Benefits of Process Improvement

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June 29, 2009
TOPIC

- Quality
- Process Improvement Concepts
- Development of the CMMI Model
- Key practices from CMMI to achieve the ‘Quality’
- Benefits
- Questions and Answers
Business Goals

• Higher profit
• Higher product quality
• Higher customer satisfaction
Quality

• Deliver products and services better, faster, and cheaper.
The Process Management Premise

- The quality of a system is highly influenced by the quality of the process used to acquire, develop, and maintain it.
- This premise implies a focus on processes as well as on products.
  - This is a long-established premise in manufacturing.
  - Belief in this premise is visible worldwide in quality movements in manufacturing and service industries (e.g., ISO standards).
• A process is a set of practices performed to achieve a given purpose; it may include tools, methods, materials, and/or people.
## Process

### Source / Reference

<table>
<thead>
<tr>
<th>Source / Reference</th>
<th>Definition of Process</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concise Oxford Dictionary</td>
<td>“a course of action or proceeding, esp. a series of stages in manufacture or some other operation”</td>
</tr>
<tr>
<td>Webster’s Dictionary</td>
<td>“a system of operations in producing something…a series of actions, changes or functions that achieve an end result”</td>
</tr>
<tr>
<td>IEEE P1220</td>
<td>“A system of operation or series of actions, changes, or functions, that bring about an end or result including the transition criteria for progressing from on stage or process step to the next”</td>
</tr>
<tr>
<td>ISO 12207</td>
<td>“A set of interrelated activities, which transform inputs into outputs”</td>
</tr>
<tr>
<td>ISO 9000: 2000</td>
<td>“A system of activities which use resources to transform inputs to outputs”</td>
</tr>
<tr>
<td>Garg and Jazayeri (1996)</td>
<td>“a set of partially ordered steps intended to reach a goal”</td>
</tr>
</tbody>
</table>
Quality Leverage Points

• While process is often described as a leg of the process-people-technology triad, it may also be considered the “glue” that unifies the other aspects.

– Everyone realizes the importance of having a motivated, quality work force but even our finest people can’t perform at their best when the process is not understood or operating “at its best.”

Major determinants of product cost, schedule, and quality
Why Focus on Process?

- Process provides a constructive, high-leverage focus...
  - as opposed to a focus on people
    + Your work force, on the average, is as “good” as it is trained to be.
    + Working harder is not the answer.
    + Working smarter, through process, is the answer.
  - as opposed to a focus on technology
    + Technology applied without a suitable roadmap will not result in significant payoff.
    + Technology provides the most benefit in the context of an appropriate process roadmap.
Early Process Improvement

• The theories of process management are a synthesis of the concepts of Deming, Crosby, Juran, and others.

• Over the past 30 years, these theories have been used to address problems common to many organizations.

• Solutions have been discovered, but a gap existed between the state of the practice and the state of the art.

• Many of these concepts have been used to build process-improvement models.
What Is a Process Model?

• A model is a structured collection of elements that describes characteristics of effective processes.

• Processes included are those proven by experience to be effective.
## Related Models

<table>
<thead>
<tr>
<th>Model</th>
<th>Examples of Related Models</th>
</tr>
</thead>
<tbody>
<tr>
<td>Software CMM®</td>
<td>Software Acquisition CMM (SA-CMM)</td>
</tr>
<tr>
<td></td>
<td>Personal Software Process (PSP) and Team Software Process (TSP)</td>
</tr>
<tr>
<td>People CMM (P-CMM)</td>
<td></td>
</tr>
<tr>
<td>Systems Engineering Capability Model (SECM)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>Information Technology – Software Process Assessment (ISO/IEC 15504)</td>
</tr>
</tbody>
</table>
How Is a Model Used?

A model is used

• to help set process improvement objectives and priorities
• to help ensure stable, capable, and mature processes
• as a guide for improvement of project and organizational processes
• with an appraisal methodology to diagnose the state of improvement efforts
Why is a Model Important?

- A model provides
  - a place to start
  - the benefit of a community’s prior experiences
  - a common language and a shared vision
  - a framework for prioritizing actions
  - a way to define what “improvement” means for your organization

- “All models are wrong; some are useful.”
  - George Box
Multiple Models

• The SEI, ISO, EIA, and other organizations have generated models
  – based on widely-accepted practices
  – with a proven history of benefits

• These successful efforts generated a number of related models
Why Use CMMI?

- The purpose of CMMI is to provide guidance for improving your organization’s processes and your ability to manage the development, acquisition, and maintenance of products or services.

- CMMI places proven approaches into a structure that
  + helps your organization examine the effectiveness of your processes
  + establishes priorities for improvement
  + helps you implement these improvements
CMM Integration Project

• The CMM IntegrationSM Project was formed to
  – build an initial set of integrated models
  – establish a framework to enable integration of future models
  – create an associated set of appraisal and training products

• Source models serving as the starting point for CMMI were
  – SW-CMM (software) V2.0 Draft C
  – EIA/IS-731 (systems engineering)
  – IPD-CMM (integrated product development) V0.98
CMMI framework

The CMMI Framework is the structure that organizes the components used in generating models, training materials, and appraisal methods.

The CMMI Product Suite is the full collection of models, training materials, and appraisal methods generated from the CMMI Framework.

The components in the CMMI Framework are organized into groupings, called constellations, which facilitate construction of approved models.

- **CMMI-DEV** provides guidance for managing, measuring, and monitoring development processes.
- **CMMI-SVC** provides guidance for delivering services within organizations and to external customers.
- **CMMI-ACQ** provides guidance to enable informed and decisive acquisition leadership.

16 Core Process Areas used in all
CMMI Breakdown

CMMI Version 1.2

CMMI Model
Foundation (Common) Process Areas 16

Six Specific Process Areas focus on Development Specific Practices

CMMI - Dev

Six Specific Process Areas focus on Acquisition Specific Practices

CMMI - Acq

Six Specific Process Areas focus on Service Specific Practices

CMMI - Service
CMMI Synergy

CMMI Model

Synergy

CMMI - Dev
Supplier

CMMI - Acq
Acquirer

CMMI - Service
Service/Operations

CMMI Version 1.2
CMMI Level 2 Process Areas

- **Measurement and Analysis**: The purpose of Measurement and Analysis (MA) is to develop and sustain a measurement capability that is used to support management information needs.

- The initial focus for measurement activities is at the project level. However, a measurement capability may prove useful for addressing organization- and/or enterprise-wide information needs. To support this capability, the measurement activities should support information needs at multiple levels including the business, organizational unit, and project to minimize re-work as the organization matures.
Early consideration of Quantitative Management is important.

- Measurements needed for performing quantitative management may (or may not) be different from measurements needed for understanding your processes at lower levels.
- To perform quantitative management, analysis of a history of measurement data is required.
- Delaying consideration of measurement needs for quantitative management impacts the existing measurement program.
Benefits of Implementing SPI

• Error avoidance instead of error removal
• Strengthening of communication on all levels
• Efficient integration of new employees
• Decreased development costs
  – Software reuse
  – Improved estimation of cost and time
  – Improved use of the tools
• Faster project start
  – Access to data of past projects
• Independence of “heroes”
Benefits of Implementing SPI

- Reduces development and maintenance costs
- Improves customer satisfaction
- Reduces cycle time
- Increase profitability
- Improves professional staff
### Results of Process Improvement Initiatives - Benefits

<table>
<thead>
<tr>
<th>Metric Category</th>
<th>Measurement</th>
<th>Benefits Realized by Various Software Organizations</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Productivity</strong></td>
<td>Increase in Productivity</td>
<td>10 – 20 percent, 90 – 100 percent, 50 percent, 15-20 percent, 5 percent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>130 percent, 12 percent, 2.5 – 6.3 percent, 35 percent</td>
</tr>
<tr>
<td><strong>Quality</strong></td>
<td>Reduction in Defects</td>
<td>10 percent, 80 percent, 50 – 70 percent, 50 percent</td>
</tr>
<tr>
<td></td>
<td>Reduction in Error Rate</td>
<td>45 percent</td>
</tr>
<tr>
<td></td>
<td>Product Error Rate</td>
<td>From 2.0 down to 0.11 per thousand source lines of code</td>
</tr>
<tr>
<td></td>
<td></td>
<td>From 0.72 down to 0.13 per thousand non-commented source statements</td>
</tr>
</tbody>
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<tr>
<th>Metric Category</th>
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<tr>
<td>Schedule</td>
<td>Within Estimate</td>
<td>5 percent of estimate</td>
</tr>
<tr>
<td></td>
<td>On – time Deliverables</td>
<td>From 51 percent up to 94 percent on time</td>
</tr>
<tr>
<td></td>
<td>Project Completion</td>
<td>From 50 percent down to 1 percent late</td>
</tr>
<tr>
<td></td>
<td>Savings in Schedule</td>
<td>10 percent, 20 percent</td>
</tr>
<tr>
<td>Effort</td>
<td>Reduction in Rework</td>
<td>5 to 10 percent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>From 40 percent down to 25 percent of effort</td>
</tr>
<tr>
<td></td>
<td></td>
<td>From 41 percent down to 11 percent of project cost.</td>
</tr>
</tbody>
</table>
The benefits of CMMI

The performance results in the following table are from 30 different organizations that achieved percentage change in one or more of the six categories of performance measures below.

<table>
<thead>
<tr>
<th>Performance Category</th>
<th>Median Improvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cost</td>
<td>34%</td>
</tr>
<tr>
<td>Schedule</td>
<td>50%</td>
</tr>
<tr>
<td>Productivity</td>
<td>61%</td>
</tr>
<tr>
<td>Quality</td>
<td>48%</td>
</tr>
<tr>
<td>Customer Satisfaction</td>
<td>14%</td>
</tr>
<tr>
<td>Return on Investment</td>
<td>4:1</td>
</tr>
</tbody>
</table>

CMMI provide:
- Guidance for efficient, effective improvement across multiple process disciplines in an organization
- Improvements to best practices incorporated from the earlier models
- A common, integrated vision of improvement for all elements of an organization
References

- Introduction to CMM presentation: Carnegie Mellon University
- Articles under [www.sei.cmu.edu](http://www.sei.cmu.edu)
Questions and Answers

THANK YOU