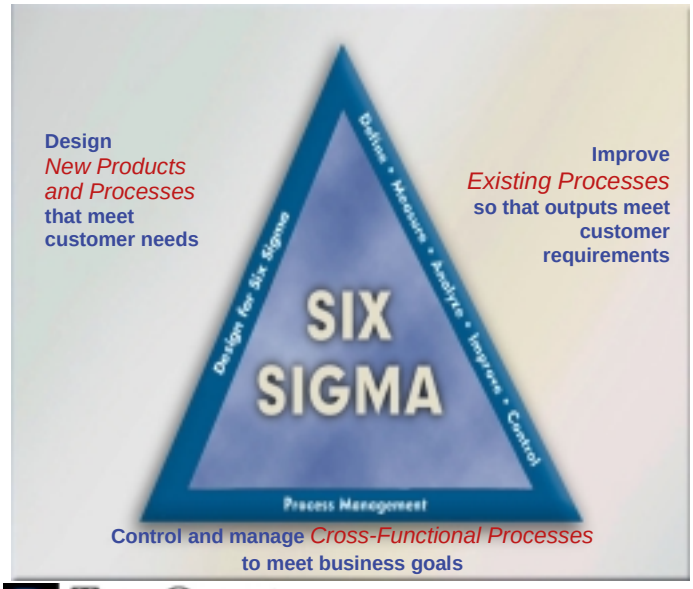


Contract Type



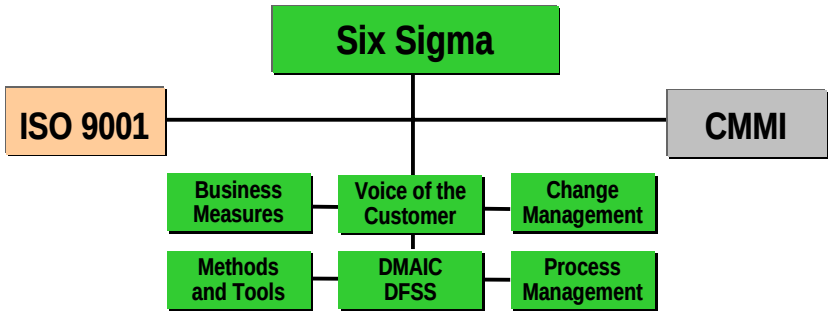
- **2001 sales of $3.1B**
- **15,000 employees**
- **Solutions for clients range from architecture to development and sustainment**

Six Sigma Methodologies



- **D-** Each project must have a business case and sponsor
- **M-** You can't manage what you don't measure
- **A-** Solve the problem, not the symptoms
- **I-** Push for innovations, breakthrough thinking
- **C-** Who is accountable for making the fix stick?

Enterprise-Wide Process Improvement



- ISO 9001 provides a quality management discipline for all project and functional areas
- Six Sigma provides a comprehensive framework for ensuring process improvements support corporate goals
- CMMI ensures use of industry best practices in software and systems engineering

Using Six Sigma with CMMI

For individual processes:

- **CMM/CMMI identifies *what* activities are expected**
- **Six Sigma identifies *how* activities might be improved (more efficient, more effective, …)**

Example – Project Planning in CMMI

SG 1 Establish Estimates
- SP 1.1 Estimate the Scope of the Project
- SP 1.2 Establish Estimates of Project Attributes
- SP 1.3 Define Project Life Cycle
- SP 1.4 Determine Estimates of Effort and Cost

SG 2 Develop a Project Plan
- SP 2.1 Establish the Budget and Schedule
- SP 2.2 Identify Project Risks
- SP 2.3 Plan for Data Management
- SP 2.4 Plan for Project Resources
- SP 2.5 Plan for Needed Knowledge and Skills
- SP 2.6 Plan Stakeholder Involvement
- SP 2.7 Establish the Project Plan

SG 3 Obtain Commitment to the Plan
- SP 3.1 Review Subordinate Plans
- SP 3.2 Reconcile Work and Resource Levels
- SP 3.3 Obtain Plan Commitment

Could fully meet CMMI goals and practices, but still write poor plans

Six Sigma can be used to improve planning process and write better plans

CMM/CMMI and Six Sigma Comparison

Both use same tools and methods

CMM/CMMI adds organizational focus to 6σ work

Benefits of 6σ activities increase with maturity level

Level	Focus	Constraints
5	Full toolset used to make continuous improvements	
4	Statistics used to stabilize and predict performance	Process must be stabilized before making improvements
3	Simple tools applied to standardized processes	Large variation in performing standardized processes
2	Simple tools applied to problems within projects	Projects use different processes

Six Sigma and Level 4 Lessons

Typical Six Sigma	Level 4 Six Sigma
Business justification for Six Sigma projects must substantiate improvement	Achieve stable and predictable results – don't perturb current capability
Quantified business case	Level 3 capability numbers are myth – business improvement case fiction
Short duration projects – 4 to 6 months or less	Demonstrating stable and predictable process takes considerable time
Full power of Six Sigma assumes a well-defined, consistent process	Level 3 organizations use Six Sigma to shore up Level 3 for Level 4

Overall Lessons Learned

Level 3 metrics, measurement processes, and goal setting are generally inadequate for Levels 4 and 5

Six Sigma is an enabler for higher maturity

- focus on data, improvement paradigm
- tying improvements to business goals
- tools and methods support the Level 4/5 analysis tasks

CMM/CMMI practices provide a framework for focusing Six Sigma projects

Basic quality management tools (without Six Sigma overhead) are useful and effective at lower maturity levels

Contract Information

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