

USING BPMN FOR MODELING BUSINESS PROCESSES IN E-GOVERNMENT – CASE STUDY

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Abstract - *This paper presents an application of BPMN for the modeling of Tax Administration processes within the One-Stop-Shop system for the registration of business entities, using a modern software tool. The primary goal of this paper is to draw attention to a possible application of BPMN and to present identified difficulties in ensuring simple means of process modeling and information sharing among the business users and process implementers. It was shown that BPMN facilitates communication among the key parties in cross-organizational e-Government. Additionally, the conclusion was that using BPMN can be a useful starting point for highlighting critical points in collaboration of involved processes.*

1. INTRODUCTION

Establishing cross-organizational e-Government is a considerable technological and organizational challenge. Process modeling and process reorganization have been recognized as being of utmost importance for making e-Government implementations successful [1]. In order to be successful, before a major e-Government project is launched, a thorough understanding and a detailed inventory of business processes is necessary. Any major e-Government project requires a detailed workflow analysis beyond the high-level business process analysis [2]. In addition, so-called electronic interconnection of public bodies implies carefully planned collaboration of their business processes in order to enable effective and efficient delivery of services to the third parties. Complex cooperation of business and technical teams, from all parties involved, is inevitable.

It is crucial to put significant effort, first in understanding of and sharing knowledge on internal business processes, and second in getting insight in relevant processes of a partner organization. Only then, it is possible to start identifying events of mutual interest and defining collaboration processes.

Simultaneously, the problem of adjustment and improvement of internal processes should be addressed. One should have in mind that people change processes, not only information and communication technology (ICT) without people. While renewing information system (IS), it is important to start introducing changes in business processes governed by both people and ICT [3]. In e-Government processes, this imposes the need, first of all, for identification of unnecessary work steps in process realization, refinement of task responsibilities for the

tasks and comprehension of (mis)alignment of technologies and working procedures.

This paper presents some of the research results in the field of business process analysis and modeling applied in the project of the integration of Tax Administration of Republic of Serbia (TA) processes within the One-Stop-Shop system for the registration of business entities with the usage of web service technology. The paper describes the application of BPMN for the high level modeling of TA's processes with special emphasis on collaboration of TA's and Serbian Business Registers Agency's (SBRA) processes. The primary goal of the paper is to present, in brief, the key experiences gained while working in this project related to: the applicability of BPMN; identified obstacles in process modeling and sharing of information on processes among interested parties of various profiles in e-Government. This paper does not pretend to describe the entire methodology and practice applied in the project. This paper gives the case background, elaborates on selection of modeling notation, presents a tool that has been used and finally gives the overview of the approach used in the case study. In this paper, also, "lessons learned" were presented that can be helpful to others, interested in practical application of BPMN. At the end, conclusions were summarized and overview of the current state of this research was given.

2. CASE BACKGROUND

Case study described in this paper was realized within the project of the integration of TA's processes within the One-Stop-Shop system for the registration of business entities with the usage of web service technology. In e-Government, One-Stop-Shop implies electronic networking of several public bodies and integrates provision of services. Networking SBRA and TA refers to integration of providing services related to the registration of business entities and registration of taxpayers. Previous solution is based on the batch data exchange process. This project, among others, had as a goal to enable "real-time" communication between SBRA and TA over web services. As ICT solutions, usually have the main role in fundamental changes of business processes, realization of ICT project has to be encompassed by adequate process treatment, which is the approach used in this project.

Basic processes of TA that follow a life cycle of a taxpayer in the Register of taxpayers, included in the case study are: Registration of taxpayer through SBRA, Editing data on a taxpayer, Temporary withdrawal of Tax Identification Number (TIN), Cancellation of Decision on

temporary withdrawal of TIN and Permanent withdrawal of TIN.

3. SELECTING A MODELING NOTATION

There is a great number of graphical notations suitable for presentation of processes in the form of diagrams. Some of them are closely related to the certain software tools and are usually recommended by vendors or consultants. However, notations developed by standardization groups or open consortia usually achieve great receptivity. BPMN (Business Process Modeling Notation, i.e. Business Process Model and Notation from version 2.0) was created from the expertise and experience with many existing notations, while trying to consolidate them into one standardized notation. Examples of evaluated notations or methodologies used for the development of BPMN are: UML activity diagrams, UML EDOC business processes, IDEF, ebXML BPSS, ADF (Activity-Decision Flow) diagram, RosettaNet, LOVeM and EPCs (Event-Process Chains) [4].

BPMN was initially developed by the BPMI (Business Process Management Initiative). Since BPMI is integrated into OMG (Object Management Group), further development of BPMN is realized within this standardization body. The basic goal that was strived to was creating notation that would be comprehensible to all business users, from the analysts that create the first drafts of the processes, to the technical developers responsible for application of technologies that enable execution of those processes in real environment, and finally, to the business people who would manage and monitor those processes. Second, nothing less important goal, as stressed in the BPMN specification, was to ensure that XML languages for business process execution, such as WSBPEL (Web Services Business Process Execution Language), could be graphically represented using process-oriented notations. Figure 1 shows the core set of BPMN constructs.

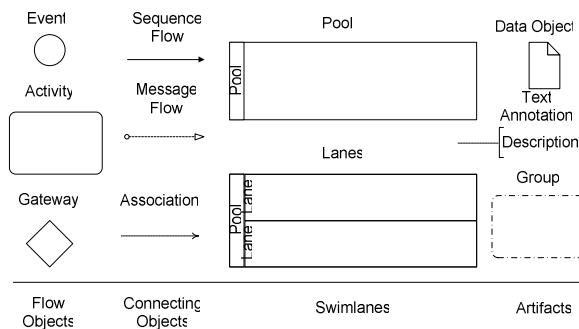


Figure 1: Core set of BPMN constructs

BPMN 2.0 which second Beta version was published in June 2010 is expected to bring in the improvements and novelties and to arise additional research and commercial interest. One of the most important changes in BPMN 2.0 is that it additionally contains metamodel. In the prior BPMN specifications, BPDM (Business Process

Definition Metamodel) was used as a metamodel. Hence is the change in name to Business Process Model and Notation with preservation of acronym - BPMN. Included in the new version is also pattern-based mapping to WSBPEL. The introduced changes, comparing to BPMN 1.2 can be divided into notational and technical. The major notational changes refer to the addition of Choreography diagram and the addition of Conversation diagram, as well as to some new types of events. The major technical changes include, besides the formal metamodel, interchange formats for abstract syntax model and diagrams interchange in both XMI (XML Metadata Interchange) and XSD (XML Schema Definition), as well as XSLT (Extensible Stylesheet Language Transformations) transformations between the XMI and XSD formats [5]. Namely, the prior versions of BPMN did not specify, neither the way in which BPMN diagrams were stored in computer-readable format, nor the diagrams exchange mechanisms. Consequently, different tools that support BPMN kept resulting diagrams in different formats.

Selection of BPMN, as a business process modeling language has several benefits. The growing support for BPMN diagram styles in process modeling tools leads to the more widespread availability of industry reference models created in BPMN. Since, cross-organizational, as well as inter-organizational collaboration depends of mutual understanding of business context of all parties involved, there are strong indications that the choice of a standard notation facilitates establishment of partnerships, since models become convenient communication tool of that purpose. Using a standardized modeling language facilitates the understanding of models, which has, for a consequence, facilitated consolidation of cross-organizational processes [6].

Beside practical reasons, the language expressiveness has to correspond to the concrete requirements. The expressiveness of BPMN was examined and verified in [7].

BPMN offers a rich set of symbols with which many concepts from the real world can be represented in a way that most users will intuitively understand. Also, the provided guidelines for process modeling facilitate learning process and improvement in quality of communication between the consultants the process participants.

However, the selection of the modeling language is just one step in creating modeling approach. Moreover, the selection of the language is not the most critical aspect in process modeling. Regardless the notation selection, it is necessary to apply certain modeling principles and guidelines to ensure that resulting models are comprehensible, consistent and comparable [8].

4. ABOUT THE CASE TOOL

For BPMN model design, Sparx Systems Enterprise Architect was used [9]. BPMN add-in of this modern

software tool ensures functional implementation of BPMN. This tool, in brief, enables Enterprise modeling (UML 2.3, SysML, UPDM, TOGAF, Zachman, DDS, SOA, SOMF), integration with other tools (Eclipse, MS Visual Studio, versioning tools and other), certain MDA

functionalities, etc. Speaking of BPMN, versions 1.0 and 1.1 are supported. BPMN model transformation to WSBPEL, as one of the advanced functionalities, was ensured.

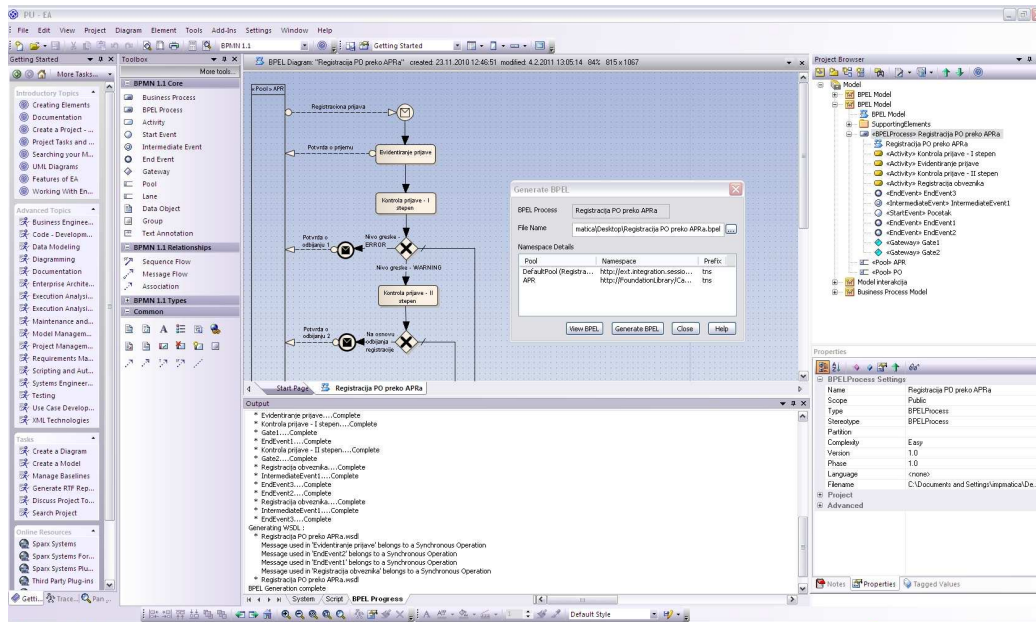


Figure 2: BPMN in Sparx Systems Enterprise Architect

In its last report, from October 2010, Gartner had placed Sparx Systems into Niche Players quadrant in its Magical quadrant for Enterprise Architecture tools. This report states that vendors from Niche players quadrant have tendency of having advantages in many fields, but often lack in functional breadth, global presence, industry breadth or market focus. More specific, as the strengths of this vendor are stated: simple, low-cost shareware model, as well as the usability of the tool that has been developed using external experts to ensure a high level of productivity with the tool. However, this tool lacks the full functionality of many of the major players because of which, potential buyers are advised to be careful and evaluate capabilities given the requirements [10].

Considering our needs so far, and cost-to-capabilities ratio of this tool, it makes a good choice, not only in the field of business process modeling, but in the much wider application in software development and management of software projects.

5. APPLIED MODELING APPROACH

Modeling of the Tax Administration processes within the One-Stop-Shop system for the registration of business entities is characterized by the iterative approach. First drafts of the processes have been created after the internal meetings with TA team and gathering input from the key users in the forms of specifications of core activities and important events in the relevant processes. The team comprised of the crucial users, responsible for decision making and IT experts with constant support from the

TA's team of legal experts. The focus was on designing TA's the high level processes model with the stress on collaboration between TA's and SBRA's processes. Model was developed in several iterations, based on the conclusions from the joint meetings with TA's and SBRA's teams for business processes ("business teams" in further text), internal meetings of TA's team and available documentation.

One of the main challenges in this phase was to define collaboration processes in the conditions of legal ambiguities and non-conformities of by-laws. All process models and their development through phases were documented. Processes design and collaboration processes design represent input for implementation and have to be approved by the technical teams from the point of feasibility.

The first question that imposes in application of BPMN is whether to use the core set or an extended set of constructs. Having in mind set goals, it was important to maintain simplicity and comprehensiveness of diagrams. However, own experience and experience of others, tell us that the constructs from the extended set which have more precise semantics can be very useful (some more than others). Still, such elements also have more complex semantics that needs to be presented to the users which are not familiar with BPMN. For example, message event has a broader meaning, and does not refer only to the web services calls, as technically oriented participants initially thought. The usage of BPMN constructs in real-life process modeling practice is the topic addressed in [11].

In case study presented in this paper, the following constructs have been used beside the core set of constructs: extended set of tasks (sub-processes, tasks with additional semantics – Standard loop) for the highest level, extended set of flow constructs (Default Flow), extended set of gateways (Data-based), extended set of events (Messages, Rule Events).

Application of BPMN model for highlighting collaboration of TA's and SBRA's processes was of the utmost importance in the study. A collaboration process depicts interactions between two or more business entities. These interactions are defined over the series of steps that represent patters of message exchange between involved entities. Figure 3 presents the BPMN collaboration process diagram of Registration of taxpayer through the SBRA. Diagram is simplified for the purpose of this paper in such manner that certain steps have been abstracted as well as the relation with the appropriate internal process in the TA. The presented TA's private process model shows activities with certain level of abstraction which is convenient for comprehending their interactions with the process of SBRA. SBRA's process has been presented as a black box. The focus is on message exchange, which enabled initial highlighting of critical points in the involved collaboration processes.

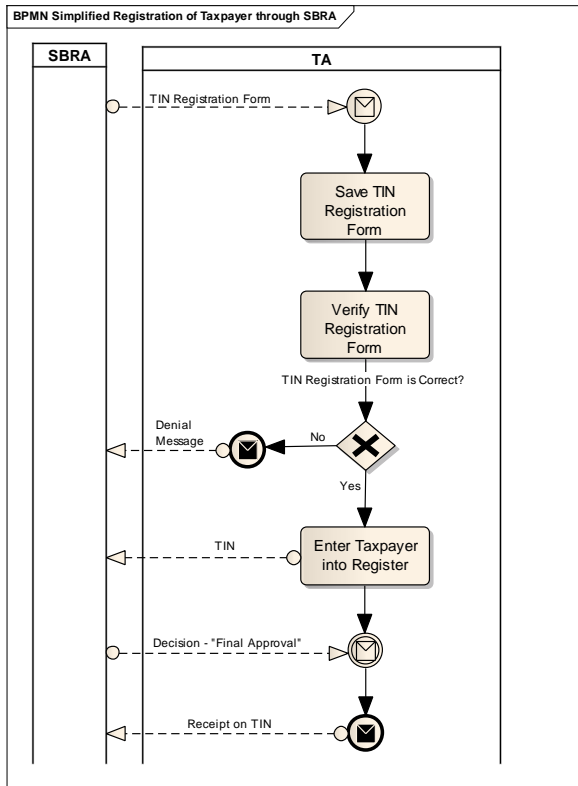


Figure 3: Simplified BPMN diagram: Registration of taxpayer through the SBRA

In the process model design, it was strived to apply generally accepted, applicable guidelines for business process modeling described in literature. GoM (Guidelines of Modeling) describe 6 criteria that can be

applied in order to ensure quality of the model. Guidelines are quite general, which means they are not pointed towards a single method or model type. Beside basic guidelines – Correctness (syntactic and semantic), Relevance and Economical efficiency; optional guidelines – Clarity, Comparability and Systematic design can play a great role in the concrete applications of model [8]. Based on the criticism of this and similar approach as theoretical and non-practical for the inexperienced modelers, seven guidelines for process modeling have been proposed, based on the solid empirical ground [12]. These are: (1) Use as few elements in the model as possible, (2) Minimize the routing paths per element, (3) Use one start and one end event, (4) Model as structured as possible, (5) Avoid OR routing elements, (6) Use verb-object activity labels, (7) Decompose the model if it has more than 50 elements [12]. Even though recommended 7 guidelines were focused on EPCs notation, most of them are possible to use with no obstacles for BPMN models as well. In our case, guideline number 3 was not possible to apply. Several end events was inevitable due to the existence of positive and negative outcomes of the processes that are handled in different manners. Besides, the processes Temporary withdrawal of TIN and Cancellation of Decision on Temporary withdrawal of TIN are characterized by 2 start events. When several start events exist, it is necessary to have all labeled in order to identify alternative start conditions. Application of GoM and 7PMG guidelines on BPMN models is discussed in [13].

For the processes included in the case study, it was confirmed that syntactic correctness is the easiest to ensure, thanks, to the great extent, to syntactic validation which is a feature of modern tools, but to the manual checks as well. However, many ambiguities can be found in BPMN specifications (approved versions) due to the lack of formalization [14], which we came across as well. In situations like that, it is desirable to look into and consult the best practice. Potential pitfall that should be avoided are model modifications imposed by the interested parties which lead to the technically incorrect models. Semantic correctness is achieved in the context of appropriate domain and model, which is the reason why there are no concrete guidelines. Our experience testifies that it is of utmost importance to establish good cooperation with domain experts that are familiar with modeling methodology.

Relevance of the model is based on the minimalistic approach, according to which, models need to hold exact quantity of information required by their purpose. In practice, question of relevance is very debatable. The BPMN models, beside graphical notation include metamodels with attributes for graphical elements which enable representation of information “under” the visual layer. Still, for the technical and practical reasons, the interested parties are mostly directed to the level of diagram. Our approach in the project entailed documenting the models, so that every diagram is accompanied by the detailed description of process model, and yet not to have graphical representation loaded with details. In this manner, it was enabled to have

a graphical representation of the processes, along with accompanying information in text format available to all the participants of the “business teams” meetings that had a freedom to intervene on paper and express their remarks and suggestions. It was showed that the Text Annotation and Data Object, in some cases, can be useful graphical elements for keeping diagram simple and understandable.

Economical design can be achieved through usage of the predefined model building blocks. The tool that was used enables creation of such building blocks so that each following process model is not created from the scratch. Application of patterns, as starting point, is encouraged for the creation of related building blocks.

When looking into the optional criteria, for the approach presented in this paper, clarity criterion was of great interest. It is evident, that without readable, understandable and useful model, all other efforts are in vain. However, clarity criterion is very subjective. If models are used as a means of communication between a large number of participants of different profiles, this rule should be kept in mind and carefully approached through the establishment of appropriate cooperation with participants in the process design.

The lack of ontological completeness and clarity is discussed in [15]. In respect to this, identified difficulties in our work, can be related to construct deficit and construct overload. Construct deficit we have in mind is referred to the inexistence of detailed demarcation of systems and sub-systems. This deficit, in certain cases, leads to difficulties in modeling inter-organizational processes and to the problems in model structuring. Specifically, in our case, this referred to the modeling relations of scope processes with certain internal processes and to model structuring with regards to its potential enhancement. The problem is illustrated in Figure 4. Process Audit of related entities is not necessarily related to the process of Registration of taxpayer and can be triggered in other processes as well. For that matter, it is not convenient to be represented as a sub-process. It remains to be represented through the usage of Pool construct, as in the Figure 4 (lower right corner). However, this construct is typically used for external entities.

The targeted construct overload usually refers to the fact that the BPMN constructs Pool and Lane are used to present a whole range of concepts such as a process, a specific organizational entity, an application system, a set of entities and so on. Therefore, it is necessary to put in extra effort to make users familiar with the model and the meaning these constructs have in each model. Speaking of construct redundancy, it was tried to deal with it through the selection and consistent application of one type of construct, when more constructs could have been applied.

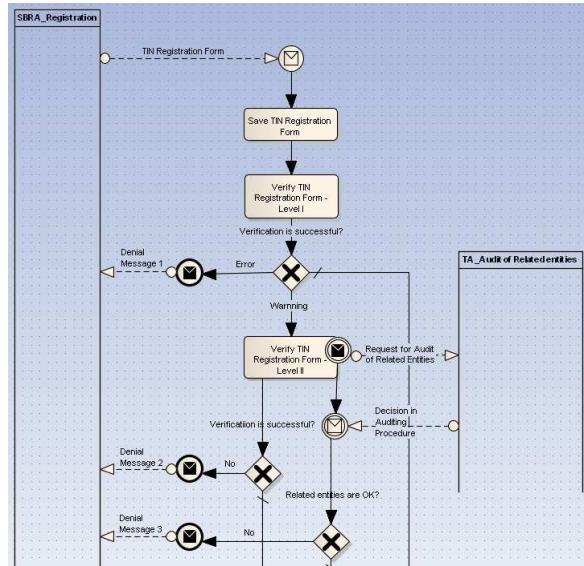


Figure 4: BPMN diagram: Difficulties in modeling relations of inter-organizational processes

6. LESSONS LEARNED

For BPMN to be successfully used as a means of communication between a large number of participants of different profiles in defining processes and collaboration of processes in e-Government (and in general), it is crucial to models that are designed and read well. This can be achieved by following generally accepted, applicable (given the purpose) guidelines of process modeling. Level of abstraction needs to be determined, so users could relatively easy spot the critical points in the model. Models should neither be too simplified, nor too complicated, because they can easily lose that capability. Establishing adequate cooperation with interested parties is of utmost importance for proper design and interpretation of models.

Although BPMN ensures notation that is, to the certain extend, readily understandable by the business users, some misunderstandings are possible to occur even with the usage of constructs with simple semantics. Therefore, it is necessary to make sure that the BPMN models are interpreted correctly, with the usage of adequate subset of constructs and adequate presentation of their semantics to the users.

7. CONCLUSION

This paper presented some experiences in application of BPMN for the modeling of Tax Administration business processes within the One-Stop-Shop system for the registration of business entities. Authors consider that using BPMN, despite of its deficits and imprecision (limited to approved versions), can be a useful starting point for highlighting critical points in collaboration of involved processes, as well as in facilitating communication among the key parties, in cross-organizational e-Government.

Having in mind expected BPMN development, permanently noticing that academic and professional community and vendors have a great interest in this topic, authors believe that is realistic expectation to see the increase in number of research project and published articles dealing with application of BPMN in e-Government development.

Based on the findings of the research presented in this paper and strategic plan for the Tax Administration information system development based on SOA technology implementation, further research and development will be focused on exploring possibilities of effective transformation of realized BPMN models to WSBPEL.

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Research presented in this paper was partly performed within projects TR 14021 and TR 13004 supported by the technological development program of the Ministry of Science and Technological Development of the Republic of Serbia.

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