

Legal Requirements for Public Process Modeling

A BPMN Meta-model Extension

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Abstract— Actually, business process modeling presents an important issue for public institutions. However, due to the high complexity of public processes and their characterizing requirements, such as legal one, appropriate modeling languages are not really available yet. In this work, we propose an extension of one of the most useful modeling language, namely Business Process Modeling Notation (BPMN), to support legal requirements.

Keywords- Business Process Management (BPM); Process Modeling; Business Process Modeling Notation (BPMN); Public Processes; Legal Requirements.

I. INTRODUCTION

Face to their hard environment, translates by the increased needs of citizens, public institutions work to improve their efficiency. These actions often pass by an improvement or a reorganization of their processes. To achieve this, the Business Process Management (BPM) aims to model these processes in order to better understand them, to put in evidence the interactions and to improve them.

The main objective of business process modeling is to produce a description of reality. It must represents rules, objectives, relationships and interactions of processes. However, due to the high complexity of public processes and their characterizing requirements, such as legal one, appropriate modeling languages are not really available yet [1-3]. Indeed, the modeling in this context cannot concentrate exclusively on the needs of customers because the internal workflow of public institutions is governed by a fairly strict legal framework. For this purpose, several research works try to exploit those who are already successfully deployed in the private sector, by proposing extensions or adaptations.

Several process modeling languages and notations exist. One of the most broadly used languages is Business Process Modeling Notation (BPMN). Its primary motivations are to provide a meta-model and an easy standard way in order to define, model and visualize business process models. However, despite its rich range of notations, this language has several limitations which make it incapable to represent some kinds of processes (such as public processes). In other words, BPMN does not provide all notations that allow representing their requirements characterizing.

The objective of this work is to focus on the legal requirement by proposing an extension for BPMN meta-model for covering some of its various concepts. These are provided by the set of legal texts associated to each public institution.

The treated aspects in this paper are: (1) organizational aspect: a public process can be inter-organizational and in this case an organizational unit or a public institution is considered as a business role, (2) service aspect: the main mission of public institutions is to provide services to its citizens and stakeholders. Therefore, it is important to represent this purpose during the process modeling, (3) process aspect: to ensure compliance management of processes with the law that governing them, the modeling of such processes must provide notations for distinguishing the legal components (i.e. provided by legal texts). These represent the stable parts of the future models, (4) process evaluation aspect: public processes must be evaluated in order to determine whether desired objectives are achieved or not. Evaluation of the essence of public processes, as well as the final output (service) is essential to ensure the value creation on a continuous basis, and therefore the satisfaction of stakeholders and citizens.

The remainder of the paper is organized as follow:

- The business process modeling is one of BPM lifecycle phases. This one is presented in the second part.
- Public processes are heavily based on legal regulations and norms, and it is indispensable to consider them in the modeling phase. To achieve this, modeling approach, that we have proposed, is presented in the third part.
- As previously mentioned, we try to propose an extension of BPMN meta-model. This language, as well as their basic elements, are presented in the fourth part.
- Despite the rich range of graphic notations offered by BPMN, this language has a number of limitations which induced researchers to propose extensions depending on the target environment. Some works of these are presented in the fifth part.

- BPMN extension must obey to a specific extension mechanism. It also lists a set of permissions and rules that must be considered. This mechanism as well as the extended meta-model and the new added aspects are illustrated in the sixth part.
- Finally, we conclude the paper with a conclusion and some future works in the seventh part.

II. BUSINESS PROCESS MANAGEMENT LIFE CYCLE

BPM is a process-centered approach which combines information and communication technologies (ICT) with the process and governing methodologies in order to achieve targets in perfect alignment with the strategy of the company [4]. It is the result of the collaboration between business professionals and computer engineers in order to promote the implementation of efficient, flexible and transparent business processes [4].

The main benefits of BPM as a management discipline are the organization, the stowing of ICT and the performance monitoring [5]. Today, this one is associated to workflow technologies to give birth of the Business Process Management Systems known as BPMS. The BPMS are new generation of software allowing the rapid development of process-oriented applications and workflow management systems (WfMS) are one of its main tools.

The BPM life cycle requires an iterative view to ensure that the processes can evolve and be optimized in short cycles. Several life cycles are proposed in numerous research works. The analysis of around ten of those last ones indicates that life cycles differ as the emphasis is put on (a) the will of piloting such as (ISO 9000, on 2002), (b) the business level such as (Bischoff and Huschke, on 2008) or (c) information systems such as (Van Der Aalst, on 2010).

In the context of our research, we attempted reconciliation by proposing a generalized life cycle including five phases: plan, design, deploy, pilot end evaluate.

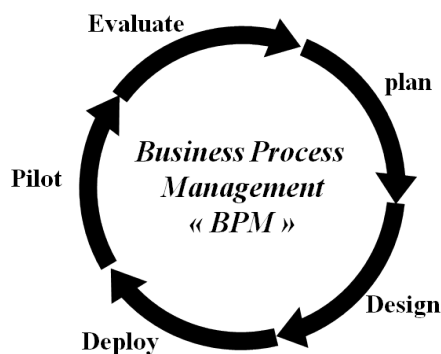


Figure 1. BPM generalized life cycle [5]

In this work, we focus on the phase of "Design." This one includes design and normalization of business processes. It generally uses a business process modeling language in order to graphically represent and simulate the set of processes.

Bad design involves a complex correction and a difficult evolution of business processes.

III. LEGAL REQUIREMENTS FOR PUBLIC PROCESS MODELING

Management and modeling of public processes can inherit the same approach used in private sector, but by taking into account the characteristics of these processes: in a context of public institution, processes are heavily based on legal regulations and norms [1][5][13].

The adopted modeling approach in this context research attempts to integrate the legal requirement through two main phases [5][11]:

A. Meticulous study of legal texts

Several legal texts are assigned to each public institution. These include all key concepts, rules and principles characterizing the process models to deploy. They also regulate how to create some outputs and specially services. The first step of the modeling phase is to extract these concepts. The objective is:

- Management of process compliance to develop with the laws that govern business activities.
- Identification of stable parts of process.
- Extraction of Business Rules and characteristic concepts.
- Extract of roles with their required skills in order to treat specific business activities.

All concepts resulting from this phase should not be reconsidered during the next phases.

B. Study of current processes

Its goal is to enrich the previous phase with other operational aspects. This phase includes:

- Identification of quick gains by identifying the operational flow in accordance with law.
- Collecting metrics of the current processes which allows enriching those described in the law and produce an analytical view of the organization.
- Extraction of actors with their required skills in order to identify those able to occupy the roles extracted from legal texts.

In order that all processes be modeled coherently according to legal requirements, it is important that the chosen modeling languages, support the different concepts extracted from the law.

However, appropriate modeling methodologies and tools are not really available yet. Therefore, many studies try to exploit those who are already successfully deployed in the private sector, by proposing extensions or adaptations.

IV. BUSINESS PROCESS MODELING NOTATION

The main objective of business process modeling is to produce a description of reality. As a consequence, it is important to have a notation that allows modeling the essence of processes as clearly as possible. This notation must represent rules, objectives, relationships and interaction of process.

Among the most common modeling languages is Business Process Modeling Notation (BPMN). BPMN allows describing business processes through a standardized graphical notation. Its primary goal is to provide a notation that is readily understandable by all business users, from the business analysts that create the initial drafts of the processes, to the technical developers responsible for implementing the technology that will perform those processes, and finally, to the business people who will manage and monitor those processes [10].

The four basic categories of elements of BPMN are: flow objects, connecting objects, swimlanes, and artifacts. Flow objects are the main graphical elements to define the behavior of a business process. There are three: events, activities, gateways. The following figure summarizes these different notations:




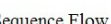




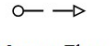
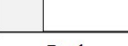
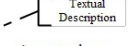


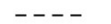

Flow Objects	Connecting Objects	Swimlanes	Artifacts
Events  Start  End  Message	 Sequence Flow	 Lane	 Data Object
Activities  Activity  Sub-process	 Message Flow	 Pool	 Annotations
Gateway  And Join/Split  Or Join/Split	 Association Flow		 Group

Figure 2. Basic categories of elements of BPMN [10]

The global meta-model representing these components are shown in the following figure:

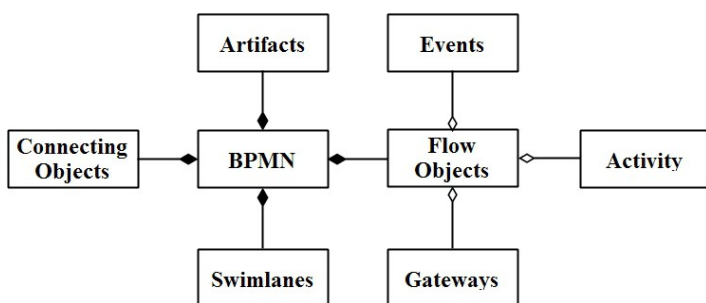


Figure 3. Global meta-model of BPMN [10]

V. RELATED WORKS

Despite the rich range of graphic notations offered by BPMN, this language has some limitations. For example, lanes and pools represent only organizational roles. They don't provide any information about their performance and skills. Another example is that BPMN don't provide possibilities to evaluate modeled processes and then possibilities to improve them. Some other limitations of BPMN are also detailed in [7].

Consequently, several studies look to extend the BPMN meta-model by enriching existing notations with others, in order to support the characteristics of the target context.

We cite, as example the work of [8] that focuses on the social aspect. The proposed approach consists in defining specific notations for BPMN in aim to describe the social behavior of processes supporting social networks. The proposed extension allows the specification of social activities (Publish, Comment, Vote, Invite, Rank) and social events (Receive Social Content, Receive Social Event). This one is made at the level of BPMN meta-model, as well as at the level of its notation. The authors also describe a technical framework for modeling and implementing these processes as integrated Web applications.

There's also the work of [6] that proposes an extension to the BPMN 2.0 meta-model and notation to support the modeling and visualization of resource perspective by means of this language. For these authors, the resource perspective of business processes refers to the link between the activities defined in the processes and the entities that carry out the work related to them, which are called resources. The extension is made at the level of 'lanes' and 'pools' by considering three aspects that must be represented in a process model: resource structure, work distribution and authorization.

Another work is [9] which propose an integrated environment for the development of business processes with security requirements in the Cloud. Indeed, the deployed business process can be suitable for specific applications. The extension of business process was studied to add security requirement to BPMN elements. Different security requirements were integrated like: integrity, privacy, access control, attack harm detection and non repudiation.

VI. EXTENSION OF BPMN META-MODEL FOR PUBLIC PROCESSES MODELING

As mentioned above, BPMN meta-model is extended by adding new attributes and elements to its predefined elements. However, Object Management Group¹ defines an extensibility mechanism that allows adding graphical elements and new features like attributes or markers to the modeling notation. We use this mechanism to define the additional elements which are needed to model public processes. It also lists a set of permissions and rules that must be considered.

This mechanism permits the following extensions [10]:

¹ Object Management Group (OMG): a non-profit association whose objective is to standardize and promote the object model (eg. UML, BPMN, CORBA, MDA, etc.).

- Additional attributes may be added to the elements defined in the specification.
- Additional markers and indicators may be added to graphical elements which are already defined in the specification.
- Additional graphical elements representing any kind of artifact may be added.
- Usage of colors for defining semantics is permitted.

The rules to respect during the extension mechanism [10]:

- The defined shapes in the specification must not be changed, and the shapes of extension elements must

not conflict with the shapes defined in the specification.

- The graphical elements should be easy to understand by any viewer of the process diagram.
- The extension elements should have the "look-and-feel" of BPMN. The main purpose of these rules is that the particular requirements of different domains can be easily understood by business experts.

The added extension elements can be classified into four categories: (1) organizational aspect, (2) service aspect, (3) process aspect, and (4) process evaluation aspect. The figure 4 represents the proposed extension.

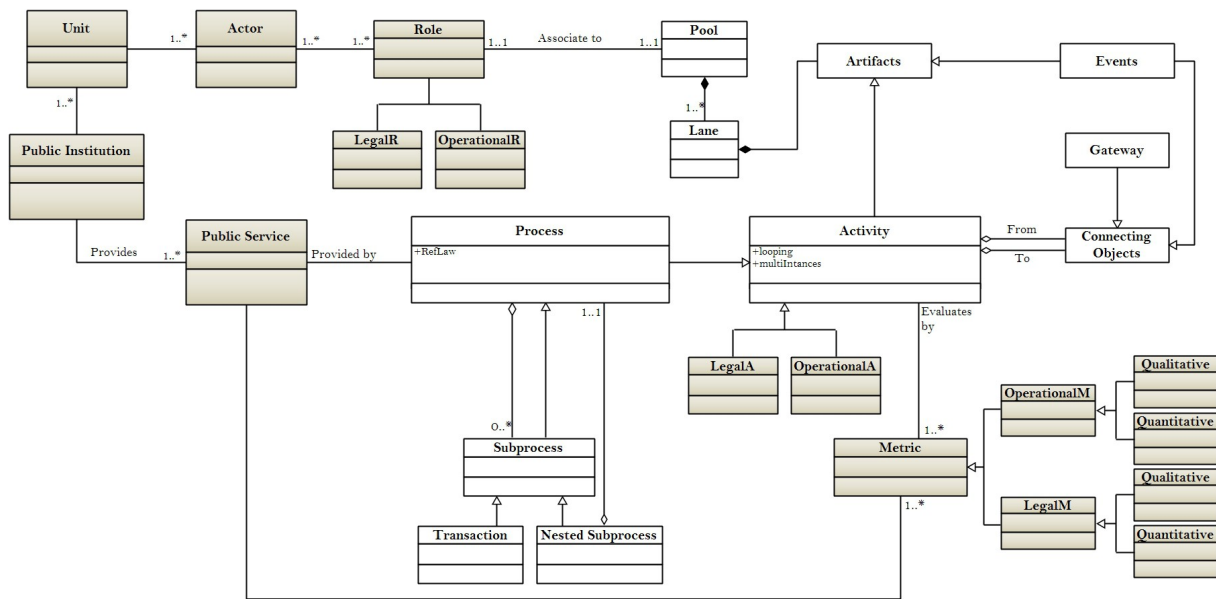


Figure 4. The extended meta-model

A. Organizational aspect

This is an important and indispensable aspect for the public process modeling. It identifies all participants implied in performing process.

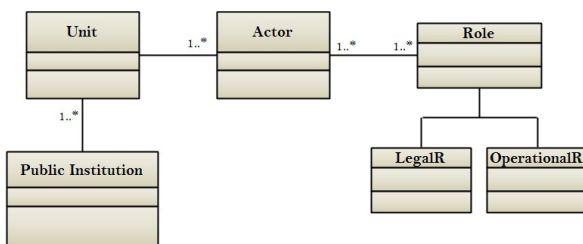


Figure 5. Component elements of organizational aspect

It covers, on one hand, the set of organizational "units" composing the "public institution", and on the other hand, the affectation of "actors" to each organizational unit.

Each "actor" takes one or several "roles" and each role can be affected to one or more actors.

Let remember that, in our context, we distinguish between legal and operational concepts. For this purpose one role can be "legal role" or "operational role".

Furthermore, each role is represented using "pool" or "lane". Note that in such a context the public processes can be inter-organizational. Thus, a "pool" can also be used for the representation of an organizational "unit" or more a "public institution".

To represent these concepts, we define the following notations which are associated to a "pool" or a "lane".


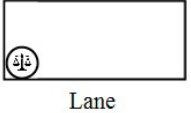
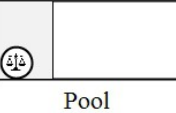

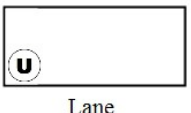
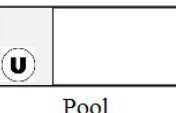

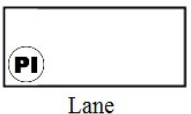
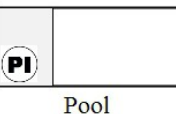
Notation	Example	
Legal Role 	 Lane	 Pool
Organizational Unit 	 Lane	 Pool
Public Institution 	 Lane	 Pool

Figure 6. Organizational aspect notations

B. Service aspect

This dimension represents the final output provided by an organizational "unit" (or public institution) as a result of the execution of a "process".

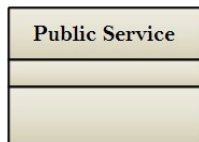


Figure 7. Component elements of service aspect

This component must describe the type of service and the beneficiary social entity. We define the notation below, to represent the textual description of the service resulting from a given process.

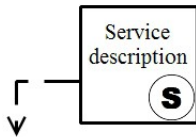


Figure 8. Notation for service description

C. Process aspect

A process is a set of interrelated or interacting activities which transforms inputs into output elements. Activities represent the core of any process.

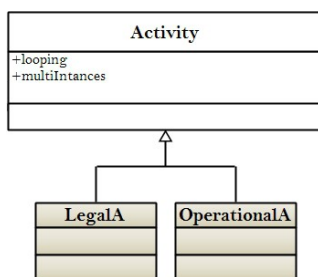


Figure 9. Legal and operational activities

Any process is subject to changes. These latter can be frequent for some parts and rare for others. Hence we talk about stable/unstable parts of the process.

In the context of public process it is important to distinguish between stable and unstable parts. This manner allows managing and verifying process compliance with law that governs them.

Stable parts are represented by activities described in the law "Legal Activity", while unstable ones provided by the current process "Operational Activity".



Figure 10. Notation for legal activity

D. Evaluation aspect

Public processes are evaluated in order to determine whether desired objectives are achieved or not. Evaluation of the essence of public processes, as well as the final output (service) is essential to ensure the value creation on a continuous basis, and therefore the satisfaction of stakeholders and citizens.

Two families of metrics are used in the context of our work: (1) legal metrics, and (2) operational metrics. Each of them includes quantitative and qualitative metrics.

Quantitative metrics are direct measurements. For public institution, it may be presented, for example, by the execution time of a given activity, the number of claims or rejection.

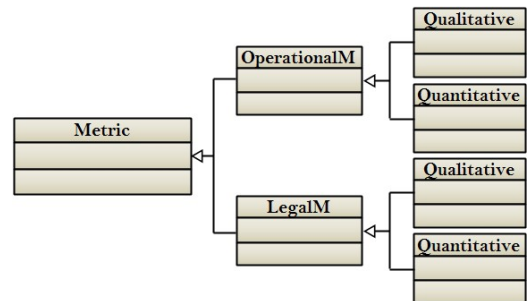


Figure 11. Component element of evaluation aspect

Qualitative indicators are indirect measurements performed from certain assumptions to define the degree/level of an indicator. They can be translated, for example, by the degree of citizens satisfaction (satisfied, not satisfied) or employee efficiency (very good, good, bad).

For this category, we also propose to use "Swimlanes" for the evaluation. Activities can be aligned using "pool" or "lane" based on their computation in a particular dimension and their attributes. For example, whether a given activity should be performed in a given time, the temporal aspect should be evaluated. Therefore, it is important to define levels which indicate its status (e.g. low, medium, high).

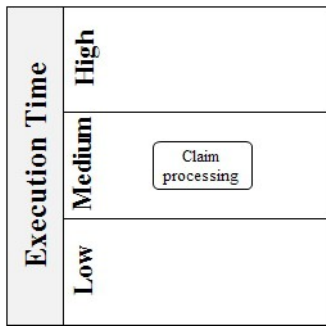


Figure 12. Example of temporal metric representation

Due to the diversity of metrics that can be considered in this context, this notation is insufficient. Hence, we plan to improve this aspect with other notations (e.g. the use of colors).

VII. CONCLUSION

In this paper we addressed the problem of public process modeling. Remember that these are characterized by a number of requirements, among which we cite the legal one.

We have proposed an extension of BPMN meta-model to support some concepts provided by the set of legal texts governing public institution. Specifying that for reasons of space a demonstration of this extension using an example is not discussed in this paper.

As perspective to this work, we plan to more develop the evaluation aspects (e.g. establishing specific metrics such as, cost, response time, etc.) and extend the meta-model to cover all aspects that remain. In addition, we plan also to develop an integrated tool support for representing this extension.

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