Putting Business Goals in Context for Measurement

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Professional experience

- Professor of Computer Science at the University of Insubria at Varese, Italy.
- Scientific consultant in digital innovation projects at CEFRIEL – Politecnico di Milano.

Scientific Activity

- Research: Empirical software engineering, software metrics and software quality evaluation; project management and effort estimation; Software process modeling, measurement and improvement; Open Source Software.
- Several international research projects
- Reviewer of EU funded projects.
- Co-author of over 180 scientific articles.
- PC member of several international Software Engineering conferences
- Editor in chief of the IARIA International Journal On Advances in Software (2013-2018).
- IARIA fellow since 2011

Objective

- Effective software measurement in a business organization requires a deep understanding of the business context.

   → we need to describe the business world and place business goals into their context.

- We propose a method to precisely describe the business domain and its characteristics, the business goals, the strategies, their relationships with the software activities carried out to support the strategies, and how strategies are selected
  - based on Jackson's ideas on domain representation
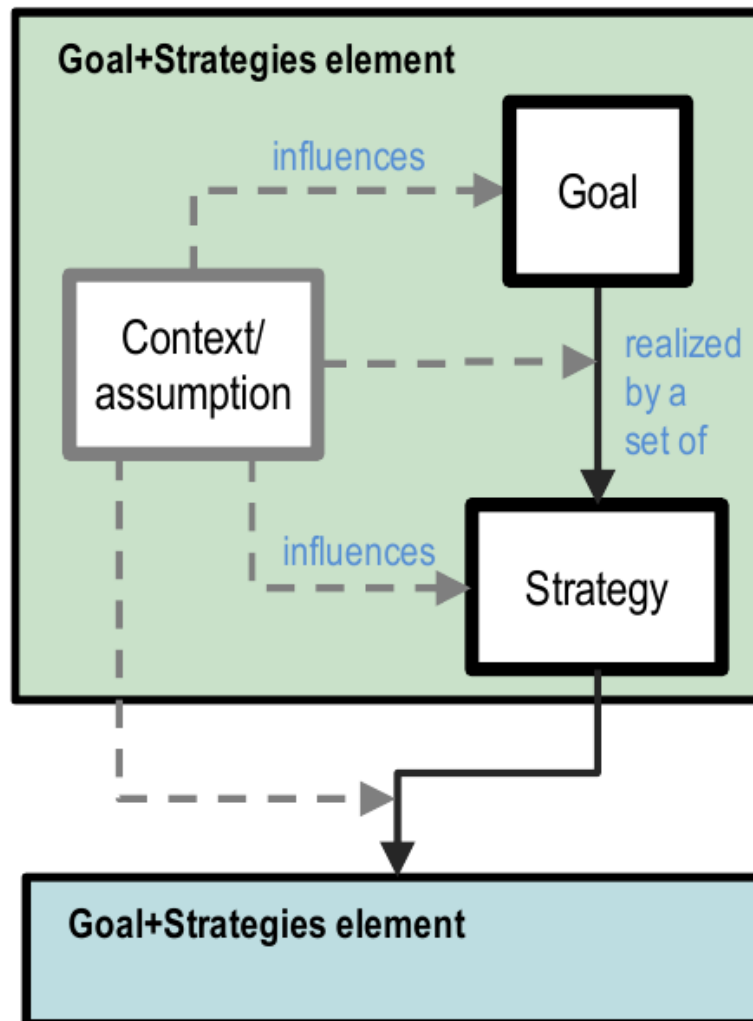 - using concepts from the GQM+Strategies technique

GQM+strategies

- Basili et al. proposed GQM+strategies *"for explicitly linking measurement goals to higher-level goals, and also to goals and strategies at the level of the entire business."*

GQM+strategies
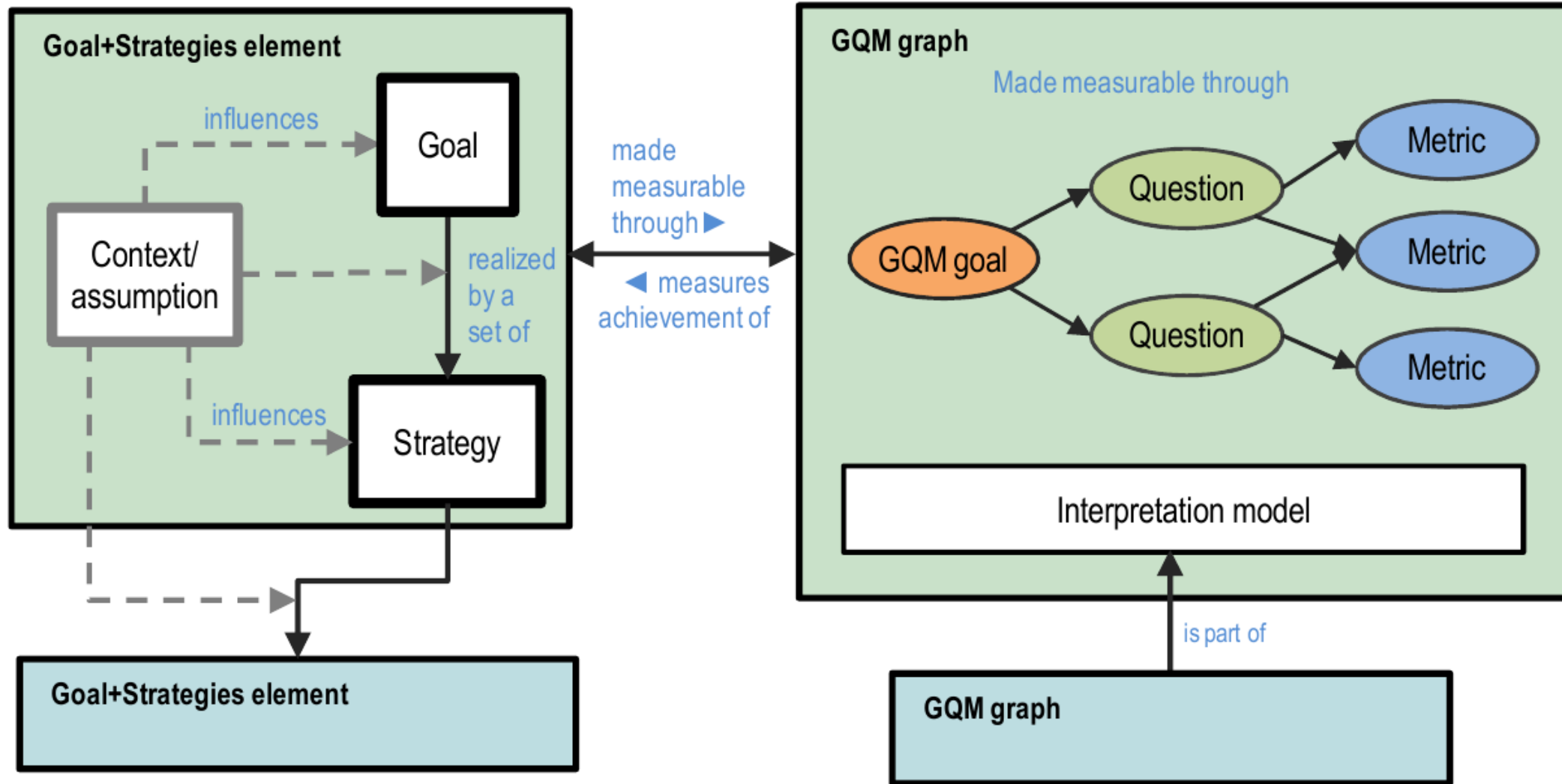
GQM+strategies

- A top-level business goal is set, according to some unknown, which we treat it as an "axiomatic" goal.
- The business context is known (partly only in terms of assumptions).
- A strategy is devised to reach the business goal in the given context.
- Implementing the strategy may require achieving lower-level goals, etc.

A limit of the GQM+strategies

- Basili et al. did not provide a notation for describing contexts, goals, and strategies.

- We propose to use Jackson's notation, which appears very well suited to this end.

Context, goals and strategies

- We use the approach proposed by prof. Jackson to describe the relationships that link context, goals and strategies.

- We have a context in which a given desirable situation (goal) does not hold:
$$Context \nvdash Goal$$

- Therefore, we introduce a strategy that is expected to achieve the goal
$$Context, Strategy \vdash Goal$$

Knowledge of the business world, which is given and cannot be changed

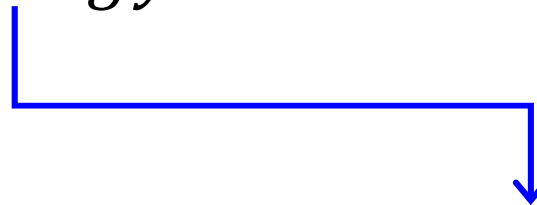Decided based on the goal and the context

Strategies and goals form hierarchies

- Having devised a strategy that is supposed to let us achieve a business goal, usually implementing that strategy involves achieving one or more sub-goals, which on their turn require specific strategies, etc.

$$Context, Strategy \vdash Goal$$

$$Context, LowerLevelStrategy \vdash Strategy$$

Example

- Goal: Reduce cost of SW development
- Context knowledge: Optimal usage of resources minimizes the cost of SW development
- Strategy: Use available resources more effectively

How can we use available resources more effectively?

- Goal: Use available resources more effectively
- Context knowledge: Development plans based on reliable estimates of resource needs lead to better resource usage
- Strategy: Define resource allocation plans based on reliable estimates

How can we get reliable resource usage estimates?

…

GQM+strategies
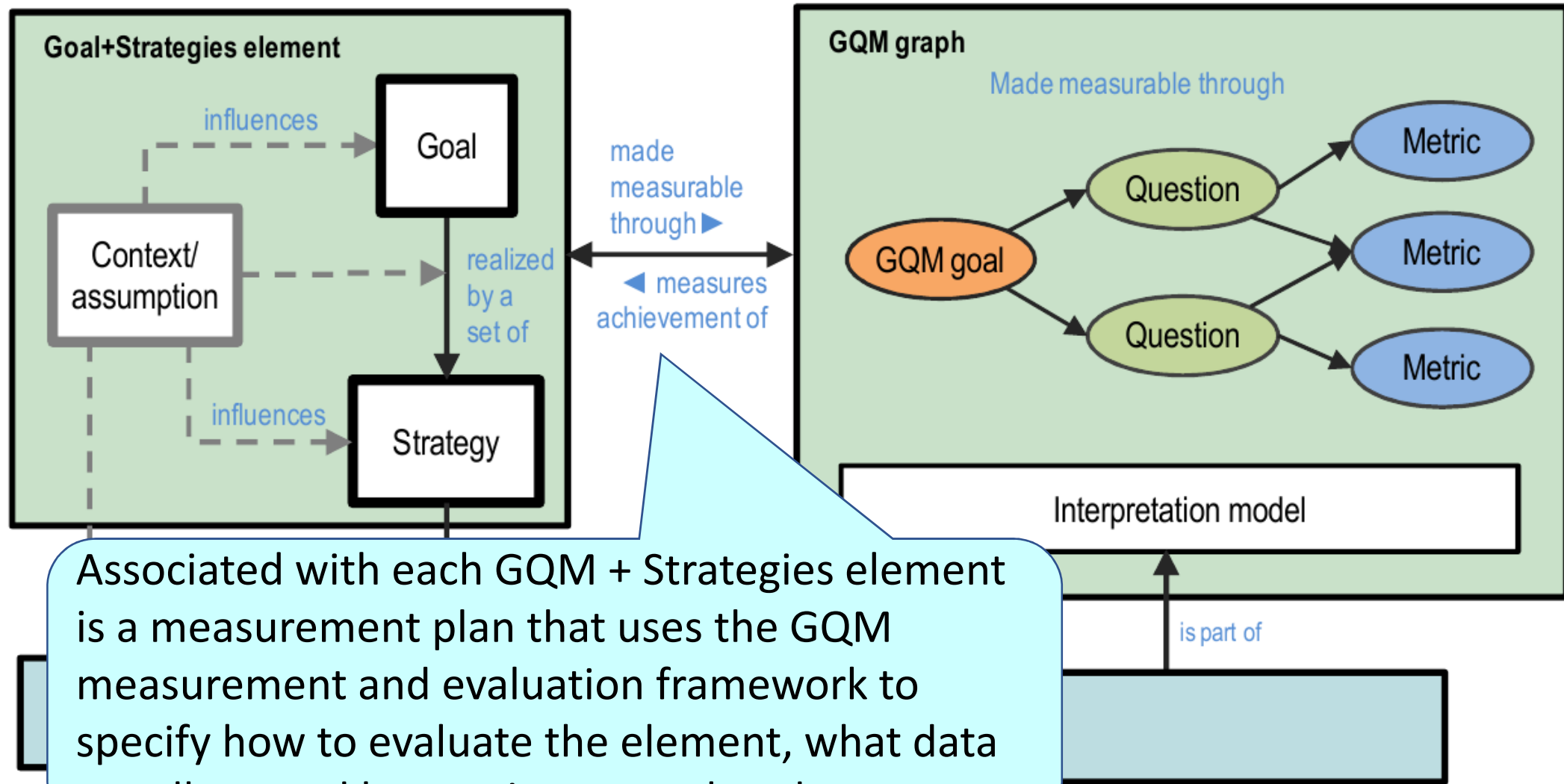
What should be measured, and how

- Of course, we would like to know if and to what extent the goals were attained.

- However, especially if a goal was not attained satisfactorily, we need to know why, so as to do better in the future.
- E.g., we need to know if
  - Assumptions about the context were correct
  - The context did not behave as expected
  - The strategy was not applied correctly
  - Everything was as expected, but the strategy did not work nonetheless: so, the entailment was not correct (which is possible, when an informal correctness argument was used)

What should be measured, and how

- The adopted notation provides clear indications on what should be measured.

- It seems natural and effective to associate specific measurement plans to each part of the entailment:
  - Context: if the context description contains assumptions, it is generally a good practice to measure to what extent the assumptions are true.
  - Goal: we want to know to what extent the goal has been achieved.
  - Strategy: we want to know how the strategy has been applied and related characteristics (for how long, how many resources were used, etc.).
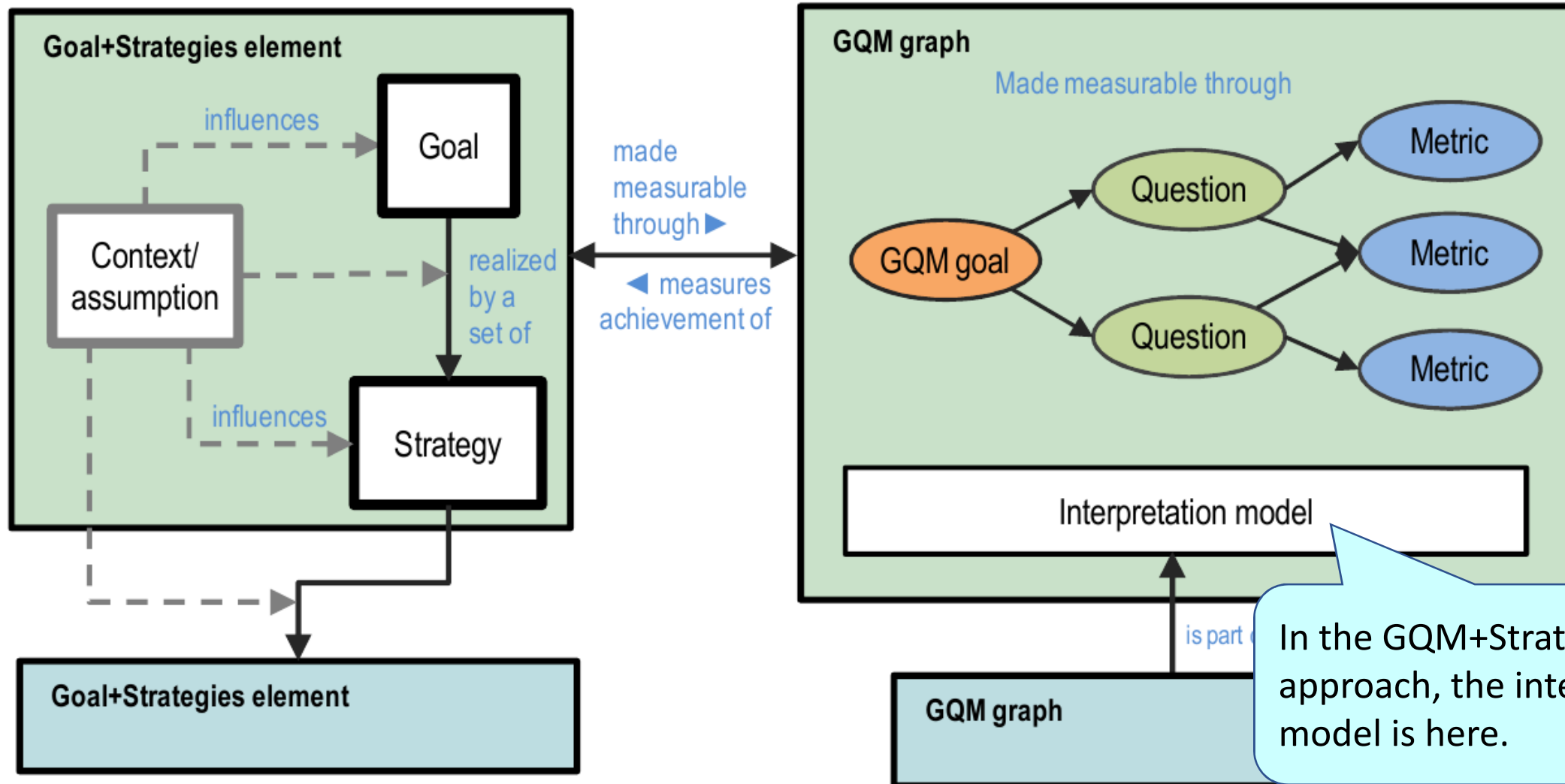
What to measure and how: our proposal

Interpretation of measures

- Collected measures have to be interpreted.
    - Data have to be converted into information.

- How?
- I.e., where is the "interpretation model" for the collected data?
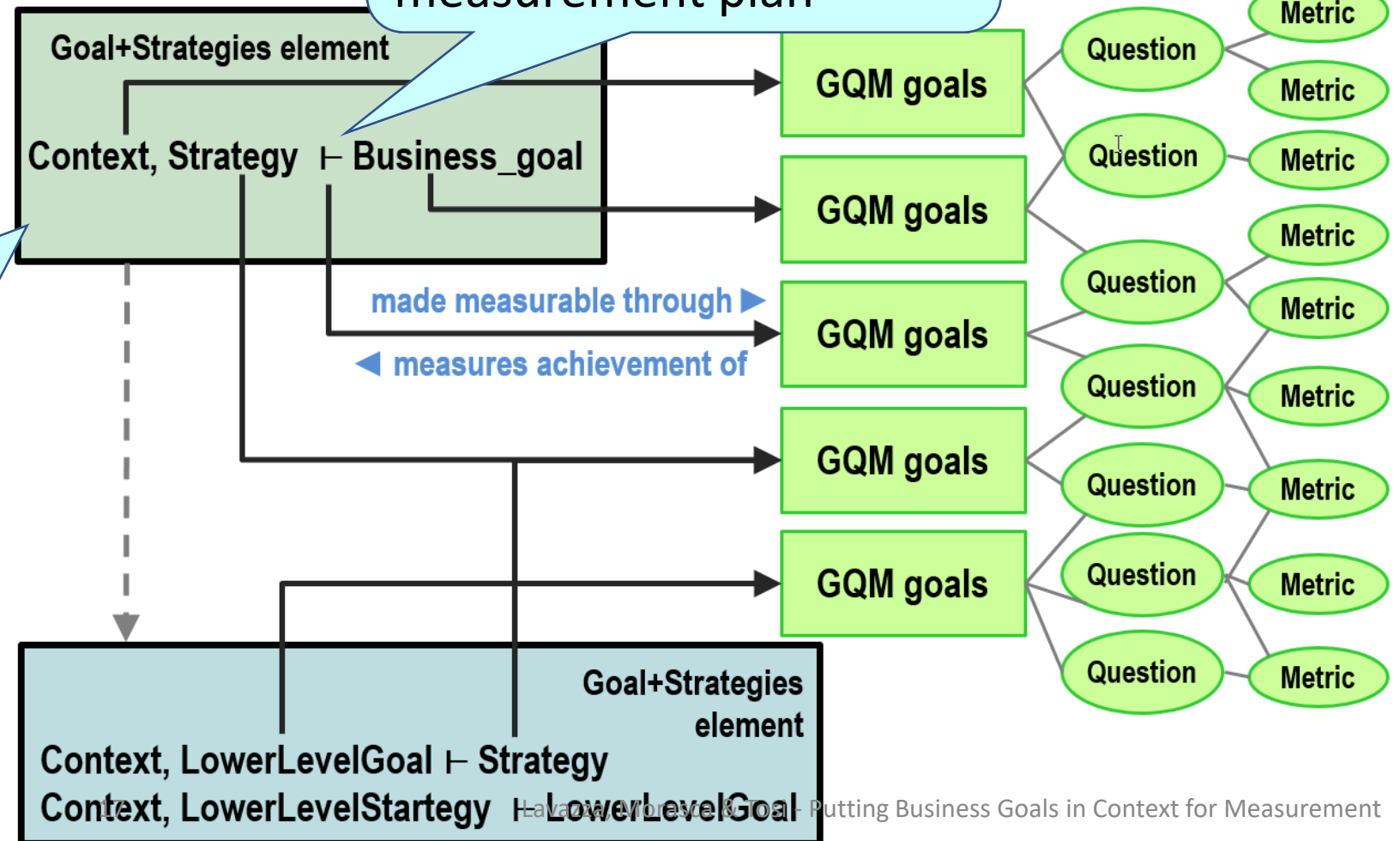
Interpretation of measures

Interpretation of measures

With our approach, the interpretation model is either straightforward, or it descends from the entailments that connects context, strategies and goals

The entailment itself is evaluated via a proper measurement plan

Goal+Strategies element

Context, Strategy ⊢ Business_goal

made measurable through ▶

◀ measures achievement of

GQM goals

GQM goals

GQM goals

GQM goals

GQM goals

Question — Metric
Question — Metric
Question — Metric
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Goal+Strategies element

Context, LowerLevelGoal ⊢ Strategy
Context, LowerLevelStartegy ⊢ LowerLevelGoal

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Interpretation of measures

- It can happen that measures reveal a successful situation at some level, but an unsatisfactory outcome at the upper level.
- Example:
  - Top level: decrease customer complaints by 10% by improving the reliability of the core feature of our product
  - Lower level: improve the reliability of the core feature of our product by adopting a process that eases detecting and removing defects
  - Measurement at the lower level indicates that the product reliability was actually improved.
  - Measures at the top level indicate that customer complaints did not decrease significantly
    - Reason: product reliability requires proper configuration via many parameters, which most users are not able to handle.

Conclusions

- We proposed some practices to help organizations better represent their business goals and how to achieve them (mostly via software), and to link the business-oriented descriptions with measurement goals and plans.

- Our proposal is based on Jackson's ideas on domain representation and concepts from GQM+Strategies, and allows for the precise description of the business domain, the business goals, the strategies, and their relationships.

- The proposed descriptions
  - Ease the definition of measurement plans
  - Suggest the interpretation of the collected data.

Thanks for your attention!

Questions?