Harvesting CMMI® Benefits –
The Six Sigma Sickle
SEPG Conference -2006
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Key Facts About Tata Consultancy Services (TCS)

- Established in 1968
- U.S. offices established in 1979
- More than 45,000 associates globally, with more than 9,000 in the U.S.
- FY 2004-2005 revenues of $2.24 B (60% coming from North America)
- Publicly-held – Market cap of approx. $12 B
- Global presence – Operations in 32 countries, 153 offices across the globe
- More than 50 locations in the U.S.

“TCS has the size and reach unlike any other Indian software company.”

The Wall Street Journal – June 30, 2004
The Business Case for Process Improvement @ TCS – WHY

- Cost
  - Productivity Improvement
  - Competitive Advantage

- Time
  - Global Delivery Capability
  - Process Agility
  - Reusability

- Quality
  - High Quality Delivery
  - Reliability
  - Maintainability

\[ y = f(x) \]
The Critical Decision: Organization Process Framework

<table>
<thead>
<tr>
<th>Factors for Framework Selection*</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>General:</strong></td>
</tr>
<tr>
<td>Geographic Origin/ Spread</td>
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<tr>
<td>Scientific Origin</td>
</tr>
<tr>
<td>Development/ Stability</td>
</tr>
<tr>
<td>Popularity</td>
</tr>
<tr>
<td>Software Specific</td>
</tr>
<tr>
<td>Prescriptive/ Descriptive</td>
</tr>
<tr>
<td>Adaptability</td>
</tr>
<tr>
<td><strong>Process:</strong></td>
</tr>
<tr>
<td>Assessment</td>
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<tr>
<td>Assessor</td>
</tr>
<tr>
<td>Process Improvement method</td>
</tr>
<tr>
<td>Improvement Initiation</td>
</tr>
<tr>
<td>Improvement Focus</td>
</tr>
<tr>
<td>Analysis techniques</td>
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<tr>
<td><strong>Organization:</strong></td>
</tr>
<tr>
<td>Actors/ Roles/ Stakeholders</td>
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<tr>
<td>Improvement Focus</td>
</tr>
<tr>
<td>Analysis techniques</td>
</tr>
<tr>
<td><strong>Quality:</strong></td>
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<tr>
<td>Quality Perspective</td>
</tr>
<tr>
<td>Progression</td>
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*Source: A Taxonomy to Compare Software Process Improvement Frameworks, 12th International Conference on Software Quality

Best of People and Technology cannot guarantee best of the Products and Services unless the Processes are Effective.
Why CMMI works for TCS

• Most endorsed benchmark for a process industry
• Focuses on ability to manage the development, acquisition, and maintenance of products and services
• Facilitates enterprise-wide process improvement
• Provides a consistent, enduring framework that accommodates new initiatives
• Comprehensive framework providing a clear roadmap to develop and optimize processes
• Can be adapted along with other Quality Models: ISO, TBEM, PCMM

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CMMI Maturity Levels

TCS has been assessed Enterprise wide to be operating at CMMI Level 5 in Sep 2004

1. Initial
   - Process unpredictable, poorly controlled and reactive

2. Managed
   - Process characterized for projects and is often reactive

3. Defined
   - Process characterized for the organization and is proactive

4. Managed
   - Process measured and controlled

5. Optimizing
   - Focus on process improvement

Source: CMMI V 1.1 Tutorial
Six Sigma Sickle: The Rigor for Success

1. Project Charter, Process Mapping
2. Affinity Diagram, QFD, CTQ Drill Down tree, Benchmarking, FMEA, QFD, CBM, Hypothesis Testing, Cost Benefit Analyses
3. Causal Analysis Tools, TRIZ, Regression Analysis
4. Process Capability Analysis, Statistical Process Control
5. Quantitatively Managed
   - Optimizing
   - Defined
   - Managed
   - Initial
Strategic Challenges @ TCS

1. Accelerating Customer Acquisition

2. Building a Culture of Ownership, and Empowerment

3. Seamlessly integrating organizational processes

4. Accelerating Revenue Growth and Sustaining Profitability in the long term

- Bring in Customer driven excellence mind set
  - Customer Satisfaction Level
  - Customer Referral
- Quality in deliverables, do it first time.. Every time
  - Cost of Quality

Quality Framework - iQMS
CMMI know “WHAT” → Six Sigma know “HOW”

But do you know how to do this?

Six Sigma tells you How

“What”s of CMMI
• Causal Analysis and Resolution
• Quantitative Project Management
• Organizational Process Definition
• Risk Management
• Decision Analysis and Resolution
• Requirements Development

Know How with Six Sigma
• Ishikawa, Pareto Chart
• Control Charts
• Process Mapping
• Failure Mode Effect Analysis, PPA
• Criteria Based Matrix
• Affinity Diagram, QFD

Together, Six Sigma and CMMI help organizations improve marketplace competitiveness and achieve business goals faster
CMMI know “WHAT” → Six Sigma know “HOW” : Example

**CMMI Process Areas (Example)**
- Causal Analysis and Resolution

**Applicable Six Sigma Tools (Example)**
- **Ishikawa / Fishbone diagram**
  - What is a Ishikawa Diagram?
    - A visual tool used to brainstorm and logically organize possible causes to address a specific problem or effect
  - How it is relevant?
    - Ishikawa Diagram helps addressing SG1 of Causal Analysis and Resolution as it helps in identifying the root causes
- **Pareto Chart**
  - What is a Pareto?
    - Pareto chart is a vertical bar graph where a series of bars whose heights reflect the frequency or impact of problems are arranged in descending order of height from left to right
  - How it is relevant?
    - Pareto Chart helps addressing the PA Causal Analysis and Resolution as it helps in identifying the vital causes responsible for 80% of the defects

**PA of Maturity Level 5**

The purpose of Causal Analysis and Resolution is to identify causes of defects and other problems and take action to prevent them from occurring in the future

**Specific Goals**
- SG 1: Determine Causes of Defects
- SG 2: Address Causes of Defects
The purpose of the Quantitative Project Management process area is to quantitatively manage the project’s defined process to achieve the project’s established quality and process-performance objectives.

**Specific Goals**

- SG1: Quantitatively Manage the Project
- SG2: Statistically Manage Sub-process Performance

**Applicable Six Sigma Tools (Example)**

**Control Charts**

*What are Control Charts?*

A control chart is a graphical plot of a parameter over time used to identify special cause (assignable) variations and to make adjustments to the process being monitored.

*How it is relevant?*

Control Charts are the primary tools used for Statistical process Control and hence can be used to achieve the Specific Goal 2 of the PA Quantitative Project Management.
CMMI know “WHAT” → Six Sigma know “HOW” : Example

**CMMI Process Areas (Example)**

| Risk Management |

**PA of Maturity Level 3**

The purpose of Risk Management is to identify potential problems before they occur, so that risk-handling activities may be planned and invoked as needed across the life of the product or project to mitigate adverse impacts on achieving objectives.

**Specific Goals**

- SG 1: Prepare for Risk Management
- SG 2: Identify and Analyze Risks
- SG 3: Mitigate Risks

**Applicable Six Sigma Tools (Example)**

| Potential Problem Analysis (PPA) |

**What is PPA?**

The potential-problem analysis method is designed to provide a challenging analysis of a developed idea or action in order to pre-empt any potential for going wrong.

**How it is relevant?**

PPA helps in addressing the specific SG2 of Risk Management as it:
- lists possible causes for each potential problem
- develops preventive actions and contingency plan

| Failure Mode Effect Analysis (FMEA) |

**What is FMEA?**

A tool to identify failure modes of a process or product, estimate the risks (severity, occurrence and detection) and prioritize actions to be taken.

**How it is relevant?**

FMEA helps in achieving the specific goals of Risk Management PA as it:
- identifies potential failure modes and rates the severity of their effect
- offers an objective evaluation of the occurrence of causes and the ability to detect when those causes occur
- ranks the order of potential product and process deficiencies
- focuses on eliminating product and process concerns
Integrating Six Sigma with iQMS - Project Start Up

Deliverables:
- Task Order
- Project Plan

Six Sigma Tools
- COPIS
- Project Charter
- MGPP

Templates
- Project Plan Template
- Status report Template
- Project Monitoring Review Report Template

Checklists
- Project Start Up Checklist
- Review Report for Contract
- Project Plan Review Checklist
Integrating Six Sigma with iQMS - Requirement Analysis

Deliverables:
- System Requirement Specification (SRS)
- Updated Project Plan

Six Sigma Tools
- Affinity Diagram
- QFD
- CTQ Drill Down Tree

Templates
- Traceability Matrix Template
- System Requirement Specifications Template

Standards and Checklists
- Requirements Standards

Business Needs | Requirements Gathering | Requirements Analysis

Go
- SRS Released
- Updated project Plan Released
Integrating Six Sigma with iQMS - System Design

Deliverables:
- High Level Design (HLD)
- Usability Plan
- Prototype

Six Sigma Tools
- Use Cases
- Structure Diagrams
- Pugh Matrix
- Risk assessment

Templates
- Traceability Matrix Template
- Design Template

Standards & Checklists
- Standards for Design

Go
- HLD Released
- Usability Plan Released
- Reviewed prototype
Integrating Six Sigma with iQMS - Design, Build & Test

Deliverables:
- Low Level Design (LLD)
- Unit Test Plan (UTP), Unit Test Specifications (UTS)
- System Test Plan (STP), System Test Specifications (UTS)
- Code

Six Sigma Tools
- Control Impact Matrix
- Cost Benefit Analysis
- Design of Experiments
- Simulation and Modeling
- FMEA
- Validation Plans

Templates
- Traceability Matrix Template
- Low Level Design Template
- Test Plan Template

Standards and Checklists
- Standards for Design
- Coding Standards
- Code Review Checklists
- Final Inspection Checklist

Exit Criteria
- LLD Released
- UTP, UTS Released
- STP, STS available
- Reviewed and unit tested code
Integrating Six Sigma with iQMS - Verification & Validation

Project Start-Up
Define
- Requirement Analysis
- Measure
- System Design
- Analyze

Detailed Design
- Design
- Build & Test
- Verification & Validation
- Verify

Stop

Deliverables:
- Acceptance letter from Client
- Client Feedback
- Project Wind-up Note

System Validation
Acceptance Testing
Project Wind Up
Exit Criteria

Six Sigma Tools
- Risk Management
- FMEA
- Control Charts
- Process Management Charts

Templates
- Traceability Matrix Template
- Wind Up Note Template
- Client Feedback Template

Standards and Checklists
- Standards for Testing
- Branch Metrics Standards
Six Sigma Sickle: Harvesting for Success

Organizational Innovation and Deployment:
Set up Siebel CoE

Causal Analysis and Resolution:
Reduction of Defects

Quantitative Project Management:
Improve SPAN

Risk Management:
Business Continuity and Disaster Recovery

Requirements Management:
Requirement Management process
Requirements Process – Requirements Management

Define

Business Case / Project Needs:
The Data-Dynamics group at offshore are getting requirements and modification details about Informatica mapping/SP through email/Tcons. Whenever any new changes comes for an existing mapping or SP, the developer first gathers all the design documents and modification history. This requirement gathering process is extremely time consuming and prone to errors. With the increasing number of mappings/SPs developed at offshore, keeping track of all requirements/designs docs/modification histories is getting difficult day by day.

Problem Statement:
In the last 6 months there have been continuous changes in all the deliverables (Informatica Mappings, SPs, Functions) provided by the data dynamics team of CPQ Selectica Project at offshore. On an average a developer takes 30 mins to 2 hours to gather all requirements related to any deliverable. This leads to delayed output form the offshore team leading to customer dissatisfaction.

Goal Statement:
To reduce the time taken to retrieve all information for any deliverable at offshore to less than 10 mins by FW44.

MGPP:
1. Specify CTQs
2. Develop Process Flow

Measure

Customer Segmentation:

Impacted Customers:
Onsite Coordinators
Offshore Developers
Data Migration Team at onsite
Data Migration Team at offshore

CTQ Measures:
• Ensuring 100% execution of Improvement of Requirement Management Process.

Analyze

High Level process map :

1. Specify CTQs
2. Develop Process Flow

Verify

Design Evaluation – Actual results: Actual results from the collected data after the implementation of the monitoring system indicated 100% efficiency in requirement management.

• The Data-Dynamics group at offshore was receiving Requirements via emails or tele-cons and keeping track of requirements/designs docs/modification histories was a huge challenge.

• Six Sigma DMADV rigor was used to identify stakeholder needs.

• Requirements Management system was developed as part of the improvement.

• Actual results from the collected data after the implementation of the monitoring system indicated 100% efficiency in requirement management.

Alternating Architecture:
Two different architectures were available:
1. Client-Server Architecture
2. Distributed Architecture
Business Continuity and Disaster Recovery: Risk Management

Business Situation
- After Sept 11, existing business continuity plans were inadequate to cater to increasing customer concerns on security and continuity.
- There was a need to re-engineer current processes in continuing support services even after a disaster situation.

- **Existing Business Continuity Plans (BCP) and Disaster Recovery Plans (DRP) were inadequate to cater to increasing customer concerns on security and continuity.**
- **Six Sigma DMAIC rigor used to enhance Business Continuity Plan.**
- **Mission Critical applications were identified and back up support personnel created at alternate locations.**

Goal:
To improve Business Continuity and Disaster Recovery Planning.

Measure:
The two Critical Recovery Timeframes were:
- **x**, Business Continuity
- **y**, Disaster Recovery

Analyze:
- The disaster scenarios and its root causes were analyzed.
- The impact of the disaster in terms of service outage and cost of failure were determined.

Improve and Control:
- BCP enhanced.
- Mission critical applications (MCAs) identified.
- Backup support personnel at alternate locations for MCAs created.
- Processes for role transition of backup personnel documented.
- Mock drills conducted to assess readiness for disasters.

**TATA CONSULTANCY SERVICES**
## Reduction of Defects – Causal Analysis and Resolution

**Define: Business Case**
A high level study of operational metrics in Defect Tracker for business website indicated that roughly 50% of the cases reported were either defects in delivery or production problem. Further the cycle time for fixing defects, when reported was unpredictable.

**Goal Statement:**
To reduce the number of defects and production problems reported, by 50%. To fix 100% defects reported, within an acceptable and agreed upon time frame, with a tolerance of 5%.

**Measure: CTQ's and Baseline**

<table>
<thead>
<tr>
<th>CTQ</th>
<th>Severity 1</th>
<th>Severity 2</th>
<th>Severity 3</th>
<th>Severity 4</th>
<th>All</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Defects (%)</td>
<td>45.12</td>
<td>4.84</td>
<td>6.22</td>
<td>13.69</td>
<td>45.12</td>
</tr>
<tr>
<td>Cycle Time - Response Time (Days)</td>
<td>4.49</td>
<td>8.29</td>
<td>11.68</td>
<td>17.3</td>
<td>11.65</td>
</tr>
<tr>
<td>Cycle Time - Resolution Time (Days)</td>
<td>7.39</td>
<td>10.68</td>
<td>19.24</td>
<td>39.93</td>
<td>11.65</td>
</tr>
</tbody>
</table>

**Analyze & Improve: Vital X’s and Solutions**

- **CTQ**
  - Reduction of Defects
  - Cycle Time – Resolution Time (Days)

- **Vital X (In Control)**
  - Inconsistency in Testing
  - Time to Schedule Development
  - Time for Clarification
  - Time for Estimation

- **Improvement Plan**
  - Dedicated Quality Assurance Team
  - New Testing Process
  - Separate Team for Change Requests

**Control: Process Improvements**

- A dedicated Quality Assurance Group and a separate group for defect change requests was set up within the project team.

- Causal Analysis techniques were used to identify vital causes and solutions to address them were identified using Six Sigma rigor.

- Customer signed off savings of USD 125,000 incurred through the improvements.

**Improvements across the board.**

Net Revenues signed off by Customer: $125,000
**Setup Siebel CoE – Organizational Innovation and Deployment**

**PA - Organizational Innovation and Deployment:**
To select and deploy incremental and innovative improvements that measurably improve the organization’s processes and technologies. The improvements support the organization’s business objectives and process-performance objectives as derived from the organization’s business objectives.

**Analyze:**
- High Level Process Map was prepared
- Scorecard developed to monitor the CoE

**Define:**
- Using Six Sigma DMADV rigor a Siebel Center of Excellence was developed at GDC
- Members of the CoE were deployed for the customer projects
- Customer signed off savings of USD 581,250 incurred through the improvements

**MGPP:**
- Phase 1: Set up Siebel Center of Excellence (CoE) by using “Fixed Price” pricing model and achieving high offshore leverage.
- Phase 2: On successful deployment, ODC team Siebel Certified, SLAs defined and reported

**Measure:**
- Achieved First Time Right and On Time Delivery by the Center of Excellence team

**Verify:**
- FTR and OTD SLAs met by the ODC Team
- Benefits sign-off by Customer Quality Leader
- Cost Savings: (Contractor) – (Fixed Price Cost) (US $)
  - 791,250 – 210,000 = 581,250

**Quarterly Tracking Sheet**

**Measured:**
- Compliance of the SLA between ODC Support team and IT Team
- Customer satisfaction index as expected
- Siebel Application performance meets SLAs with End Users

**CBM was used to prioritize CTQs**
For questions contact

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