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# Using CMMI for Acquisition in Integration Organizations

## Demonstrating Excellence When You Don't Design, Develop, or Produce

### November 18, 2009

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Process Lead
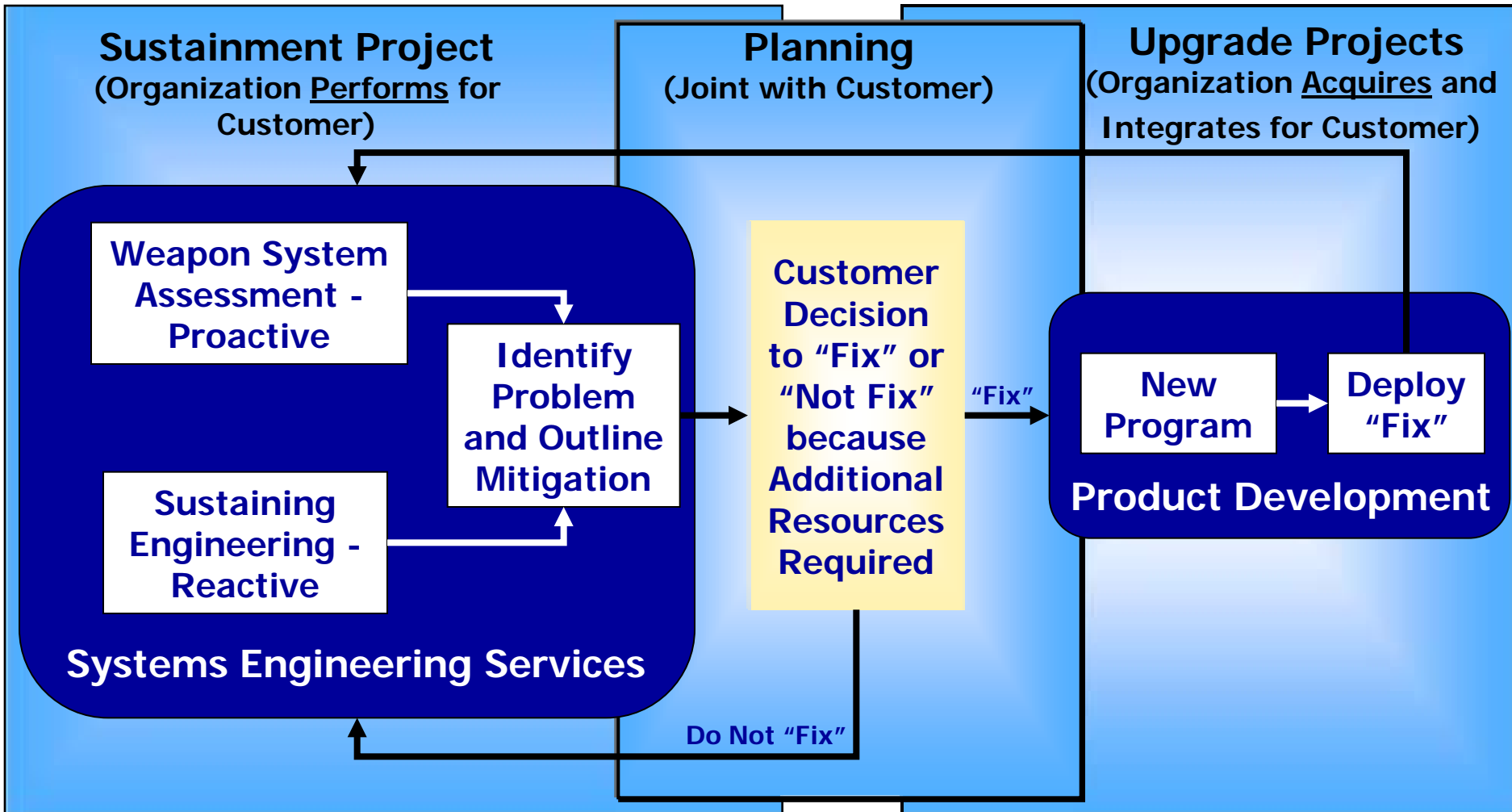SSSD Missile Systems
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# History and Background

- Organization sustains a complex, nuclear weapon system which has been fielded and continuously operational since the early 1960s

- Mission is to continuously evaluate the weapon system
  - Assess key performance parameters against target levels
  - Predict future trends in key parameters
  - Identify risks to maintaining performance levels
  - Propose mitigation programs to refurbish and/or modernize subsystems
  - Plan/implement programs to design and deliver subsystems to sustain key performance parameters above spec limits
  - Update assessments based on progress of modernization programs

- The business model loops back upon itself!

# Continuous Sustainment Model



**Sustainment Project** (Organization _Performs_ for Customer)

**Planning** (Joint with Customer)

**Upgrade Projects** (Organization _Acquires_ and Integrates for Customer)

Weapon System Assessment - Proactive

Sustaining Engineering - Reactive

Identify Problem and Outline Mitigation

**Systems Engineering Services**

Customer Decision to "Fix" or "Not Fix" because Additional Resources Required

"Fix"

New Program

Deploy "Fix"

**Product Development**

Do Not "Fix"

# CMMI in the Organization

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- Organization/Programs externally appraised at Maturity Level 3 in 2003
  - CMMI-SE/SW v1.1 model
  - N/A on Product Integration (PI) and Technical Solution (PS)

- Organization/Programs externally appraised at Maturity Level 5 in 2005
  - CMMI-SE/SW v1.1 model
  - N/A on Product Integration (PI) and Technical Solution (PS)

- SE/SW Model not a good fit for the business
  - Strongest processes not included in assessment
  - Two key engineering processes not applicable
  - **Results were not published by SEI**

**Maturity Level**

**5***

*Although High Maturity (ML 4 and 5) Process Areas were satisfied for appraisals, we could not officially claim to have achieved the Maturity Level

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# CMMI Model Alternatives

- Is there a CMMI model that fits the business and showcases its strongest processes?
    - Need CMMI for customer satisfaction and future business

- Piloted Services Model
    - Process Areas did not model strengths
    - Geared for help-desk type of services
    - Many process areas were not applicable to our business
    - SCAMPI Method does not permit "N/A" Process Areas when using the staged representation

- Piloted Development Model
    - Evidence for Requirements Development, Tech Solution, Product Integration,  Verification, and Validation was weak when applied to products produced by the organization
    - Internally produced products not a significant element of the business
    - Evidence in Engineering PAs unlikely to successfully pass a DEV appraisal
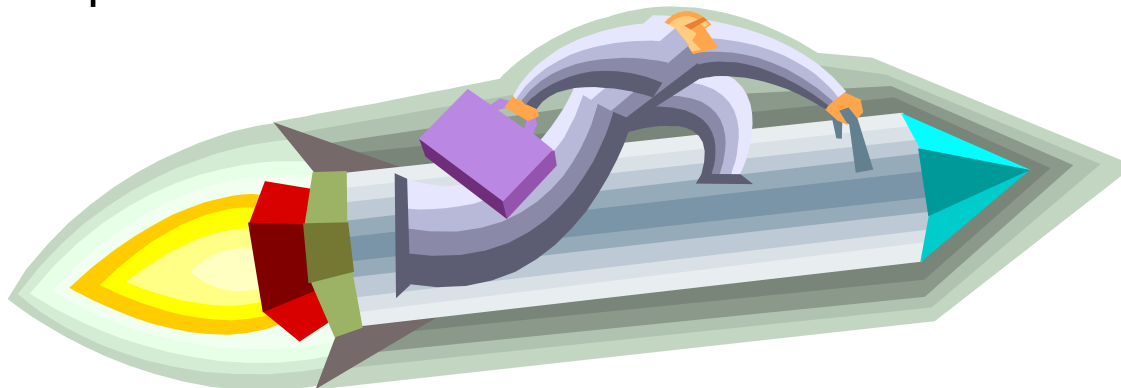
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# CMMI Acquisition Model Pilots

- CMMI-ACQ v1.2 SCAMPI-B in October 2008
  - New model not well understood by organization
  - Only ACQ unique process areas evaluated
  - Assessment conducted by government personnel
  - Only 2 weeks allowed to prepare evidence
  - Process areas applied retroactively to projects
  - Results generally positive

- CMMI-ACQ v1.2 SCAMPI-C in May 2009
  - Improved understanding of model
  - All process areas evaluated
  - 2 months to prepare evidence
  - More work to do, but...
  - Results very positive!
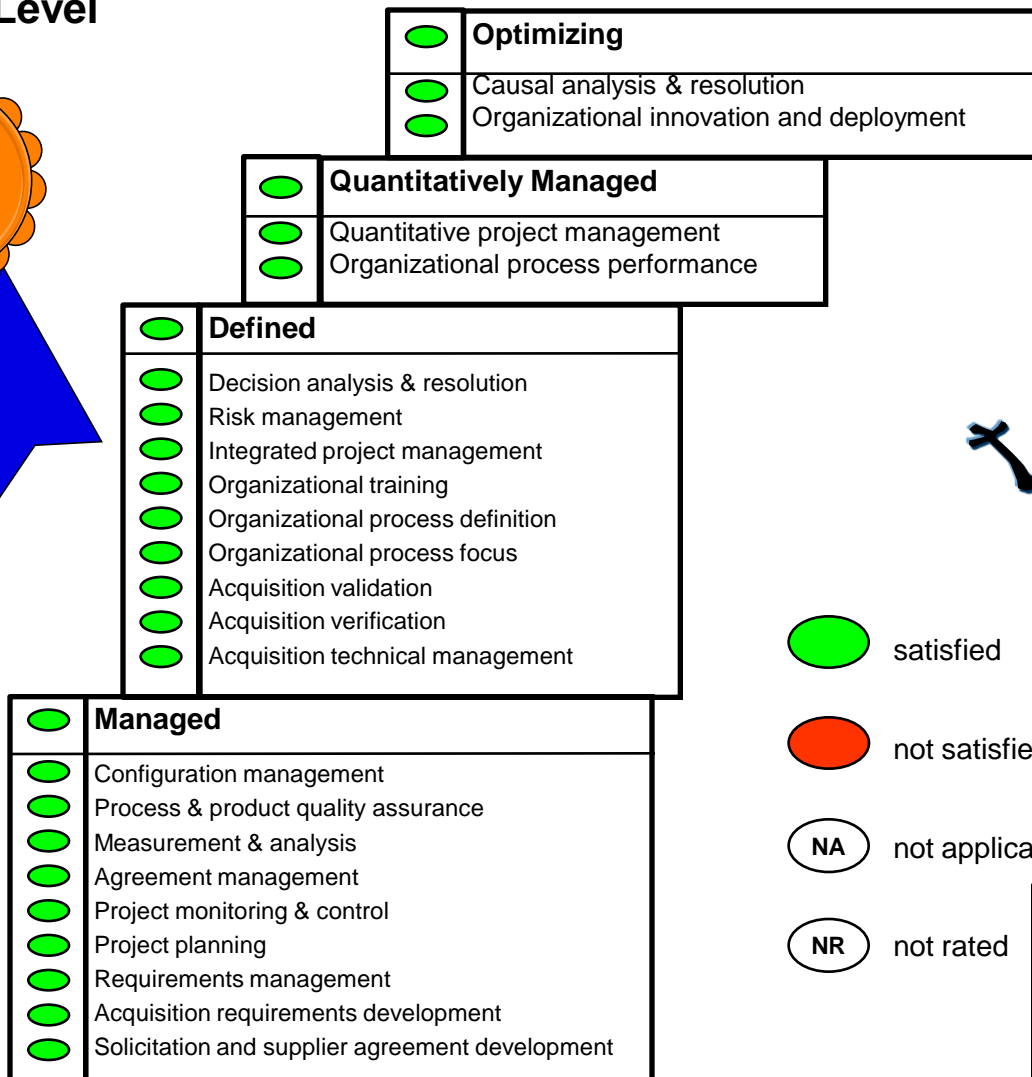
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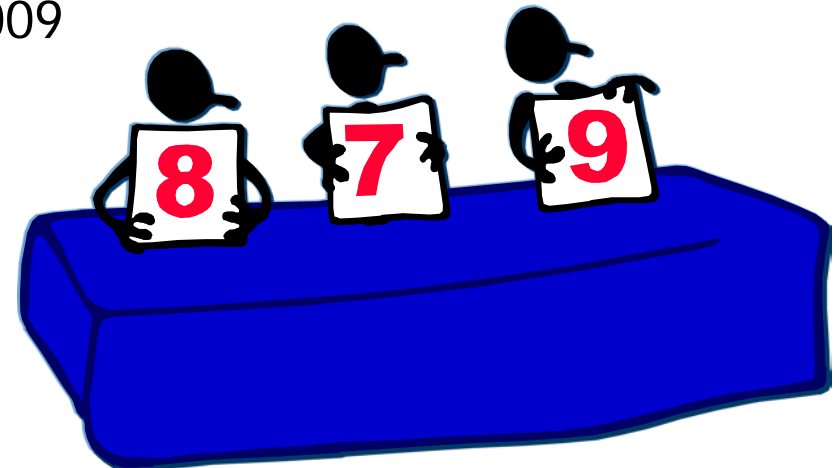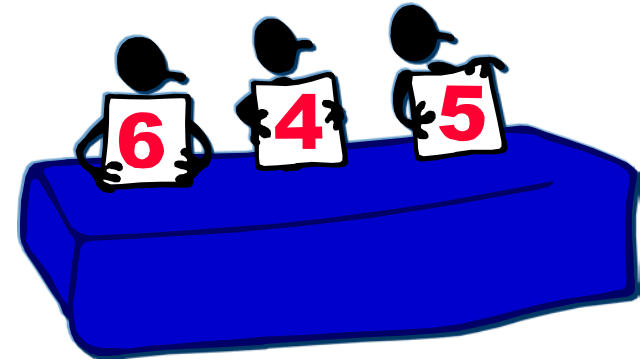
# Comparing Unique Elements in ACQ and DEV Models

| CMMI-Acquisition (v1.2) vs CMMI-Development (v1.2) Process Area Relationship | | |
|---|---|---|
| **Unique to Acquisition** Model (CMMI-ACQ v1.2) | Process Area | **Unique to Development** Model (CMMI-DEV v1.2) |
| AM | Agreement Management | *With SSAD, generally equivalent to SAM (See SAM SG1)* |
| ARD | Acquisition Requirements Development | *Comparable to RD with procurement focus rather than internal design focus* |
| ATM | Acquisition Technical Management | *No equivalent: incorporates parts of IPM, RD, RM, TS, VAL, and VER* |
| AVAL | Acquisition Validation | VAL (*plus elements of VER*) and SAM SP2.3 |
| AVER *(verification of internal work products)* | Acquisition Verification | *No equivalent* |
| *No Equivalent* | Product Integration | PI |
| PMC *(one additional SP not in Dev PMC)* | Project Monitoring and Control | PMC |
| PP *(two additional SPs not in Dev PP)* | Project Planning | PP |
| *Comparable to ARD with internal design focus rather than procurement focus* | Requirements Development | RD |
| SSAD | Solicitation & Supplier Agreement Development | *With AM, generally equivalent to SAM (See SAM SG1)* |
| *SSAD / AM comparable to SAM (plus unique SSAD requirements)* | Supplier Agreement Management | SAM |
| *No Equivalent* | Technical Solution | TS |
| AVAL encompasses | Validation | VAL |
| AVAL generally encompasses | Verification | VER |

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# CMMI Acquisition Model Practices

- Acquisition Model practices showcase the organization's strengths
  - DEV Model SAM is a Project Management process (ancillary to engineering), while ACQ Model SSAD and AM are Acquisition processes (core business)
  - ARD deals with developing requirements performed by others
  - ATM deals with analyzing rather than developing solutions
  - AVAL deals with evaluating procured products

- Other process areas already operating well under DEV Model

- Pilot results were very encouraging

- Decision to proceed with external SCAMPI-A in October 2009

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# CMMI Acquisition Model Implementation Successful

**Maturity Level**

**5**

**Optimizing**
- Causal analysis & resolution
- Organizational innovation and deployment

**Quantitatively Managed**
- Quantitative project management
- Organizational process performance

**Defined**
- Decision analysis & resolution
- Risk management
- Integrated project management
- Organizational training
- Organizational process definition
- Organizational process focus
- Acquisition validation
- Acquisition verification
- Acquisition technical management

**Managed**
- Configuration management
- Process & product quality assurance
- Measurement & analysis
- Agreement management
- Project monitoring & control
- Project planning
- Requirements management
- Acquisition requirements development
- Solicitation and supplier agreement development

satisfied

not satisfied

NA    not applicable

NR    not rated

*First recorded Maturity Level 5 for ACQ Model!*

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# CMMI Acquisition Model – One Question



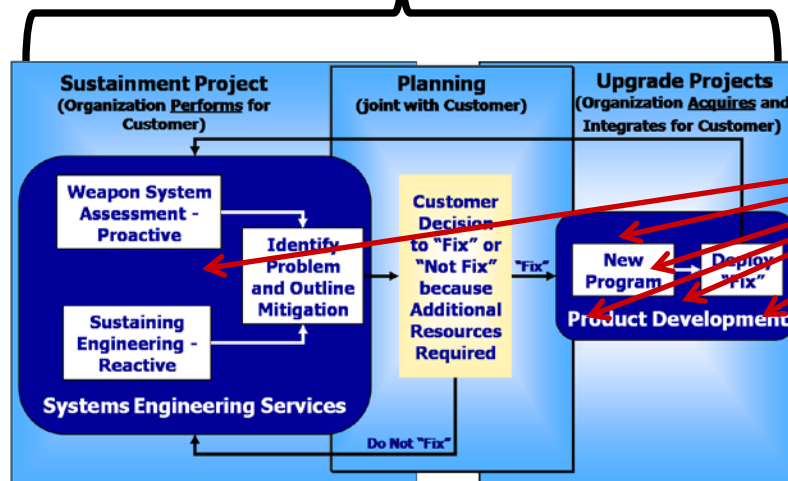**Organizational Unit Characterization By Level**

What's up with Quantitative Project Management (QPM)?

# Quantitative Project Management

- QPM SG 1 – Quantitatively manage the project

- QPM SP 2.3 – Monitor the performance of selected subprocesses

- Model presumes that projects manage subprocesses independently
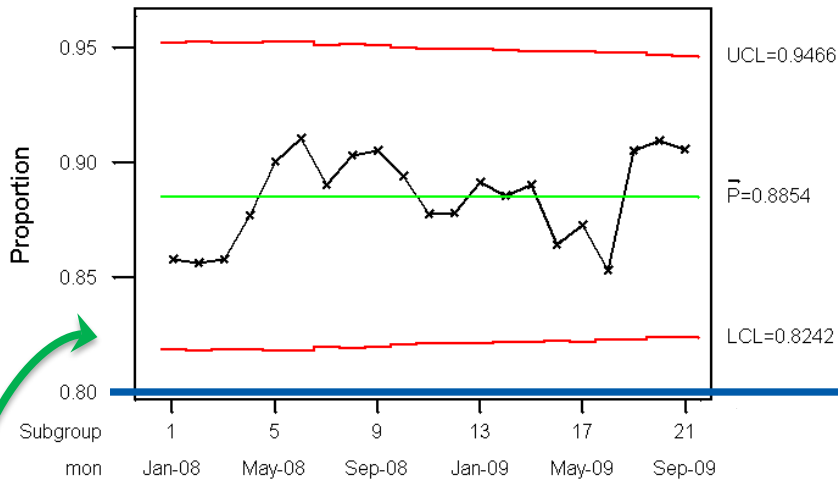


Processes

Projects

Projects in the organization use a common process set managed by PROCESS owners, not PROJECTS

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# Process Standardization and Consolidation
## An Alternate Practice?

- Some process are truly organizational or project unique

- Most processes managed jointly on behalf of several projects by a PROCESS Lead
  - All applicable projects follow standard process and contribute data
  - Analysis (control charts, trends, etc.) is at the summary level
  - Sample sizes are larger and more meaningful
  - Reaction to special cause variation is handled by process lead
  - Innovative improvements coordinated at the process level

- Any project can suggest improvements and innovations
  - Process lead analyzes and reacts
  - Process must be flexible enough to allow all projects to operate
  - Improvements good for one project generally good for all

- Difficult to produce meaningful project-specific evidence for QPM

# Is the Process Capable or Not?

Process X - Pooled Data for Applicable Projects
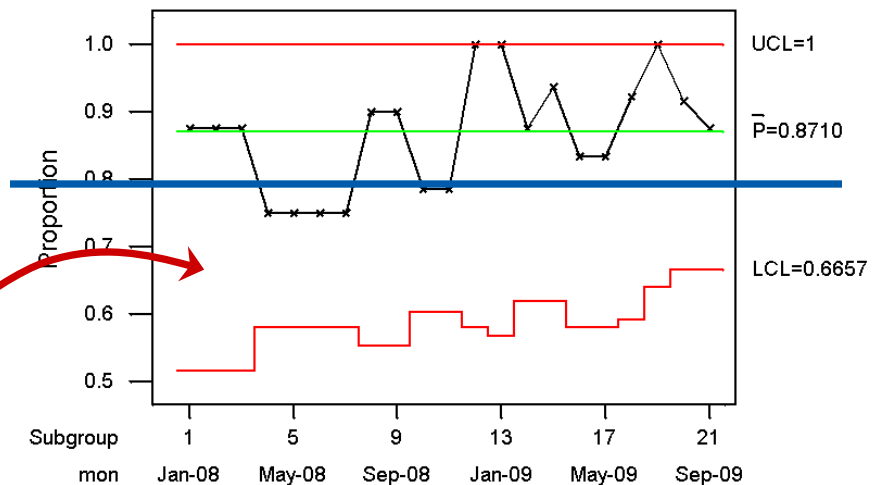


UCL=0.9466
$\overline{P}$=0.8854
LCL=0.8242

Customer requirement
is proportion > 80%

Consolidated process
is stable and capable

Single project process
is stable but appears
not capable

Process X - One Project's Data



UCL=1
$\overline{P}$=0.8710
LCL=0.6657

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# Standardized Consolidated Processes
## Things to Consider

- Is the capability failure "real?"

- Small sample sizes can exacerbate effects of normal variation

- Do we really want the project to behave differently?

- Measuring the wrong things (or at the wrong level) can drive undesirable behavior

- Can process lead's investigations of issues at consolidated level identify project problems before it is too late?
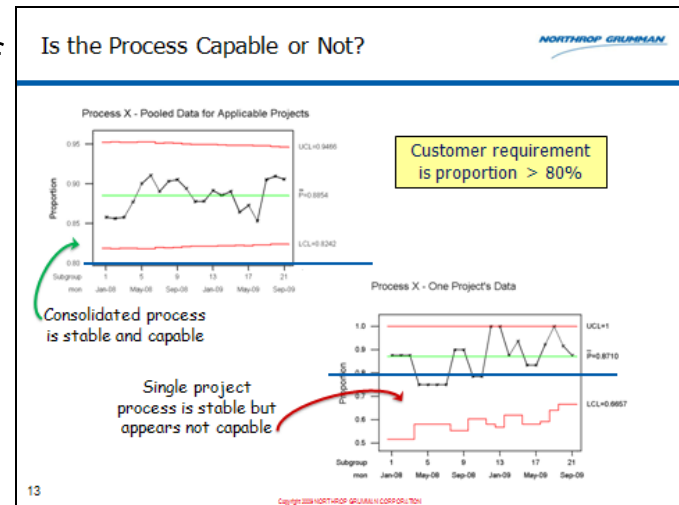


*10+ years of standardized, consolidated process management in the organization has consistently demonstrated success with multiple improvements implemented*

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# Final Thoughts

- If you created a brand new company, would you want each project to develop unique processes to execute their work?

- Could standardized processes be established and continuously improved to provide a model of process behavior for all applicable projects?

- Is consolidated process management (below the org level) an alternate practice or the desired state?

**Is this QPM issue unique to Acquisition Model only?**

# Any Questions?

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