Using Measurement to translate Business Vision into Operational Software Strategies

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BUSINESS NEEDS

Any successful business requires:

- combination of **technical and managerial** solutions
- well-defined set of **product needs**
- well-defined set of **processes** to achieve those product needs
- **closed loop processes** that support visibility, project control, learning, and improvement

Key technologies for supporting these needs include:

measurement, packaging, and reuse

of processes, products, and other knowledge relevant to the business

Measurement is the fundamental underlying framework for achieving success

Why do Organizations Measure?

Understand the Business and Create Visibility

Build baselines, show relationships

Identify critical factors

Manage and Control Based on Quantitative Evidence

Plan and estimate

Track- actuals versus estimates

Decision-making

Guide Improvement and Optimize the Activities

Prioritize

Assess

Feedback Experience to Improve Process

Package what you have learned

Measurement is a means to an end, not an end in itself

Linking measurement at all levels

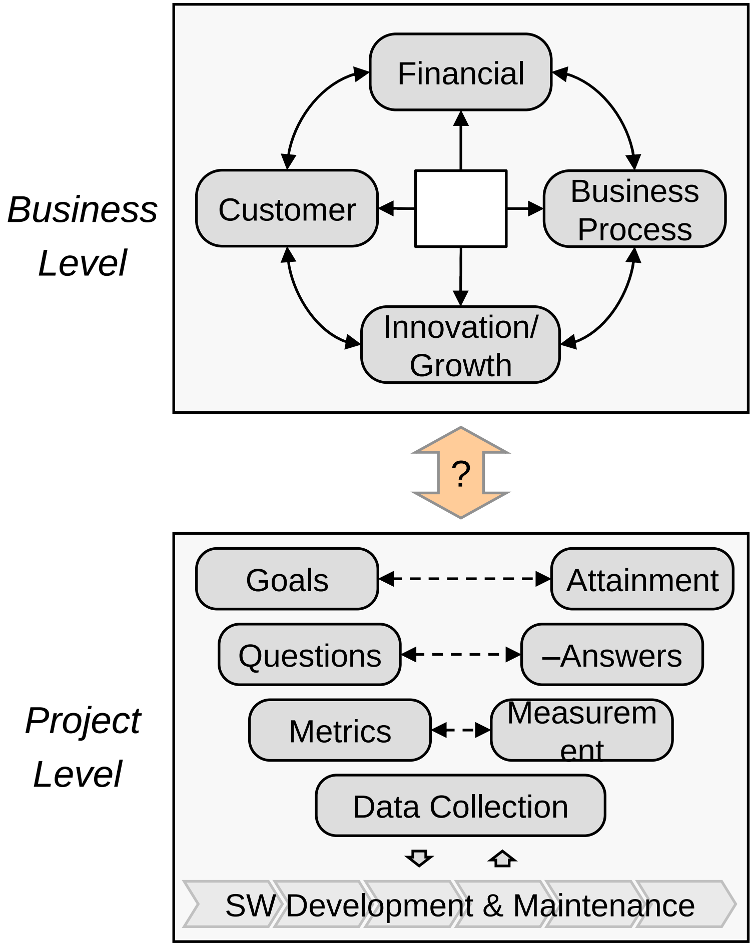
But this kind of measurement is project based

What measurement is done at the top-level?

Is it tied into project based measurement?

How are development activities contributing to business goals?

Are strategies on different levels of an organization linked to each other?



Top Level Organizational Problems

How does the organization all work in the same strategic direction?

Need alignment and communication of goals and strategies at all levels

How do I manage creative people balancing organizational goals and individual needs?

Need global and local goals, strategies, context, and assumptions

How do I monitor and evaluate the achievement of my goals and strategies?

Need hierarchical measurement and interpretation models

Requirements for a Successful Business

Organizations need to be able to

- develop operational business goals
- define strategies for implementing them
- communicate the goals throughout the organization
- translate the goals into lower levels for projects
- assess the effectiveness of their strategies
- recognize the achievement of their business goals
- measure for visibility, control, and improvement

We need to develop and connect goals and strategies at all levels in the organization and make them measureable

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GQM⁺Strategies® Features Help Address Common Issues

- Align the business at all levels of the organization in a seamless way
- Link goals and strategies from the top management level down to the project level
- Control success/failure of goals and strategies through measurement
- Document the rationale for linking goals and strategies (context and assumptions)
- Close gaps and let all goals and measurement data contribute to a consistent and meaningful story
- Provide a means of assessing the value of different approaches, such as agile and Lean

Basic concepts

Business Goals: Goals the organization wishes to accomplish in general in order to achieve its objectives

Context Factors: Environmental factors representing the organizational environment

Assumptions: Estimated unknowns affecting the interpretation of the data

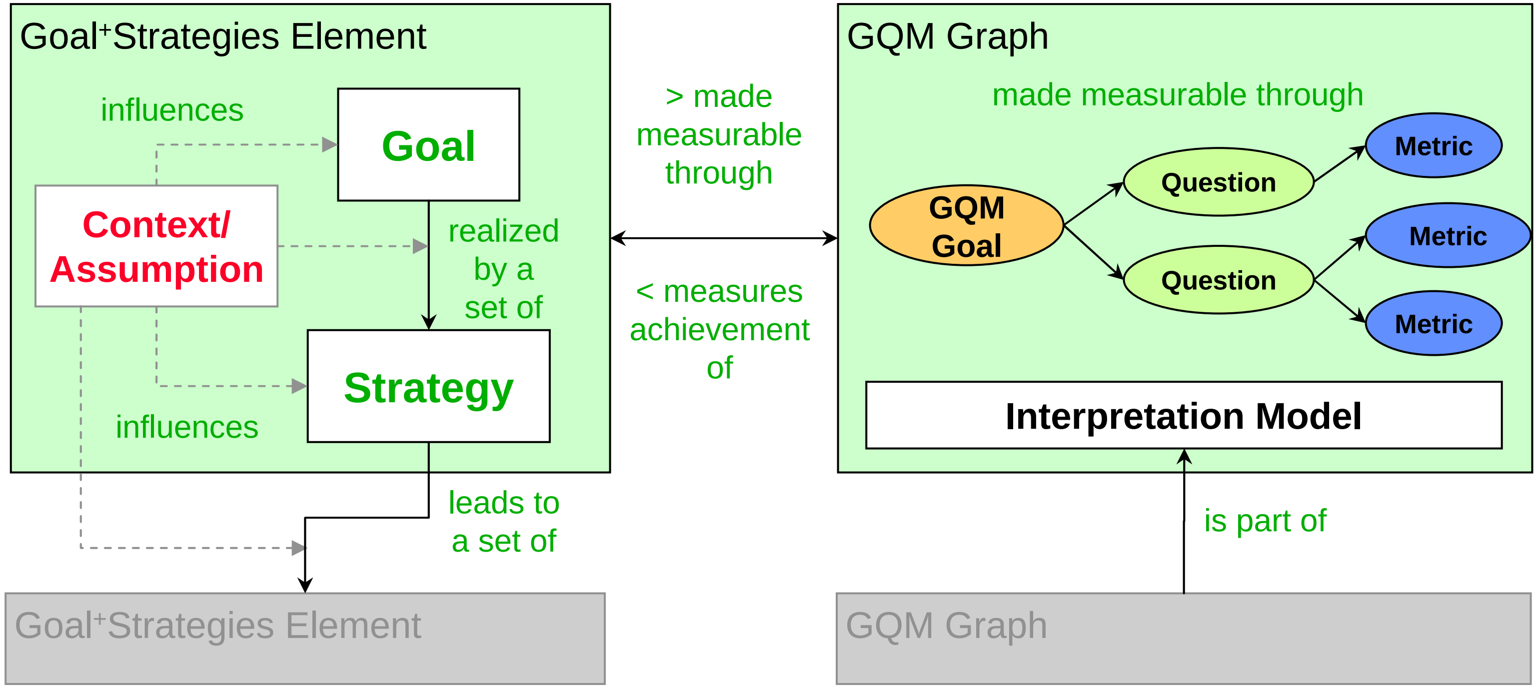
Strategy: A possible approach for achieving a goal that may be refined by a set of concrete activities (i.e., business or development processes)

Level i Goals: A set of lower-level goals inherited from level i-1 goals as part of the level i-1 goal strategy

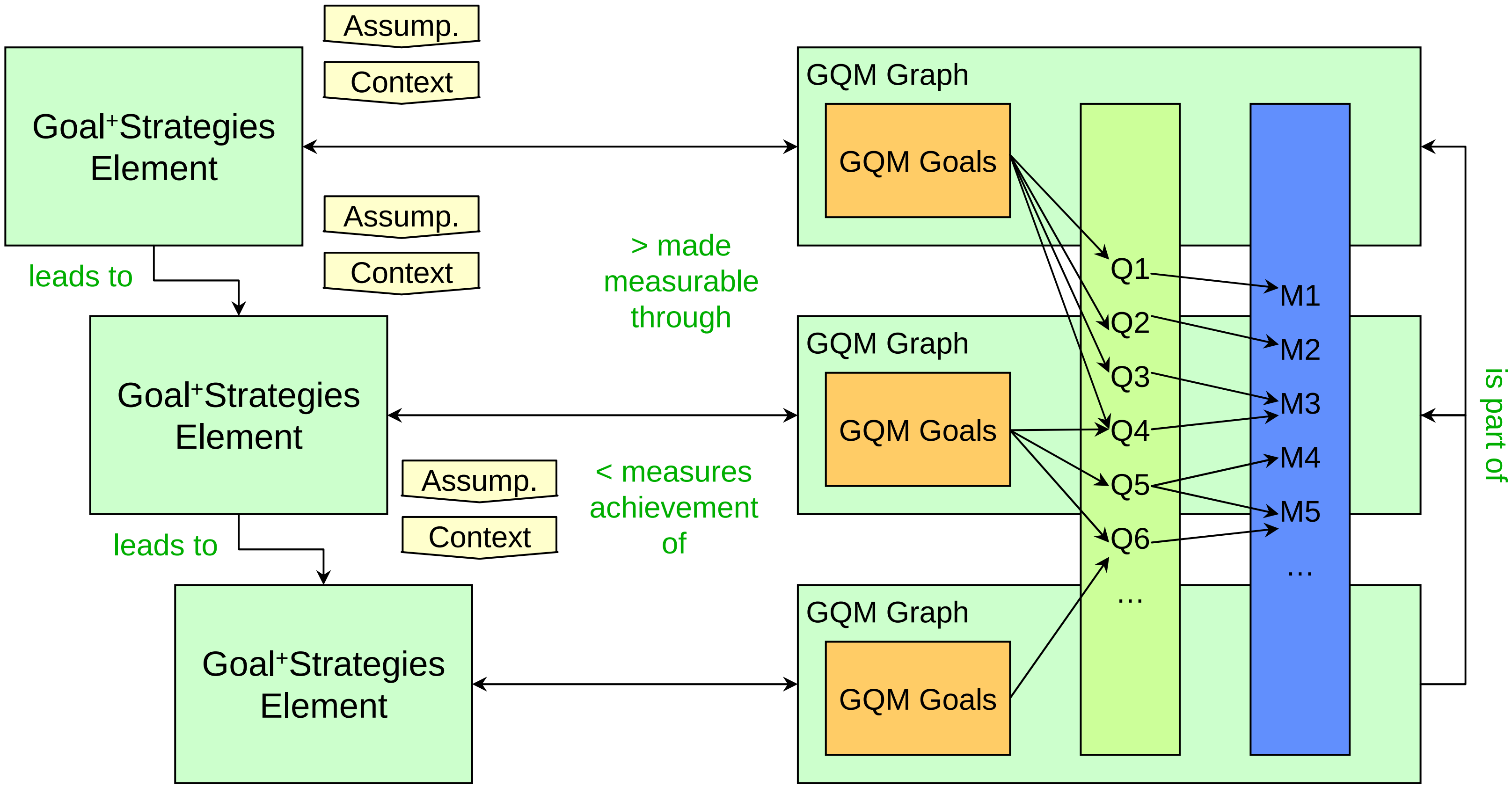
GQM Goals: Measureable goals associated with each business goal

Interpretation Models: Models that help interpret data to determine whether goals at each level is achieved

Tying Strategies to GQM: A Complete Goal^{+}Strategies Element



Linking Goals at Multiple Levels: A Sample GQM⁺Strategies Grid



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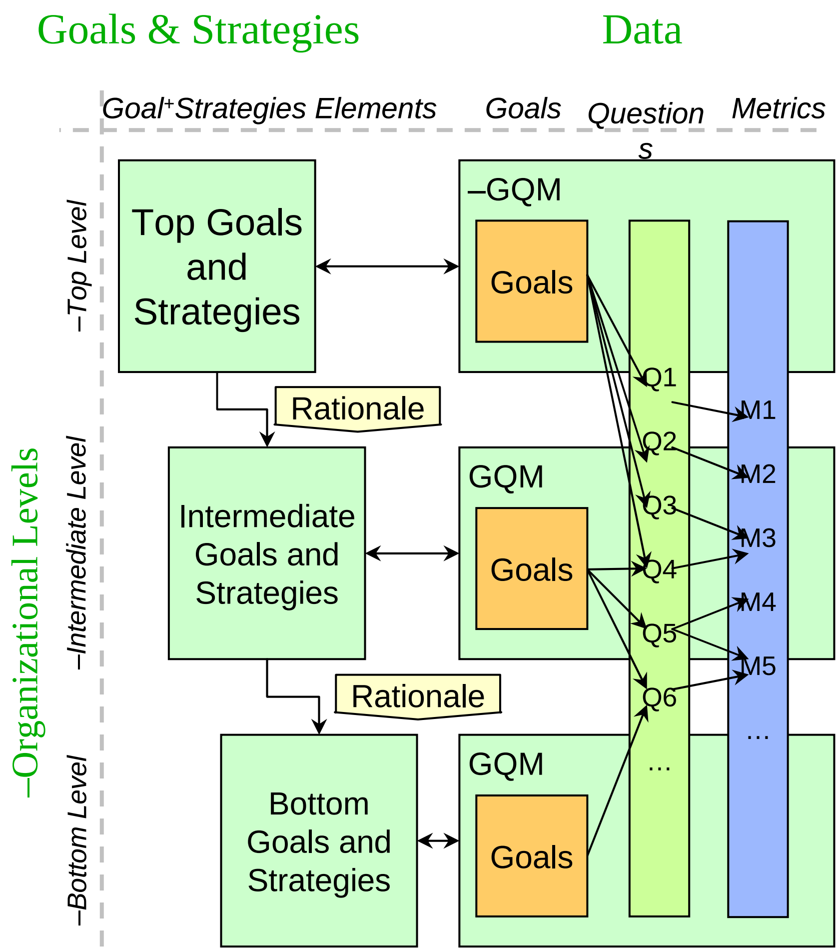
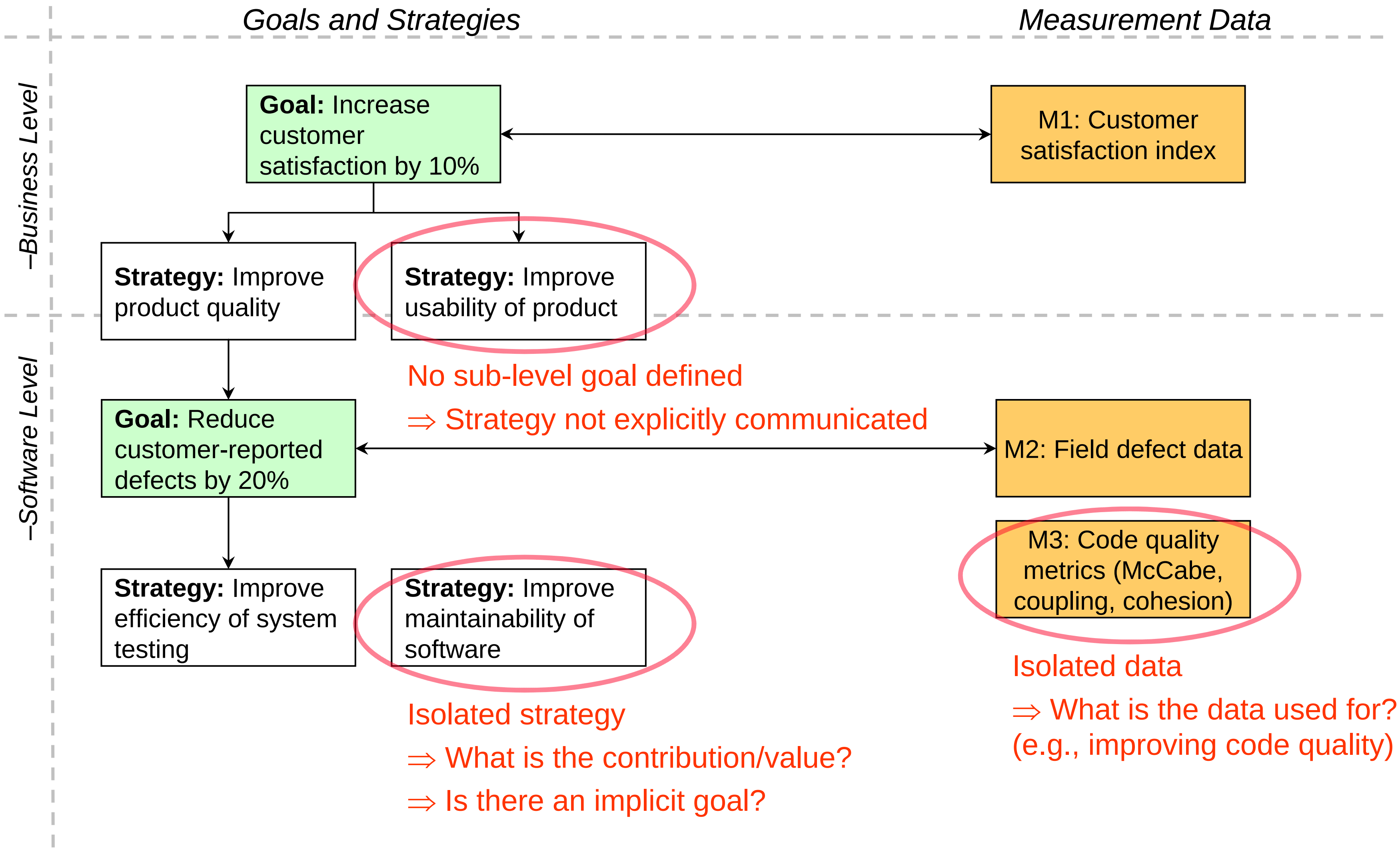


Standard Problems



Example Business Goal: Level 1

Context: Organization, ABC, provides information services to customers through the Web. Customers pay for access to information via software that searches, analyzes, and presents information, not for software

Context: The amount of revenue generated at ABC is determined by the number of times customers access the ABC software products, not the number of customers

ABC business goal*:* Increase profit through increased customer usage of the Web-based software services

Assumption: There are enough CMMI projects with a maturity level > 1 to provide a 15% improvement, so the organization can manage a 10% improvement if the level 1 projects remain the same

Business Goal: Level 1

Activity	Increase
Focus	Net Income
Object	ABC Web Services
Magnitude (degree)	10% per year
Timeframe	Annually, beginning in 2 years
Scope	Development Groups: 15%/year for all CMMI projects with maturity level > 1
Constraints (limitations)	Available resources, ability to sustain CMMI levels, …
Relations to other goals	CMMI Goals

Business Goal: Level 1

Strategies: **deliver added functionality at regular and frequent intervals to encourage more usage**, increase the rates charged to customers, reduce development costs, ...

Assumption: Added functionality will lead to increased customer satisfaction, which will in turn lead to higher usage

GQM Goal: <u>Analyze the</u> trend in profit <u>for the purpose of</u> evaluation <u>with respect to</u> a 10% increase in annual income per year <u>from the point of view</u> of ABC's management <u>in the context of</u> ABC

GQM Questions: What is the profit figure for this year (P0)? What is the profit figure for each succeeding year (P(x))?

Business Goal: Level 1

Interpretation model:

Starting in year 2, i.e., for x = 2, 3, …

if $P(x) \geq 1.1 * P(x-1)$

then the goal has been satisfied,

else if added functionality was increased appropriately

then some assumption or level 1 strategy, is wrong

The full interpretation is dependent on the lower level goals, e.g.

else if added functionality was not increased by 5% then the level 2 strategy was not effective, ...

Level 2 Goal

Based upon the chosen level 1 strategy we define our next level goal

- **Level 2 Goal:** Deliver the right kind/amount of added capability (5% more) every 6 months (requires accurate estimates of cost and schedule (10% variance) (for CMMI level 2 or better projects)
- **Strategy:** Use **MoSCoW** to determine what capabilities to deliver and **COCOMO** to check that the selected capabilities can be delivered on schedule and within cost
- **Definition: MoSCoW** is a method for negotiating with the customer on the importance of delivery of each functional requirement. MoSCoW stands for: M - MUST have this, S - SHOULD have this if at all possible, C - COULD have this if it does not affect anything else, W - WON'T have this time but WOULD like in the future.
- **Definition**: **COCOMO** is a cost and schedule estimation model based upon a number of project specific variables, including size.

Level 2 Goal

- **Context:** there are experts available who can tailor, teach, and apply the MoSCoW and COCOMO approaches

- **Assumption:** can estimate percent of function delivered, e.g., can use a proxy like additional lines of code delivered, number of function points delivered, or a formula based upon a count of actual requirements weighted in some way (hard, medium, easy).

- **Assumption:** the backlog of customer-requested requirements continues to grow and requirements are characterized by M, S, C, W and complexity of implementation

Level 2 Goal Template

Activity	Deliver
Focus	More usable functionality, e.g., M type requirements
Object	Backlog of customer-requested requirements
Magnitude (degree)	5 % more than the prior release
Timeframe	Every 6 months, beginning in 2 years
Scope	Development Groups:15%/year for all CMMI projects > 1
Constraints (limitations)	Available resources, ability to sustain CMMI levels, ability to estimate cost and schedule for a release,…
Relations to other goals	Achievement of cost and schedule estimate accuracy, Ability to improve CMMI levels of development groups, …

Level 2 Goal

- **GQM Goal**: Analyze each 6 month release for the purpose of evaluation with respect to a 5% new function growth as compared to prior function growth from the point of view of the services project manager in the context of ABC services.

- **GQM Questions**: What was the **amount of function** delivered at each release? What was the % of new M, S, C, and W requirements released? What is the % growth from the prior release?

- **Interpretation model**: **If** at each 6 month milestone the growth in functionality of a release $\geq$ 5%

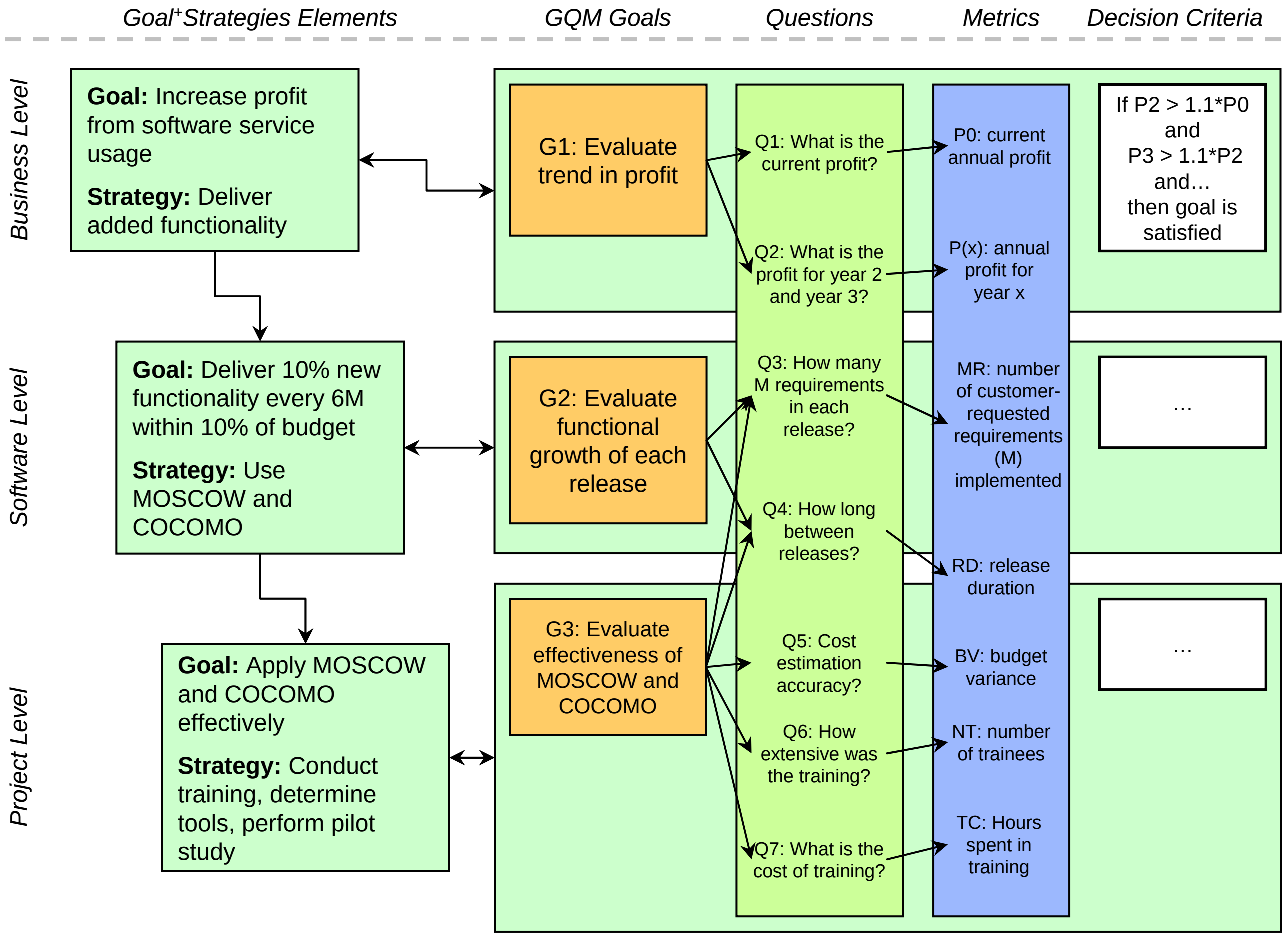
  then the level 2 goal is satisfied for this release

  else, assumptions about MoSCoW are not working **or** our estimation of cost or schedule is not right, …

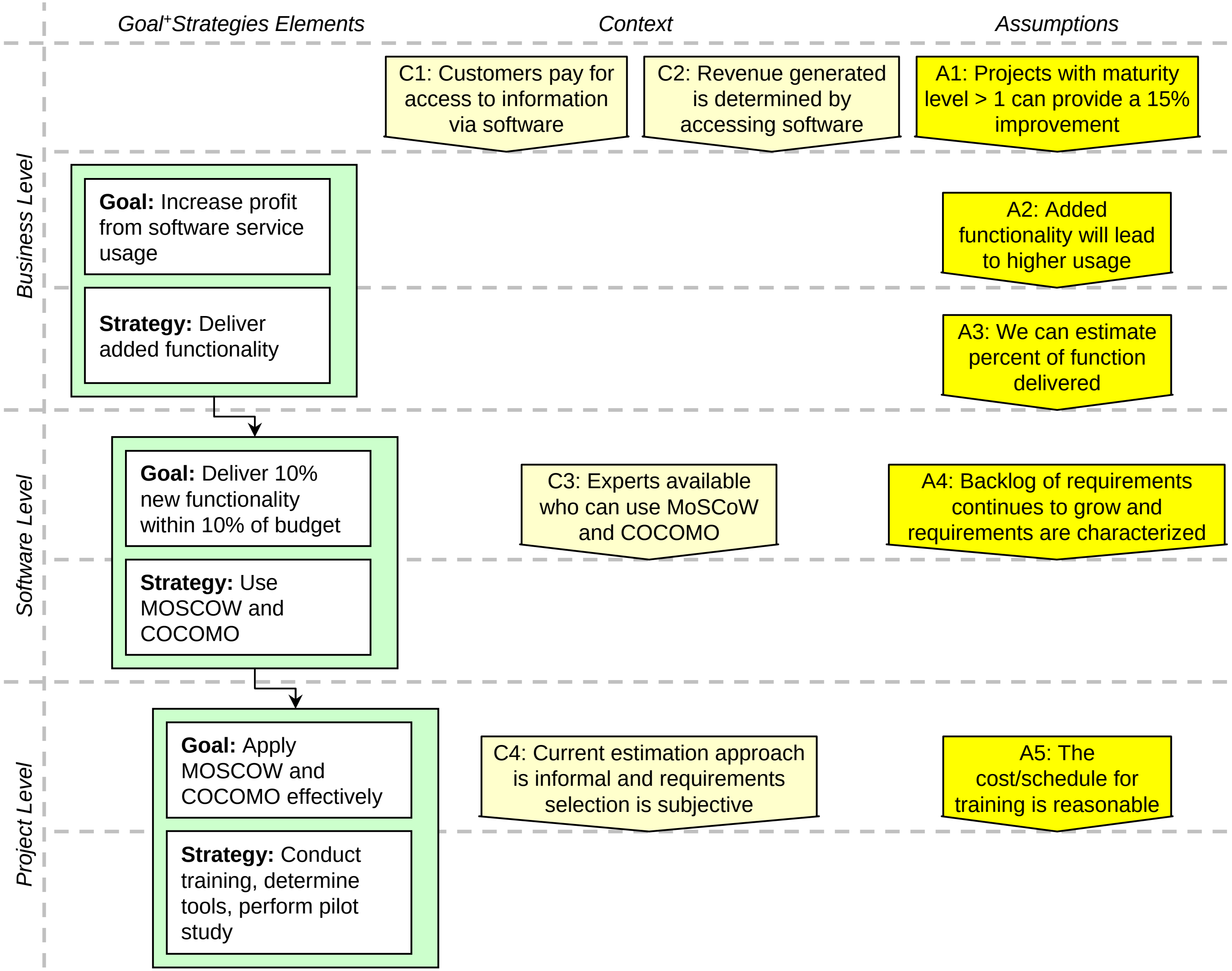
  else if goal 1 is satisfied but goal 2 is not

  then investigate why, e.g., delivery of some particular functionality alone caused the gain.

Measuring Increase Net Income



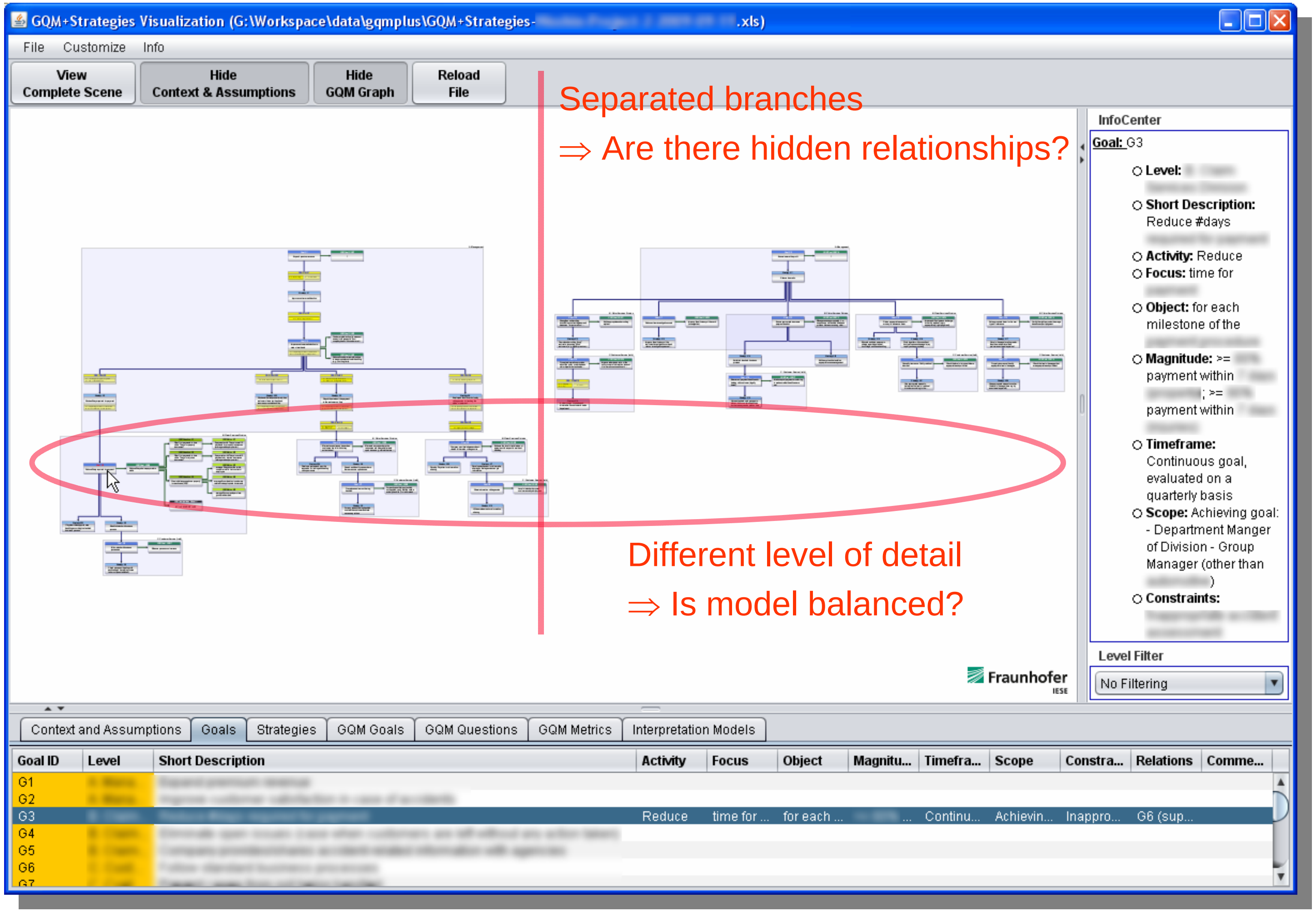
Context and Assumptions for Increase Net Income



Who is Using GQM^{+}Strategies®?

Business	Domain	Application
European telecommunications company	Telecommunications	Drive strategic improvement programs, support paradigm shift toward purpose-driven metrics
European automotive supplier	Automotive	Support CMMI’s Measurement and Analysis process area
South American Oil company	Oil drilling	Identify the most relevant data to determine when and where to drill
International software company	Embedded systems used in telecommunications	Increase the visibility at all organizational levels of how strategic decisions impact operations
Asian insurance company	Information systems	Align strategies and goals for new business domain
Asian systems engineering organization	Safety-critical software for aerospace domain	Increase visibility of goals and strategies and derived measurement goals to enhance supplier collaboration
Joint research project to develop a common software platform	Support of complex, dynamic business processes in a variety of domains, including logistics, retail, and customized industrial facilities	Align project objectives and business objectives of involved research and industry partners

Real Example



Summary

explicit **linkages** between **goals** at the **strategic** and project level

templates to define all types of goals at the level of detail necessary and track their relationships to each other

tracking of **context factors and assumptions** so the effect of changes in context and the status of the assumptions can be assessed

interpretation models tying together measurement goals, context factors, assumptions, and data

transparency of measurement motivations and goals **at different levels of the organization**

tracking of business success

Ongoing Activities

A **tool** under development to support visualization and navigation through the grid

ROI for goals and strategies is being added to the grid by using the GQM+Strategies notation to represent benefits and cost analysis via Value based Software Engineering

The actual costs and benefits are tracked through a cost-benefit GQM graph

A organizational model of Earned Value Analysis that uses benefits and cost analysis as well as the grid hierarchy to identify measureable costs and benefits

A mechanism for prioritizing and evaluating various goal and strategy solutions