

The Rule-Transformation Approach toward Intelligent Business

Andrej Kovacic

Department of Information & Management Science
Faculty of Economics, University of Ljubljana
Kardeljeva pl. 17, 1000 Ljubljana
Slovenia
andrej.kovacic@uni-lj.si

Ales Groznik

Department of Information & Management Science
Faculty of Economics, University of Ljubljana
Kardeljeva pl. 17, 1000 Ljubljana
Slovenia
ales.groznik@uni-lj.si

Abstract: The main goal of the paper is to present the business process renovation as the key element of e-business orientation and the highest level of strategy for managing change that commonly cannot be handled by continuous improvement and reengineering methods or organizational restructuring. The paper introduces a business rule-transformation approach to business renovation. Its motivation is to help establish an environment and approach in which business rules can be traced from their origin in the business environment through to their implementation in information systems.

I. INTRODUCTION

The traditional 'old economy' companies urgently need to build on and re-evaluate their current business models and create new ones. Accordingly, e-business initiatives have truly strategic imperatives: creating a totally different business model. An e-business model generally means the adapting of a company's current business model to the Internet economy. Business Renovation (BR) is the highest level of a strategy for managing change that usually cannot be handled by continuous improvement and re-engineering methods or organizational restructuring [12]. According to Jacobson, we view business renovation as an umbrella concept for strategic information system (IS) planning, and both Business process reengineering (BPR) and Continuous Process Improvement (CPI) [11]. We also observe that business renovation is now taking significant roles in business processes - creating new business rules, causing new product development and commanding new procedures.

In this paper, business renovation is presented as the highest level of strategy for managing change intelligent business that commonly cannot be handled by continuous improvement and reengineering methods or organizational restructuring. BR argues for a balanced approach in which we attempt to manage realistic changes rather than always seeking radical change. In our paper we also introduce business rules and a rule-based Business Renovation methodology to provide a uniform modeling approach at different abstraction levels.

II. BUSINESS RULES AND BUSINESS ACTIVITY META-MODEL

Business rules have grown in importance and popularity in the last few years. They have become recognized as distinct concepts that play a key role in developing applications, which are flexible and amenable to change [2], [3], [6], [21]. While a lot of work has already been done in various fields of business rule research, most notably in rule analysis, classification, articulation, and formalization [9], [10], [13], [17], a broader view, namely a behavioral or conceptual view on

business rules in e-business environment, is required. The fact is that business rules are constantly changing at the business level, but we are not able to keep up with the changes that are required for supporting IS.

The application of Information Technology (IT) can break old business rules that limit the way in which work is performed (some typical examples are given in Turban *et al.* [19]). While it has been emphasized many times in the last few years [4] that business rules - if appropriately implemented - can help keep information systems aligned with the business environment, there is still no framework to explain how to do this.

Business rules can be classified in many different ways. The categorization described here is only an example of business-rule taxonomy that we have found useful for our research. Global rules that relate to an overall business process act as an interface between a particular business process and the goal that the process has to achieve. They define or restrict organizational behavior. Such rules should be broken down into detailed behavioral rules governing specific business process activities and further into rules that control the operations within these activities. When examining business rules with regard to business processes, the following three relationships stick out:

- ❖ business rule relating to the overall business or Global rule;
- ❖ business rule relating to business process or Activity rule; and
- ❖ business rule relating to the IS/WF procedure/definition or Structural rule.

The following example illustrates the different rule types. At the business level, we can usually find a global business rules, such as: "Establish the optimal connections with our suppliers, establish an e-payment system..., including supply constraints...". Performing business activity, at the business process level, from these rules an business activity rule is derived: "An invoice, received by mail or received via Internet, may be registered only if it has been received from our existing supplier". At the IS/WF level, the structure of this rule is transformed to (an ECAA notation):

```
Business rule: "INVOICE_REGISTRATION":  
ON (invoice) OR (e-invoice)  
IF (related order exists) AND (receipt exists)  
THEN begin invoice registration  
raise event "INVOICE_ACCEPTED"  
ELSE reject invoice  
raise event "INVOICE_REJECTED"
```

When developing *IS/WF components* or applications in support of business processes, both business rules that apply to an overall process and the rules that apply to a

specific process-activity rule have to be considered and broken down into detailed (structural) rules. A process-activity rule or life-cycle rule is an assertion that governs or constrains changes to business objects or facts. Finally, we define detailed structured rules as specifications of requirements for the development of IS/WF applications.

The taxonomy of structural rules is based on Odell's work with additional classes coming from the GUIDE scheme [9]. A list of different business rule taxonomies and requirements can be found in Gottesdiener (1997, 2000). It was shown in the work of Herbst [10] that a combination of *Events*, *Conditions* and *Actions* (known as an ECA structure) can be used to specify single business rules. These rule components can be defined as follows:

- The event component specifies when a rule has to be executed. It indicates the transition from one process relevant status to another.
- The condition component indicates a condition to be checked before any action is triggered.
- The action component states what has to be done on the result of the evaluation of the condition component.

At this structural level, business process can be viewed as a sequence of business rules that define how the thread of control is passed from one activity to another and in what circumstances the transition can happen. ECA-structure rules are used to specify dynamic behavior in database management systems. Some authors have argued that this structure is also appropriate for formalizing business rules at the conceptual level (global and activity rules). For the purpose of consistent rule representation, modeling, transforming and refinement ECA notation has been extended to ECAA rules that allow specifying an alternative action to be executed when the evaluation of the condition component returns false.

We used an IDEF1X notation convention in the meta-model's development. Relationships between entities have n:m cardinality. A global rule (Figure 1; in the center) is an

aggregation of behavioral and structural business-rule components. The first (left) part of the meta-model contains the entities and relationships related to business process and behavioral features (Entities: Goal, CSF-Critical Success Factor, Business Process, Activity, Global Rule, Activity Rule, and Event), the right part of the meta-model is focused on structural and IS/WF implementation characteristics (Entities: Data Object, IS/WF Component or module, Structural Rule, Event, Condition and Action).

We regard the business activity meta-model as an appropriate starting point for the business-rule refinement process at the business process activity level. The business rules that underline the business activities are first described in a natural language. In subsequent steps, these rules are refined in a structured way as a set of structured rules representing the business process at different abstraction levels. In the case of small and less complex models, a manual revision is more economic and less time-consuming. The business activity meta-model concentrates on the role business rules play with respect to IS/WF-related concepts. Its job is to describe the activities that must be undertaken to achieve an explicit goal and establish a clear link between business and IS/WF modeling.

In the light of our experience we agree with the rule-transformation approach. This approach suggests transforming a rule-based description of a business process in one or more refinement steps into a rule-based WF specification. Here, we see expectations that structural (ECA or ECAA) rules may not only be used to specify dynamic behavior in database management systems, but also for formalizing business rules at the conceptual (business and Business process) level as unrealistic.

To support the transition between the business model and the IS/WF model, we propose the following approach based on a hierarchical derivation of business rules in the rule repository, performed by three subsequent iterative development phases, from the higher (behavioral) to the lower (structural) level of abstraction. During each of these phases business rules are discovered, documented, and modeled.

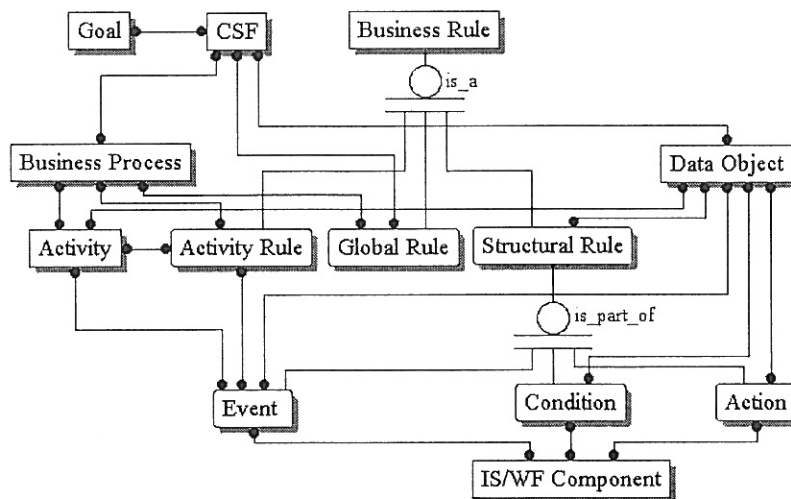


Fig. 1. Business activity meta-model

III. BUSINESS RENOVATION APPROACH (BRA)

In this section we provide the rule-transformation approach as an iterative methodological framework that incorporates the best practices of more than 10 business renovation projects. Our business renovation approach (BRA) incorporates certain fundamental principles that are already known in business system planning, business process reengineering, and the IS development environment: business rules and business activity meta-model, iterative development and prototyping. This approach involves a radical departure from traditional decomposition approaches to IS development. It exploits 'contingency theory' and some advanced ascertaining of existing business-rule approaches [18], [7], [16], [8], [14], [15]. In other words, the impact of information technology (IT) on business performance is contingent on whether organizational processes, such as business renovation, have also been implemented. Specifically, doing more business renovation increases the return on investing in IT. In terms of BRA, IT and business processes are viewed as complementary factors, they must be changed in a co-ordinated way to improve performance. BRA uses an abstraction approach focusing on *business processes, business rules and data* in a system from which all knowledge of the business derives.

BRA planning, development, and the implementation process, as seen from the developers' point of view, can be divided into several iterative development phases, as follows (Figure 2):

1. strategic BR planning,
2. business process restructuring and IA development, and
3. IS/WF development and implementation.

A. Strategic BR planning

Strategic planning focuses on the direction of the organization and actions necessary to improve its performance [14]. Researchers recently demonstrates that CSF concept is interpretive in character and as such it may be employed for research on the system development process [5]. In our extended CSF approach, which is

derived from the Pareto's Law (the philosophy of the "80/20"), CSF method of strategic control [20], and some ascertaining of the business rule approach, the first steps are to establish the goals and objectives of the company as a whole, and determine its business strategy. The next step is to generate the critical success factors required to realize this strategy. This is done by electing critical information set from the top management and the key staff. The data obtained from the interviews and other sources is further refined and prioritized through group sessions during which the core business processes (CBPs) and key performance indicators (KPIs) are agreed. Core business processes are those with the highest total impact on the level of performance, and by management team opinion essential to fulfill the mission, goals, and CSFs of the company. The strength of using CSFs is that they provide the important link between the business strategy, business process renovation strategy and the information system development strategy. To be able to establish this link extended CSF approach, additionally to present results, recognizes and determines two distinct results: the key *information requirements* of top executives and business rules or business statements relating to overall business (*Global rules*). Information requirements and global rules should be written in business language. They should be concise and clear. They should state business requirements, not system requirements [15]. All these results are captured in the *rule repository* and used in next phases of BR methodology.

B. Business Process Renovation and Information Architecture Development

Many different methods and techniques can be used for modeling business processes in order to give an understanding of possible scenarios for improvement. IDEF, eEPC, Petri Nets, System Dynamics, Knowledge-based Techniques and Discrete-Event Simulation are only some examples of widely used business process modeling techniques.

Process modeling tools should be able to develop AS-IS and TO-BE models of business processes, which represent both existing and alternative processes. During this project phase the information architecture is defined. Information architecture is the planning, designing and

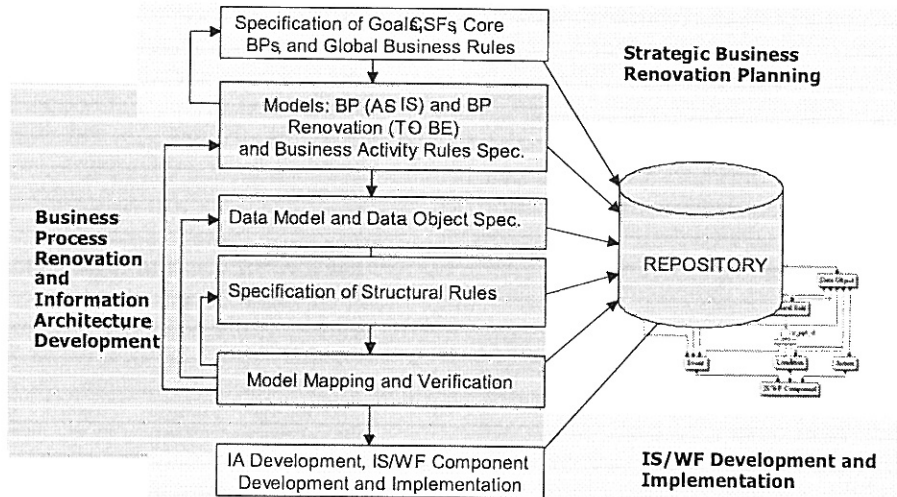


Fig. 2. Business Renovation Approach: phases and results

constructing information blueprint which cover the business process rules on the activity level, and satisfy the informational needs of business processes and decision-making. It is derived from TO-BE business process model and the strategic business process renovation plan orientations. The results of the business renovation and information architecture development phase are company's *TO-BE business process model* (Process Architecture), *global data model* (Data Architecture), and *technological/organizational foundations*. Business process model consists of a profile of major business activities performed, how are they triggered (business events), they flow in a sequence and how are they executed (activity rules), and finally the data which is transferred from one activity to the next. Process modeling is a necessary prerequisite to the data modeling, and needs to be iterative, with well defined deliverables. Here, and also in the further development of information architecture, rule "80/20" is used. Determination of the global data model or data architecture is the next step in information architecture development. Global data model is presented as Entity-Relational model containing company's major data entities and business rules in between them. It reflects global information needs of the company [20].

C. IS/WF Development and Implementation

In the phase of IS/WF development we presume that company's TO-BE business process model and global data model developed in previous stage contains its major business rules and information needs, and is a suitable foundation for further development activities. Those activities depend on the company's IS/WF development and implementation strategy.

In the case of the *proprietary (own) development* the activities are concerned into conceptual data modeling and logical database design. The final result of this stage are a database and application solutions developed for the particular selected application area or company's business process. The database is created on determining the conceptual, logical and physical parameters and database functional enhancement through constraints, triggers and stored procedures derived from a company's business activities rules. Prototyping is a design technique that we use when we uncertain about the real requirements for a new system [7]. In the context of prototyping a special emphasis must be put on the process of heuristic analysis and the role of end-users in this process. The final result of heuristic analysis is user knowledge and experiences captured in data base and application software (prototyping) solutions. New interactive computer aided software engineering tools (CASE) have become available to enable, not only design and evolutionary development of the database and related application software solutions, but also to change the business rule repository as our understanding of rule-extended development techniques evolves.

On the other hand *Enterprise Resource Planning* (ERP) application solutions and other modern-designed software packages are seen in this phase as one of the most recently emerging process-oriented tools that can enable and implement business renovation. In this context we recognize our TO-BE business process model and business-rule model as the starting point of ERP implementation process. The second condition or starting

point presents the existing (reference) ERP process model. Comparing both models and related business rules we check the degree of match between our way of doing business and the standard practices embedded in the software package. Research shows that even a best software package can meet only 70 percent of the organizational needs [1]. We have to change our business processes (TO-BE model) to conform to the ERP solution or customize the software to suit our needs. The first case leads to higher degree of standardization, but also to inflexibility and possible lower business competitiveness. ERP customization is on the other hand related to enormous implementation costs and project uncertainty. In either of those cases, the BR team should make another iteration on the business process design in the TO-BE model [5].

IV. CONCLUSION

The new doctrine of e-business requires an organization to shift towards new intelligent business concepts and introduce modern IT by strategic IS planning and BPR. The redesign of business processes and implementation of application program solutions can best face the challenges of today's ever-changing business environment. The rapid and constant changes that are very common in today's business environments affect not only business itself, but also its supporting applications. As a result, information systems require constant change, renovation and adaptation to meet actual business needs. Thus, a continuous business-rule management environment is required in which each business-rule instance can be traced from its origin through to its implementation. In IS maintenance, such a link is essential as it provides information on the software modifications required in response to changes in business policies, organizational tactics, external laws, regulations etc. In the paper we introduce a business rule-transformation approach to business renovation as a framework that employs an enterprise-modeling method for business rule elicitation, specification and business-rules refinement in the business renovation process.

V. REFERENCES

- [1] Al-Mashari, M., and Zairi, M. "BPR implementation process: an analysis of key success and failure factors", *Business Process Management Journal*, Vol. 5, No. 1, , 1999, pp. 87 – 112.
- [2] Bajec M., Krisper M. and Rupnik R.,. "Using Business Rules Technologies To Bridge The Gap Between Business And Business Applications". *Proceedings of the IFIP 16th World Computer Congress 2000, Information Technology for Business Management* (RECHNU, G. Ed), pp. 77-85, Peking, China.
- [3] Barnes, M. and Kelly, D., "Play by the Rules", *Byte* (Special Report), 22(6), 1997. pp. 98-102.
- [4] Bosilj Vuksic, V., Spremic, M. and Kovacic, A., "Managing Change Toward E-Business Era: Slovenian and Croatian Perspectives", *Proceedings of the 8th Slovenian Informatics Conference*, Slovenian Society Informatika, Portoroz, Slovenia, 2001, pp. 12-27.

- [5] Butler, T. and Fitzgerald, B., "Unpacking the systems development process: an empirical application of the CSF concept in a research context", *The Journal of Strategic Information Systems*, Vol.8, Issue 4 December 1999, pp. 351-371.
- [6] Date, C. J., *What Not How: The Business Rules Approach to Application Development*. Addison Wesley Longman, Inc.: 2000.
- [7] Haggerty, N., "Modeling Business Rules Using the UML and CASE", *Business Rules Journal*, October 2000.
- [8] von Halle, B., *Business Rules Applied*, John Willey & Sons, Inc., New York: 2002.
- [9] Hay, D. and Healy, K.A., "GUIDE Business Rules Project, Final Report – revision 1.2.", GUIDE International Corporation, Chicago: 1997.
- [10] Herbst, H., *Business Rule-Oriented Conceptual Modelling*, Heidelberg, Physica-Verlag: 1997.
- [11] Jacobson, I., *The Object Advantage*, Addison - Wesley, ACM Press Books: 1995.
- [12] Kovacic, A., "Business renovation projects in Slovenia", *Business Process Management Journal*, Volume 7, No. 5, 2001, pp. 409-19.
- [13] Moriarty, T., "Business Rule Management Facility: System Architect 2001", *Intelligent Enterprise*, 3, 12. August 2000.
- [14] O'Regan, N. and Ghobadian, A., "Formal strategic planning: Key to effective business process management", *Business Process Management Journal*, Volume 8, No. 5, 2002, pp. 416-29.
- [15] Perkins, A., "Business Rules Are Meta Data", *Business Rules Journal*, Vol. 3, No. 1, January 2002.
- [16] Presley, A.R. and Liles, D.H., "A holon-based process modelling methodology", *International Journal of Operations & Production Management*, Vol. 21, No. 5/6, 2001, pp. 565-581.
- [17] Ross, R., *The Business Rule Book: Classifying, Defining and Modelling Rules*, Second Edition, (Ross Method, version 4.0). Business Rule Solutions, Inc., Houston, Texas, 1997.
- [18] Ross, R., "Exploring Business Rules", *Business Rules Journal*, Website revision, April 1999
- [19] Turban, E., McLean, E. and Wetherbe, J. *Information Technology for Management*, John Wiley & Sons, New York, NY., 1998.
- [20] van Veen-Dirks, P. and Wijn, M., "Strategic Control: Meshing Critical Success Factors with Balance Scorecard", *Long Range Planning*, Vol. 35, 2002, pp. 407-427.
- [21] Youdeowei, A., *The B-Rule Methodology: A Business Rule Approach to Information Systems Development*, Ph.D. Thesis, Department of Computation UMIST, Manchester, United Kingdom, 1997.