Towards a Method for Integrated Semi-Automated Business Process and Regulations Compliance Management for Continuous Requirements Engineering

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Abstract. Continuous change of requirements poses a challenge for every modern organization. Especially, ever changing regulatory requirements that affect business processes and, if not fulfilled, can cause an organization even legal problems. Also there is increased pressure on regulatory institutions when it comes to maintaining integrity and coherence of requirement package. By regulatory requirements we mean legislation, regulations of municipalities, external regulatory requirements and also internal organizational policies. The purpose of this paper is twofold, first, we briefly discuss existing limitations in existing business process modelling solution in the context of compliance management, and, second, we propose a high-level method to support organizations stay compliant with regulatory requirements in the changing environment.

Keywords: Business process compliance, compliance management, regulatory requirements.

1 Introduction

From one side, modern organizations are under constant pressure to adhere to various types of regulations, e.g., legislation, regulations, internal policies, and industry best practices. Non-adherence to regulations can cost organization legal problems, and can lead to unsatisfied customers and profit-loss for shareholders. From another side, to improve daily operations and implement best practices, organizations nowadays are empowered with business process modelling methods and tools. A plethora of business process modelling tools exists to help organization analyse existing business processes – starting from drawing *as-is* business process diagrams to executing *to-be* business process models. However, there is a gap between continuously changing business process models that are maintained in a specific set of tools, and continuously changing regulatory requirements that usually are maintained outside organizations. There are tools that provide support for compliance management by means of *Business Rules Engine*, however, in most cases business rules must be entered manually and there is no live linkage with external legislative and regulative sources.

This gap uncovers the need to develop a method for compliance management solution that is capable to link business process models with regulatory documents, and mechanisms for analysing changes in both to continuously support compliance and requirements engineering. As a response to this need, the purpose of this paper is to present existing gap and to propose a high-level method for integrated semi-automated business process and regulations compliance management for continuous requirements engineering. *Integrated* because method implies existence of tool with two perspectives – business process modelling perspective, and regulative documents perspective. *Semi-automated* because human intelligence is a necessary condition to provide a trustful linkage between business process models and regulatory documents. We assume that the tool for integrated automated business process compliance management must integrate business process modelling solution, solution for processing a regulatory document, solution for linking regulatory document with business process model and automated compliance maintenance between business process model and regulatory document.

Let's review an example from the payment card industry. Payment card industry organizations (VISA, MasterCard, China UnionPay, etc.) periodically release requirements, which card issuers and acquirers (typically banks and processing centers) must be compliant with, see Figure 1. As a result card software vendors must evaluate gaps and implement necessary changes for software. Failure to comply with requirements threatens with potentially unsatisfied customers and heavy fines from international payment card organizations.

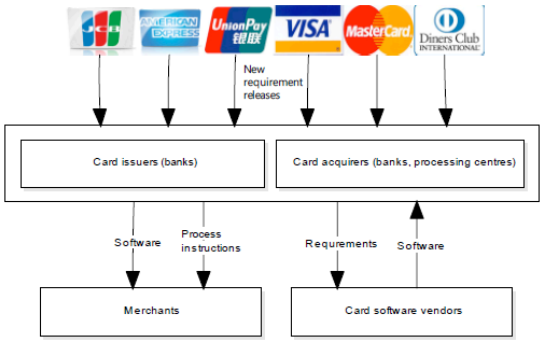

Fig. 1. Requirements of payment card industry to third parties.

Nowadays organizations employ industry modelling standards like BPMN [1] to understand and improve business processes. Business Process Model and Notation (BPMN) [1] is the de-facto standard for representing in a very expressive graphical way the processes occurring in virtually every kind of organizations [2]. BPMN specification [3] states the ambition to provide the common language and visual notation for both business and technical users. An a priori imposed standard vocabulary is meant to avoid frequent meta-discussions on concepts between model stakeholders, and to facilitate knowledge transfer [4].

The paper is structured as follows. In Section 2 related work is presented. In Section 3 we discuss existing gap in compliance management. In Section 4 we present a high-level method. In Section 5 brief conclusion and directions of future work are presented.

2 Related Works

Compliance of business processes has a significant research track and still attracts interest from academia and practitioners. For instance, the author of [5] contributes a comprehensive survey of existing solutions to Regulatory Compliance Management (RCM) and attempts to give a definition of RCM in the context of BPM.

To illustrate the spectrum of approaches we can look in the thesis [6] where the author provides a formal approach to support process design-time compliance checking. The thesis addresses the problem of consistency checking among various compliance requirements. Also, the thesis discuss checking compliance requirements against process models automatically.

In [7] the authors propose logic based formalism for describing the semantics of business contracts and the semantics of compliance checking procedures and close the gap between business processes and business contracts. In [8] the author focuses on compliance by design and extends artefact-centric approach to model compliance rules using Petri nets and shows how compliant business processes can be synthesized automatically from the point of view of the involved business objects. In [9] authors present an end-to-end pattern based approach for the specification of compliance requirements where compliance patterns are visually represented as BPMN-Q queries.

In [10] authors present principles for creating flexibility and agility when implementing new or revised policies into business processes. These principles include: 1) defining and using business services, 2) integrating and orchestrating business services through the use of events, 3) separating process, knowledge and resources and 4) implementing policy in an integrated manner. In [11] authors analyse conceptualisation of modelling methods and conclude how the components of a specific implementation platform support the design of modelling methods.

One of the main issues legal informatics domain addresses is how to link business process models to the legal documents in order to create traceable laws models [12] Changes in legal documents obligate the organization to correspondingly alter its business processes in order to function in an existing environment. The authors of [12] state that legal documents must have a formal, machine-readable structure in order to access legal documents and bond them or specific parts of them to business process model elements as well as process sequence and data flow.

In [9] the authors address the issue of utilizing a visual language, BPMN-Q, to create a pattern-based approach for the specification of compliance requirements and to express the compliance requirements visually in a way similar to that used by business experts to build process models.

The Legal Knowledge Interchange Format (LKIF) is a semantic web based language for representing legal knowledge in order to support modeling of legal domains and to facilitate interchange between legal knowledge-based systems [13].

AKOMA NTOSO schema is a set of XML machine-readable descriptions of official documents such as legislation, debate record, minutes, etc. that allow exchanging and reusing parliamentary, legislative and judiciary documents more efficiently enabling addition of descriptive structure (markup) to the content of parliamentary and legislative documents [14]. There are several tools available which implement AKOMA NTOSO standard, the most extensive one is Lime tool [15]. Presently, standard considers set types of regulations which can be marked up with standard schema. Customization of schema to make it fit to the structure of regulations of Republic of Latvia is required.

3 Existing Gap

OMG [16] has recognized model serialization and interchange between BPMN tools as an important issue. They initiated the BPMN Model Interchange Working Group (BPMN MIWG) [17] with the goal to provide support for modeling tool developers and the standard-related issues which inhibit interchange of models between tools [18]. Outputs of initiative are [17]:

1. BPMN 2.0 Test Cases (Models, Diagrams, Serializations)
2. Feature Test Matrix
3. BPMN 2.0 Issues
4. Interchange Guidelines

This demonstration proves to the BPM community that BPMN is delivering on its promises by showcasing leading 12 BPMN vendors implementing the BPMN interchange format [19]. There are known problems with model interchange: Most of the effort in creating BPMN 2.0 involved development of the formal meta-model and its corresponding XML representation. Most BPMN tool vendors use XSD format.

Schema validation is not enough to guarantee BPMN 2.0 model correctness. The model must be created in accordance with the rules that are defined in the specification. A model can be valid per BPMN 2.0 XSD, but the rules might be violated [20].

The latest version of the Business Process Modeling Notation (BPMN 2.0) [1] adopts choreography as a first-class citizen. However, it remains an open question whether BPMN 2.0 is actually appropriate for capturing this concept.

In previous versions of BPMN, the only way to represent choreographies was via collaboration diagrams. In this new version, the choreography diagram and the conversation diagram were introduced in addition to the collaboration diagram. [X] Another way to look at choreography in BPMN 2.0 is to view it as a type of business contract between two or more organizations [21].

There is a lack of text processing tools for Latvian language in regards of natural language processing. Such tools could help to extract actors, tasks, time constraints, conditions and other elements of business processes from regulations in an automated way. However, Latvian language grammar can be considered quite complex and lots of researches are still required to move into advanced automated natural language processing solutions. Pattern recognition and machine learning offer significant tools for automatically analyzing the content of digitized documents and improving their

presentation [22]. In [23] the authors present a technique for detecting behavioral differences between business process models. Compared with the previous technique [5], the technique in this paper improves the efficiency of the detection by at least four orders of magnitudes [24].

4 Proposed High-Level Method

This section presents a high-level method for semi-automated analysis of regulations, in order to enable linkage of regulations to business process elements.

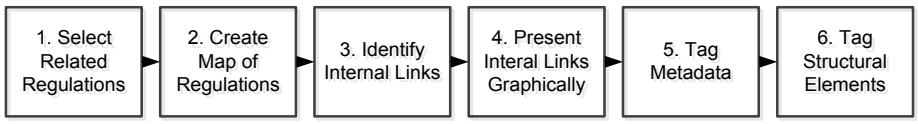

Fig. 2. The steps of the proposed method.

Proposed method consists of the following steps:

1. *Selecting related regulations*. This step is required in order to identify all related regulations to the business process modeling domain, i.e, identify all regulations which are relevant to business domain of particular business process model which is to be modeled or updated. Usually, this is a manual step performed using regulations databases and search engines. To make this step simpler, tool support is required to enable regulations interlinkage and categorization in business domains, thus choosing relevant business domain, related regulations can be found. In Latvia, the largest Internet portal of regulations [25] already enables regulations interlinkage and search of related regulations. Source is available publicly and free of charge.
2. *Creating map of regulations*. This step is required to visualize related regulations in a single landscape to gain general, macro view on regulations which governs particular business domain. This view is required to facilitate understanding of linkage of regulations and in case of changes of one regulation to be able quickly identify possibly affected related regulations which might require consideration for a change as well.
   In Figure 3 example of typical, basic map of regulations for Law of Republic of Latvia is presented. Usually, law is surrounded by multiple Regulations of Cabinet of Ministers, Regulations of Municipalities, Instructions issued by Public Authorities and modifications of Law itself. This basic map can be extended to add also explanations, translations, debate documents and other documents as required depending on the type of regulation considered.

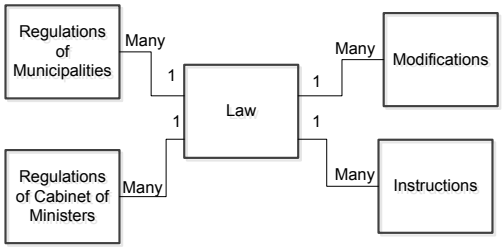

Fig. 3. The example of typical, basic map of regulations for Law of Republic of Latvia

3. *Identifying internal links in regulation*. This step moves from general, macro view of scope of regulations governing particular business domain as presented in Map of Regulations to a specific, detailed view offers particular regulation. Internal links represent internal structure of the regulation.
4. *Representing internal links graphically*. In [26] authors have proposed representation of internal and external links of regulation in a form on regulations diagraph. In scope of this method approach presented in research [26] is limited to representing internal links only.

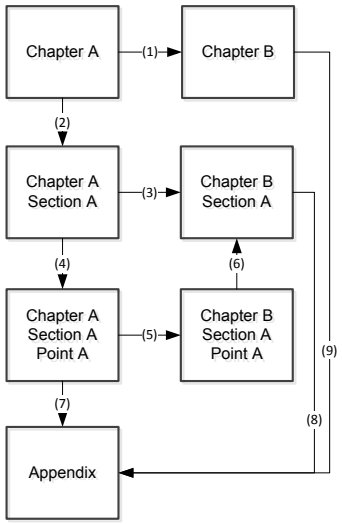

Fig. 4. A typical internal relations used in Laws of Republic of Latvia.

In graph presented in Figure 4 typical internal relations used in Laws of Republic of Latvia are represented. These relations are as follows: reference from chapter to other chapter of the same regulation (1); reference from chapter to section of the same chapter (2); reference from section of chapter to other section of other chapter (3); reference from section of chapter to the

point of section of chapter (4); reference from point of section of chapter to point of section of other chapter (5); reference from point of section of chapter to the section of chapter (6); references to the appendix of regulation (7, 8, 9). This list of internal relations is not exhaustive and might differ depending on type of regulation. This view is required to facilitate understanding of linkage of internal structure of regulation by decomposing structure of regulation and in case of changes of one part of regulation to be able quickly identify possibly affected related parts of regulation which might require consideration for a change as well.

5. *Tagging metadata of regulation*. This step is required to enable search of regulation by various metadata as well as other capabilities of automatic processing of regulations. Akoma Ntoso [10] standard was investigated to implement this step. Standard provides set of standard tags to mark up metadata elements which describe regulatory documents. Important feature of standard is a concept of separation of metadata of regulation from content of regulation. According to the standard all metadata is editorial in nature, it is not content, but statements about the content. The Akoma Ntoso metadata section provides a separate place for enriching a document with metadata, a place that is clearly identified as such and is dated and authored differently than the content of the text itself [10].
6. *Tagging structural elements of regulation*. Authors in [27] have introduced automatic identification of structure of regulation in tool prototype. This step is required to enable automatic process of structure of regulation. Once document is structured into structural parts, it is possible to enable change identification, e.g. clearly identify which section/chapter/point is changed when new version of regulations becomes available. This becomes important when references to particular structure of regulations are used, for example, references from business process elements. Previous work [22] of authors can be extended to apply Akoma Ntoso standard to markup the structure of the content (chapter, sections, clauses, et.) and to markup the semantic aspects of some parts of the text (such as references, times and dates, people, etc.) [10]. Standard provides standard set of markups, however, specific customization for regulations of Republic of Latvia is required.

When these steps are performed, regulations can be considered as prepared for further processing and linkage to business process models and elements of business process. Following further steps may be performed: tagging of business process elements in regulation (7) using extensions of sematic markup provided by Akoma Ntoso standard and construction of business process model from business process elements (8).

The method describes preparation of regulation for processing in information system with specific purpose: to enable linkage of regulation with business process models thus enabling capabilities to ensure mutual compliance and change management. Method might be extended to include representation of the flow of information between actors or functions, in order to be able to (re-)act in a timely fashion on changes on the process level.

5 Conclusions

This paper presents the high-level method for processing regulations to enable linkage of regulations with business process models thus enabling capabilities to ensure mutual compliance and change management. The main contributions of the paper are 1) highlighting existing limitations in existing business process modelling solutions in the context of compliance management, and, 2) proposing a high-level method to support organizations stay compliant with regulatory requirements in the changing environment.

This paper presents high-level method for semi-automated analysis of regulations, in order to enable linkage of regulations to business process elements. Method consists of six steps which walk through structuring regulation to enable automatic processing of regulation and prepares text of regulation for linkage to business process elements.

Proposed method is one part of a meta-model, so future tasks are to develop and validate tool prototype which implements proposed method and overall solution to meet the objective of agile regulation and process management.

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