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Extracting Business Vocabularies from Business Process Models: SBVR and BPMN Standards-based Approach*

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Abstract. Approaches for the analysis and specification of business vocabularies and rules are very relevant topics in both Business Process Management and Information Systems Development disciplines. However, in common practice of Information Systems Development, the Business modeling activities still are of mostly empiric nature. In this paper, basic aspects of the approach for business vocabularies' semi-automated extraction from business process models are presented. The approach is based on novel business modeling-level OMG standards “Business Process Model and Notation” (BPMN) and “Semantics for Business Vocabularies and Business Rules” (SBVR), thus contributing to OMG’s vision about Model-Driven Architecture (MDA) and to model-driven development in general.

Keywords: SBVR; BPMN; business vocabulary; business rules; business process model.

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INTRODUCTION

Recent trends in the areas of Business Process Management (BPM), Information Systems Development (ISD) and Business Rules Management (BRM) show that these three should not be treated as competing but rather as complementary, and equally important, disciplines. Business vocabularies and rules (BV&R) can contribute greatly to intra- and inter-organizational communication, and other business knowledge exchange and transformations-oriented activities [3], [4], [12], [15].

To support its vision about Model-Driven Architecture (MDA [6]), Object Management Group (OMG) has also contributed to the standardization of business modeling discipline (in the context of ISD, but also BPM) by providing such business modeling-level standards as “Business Process Model and Notation” (BPMN [5]) and “Semantics for Business Vocabularies and Rules” (SBVR [7]). Nevertheless, integration among different interrelated concepts (aspects) of the whole Business model itself remains quite loose and empiric. None of the current OMG developments define how these standards interrelate and link to each other. Any process-related concepts are out of scope in SBVR specification; at the same time, BPMN has very poor support for the concepts related to BV&R. Indeed, today, one of the main concerns of the professionals working in the areas of BPM and ISD is the lack of efficient, standards-based approaches that allow the development of business process models and conceptual IS design models synchronized with formalized, well-structured BV&R specifications.

The scope of this short paper is limited to one aspect of bi-directional BP→BV&R integration, i.e. semi-automated one-way extraction of SBVR business vocabularies from BPMN business process diagrams (BP → BV).

BPMN AND SBVR: DEFINITIONS AND ARGUMENTATION

Business Process Model and Notation (BPMN).The main diagram of BPMN is a Business Process Diagram (BPD). There are four categories of core elements in BPD: Swim lanes, Flow Objects, Connecting Objects and Artifacts (Table 1). The core elements are the basic source of knowledge in the process of SBVR BV formation.

Analysis of Bunge-Wand-Weber ontology [10] showed that compared to other BP modeling languages BPMN covers the largest amount of real world concepts and it is well-understood and accepted by business experts [1], [2]. Judging from these results one can conclude that BPMN models provide the most of the formalized business knowledge, from which BV (and later, BR) may be extracted.Wahl and Sindre [17] also indicated that BPMN is

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clearly understandable and well-suited for BP modeling. Compared to BPMN, software systems modeling-oriented standards, like UML and IDEF, lack sufficient semantic expressiveness; also, such languages hold a number of concepts, constructions and rules that can be treated as excessive for BP modeling needs [9].

Another argumentation to use BPMN is the fact that this standard formally integrates into OMG’s Model Driven Architecture (MDA [6]), which is widely accepted standard by CASE tools developers and other R&D communities. From MDA perspective, BPMN BPD is a part of Business model.

**Semantics for Business Vocabularies and Rules (SBVR).** Business vocabulary (BV) is defined to contain a set of “specialized terms and definitions of concepts that a given organization or community uses in their talking and writing in the course of doing business” [7]. According to so called business rules “mantra” (followed from “Business Rules Manifesto” [8]), business rules (BR) are built on facts and facts are built on terms. Terms (Concepts) and Facts are the ones that form the basis of any BV. In its turn, one cannot properly specify and manage BR without having the support of a proper BV.

Among other approaches of BR specification using natural language expressions [11], [14], [16], arguably, the most significant one is the “Semantics of Business Vocabulary and Business Rules” (SBVR) standard [7]. The vision of SBVR is to express business knowledge in a controlled natural language, which would be unambiguous and understandable to business and IT people as well as computer systems.

The complete SBVR BV meta-model contains over one hundred concepts defining various aspects of a BV. Due to the scope of this paper, this large structure can be scaled down to the following core elements:

- **Noun Concept**, which can be specialized to General Concept and Individual Concept (and also, Role, which is out of scope in this paper). General Concept is a noun concept that classifies things on the basis of their common properties. Individual concept is a noun concept that corresponds to only one object (thing).
- **Fact Type** is a concept that denotes some type of relationship between two or more noun concepts or a characteristic of the noun concept. Following the definition, fact types are defined using the existing noun concepts, which have been already defined in BV. A Fact Type has a final set of specializations.

Four types of font styles with concrete formal meaning are used to represent noun concepts, fact types and business rules in SBVR-based Structured English or any other chosen language (e.g. Lithuanian):

- ‘*term*’ font is used to represent general concepts (object types) and roles, e.g. ‘*customer*’;
- ‘*Name*’ designates individual concepts that usually are proper nouns, e.g. ‘*Lithuania*’, ‘*IBM*’;
- ‘*verb*’ font represents a verb, a preposition, or a combination of these two, e.g. ‘*customer provides order*’;
- ‘*keyword*’ font represents linguistic symbols that are used to construct statements and definitions, e.g. ‘*each*’, ‘*It is obligatory that*’.

SBVR BV has glossary-like entries, which specify concepts having representations in the vocabulary (Fig. 1, lower right GUI window). Each entry is for a single concept.

As of yet, SBVR is probably the first initiative to formalize and standardize the definition of BV suitable for wide-range practical applications. Being an OMG standard, SBVR initially has a strong support from the world’s BPM community, CASE tools developers and other R&D parties. From the MDA perspective, BV and BR have to be defined at Business modeling level of MDA, i.e. in parallel with BP modeling. SBVR is fully integrated into the OMG’s MDA via MOF or Eclipse Metamodeling Framework (EMF).

**EXTRACTING SBVR BV FROM BPMN BPD**

**Mapping the Elements of BPMN and SBVR.** In order to develop BP→BV transformation rules, we first identified the mappings between the elements of BPMN and SBVR metamodels (Table 1).

The proposed BP→BV approach consists of several stages. First, certain business rumblings are being extracted from BPD, and candidate business objects and expressions (O&E) formed (upper right GUI form in Fig. 1). After that, SBVR BV entries for noun concepts and fact types are formed from these business O&E. During the extraction of business rumblings, markings “A”, “M” and “Alt_M” (Table 1) have the same meaning – they all mean that the marked BPD elements are used as sources of knowledge for automatic extraction of certain business rumblings.

When all rumblings are extracted, the meaning of the markings becomes important: “A” implies that a candidate business O&E can be automatically identified and extracted from the particular business rumbling; “M” implies manual identification and extraction of certain business O&E, and “Alt_M” designates the secondary (alternate) source for manual identification and extraction of one or more candidate business O&E. For example, in Table 1, the intersection of the BPMN element *Lane* with the SBVR element *Noun Concept* is marked with “A”, which means that the all business objects of the type *Lane* in any BPMN BPD will be the subject for automatic identification and
extraction of certain business objects in order to form *Noun Concept* entries in SBVR BV (e.g. ‘customer’ and ‘supplier’ from the presented BPD in Fig. 1).

**TABLE 1.** Mapping pairs of core elements of SBVR and BPMN meta-models for BV extraction

<table>
<thead>
<tr>
<th>Group</th>
<th>BPMN BPD</th>
<th>SBVR BV</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group Element</td>
<td>Group Element</td>
<td>Noun Concept</td>
</tr>
<tr>
<td>Swimlanes</td>
<td>Lane</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Pool</td>
<td>A</td>
</tr>
<tr>
<td>Flow Objects</td>
<td>Event</td>
<td>Alt, M</td>
</tr>
<tr>
<td></td>
<td>Activity</td>
<td>Alt, M</td>
</tr>
<tr>
<td></td>
<td>Gateway</td>
<td>Alt, M</td>
</tr>
<tr>
<td>Connecting</td>
<td>Sequence Flow</td>
<td>-</td>
</tr>
<tr>
<td>Objects</td>
<td>Sequence Flow (with Condition)</td>
<td>Alt, M</td>
</tr>
<tr>
<td></td>
<td>Message Flow</td>
<td>-</td>
</tr>
<tr>
<td></td>
<td>Message Flow (with ref. Message)</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Association</td>
<td>-</td>
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<tr>
<td>Artifacts</td>
<td>Data Object</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Data Object (with State)</td>
<td>A</td>
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<tr>
<td></td>
<td>Data Store</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Group</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td>Text Annotation</td>
<td>Alt, M</td>
</tr>
</tbody>
</table>

**Algorithm and Implementation of the BP→BV Approach.** On the implementation level, the proposed BP→BV approach may be viewed as an extension to one of our recent developments – *VeTIS* tool [3], which may be used as a stand-alone tool or as a plug-in of the *MagicDraw UML* tool.

**FIGURE 1.** Interaction of BPMN Modeler (*MagicDraw UML*), BP→BV plug-in (*MagicDraw UML*) and *VeTIS* tool (*Eclipse*)

At this point, the main objective of the research is to extend the functionality of *MagicDraw UML* tool by adding new BP→BV extraction feature and thus allowing end-user to work with SBVR BV in parallel to BP modeling.
Stage 1 deals with the extraction of business rumbles and formation of candidate business objects and expressions (O&E), from which SBVR noun concepts and fact types will be formed (Label 1 in Fig. 1). In Stage 2, the algorithm follows the basic principle of BR “mantra”, which, once again, states that facts are built on terms – therefore, one must specify a set of noun concept entries (Stage 2.1) before specifying fact types (Stage 2.2) in SBVR BV (in Fig. 1, Label 2 marks the formation of SBVR BV entries from the selected business O&E). In this paper, Stage 3 could be assumed as a straight forward process of SBVR BV validation with business domain expert.

CONCLUSIONS

Authors of this paper emphasize the necessity to integrate BPMN-based BP modeling with the development of SBVR standard-based BV (and, successively, BR). Guidelines for semi-automated extraction of SBVR BV from BPMN BPD are presented in this paper. The stand-alone prototype implementation proved promising. However, the aim is to extend the previously developed VeTIS solution [3]. Such implementation of the BP BV approach would provide certain benefits, such as: faster development of well-structured, formalized business vocabularies, ready for various areas of application, including model-driven ISD; increased quality and completeness of the business model; possibility to track changes in business model and conceptual IS models. Further research could result in the development and implementation of BP BV & R two-way synchronization approaches. Certain research and development has already been done in this area [13].

REFERENCES