Goal-Oriented Business Process Engineering Revisited: a Unifying Perspective

Dina Neiger[1], Leoind Churilov[1]

[1] School of Business Systems, Faculty of Information Technology, Monash University, Victoria 3800, Australia

Abstract. The goal-oriented approach to business modeling was identified as one of the “three most important issues in driving business processes towards their goals” by the Business Process Management Journal [1]. Although goal-oriented process engineering is gaining momentum, with frameworks, methods and tools being developed in increasing numbers, it continues to be segmented across various research disciplines, with duplication of effort and lack of a coordinated approach to this important research problem. While it is both unlikely and undesirable to have a single method that addresses all business needs, understanding the relationship between the existing approaches will help to identify overlaps and articulate gaps reducing duplication of effort and providing direction for future research. The aim of this paper is firstly, to build on existing assessment frameworks to provide a coherent review of goal-oriented process engineering that crosses disciplinary boundaries; and secondly, to provide an alternative perspective on goal-oriented process engineering by integrating decision and process management based methodologies.

1 Introduction and Background

“Paving of the cow path” is how Yu and Mylopoulos ([2], p. 16) describe traditional modeling techniques that address the “what” of the business process without the “why”. Goal-oriented approaches aim to avoid this dilemma by complying with the premise that “human activity is inherently purposeful” ([3], p. 19). In a more pragmatic view of the world, goal-oriented approaches are the result of the need to ensure effectiveness as well as efficiency of organizations [4], [5].

This paper is motivated by an apparent need to consolidate in a coherent framework, the growing number of goal-oriented approaches to process engineering originating from the decision, system and process points of view representing Decision Sciences, Requirements Engineering and Business Process Management disciplines (respectively).

Neiger D. and Churilov L. (2004).
Goal-Oriented Business Process Engineering Revisited: a Unifying Perspective.
In *Proceedings of the 1st International Workshop on Computer Supported Activity Coordination*, pages 149-163
DOI: 10.5220/0002670401490163

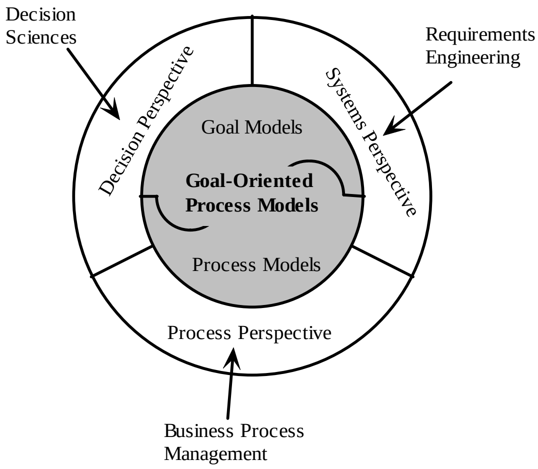

Fig. 1. Multi-disciplinary view of goal-oriented process modeling.

The goal-oriented view of business process engineering dictates that business *goals* are the driving force for structuring and evaluating business processes. Furthermore, to ensure congruency between organizational values and actions, both goal and process models should be capable of representing various organizational perspectives (refer to Figure 1). For a goal model, this includes ability to separate between different types of goals and to describe relationships between them (e.g. [6]). For a process model, this incorporates the ability to model the sequential nature of business activities as well as the resources, inputs and outputs linked to the process (e.g. [7], [8]). Goal-oriented process engineering approaches are often the result of integration or extension of existing goal modeling and process modeling approaches. A brief introduction to the goal modeling and process modeling perspectives within the Decision Science, Requirements Engineering and Business Process Management disciplines is included to provide the context for the rest of this paper.

The concept of goals and objectives is well established within the Decision Sciences context. However, the need to link specific decision objectives to the overall organizational objectives and values has been recognized only relatively recently [9], [10]. This has resulted in a "value-focused thinking" framework for elicitation and structuring goals. Similarly, the development of goal-models has been a recent phenomenon with the business process management community following an increasing awareness of the importance of aligning process models with organizational goals (e.g. [3], [11]). Interestingly, the field of Requirements Engineering (RE) is considerably more advanced in the area of goal modeling and its links to business processes [6]. Goal models within RE cater for multiple goal types and relationships among goals and links to other elements of business processes.

These developments in goal-oriented requirements engineering have inspired a number of frameworks (some accompanied by modeling tools) for goal-oriented business process engineering (e.g. [2], [12], [13], [14]). Generally, these frameworks address the "development of business process software" ([15], p. 4) goal of business process modeling. The other approaches to business process engineering better cater for additional aims of business process models defined by Aguilar-Saven ([15], p. 4) as “learning about the process” and “making decisions on the process”. For example, within the business process management the focus of business process modeling is on “documentation, analysis and design of the structure of business processes, their relationship with the resources needed to implement them and the environment in which they will be used” ([16], p.2) whereas within the context of Decision Sciences, the term process (and correspondingly process model) would usually refer to the decision making processes within the organization.

Even from a brief overview provided above, it is evident that the field of goal-oriented process engineering is highly fragmented along disciplinary lines. Unification of goal-oriented process engineering will help avoid duplication of effort while identifying gaps in the existing approaches. The objectives of this paper are:

– to facilitate unification of goal-oriented process engineering field by providing a cross-disciplinary framework for assessment of existing approaches; and
– to propose an integrated framework that aims to close gaps in existing goal-oriented process engineering approaches.

This paper is structured as follows. Goal models and process models are reviewed from each of the three perspectives illustrated in Figure 1 in Sections 2 and 3. Section 2 includes assessment of goal models using the Nishit framework [14] that outlines a set of desirable qualities in the goal model, and is the only framework identified in the literature that allows discipline independent comparison of goal models. Accordingly, Section 3 includes a cross-disciplinary comparison of process models using the Giaglis-Curtis framework [7] that describes process perspectives that are required for a comprehensive process model. This is followed by a discussion of implications of the individual assessments for evaluation of goal-oriented process modeling approaches and a review of a goal-oriented process model that integrates both Decision Sciences and Business Process management perspectives with the aim of addressing shortcomings identified within the individual methods (Section 4). The paper is concluded with a brief summary and an outline of future research directions.

2 Goal Modeling

Generic models that are linked to existing process modeling techniques with the aim of developing a goal-oriented process model, and specific models that form part of an individual process modeling technique are included in the discussion. Goal models are discussed within the context of the three disciplines corresponding to the decision, systems and process perspectives (as illustrated in Figure 1).

2.1 Decision Sciences

Within the decision analysis field two goal models are of particular interest in the context of process engineering: “the value focused thinking” framework that forms the basis of the generic goal model in classical decision analysis; and an implicit goal model included within the system dynamics approach to decision making.

Value-Focused Thinking Framework. In classical decision analysis, goals are usually referred to as objectives and are structured using the "value-focused thinking" framework developed by Keeney and Raiffa [9]. Within this framework, objectives are defined as "a statement of something that one wants to strive toward" ([10, p.34]) and are structured in two levels: the fundamental objectives hierarchy reflecting the fundamental values of the business and the means-ends objectives network reflecting the means of achieving fundamental objectives.

A set of questions for identification of fundamental and means objectives and the movement within the hierarchy and the network is included within the framework in order to facilitate elicitation and structuring of objectives. This model was originally developed in order to link the narrow objectives of individual decision problems to a wider organizational context. However, due to the generic nature of the model, it has also been used to link process goals to a wider organizational context (as illustrated in the model introduced by Neiger and Churilov [17] discussed in a latter part of the paper), and to separate causal and abstract relationships between objectives in requirements engineering [18]. One of the shortcomings of this model is the limited representation of logical relationships among objectives (e.g. it is assumed that all lower level objectives need to be satisfied in order for the parent objective to be satisfied), although this can be somewhat overcome by strong links between the framework and Multiple Criteria Decision Analysis models [19] to allow other influencing and logical relationships to be represented.

Systems Dynamics. System dynamics (and its application to business, referred to as business dynamics [20]) is used both for decision making [21] and structuring business processes [7] using causal loops and stock and flow diagrams. Causal loops represent the "interdependencies and feedback processes" ([20], p.191) within the business, while stock and flow diagrams represent "the state of the system and generating the information upon which decisions and actions are based" ([20], p.192). This approach to business modeling allows for representation of time delays and non-linearities inherent in the dynamic nature of a business whilst the rigorous mathematical foundation for system dynamics makes possible a seamless link from a business model to a simulation model to allow quantitative evaluation of 'what if" scenarios.

The strong emphasis on causality within the system dynamics framework provides solid foundations for decision analysis by highlighting causal and feedback mechanisms within the organization and its wider environment. The disadvantage of this approach, from a process modeling point of view, is that it inhibits representation of the sequential nature of business processes. System dynamics is therefore discussed within the Decision Sciences sections of this paper.

There are no separate goal models within System Dynamics since goals are represented within causal loops and stock and flow diagrams as "concrete targets" that guide corrective action if the actual performance of the system falls short of a satisfactory outcome. These targets are also commonly referred to as Key Performance Indicators (KPIs) and are derived by quantifying organizational objectives with aim of reducing complexity associated with solving optimization problems and in accordance with the principle of bounded rationality ([20], ch. 15).

2.2 Requirements Engineering

Supporting organizational change resulting from transition between "as is" and "to be" process models is considered to be "the overriding purpose of requirements development for business processes" ([13], p.2). Within this context, goals are defined as "statements which declare what has to be achieved or avoided by a business process" ([3], p.20) and provide motivation for process description. Hurri [18], Kavakli [12] and Lamsweerde [6] provide comprehensive reviews of goal-oriented requirements engineering including a review of generic goal models referred to as goal-refinement (or goal-reduction) graphs and links between generic models and elements of process models incorporated in individual RE methods such as i*, GDC, KAOS, etc [12]. For the purposes of completeness, a brief summary guided by the Lamsweerde's review [6] of generic approaches to goal modeling within the requirements engineering is provided.

Lamsweerde ([6], p. 3) lists the following dimensions for goal classification according to goal type: functionality, verification, temporal, system state and goal level. Within the functionality dimension the goals are divided into *functional* goals that refer to "services that the system is expected to deliver" including an ability of a system to satisfy requests and provide required information; and *non functional* goals that refer to "expected system qualities such as security, safety, performance, usability, flexibility, customizability, interoperability and so forth". Verification dimension is concerned with whether goal "satisfaction can be established through verification techniques", if it can then the goal is referred to as a *hard* goal, otherwise the goal is categorized as a *soft* goal. Temporal behavior of the goal is classified into three classes: *achieve* (or cease) goals "require some target property to be eventually satisfied in some future state (resp. denied); *maintain* (or avoid) goals "require some target property to be permanently satisfied in every future state (resp. denied)"; and *optimize* goals favor behaviors "which better ensure some soft target property". Similarly system state and goal level dimensions classify goals according to desired system states and goal levels.

According to Lamsweerde ([6], p. 3) name, specification, priority, utility and feasibility are the four goal attributes that can also be used to characterize goals within the requirements engineering context.

Requirements engineering goal models cater for a variety of goal modeling structures using different types of links to "relate goals (a) with each other and (b) with other elements of requirements models" ([6], p. 3). AND/OR refinement graphs are widely used to describe relationships between goals. Refinement is referred to a set of sub-goals that either positively or negatively support a parent goal. AND-refinement describes situations where "satisfying all subgoals in the refinement is sufficient for satisfying the parent goal", whereas OR-refinement means that "satisfying one of the refinements is sufficient for satisfying the parent goal". Within this context a conflict link is introduced for situations when "satisfaction of one of them may prevent the other from being satisfied". While the above definitions refer to goal satisfaction, Lamsweerde [6] provides alternative definitions in terms of goal satisficing guided by the principle of bounded rationality.

Links between goal models and other elements of requirements models such as operations, scenarios, objects, agents and organizational policies, enable goal-oriented approaches to process engineering within the requirements engineering context.

One of the limitations of the requirements engineering goal model is the lack of separation between abstract relationships (depicted within the fundamental objectives hierarchy in the value-focused framework) and causal relationships (depicted within the means ends network in the value-focused framework) that allow for function and non-functional goals to be related to each other without confusion ([18], p. 34).

2.3 Business Process Management

Business Process Management models often include components of decision science and requirements engineering paradigms, while on the whole, being more concerned with the sequence of activities within the process and having broader organizational context than either decision sciences or requirements engineering techniques. While there is a widespread agreement within the Business Process Management field on the importance of linking processes to goals ([3], [11], [16], [22], [23]) there is no universally accepted generic model for goals or their relationship to a process model. The spectrum of goal representation starts with modeling methods that have no concept of goals and progresses through to fully goal-driven process modeling frameworks incorporating all intermediate steps.

To avoid the impossible task of reviewing every process modeling technique from a goal modeling perspective, the process modeling methods have been classified into four categories: traditional, coordination, socio-technical and generic. This classification is based largely on the categories introduced by Katzenstein and Lerch [24] of business process models that were based on the ability of the process modeling techniques to represent social context including goals. The generic category was added to Katzenstein and Lerch classification to accommodate the concept of generic methodologies that have business process modeling capabilities [15]. The goal-modeling aspects of each class are reviewed in this section.

Traditional System Methodologies. Traditional systems analysis methodologies refer to methodologies that were used to develop information systems, for example flowcharts, dataflow diagrams and IDEF suite of process models. Despite recent proposals to make some traditional methodologies goal-friendly (e.g. Downs & Lunn in [11]), these methodologies generally do not have goals as part of their model elements and therefore are of no further interest in the context of goal modeling.

Coordination Models. Models included in this class are derived from computer science, operations management and the quality movement including Petri-net based models generally used for workflow modeling, other workflow modeling languages, object-oriented business process models including UML based models, and others such as Rummler-Brache model and Role Activity Diagrams. These models usually have a concept of goal, with some methods such as UML having capacity to explicitly link activities and corresponding goals. Most methods within this category especially those used to model the workflow rely on an underlying process model for linkage to goals.

Kueng [3] proposed a goal-based business process model to be used as a basis for an object-oriented business model (without loss of generality the model can be adopted to other coordination models). The four steps involved in this method as described by Kueng ([3], p.22) are:

1. Goal modeling that defines goals by asking the question “why has something to be done?”
2. Activity modeling that defines activities and output by asking the question “what has to be done?”
3. Role modeling that defines logical dependencies between activities by asking the question “when has it to be done?”
4. Object modeling to define the roles and assign them to activities by asking the question “by whom has it to be done?”

Within this framework the goals are represented by a Goal/Means-hierarchy that is used to decompose process-related goals until they can be transformed into activities that can be carried out within the process. However the Goal/Means-hierarchy doesn’t reflect the contradictory, independent and complementary nature of relationships that exists between goals. One of the strengths of this methodology is that it encourages an evaluation of the business process model using goals.

Socio-technical Qualitative Systems. Socio-technical qualitative systems (such as Goal-Exception-Dependency framework (GED), and Multiview) are based on the principle that “both technology and people matter” ([24], p.388). One of the advantages of these systems is their ability to capture and organize goals such as for example, the GED framework [24]. Within this framework, a goal/exception diagram is used to represent “process-level and individual goals, the relationship among those goals, the exceptions that have emerged in the process, and the goal conflicts that are reflected in those exceptions” ([24], p.401). According to the GED framework authors, this model provides “the same reasoning and communication advantages as cognitive maps and as the more specific goal-based causal reasoning” of requirements engineering methods such as i* ([24], p.401).

Generic Methodologies. Generic methodologies are more encompassing than business process models alone as they include other capabilities. For example, the ARIS methodology is based on the concept of an extended-event-driven process chain (e-EPC) model of a business process ([16], [23], [25], [26]) but includes objectives diagram and a balance-score card tools within its tools set. Similarly, the GRAI GIM methodology makes explicit the *why* dimension of the process and articulates how objectives can be reached through its decision view [27]. The uniqueness and advantage of these methodologies is that various tools are seamlessly linked to each other providing ‘a simple yet clear view of the business’ ([28], p. 149) through multiple views of a business process. The ARIS methodology is of particular interest as it is considered to be one of the most “advanced tools available in the market place” ([29], p.12) and it has a large market share (through its integration within the SAP suite [28], [30] in the corporate and government sectors in the developed countries [31].

Within ARIS, goals are implied in the definition of a function as “a technical task or action performed on an object to support one or more company goals” ([32], p.4-1). This approach assumes that company goals and objectives are known to the modeler in advance and are supported by functions [23]. There is no accompanying framework for goal-oriented business process modeling.

Other Goal Models. Discussed goal models within the business process management context, are either part of or tightly integrated with existing process modeling methodologies and tools. As the importance of goal-orientation in business process modeling becomes more apparent to researchers and practitioners within this field, other conceptual approaches to goal modeling and goal-oriented process modeling will arise independent of already existing tools and techniques. The Workshop on Goal-Oriented Business Process Modeling [11] and a follow-up special issue of the Business Process Management Journal on Goal-Oriented Business Process Modeling (to be published in 2004, [1]) has identified a number of such approaches.

Within the material currently available (see web site) the general pattern is towards identification and structuring goal using methods similar to Requirements Engineering methods described above (e.g. AND/OR reduction graphs, identification of various relationships among goals, linkage between goals and actors responsible for them). The exception is a "state-flow view of business processes" advocated by Khomyakov and Bider [33] that defines the process as a trajectory between system states with the business goal being described as a final state that business is aimed to achieve. This model has more in common with the Dynamic Programming [34] view of the process than with traditional process modeling approaches. In this context, a goal is expressed in terms of "reaching the surface in the state space of process variables" ([35], p.3).

2.4 Goal-Modeling Comparison

In "A study on Goal-Oriented Business Process Modeling", Nishit [14] identified the following elements as being important for a goal-oriented business process model: goal concept (present in all goal models by definition), goal relationship including logical, causal and influencing relationships, and an evaluation mechanism to enable an assessment of the level of achievement of different goals. While this model requires further development and refinement (for example implementation issues need to be included in the model) it provides a good starting point for comparison of goal modeling capabilities across disciplines and methodologies. Table 1 summarizes the properties of the discussed goal models according to the 4 criteria. Traditional system methodologies are excluded from the table, as they do not have the concept of goal. Requirements engineering goal-models are combined as they have mostly the same characteristics as far as assessment criteria are concerned. In the Business Process Modeling category only one methodology was evaluated as a representative of its group to avoid comparison of 'like' methods.

Table 1. Comparison of goal models.

Discipline	Goal modeling methodology	Goal model	Goal relationship			Evaluation mechanism
			Logical	Causal	Influencing	
Decision Analysis	Value-Focused Thinking	Objectives hierarchy, Means-ends network	Some	Yes	Yes	Some
	System Dynamics	Stock & Flow, Causal Loop diagrams	No	Yes	Yes	Yes
Requirements Engineering	Various	Goal refinement graphs	Yes	Yes	Yes	i* [14]
Business Process Modeling	Coordination models (Kueng)	Goal-means hierarchy	Yes	Some	Some	Yes
	Socio-technical qualitative systems (GED)	Goal-exception diagram	Yes	Yes	Yes	No
	Generic methodologies (ARIS)	Objectives Diagram, Balance-Score Card	No	Some	No	Some
	State-flow model	System equations	Some	Yes	No	Yes

3 Business Process Modeling

As the purpose of this paper is to compare goal-oriented process modeling techniques rather than to provide an overall comparison or review of process models the scope of this section has been limited to the process modeling techniques associated with or incorporating goal models described in the previous section.

In discussing process modeling capabilities of various goal-oriented methodologies, references are made to the four perspectives of business process models used as a basis for the Giaglis-Curtis taxonomy of business models ([7], p.212):

1. The *functional* perspective represents *what* process elements (activities) are being performed.
2. The *behavioral* perspective represents *when* activities are performed (for example, sequencing) as well as aspects of *how* they are performed through feedback loops, iteration, decision-making conditions, entry and exit criteria, and so on.
3. The *organizational* perspective represents *where* and *by whom* activities are performed, the physical communication mechanism used to transfer entities, and the physical media and locations used to store entities.
4. The *informational* perspective represents the information entities (*data*) produced or manipulated by a process and their interrelationships.

3.1 Decision Sciences

Generally, the main weakness of decision analysis methodologies is the weak representation of activities aimed at fulfilling business objectives (i.e. the *functional* perspective). For example, within the value-focused framework the link to activities responsible for fulfilling objectives is not made. Similarly, the System Dynamics approach provides limited support for representation of *functional* and *informational* perspectives [7] due to its focus on the process as "defined by flows and accumulations and controlled in terms of information feedback and process parameters" ([20], p.12). This approach results in a *behavioral* representation of the business that "can be used to show how a change in any stage of the process can propagate to all subsequent stages" ([20], p.12).

Despite the obvious limitations of decision analysis methods in modeling business processes, their ability to enrich existing process models by facilitating greater decision support capability and a more strategic approach to process engineering makes them very useful tools in goal-oriented process engineering.

3.2 Requirements Engineering

Kavakli ([12], p. 238) identifies three core RE activities: requirements elicitation, requirements specification and validation. The latter two activities are concerned with specification of system components and validating system specifications (respectively) and as such do not directly involve process engineering. On the other hand, process engineering is an important component of the requirements elicitation activity that is concerned with understanding of the current organizational situation and the need for change ([12], p. 239). Within this context, the i* strategic rationale modeling is identified by Kavakli as one of the two goal-oriented approaches within the scope of requirement elicitation. As was shown Table 1, i* has the most comprehensive goal model within the RE field and from a process modeling perspective it can be described as an agent-oriented approach that defines processes "according to the organizational agent that performs certain tasks" [13]. This and similar approaches effectively represent *behavioral* and *organizational* perspectives but less effective in representing *functional* and *informational* perspectives.

The S^3 framework proposed by Loucopoulos ([13], p.1) aims to overcome this limitation by adopting a 'multifaceted approach that addresses issues that arise from the nature of the business processes and of the RE process itself". Within the S^3 framework business process models incorporate goals (strategy or "why" dimension), activities (service or "what" dimension) and collaboration between organizational actors (support or "how" dimension). System Dynamics is proposed by Loucopoulos ([13], p.3) as an integrating modeling paradigm. While not specifically goal-oriented, this approach integrates goal models adopted by requirements engineering to a broader process engineering context. The framework in its current presentation [13] doesn't include implementation guidelines or an illustration of its application in practice; hence it is difficult to compare it with other approaches in the field.

3.3 Business Process Management

Traditional system methodologies and coordination models have a strong focus on the *functional* perspective of business process modeling. Giaglis [7] provides a comprehensive assessment of these techniques that is used in the Comparison section of this paper. Other goal-oriented business process management models discussed in this paper are excluded from the Giaglis review and therefore justify a brief discussion.

Katzenstein and Lerch [24] provide a review of socio-technical systems from process redesign point of view. It is clear that, similar to requirements engineering models, these systems provide better than average representation of roles, goals and dependencies (*behavioral* and *organizational* perspectives) but lack other process perspectives. For example, the sequential flow of activities critical for a process model is not represented within the GED methodology.

The strength of generic methodologies, on the other hand is their ability to represent all process perspectives in a coherent but simple to understand manner. For example, within ARIS, the functional perspective is represented in the process view and with a functional tree model, behavioral perspective is represented through an event-driven process chain that illustrates sequencing and the details of individual activities through the decomposition capabilities of the tools. The organizational chart provides the “who” component of an organizational perspective, while the Data/Output view and information flows ensure that information flows demonstrate informational process inputs and outputs and their interrelationships.

The state-flow view of the business process is able to demonstrate the sequential nature of the process but has a limited applicability with respect to other perspectives.

3.4 Business Process Modeling Comparison

Table 2 summarizes discussion in this section. Categories presented in Table 2 are limited to the depth dimension of the Giaglis-Curtis framework for ease of presentation. The choice of the depth dimension over breadth was motivated by the fact that the depth dimension aims to analyze qualities of process modeling techniques across disciplinary boundaries while the breadth dimension is more aligned to disciplinary boundaries ([7], p. 213). The absence of breadth dimension means that some of the modeling techniques requirements are not discussed (e.g. process automation, decision support, etc.). Future research is planned to provide a more complete assessment of goal-oriented process modeling methods from the process modeling point of view in the context of the Giaglis-Curtis and other evaluation frameworks (e.g. [7], [15], [24], [29], [36], [37]).

Table 2. Comparison of goal models.

Discipline	Goal modeling methodology	Process model	Modeling Perspective			
			What	When How	Where Who	Data
Decision Analysis	Value-Focused Thinking	not applicable	No	No	No	No
	System Dynamics	Stock & Flow, Causal Loop diagrams	Some	Yes	Yes	Some
Requirements Engineering	Various	i*	Some	Yes	Yes	Some
Business Process Modeling	Coordination models (Kueng)	UML	Yes	Some	Some	Yes
	Socio-technical qualitative systems	GED	Some	Yes	Yes	Some
	Generic methodologies	ARIS	Yes	Yes	Yes	Yes
	State-Flow model		Some	Yes	Some	Some

4 Goal-oriented Business Process Engineering – an Integrated Approach

While it is possible to identify strengths and weaknesses of goal-oriented business process modeling by simply looking at Table 1 and 2 side by side, the multi-dimensional nature of the problem (that would be compounded if other criteria or dimensions were introduced) makes it difficult to determine the best model in a particular situation. A Multi-Criteria Decision Analysis [19] model using these (and/or other criteria) would facilitate a dynamic assessment of goal-oriented process modeling incorporating priorities and constraints of individual modelers and situations and will be the subject of future research. Within the scope of this paper it is sufficient to say, that requirements engineering provides the best compromise in the field of goal-oriented process modeling within the scope of existing modeling technique. However, the complementary nature of ARIS and value-focused thinking methodologies suggests itself to an integrated approach that would provide the best of both worlds.

By integrating value-focused thinking and ARIS approaches, we provide a decision perspective on goal-oriented process modeling (for more detail refer to [5] and [17]). Within this perspective, decision analysis tools, and in particular, the “value-focused thinking” framework is used to identify and structure objectives of business processes that are represented using ARIS methodology. The resulting conceptual model and implementation framework facilitate expression of each goal in some aspect of a process model by:

1. Modifying the “value-focused thinking” framework to include logical relationships that are not currently available within the model.
2. Structuring functional and process objectives within the ARIS framework as a means-ends network using Keeney’s principle for identification and linkage between the objectives.

3. Using the means-ends network to guide the decomposition of the business process while taking advantage of the hierarchical and nested models functionality available within ARIS.

The integration of these two methodologies within a single model, builds on the strength of these methodologies while addressing the shortcomings identified within them. Among advantages of using the proposed model are: a rational approach towards process decomposition that facilitates achievement of business objectives by business processes; an ability to integrate a vast library of decision models into process modeling to address both efficiency and effectiveness objectives of business; and access to the process modeling capabilities of widely adopted software applications.

5 Summary

As is clear from the modeling literature, “the suitability of a modeling approach will depend on the goals and objectives for the resulting model. A given language construct or type will be better suited to achieving some modeling objectives than others” ([38], p.86). None of the models discussed in this paper aim to be universal or the only “correct” goal-oriented approach to process engineering. Each model is suited to its particular environment and objectives. That aside, understanding of the available goal-oriented process engineering approaches provides opportunities for collaboration in addressing outstanding research problems and minimizes the duplication of effort that can result from a lack of coordination.

It is hoped that this paper goes some way towards informing various research communities of the development in the field of goal-oriented process engineering by providing a coherent framework for the evaluation of various fields, pointing to the current research in this area within each field and identifying future research directions that include but are not limited to:

– a more comprehensive framework for evaluation of goal models in the context of business process engineering;
– a more in in-depth analysis of goal-oriented process modeling methods using existing process modeling evaluation frameworks;
– an application of MCDA to evaluation of goal-oriented process modeling with the aim of developing an easy to use tool for practitioners looking to choose or assess available techniques;
– further development of an integrated methodology aiming to utilize the best of both goal and process modeling.

References

1. Business Process Management Journal: A Special Issue on Goal-Oriented Business Process Modeling. Call for Papers, (2003) http://taddeo.emeraldinsight.com/vl=7648798/cl=23/nw=1/rpsv/journals/bpmj/call4.htm, (last accessed 1/6/2003)

2. Yu, E. S. K., Mylopoulos, J.: AI Models for Business Process Reengineering. IEEE Expert, IEEE (1996) 16-23
3. Kueng, P., Kawalek P.: Goal-Based Business Process Models: Creation and Evaluation. Business Process Management Journal , Vol. 3, No. 1 (1997) 17-38
4. Daellenbach, H. T.: Systems and decision making: a management science approach, Wiley, Chichester (1994)
5. Neiger, D., Churilov, L.: Goal-Oriented Decomposition of Event-Driven Process Chains with Value-Focused Thinking. In Proceedings of the 14th Australasian Conference on Information Systems (ACIS 2003), Paper #168, Perth, Western Australia 26-28 November (2003)
6. van Lamsweerde, A.: Goal-Oriented Requirements Engineering: a Guided Tour. In: Proceedings RE'01 5th IEEE International Symposium on Requirements Engineering, Toronto, August 2001, 249-263
7. Giaglis, G. M.: A Taxonomy of Business Process Modeling and Information Systems Modeling Techniques. The International Journal of Flexible Manufacturing Systems, Vol. 13 (2001) 209-228
8. Sandoe, K., Corbitt, G., Boykin, R.: Enterprise Integration. John Wiley & Sons, Inc, New York, Chichester, Weinheim, Brisbane, Singapore, Toronto (2001)
9. Keeney, R. L., Raiffa, H: Decisions with Multiple Objectives: Preferences and Value Tradeoffs. J. Wiley, New York (1976)
10. Keeney, R. L.: Creativity in Decision Making with Value-Focused Thinking. Sloan Management Review, Summer (1994) 33-41
11. GBPM'02: Workshop on Goal-Oriented Business Process Modeling, London, UK, 2 September (2002), http://www.ibissoft.se/gbpm02/gbpm02.htm (last accessed 24/05/2003)
12. Kavakli, E.: Goal-Oriented Requirements Engineering: a Unifying Framework. Requirements Eng, Vol. 6, (2002), 237-251
13. Loucopoulos, P.: The S^3 (Strategy-Service-Support) Framework for Business Process Modelling. In: Proceedings of the Workshop on Requirements Engineering for Business Process Support (REBPS'03), Klagenfurt/Velden, Austrlia, June 17 (2003), www.co.umist.ac.uk/~pl/ (last accessed 11/12/2003)
14. Nishit, C.: A Study on Goal-Oriented Business Process Modeling. Masters Thesis, Graduate School of Decision Science and Technology, Department of Industrial Engineering & Management, Tokyo Institute of Technology (2002), www.is.me.titech.ac.jp/paper/2001/master/nishit.pdf (last accessed 4/11/2003)
15. Aguilar-Saven, R. S.: Business Process Modelling: Reviw and Framework. Int. J. Production Economics (forthcoming), available on line at www.sciencedirect.com (2003)
16. Davis, R.: Business Process Modelling with ARIS: a Practical Guide. Springer-Verlag, London, Berlin, Heidelberg (2001)
17. Neiger, D.,Churilov, L.: Structuring Business Objectives: a Business Process Modeling Perspective. In Business Process Management, eds. van der Aalst, W., ter Hofstede, A. and Weske, M., Springer-Verlag, Berlin Heidelberg, LNCS 2678, (2003) 72-87
18. Hurri, J.: Using Decision Tools in Deciding System Product Requirements: Literature Review and a Behaviourally Motivated Lightweight Tool. Licentiate Thesis, Department of Computer Science and Engineering, Helsinki University of Technology (2000), http://www.cis.hut.fi/jarmo/publications/hurri-licentiate.pdf (last accessed 11/12/2003)
19. Vincke, P.: Multicriteria decision-aid. Wiley, Chichester (1989)
20. Sterman, J. D.: Business Dynamics: Systems Thinking and Modeling for a Complex World. The McGraw-Hill Companies, Inc., United States of America (2000)
21. Clemen, R. T., Reilly T.: Making Hard Decisions with Decision Tools. 2nd rev. ed. Brooks/Cole, United States of America (2001)
22. Huxley, C. M.: An Improved Method to Identify Critical Processes. Masters Thesis, School of Information Systems, Faculty of IT, Queensland University of Technology (2003)

23.Scheer, A.-W.: ARIS – Business Process Modeling. 3rd edn. Springer-Verlag, Berlin Heidelberg (2000)
24.Katzenstein, G., Lerch, F. J.: Beneath the Surface of Organizational Processes: a Social Representation Framework for Business Process Redesign, ACM Transactions on Information Systems, Vol. 18, No. 4, (2000) 383-422
25. Scheer, A.-W.: Business process engineering: reference models for industrial enterprises. Study edn. Springer-Verlag, Berlin, Heidelberg, New York (1998)
26.Scheer, A.-W.: ARIS – Business Process Frameworks. 3rd edn. Springer-Verlag, Berlin Heidelberg (1999)
27.GRAISOFT: http://www.graisoft.com/gb/solutiongb/gimgb1.html (last accessed 1/12/2003)
28.Keller, G., Teufel, T.: SAP R/3 Process – Oriented Implementation: Iterative Process Prototyping. Addison Wesley Longman, Harlow, England (1998)
29.Vernadat, F. B.:Enterprise Modelling Languages. ICEIMT'97 Enterprise Integration – International Consensus, EI-IC ESPRIT Project 21.859 (1997) http://www.mel.nist.gov/workshop/iceimt97/pap-ver3/pap-ver3.htm (last accessed 1/12/2003)
30.ARIS for mySAP.com: http://www.leonardo.com.au/products/aris_mysap.html (last accessed 11/12/2003)
31.Stein, A., Hawking, P., Foster, S.: ERP Post Implementation: a New Journey. In Proceedings of the 14th Australasian Conference on Information Systems (ACIS 2003), Paper #178, Perth, Western Australia 26-28 November (2003)
32.IDS Scheer: ARIS Methods Manual, Version 5, IDS Scheer (2000)
33.Khomyakov, M., Bider, I.: Achieving Workflow Flexibility through Taming the Chaos. Journal of Conceptual Modeling, Vol. 21 (2001)
34.Sniedovich, M.: Dynamic Programming. Marcel Dekker, NY (1991)
35. Bider, I.: Goal-Oriented Patterns for Business Processes: Position Paper for GBPM'02. Workshop on Goal-Oriented Business Process Modeling, (2002), http://www.ibissoft.se/gbpm02/gbpm02.htm (last accessed 24/05/2003)
36.Hommes, B-J., van Reijswoud, V.: Assessing the Quality of Business Process Modelling Techniques. In the Proceedings of the 33rd Hawaii International Conference on System Sciences, IEEE (2000)
37. Mentzas, G., Halaris, C., Kavadias, S.: Modelling Business Processes with Workflow Systems: an Evaluation of Alternative Approaches. International Journal of Information Management, Vol. 21 (2001) 123-135
38. Curtis, B., Kellner, M. I., Over, J.: Process Modeling. Communications of the ACM, Vol. 35, No. 9, (1992) 75-91