A DEPLOYMENT PROCESS FOR STRATEGIC MEASUREMENT SYSTEMS

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- GQM+Strategies Deployment Process
- Success Factors and Benefits
- Summary
Motivation

Digitalization of Business Models

- Software - pervasive element of business models
- Software Engineering decisions increasingly depend on high level management and business goals
- Software Engineering decisions have to be aligned and consistent with high level business goals

Consequences of Misalignment

- Software activities contribute limited value & waste of resources
- Software activities are often seen as cost driver that are easy to substitute
- \( \rightarrow \) Core competencies for business success are outsourced

Alignment of Software Activities with Business Goals becomes increasingly important

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Alignment Gap

BSC

Business/Organizational Level

Customer Focus

6σ

GQM

Software/Project Level

PSM

Financial

Customer

Vision and Strategy

Business Process

Innovation/Growth

Goal Attainment

Questions

Answers

Metrics

Measurement

Data Collection

IT Governance

CoBIT

SOFTWARE DEVELOPMENT AND MAINTENANCE

IT Governance

GQM Strategies

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GQM*Strategies Conceptual Model

Goals and Strategies

Goal*Strategies Element

Goal
-> Context/Assumption
-> Strategy

Goal*Strategies Element

Strategy

Goal

realized by a set of measurable through

influences

leads to a set of

influences

Measurement Model

GQM Graph

made measurable through

> made measurable through

< measures achievement of

GQM Graph

is part of

Interpretation Model

Metric

Metric

Metric

Question

Question

GQM Goal

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Linking Goals at Multiple Levels

Goals and Strategies

*Goal+Strategies Elements*

Measurement Data

*GQM Goals*  *Questions*  *Metrics*

Rationale

leads to

> made measurable through

leads to

< measures achievement of

Software Level

Business Level

Project Level

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GQM+Strategies Deployment Process

0. Initialize
   Assure commitment and resources
   Define responsibilities

1. Characterize
   Define application scope
   Characterize environment/context

2. Set Goals
   Determine organizational structures
   Perform gap analysis & prioritize goals
   Perform grid derivation process

3. Choose Process
   Plan implementation of strategies
   Organize data collection and analysis

4. Execute Model
   Apply strategies
   Collect and validate data

5. Analyze
   Analyze data and revise strategies
   Review and communicate results

6. Package
   Adapt and improve grid
   Correct wrong assumptions

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GQM+Strategies Deployment Process

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6. Package
Adapt and improve grid
Correct wrong assumptions

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1. Characterize: Characterize Environment

- **(CA.1) Identify the context**
  - Company XYZ builds a class of shrink-wrapped products
  - Using a standard set of processes and tools that cover the life cycle
  - The latest product is sold directly to customers
  - This is a small organization with no contracting, i.e., they build the next version of the product themselves

- **(CA.2) Identify assumptions**
  - Customer satisfaction with the product will create customer loyalty, which will cause customers to buy the next version of the product
2. Set Goals: Perform Gap Analysis

**Goals and Strategies**

**Business Level**

**Goal:** Increase customer satisfaction by 10%

- **Strategy:** Improve product quality
- **Strategy:** Improve usability of product

**Goal:** Reduce customer-reported defects by 20%

- **Strategy:** Improve efficiency of system testing
- **Strategy:** Improve maintainability of software

No sub-level goal defined ⇒ Strategy not explicitly communicated

**Software Level**

**Measurement Data**

- **M1:** Customer satisfaction survey
- **M2:** Field defect data
- **M3:** Code quality metrics (McCabe, coupling, cohesion)

Isolated strategy ⇒ What is the contribution/value?
⇒ Is there an implicit goal?

Isolated data ⇒ What is the data used for? (e.g., improving code quality)
2. Set Goals: Derive Goals

- Ask for the basic motivation (context and assumptions)
  - **Context 1:** The market for our class of product is becoming highly competitive and there is a need to safeguard our place in the market.
  - **Assumption 1:** Improving customer satisfaction with each new product will lead to customer loyalty, which will help safeguard our place in the market.
- (G.2) Identify an initial set of potential high-level goals
  - Increase customer satisfaction for the next product
- (G.3) Prioritize goals
  - Only one goal was selected for Company XYZ
- (G.4) Ask questions to (semi-)formalize the business goal (goal template)
## 2. Set Goals: Formalize Top-Level Goal

<table>
<thead>
<tr>
<th>Activity</th>
<th>Increase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Focus</td>
<td>Customer satisfaction</td>
</tr>
<tr>
<td>Object</td>
<td>Product “Splash”</td>
</tr>
<tr>
<td>Magnitude (degree)</td>
<td>10% reduction in number of customer complaints</td>
</tr>
<tr>
<td>Timeframe</td>
<td>12 weeks after release</td>
</tr>
<tr>
<td>Scope (context)</td>
<td>Web Products Division, Splash Project Manager</td>
</tr>
<tr>
<td>Constraints (limitations)</td>
<td>Splash price and functionality</td>
</tr>
<tr>
<td>Relationships with other goals</td>
<td>Can conflict with development cost goals, schedule goals, …</td>
</tr>
</tbody>
</table>
2. Set Goals: Define Associated Strategy

- Document context and assumptions
  - Assumption 3: Many customer complaints are due to product reliability problems

- (S.1) Brainstorm potential strategies
  - Build reliability in (e.g., implement fewer defects)
  - Test reliability in (e.g., remove more defects)

- Document context and assumptions
  - Context 2: Little control over development process (too late)
  - Context 3: Limited budget for process improvement

- (S.2) Decide on a strategy
  - Test reliability in (e.g., remove more defects)
2. Set Goals: Define GQM Graph

- **(M.1)** Define GQM goal: Analyze customer complaints trend for Splash for the purpose of evaluation with respect to 10% improvement over history from the point of view of quality management in the context of Web Products Division of XYZ

- **(M.2)** Identify the GQM graph
  - **Assumption 2:** Customer satisfaction can be measured by # of customer complaints
  - Measures and models
    - CCS = Number of customer complaints after release of Splash
    - CCB = Average number of customer complaints after release of baseline products
    - CCR = CCS / CCB
  - Decision criteria in the interpretation model
    - If CCR <= 0.9, the business goal is achieved
**Summary: GQM*Strategies Grid**

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**Goal**:

- **Goal**: Increase customer satisfaction by 10%

**Strategy**:

- **Test reliability** in

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**GQM Goals**

- **G1**: Evaluate trend in customer complaints

**Questions**

- **Q1**: How many customers do complain for baseline products?
- **Q2**: How many customers do complain for Splash?

---

**Metrics**

- **CCB**: # customer complaints for baseline products
- **CCS**: # complaints for next Splash release

---

**Criteria**

- **CCR**: Customer Complaints Ratio
  - **CCS / CCB** ≤ 0.9

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**Summary: GQM*Strategies Grid**

**Business Level**

- **Goal**: Increase customer satisfaction by 10%
- **Strategy**: Test reliability in

**Software Level**

- **Goal**: Reduce customer-reported defects by 20%
- **Strategy**: Introduce new sys. test process

**Goal*Strategies Elements**

<table>
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<tr>
<th>Goal</th>
<th>Strategy</th>
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<tbody>
<tr>
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<td>Test reliability in</td>
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<td>Introduce new sys. test process</td>
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**GQM Goals**

<table>
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<tr>
<th>GQM Goals</th>
<th>Questions</th>
<th>Metrics</th>
<th>Criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>G1: Evaluate trend in customer complaints</td>
<td>Q1: How many customers do complain for baseline products? Q2: How many customers do complain for Splash? Q3: How many SW defect-related complaints are reported for baseline products? Q4: How many SW defect-related complaints are reported for Splash?</td>
<td>CCB: # customer complaints for baseline products CCS: # complaints for next Splash release</td>
<td>CCR: Customer Complaints Ratio CCS / CCB &lt;= 0.9</td>
</tr>
<tr>
<td>G2: Evaluate trend in customer-reported defects</td>
<td></td>
<td>CDB: # customer-reported defects for baseline products</td>
<td>CDR: Customer-reported Defects Ratio CDS / CDB &lt;= 0.8</td>
</tr>
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**Metrics**

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## Summary: GQM+Strategies Grid

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<th>Criteria</th>
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<tbody>
<tr>
<td><strong>Goal:</strong> Increase customer satisfaction by 10%</td>
<td><strong>G1:</strong> Evaluate trend in customer complaints</td>
<td>Q1: How many customers do complain for baseline products?</td>
<td><strong>CCR:</strong> Customer Complaints Ratio</td>
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</tr>
<tr>
<td><strong>Strategy:</strong> Test reliability in</td>
<td></td>
<td>Q2: How many customers do complain for Splash?</td>
<td></td>
<td><strong>CCR:</strong> Customer Complaints Ratio</td>
</tr>
<tr>
<td></td>
<td><strong>G2:</strong> Evaluate trend in customer-reported defects</td>
<td>Q3: How many SW defect-related complaints are reported for baseline products?</td>
<td><strong>CCS:</strong> # complaints for baseline products</td>
<td><strong>CCR:</strong> Customer Complaints Ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q4: How many SW defect-related complaints are reported for Splash?</td>
<td></td>
<td><strong>CCR:</strong> Customer Complaints Ratio</td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q5: What is the ratio of defects slipped through system test for baseline projects?</td>
<td><strong>CDS:</strong> # customer-reported defects for baseline products</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td>Q6: What is the ratio of defects slipped through system test for pilot projects?</td>
<td></td>
<td><strong>CCR:</strong> Customer Complaints Ratio</td>
</tr>
<tr>
<td></td>
<td><strong>G5:</strong> Evaluate improvement in defect slippage</td>
<td></td>
<td><strong>DB:</strong> % defects slipped for baseline projects</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td><strong>DP:</strong> % defects slipped for pilot projects</td>
<td></td>
</tr>
<tr>
<td><strong>Goal:</strong> Reduce defect slippage by 20%</td>
<td><strong>G3:</strong> Evaluate trend in defect slippage</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strategy:</strong> Introduce new sys. test process</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Goal:</strong> Reduce customer-reported defects by 20%</td>
<td><strong>G4:</strong> Evaluate trend in customer-reported defects</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Strategy:</strong> Do pilot projects with new system test process</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Example**

- **CCR:** Customer Complaints Ratio
  - **CCR:** Customer Complaints Ratio <= 0.9

- **CDR:** Customer-reported Defects Ratio
  - **CDR:** Customer-reported Defects Ratio <= 0.8

- **DSR:** Defect Slippage Ratio
  - **DSR:** Defect Slippage Ratio <= 0.8

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**Summary: Context and Assumptions of the Grid**

<table>
<thead>
<tr>
<th>Level</th>
<th>Goal:</th>
<th>Strategy:</th>
<th>Context:</th>
<th>Assumptions:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Business Level</td>
<td>Increase customer satisfaction by 10%</td>
<td>Test reliability in</td>
<td>C1: Highly competitive market</td>
<td>A1: Improving satisfaction will increase customer loyalty</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C2: Little control over development process</td>
<td>A2: Satisfaction = no complaints</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>C3: Limited budget</td>
<td>A3: Complaints are due to reliability</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>A4: Reducing defects by 20% reduces complaints by 10%</td>
</tr>
<tr>
<td>Software Level</td>
<td>Reduce customer-reported defects by 20%</td>
<td>Introduce new sys. test process</td>
<td>C4: New system test process available</td>
<td>A5: Reducing slippage by 20% reduces defects by 20%</td>
</tr>
<tr>
<td>Project Level</td>
<td>Reduce defect slippage by 20%</td>
<td>Do pilot projects with new system test process</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

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GQM+ Strategies Modeling Tool Support
Success Factors and Benefits

GQM+Strategies provides …

- Tailorability
- Traceability
- Understandability
- Measurability
- Integration

Benefits

- Improved communication
- Improved analysis, decision-making and controlling
- Improved organizational learning

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Summary

- **GQM+Strategies:**
  - Allows seamlessly describing goals and strategies and their rationales
  - Provides integrated measurement for maximizing information while minimizing data collection

- **GQM+Strategies Process:**
  - Provides a systematic way for deploying organizational measurement
  - Provides maintenance capabilities for measurement systems
  - Can be integrated with organizational planning processes
  - Allows to systematically realize alignment and measurement benefits
Thank you for your attention!

Questions?
Contact Information

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Fax: +49 (0) 631 / 6800-92254
E-mail: martin.kowalczyk@iese.fraunhofer.de
## GQM+Strategies® Application Areas

<table>
<thead>
<tr>
<th>Business</th>
<th>Domain</th>
<th>Application</th>
</tr>
</thead>
<tbody>
<tr>
<td>European telecommunications company</td>
<td>Telecommunications</td>
<td>Drive strategic improvement programs, support paradigm shift toward purpose-driven metrics</td>
</tr>
<tr>
<td>European automotive supplier</td>
<td>Automotive</td>
<td>Support CMMI's Measurement and Analysis process area</td>
</tr>
<tr>
<td>European network testing company</td>
<td>Telecommunications</td>
<td>Evaluate cost, benefit, and schedule for modernizing existing product suite</td>
</tr>
<tr>
<td>International software company</td>
<td>Embedded systems used in telecommunications</td>
<td>Increase the visibility at all organizational levels of how strategic decisions impact operations</td>
</tr>
<tr>
<td>Asian insurance company</td>
<td>Information systems</td>
<td>Align strategies and goals for new business domain</td>
</tr>
<tr>
<td>Asian systems engineering organization</td>
<td>Safety-critical software for aerospace domain</td>
<td>Increase visibility of goals and strategies and derived measurement goals to enhance supplier collaboration</td>
</tr>
<tr>
<td>Research project to develop a common software platform</td>
<td>Support of complex, dynamic business processes in a variety of domains, including logistics, retail, and customized industrial facilities</td>
<td>Align project objectives and business objectives of involved research and industry partners</td>
</tr>
<tr>
<td>International gas and oil company</td>
<td>Information systems</td>
<td>Alignment and value of IT</td>
</tr>
</tbody>
</table>
GQM+Strategies® Grid Derivation Process
(top-down, bottom-up, or a mixture)

Goals and Strategies

CA: Elicit General Context & Assumptions
1. Gather general context
2. Identify assumptions

G: Define Goals
1. (Elicit implications of strategy*)
2. Identify potential goals*
3. Select promising goals*
4. Formalize selected goals*

S: Make Strategy Decisions
1. Brainstorm potential strategies for each goal*
2. Decide on strategies*

Measurement Data

M: Define GQM Graphs
1. Define GQM goals for each selected goal on the appropriate level*
2. Specify the GQM graph for evaluating the goal*
3. Identify relationships between the interpretation models*

Refine?

* Document context and assumptions

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