Efficient identification of rationales by stakeholder relationship analysis to refine and maintain GQM+Strategies models

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Abstract. GQM+Strategies[1] is an approach that aligns the business goals at each level of an organization to strategies to achieve overall business goals and assesses the achievement of such goals. Strategies are extracted from business goals based on rationales (contexts and assumptions). Using the proposed approach, which refines the GQM+Strategies model by extracting rationales based on the analysis of the relationships between stakeholders, it is possible to extract rationales exhaustively and to reconsider the GQM+Strategies model even if the business environment changes.

Keywords: Software development, GQM+Strategies, Stakeholder, business goal, organizational change, rationales (contexts and assumptions)

1   Introduction

Currently, software is responsible for a lot of business in corporate activities. Although individual IT systems have been developed, it is unclear if the IT/software related strategies and the organization business goals are aligned. One approach to resolve this issue is GQM+Strategies, which aligns the business goals of each level to the overall strategies and goals of the organization as well as assesses the achievement of business goals. By ensuring alignment in GQM+Strategies, it is possible for the entire organization to communicate easily and to work toward common goals.

Nowadays both the business and technical environment are changing rapidly. Thus, a model must continuously evolve [1][2]. To understand these changes, an analysis and validation mechanism that adapts the relationships among stakeholders, business goals, and strategies to GQM+Strategies is necessary. As related works, a research evaluating rationales and business goal via utilizing GQM+Strategies for Business Value Analysis [3] is given. However, it is unclear how to extract rationales efficiently and exhaustively. This work proposes Context-Assumption-Matrix (CAM) to refine business goals and strategies iteratively by analyzing the relationships of stakeholders as a complement of GQM+Strategies and Context Assumption (C/A) extraction sheet to unify the expressive style of context and assumption.

This paper examines the following three research questions.

RQ1: Can CAM and C/A extraction sheet efficiently extract new rationales?

RQ2: Can CAM exhaustively extract rationales?

RQ3: When the management policy or business environment changes, can the rationales and GQM+Strategies Grid be easily analyzed via using CAM?

The contributions of this paper are two-fold. First, the proposed method may provide a way to efficiently and exhaustively extract contexts and assumptions. Second, when the management or business environment changes, the GQM+Strategies, contexts, and assumptions can be easily analyzed.

2 Background

2.1 GQM+Strategies

The GQM+Strategies approach extends the goal/question/metric paradigm to measure the success or failure of goals and strategies, while adding enterprise-wide support to determine actions on the basis of the measurement results [4].

GQM provides support for measurements by developing software-related goals and generating questions to refine goals and to specify measures that need to be considered in order to answer the generated questions [5]. Although the GQM approach can measure whether a business goal is achieved in an organization or project, it does not provide a mechanism to link higher-level business goals to lower-level goals nor does it support and integrate goals at different levels of the organization. GQM+Strategies creates maps between goal-related data at different levels, so that the insights gained relative to a goal at one level can help satisfy goals at higher levels [6].

The major feature of GQM+Strategies is to determine business goal strategies based on rationales as "contexts" and "assumptions". Contexts are environmental characteristics. Assumptions are aspects of uncertain environments, including estimated ones. Although many strategies are considered for a goal, the best strategies are then selected based on the rationales. Because all of the selected strategies are detailed to lower level goals, it is possible to determine strategies that reflect the actual business environment. Figure 1 overviews the concepts of GQM+Strategies. The GQM+Strategies grid visually confirms the link between a goal and strategy, allowing the entire organization to communicate easily and to work toward the same goal. Furthermore, through the GQM paradigm, it is possible to evaluate whether the goals at each level are achieved.
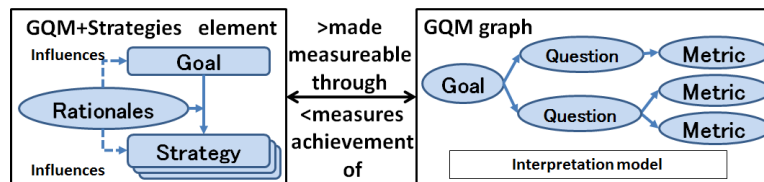

Fig. 1. GQM+Strategies components (based on Basili et al. [4]).

2.2 Motivating Example

As an example, we applied GQM+Strategies to a stationary company, which sells stationary to corporations. The company takes orders from corporate customers and then ships based on the order form. Figure 2 overviews the corporate structure of the stationary company. Although the scope of the application is the sales department, the purpose of using the GQM+Strategies is to improve accepting orders in the sales department and the shipping business. Figure 3 shows a level 3 business goal and strategy and the rationales.
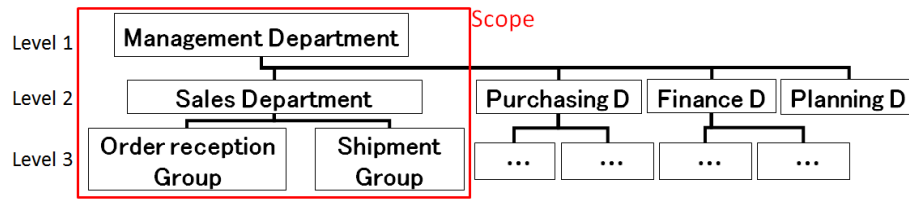

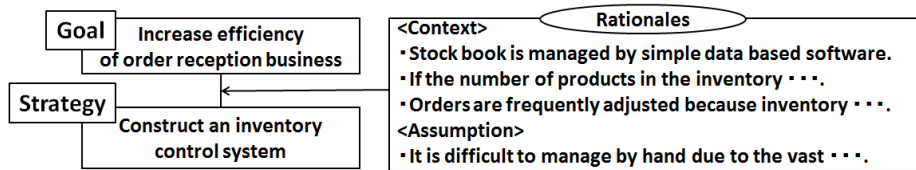**Fig. 2.** Corporate structure of a stationary company

Fig. 3. Business goal, strategy, and rationales (excerpt)

Although the GQM+Strategies process derives business goals, strategies, and rationales, it is unclear whether these contexts and assumptions cover all existing goals and strategies. As an example, there may be a context that ensuring budget of system construction is difficult. The lack of contexts and assumptions tends to be misleading and incorrect strategies are derived. Therefore, the mechanism must be able to extract contexts and assumptions efficiently and exhaustively.

Business environments are constantly changing. As an example, consider a management policy when a company starts with individuals, but is sold to corporations. The GQM+Strategies grid must be adjusted, and some contexts and assumptions may change. However, it is difficult to grasp what has changed. Thus, the mechanism must also be able to a grasp the exact change and adapt the GQM+Strategies.

3 Our Approach

GQM+Strategies does not have a method to check contexts and assumptions without omissions. In section 3.1, we propose the Context-Assumption-Matrix (CAM), which is a method to extract contexts and assumptions efficiently and exhaustively by analyzing the relationships between stakeholders.

Often contexts and assumptions are described ambiguously. Thus, in section 3.2, we propose the Context Assumption Extraction Sheet (CA Extraction Sheet), which is an expressive style of contexts and assumptions related to CAM.

3.1 Context-Assumption-Matrix

CAM organizes contexts and assumptions between stakeholders in a two-dimensional table. Contexts and assumptions often occur between stakeholders. Our approach defines stakeholders as people, systems, or processes. This definition allows CAM to respond to the actual shape of corporations. Figure 4 provides an example of applying CAM to a stationary company and GQM+Strategies grid.
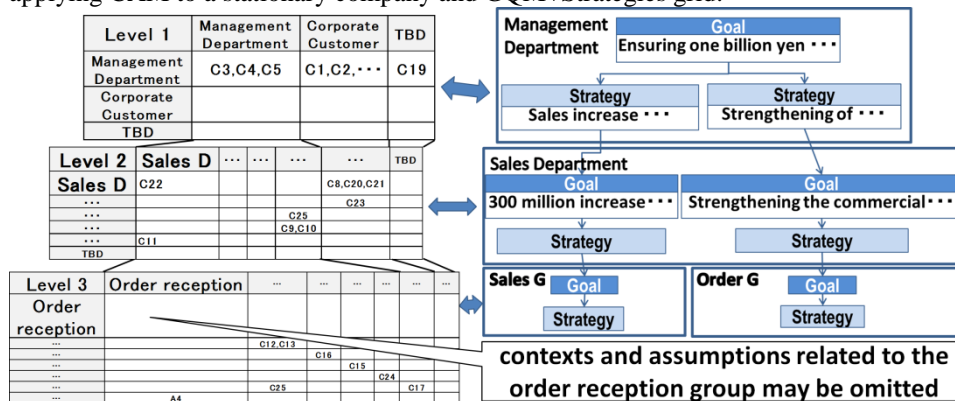

Fig. 4. CAM and GQM+Strategies grid of a stationary company (excerpt)

Each row element denotes a stakeholder who views the context or assumption. Each column element represents a stakeholder who is the subject of the context or assumption. TBD means a stakeholder who is undecided or does not currently exist. Row and column elements have commonalities. For example, in figure 4, there is C2 (Context 2) in level 1: "Profit rate decreases due to a recession of customers." This means that the "Management Department" views that the "Corporate Customer" is experiencing a recession. In CAM, "Context 1" is written as "C1". The details of the contexts and assumptions are described in the Context Assumption Extraction Sheet, which is explained in the next section.

CAM has a hierarchy, which corresponds to the corporate structure similar to GQM+Strategies. In this case, CAM has three levels because the example stationary company has three levels. The stakeholders of CAM have the same levels as the corporate structure.

The example in Figure 4 shows how to use CAM when the order reception group in level 3 lacks contexts or assumptions. It is possible that contexts and assumptions related to the order reception group may be omitted. In fact, there is a context, "When the order reception group receives an order, it must confirm that the order is placed by a registered customer on the basis of the customer ledger." In addition to the strategy in Fig. 3, it is possible to plan a new strategy, "Construction of a customer information control system" based on this context. By organizing the contexts, assump-

tions, and stakeholders two-dimensionally in CAM, the contexts and assumptions can be visually reviewed.

3.2 Context Assumption Extraction Sheet

Contexts and assumptions are often described ambiguously. For example, consider the context: "We take an order via telephone, FAX or email from a corporate company." This context does not clarify who "we" refers to, which may lead to a misunderstanding of the context or assumption even if these are extracted via CAM. Therefore, it is important that the expressive style of context and assumption is unified.

To unify the expressive style, we developed the context assumption extraction sheet (C/A Extraction Sheet). Table 1 shows the definitions and an example of a C/A Extraction Sheet. By employing this expressive style, it is possible to describe contexts and assumptions exactly. Furthermore, the "viewpoint" in this sheet corresponds to the row elements, while "who" in this sheet corresponds to the column elements in CAM. Conversely, it is possible to create CAM by extracting the contexts and assumptions in this sheet.

Table 1. Definitions and example of the C/A Extraction Sheet

Item	Explanation	Example
Level	Level of corporate structure	Level 3
when	Period of Context and Assumption	until now
viewpoint	Stakeholder who views context or assumption (row element in CAM)	Order Group
who	Stakeholder who are subject of Context or Assumption (column element in CAM)	Order Group
what	Contents of Context and Assumption	We take an order via telephone or FAX.
+/-	Context and Assumption are positive or negative + is positive, - is negative, +- is positive and negative	+-
Source	Source of Context and Assumption	business outline

3.3 Steps of our approach

This section explains how we use the GQM+Strategies grid, CAM, and the C/A Extraction Sheet. Our approach uses the following steps.
1. Collect contexts and assumptions using the C/A Extraction Sheet.
2. Extract stakeholders of CAM from the corporate structure.
3. Apply the contexts and assumptions collected to CAM.
4. Use CAM to extract missing contexts and assumptions.
5. Create GQM+Strategies Grid based on contexts and assumptions.
6. Update CAM and the C/A Extraction Sheet by referring to the related stakeholders when the management policy or business environment changes.
7. Update the GQM+Strategies Grid based on contexts and assumptions.
8. Repeat steps 6 and 7.

4   Discussion

We applied CAM and C/A extraction sheet to a stationary company. In this case, we discuss research questions. We're going to adapt to various examples in the future.

RQ1: Can CAM and C/A extraction sheet efficiently extract new rationales?

People unfamiliar with GQM+Strategies have difficulties deriving contexts and assumptions without hints. As shown in Figure 4, we can get information of stakeholders in CAM. We can also extract rationales by fitting the items in C/A extraction sheet in Table 1. CAM and C/A extraction sheet can extract new rationales efficiently.

RQ2: Can CAM exhaustively extract rationales?

As shown in Figure 4, CAM has stakeholders in the organization as elements. Based on relationships of stakeholders, we can verify rationales exhaustively.

RQ3: When the management policy or business environment changes, can the rationales and GQM+Strategies Grid be easily analyzed via using CAM?

As shown in Figure 4, CAM has a mechanism of extracting rationales by analyzing relationships of stakeholders. Accordingly, if changes related to stakeholders, we can extract elements related to change via using CAM.

5   Conclusion and Future Work

Often insufficient requirements management was on top of the list of factors contributing project failures [7]. GQM+Strategies is an effective approach to align business goals with systemization strategies. However, rationales may be ambiguous or omitted. In our approach, ideal rationales are extracted by analyzing relationships of stakeholders in an organization. Moreover, we propose a mechanism that can respond to changes in the management policy or business environment.

To demonstrate the effectiveness of CAM, we will conduct an experiment involving 50 students majoring in information sciences at Shimane University in Japan in February 2014.

References

[1]   T Adam, et al. "Aligning software projects with business objectives." *6th* IWSM-MENSURA. IEEE, 2011.

[2]   Ebert, Christof, et al. "Requirements Engineering–Industry Needs." *16th* RE, 2008.

[3]   Mandi ́ c, V. Basili, et al "Utilizing GQM+ Strategies for business value analysis: An approach for evaluating business goals" 4*th ESEM*. ACM, 2010.

[4]   J Munch, et al. "Experiences and Insights from Applying GQM+Strategies in a Systems Product Development Organization", 2013 39th SEAA p21

[5]   V. R. Basili, et al. "Linking software development and business strategy through measurement," *Computer*, vol. 43, no. 4, pp. 57‑65, 2010.

[6]   Kaneko Tatsuya, et al. "Application of GQM+ Strategies® in the Japanese Space Industry." 6th IWSM-MENSURA, IEEE, 2011.

[7]   E Christof. "Requirements before the requirements: understanding the upstream impacts." 13*th* RE, IEEE, 2005.