



## AN OPEN ISSUES IN BUSINESS RULES – BASED INFORMATION SYSTEM DEVELOPMENT

**Ruta Dubauskaitė\*, Olegas Vasilecas**

*Department of Information Systems, Vilnius Gediminas Technical University,  
Sauletekio al. 11, LT-10223, Vilnius, Lithuania*

*Received Januar 10, 2009, accepted August 21, 2009*

**ABSTRACT.** All rules are not usually elicited from business system, sometimes they are damaged during transformation from business level to program system or implementation level in information system development process. Hence, in this paper we propose an idea how to improve the process of creating the correct set of business rules. It is suggested to use ontology to avoid incorrectness. Besides, researches state that using templates of business rules can enable us to define rules in more precise way. It is proposed to rely on the integrated framework of business rules elicitation, which came after detailed analysis of business rules and their elicitation process. The main activities in business rules elicitation process on business, information and program systems levels are defined in the framework, and the actual open issues are formulated. Provided suggestions shows trends in evolution of tools that facilitate activities concerned to using the rules.

**Keywords.** Business rules, ontology, templates of business rules, transformation of business rules.

**Short title.** Business Rules Based ISD.

\*Corresponding author, email: rutad@isl.vgtu.lt, phone: +370 5 2744860

## Introduction

The environment of enterprises changes constantly and changes appear in the business. Business logic (it is often expressed by rules) also changes. On-line response to changes is one of the factors of enterprise competitive advantages. Information system is important for performing enterprise activities successfully, because relevant information is saved in it, which is necessary for performing business process, it supports decisions that are important for the activity. Business is performed according to rules. They make an important and integral part of each information system by expressing constraints on concepts, their interpretation, and/or relationships of a domain. Therefore, it is relevant to pay some special attention to business rules in developing the information systems.

All rules are not usually elicited from business system. Sometimes they are damaged during transformation from business level to program system or implementation level in information system development process. For example, if rules are not defined clearly they can be interpreted differently. Besides, sometimes representatives of business, analysts and designers use different concepts for defining the same objects. Hence, in this paper the solutions 'how to avoid creating incorrect set of rules' are offered.

This work covers the areas of how to improve the process of business rules elicitation from defining business rules in business system to their implementation in the software. Section 1 represents an overview of related works, business rules and their elicitation process is investigated. Section 2 concentrates on the suggested framework of business rules elicitation. Section 3 provides open issues in business rules information system development.

## 1. Overview of Related Works

### 1.1 The Analysis of Business Rules

Information systems are developed to support activities that are performed by an enterprise. Information system is a part of business system. Software systems are developed to support information system. Processes of information system are performed according to some rules. Many authors have emphasized importance of business rules [1], [2], their usage in developing the information system [3], [4] modelling [5] [6], [7] and realization [8], [9]. Therefore, it is relevant to pay special attention to business rules in developing the information systems.

Business rule is a statement that constrains or defines some aspects of particular business at the business system level [10]. Rules are represented declaratively (informally) at business system level [9–12]. The following sentence is presented as a typical example: a customer can buy more than credit limit permits. Business rules can be defined differently depending on context.

Business rule from the perspective of information system is a statement that defines how data should be processed and represented using some rule-based language [12], [13]. Rules of information processing are represented explicitly and can be interpreted in one way. These rules could be labelled as formal rules [9]. The example of this rule according to Hay [13] is represented in the following sentence: 'Total Value' of an ORDER can not be greater than the 'Credit Limit' of a CUSTOMER.

Business rule from the perspective of software system is a statement transformed to the executable rule – like trigger, constraint or fragment of application.

All three enterprise abstraction levels (business, information and software system) should be correctly integrated. The lower level system is constrained by the higher-level system. All changes in the higher level should be reflected at the lower level system correctly. The activities of enterprise should be modelled gradually from business system level to software system level. The life cycle of business rule is presented by Bajec and Krisper [14]. The consistent transformation of business rules enables common conceptualization of all systems. Hence, the following definition of business rules elicitation process is used here. Business rules elicitation process is a set of integrated activities that are performed to define business rules at business system level and to transform them to executable rules gradually.

### 1.2 The Definition, modelling and implementation of business rules

The first step of rules elicitation could be named as a rule definition. According to Ref. [1], rules definition process is usually complicated because i) often business rules are not expressed in explicit way, ii) there are different rules sources, for example, vocal language, laws, documents, domain ontology and etc. Business rules can be elicited in different ways, the main of them are document analysis and dialogue with enterprise workers. Besides, sometimes the representatives of business, analysts and designers use different concepts for defining the same objects, because the chance is that incorrectness appears during the rules elicitation. The researches state that every term, used in business should be defined clearly, because very often the same term may have several meanings [1], [15]. The vocabulary of terms as well as ontology helps to solve the problem of creating incorrect set of rules. The main disadvantage of this approach is that it allows reducing negative impact of only one factor (incorrectness because of different terms) from all factors that determine incorrectness in a set of rules.

The second step of rules elicitation could be named as rule modelling. Defined rules can be represented in different ways, for example, sentences of natural language, decision tables, diagrams, sentence of formal language etc. [9],[16]. As usually, three levels of the different representation are defined according to Ref. [17].

1. *Informal rules.* The rules are represented by semantics and syntax of natural language.
2. *Technical rules.* The UML (Unified Modelling Language) [18], the ORM (Object Role Modelling) [19] could be entitled as the typical examples of graphic modelling languages. The rules are represented by logical constructions of graphic modelling languages including: i) templates of business rules; ii) decision trees; iii) decision tables etc.
3. *Formal rules.* The rules are represented by logical constructions of the formal languages. The OCL (Object Constraint Language) [20] represents a typical example from group of formal languages. The main behaviour of the formal language is the automatic processing.

Rules represented by natural language are easily understandable by people, but they can be interpreted variously. Von Halle et al [3], [9] suggest using predefined template for rules inputting. But some other authors,

in particular, von Halle et al (Ref. [4], [9]) do not provide information, how to transform these rules into executable rules, for example, SQL triggers. Only formal rules can be transformed to executable code [16]. Hence, it is an open issue, what language should be selected in order to create more accurate set of rules. All above-mentioned languages are not standard for rules modelling. During the analysis a clearly defined methodology of rules elicitation from business system level to software system level has not been found.

Not all modelled rules are realized in software system. A part of them is presented in the text document. Another part of rules can be implemented in program code, database, using technical software [1], using business rules management systems [21].

### 1.3 The Results of Analysis

The analysis of related works has shown that the problem of creation incorrect set of rules is arising due to several circumstances: i) sometimes representatives of business, analysts and designers use different concepts for defining the same objects; ii) non-valid interpretation because the rules that are represented by natural language can be interpreted variously.

Ross et al [1], Appleton et al [14] suggest using common vocabulary or ontology for business representatives and creators of information system. The main disadvantage of this approach is that it allows reducing negative impact only of one factor (incorrectness because of different terms) from all factors that determine incorrectness in a set of rules.

Von Halle et al [3], [9] suggests using predefined template for rules inputting, which would allow defining rules in one way (one possible interpretation). But mentioned authors do not provide method for realization rules, inputted using templates, it is not clear how to transform them to executable rules, for example SQL triggers. Hence, the researches provide various ways for solving problem of creating incorrect set of rules, but these approaches are not completed and integrated.

The framework of business rules elicitation, which have come after detailed analysis of business rules and their elicitation process, is proposed in Ref [3]. The suggested framework integrates approaches of different authors. The main activities in business rules elicitation process on business, information and program systems levels are defined in the framework, and the actual open issues are formulated.

## 2. The framework of business rules elicitation

Analysis of business rules and their elicitation process shows that rules elicitation process is defined differently depending on different points of view. For example, to an analyst of information system rules elicitation means defining rules from conversations with business representatives, documents and ontology. These rules are captured by natural language. Hence from the analyst perspective the rules elicitation process is rules definition activity, which input is source of rules (vocal language, documents, ontology) and result is a set of rules (statements of natural languages). Therefore the three aspects (input, activity and result) describe a point of view of information system analyst in detail.

An analyst, an architect, and a designer can analyze rules elicitation process differently. Table 1 describes business rules elicitation process from different points of view and aspects. Hence, an information system analyst starts the process of rules elicitation from rules definition. He/she defines business rules by analyzing the documents of enterprise, domain ontology, talking with enterprise employers. Using pre-defined rules templates analyst input defined rules to computerized system (see Table 2). During this process the specification of business rules is created, rules are represented by partially formal language, for example, structured English language.

More information about the classification of rules and rules classes templates are provided in von Hale's work [3]. An architect transforms partially formal rules to formal rules that can be automatically transformed to executable code.

Table 1. The framework of business rules elicitation

View point	Aspects			
	Input sources for definition of rules the rule	Definition of rules	Result of definition	Typical sample of language for representing
Analyst	Sentences of vocal language, documents (laws, orders), domain ontology, etc.	Semantic and syntax of vocal language, templates of documents, etc.	Constructions of natural language	English, German, French, Lithuanian
	Sentences of natural systemized language	using predefined template for rules inputting	Specification of rules - partially formal language	Structured English language
Architect	Specification of rules	Modelling of rules	Graphic model or formal language	UML diagram, OCL
Designer	Model of rules	Transformation of rules	Implemented rules, executable code	SQL, JAVA, C++

Table 2. Templates of rules

No.	Template	Example
1.	<b>&lt;term 1&gt; IS A &lt;term 2&gt;</b>	<b>Bus IS A vehicle</b>
2.	<b>&lt;term 1&gt; MUST NOT BE IN LIST &lt;a, b, c&gt;</b>	<b>The status of items on offer MUST NOT BE IN LIST &lt;sold, not brought&gt;</b>
3.	<b>&lt;term&gt; IS COMPUTED AS &lt;formula&gt;</b>	<b>Total sum IS COMPUTED AS sum1 + sum2 + sum3</b>

Rules elicitation process is represented graphically in the Fig. 1. Successive performing of all activities allows implementing more correct set of rules. However, defined activities are rather recommended than mandatory. Before choosing one or another the approach of business rules

system development every enterprise should take into account various factors, for example, critical importance of developed system (if system is critically important), objectives, time and budget resources, qualification of employers, tools end etc.

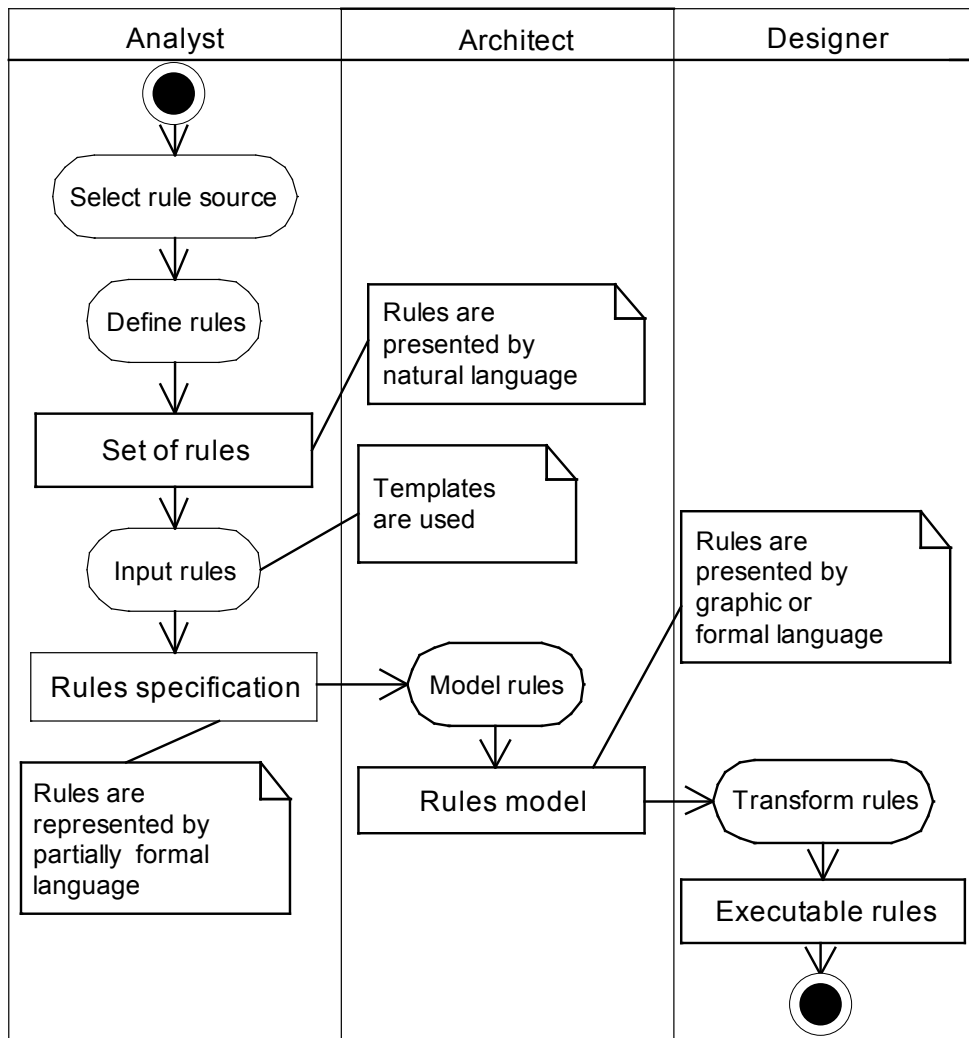


Fig. 1. Process of rules elicitation

### 3. Open issues in business rules – based information system development

The suggested framework, the aspects and views of business rules elicitation process help to define open issues in business rules - based on system development they are as follows.

1. Work with domain ontology, for example, automated generation initial set of rules from selected domain ontology.
2. Work with templates. Template should enable to input various types of rules.
3. Extension of the selected modelling language with special symbols for business rules modelling.
4. Automatic transformation rules of information system to executable rules (rules of software system).
5. The main issue is to integrate and improve approaches, methods that are suggested by various researches on above-mentioned issues.

CASE (Computer-Aided Software Engineering) tool, which facilitates all rule elicitation activities (generation rules form ontology, rules inputting through templates, automated generation of executable rules etc.) during the analysis of MagicDraw [22], Power Designer [23] and others tools have not been found. Hence, solutions of defined issues and their realization in CASE tool enable to create rule-based systems easier and more qualitative.

### References

- [1] Ross R. G. Principles of the Business Rule Approach. Addison Wesley, 2003.
- [2] Ross R. G. Business Rule Concepts. Business Rule Solutions Inc., 1998.
- [3] von Halle B. Business Rules Applied: Building Better Systems Using the Business Rules Approach. John Wiley & Sons, 2002.
- [4] Morgan T. Business Rules and Information Systems: Aligning IT with Business Goals. Addison-Wesley, 2002.
- [5] Herbst H. Business Rule-Oriented Conceptual Modelling. Physica-Verlag, 1997.
- [6] OMG. Semantics of Business Vocabulary and Business Rules (SBVR), 2006, Available at [<http://www.omg.org/docs/dtc/06-03-02.pdf>], retrieved 2009 03 19.
- [7] Guarino N. Formal Ontology and Information Systems. In Proc. of FOIS'98, Trento, Italy, IOS Press, 1998, 3-15.
- [8] Date C. J. An Introduction to Database Systems. Addison Wesley Longman, 2000.
- [9] Chisholm M. How to Build a Business Rules Engine. Morgan Kaufman Publishers, 2004.
- [10] Zachman J. A., Sowa J. F. Extending and formalizing the framework for information systems architecture. IBM Systems Journal, IBM Publication, vol. 31(3), 1992, 590-616.
- [11] Perrin O., Godart C. An approach to implement contracts as trusted intermediaries. In: Shan, M. C. (ed.): Proc. of the First International Workshop on Electronic Contracting (WEC'04), IEEE Xplore, 2004, 71-78.
- [12] Lebedys E., Vasilecas O. Analysis of business rules modelling languages. In Proc. of the IT'2004, Lithuania, Technologija, 2004, 487-494.
- [13] Hay D. C. Requirements Analysis: From Business Views to Architecture. Prentice Hall PTR, 2003.
- [14] Bajec M., Krisper M. Issues and challenges in business rule-based information systems development. In Bartmann D., Rajola F., Kallinkos J. (eds.). Proc. of Information systems in a rapidly changing economy, Regensburg: Institute for Management of Information Systems, 2005, 1-12
- [15] Appleton D. S. Business Rules: The Missing Link. Datamation 30, 1984, 145-150. Available at [<http://www.dacom.com/News/publications/busrules.asp>], retrieved 2008 08 08 .
- [16] Booch G., Rumbaugh J., Jacobson I. The Unified Modelling Language User Guide. Addison-Wesley, 2000.
- [17] Vasilecas O., Saulis A. Informacinių sistemų kūrimo metodai ir technikos (The Methods and Techniques of Information System Development). Paskaitų medžiaga, Lithuania, 2007, 110 - 183.
- [18] OMG. OMG Unified Modeling Language (OMG UML), Infrastructure, v2.1.2, OMG Document: formal/2007-11-04, 2007. Available at [<http://www.omg.org/cgi-bin/doc?formal/07-11-03>], retrieved 2008 09 11.
- [19] Halpin T. Object-Role Modeling (ORM/NIAM). In Handbook on Architectures of Information Systems. Springer-Verlag, 1998, 81–102.
- [20] OMG. UML 2.0 OCL Specification, 2003. Available at [<http://www.omg.org/docs/ptc/03-10-14.pdf>], retrieved 2008 09 20.
- [21] Vasilecas, O., Avdejenkov, V. Business Rules Applying to Credit Management. In K. Elleithy (ed), Advances and Innovations in Systems, Computing Sciences and Software Engineering, Springer Netherlands, 2007, 481-483.
- [22] No Magic. Magic Draw tool. Available at [<http://www.magicdraw.com/>], retrieved 2009 03 24.
- [23] Sybase. Power Designer tool. Available at: [<http://www.sybase.com/products/modelingdevelopment/powerdesigner/>], retrieved 2009 03 24.

### Conclusion

The analysis of related works on business rules elicitation has shown that there is no standard, which would define activities of business rules elicitation process. It can be understood differently depending on the point of view. Authors propose to integrate these views into framework by aspects. Suggested framework provides requirements which while implemented would help to create more correct set of rules. For example, information system analyst should use predefined templates for inputting rules, it allows to interpret inputted rules in one way.

Open issues in business rules – based on information system development have been formulated after investigating the suggested framework of rules elicitation. The main issue is to integrate and improve approaches, methods that are suggested by various researches. Solutions of defined issues and their realization in CASE tool enable to create rule-based systems easier and more qualitative.

### Acknowledgements

The work is supported by Lithuanian State Science and Studies Foundation according to High Technology Development Program Project "Business Rules Solutions for Information Systems Development (VeTIS)" Reg. No. B-07042