Understanding Strategy: a Goal Modeling Methodology†

Ricardo Mendes, André Vasconcelos, Artur Caetano, João Neves, Pedro Sinogas, José Tribolet

Centro de Engenharia Organizacional, INESC Inovação,
Lisboa, Portugal

Abstract

This paper introduces advances to the topic of business goal modeling. The major guidelines to the presented work are the increasing of representational power of goal models, the introduction of goal achievement indicators and the development of a methodology for capturing goals and associating them with business processes. Increased representational power on goal models can be gained by introducing management theories' concepts like measures and indicators and the business stakeholders and pressure groups.

1 Introduction and Motivation

In the industrial age, enterprises tended to organize according to a functional view in which the business was organized along individual lines of work such as production, sourcing, distribution, marketing and technology [1]. This functional view became the major menace to the survival of major companies in the late twentieth century, as severe changes in the social and technological environment led to new market rules. Companies where forced to deal with constant mergers and acquisitions, market deregulation and globalization. In order to respond to this new environment a new way of managing business arose, as managers begun to view the organization in terms of business processes instead of functions [2]. Each business process integrated activities from various organizational functions in a cross-functional value stream.

Rearranging the business around a set of core business processes yielded the need to model and measure the performance of each process [2], giving birth to a research area known as Business Process Modeling (BPM). By modeling the business processes, managers could increase their level of knowledge about the business and the organization and identify problems and their solutions [3]. Since measuring the performance of business processes demanded the establishment of goals to be achieved within each process, the goals became a prime subject of interest to the BPM community, giving way to a new area of research, Goal Modeling. Overall Business Process Modeling will be further discussed on section 2 and a more detailed explanation of the current status of Goal Modeling will be presented on section 3.

The purpose of this paper is to present a new approach towards Goal Modeling. This approach comprehends the creation of representational models for goals and related concepts and the development of a methodology for capturing goals and their relations with business processes. Section 4 presents the concepts this approach introduces;

section 5 presents a formal notation for modeling goals and related concepts; in section 6, the developed methodology is presented and discussed; finally, in section 7, conclusions are made and future work is presented.

2 Business Process Modeling

Creating a model of a dynamic and highly non-deterministic entity like an organization is a difficult task. Nevertheless, the creation of this abstraction of real world is of fundamental importance to allow managers to abstract from irrelevant details and focus on the important problems.

Most authors consider the core of business modeling to be Business Process Modeling. The description of the structure and behavior of core business processes tries to represent an organization's value adding processes. In this paper, the definition adopted is the one presented by Nilsson [4], that is also supported by most authors in the bibliography [5,6,7]: Business processes are collections of activities that take one or more kinds of inputs and create an output that is of value to the costumer. Business processes have goals and are affected by events occurring in the external world or other processes.

This definition raises the need to clarify some concepts commonly referred in BPM literature:
– Resources are objects within the business that are manipulated through processes. Resources are arranged in structures and have relationships with each other;
– Goals represent the purpose or the outcome that the business as a whole is trying to achieve. Goals can be broken down into sub-goals and allocated to individual parts of the business (such as processes);

As was stated in the previous section, this paper is primarily focused on the challenge of modeling business goals.

3 Goal Modeling

The approach to goal modeling adopted in this paper is mostly based on the goal patterns described by Nilsson [4]. His approach towards goal modeling is based on the following notions:
– *Goals* control the behavior of the business and show the desired states of some resources in the business;
– *Problems* are obstacles that hinder the achievement of goals. They are related to goals, in the way that they not only express adverse conditions to the accomplishment of business purposes but also give way to the creation of new goals that aim at eliminating problems (these goals are usually sub-goals of the one associated with the raised problem);
– *Contradictions* between goals arise when two mutually exclusive goals exist.

In this approach, two sub-goal classes are defined: the Quantitative Goal and the Qualitative Goal. A Quantitative Goal is aimed at describing goals that can easily be measured through some value that is to be achieved. On the other hand, a Qualitative Goal requires human judgment to verify its achievement since it is difficult to describe in measurable terms. Qualitative Goals must have an associated goal description. Quantitative Goals, besides having a goal description, have also a goal value, a current value and a unit of measurement. Goals can be hierarchically related or merely linked to each other (such as contradictory goals).

Problems, as goals, can be decomposed into sub-problems. Since a problem is always associated with a goal, the hierarchy of problems usually reflects the hierarchy of goals.

According to Kueng [8], goal modeling serves the purpose of iteratively reduce or decompose goals until they can be transformed into activities which have to be carried out within a process. Thus, the redefinition of business goals can start a process of reorganization and reengineering of business processes and inherent activities and the supporting information systems.

3.1 Major difficulties in Goal Modeling

In this section we try to clarify the problems associated with goal modeling, and which we aim at solving through the work presented in this paper. These problems are:

– Having a common basis for discussing business strategy and goals among the business participants [8]. There is a need for a common representation language that is simple and easy to understand, but maintains the formality needed to provide input for business process and information systems modeling.
– Capturing business goals from the participants' minds [8]. Since goals come from a strategic thinking process, they are inherent to the managers' minds. We must provide an appropriate framework (that involves concepts that are familiar to them) in order to create the conditions to capture business information.
– Matching business goals and processes. Strategic business planning usually leads to a new set of goals that must be achieved by business processes. This leads to the problem of identifying which processes must be revised in order to aim for the new goals. The revision of these processes yields yet another problem: since processes exist for a given purpose, they aim at achieving a given goal. The process of reevaluating the business process must then begin by identifying major inconsistencies between current and new business goals.

The representation of goal models using an adequate language will be addressed in section 5, were a formal notation for goal modeling is presented and discussed. The second and third problems are addressed in the next section, where new concepts on goal modeling are introduced, in order to increase the representational power of goal models and set the ground for a goal modeling methodology.

4 New Concepts in Goal Modeling

Business modeling is primarily about representing a simplified vision of the company's reality through models [8]. Goal modeling couldn't serve a different purpose but has an additional problem. Unlike business processes, goals exist only in manager's minds (at least until they are properly reflected into business processes). And even if we could extract them into some kind of representation, not all business participants would agree to the goals, since each one of the participants would have different perspectives on business and different needs.

One way of trying to cope with this reality is putting goals into context. By associating goals with the business actors (internal or external) they involve and the resources they relate to, we could provide a better basis for common understanding between business participants. Besides increasing representational power of goal models, considering the relations between goals, actors and resources would set the ground for addressing the matching between business goals and processes (as stated in

the previous section). The two following subsections provide further insight on each of these concepts and further explore their use in the representation of business reality. The third subsection explores the differences between strategic and operational goals.

4.1 Stakeholders and Pressure Groups

According to Ward [9], one of the most important issues in strategic planning is identifying strategies towards stakeholders and pressure groups. Stakeholders have direct interests in the company and expect some form of benefit from its success (examples of stakeholders are shareholders, competitors or employees). On the other hand, pressure groups impose demands on the enterprise, as they require management to acknowledge them and respond in an adequate way (examples of pressure groups are competitors, clients or unions).

Since business goals are highly dependent on the interests of stakeholders and pressure groups, we sustain that, when modeling goals, a strong association to them should be considered. This has two advantages:

– Unifying business participants' views on goals, since most disagreements come from the different perspective one has over business. It is highly probable that, once framed in a concrete reality of business, most business participants share similar business goals.
– Tightening the bond between goals and processes. Since business processes equally relate to stakeholders as resources, by relating goals to those same stakeholders we have a partial matching between goals and processes.

In section 6 we will further address this subject and explore the interactions between goals, processes and stakeholders.

4.2 Resources, Measures and Indicators

Identifying business resources is a difficult task. In a company, it is easy to find several different meanings for the same business term [9]. Resources are a paradigmatic case of these divergent perspectives. This is also one of the reasons goals are seldom ambiguous. By associating goals with resources, we increase the precision of goal models and increase the representational power of goal models.

Additionally, and similarly to what was referred for stakeholders, this association tightens the bonds between goals and processes, since business processes manipulate resources. This gives us an additional measure for matching goals and processes.

Managers control their company through a set of indicators over resources [1]. Traditionally, only financial measures are considered for management, but some management theories, like the Balanced Scorecard, state that other business perspectives should be considered. This yields the need for (1) representing the indicators associated with goals; (2) classifying indicators according to their perspective or type. Business processes are responsible for producing the necessary information for compiling the indicators. Knowing the set of indicators is simultaneously useful for business process and information systems modeling, since they constitute a set of informational requirements.

Following these concepts, the formal notation for modeling goals presented in section 5 includes the association of goals with resources and indicators.

4.3 Strategic vs. Operational Goals

In the previous section, we referred to a management theory called the Balanced Scorecard [1]. This theory aims at providing a system of goals and measures, aligned through the several organizational levels, in order to obtain the strategic alignment of the company. The main principles postulated by the Balanced Scorecard are the division of goals and measures into strategic or operational and their alignment into four fundamental perspectives: financial, client, internal processes and growth and learning.

Following Kaplan's work, we find it necessary to classify goals as strategic or operational. Operational goals are usually associated with short term returns the company must achieve. Strategic goals concern long term strategic purposes the company must meet.

5 A formal notation for Goal Modeling

5.1 Eriksson-Penker Business Extensions

The Eriksson-Penker Business Extensions [5] create a set of extensions to the Unified Modeling Language (UML) in order to represent business concepts. Being one of the most important features of Business Modeling, Goal Modeling is also considered in these extensions. In these extensions, goals are represented as objects of UML classes that have the stereotype «goal» and are arranged in goal diagrams. A goal diagram describes the business goals and the associated problems. By doing so, a goal diagram establishes *why* the business exists, *what* the business is trying to achieve and *what* the strategies for achieving those goals are. A goal diagram is composed of several UML object diagrams, representing specific high-level goals broken down into sub-goals.

The relationships between goals are dependencies and associations. Dependencies usually describe hierarchical relations between goals whereas associations show links between goals, such as *contradictions*.

This approach considers the decomposition of goals into quantitative and qualitative goals (as was presented in section 3). Both quantitative and qualitative goals have a *description* attribute. Since quantitative goals are measurable, they must have further attributes, like *goal value*, *current value* and *unit of measurement*. *Problems* are represented in the goal diagram as stereotyped notes.

5.2 New Goal Related Extensions to UML

Following the concepts introduced in section 4, we would like to propose new extensions to the UML profile defined by Eriksson and Penker. The concepts we find important to modify or introduce relatively to Eriksson's approach are:
– Goals: are further classified as strategic or operational through an attribute *type*.
– Resources: in Nilsson's approach, resources were associated only with business processes. In section 4 we presented the reasons for considering this association important when capturing the complexity of a real business.
– Indicators represent the mechanisms managers possess to verify de degree of achievement of one or more goals. Indicators can be financial (like revenues, costs or production values) or non-financial (like the degree of costumer satisfaction).

− Stakeholders are resources that represent the company's stakeholders and pressure groups. As was stated in section 4, these groups are of great importance to managers since they influence and condition the way business runs. Although these groups may have different elements, we found it useful to simplify their representation by collapsing both groups into a single one called the Stakeholders.

Table 1 presents the goal stereotype and Figure 1 presents its predefined classes.

Extended meta-class	Core::Class
Semantics	Represents a goal that was originated by an organizational process of strategic planning. It can be further described in natural language.
Diagram Notation	UML Class icon with the «goal» stereotype.
Meta-model	
Attributes	description, type
Predefined classes	Qualitative Goal, Quantitative Goal

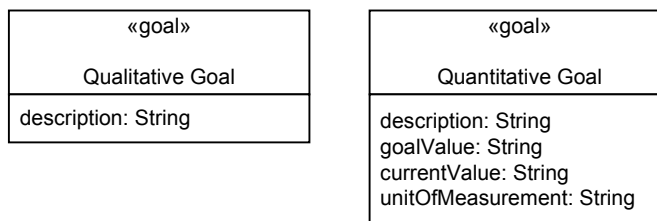**Table 1 - Goal Stereotype**

Figure 1 - Predefined goal classes

6 Goal Modeling Methodology

In previous sections we presented the fundamental concepts and a formal notation regarding goal modeling. In this section we present a methodology that intends to complement goal representation with a process for capturing goals and associating them with the business processes that aim at their achievement.

Business goals are fruit of a process of strategic thinking from managers. In order to model business goals, we have to interact with managers and transpose their ideas into a simplified model. Those captured goals express the manager's thoughts at that time and may therefore be different or even inconsistent with the existing business processes' goals. In order to achieve the new set of goals, the company might have to undergo a process of business process rethinking, of which the first step is the identification of the processes that must be analyzed and reengineered. A goal modeling methodology should therefore allow this identification, by not only identifying which processes should support which goals but also by identifying which goals must originate new processes and which processes have lost sense.

The next sections will present the fundamental requirements of a goal modeling methodology, the developed methodology and the results obtained.

6.1 Requirements for a goal modeling methodology

Following the issues introduced in sections 3 and 4, the major issues a goal modeling methodology should answer to are (1) Capturing the business goals towards stakeholders; (2) Associating goals with the processes that must achieve them; (3) Identifying which processes have to change in order to accomplish new business goals; (4) Identifying the measures or indicators that should provide insight over the degree of fulfillment of each goal; (5) Identifying which processes should produce the necessary information for obtaining the indicators.

6.2 Methodology

Following the approach presented in sections 4 and 5, the major guidelines governing this methodology are (1) business goals are set towards stakeholders; (2) business processes have inherent goals; (3) the process of defining new business goals may provoke the need for rethinking the business processes; (4) in order to manage business, goals must be associated with indicators.

The presented methodology is composed of 5 major phases. The first phase is primarily concerned with obtaining a model that represents the business goals towards stakeholders. The second phase aims at associating the captured goals with the processes that should achieve them. The third phase concerns identifying the goals of each existing ("as is") business process. In the forth phase, the inconsistencies between current and desired business goals are identified and represented. In the fifth and last phase, the indicators associated with the goals are identified and represented in association with both goals and processes.

6.2.1 Phase 1: Goals towards Stakeholders
Purpose: Obtaining the business goals towards stakeholders.
Participants: Managers and modelers.
Deliverables: Goals-Stakeholders-Resources Model, containing the goals to achieve and their relations towards stakeholders and resources

Description

1   Main stakeholders are identified by looking at business processes, strategy and mission declarations or by direct interview with managers.

2   Managers identify goals towards each stakeholder and associate each goal with one or more resources.

3   A Goals-Stakeholders-Resources model is built.

Termination Condition: Every stakeholder is associated with at least one goal.

6.2.2 Phase 2: Connecting Goals and Business Processes

Purpose: Associating the captured goals with the underlying processes.

Participants: Managers, process owners and modelers.

Deliverables: Goals-Process Model, containing the goals to achieve and their association with the processes that must achieve them; Goal Model, representing goals with no supporting processes; Process Model, representing processes with no goals.

Description

1   Goals captured in the previous step are matched with current business process, by having in consideration:

   a.   Resources associated with goals and processes.

   b.   Stakeholders associated with goals and resources associated with processes.

   c.   The process owner's ideas about each goal in relation to it's process.

   d.   The manager's ideas about each goal and process.

2   The following models are built:

   a.   Goals-Process Model, associating the goals and the business processes

   b.   Goal Model, representing goals with no supporting processes

   c.   Process Model, representing processes with no identified goals

3   Managers and Process owners express their opinion about the produced diagrams. If they find any incorrections, associations between goals and processes must be reevaluated (step 1 of the current phase). If incorrections are still encountered, the process rolls back to phase 1.

4   The process proceeds to phase 3 when no more matches can be obtained.

Termination Condition: The matching between goals and processes is complete.

6.2.3 Phase 3: Modeling current business process goals

Purpose: Identifying existing business processes' goals.

Participants: Process owners and modelers.

Deliverables: Goals-Process Model, representing the goals of existing processes.

Description

1   Each process owner states it's process current goals.

2   A Goal-Process model expressing the goals of the current processes is built in accordance to the information provided by all the processes owners.

Termination Condition: All business processes have at least one goal.

6.2.4 Phase 4: Identifying Inconsistencies

Purpose: Identifying inconsistencies between current and desired business goals.

Participants: Managers, process owners and modelers.

Deliverables: Goal Model, representing inconsistencies between goals.

Description

1   Managers and process owners are confronted with the goals produced in phases 1 and 3 and asked to identify:

a. Inconsistencies between goals produced in phase 1.
b. Inconsistencies between goals to achieve and current processes' goals.
2   Based on the results of the previous step and on the models produced in phase 2, the following models are produced:
a. Goal-Process Model, containing the processes whose goals haven't changed.
b. Goal-Process Model, containing the processes whose goals have changed (identified in the previous step).
c. Goal Model, representing goals for which no supporting processes were found
d. Process Model, representing process for which no goals have been identified (a revised version of the model produced in phase 2)

Termination Condition: All inconsistencies are identified.

6.2.5 Phase 5: Identifying Indicators

Purpose: Identifying indicators associated with goals.
Participants: Managers, process owners and modelers.
Deliverables: Goals-Indicators Model, containing indicators associated with goals, processes and resources
Description
1   Managers and Process owners identify indicators that can allow the control of the performance of business towards the goals set
2   Each indicator must be associated with at least one goal, one resource and one process.
3   A Goal-Indicators model is created, containing the information produced in the previous step.

Termination Condition: Each goal has at least one indicator.

6.3 Results

This methodology aims at providing answers to the major requirements raised before.

The Goals-Stakeholders-Resources produced in phase 1 answers to requirement 1 (Capturing the business goals towards stakeholders).

Requirement 2 (associating goals with the processes that must achieve them) is satisfied through phase 2. By matching resources and stakeholders from goals with business processes' resources, the process of associating goals to processes is automatically reinforced.

Requirement 3 (identifying which processes have to change in order to accomplish new business goals), which is of fundamental importance to reengineer business processes, is accomplished by identifying which processes have no goal, which goals have no supporting process and which processes have seen their goals change (phases 2, 3 and 4).

Finally, requirements 4 (identifying the measures or indicators) and 5 (identifying which processes should support the indicators) are accomplished by the production of a goals-indicators model in phase 5.

7 Conclusions and Future Work

The work presented in this paper is based on previous approaches to goal modeling, but extends them to introduce new concepts from management theories. Due to the specificity of goal modeling (relatively to business modeling), a particular

methodology must be developed. The methodology presented in this paper provides the major steps towards obtaining a model of business goals and correspondent indicators and their connections to business processes and resources.

Being the result of work in progress, the presented representational models and methodology are still in development and haven't still got enough industry testing (although industry-related projects are undergoing and these advances are being tested in real world companies).

Much work is still to be done in this area. One of the threads that have still to be addressed is the creation of software tools supporting this framework, namely for aiding the creation and manipulation of models and automating (at least partially) the matching between goals and processes.

Another line of work to be pursued is the creation of goal patterns. Goal patterns that relate common processes in specific industry areas can be created in order to aid the manager's strategic thinking process and simultaneously aid the introduction of the sector's best practices into the company's business processes.

We support the idea that goal modeling is an essential part of business modeling since it sets the ground for guiding the process of identifying business processes and rethinking them in light of a new business strategy. This paper presents the work being developed in that sense and introduces advances in the subject.

References

1. Kaplan, D. and D. Norton, 1997. The Balanced Scorecard, HBS Press.
2. Kavakli, V. and P. Loucopoulos, 1998. Goal-Driven Business Process Analysis – Application in Electricity Deregulation, CAiSE 98, Springer Verlag.
3. Jacobs, S. and R. Holten, 1995. Goal Driven Business Modeling – Supporting Decision Making within Information Systems Development, COOCS 95.
4. Nilsson, A., C. Mollis, and C. Nullborn, 1999. Perspectives on Business Modeling, Springer-Verlag.
5. Eriksson, H. and M. Penker, 2000. Business Modeling with UML – Business Patterns at Work, Wiley Computer Publishing.
6. Marshall, C., 2000. Enterprise Modeling with UML. Addison-Wesley.
7. OMG, 1999. Business Object Component Architecture – Enyclopedia, Revision 1.2.
8. Kueng, P. and P. Kawalek, 1996. Goal-Based Business Process Models: Creation and Evaluation, IPG: Working Paper.
9. Ward, J., P. Griffiths. Strategic Planning for Information Systems, John Wiley & Sons, 1998.
10. Anouncing the Standard for INTEGRATION DEFINITION FOR FUNCTION MODELING (IDEF0). Federal Information Processing Standards Publication 182, 1993.