Business Processes and Regulations Compliance Management Technology

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***Abstract*—Organizations must comply with a number of external and internal regulations for business governance and must ensure that their processes are running accordingly to requirements of regulations. Therefore business process and regulations compliance analysis audit and management tasks take a very important role in daily operational activities for each organization. Due to high complexity this task can become challenging. In some domains regulations are changing rapidly. Process models must be flexible and easy adjustable to changing requirements, since the lack of ability to comply with regulations can lower down the competitiveness of an organizations. Thus, rapid changes of regulations require rapid changes of related business processes. The goal of the PhD work is to develop business process and regulations compliance management technology which should enable business process construction from regulations and change monitoring of regulations and business processes to ensure easy and rapid modification of business process model or regulations, thus also ensuring compliance.**

***Index Terms*—business process, regulations, compliance.**

I. Research Questions and Hypotheses

In most organizations business processes are affected by requirements of regulations. Many organizations use business process management methodologies to model, simulate, execute, monitor and optimize business processes. Business process models can also serve as a proof that organization is running accordingly to regulations. To ensure such a proof, organizations must form and manage linkage between regulations and business processes [1].

With the regulations the author means documents which record knowledge about "what" and "how" the goals of the organisations must be achieved and products or services produced or provided [9], in other words, any document which contain valid source of regulatory requirements according to which business processes of the organization must be executed [1].

From an organization's point of view, the challenge is the traditional approach of treating regulations separately from business processes [2]. At a high level of abstraction regulations can be divided into the following categories: mandatory regulations, which are issued by governing bodies; "good to have" non-mandatory regulations such as various industry standards; and internal regulations, which are developed by enterprise. From the enterprise point of view, the first two types of regulations are regarded as external regulations. Internal regulation may depend on (or mirror) external regulations as well as they may be independent of external regulations [2].

Usually organizations ensure business process compliance with regulations through audits. Due to the need to provide regular updates on compliance, a more strategic approach of compliance management is needed. This implied a shift from regular reviews to continual assurance and introduced a need for advanced compliance management methodologies and tools that reflect and ensure real time compliance management [2].

In many cases organizations have their business processes specified independently or not specifically linked with regulations, even if business processes are directly impacted by regulations, e.g. in governmental and municipal organizations. Reasons for such situation can be lack of widely known and easily applicable methodologies and weak support of easy to use IT tools to link business processes to regulations [4].

Since requirements under which an organization must operate are expressed in regulations and business processes represent procedure how these requirements should be executed, it is a rational need to find a way to link these two concepts. Characteristics of regulations make them challenging to use and directly apply in business processes, therefore captured (identified) business process elements within regulatory text can be a point to link regulatory documents with business process model.

The following issues are selected for further investigations as research questions in order to address business process and regulations compliance management [4]:

- *Management of regulations* - extraction of regulatory requirements; development of regulatory document generation and update algorithm, solutions for versioning of regulations.
- *Linkage of regulations to business processes* - solutions to link business processes with regulations and representation capabilities of regulatory text parts/elements within business process model and business process elements.

- *Compliance management* - compliance algorithms and software tools capabilities to enable regulations and business process compliance management.

Goal of the PhD work is to develop business process and regulations compliance management technology which will consist of the method & tool prototype. Developed method & tool should address and provide solutions for the following topics:

- Management of regulations - solutions for retrieval, storing, updating, and versioning of regulations).
- Extraction of requirements from regulations - solution for capturing requirements from regulations which are affecting business processes.
- Linkage of business processes and regulations.
- Business process and regulations mutual change management and on-time compliance monitoring.

II. The State of the Art

There is a lot of research available that propose approaches and solutions for analyzing regulations, capturing requirements from regulations, facilitating understating of regulations by graphical representation offering various modelling languages and syntaxes, and managing compliance with requirements and business processes.

Kharbili [10] presents a conceptual framework and thorough analysis of existing approaches to automated regulatory compliance management. Relationships between business processes and regulations are analyzed and some suggestions about their monitoring are provided in research [11]-[15].

The most important work that is related to my PhD work are the following:

Kiyavitskaya et al [7] have proposed method for extracting rights and obligations from regulations and continuing the research [8] they have examined tools to support this by applying Cerno framework for textual semantic annotation and have proposed a tool for semi-automatic semantic annotation of concepts. In research authors have focused on alignment of information system requirements with regulations. However, ideas of research can be analyzed and expanded with focus to align requirements with business processes. Also national (in this case Latvian) language semantic challenges need to be addressed in further research of PhD work.

Araujo et al [4] represent the method for validating business processes with respect to business rules that are captured from regulations. The method does not address challenges of extracting requirements from regulations; however it is practical and applicable approach to trace and visualize compliance.

Governatori et al [6] validates business processes with business contracts by providing logic-based formalism for describing both semantics of contract and semantics of compliance checking procedures. Approach is valid in scope of PhD research and will be applied in further case studies by testing it to regulations, as both, regulations and contracts, contain requirements for business processes.

Also other research [21]-[28] ideas might be applicable in scope of further research.

Process management and governance frameworks are under investigation as they specify how processes can be managed or governed. Specific regulations and governance frameworks include, but are not limited to:

- Basel II [16] - regulation for the banking and financial sectors, which is the required implementation of the EU in all EU countries since January 1, 2007.
- Sarbanes-Oxley Act (SOX) [19] - federal law in the United States of America to ensure the accuracy and reliability of published financial data.
- Control Objectives for Information and Related Technology (COBIT) [17] - comprises a range of the best practices for IT management and control. COBIT is a top-down approach from the enterprise goals, to the derived IT goals, to their impact on IT architecture [18].

III. Author's Contributions and Originality

Several research topics have been covered so far in scope of PhD work with great contribution of supervisor professor and in collaboration with other colleagues.

This sections further details research made so far [1], [2]. [3].

In research paper [1] a high-level architecture of Document Analysis & Change detection system has been proposed, responsible for retrieval of the regulations, document analysis and preparation for linkage to the business processes.

To enable linkage of the business process to the regulations in the business process management tools, authors of research faced the following challenges: (1) analysis of regulations, (2) detection of changes in regulations and application of detected changes to related business process models and elements, and (3) linkage integration in the business process management tools [1].

The goal of the research was to describe an approach to transform regulations into the form that contains annotated structural parts such as chapters, sections, articles, and sub articles that facilitate business process linkage to the specific structural part of relevant regulation, and link these structural parts to the business process. Also an approach for business process and regulations' change management was proposed. By applying this approach of regulations' change management authors could ensure regulation change monitoring thus facilitate up-to-date business process compliance with the regulations [1].

Results of the approach [1] were tested in practical example in ARIS business process management tool. Basic concept of the proposed approach are that regulation can be annotated and divided into structural parts thus enabling linkage options from particular business process activities to specific parts of the regulation. For annotation of regulation, UIMA annotation was selected. UIMA is appropriate for identification of structural parts of the regulation, because it ensures simple development and usage mechanism of the new components (Analysis Engine, UIMA PEAR). However the developed Paragraph

annotator should be improved to ensure higher precision of the detection of the structural parts of the regulation [1].

Research [2] reports an experience of authors in creating an enterprise model compliant with the Latvian Accounting Law. The focus is on a possibility to represent parts of the law in the form of business processes. The issues that the law considers together with the information on processes are organized in related sub-models. The main elements of the enterprise model sufficient for representing issues prescribed by the regulations were presented and discussed. The suitability of the de facto business process modeling standard BPMN 2.0 for representing regulations were examined [2]. The paper reports on enterprise modeling experiment that is based on a representation of regulations as reusable business process model parts. The experiment showed that for proper positioning of the parts it is necessary to represent in models not only the process as sequence of elements, but also other related information available in regulations. The paper proposes the enterprise model suitable for modeling regulation. The comparison of this model to a well-known enterprise model helps to see that the enterprise model has to include an events model as one of its sub-models for regulations modeling purposes [2].

The paper [2] contributes with described and illustrated limitations of BPMN 2.0 in its applicability for regulations modeling. It is a matter of future research to overcome these limitations, since due to its popularity the BPMN is still the main candidate for modeling regulations in situations where models are developed for public use [2]. Further experiments with other regulations may reveal some new requirements for enterprise and process models. The general aim of the research [2] is to provide reusable business process model parts (that mirror regulations) in cloud solution [3] in order to enable easier enterprise business process compliance to regulations.

In Research [3] authors proposes an approach for managing regulation-dependent business process parts in cloud solution. The commonalities and differences between business processes of organizations depend on the level of abstraction at which the processes are represented [3]. At lower levels of abstraction the processes are complex and their variations cannot be captured by specific business process frameworks. However there are some parts of processes that are common to many enterprises or several units in an enterprise, for instance, the process parts that must conform to particular regulations [3]. The purpose of the approach is to minimize the total time, which organizations use for incorporation of regulations in their business processes [3].

Cloud solution considers the following capabilities [3]:

- Enterprise can access its private resources such as internal regulations stored on the cloud.
- Multiple enterprises can access the same resources such as external regulations [3].

Enterprise business processes must comply with or take into consideration many different regulations. Parts of these regulations are common to several organizations or several processes in the same organization. Analysis of these regulations and their inclusion in business process models require large amount of time and effort. In this paper authors envision an approach where regulations are translated into business process model "spare parts" or raw materials that can be used by designers of business processes at several enterprises (or several units in one enterprise) [3]. The solution is based on the use of the regulation digraph, which is related to the regulations and the business process "spare parts" or raw materials amalgamated in the spare parts repository. The research presented in the paper only blueprints the approach and needs further researche and experiments [3].

IV. The Research Methods

Primary research methods are collation, summary and synthesis of existing researche and information in scope of dissertation thesis, as well as original research to develop solutions for the identified problems through creating and validation of new approaches using design science approach.

Also an evaluation of a prototype to provide credible evidence of results in target user groups, collection and analysis of user feedback and evaluation of feedback against the goals of the research to be achieved is planned.

V. A Description of the Progress

A. Current Progress of the Research

There were the following stages set to reach goals of PhD work:

(1) To collect, analyze and to get introduced with background materials and related publications.
(2) To create method to determine applicable regulations to business processes; to classify and structure regulations; to ensure traceability within regulation itself and other applicable regulations.
(3) To create method to extract (capture) requirements from applicable regulations; transform or link regulatory constructs to business process elements and models.
(4) To link business process model and steps with regulatory document; to model business processes incorporating requirements/regulatory constructs; to handle inconsistencies between regulatory requirements.
(5) To ensure traceability between business process and its steps with requirements, to ensure that all applicable requirements are present.
(6) To provide real time compliance monitoring and change detection; to create change detection procedure and solution architecture.
(7) To develop software solution prototype.

From above list following tasks have already been addressed: task (1) is in constant progress to follow news in research themes associated with PhD work; tasks (2) – (3) are partly done in research [1] and [3], however additional research and validation of new ideas are required; tasks (4) – (5) are also partly done in research [1], [2] and [3], but also additional research is required; tasks (6)-(7) yet to be performed. However, main activities to combine work done so far in

applicable method and conduct further research to reach the goals are still to be completed.

B. Further Research

Develop method to identify business process elements in regulatory text (manually or automatically); analyze and select suitable business process modelling language; develop compliance monitoring method and algorithm; validate solution idea with target user groups and develop software solution prototype.

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