




**Measurement-based Alignment of
Software Strategies and Business Goals
IPA / SEC Tutorial**

presented by
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Agenda		
Morning (AM)	10:00	Session I:
	-	Introduction to Software Measurement
	11:00	
	11:00	Session II:
	-	GQM+Strategies
	12:30	
	Lunch	
Afternoon (PM)	13:30	Session III: Exercises Part A -
	-	GQM and GQM Abstraction Sheets
	14:30	
	14:30	Session III: Exercises Part B -
	-	GQM+Strategies
	16:00	

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Session II: GQM+Strategies

- Motivation
- GQM+Strategies Overview
- Example: Customer Satisfaction
- Conclusions


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Linking goals is important...

- Software and system engineers are frequently faced with apparently **unrealistic goals**
- It is not clear, how **development activities contribute to business goals**
- It is often hard to demonstrate **how improvement strategies generate business value**
- We need support for
 - ☐ Defining and integrating corporate goals with lower-level goals
 - ☐ Mapping goals to data, maximizing use of existing data
 - ☐ Evolving goals and data collected as the organization matures




There is a need for well-defined measurement programs

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...but it is hard to do...

- Building an **effective measurement program** is difficult
- It involves observation, experience facilitation, collaboration, decision making, analysis and synthesis about goals, contexts, and assumptions
- It assumes an **organizational structure** that sustains the process and learns
- Most organizations fall short of putting together a successful program

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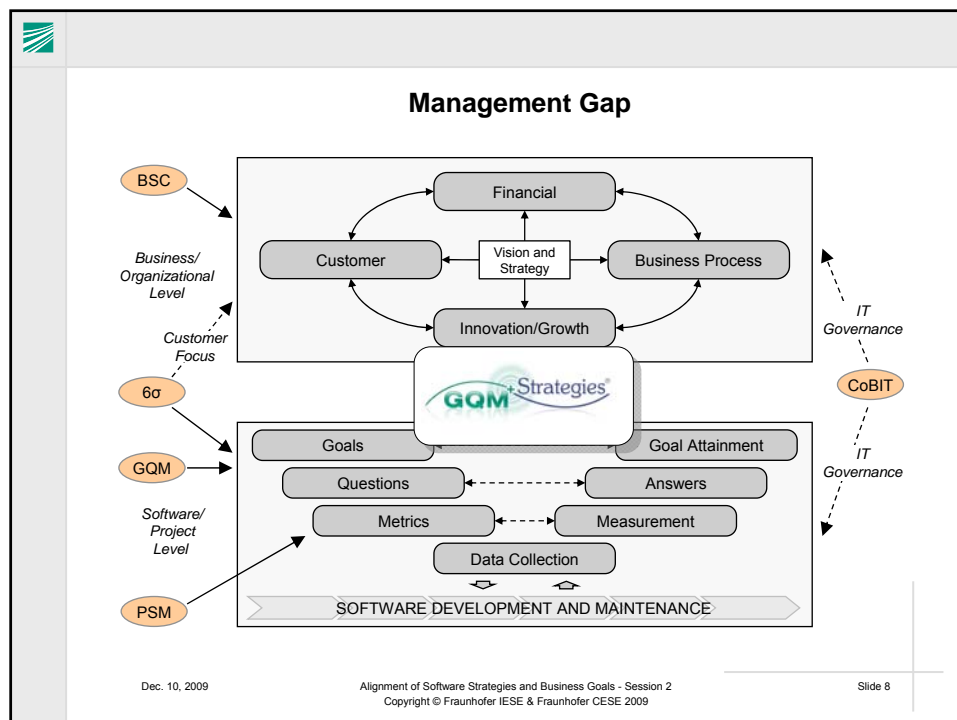
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...and here are some steps to follow

- **Define the right goals**
 - Link goals at all levels (e.g., business, system, software, project)
 - Use corporate goals to generate lower-level goals
 - Inherit lower-level goals from upper-level goals
 - Identify the context and temporal aspects of a goal
- **Collect the right data**
 - Quantify and interpret the goals at all levels
 - Justify what and why data is collected at each level
 - Maximize benefits and minimize data collection/analysis cost
 - Take maximum advantage of existing data
- **Define and sustain the measurement process**
 - Create the right organizational structure
 - Get feedback to projects in a timely fashion
 - Maintain commitment within all organizational levels

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Overview of Related Approaches

- **Goal Question Metric (GQM)** is a top-down method for defining measurements according to stated measurement goals
 - **Benefit:** Flexible framework for defining measurement programs
 - **Weakness:** Does not guarantee alignment with business goals
- **CoBIT®** is an approach for quantitative IT governance that distinguishes different goal levels and provides predefined metrics
 - **Benefit:** Explicit linkage of IT-specific goals and metrics
 - **Weakness:** Limited customization support
- **Practical Software and System Measurement (PSM)** guides project managers in selecting, collecting, analyzing, and reporting specific software issues
 - **Benefit:** Project needs / characteristics guide metric selection
 - **Weakness:** Measurement as software project level activity
- **Balanced Scorecard (BSC)** incorporates four measurement views: financial, customer, internal business process, and learning and growth measurement
 - **Benefit:** Links measurements to company goals
 - **Weakness:** No support for project measurement
- **Six Sigma (6σ)** is a continuous quality improvement method adapted from the manufacturing domain
 - **Benefit:** Aims at understanding and controlling process-product dependencies with a focus on defect measures
 - **Weakness:** Does not explicitly link measures to business-level goals

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Why do we want the connection?

- **Because...**
 - Higher level goals should influence lower level goals and strategies
 - Lower level goals and data should influence high-level decisions
 - Various development and measurement activities should be justified (defended) in terms of larger business objectives
 - Goals and data at all levels need to contribute to a consistent and meaningful story
 - The business needs to be aligned at all levels
- **In order to...**
 - **clarify and harmonize** goals and strategies
 - **communicate business goals** throughout an organization
 - **align goals** with a strategy
 - **monitor** the deployment strategy
 - **obtain feedback** about a strategy and business goals

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Session II: GQM+Strategies

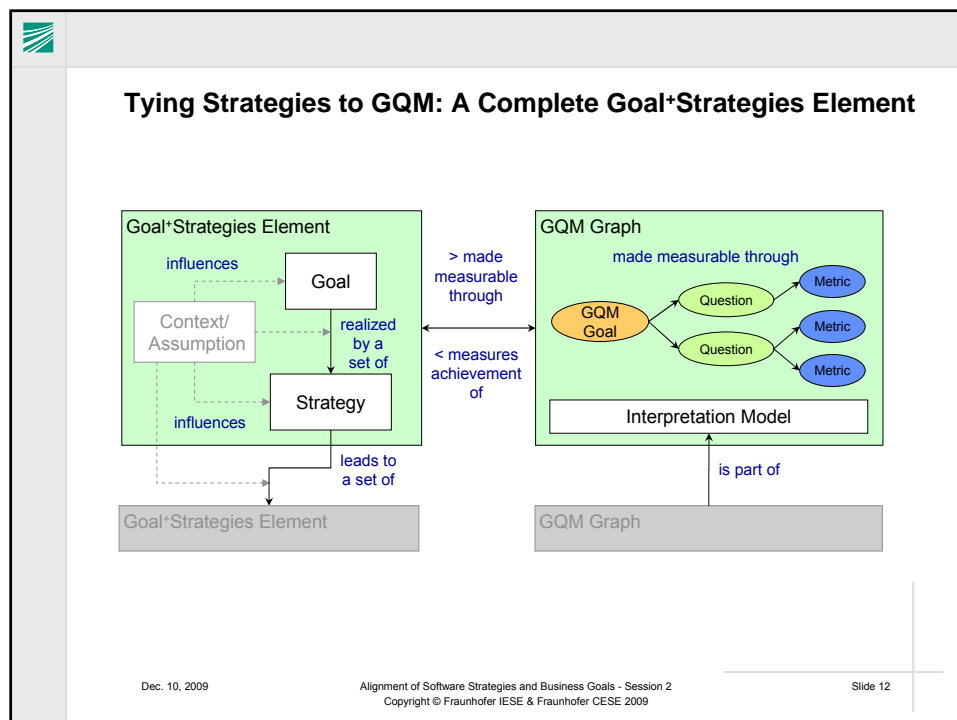
- Motivation
- **GQM+Strategies Overview**
- Example: Customer Satisfaction
- Conclusions

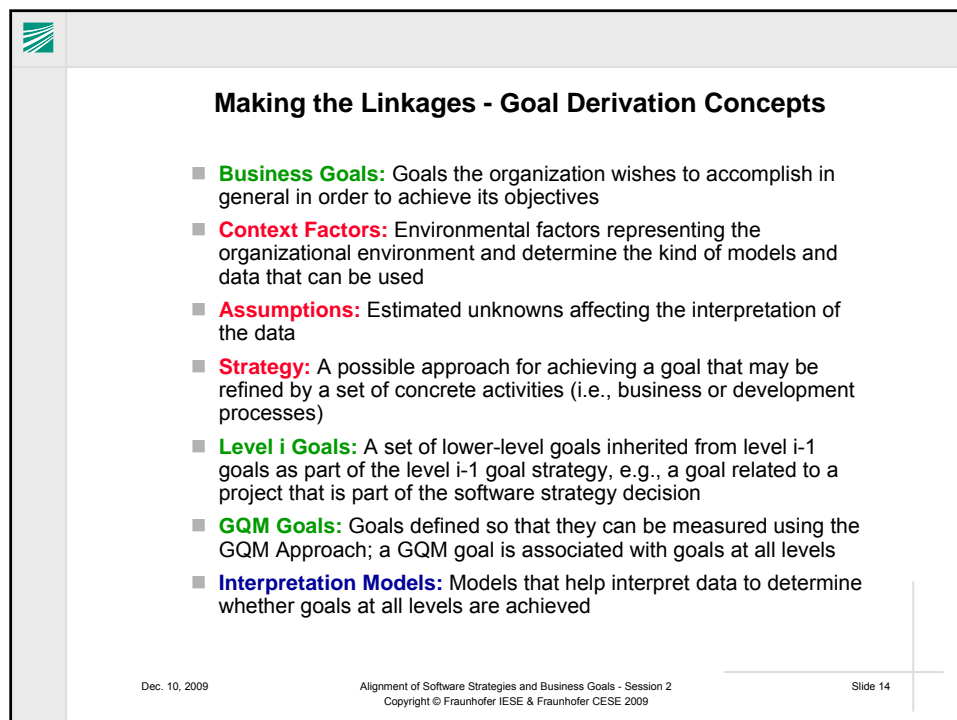
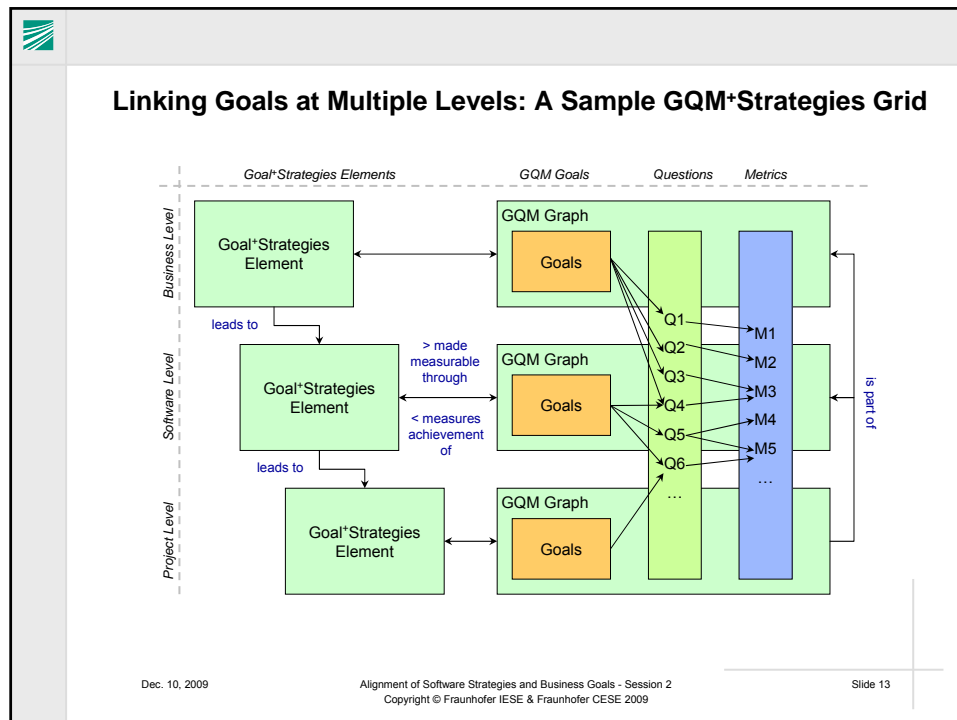
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Making the Linkages - Goal Derivation Concepts (cont.)

- **GQM+Strategies Element:** A single goal and derived strategies (including a set of concrete activities), as well as all context information and assumptions that explain the linkage between the goal and corresponding strategies
- **GQM Graph:** A single GQM goal (that measures a GQM+Strategies Element), corresponding questions, metrics and interpretation models
- **GQM+Strategies Grid:** Integrated collection of all GQM+Strategies elements, GQM graphs, and all links; a GQM+Strategies Element may have multiple GQM goals associated to it
- **Goal Tree:** The tree of all GQM+Strategies elements generated by a single GQM+Strategies element including the element itself and links to lower level goals and upper level strategies

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General GQM+Strategies Grid Derivation Process

Determine a GQM+Strategies element and corresponding GQM graph taking advantage of context and assumptions

Task "Define Goals"

- Determine and define a goal and its links to upper-level goals and strategies, if any
- Identify context and assumptions

Task "Define GQM Graphs"

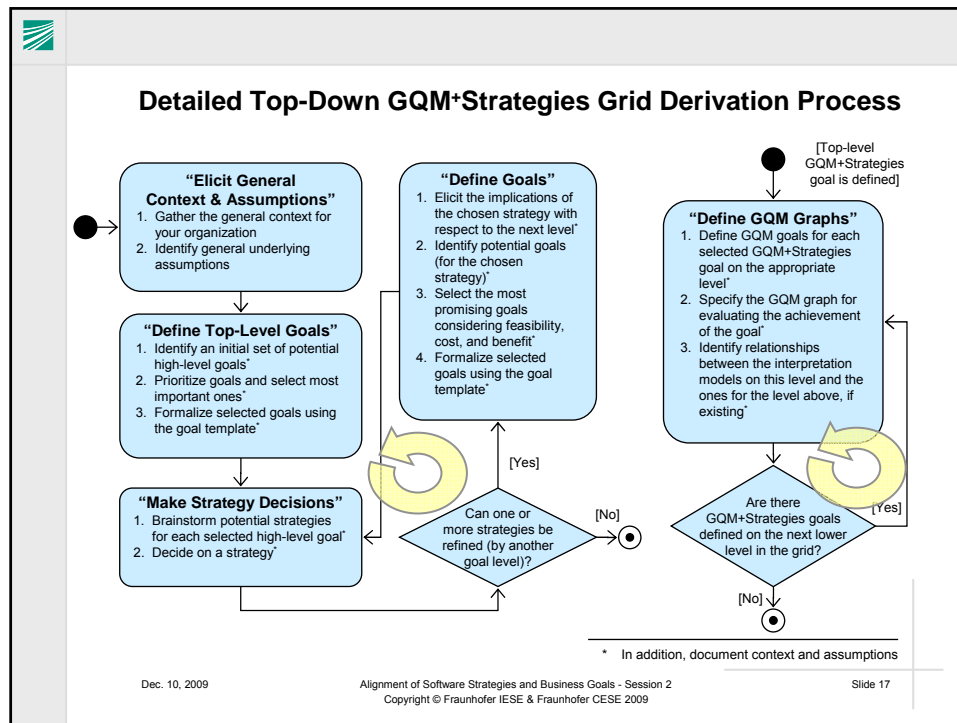
- Develop a GQM graph (GQM goal, questions, metrics, and interpretation model) for the goal and strategy decisions
- Identify context and assumptions

Task "Make Strategy Decisions"

- Select strategy decisions to accomplish the goal
- Identify context and assumptions

- You have to iterate the tasks until the grid is complete
- There is no strict sequence of tasks in the general grid derivation process
- Tasks for deriving a complete grid may also be performed in parallel
- You may also return and fully complete a task after another one has been performed

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Session II: GQM+Strategies

- Motivation
- GQM+Strategies Overview
- **Example: Customer Satisfaction**
- Conclusions


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Basics: Elicit General Context & Assumptions

Elicit General Context & Assumptions
Define Top-Level Goals
Define Top-Level GQM Graphs
Make Strategy Decisions
Define Goals
Define GQM Graphs
Make Strategy Decisions
Define Goals
Define GQM Graphs
Make Strategy Decisions
...

1. Gather the context for your organization (the organization for which you are setting business goals)
 - ☐ Characterize the product or service
 - ☐ Identify your existing processes, tools, etc.
 - ☐ Characterize your customers
 - ☐ Characterize income sources and business model
 - ☐ Characterize your organizational interfaces
 - ☐ Characterize the existing measurement program (goals, models, data)
2. Identify assumptions
 - ☐ What do you believe to be true but for which you have little or no empirical evidence?
 - ☐ For instance, assumptions about the technology, market, customers, your organization, workforce, etc.

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Example

Elicit General Context & Assumptions

Elicit General Context & Assumptions
Define Top-Level Goals
Define Top-Level GQM Graphs
Make Strategy Decisions
Define Goals
Define GQM Graphs
Make Strategy Decisions
Define Goals
Define GQM Graphs
Make Strategy Decisions
...

1. Gather the context
 - ☐ Company XYZ builds a class of shrink-wrapped products
 - ☐ Using a standard set of processes and tools that cover the life cycle
 - ☐ For the general market
 - ☐ And 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
 - ☐ And they have some measures in place mostly to help manage products
2. Identify assumptions
 - ☐ Customer satisfaction with the product will create customer loyalty, which will cause customers to buy the next version of the product

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Interview Questions to Identify Top-Level Goals

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions


...

- What are the organizational principles that you do not want to change?
 - ☐ What are the key elements of your environment?
e.g., transparency, employee satisfaction, controlled risk, learning environment, a pleasant place to work, ...?
 - ☐ Is your organization risk-averse, risk-neutral, or risk-driven?
- What are your business goals?
 - ☐ What do you want to happen next?
 - ☐ Where do you see your organization being in 5, 10 years?
 - ☐ How do you want to grow, e.g., new customers, new competencies?
 - ☐ How would you define success, e.g., do you want to improve some aspect of the business?
 - ☐ Is there some specific, more detailed goal you want to achieve?

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Essential Types of Goals

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

...


- **Growth goals:** acquire new projects with current competence areas; expand existing projects set; evolve existing competencies; build new competencies
- **Success goals:** deliver good products to customers; control costs; shrink schedule; increase profits; get corporate visibility (awards, etc.), build core competence
- **Maintain principal (internal) goals:** transparency, employee satisfaction, controlled risk, learning environment
→ measure to assure no decrease
- **Specific focus goals:** make helpdesk more efficient, predict if proposed effort has a good ROI

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Basics: Define Top-Level Goals




1. Identify an initial set of potential high-level goals
 - ☐ What are the organizational principles that you do not want to change, i.e., aspects of your organization you want to keep as is?
 - ☐ What are your business goals?
2. Prioritize goals
 - ☐ Identify hierarchical relationships (sub-goals inherited by the divisions, projects, individuals)
 - ☐ Identify conflicts (complementary, conflicting, and indifferent goals)
3. Formalize the goals

⇒ Document context and assumptions for all steps

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Example

Define Top-Level 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

1. Identify an initial set of potential high-level goals
 - ☐ Increase customer satisfaction for the next product
2. Prioritize goals
 - ☐ Only one goal was selected for Company XYZ
3. Ask questions to formalize the business goal (using the goal template)

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Example

Formalize Top-Level Goal

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals

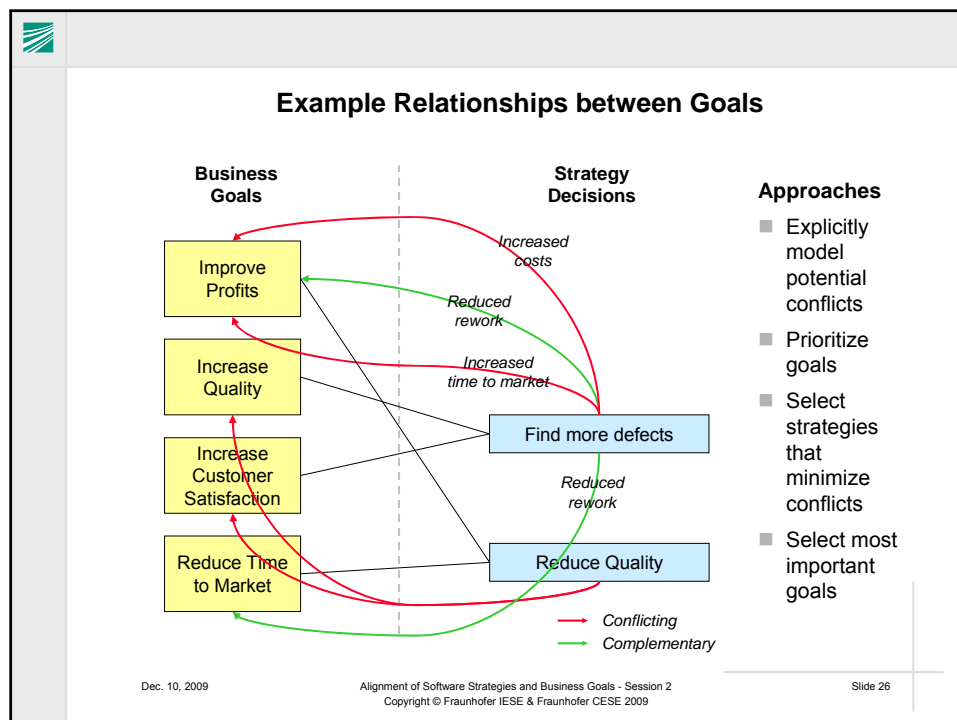
Define GQM Graphs


Make Strategy Decisions

...


Activity	Increase
Focus	Customer satisfaction
Object	Product "Splash"
Magnitude (degree)	10% reduction in number of customer complaints
Timeframe	12 weeks after release
Scope (context)	Web Products Division, Splash Project Manager
Constraints (limitations)	Splash price and functionality
Relationships with other goals	Can conflict with development cost goals, schedule goals, ...

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Basics: Define Top-Level QM Graphs




1. Define GQM goals
 - ☐ **Object:** process, product, resource, ...
 - ☐ **Purpose:** characterize, evaluate, predict, motivate, improve
 - ☐ **Quality Focus:** cost, correctness, defect removal, changes, reliability, user friendliness
 - ☐ **Viewpoint:** user, customer, manager, developer, corporation
 - ☐ **Context:** problem factors, people factors, resource factors, process factors
2. Identify the GQM graph for evaluating the achievement of the goal
 - ☐ Questions, measures and models
 - ☐ Decision criteria in the interpretation model

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Example

Define Top-Level QM Graphs




1. Define GQM goals
 - ☐ 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**
2. Identify the GQM graph for evaluating the achievement of the business goal
 - ☐ **Assumption 2:** Customer satisfaction can be measured by # of customer complaints
 - ☐ Measures and models
 - ☐ CCS = Number of customer complaints in the first 12 weeks after release of Splash
 - ☐ CCB = Average number of customer complaints in the first 12 weeks after release of a set of baseline products
 - ☐ CCR = CCS / CCB
 - ☐ Decision criteria in the interpretation model
 - ☐ If CCR ≤ 0.9, the business goal is achieved


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Basics: Make Strategy Decisions



1. Brainstorm potential strategies
 - ☐ What are the different ways that the Business Goal could possibly be achieved?
2. Strategy decisions
 - ☐ Decide on a strategy, based on context factors, assumptions, feasibility, etc.


⇒ Document context and assumptions for all steps

- ☐ What context factors affect the choice of strategy?
- ☐ Make explicit any assumptions that affect the choice of strategy

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Example

Make Strategy Decisions



⇒ Document context and assumptions

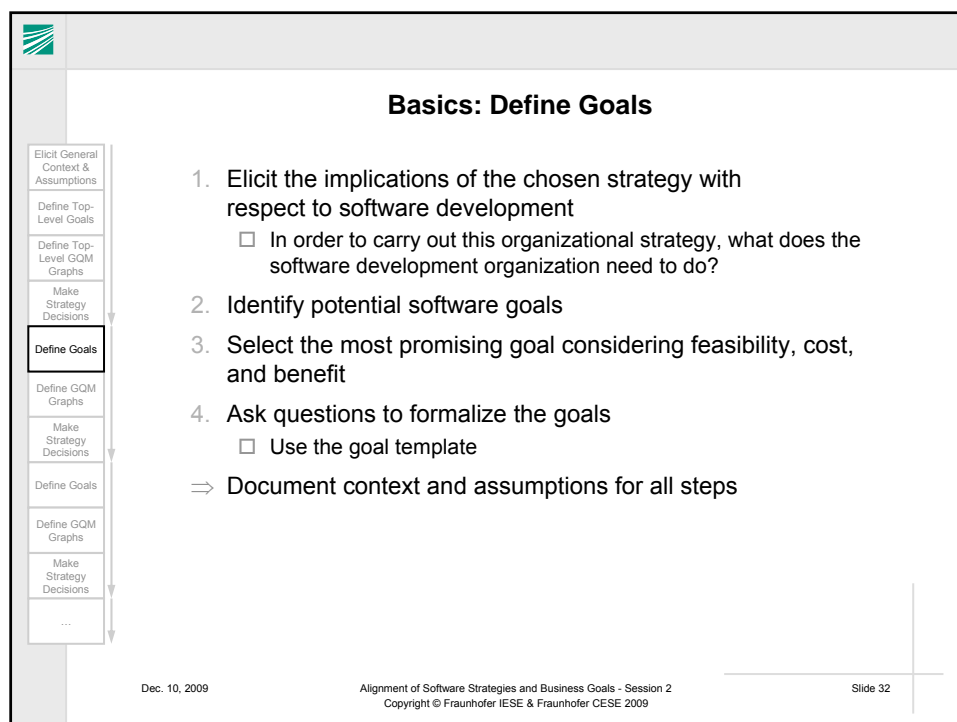
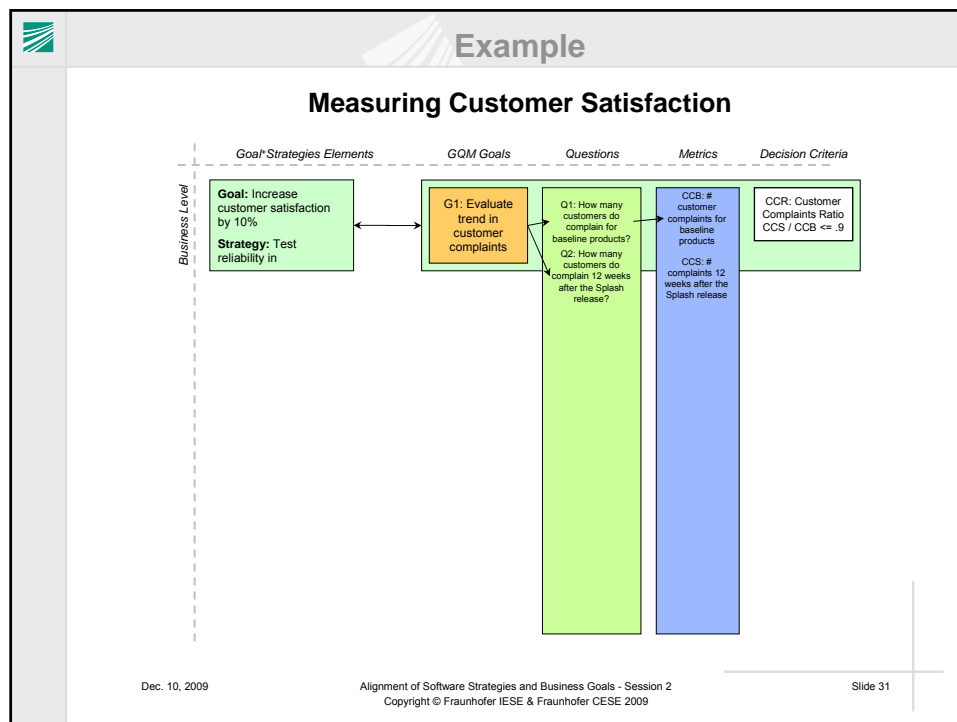
- ☐ **Assumption 3:** Many customer complaints are due to product reliability problems


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
2. Decide on a strategy
 - ☐ Test reliability in (e.g., remove more defects)

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Example

Define Second-Level Goals (1/2)

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals


Define GQM Graphs

Make Strategy Decisions

...

1. Elicit the implications of the chosen strategy with respect to software development
 - ☐ To test in reliability, the software test processes must be examined
2. Identify potential software goals
 - ☐ Decrease customer-reported defects by improving
 - ☐ System test effectiveness
 - ☐ Unit test effectiveness
 - ☐ Acceptance test effectiveness

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Example

Define Second-Level Goals (2/2)

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions


...

⇒ Document context and assumptions

- ☐ **Context 4:** There is a new system test process that seems appropriate for our context
- ☐ **Assumption 4:** We can decrease the total # of customer complaints by 10% by reducing customer-reported software field defects (i.e., those that slip by system test) by 20%

3. Select the most promising goal considering feasibility, cost, and benefit
 - ☐ Decrease customer-reported defects by improving system test effectiveness
4. Ask questions to formalize the software goal

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Example

Formalize Second-Level Goals

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals


Define GQM Graphs

Make Strategy Decisions

...

Activity	Decrease
Focus	Customer-reported software defects
Object	System test process for Splash
Magnitude (degree)	20%
Timeframe	12 weeks after release (might check every week)
Scope (context)	Web Products Division, Splash Software Manager
Constraints (limitations)	Development cost and functionality
Relationships with other goals	Can conflict with development cost goals, schedule goals, ...

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Basics: Define GQM Graphs

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs


Make Strategy Decisions

...

1. Define GQM goals
2. Identify the GQM graph for evaluating the achievement of the goal
 - ☐ Measures and models
 - ☐ Decision criteria in the interpretation model
3. Identify relationships between this interpretation model and the one for your higher-level goal

⇒ Document context and assumptions for all steps

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Example

Define Second-Level QGM Graphs (1/2)

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level QGM Graphs

Make Strategy Decisions

Define Goals

Define QGM Graphs

Make Strategy Decisions

Define Goals


Define QGM Graphs

Make Strategy Decisions

...

1. Define QGM goals
 - ☐ Analyze the trend in unique customer complaints that are due to software defects
 - ☐ for the purpose of evaluation
 - ☐ with respect to 20% reduction when compared to prior projects
 - ☐ from the point of view of quality management
 - ☐ in the context of Web Products Division of XYZ
2. Identify the QGM graph for evaluating the achievement of the goal
 - ☐ Measures and models
 - ☐ CDS = Number of unique customer complaints that are due to software defects in the first 12 weeks after release of Splash
 - ☐ CDB = Average number of unique customer complaints that are due to software defects in the first 12 weeks after release of a set of baseline products
 - ☐ CDR = CDS / CDB
 - ☐ Decision criteria in the interpretation model
 - ☐ If $CDR \leq 0.8$, the goal is achieved

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Example

Define Second-Level QGM Graphs (2/2)

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level QGM Graphs

Make Strategy Decisions

Define Goals

Define QGM Graphs

Make Strategy Decisions

Define Goals


Define QGM Graphs

Make Strategy Decisions

...


3. Identify relationships between this interpretation model and the one for your higher-level (business) goal
 - ☐ If $CCR \leq 0.9$ (i.e., the number of customer complaints is reduced by 10%)
 - ☐ Then we have achieved our business goal
 - ☐ Else
 - ☐ If $CDR \leq 0.8$ (i.e., the number of unique customer complaints due to software defects is reduced by 20%)
 - ☐ Then Assumption 4 is wrong
 - ☐ Check Assumption 4: We can decrease the total # of customer complaints by 10% by reducing customer-reported software field defects by 20%
 - ☐ Else reconsider the "testing in" strategy

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Example

Make Second-Level Strategy Decisions



Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

...

1. Brainstorm potential strategies
 - ☐ Because of **Context 4** (“There is a new system test process that seems appropriate for our context”), the one and only strategy is to introduce a new system test process
2. Decide on a strategy
 - ☐ Introduce new system test process

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Example

Measuring Customer Satisfaction

	Goal/Strategies Elements	GQM Goals	Questions	Metrics	Decision Criteria
Business Level	Goal: Increase customer satisfaction by 10% Strategy: Test reliability in	G1: Evaluate trend in customer complaints	Q1: How many customers do complain for baseline products?	CCB: # customer complaints for baseline products	CCR: Customer Complaints Ratio CCS / CCB <= .9
		G2: Evaluate trend in complaints related to software defects	Q2: How many customers do complain 12 weeks after the Splash release?	CCS: # complaints 12 weeks after the Splash release	
Software Level	Goal: Improve system test effectiveness by 20% Strategy: Introduce new system test process		Q3: How many software defect-related customer complaints are reported for baseline products?	CDB: # software defect-related customer complaints for baseline products	CDR: Ratio of Customer Complaints Related to Software Defect DDS / CDB <= .8
			Q4: How many software defect-related customer complaints are reported 12 weeks after the Splash release?	CDS: # software defect-related customer complaints 12 weeks after the Splash release	

Note: Arrows in the original diagram indicate dependencies and groupings. For example, the Business Level Goal is linked to G1 and G2. G1 is linked to Q1 and Q2. G2 is linked to Q3 and Q4. Q1 and Q2 are linked to CCB and CCS. Q3 and Q4 are linked to CDB and CDS. CCB and CCS are linked to CCR. CDB and CDS are linked to CDR.

Example

Define Third-Level Goals

Elicit General Context & Assumptions
 Define Top-Level Goals
 Define Top-Level GQM Graphs
 Make Strategy Decisions
 Define Goals
 Define GQM Graphs
 Make Strategy Decisions
Define Goals
 Define GQM Graphs
 Make Strategy Decisions
 ...

⇒ Document context and assumptions

- **Assumption 5:** Reducing slippage by 20% reduces reported defects by 20%
- **Context 5:** Baseline data exists on defect slippage
- **Assumption 6:** The projects that form the baseline are relevant to the current project

1. Elicit the implications of the chosen strategy with respect to the next level
 - Apply the new system test method to see if it reduces defect slippage by at least 20% and generates the necessary improvement regarding customer complaints
2. Identify potential goals
 - Reduce system test defect slippage by 20%
3. Select the most promising goals considering feasibility, cost, and benefit
 - Reduce system test defect slippage by 20%
4. Formalize the goals

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Example

Formalize Third-Level Goals

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 Define Top-Level GQM Graphs
 Make Strategy Decisions
 Define Goals
 Define GQM Graphs
 Make Strategy Decisions
Define Goals
 Define GQM Graphs
 Make Strategy Decisions
 ...

Activity	Decrease
Focus	Defect slippage
Object	New system test process for Splash
Magnitude (degree)	20%
Timeframe	12 weeks after release (might check every week)
Scope (context)	Web Products Division, Splash Software Manager
Constraints (limitations)	Development cost and functionality
Relationships with other goals	Can conflict with development cost goals, schedule goals, ...

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Example

Define Third-Level GQM Graphs (1/2)

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

...

1. Define GQM goals
 - ☐ Analyze [the system test process for Splash](#)
 - ☐ for the purpose of [evaluation](#)
 - ☐ with respect to [20% defect slippage compared to prior projects](#)
 - ☐ from the point of view of [quality management](#)
 - ☐ in the context of [Web Products Division of XYZ](#)
2. Identify the GQM graph for evaluating the achievement of the goal
 - ☐ Measures and models
 - ☐ DP = ratio of defects found in system test to those found after system test (customer reported + found in acceptance test) on this project
 - ☐ DB = the ratio of defects found in system test to those found after system test in baseline set of projects
 - ☐ DSR = DP / DB
 - ☐ Decision criteria in the interpretation model
 - ☐ If $DSR \geq 1.2$, there is at least a 20 % improvement
 - ☐ If $1 \leq DSR < 1.2$, method is better than history but not good enough

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Example

Define Third-Level GQM Graphs (2/2)

Elicit General Context & Assumptions

Define Top-Level Goals

Define Top-Level GQM Graphs

Make Strategy Decisions

Define Goals

Define GQM Graphs

Make Strategy Decisions

Define Goals

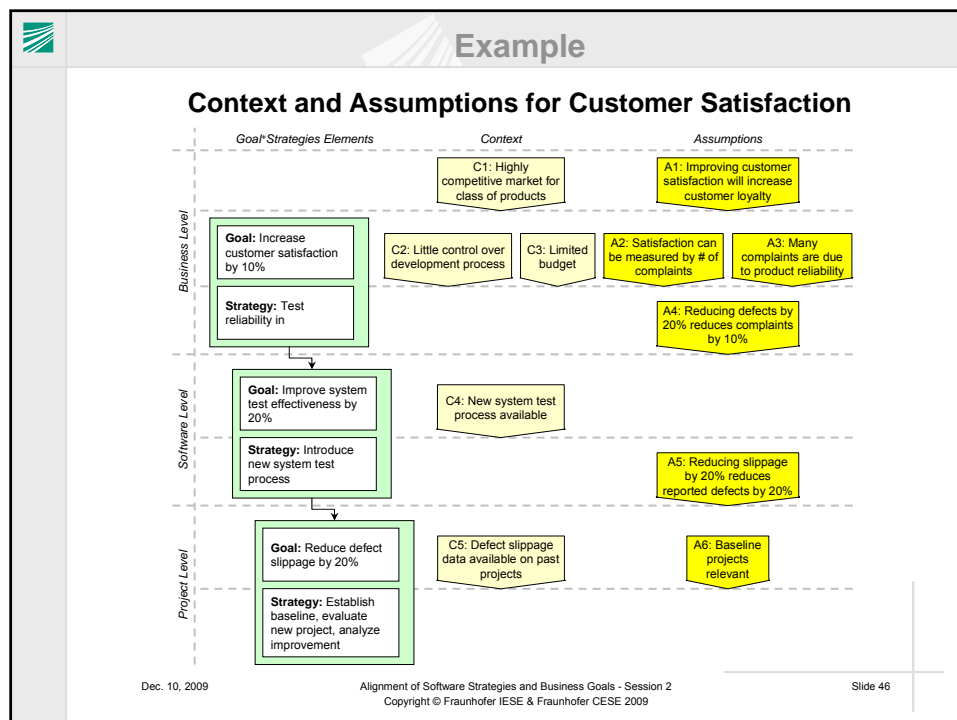
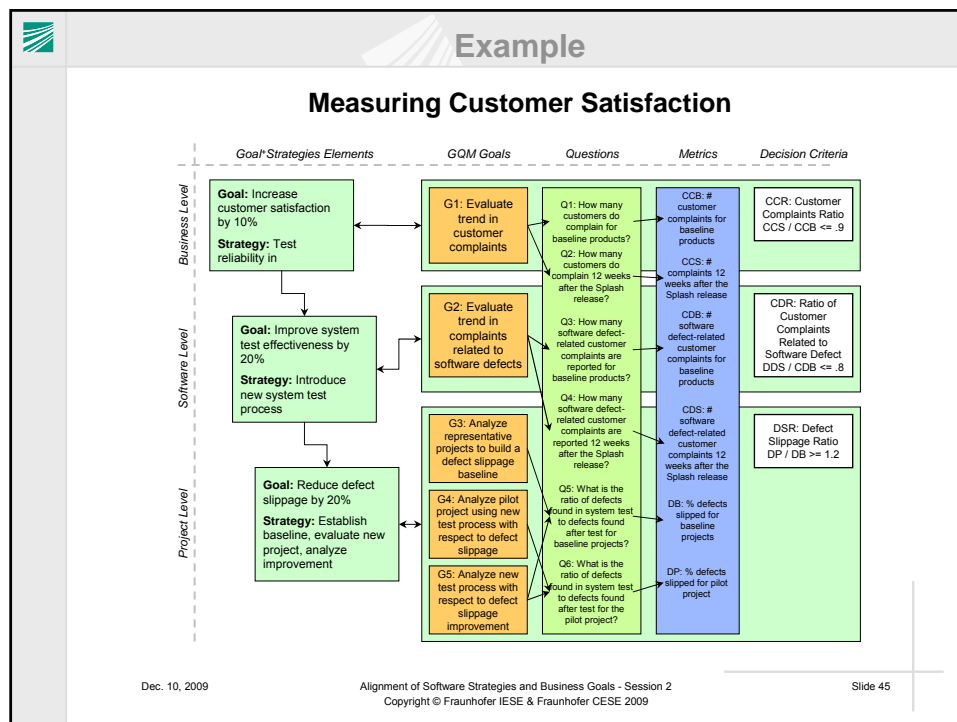
Define GQM Graphs

Make Strategy Decisions

...

3. Identify relationships between this interpretation model and the one for your higher-level (software) goal
 - ☐ **If** the customer-reported defects are reduced by at least 20%,
 - ☐ **Then** we have achieved our software goal
 - ☐ **Else**
 - ☐ **If** the defect slippage from system test is reduced by at least 20%
 - ☐ **Then** Assumption 5 or 6 is wrong
 - ☐ [Check Assumption 5](#): Reducing slippage by 20% reduces reported defects by 20%
 - ☐ [Check Assumption 6](#): The projects that form the baseline are relevant to the current project
 - ☐ **Else** reconsider the software strategy
 - There are more GQM goals (not discussed in this example) on this level that could be followed depending on whether historical data on defect slippage exists, such as
 - ☐ Analyze representative projects to build a defect slippage baseline
 - ☐ Analyze pilot project using new test process with respect to defect slippage

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Example

What happens next?

- **Getting Commitment**
 - Splash Software Manager goes to the Web Products Manager and asks for the resources;
 - to justify this request, the Splash Software Manager can point to a clear link between the resources needed and the business goal they support
- **Detailed Planning**
 - Splash Software Manager creates detailed plan of activities (the steps of the strategy), how the resulting information needs to be passed back up the line (the strategy), and who is interested
- **Execution and Monitoring**
 - Web Products Manager gets the information needed to show how customer satisfaction (the original success goal) is being addressed, and whether it's effective or not

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Example

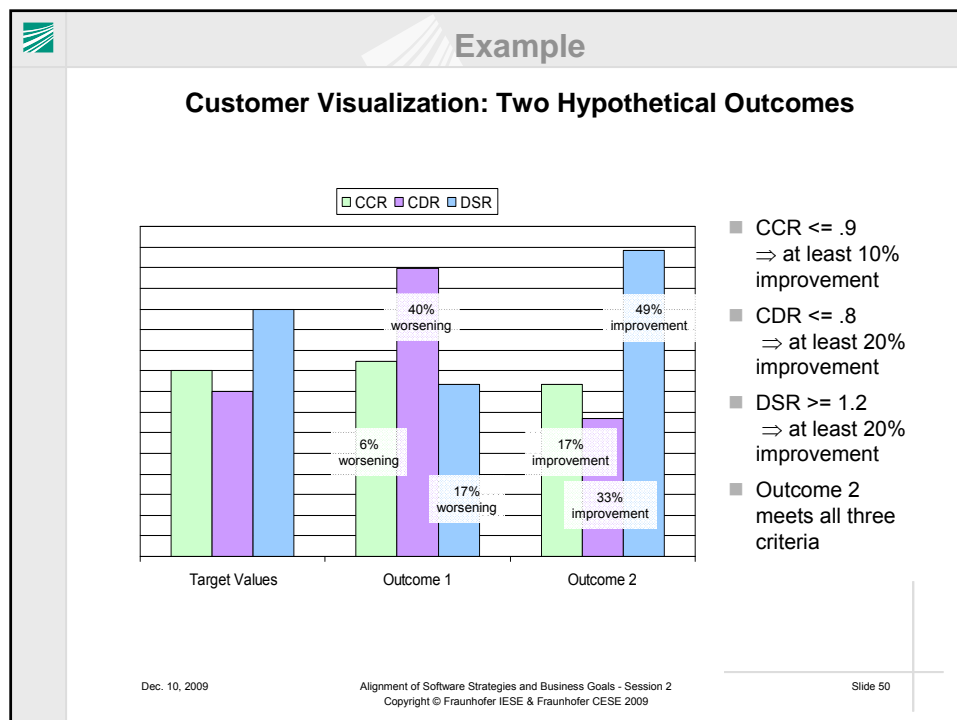
Data Collection: Definition of a Measurement Plan


Metric	Scope	Collection Time	Data Source	Collection Resource
CCB: # customer complains for baseline products	Past Products similar to "Splash"	once	Issue Tracking System	Customer Support Person
CCS: # customer complains	Web Product "Splash"	weekly	Issue Tracking System	Customer Support Person
CDB: # software-related customer complaints for baseline products	Past Products similar to "Splash"	once	Issue Tracking System; Defect Tracking DB	Project Manager
CDS: # software-related customer complaints	Web Product "Splash"	weekly	Issue Tracking System; Defect Tracking DB	Project Manager
DB: % defects slipped for baseline projects Baseline	Past Products similar to "Splash"	once	Issue Tracking System; Defect Tracking DB	Project Manager
DP: % defects slipped for pilot project	Web Product "Splash"	weekly	Issue Tracking System; Defect Tracking DB	Project Manager


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Example			
Data Analysis: Two Hypothetical Outcomes			
Goal	Decision Criteria	Result	Analysis
Business Level: 10% improvement in number of customer complaints	CCR = CCS / CCB ≤ 0.9	Outcome 1: CCR = 0.94 Outcome 2: CCR = 0.83	Outcome 1: Not Achieved Outcome 2: Achieved
Software Level: 20% improvement in number of unique customer complaints related to SW defects	CDR = DDS / CDB ≤ 0.8	Outcome 1: CDR = 1.40 Outcome 2: CDR = 0.67	Outcome 1: Not Achieved Outcome 2: Achieved
Project Level: 20% improvement in defect slippage	DSR = DP / DB ≥ 1.2	Outcome 1: DSR = 0.83 Outcome 2: DSR = 1.49	Outcome 1: Not Achieved Outcome 2: Achieved

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Example

Customer Interpretation: Two Hypothetical Outcomes

- **Given Outcome 1:** “test reliability in” is not promising
 - Are there differences between the current and the baseline products that might explain the results?
 - What are the influencing factors?
 - Are there other changes that can be made to the process that may yield better results in the future?
- **Given Outcome 2:** “testing reliability in” appears to have improved the current customer complaint issues
 - Is “testing reliability in” feasible to continue into the future given the added costs to the project?
 - Should we continue to use the new test approach on other projects?
 - Is it more feasible to improve the process for producing the product in other ways that will prove to be cheaper in the long run?

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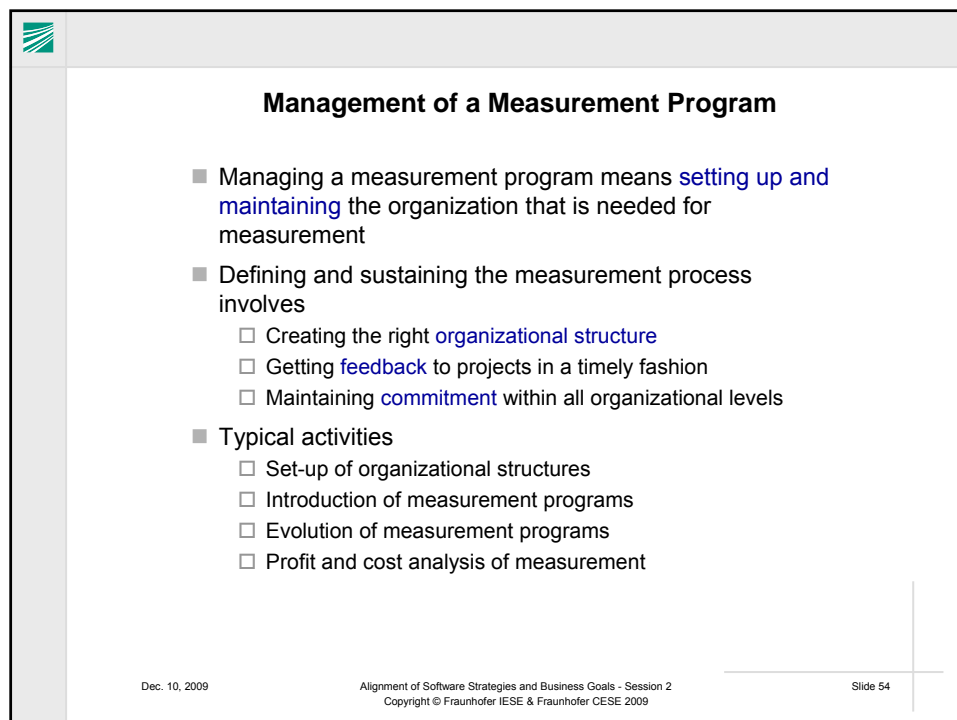
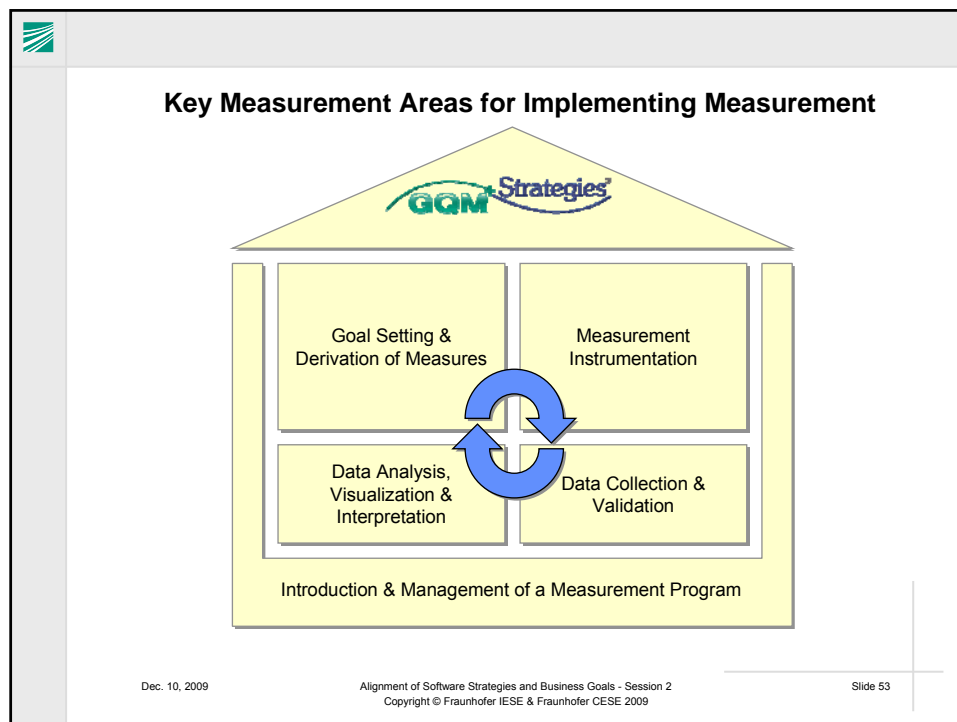
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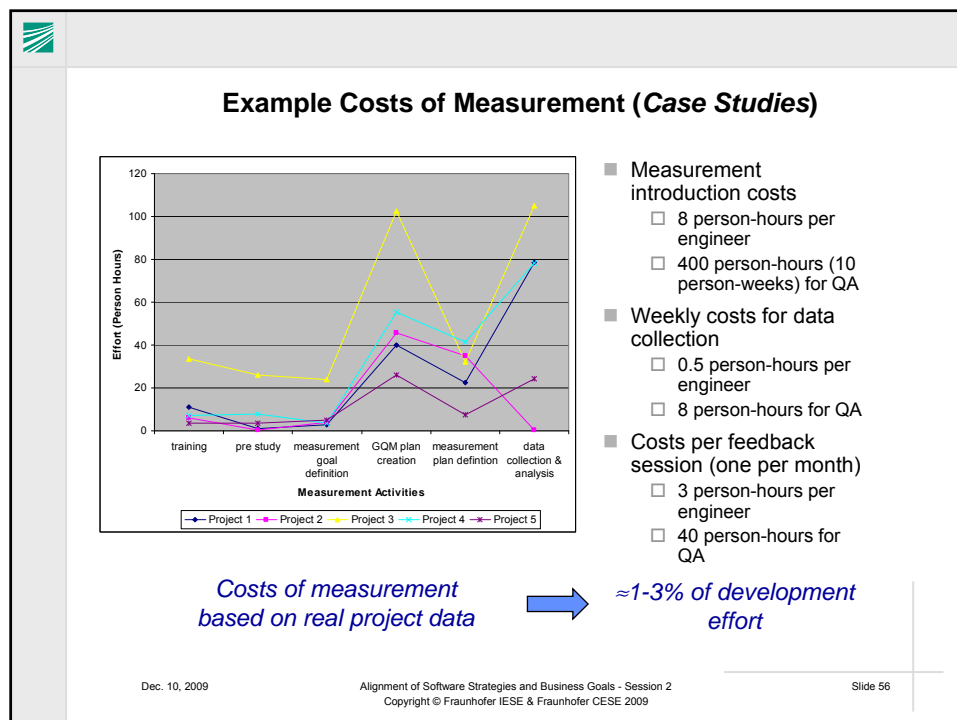
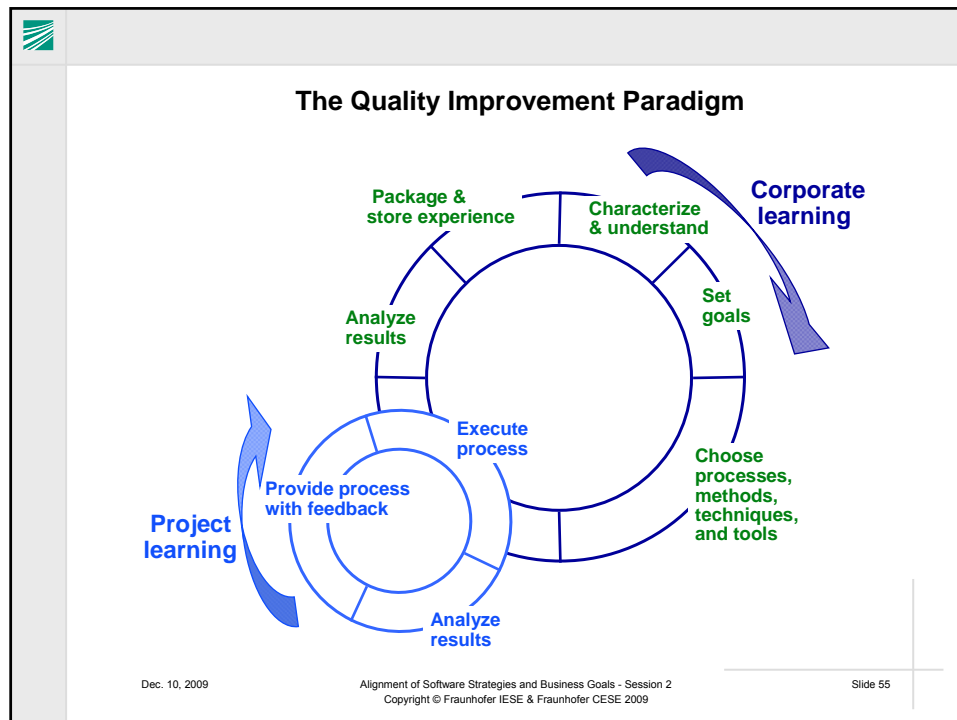



Session II: GQM+Strategies

- Motivation
- GQM+Strategies Overview
- Example: Customer Satisfaction
- **Conclusions**










Example Costs of Measurement (NASA SEL)

- **Context:** A mature measurement program
- **Data collection** < 2% of project costs, includes completing forms, participating in interviews, attending training sessions, and helping characterize project development
- **Data processing** < 3% of project costs, includes collecting, archiving, validating, and maintaining the measurement data
- **Analysis** < 5% of project costs, includes design of studies, information analysis, project interaction, packaging
- | Benefit | 1987 to 1991 | 1991 to 1995 |
|-------------------------|--------------|--------------|
| Defect Rates reduced by | 75% | 37% |
| Cost reduced by | 55% | 42% |
| Reuse improved by | 300% | 8% |

☐ Functionality of these systems increased by a factor of five (during the years 1976 to 1992)


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Success Factors and Recommendations


- Get Support
 - ☐ Missing management commitment
- Get Acceptance
 - ☐ Project manager and project members are difficult to convince regarding the benefits of measurement
 - ☐ Fear of misusing measurement data, e.g., for being assessed
 - ☐ Getting data from external organizations (e.g., suppliers)
- Avoid Manipulations
 - ☐ Analysis results may be manipulated in order to make the results look better
- Steer Effectiveness
 - ☐ Measurement program is not as effective as expected
- Control Costs
 - ☐ Measurement costs too much overhead

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Tutorial Summary

- Today we have talked about software measurement:
 - Why it's done
 - Why it's important
 - How it can be linked to an organization's goals and strategies
 - The GQM approach and the GQM+Strategies approach
 - The nuts and bolts
 - Some advice
 - Some examples
- **Bottom line:** Software measurement is not just about software; it contributes to measuring and achieving organizational goals



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Next Steps

- Start talking about measurement in your organization
- Choose some goals (start small)
- Document business goals, strategies, software goals, GQM goals, etc.
- Trace down to just a few measures
- Collect some data and see what it tells you
- Iterate!

Thanks for your attention!


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