KNOWLEDGE MANAGEMENT USING BUSINESS RULES

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ABSTRACT

In today's rapidly changing market environment, almost every company has to be able to quickly adjust its business strategy. Simultaneously, it can be observed a faster growth of requirements on knowledge management. Alongside the knowledge bases for collection the knowledge in unstructured form, for many applications, it is usable to formulate the knowledge for decisions and checks in a structured form. This requirements can be fully satisfied with adoption of the business rules approach. Business rules is a name for relatively big group of specifications and techniques. They are suitable to complement the process modeling of enterprises. The defined rules can be comprehensible for humans (managers, domain experts etc.) as for inference engines. Creation of business rule sets is a way of creation a structured knowledge base. In this paper, there is summarized information about opportunity of collection and management of knowledge using the business rule approach. The mentioned knowledge have been learned not only on theoretical basis but also using the experiences of the rule experts. The research in the field of business rules is currently on a crossroad, because still more experts think, that business rules may be closer to the prime role of expert systems. It can be stated that business rules can be successfully used also for solving of tasks with an acceptable degree of uncertainty. Such tasks can be found mainly in the field of marketing activities or client ratings.

KEY WORDS

Business rules, knowledge management, data mining, rule learning, knowledge base.

INTRODUCTION

In conjunction with the development of the new economy occurred in the last century, there is a significant increase of the impact of knowledge on the prosperity of businesses. The main production factors are not only the labor, land and capital, but also the currently "most important" factor - knowledge. The methods and tools of knowledge management have been developing for really long years. In the presence, many enterprises know that the knowledge have to be collected, managed and effectively re-used. Concurrently, it is almost clear, that the employees cannot be absolutely replaced by an information (expert) system.

In the course of exploitation of "enormously smart" expert system it was designed a user friendly way of processing of the business knowledge saved in a form of rules. It was the birth of business rules and business rules management systems.

Business rules are simple structured rules. They can be used for exchange of the knowledge between employees and event between businesses, but they can be also used for automatic application of restrictions, actions, reactions etc. However, it is necessary to mention, that "business rules" is not a name of one specification or standard. It is rather a group of specifications and an enterprise modeling method.

Management of knowledge using business rules has developed since 80s, but it is still not possible to say, that it is used in the most of companies, which can profit from its application. In this paper, there are summarized the basic insights about possibilities of business rules and its usage in the real world applications. The findings also come from the experiences of the rule experts, collected during interviews and within using a questionnaire for the participants of the conference RuleML 2015.

KNOWLEDGE WITHIN COMPANIES

As mentioned in the previous paragraphs, the knowledge is very important for the most effective life of business companies and even of non-profit organizations. In connection with the transformation from "traditional" to "information" companies, all organizations have to deal with knowledge of their employees and collect it into a *knowledge base*. Optimally, it should be realized with a suitable support of the information system. (Veber, et al., 2009) It can be talk about the *knowledge management*. The mission of the knowledge management is the externalization of the "internal knowledge of the company". This knowledge can be found in the minds of the employees, in a tacit form. For sharing between individual employees, the knowledge has to be transformed into the *explicit form.* For the best market share, the company should share the knowledge of employees and combine it with the actual data saved in the information system.

From the perspective of the form of knowledge and the knowledge management, the externalized (explicit) knowledge can be saved and management using two different ways. On the one side, there are knowledge bases of unstructured or semi-structured partial knowledge. This knowledge can be effectively managed within a wiki system, web content management system or articles connected with a mind map. On the other side, there are structured forms of knowledge – *ontologies*, optionally in conjunction with *rules*.

For the comprehensive support for management of the business processes, it is useful to combine both – structured and unstructured – expression forms of the internal, business knowledge. In many cases, companies prefer the unstructured or semi-structured form of knowledge expressions, when starting with using of knowledge management. The unstructured form (plain or hypertext articles, comments, e-mail with advices etc.) are closer to the natural talk between the interested employees.

In the case of implementation of a new version of the information system, it is necessary to use these unstructured expressions of knowledge and combine it with temporarily collected knowledge gained from interviews with selected employees and with the knowledge found in the source code of the previous version of the implementation. From the perspective of the "classical" methodologies for implementation of an information system, this collection and completion of knowledge is a substantial part of the detail analysis, before real coding of the application. (Voříšek, 2008) Subsequently, the knowledge is used for the design and implementation of the source code. Also the knowledge is "hard-coded" in the applications. This process of collection of knowledge and subsequent implementation is ingrained and very often (even usually) used, but in today's rapidly changing environment, it is not very effective. The business logic coded is not easy adjustable, the changes are long lasting and expensive. This problem can be partially solved using agile development methodologies, but only in the possibility of a progressive refinement of requirements and partial rules of behavior. In order to create a flexible and sustainable implementation of an information system, the business logic, defined using the shared knowledge, gained from the business employees, should be separated from the source code of applications. It is suitable to use a term dictionary (ontology, terms enumerations an so on) and rules for definition of individual decisions, checks and derivation from terms. The role of such rules can be excellently fulfilled using business rules.

BUSINESS RULES – WHAT THEY REALLY ARE?

The term "business rules" is a name of relatively big group of specifications and standards of rules and also an approach to modelling of enterprises. The basic idea behind the creation of business rules is: *„Rules build on facts, and facts build on terms."* (Ross, 2003) From the perspective of modeling, this

business rules are suitable method for extension of the currently usually used approach of modeling of the business processes. In business rules, the main questions are "Why?", "What?" and "How?" should be performed a concrete business activity. All the collected answers should transformed into form of simple, clear and human friendly rules.

The main assumptions for the effectively usage of business rules were defined in the "The Business Rules Manifesto" by the Business Rules Group. (2003) The business rules were developed from the best practices of the expert systems, but the target of their application was absolutely other. The business rules should not be used for building of complex knowledge bases for standalone solving of business problems or giving of expert answers. They should be used for management of really defined rules, applied in the business. However, nowadays, the business rules are used also for collection of knowledge from the employees and for solving of problems with a certain level of uncertainty.

SPECIFICATIONS OF BUSINESS RULES

Because the term "business rules" refers to a "modeling concept" rather one specific standard, for usage of business rules in a practical use case, it is necessary to explore existing specifications and formats, test relevant software components and select a concrete specification. Currently, there are many specifications of business rules. These specifications are not fully compatible and mutually convertible. In terms of the types of business rules it is possible to distinguish declarative, repression, derivation and action/reaction rules. Not all specifications support all these rule types.

Another selection criterion is proposed purpose of the created knowledge base in form of business rules. In case if the knowledge should be primary used by humans (members of the company management, domain experts etc.) it is suitable to select a specification of business rules, which is based on the natural language. A suitable example is the specification *Semantics of business vocabulary and rules – SBVR*. (Object Management Group, 2015) However, a big advantage of business rules is the possibility of a simple connection of rules into the models of processes and simple automatic evaluation and enforcement of the rules. For this purpose, it is preferable to use a technically more focused specification – *RuleML*, *Drools DRL*, *Jess* etc.

The third important criterion of selection should be the compatibility of the software component for support of the specification in combination with the existing software components, already used in the company. Most specifications are supported with software component written in Java or .NET. Based on the search and on the practical testing, it is possible to say, that in terms of functionality, the most commonly used components are mutually similar. Equally they are similar regardless the usage license or price. The differences are mainly in the commercial support added to the available software components and packages.

Business rules are always build over a unified terms dictionary. This dictionary should be shared between all departments of the company. (Ross, 2003) Depending on the selected specification, the role of the terms dictionary can be fulfilled using a business ontology, database columns or specifically created dictionary. Of these options the ontologies have gained in popularity recently. Their creation and deployment can be observed in private companies also in the public administration. (Dudáš, et al., 2013)

LEARNING OF BUSINESS RULES?

For the real, practical implementation of the knowledge base in form of business rules it is necessary to achieve the sufficient complexity of the saved knowledge. It is usually necessary to manage and use tens to hundreds of individual rules. Manually creation of a big knowledge base is really challenging to the ability of domain experts and managers of the company. For this reason, the possibilities of (semi-)automatic learning of business rules has been a relevant topic of research in the recent years. Ways of obtaining of business rules:

   manual input by human – domain expert

- o traditional way of obtaining of business rules
- o best control of business rules
- o time consuming
- o the risk of non-inclusion of all necessary business rules

automated identification of business rules in unstructured texts, ontologies and processes

- o combination of automatically identified rules with manual control
- o current research topis – see (Sharma, et al., 2014), (Bernotaityte, et al., 2013) (Sellner, et al., 2011)

learning of business rules from historical data

- o many comments about the appropriateness
- o dependent on the quality of data and ability of the data mining expert
- o currently only one existing implementation – component RuleLearner in the system OpenRules (http://`openrules.com`) , but it is not distributed. It is available only for experts from the company OpenRules, Inc.

In relation with the development of business rules, however, was one very important question: "What should be defined in the form of business rules?" On the basis of available publications and also on the basis of the realized interviews, it is possible to identify two groups of experts on the problematic of business rules.

The first group believes, that business rules should cover only the knowledge, which is really written in the existing corporate standards and determinations of the key managers. This ensures the absolutely reliability of the defined business rules. It is not possible to contest them and there exists a clear responsibility for the conclusions. With this 100% reliability, business rules have enforced in the real applications - compared to experts systems, which are substantially the past. Most supporters of this group are in the American group of researchers, standing behind the emergence of the first standards of business rules.

The members of the second group believe, that business rules can also play the role of "small expert system". Respectively it can be said that business rules can slowly go back to fulfilment of the main goal of expert systems. Business rules should not play the role of absolutely all-embracing decision and directional system. But it is however possible to use partial rule sets with a partial uncertainty. For example, Business rules can be used for example for decisions on the creditworthiness of the clients when applying for loans. The appropriate decision can be influenced by statistical data gained using data mining techniques. To deal with similar classification tasks it is appropriate to use data mining models transformed into form of subset of business rules. (Kliegr, et al., 2014)

## REAL POTENTIAL OF BUSINESS RULES – EXPERT OPINIONS

Are the business rules actually used? Is it possible to gain business rules from the historical data of the company? And is it suitable? What types of companies could have the greatest benefit from adoption of the business rule approach? Obtaining answers to these questions is not quite a simple matter. To solve it, the author realized a questionnaire and some interviews with the rule experts.

The respondents of the prepared questionnaire were the participants of the conference RuleML 2015. This conference is one of the most important platforms for sharing knowledge in the field of application, design and usage of the rule systems and specifications. The responders have answered a set of questions about the applicability and the frequency of use of business rules, also as questions about the possibility of learning of business rules from the historical data. Simultaneously, there were some questions for checking the erudition of the respondents.

There are some interesting findings obtained from the answers. 60% of respondents think, that the business rule approach is used only in 30% (or less) of companies, which could have profit from the adoption of it. No experts also believe that the level of adoption of the business rule approach is higher than 70% of companies, which could profit of it. In terms of the research of methods of obtaining of business rules (other than manual input), the most of expert think, that it would be appropriate to have a method of semi-automatic learning of business rules. However, more than a half of the experts believe,

that it is necessary to realize the manual check of the learned rules. In terms of the use of historical business data for the learning of business rules, the experts are not unanimous. Essentially, they are separated into two groups of relatively equal size.

Within the questionnaire and the interview, the experts were also asked about the most important problems associated with the learning of business rules from historical data. The biggest, most important problem is the quality and size of the historical data. The companies often believe, that they have good and relevant data, but the experts have too often solve the problems with the historical continuity in the rows saved in one dataset and problems associated with incompleteness of the data. Another problem is a large number of the learned rules.
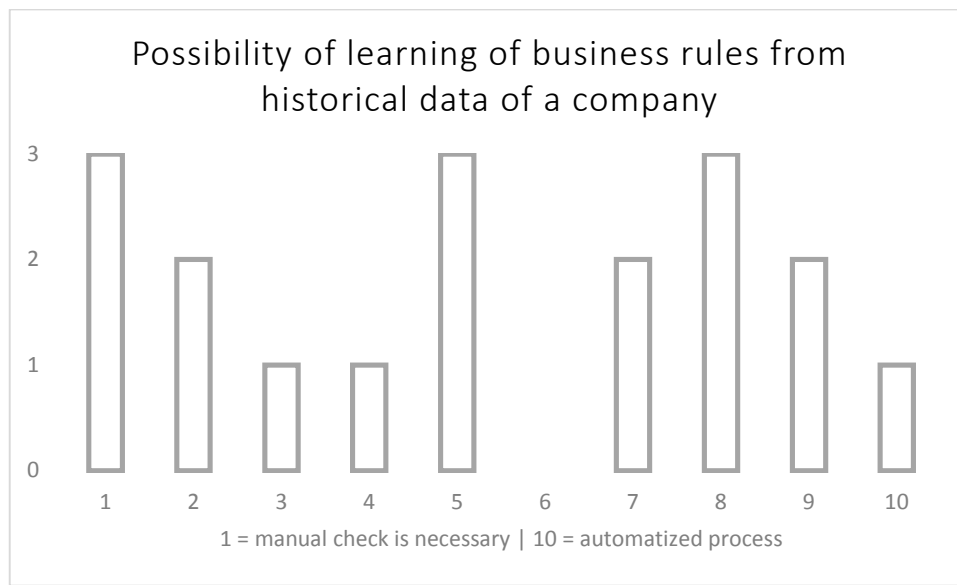
Graph 1 – Possibility of automatic learning of business rules from the historical data

The possibility of (semi-)automatic learning of business rules is suitable for solving of complex "classification" or "recommender" decisions. Suitable areas of implementation of this functionality can be found in the field of marketing (recommending of goods for individual customers, determining the appropriateness of sending of an e-mail) or in the field of reviews and checks of clients of financial institutions and insurance companies. Financial institutions and insurance companies, together with the institutions of government, are the best adopters of the business rule approach. They have really big amount of rules that must be checked and used for operational decisions on the daily basis.

From the perspective of knowledge management the experts have been asked for the potential of usage of business rules for creation of knowledge bases. If the business rules are saved in a form, which is comprehensible for the non-expert users, then it is possible to say, that a set of business rules is a good way for sharing of knowledge. It is definitely easier to use a structured set of business rules for solving of decision tasks, than the need to obtain these "rules" from documents in an unstructured form for realization of decisions of the individual employees. In terms of clarity for new employees, it is suitable to have the rules annotated with notes for the human users. Another suitable way is a connection between business rules and a base of knowledge written in an unstructured form. The connection could be based on one shared ontology. In this case, the classes and instances from the ontology should be used in the business rules. Simultaneously, the ontology plays the role of "navigation network" in the knowledge system for the unstructured knowledge expressions.

CONCLUSION

Business rules represent an interesting approach to modeling of enterprises. It is appropriate to combine this approach with process modeling of enterprises, mainly in the field of financial institutions, insurance companies also as in the field of state and local government. However, the adoption of the business rule

approach could be a benefit for enterprises in another market fields. Working examples can be found in the determination of prices for different groups of customers. Based on the feedback from the experts it should be mentioned that using of business rules could be a benefit for more companies. The benefit will be in the possibility of operational update of decision rules. Thus, the companies could respond the changes on the market more flexibly.

For companies that use business rules, it is appropriate to try methods of semi-automatic learning of the rules from the historical data. This learning is really suitable for solving of classification tasks.

The author of this paper is interested in possibility of semi-automatic learning of business rules using data mining of association rules. In the future work in this area it will be suitable to promote the usage of this business rule learning technique.

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