Extracting Business Logic from Business Process Models

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Abstract—**Business rules and business process management (BPM) are increasingly considered as complements towards the quest of better business process insight and control by researchers and practitioners. The important role of business rules in BPM is now widely accepted among application software producers, researchers and business process managers. This development resulted in extensive process maps created by many enterprises. Increasingly needed tool support for business rules management and modeling became a relevant element at the market of business application software. Although systems and organizational units involved in the business process were captured in process diagrams, business rules that govern them were often not explicitly included in the models. This paper suggests an extraction process for business rules identification from business process models. Applying this process introduces a structured approach and management aspects within rules discovery by focusing on rule sources that are important for the process goal and providing a rule structure.**

Keywords-business logic, business rules, business processes, rules extraction, complexity reduction

I. INTRODUCTION

Many efforts are already made to promote and integrate business rules modeling and management tools into business processes automation. Being ready for execution as a part of

business process management applications business rules and the business rules approach [6] still seem to lack a common methodological ground and support. Especially the fact that, before business rules can be modeled and managed they first need to be captured and extracted from different sources is often left to analyst's intuition. Well- known possible sources to look at to identify business rules are, among others: process documentation, source code or implicit sources like internal problem-solving knowledge of the employees involved in this process. But since not many enterprises capture their business rules in a structured, explicit form like documents or implicit software codes, they need to be identified first, before being captured and managed. Here the question about how to identify the potential sources of business rules emerges. Though some of them may seem obvious, like legal restrictions, standards or mandatory best practices, some are implicitly included within the elements involved in the process. On the other hand, many enterprises capture their business processes in business process models, providing a structured view for further analysis and management. That means that the knowledge on these processes was already captured once,

implying that the business rules are may have also been captured implicitly in this models, e.g. in the control and decision flows. Managing business processes and govern them is an important but also a complex task.

Many enterprises have already recognized the advantage of separated governance of business logic [4], [11] and start modeling their business rules as partly representations outside the process models. Nevertheless business analysts often capture business processes according to their documentation or information gathered in interviews during the as-is analysis. In this case business logic and constrains for the execution of business processes are both included in the resulting model, making effective management and maintenance of the business rules their extraction from the business tasks more intransparent [10]. On the other hand, for a business execution system only the directly executable

process tasks are relevant. So the question arises how to extract the knowledge on business process execution and the involved rules when a standard process description or business process model are given? In this paper a general business rules extraction process is suggested and demonstrated on a classic example of a credit check process. As real-life business processes have often a high complexity level and have multiple sources that can affect its execution, the found business rules sources need to be narrowed, so that an effective analysis and process execution are possible. Therefore, a decision tree approach to this question in also suggested here. The resulting business rules are then integrated into the process model and described using the natural language. For an automated execution of these rules their modeling and implementation into a Business Rules Management System is possible. Thus, this paper presents the first few steps a business analyst can take before formally including the rules into the process supporting IT-infrastructure.

This paper is organized as follows: In section two an exemplary business process model is shortly described. Section three presents the business rules capturing process and results of its application on the exemplary business process described above. Section four introduces an approach for importance evaluation of business objects. Section five shortly presents related work on business rules extraction. Conclusion and outlook finish the paper.

II. BUSINESS PROCESS EXAMPLE

In this section a business process model is presented using Business Process Modeling Notation (BPMN) (see figure1). The credit application process was taken from a

real-life banking process description and simplified for demonstration purposes of the business rules extraction process described in section three. In this process customer applying for a credit provides his or her requested personal and financial data. Based on the data, decision on credit amount and interest rate can be provided. Decision support is provided by the Customer Management System, CMS that also manages customer data. The process starts with an incoming request and ends (in the positive case) when customer gets the credit application form. Process steps in the diagram are numbered. Process activities are marked not only with a name but also with a two-digit number. The first digit identifies the process actor here customer service or the CMS, the second digit identifies the sequential process step number.
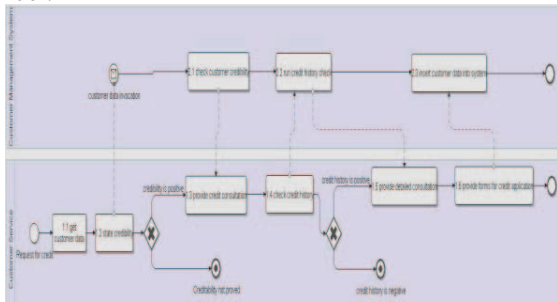

Figure 1.   Credit Check Process
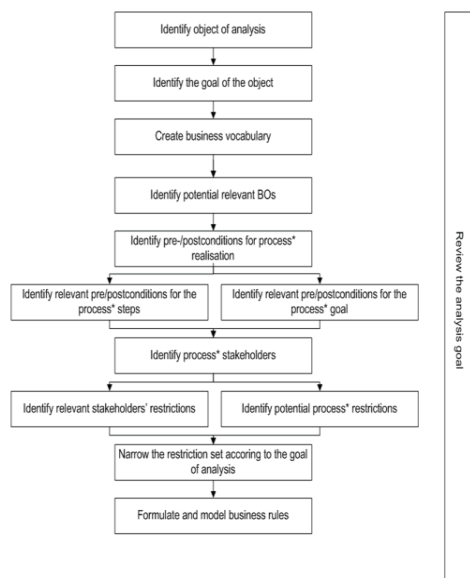
III.   BUSINESS RULES CAPTURING PROCESS

First of all a short definition of business rules is provided here. Being a constraint and definition for a business process, business rules are meant to influence and control the behavior of the business [2], specifying in declarative statements what shall be done, while business strategy defines the how it is done but on a macro level [12]. Three main clusters of business rules can be identified. One of them are business rules constrains [8]. These are must or must not statements that forbid a certain process execution. Derivation rules are calculated or derived from the already given information, i.e. certain discount policy can be captured in a set of derivation rules [8]. Often a business rule implies an IF-THEN relation that connects the business part with an element from the relevant environment. These are process rules that can trigger or hinder an action. A relevant environment is a term taken from the systemic view on the enterprise as a system that is situated in a relevant environment, i.e. system elements have (potential) connections to the elements from the outside world that can affect the business processes. The process rules are often found in the programming code of the business application that supports business processes. Now the suggested business rules capturing process is described (figure 2), while being applied on the business process model pictured above (figure1). This process can be used during the business rules-centered system analysis [3] or for business rules identification within a (set of) process(es) for their further implementation into a BPM allocation system. Therefore the assumption is made, that this discovery process can be a part

of a more complex analysis project that pursuits a certain goal. The capturing process focuses on the identification of the potential business rules sources or generators. First, the area of analysis needs to be defined. Here, the area is well limited being the self-contained business process model.

TABLE I.   EXAMPLE BUSINESS VOCABULARY

Term	Definition	Synonym
Client	a natural person who accesses or is willing to access the services offered by the credit institution	customer, beneficiary, credit user
clerk	A natural person who consults the client on questions related to the services offered by the credit institution	customer service, front desk
Credit application	is a form that captures customer's data for a further decision on the credit allowance	form, blank, application, credit form
…..	……..	……..

Further, identifying the goal of analysis helps the importance of involved potential business objects that can be business rules' sources or sinks needs to be defined. Here, the goal is to capture all business rules involved for efficient and accurate process execution using the existing business process model. Next, the goal of the object under analysis, i.e. the business process, needs to be identified. This allows further definition of the importance of involved potential business objects that can be business rules sources or sinks. The goal of the process can be identified as being a positive result of the process of the credit request, for both: customers and the credit institution, though the "positive" process output is contradictive for the involved parties when the requirements are considered. As a next step, a mandatory business vocabulary of the terms used in the analyzed context needs to be established. Here a short example of a business vocabulary is shown in table 1. Terms and their synonyms of the business vocabulary are strongly dependent on the culture and terms used in the enterprise. Now, business objects that are present in the environment of the process need to be described. Business objects can be the actors involved in the process, information systems, and market members, suppliers, etc. Since a business process is situated in a complex business environment there are multiple business objects that impact the process. Therefore their importance and relation to the goal of analysis needs to be defined. In section 4 a possible approach to this question is shown. Process- guiding rules can often be identified by the use of a gateway in a modeled process flow, which can be seen as the first step for business rules identification [9].

Figure 2. Business Rules Capturing Process

Questioning the implicit (or explicit) pre- and post conditions of a process steps realization can also provide a indication on business rules that are needed to achieve successful automated process execution. For identification of further potential business rules knowing the sources of the pre- and post-conditions for the process goal achievement can be helpful. Here the pre- and post conditions for process realization are identified as for pre-conditions: the incoming credit request, service availability for further request processing, customer data and customer management system availability; for post-conditions: filled in credit form and saved customer data. Pre- and post-conditions, as well as the stakeholders' requirements for each of the process steps are shown in the table 2 and 3 respectively. Next step of the process suggests the identification of the process stakeholders. Possible restrictions coming from the stakeholders need to be specified and their impact on the process or analysis goal evaluated. An important structuring criterion for found business rules candidates is their affiliation to the goal of the analysis. Here following stakeholders can be identified: Customer, credit institution (bank), customer service (clerk) and credit manager. Stakeholders' restrictions can be summarized as expectancy of: maximum transparency (including clear and comprehensible decision guidelines), minimal possible processing time (maximum possible process automation), maximum benefit (including clear accordance of requirements and possibilities), and maximal possible accuracy (meaning clear decision guidelines and clear requirements formulation).

The last step of the process includes formulating constrains,conditions and policies as rules and therefore making them visible and operative. In this step the identified rules are modeled and can be integrated into the allocation system for business process management.

TABLE II. TOWARDS IDENTIFIED BUSINESS RULES (A)

Process #	Process Step	Pre-Condition
1.1	Get Customer data	Correct data capturing form (content)
1.2	State credibility	Data were inserted correctly and completely into the check system
1.3	Provide credit consultation	Primer data check was successful
1.4	Check credit history	Corrected customer data Correct connection to information system
1.5	Provide detailed consultancy	Positive results from credit history check
1.6	Provide forms for credit application	Positive results from 1.2 and 1.3 Customer is satisfied with the given information
2.1	Check customer credibility	Customer data and check results captured
2.2	Run credit history check	Customer file exists Customer data complete Interfaces to information sources defined
2.3	Insert customer data	Customer file existent Checks results computed

During the entire process the main point of reference that is needed to take decisions on relevance of business objects is the goal of the analysis, i.e. the project goal. In the business context identifying controlling structures may be conducted to find aspects for automation, optimization of the process,requirements definition or analysis of requirements conformance. Further purposes may be documentation of knowledge or providing a structure for future controlling activities. Referring to the project goal during all the phases allows a focused and comprehensive information gathering and processing.

TABLE III. TOWARDS IDENTIFIED BUSINESS RULES (B)

Process #	Post-Condition	Requirements
1.1	Correct data transformation standard	Data capturing form needs to reflect the bank customer policy
1.2	Results are presented clearly and in given time	CMS to be connected to crucial information sources; Information requirements are clear and reflect business credit policy
1.3	Customer was given clear and complete information	Competency of the customer service guidelines
1.4	Results are presented clearly and completely in given time	See process step 1.2
1.5	See process step 1.3	See process step 1.3
1.6	Complete credit application form	Application form corresponds to business credit policy;

		Customer data corresponds to guidelines for credit admission decision
2.1	Results of credibility checks captured and displayed	Complete data for decision support; Indicators for decision support
2.2	Results are saved in customers file Results are displayed	Known information sources and their mapping to indicators for decision support
2.3	Results displayed and saved to customer file	Customer file update; Performance in given time

IV. IDENTIFYING CONSIDERABLE BUSINESS OBJECTS

As already mentioned above, many objects, i.e. possible sources and sinks for rules can be identified as being involved in the process. To narrow their number, or to identify further stakeholders, a decision or filtering process is applied (see figures 3 and 4). Here a possible decision tree is shown that can be used to guide the decision of whether or not to include a person and an information system respectively, e.g. an organizational role, specific person or BPM suite, as a rule source or sink that must be taken into account. The defined analysis goal is here the main referential entity. The decision process can be applied similarly to a decision on a specific application system used in the process. As information technology is often present in the business environment and is crucial for business process execution, it is important to define which application is specifically important under the consideration of the analysis goal.

Figure 4. Decision Tree for System Involvement

whether all of the stakeholders are important, i.e. significantly constrain the process flow, for business rules extraction. Using the decision trees shown in figures 3 and 4 it is easily seen, that the actors but also customer's requirements on this process are important, since he or she is directly involved in the procedure.

The CRM system can also be regarded as a process actor that is directly involved into the process execution and therefore needs to be taken into account as a business rule sink or source.

V. RESULTS OF APPLYING THE BUSINESS RULES CAPTURING PROCESS

Tables 2 and 3 show the detailed application of the business rules capturing process on process steps defining their pre- and post conditions. According to the identified requirements their clustering towards further specification of business rules can be made. To satisfy requirements for the maximum possible transparency in decision making, creation of instruments known from the area of knowledge-management like best practices or guidelines can be used. This requires externalization of the business policy, therefore allowing its consistent application and correct implementation, execution and management within the supporting informational systems. Explicit business policy will also allow the management and adaptation of data collection and evaluation. Further findings refer to the interfaces between the involved information systems. The CMS needs to support several decisions. The needed parameters can be either formulated in code or the system may communicate with other system by requesting certain parameters. In the first case the calculation rules, including the needed parameters, need to be defined. In the latter case formats and interface and compatibility requirements need to be defined so that data transfer can be performed automatically.
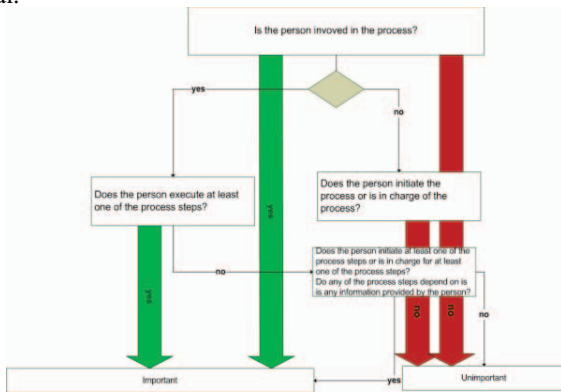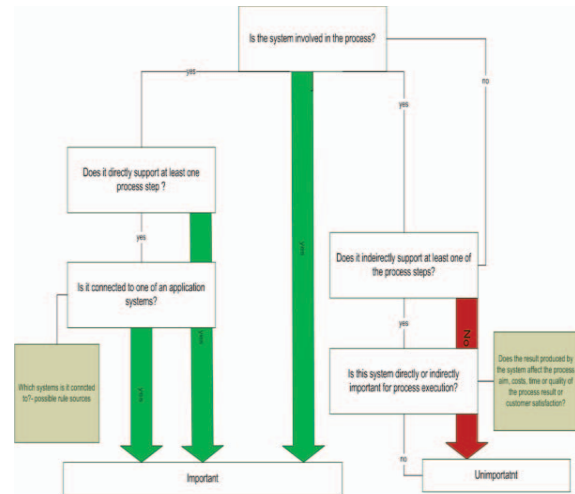
Figure 3. Decision Tree for Actor's Involvement

During the business rules capturing analysis two (personified) process actors but three stakeholders for the process execution were identified. Here the question arises,

Figure 5 shows modified exemplary business process presented in figure 1 but includes business rules that were derived from the identified requirements. Rule 1 includes the

actions and decisions taken during the credibility check, whereas Rule 1.1 is the decision regarding the particular case when the credibility check is negative. Rule 2 includes the decision logic and resulting actions for the case when the customer's credit history needs to be revised. Rule 2.1 covers the particular case when the history check delivers negative or insufficient results. These rules are derived from the process including the requirements summarized in tables 2 and 3. They show that process steps 1.2 and 1.3 are referred to by the process steps 1.4 and 1.5 as far as the requirements are concerned. Due to this fact the common underlying logic was captured using the business rules.
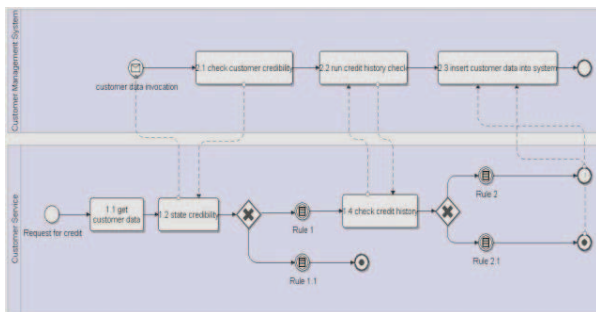

Figure 5.   Credit Check Process with Business Rules

VI.   RELATED WORK

In the area of business rules design and capturing the work of van Halle [10], [11], Morgan [4] and Ross [5], [7] is very important. Though this work is fundamental, a structured process for business rules identification is still missing. The Business Rules Group [2] sees the main source for business rules in business policies that are often described in an informal and general fashion. These statements need to be decomposed into formal and specific statements of facts, terms, etc. Next the extracted rule needs to be analyzed concerning its coverage of a fundamental aspect of the business. Similar to this approach [1] see business rules sources in business objectives and policy statements. Suggesting a structural and hierarchical refinement of objectives, goals and measures captured in those statements when the goal is completed. No further specification is made here. A concrete proceeding for rule discovery is not provided.

VII.   CONCLUSION AND OUTLOOK

In this paper a business rules capturing process based on rules identification and filtering with the focus on the analysis goal was presented. This approach is meant to reduce the number of important rules sources by defining their importance relative to the goal. It was also shown, that replacing process steps with business rules leads to a more compact process model that only includes the active tasks, while the logic is captured in the rules. Therefore, process flow automation and business logic management and integration can be performed focused and effective. A decision guiding process on requirements sources in a business process was presented and applied on a simple example. Future work will include the refinement of the business rules capturing process, a more detailed analysis of the importance evaluation of requirements sources, studies on the complexity variations of business process models with externalized business rules and broader application of the business rules capturing process.

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