Using Balanced Scorecard to help achieve CMMI Maturity Level 4

European SEPG 2005

Peter Voldby Petersen, Systematic
Kent Johnson, Borland
Agenda

- Who are we?
- Focus of CMMI Maturity Level 4
- Highlights of Balanced ScoreCard Methodology
- Goal Flow-down
- Integrating Level 4 and BSC
- Deploying Balanced ScoreCard
- Lessons and Results
Systematic Software Engineering A/S

- Established in 1985 and now Denmark’s largest privately-owned software and systems company
- 370+ employees; 70% hold a MSc or PhD in software engineering
- High employee satisfaction – attractive workplace for ambitious software engineers
- Dun & Bradstreet credit rating: AAA
- High solidity. No bank debt – fully self-financing
- CMMI Level 4 and ISO 9001:2000 and AQAP 110 + 150
- Supplier of products and projects to more than 27 countries, export share is 60%
- 97% of our customers would recommend Systematic to other customers
- For further information – see www.systematic.dk

Mission Critical

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Borland TeraQuest

World Leader in CMM/ CMMI -based services

Epner
VP

Layman
Sr. Dir.

Curtis
Chief Process Officer

Statz
VP Knowledge Management

Oxley
VP Process Management

Process Optimization:

Experience
- 11 Lead Appraisers
- 20+ yrs. each

The IT-Knowledge Company
CMMI 4 – to Control and to Predict

**Important Level 4 Concepts:**

Level 4 is focused on predicting the performance of the processes based on historical and project data and managing according.

**Quality and Process Performance Objectives** – important goals based on business objectives and past performance

<table>
<thead>
<tr>
<th>Control process variation</th>
<th>Predict quality and process performance</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Vision</strong></td>
<td><strong>Focus</strong></td>
</tr>
<tr>
<td>Known effort, costs and</td>
<td>Primarily past</td>
</tr>
<tr>
<td>quality</td>
<td>(Measures)</td>
</tr>
<tr>
<td>Predict results, e.g.</td>
<td>Primarily future</td>
</tr>
<tr>
<td>number of defects</td>
<td>(Estimates)</td>
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<tr>
<td><strong>Method</strong></td>
<td><strong>Prediction models</strong></td>
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<tr>
<td>Remove special causes for</td>
<td></td>
</tr>
<tr>
<td>variation</td>
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</table>

Source: Interpreting the CMMI
CMMI 4 – to Control and to Predict

- **Event Level Measure** – a measure taken at the completion of an event.

- **Process Performance Baseline (PPB)** – documents the historical results from a process. Used as a benchmark against actual project performance.

- **Process Performance Model (PPM)** – describes the relationship among attributes of a process and its work products. *Based on PPBs and calibrated to the project.* Used to estimate or predict a critical project value that cannot be measured until later in the project’s life (e.g., no. of delivered defects or total effort).

Source: Interpreting the CMMI
Process Performance Baselines and Models

**Status Measures**
- Size
- Effort
- Cost
- Schedule

**Event Level Measures**
- Hours per event - Productivity
- Requirement (defined)
- Requirement (designed)
- Object Implemented
- Test Executed
- Defects, Size, Hours per Event - Quality
- Design Review
- Inspection
- Test Executed
- Days Late or Early - Schedule
- Task Completed

**Process Performance Baselines**
- Review Baseline
- Defects per page and per hour
- Productivity Baseline
- Hours per requirement by phase
- Effort Distribution
- Percentage of effort by phase

**Process Performance Models**
- Effort (estimation and prediction)
- New Development
- Maintenance
- Defect Insertion and Removal
- New Development
- Maintenance

**Real Project Decisions**
Selecting the Right Business Objectives

Corporate Business Goals and Measures

- Supporting goal
- Measure
- Supporting goal
- Measure
- Supporting goal
- Measure
- Supporting goal
- Measure
- Supporting goal
- Measure

Process Improvement Recommendations and Measures

- Recommendation
- Measure
- Measure
- Measure
- Recommendation
- Measure

Strategic Goal

Selecting the Right Business Objectives
Using Balanced Scorecard (BSC) for Goals

- **BSC provides a mechanism to balance**
  - internal goals and external goals
  - past performance and drivers for future performance
  - short term and long term performance
  - People, Process, and Technology investment

**Generally used categories dimensions**
- Customers
- Finance
- Internal processes
- Learning & growth
Setting up Balanced Scorecards

- **First, establish and communicate a strategy throughout the organization**
  - identify key needs of customers and market segments; link those to financial goals
  - set financial objectives
  - focus on internal business processes and efficiencies in meeting customer needs
  - invest in learning and growth to excel with the processes

- **Within the scorecard**
  - identify how to see financial goals are met
  - set targets for meeting customer needs
  - identify process changes or innovations needed
  - match learning and improvement objectives to these
It is not a simple task!

**Focus**
- Growth
- Efficiency
- Competence

- Time
- Cost
- Quality

Making two different worlds work together...
Project Organizations are Dynamic

Time

2005

2006

Effort

1

2

3

4

△ = Definition of objectives
The Idea!

Integrate the Balanced Scorecard and CMMI Maturity Level 4

<table>
<thead>
<tr>
<th></th>
<th>Finance</th>
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<tbody>
<tr>
<td>Harmonic Growth</td>
<td>Growth in SSE turnover</td>
</tr>
<tr>
<td>Satisfied Earning</td>
<td>Profit ratio</td>
</tr>
<tr>
<td>Increased Internationalization</td>
<td>Export share of corporate turnover</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Customers</th>
<th></th>
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<tbody>
<tr>
<td>Long-term Customer Profitability</td>
<td>Involving degree</td>
</tr>
<tr>
<td>High Customer Loyalty</td>
<td>Project customers with essential additional sale</td>
</tr>
<tr>
<td>Maintain High Customer Satisfaction</td>
<td>IRIS-customers signing up for maintenance</td>
</tr>
<tr>
<td>Understand the Customer’s Business Area</td>
<td></td>
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</tbody>
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<table>
<thead>
<tr>
<th>Internal Processes</th>
<th></th>
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<tbody>
<tr>
<td>World-class Process Maturity</td>
<td></td>
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<tr>
<td>Stable and Reliable Delivery</td>
<td></td>
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<tr>
<td>Precise Estimation Ability</td>
<td></td>
</tr>
<tr>
<td>Reduction of Rework</td>
<td></td>
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<tr>
<td>Increased Productivity</td>
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</table>

<table>
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<tr>
<th>Employees</th>
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<td>Satisfied Talents</td>
<td></td>
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<tr>
<td>Visible and Motivated Management</td>
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<tr>
<td>Intensive Competence Development</td>
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<td>Active Knowledge Sharing</td>
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Goal flow down

Alignment

Define
Collect
Control
Predict
Present
Analyze
Conclude
Act!
Initial Thoughts

- The project must define their own BSC
- Both models are about business objectives, measures, indicators etc
- Both models must be integrated into the way the projects work (part of the Projects’ Defined Process)
- Two reporting mechanisms are one to many!
Balanced Scorecard: Quantifying the Strategy

Vision and strategy

Focus Areas

Objectives

Targets

Finance
To succeed financially how should we appear to our shareholders?

Customers
To achieve our vision how should we appear to our customers?

Learning & growth
To achieve our vision how will we sustain our ability to change and improve?

Internal Processes
To satisfy our shareholders and customers, at what business processes must we excel?

Vision and Strategy

Finance
- Harmonic Growth
- Satisfied Earning
- Increased Internationalization

Customers
- Long-term Customer Profitability
- High Customer Loyalty
- Maintain High Customer Satisfaction
- Understand the Customer's Business Area

Internal Processes
- World-class Process Maturity
- Stable and Reliable Delivery
- Precise Estimation Ability
- Reduction of Rework
- Increased Productivity

Employees
- Satisfied Talents
- Visible and Motivated Management
- Intensive Competence Development
- Active Knowledge Sharing

Example
Delegation and Goal Flow-down

Corporate BSC

Project’s BSC

delegation and goal flow-down

Types of delegation

Project

Staff

“Virtual”

Types of goal flow-down

<table>
<thead>
<tr>
<th>Include</th>
<th>Use objective as is</th>
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</thead>
<tbody>
<tr>
<td>Change</td>
<td>Change target value</td>
</tr>
<tr>
<td>Redefine</td>
<td>Define objective aligned with Strategic Focus Area</td>
</tr>
<tr>
<td>Omit</td>
<td>Do not define objective</td>
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Defining Objectives

**Corporate BSC**

- **Strategic Focus Area:** "Stable and reliable ability to deliver"
  - Objective: Deliveries according to schedule
    - Target: >90%
  - Objective: "The same"
    - Target: 100%

**Project’s BSC**

- **Strategic Focus Area:** "Increased Productivity"
  - Objective: LOC pr project hour
    - Target: >X
  - Objective: LOC pr implementation hour
    - Target: >Y
Quality and Process-Performance Objectives

- **Extrovert**
  - Functional requirements (i.e., scope & size)
  - Qualitative requirements (e.g., usability, response time, scalability, testability, etc)

- **Introvert**
  - Finance, Customer, Internal Processes, Employees

- **Organization**
  - Resource consumption, Cycle time, Defect injection rates, Defect removal efficiency, Delivery rate, etc

- **Project**
  - Duration, Staffing, Costs, etc

- **Strategy**
  - Functional requirements (i.e., scope & size)
  - Qualitative requirements (e.g., usability, response time, scalability, testability, etc)

- **Product**
  - Duration, Staffing, Costs, etc

- **Process**
  - Resource consumption, Cycle time, Defect injection rates, Defect removal efficiency, Delivery rate, etc
## BSC Dimensions and Degree of Control

<table>
<thead>
<tr>
<th></th>
<th>Monitor</th>
<th>Plan and track</th>
<th>Control using thresholds</th>
<th>Statistically control</th>
<th>Predict</th>
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<tr>
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CMMI level 4

- Focus primarily on implementing project goals
- Strong in implementing known/defined objectives
- Little guidance in finding the right objectives

**Synergy of Models**

**Balanced Scorecard**

- Focus primarily on defining strategy
- Strong in defining (balanced) goals
- Little guidance in implementation
Important Lessons

Communicate the vision

Plan and follow up

Change Progress Indicators

Wall of Fame
The Results

- **Systematic gets (the Business Challenges)**
  - Improved Implementation of Strategy
  - Increased Insight into the right Project Parameters

- **The Projects get**
  - Explicit, balanced objectives and evaluation
  - Management Decisions based on Quantitative Data

- **The Customers get**
  - Improved Product Quality
  - Predictability

- **The Employees get**
  - Increased Focus on Employee Development
Improvement of Estimation Ability

- Estimation precision has improved significantly since 1996
- The gap between hours spent and hours estimated has been reduced to one fifth
- The variation in the ability to meet estimates is reduced by 50%
Delivery on Time

89% of all deliveries in 2003 were on time

- Deliveries on time:
  - 66% in 2001
  - 79% in 2002
  - 89% in 2003

- In 2004 we expect to fulfill our objective that we deliver at least 90% on time
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