NORTHROP GRUMMAN DEFINING THE FUTURE

Mission Systems

CMMI Benefits at Northrop Grumman Mission Systems

CMMI Technology Conference & User Group
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Agenda

- Establishing ROI
- The Value of High Maturity
- Six Sigma Measures
- Quantitative and Qualitative Impacts

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Northrop Grumman Mission Systems

- **A leading global integrator of complex systems**
  - Based on information technology and systems engineering expertise
  - Integrated solutions: architecture, development and sustainment
- **$3.9 B Estimated 2003 Sales**
- **15,000+ Employees**
- **Diverse business base**
  - Presence in over 20 countries, 50 states
  - 2,000 active contracts and task orders

Treasury Communications System

Intercontinental Ballistic Missile Program

Guardrail

- **Near-term goal to achieve CMMI Level 5 at all sites**
  - Started in 2002 with all sites at SW-CMM Level 3

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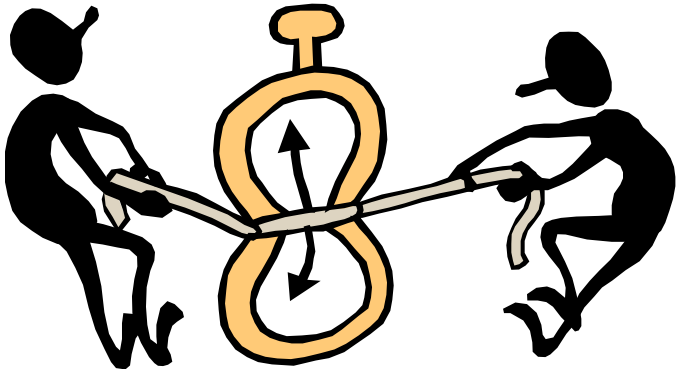
Establishing ROI



- **It is difficult to quantify the value of an improvement initiative**
- **How do you measure the change?**
  - Multiple levels – organizational, management, engineering, support
  - Multiple causes – awareness, knowledge, infrastructure
  - Short-term vs. long-term – Hawthorne effect
- **How do you measure the investment?**
  - What would we have done instead?
- **How do you determine the value of the measured change?**
  - Increased predictability – what's the value?
  - Increased productivity – who gets the benefit?
  - Better competitive position – how measured?
  - Time-frame

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Why Do We Need ROI Data?

- **Management wants to invest overhead resources wisely**
  - Similar investment decisions often based on "gut feel", not hard data – does anything else seem more likely to yield results?
  - Investment decisions may be more driven by balance of short-term performance tactics and long-term marketing strategy
  - Key question is whether you could make similar progress with less resources (or progress faster with the same resources)
- **Projects want to justify the investment to their customers**
  - Difficult to convince process skeptics
  - People view the problem from their own experiences and skills

Beware of ROI as a smokescreen for process skepticism

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A Long-Term Focus

- **Northrop Grumman Mission Systems focused on the long-term culture change**
  - More data-driven decision making
  - Identifying and meeting the customers' needs
  - Disciplined project management
  - Improved engineering first-time quality to reduce re-work
  - Efficient organizational infrastructure
  - Use of industry best-practices
  - Capturing of internal best-practices
- **Understanding the value is used to guide the CMMI deployment strategy, not justify the initiative**

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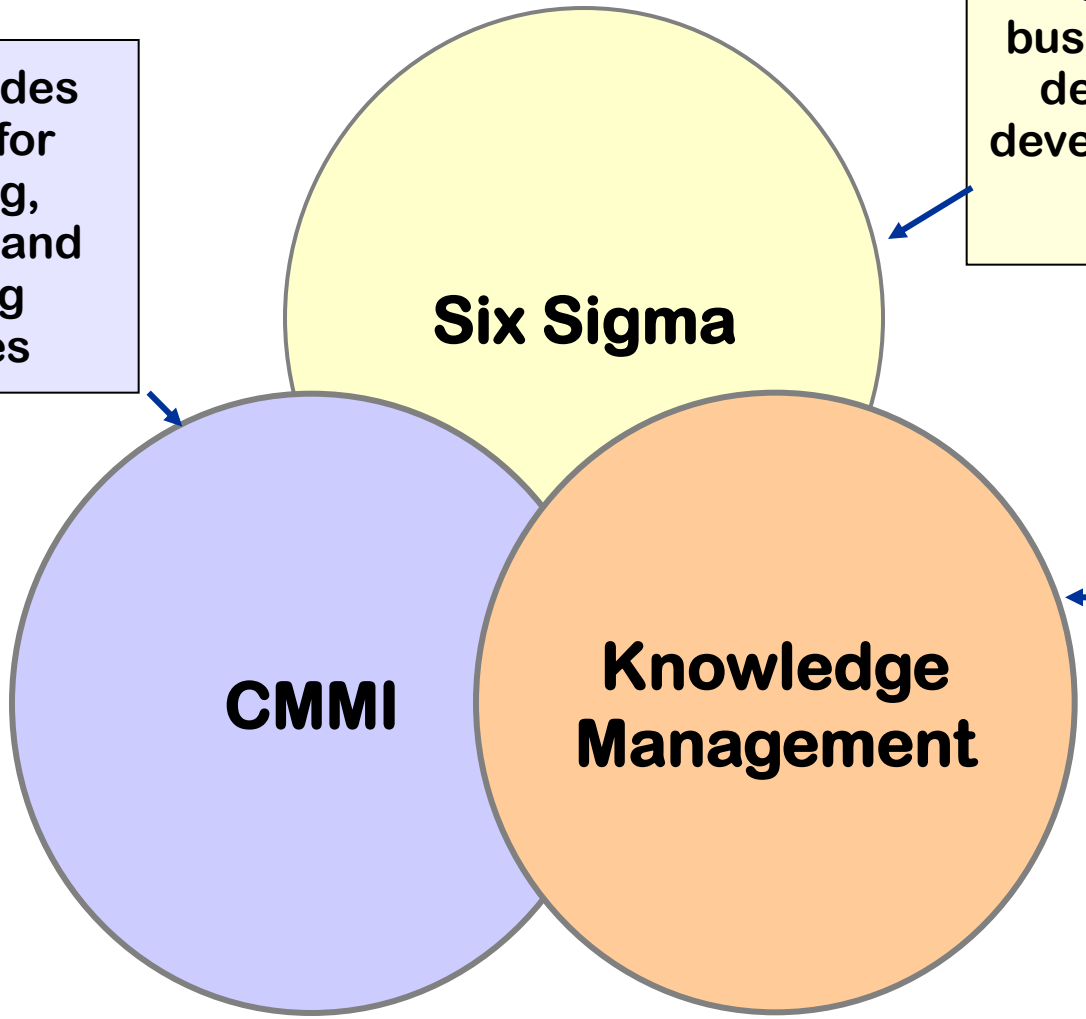
3 Keys to Competitive Leverage

CMMI provides guidance for measuring, monitoring and managing processes

Six Sigma is a business strategy to deliver value and develop a sustainable competitive advantage



KM provides a strategy to utilize data and transform it into knowledge to enable informed and decisive management leadership

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Strategies for Rapid Development

Steve McConnell, Rapid Development

- **Avoid classic mistakes**
- **Apply development fundamentals**
- **Manage risks to avoid catastrophic setbacks**
- **Use schedule-oriented practices**
  - Practices that improve development speed, allowing you to deliver software faster
  - Practices that reduce schedule risk, allowing you to avoid huge schedule overruns
  - Practices that make progress visible, allowing you to dispel the appearance of slow development

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Value in Transitioning from CMM to CMMI - 1

CMM Level 3
Organization Process Focus
Organization Process Definition
Training Program
Integrated Software Mgmt

Software Product Engineering

Intergroup Coordination
Peer Reviews

CMM Level 2
Requirements Management
Software Project Planning
Software Project Tracking & Oversight

Software Subcontract Mgmt
Software Quality Assurance
Software Configuration Mgmt

CMMI Level 3
Organization Process Focus
Organization Process Definition
Organizational Training
Integrated Project Management
Risk Management
Requirements Development
Technical Solution
Product Integration
Verification
Validation
Decision Analysis and Resolution

CMMI Level 2
Requirements Management
Project Planning
Project Monitoring and Control

Supplier Agreement Management
Product & Process Quality Assurance
Configuration Management
Measurement and Analysis

Make progress visible

Manage risks
Reduce schedule risk

Development fundamentals

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Value in Transitioning from CMM to CMMI - 2

- **CMMI provides little help in avoiding classic mistakes**
- **CMMI clarifies the importance of a defined strategy for the development fundamentals**
  - See following chart
- **CMMI more clearly specifies the risk management practices**
- **CMMI indirectly addresses schedule-oriented practices**
  - Few practices that explicitly improve development speed
  - More emphasis on reducing schedule risk
  - More emphasis on making progress visible

"Proof" to process skeptics that CMMI doesn't have value!

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A Defined Strategy

Verification Process Area

SG 1 Prepare for Verification
Preparation for verification is conducted.

SP 1.1 Select Work Products for Verification
Select the work products to be verified and the verification methods that will be used for each.

SP 1.2 Establish the Verification Environment
Establish and maintain the environment needed to support verification.

SP 1.3 Establish Verification Procedures and Criteria
Establish and maintain verification procedures and criteria for the selected work products.

Decide/document how verification will be done

Test facilities and tools, conference room for peer reviews

"Procedures" ensure the verification activity is effective

Deciding how verification will be done, and under what conditions the work product is considered verified

Further details in: "Project Management Strategies Hidden in the CMMI", 2003 CMMI

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Capability Maturity Model Integrated

Level	Focus	Process Areas
5 Optimizing	*Continuous process improvement*	Causal Analysis and Resolution Organizational Innovation and Deployment
4 Quantitatively Managed	*Quantitative management*	Quantitative Project Management Organizational Process Performance
3 Defined	*Process standardization*	Organizational Process Focus Organizational Process Definition Organizational Training Integrated Project Management Risk Management Decision Analysis and Resolution Requirements Development Technical Solution Product Integration Verification Validation
2 Managed	*Basic project management*	Requirements Management Project Planning Project Monitoring and Control Supplier Agreement Management Measurement and Analysis Process and Product Quality Assurance Configuration Management
1 Performed		

Level 5
Focus is on preventing defects and innovation (addressing common causes of variation)

Level 4
Focus is on understanding and managing special causes of variation, at both the project and organizational levels

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Six Sigma Provides a Way to Connect Process Improvement and Business Value

DEFINE	MEASURE	ANALYZE	IMPROVE	CONTROL
Charter team, map process & specify CTQs	Measure process performance	Identify & quantify root causes	Select, design & implement solution	Institutionalize improvement, ongoing control

- **The typical Mission Systems Six Sigma project**
  - Six month duration
  - 4-6 Green Belt team members (2 weeks of training)
  - Black Belt leader (4 weeks of training)
- **Six Sigma projects can help focus and measure CMMI-driven process improvements**
  - Identify the customer's needs, maximize the value/cost
  - Measure the change in capability – especially helpful at Levels 4 and 5
  - Institutionalize improvements -- drive the cultural change

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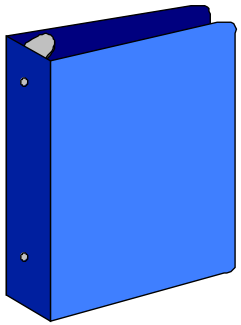
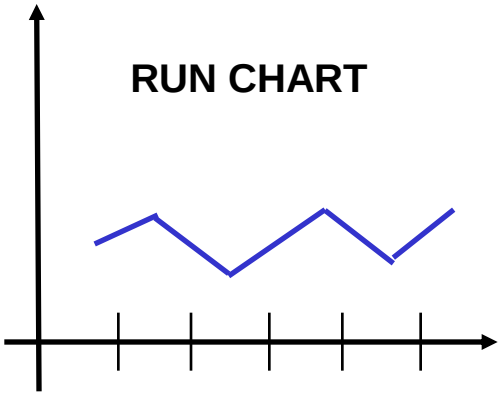
Maturity Level 4

Understanding and managing special causes of variation

Organization

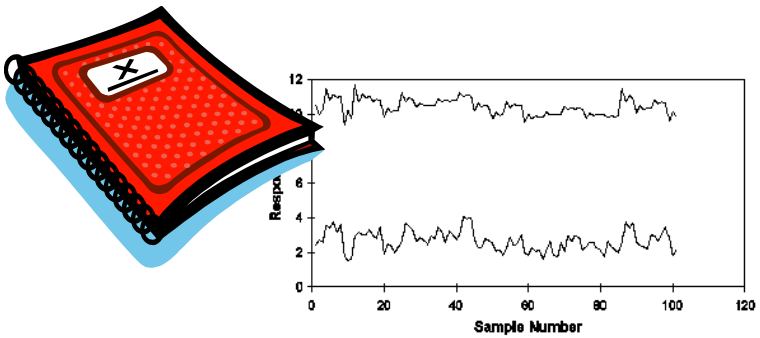
- Establishes organizational goals
- Establishes standard process
- Characterizes process performance and quality of the standard process





Project

- Establishes project goals
- Tailors standard organizational process to create project's defined process
- Selects critical subprocesses to quantitatively manage



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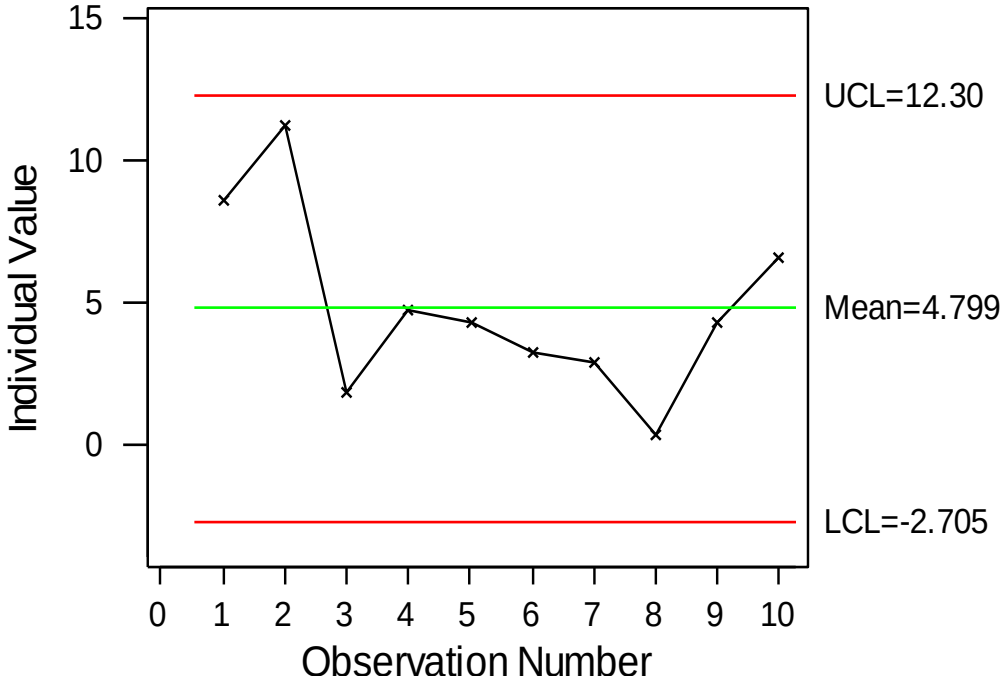
Quantitative Management Example (not real data)

Peer Reviews – Understanding the Process

- **How many errors does the team typically find in reviewing an interface specification?**
- **Useful in evaluating future reviews**
  - Was the review effective?
  - Was the process different?
  - Is the product different?



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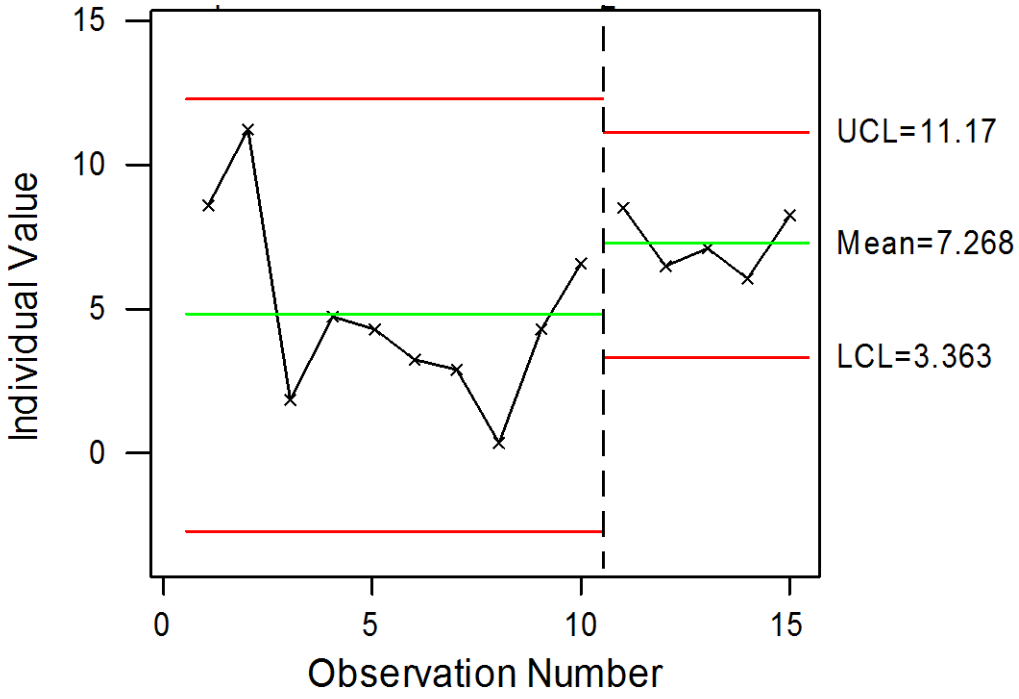
Quantitative Management Example (not real data)

Peer Reviews – Improving the Process

- **Reduce the variation**
  - Train people on the process
  - Create procedures/checklists
  - Strengthen process audits
- **Increase the effectiveness (increase the mean)**
  - Train people
  - Create checklists
  - Reduce waste and re-work
  - Replicate best practices from other projects



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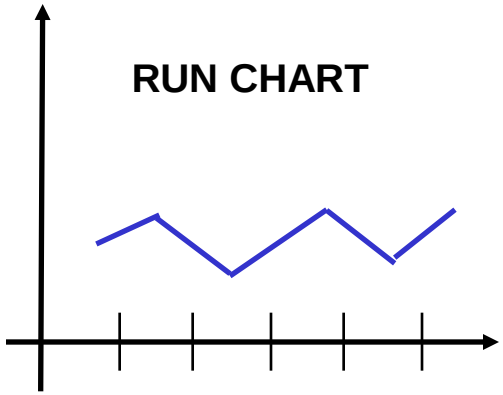
Maturity Level 5

Preventing defects and innovation (addressing common causes of variation)

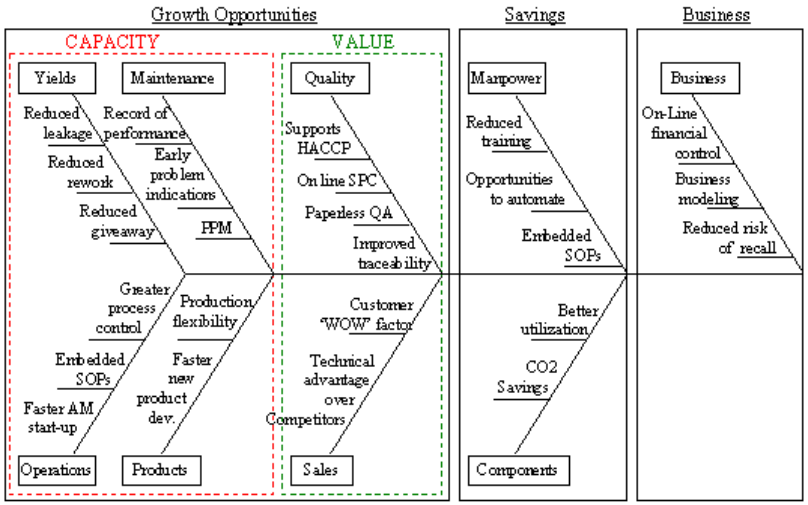
Organization

- Identifies incremental and innovative improvements
- Pilots improvements
- Deploys and measures (quantitatively) the results



Project

- Identifies causes of defects and other problems
- Takes actions to prevent them from occurring in the future



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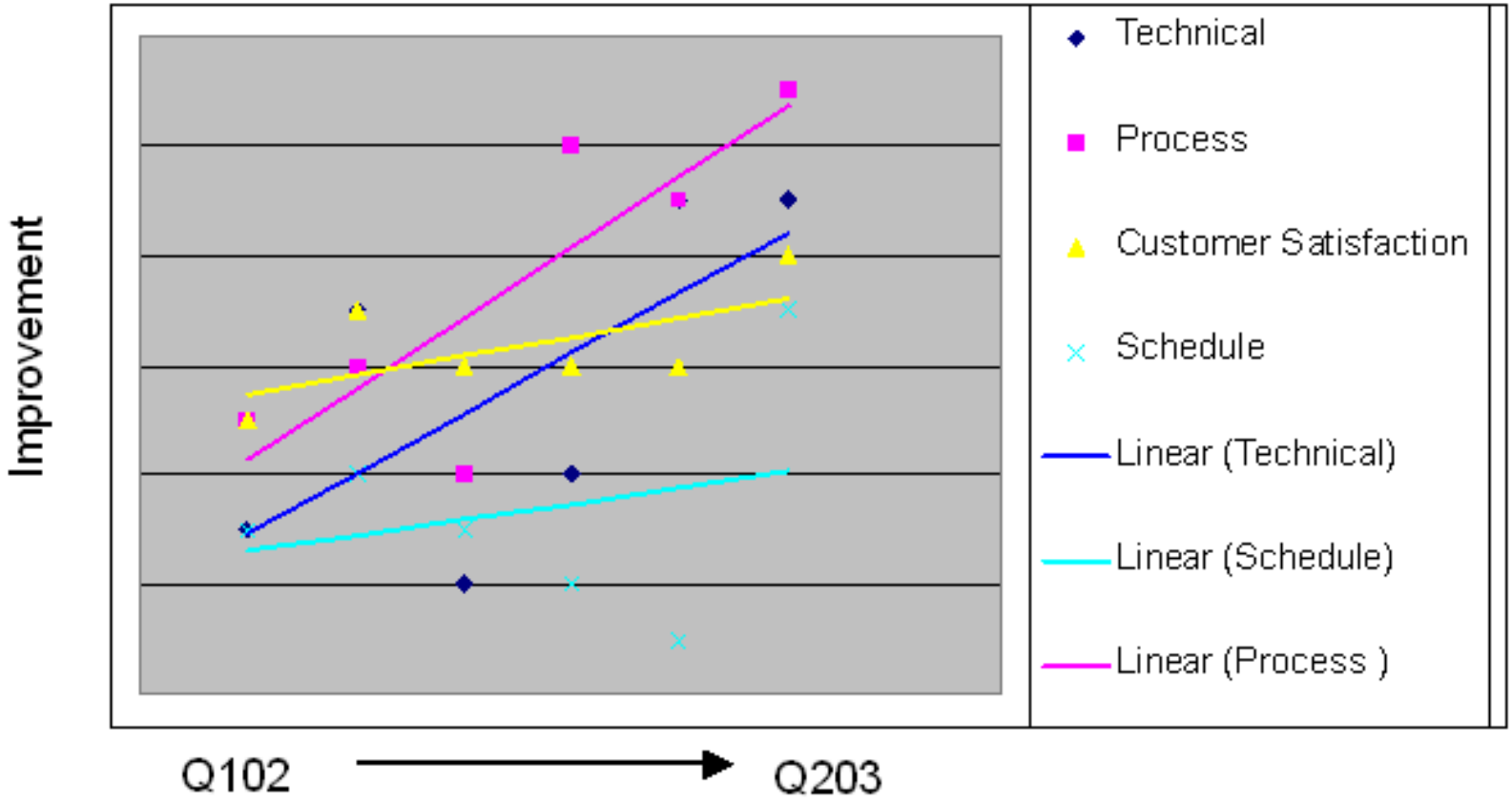
Program Performance Trends

- **Improvement in the number of successful projects, based on critical program performance categories**



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Conclusions

- **Value of transitioning from CMM to CMMI is difficult to quantify**
- **CMMI strengthens generally accepted principles of sound program management**
- **Levels 4 and 5 allow both the project and organization to focus and measure specific improvements**
- **Six Sigma is an enabler for measuring the value of specific improvements**