

BPMN: An introduction to the standard

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ABSTRACT

The *Business Process Model and Notation* (BPMN) is the de-facto standard for representing in a very expressive graphical way the processes occurring in virtually every kind of organization one can think of, from cuisine recipes to the Nobel Prize assignment process, incident management, e-mail voting systems, travel booking procedures, to name a few. In this work, we give an overview of BPMN and we present what are the links with other well-known machineries such as BPEL and XPD. We give an assessment of how the OMG's BPMN standard is perceived and used by practitioners in everyday business process modeling chores.

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1. Introduction

In the last few years a clear need for a modeling language for business processes which could be expressive and formal enough but easily understandable also by final users and not only by domain experts faced out. At the present, the state-of-the-art in the field is represented by BPMN (Business Process Model and Notation) [1], the leading standard in the frame of business processes and workflow modeling languages. It is possible to identify three different application domains for modeling languages: pure description, simulation and execution of processes. In this work we will present an introduction to BPMN assessing its position with respect to the cited application fields and comparing it with other proposals.

Use cases descriptions and documentation of complex procedures are often very difficult to understand and error prone. Since a (more or less) clear picture depicting either a workflow or a business process is in most cases self-explaining, many users aim to enrich descriptions of processes with diagrams in order to convey the intended meaning associated to the process. Moreover, examining a graphical description of a process allows users to easily discover inconsistencies and/or differences in names or acronyms, infinite loops, non-terminating conditions and so forth. Using a formal graphical notation is the de-facto standard choice to express a representation of a process which should be syntactically valid (thus assuring the consistence with the represented process) and having the same meaning as the (usually, natural language based) textual description of the process.

Domain experts are also interested in finding ways of studying properties of processes as represented through some graphical notation in order to verify the correctness of their representation,

thus checking – for example – the absence of interrupting conditions, deadlocks, infinite loops. Analysts, on the other side, are more interested in collecting data – especially about resources spent during the execution of a process – so that it is possible to check whether a process could be refined and optimized.

Finally, execution capabilities of a modeling language are of great interest of business process experts and developers. Purposes for translating a diagram into some machine readable standard language can be grouped into two main categories: sharing and execution. To share a diagram (keeping it editable from different users) across multiple domains and using many different technologies and softwares is seen as big challenge nowadays. Furthermore, the need to (semi-)automatically execute a process, often in distributed environment (like in the case of web services) is becoming more and more important.

Summarizing the argumentations we will develop in the following, it can be safely affirmed that BPMN can be used for all of these purposes, sometimes in conjunction with other languages. For descriptive purposes only, BPMN itself is probably the best choice, at the present time. For simulation purposes, BPMN can be put at work in conjunction with XPD [2], while WS-BPEL [3] can be considered the right choice to translate BPMN diagrams into directly executable code. Clearly, one has to be aware what are the features of the cited languages and, in particular, what are the differences with BPMN, which will be highlighted in the following.

WS-BPEL defines a model and a grammar for describing the behavior of a business process based on interactions between the process and its partners. WS-BPEL also introduces rather extensive mechanisms for dealing with business exceptions and process faults. Moreover, WS-BPEL introduces a mechanism to define how individual or composite activities within a unit of work are to be compensated in cases where exceptions occur or a partner requests reversal [3]. The aims of WS-BPEL, along with the choice made by the Business Process

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Management Initiative during the early steps of BPMN definition to adopt WS-BPEL as the preferred serialization format for BPMN diagrams (even if WS-BPEL had many differences from BPMN 1.x and it is less expressive [4–8]), made the choice of WS-BPEL the best suitable one as execution language for BPMN diagrams, even if the situation changed with the advent of the second major release of BPMN in January 2011. WS-BPEL had too many limitations to be considered the final choice to serialize BPMN diagrams. For instance, it is not possible to represent with a unique WS-BPEL process one BPMN collaboration diagram. The richness of BPMN had no complete correspondence in WS-BPEL. Many graphical elements, in fact, cannot be represented in WS-BPEL and almost all attributes and properties linked to them (needed to give a precise meaning to the diagram elements – and thus to the diagram itself) had no representation in WS-BPEL. On the other side, the XML Process Definition Language (XPDL) is an XML format standardized by the Workflow Management Coalition (WfMC) aimed at the interchange business process definitions between different workflow products, i.e. between different modeling tools and management suites. XPDL defines an XML schema for specifying the declarative part of workflow/business process. XPDL is designed to exchange the process definition, both the graphics and the semantics of a workflow business process. XPDL is currently one of the best file format for exchange of BPMN diagrams; it has been designed specifically to store all aspects of a BPMN diagram. [2] This distinguishes XPDL from WS-BPEL which focuses exclusively on the executable aspects of the process. WS-BPEL, in fact, does not contain elements to represent the graphical aspects of a process diagram. Thus, XPDL has been widely adopted as a common standard interchange format for BPMN diagrams. Also in this case the scenario is going to change due to the publication of BPMN 2.0. Although XPDL is an XML-based language, it has been mostly used in two application domains: to check the correctness of a BPMN diagram and to simulate process execution. Nowadays there are some tools exploiting the complete BPMN support (of both the graphical representation and the associated properties) offered by XPDL to provide verification mechanisms for BPMN processes. Among others, the web-based solutions provided by Potsdam University¹ and the BPI Community² are the best free-to-use applications supporting this kind of validation. The validation is based on the XML serialization of BPMN diagram created using XPDL, while simulation is mostly limited to a sequence of steps in which one or more tokens pass through the process elements. For XPDL compliance/support check also [9] where a list of more than 70 current implementation is published and regularly updated. As we just mentioned, in January 2011 the second major release of BPMN was published. The additions introduced encompass – among other things – a native XML serialization for BPMN, making it completely independent from other languages, such as WS-BPEL and XPDL. Nowadays they are still widely adopted and used and we can foresee they will still be used. In fact, the advent of the new version of BPMN forces many software vendors to change their tools to become compliant with BPMN 2.0 and this is a time-consuming and expensive activity. When the migration process will be finalized, we expect the spotlight will be quite completely turned on BPMN 2.0.

The XPDL 2.2 (published in 2010) effort is focused on only covering a subset of the Process Modeling Conformance class of the BPMN 2.0 specification. Thus the XPDL 2.2 schema will offer a serialization and interchange transport for BPMN 2.0: Process Diagrams, and Collaboration Diagrams\ (Without Conversation) (i.e. what was possible in BPMN 1.2). The XPDL 2.2 schema is to be backward compatible with the XPDL 2.0 and XPDL 2.1 schemas. This

backward compatibility also extends to XPDL 2.1 schema's capability to serialize BPMN 1.2 drawings.

The XPDL 3.0 (published in 2011) effort is focused on covering the complete BPMN 2.0 specification. Thus the XPDL 3.0 schema will offer a serialization and interchange transport for BPMN 2.0: Process Diagrams, Collaboration Diagrams, Conversation Diagrams, Choreography Diagrams (and all attributes).

2. Related works

Since the publication of the first version of the official BPMN specifications in 2006 many papers and books have been published. In this section we don't aim to provide an exhaustive list of them. Rather, we would suggest some interesting works which could help readers in having a better clue on BPMN and let them start practicing with such notation. Nonetheless, some cited works highlight criticisms of BPMN and compare it with other formalisms.

Starting with books the first title to be cited is the *BPMN Modeling and Reference Guide* by S. A. White and D. Miers [10] which provides an authoritative modeling guide and reference for the features of BPMN Version 1.1. One of the best books about BPMN modeling techniques with an interesting and useful focus on style is the *BPMN Method & Style* by B. Silver [11]. Since 2001 the Workflow Management Coalition publishes a series of annual handbooks entitled “Workflow Handbook”. The first article having BPMN in its title was published in 2003 in a section dedicated to workflow standards. The article, written by S. White, was entitled “XPDL and BPMN”. In 2004 another article by S. White, “Process Modeling Notations and Workflow Patterns” was published [12] and quickly became a reference work in this field, presenting a comparison between BPMN and UML Activity Diagrams, taking into account 21 out of 26 workflow patterns as published in [13]. The two editions published in 2009 [14] and 2010 [15] present with a business perspective the on-going scenario, even if in both cases there is a section dedicated to BPMN and other standards. Furthermore, the WfMC published in December 2010 – in association with Layna Fischer Editor – the “BPMN 2.0 Handbook” [16], a monograph dedicated to the new major version of BPMN, published in the same period, and the increasing interest in the new standard. It was authored by members of WfMC, OMG and other key participants in the development of BPMN 2.0. This monograph brings together industry thought-leaders and international experts in this field. In 2010 other two interesting books were published: “The Process, Business Process Modeling Using BPMN” [17] and “Mastering the Unpredictable” [18]. In the former the authors teach the key points of BPMN by examples using an unfolding business scenario, direct speeches between the modeler, process participants and the CEO. The latter, instead, wishes to present “how adaptive case management will revolutionize the way that knowledge workers get things done”, starting from the assumption that the management of unpredictable circumstances is becoming nowadays a practical reality.

On the other hand, many papers and technical reports as well as PhD and Master thesis about BPMN were published in the last few years. Some of them have been considered as reference works from many authors and business experts. In this section we aim to suggest some of them in order to let readers build basic background knowledge on BPMN and its positioning with respect to other well-known notations and standards. Moreover, reading suggested works in a chronological order could help better understand the path BPMN followed to become nowadays the de-facto business process modeling standard. Starting from 2003 with a survey made by Wil M.P. van der Aalst et al. [19] it is possible to find many other surveys comparing BPMN with other notations such as BPEL, EPC, YAWL, XPDL [20–24]. The suggested chronological path could end with two last works published in 2010: a modeling language representational analysis [25] and an empirical study of the acceptance between EPC and BPMN [26]. The key work “Workflow Patterns” [13] published in 2003 became the

¹ The Oryx Project, <http://bpt.hpi.uni-potsdam.de/Oryx> (May 2011)

² Business Process Incubator, <http://www.businessprocessincubator.com> (May 2011), leaded by Trisotech

basis for continuous updates and derivative works [27–29]. Lastly, some interesting works were published tackling an awkward subject: modeling guidelines and style [30,31] accompanied also by critics to the complexity of BPMN due to a huge set of graphical elements [32].

3. What is BPMN?

In this section we introduce the principles of BPMN, starting with an overview about workflows and business processes to better understand the need for a new modeling notation, which would be easily readable and understandable by everyone but semantically strong enough to let graphical diagrams drive the meaning, properties and execution information of a process. In the following part we introduce BPMN 2.0, the latest major version of BPMN, listing the main new characteristics and some interesting side projects derived from BPMN.

3.1. Business processes

A *business process* (BP) is a set of one or more linked procedures or activities executed following a predefined order which collectively realize a business objective or policy goal, normally within the context of an organizational structure defining functional roles or relationships. A process can be entirely contained within a single organizational unit as well as it can span several different organizations [33]. Business process collaboration across enterprise boundaries is a complex task due to the lack of a unique semantics for the terminology of their BP models and to the use of various standards in BP modeling and execution. Business process management (BPM) provides governance of a business's process environment to improve agility and operational performance. It is a systematic approach to improve any organization's business processes. BPM is not a technology and it is not related to diagram creation or systems architecture.

Business Process Modeling, instead, is defined as the time period when manual and/or automated (workflow) descriptions of a process are defined and/or modified electronically [33]. Since both Business Process Modeling and Business Process Management share the same acronym (BPM), these activities are sometimes confused with each other. Business Process Modeling is the activity of representing processes of an enterprise, so that the current (“as is”) process may be analyzed and improved in future (“to be”) [34]. Business Process Modeling is typically performed by business analysts and managers who are trying to improve process efficiency and quality. The term “Business Process Modeling” was coined in the 1960s in the field of systems engineering. In the 1990s companies started to substitute terms like “procedures” or “functions” with the terms “processes” and “workflows”.

From the 1990s to present days workflows and processes changed very rapidly [35]. In the beginning, workflows had no tool support and they were executed from single users which had to remember all the processes execution steps. In 1993 the first work sequences appeared to aid users describe the workflows and to document the process steps. The following change concerned the passage from one single user to the distribute work among different users. In 2002 there was a big distinction between the workflows and processes representations and the back-end. Users access a user interface connected to the application logic. In 2005, the possibility to change the underlying model and technologies without users take notice of the change increased the distance between the business process modeling level and the physical level. Nowadays research efforts are oriented to simplify workflows and business process modeling so that users see only the tasks they have to perform. Related to this topic, another big asset is the separation of responsibility among different users. Each user should have his own permission to perform a set of predefined actions on the workflow (or on the business process model, depending on the adopted technology). The business process access permission

policies we introduce together with business process views mechanism [36] can be a possible solution to achieve this outcome.

The Workflow Management Coalition (WfMC) published in 1995 the Workflow Reference Model, which can be summarized with the diagram shown in Fig. 1. WfMC identified five different workflow interfaces to facilitate exchange of information in a standardized way, thus enabling interoperability between different products. Each interface was initially specified as a business level statement of objective, that is to say what the interface was intended to achieve in business terms and why a standardized approach was desirable. This was subsequently followed by a detailed, but abstract specification of how the interface operated and finally (for most interfaces) a “binding” specification covering the implementation of the interface in a particular technology,³ as it is possible to see in Fig. 2.

3.2. The Business Process Modeling Notation (BPMN 1.x)

The primary goal of BPMN is to provide a notation that is readily understandable by business users, ranging from the business analysts who sketch the initial drafts of the processes to the technical developers responsible for actually implementing them, and finally to the business staff deploying and monitoring such processes [37]. BPMN was originally published in 2004 by the Business Process Modeling Initiative as a graphical notation (partially inspired by UML Activity Diagrams) to represent the graphical layout of business processes. The ever increasing number of adoptions from companies and the growing interest upon this notation caused the adoption of BPMN as OMG standard in 2006 (see Fig. 3).

BPMN provides a graphical notation in order to represent a business process as a Business Process Diagram (BPD). BPMN 1.x versions did not have a clearly defined semantics nor a native serialization format. However, BPMN 1.1 introduced a UML Class Diagram description of the notation to give a better formalization to the original version, but it was not enough to state that BPMN 1.x had a well-defined meta-model.

BPMN 1.x has four categories of graphical elements to build diagrams: Flow Objects, Connecting Objects, Swimlanes and Artifacts. *Flow Objects* represent all the actions which can happen inside a business process determining its behavior. They consist of Events, Activities and Gateways. *Connecting Objects* provide three different ways of connecting various objects to each other: Sequence Flow, Message Flow and Association. *Swimlanes* give the capability of grouping the primary modeling elements. Swimlanes have two elements through which modelers can group other elements: Pools and Lanes. Finally, *Artifacts* are used to provide additional information about Process that does not affect the flow. They are: Data Object, Group and Annotation. BPMN 1.x can model three different types of business processes using three sub-models: private or internal business processes, abstract or public business processes and collaboration or global business processes. *Private business processes* generally focus on internal, organization-specific processes and are the type of processes that have been generally modeled with workflows or BPM processes (see for example [38,19]). *Abstract processes* represent interactions between a private business process and other processes or participants, where a participant is the resource which performs the work represented by a workflow activity instance [33,38]. An Abstract process shows only those activities involved in the interactions between two or more participants. *Collaboration processes* represent the graph of activities describing – among other things – message exchange patterns between two or more business processes. A summary of most BPMN elements is shown in Fig. 4. Starting from BPMN 1.2 the number of the elements increases, even if most users use

³ WfMC, The Workflow Reference Model, WfMC website

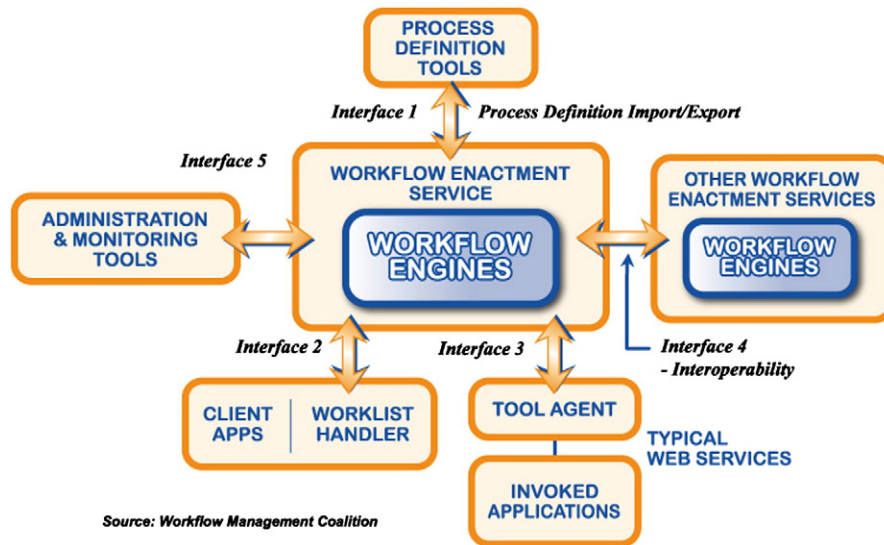


Fig. 1. The workflow reference model diagram.

only a little subset of BPMN elements to model business processes. For a complete description of BPMN elements and features refer to [39].

Fig. 5 shows a simple example of collaboration process (a user buying an MP3 player) modeled with BPMN 1.x.

3.3. The Business Process Model and Notation (BPMN 2.0)

In this section we briefly introduce BPMN 2.0, the newest major version of BPMN, which noticeably differs from the version 1.x in many aspects, either adding new characteristics or changing the elements properties as defined in the previous versions of the standard.

The BPMN 2.0 specification extends the scope and capabilities of the BPMN 1.2 in several areas [1]: it formalizes the execution semantics for all BPMN elements, defines an extensibility mechanism for both Process model extensions and graphical extensions, refines Event composition and correlation, extends the definition of human interactions, defines *Choreography* and *Conversation* models (a mean for better modeling interactions), and also resolves known BPMN 1.2 inconsistencies and ambiguities. Furthermore, BPMN 2.0 defines a

meta-model and a diagram definition model along with accompanying interchange formats both XML and XSD based.

A wide collection of new constructs are available in BPMN 2.0 given its duality with respect to diagramming to communicate or modeling for execution (e.g., there are 336 possible depiction permutations just for Tasks). With BPMN it is now possible to model a different set of processes, such as Orchestrations (both Private non-executable and Private executable (internal) Business Processes, Public Processes), Choreographies and Collaborations, which can include Processes and/or Choreographies and a view of Conversations. Also Data acquired a greater importance in BPMN 2.0. In fact, Data are no more part of the Artifacts but are a separate element category, including Data Input/Output, Collection Data Objects, Data Store and Messages.

3.4. BPMN-related projects

Many side projects based on BPMN have been started in the last few years. Some of them are focusing on specific useful extensions to the basic notation. For instance, there are projects dealing with time or business rules extensions to BPMN as well as proposing query

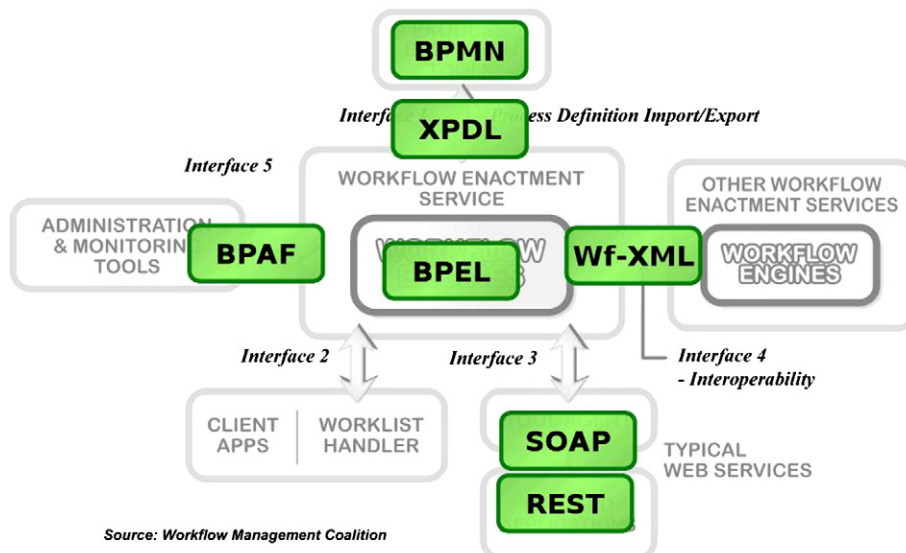


Fig. 2. The workflow reference model diagram: interfaces related standards.

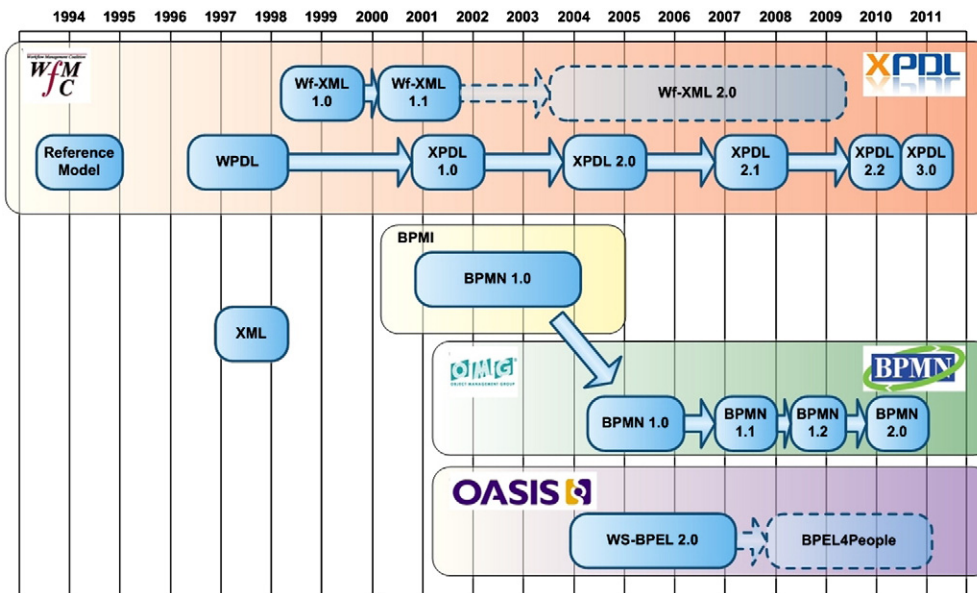


Fig. 3. Business processes related standards time-line.

languages for BPMN in order to perform searches in processes collecting information, finding specific elements, analyzing the behavior of a process. Some remarkable projects are Time-BPMN [40], an extension to BPMN which captures the temporal perspective of business processes, BPMN-Q [41], which is a language to query the structure of business processes, xBPMN [42], a revised formal control flow semantics formally specified and validated against the requirements.

4. How BPMN has been received

Since BPMN is a large and feature-rich modeling language serving a wide array of different purposes (from high-level conceptual modeling to process code execution, as we have seen), it is valuable to collect the feedback of a non-negligible number of users (possibly from different communities), in order to get an insight on what are

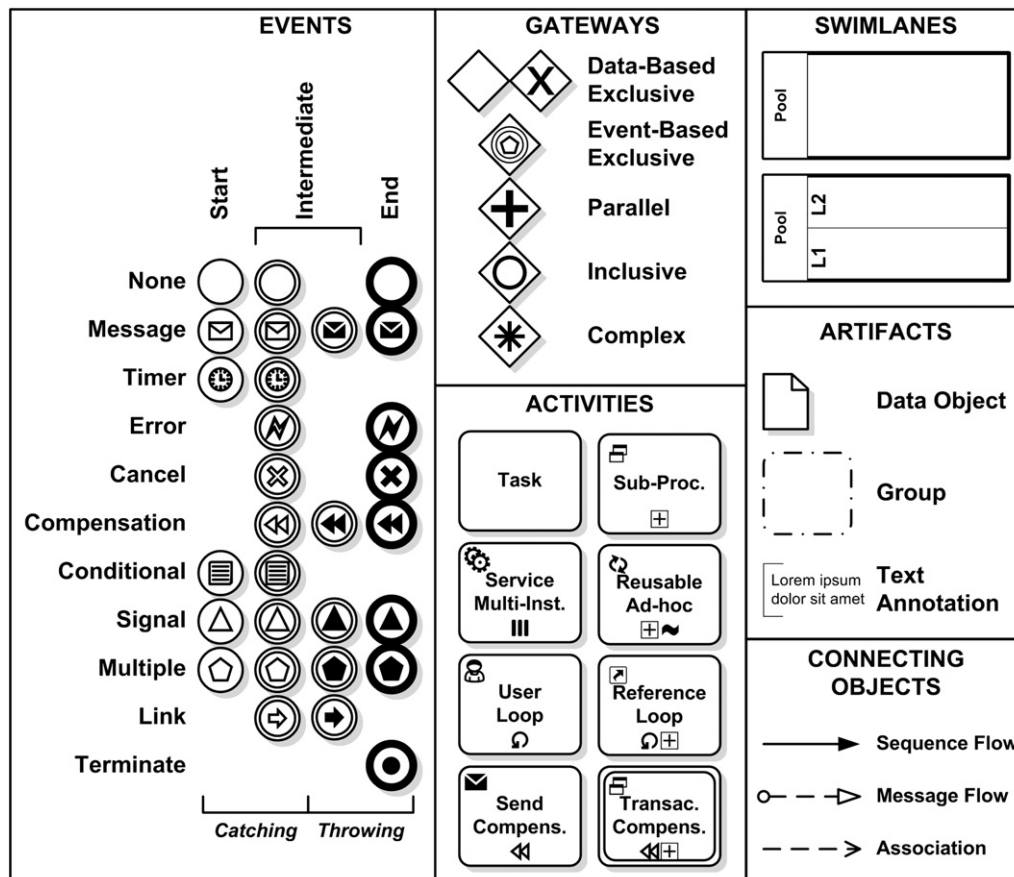


Fig. 4. BPMN 1.2 elements' summary.

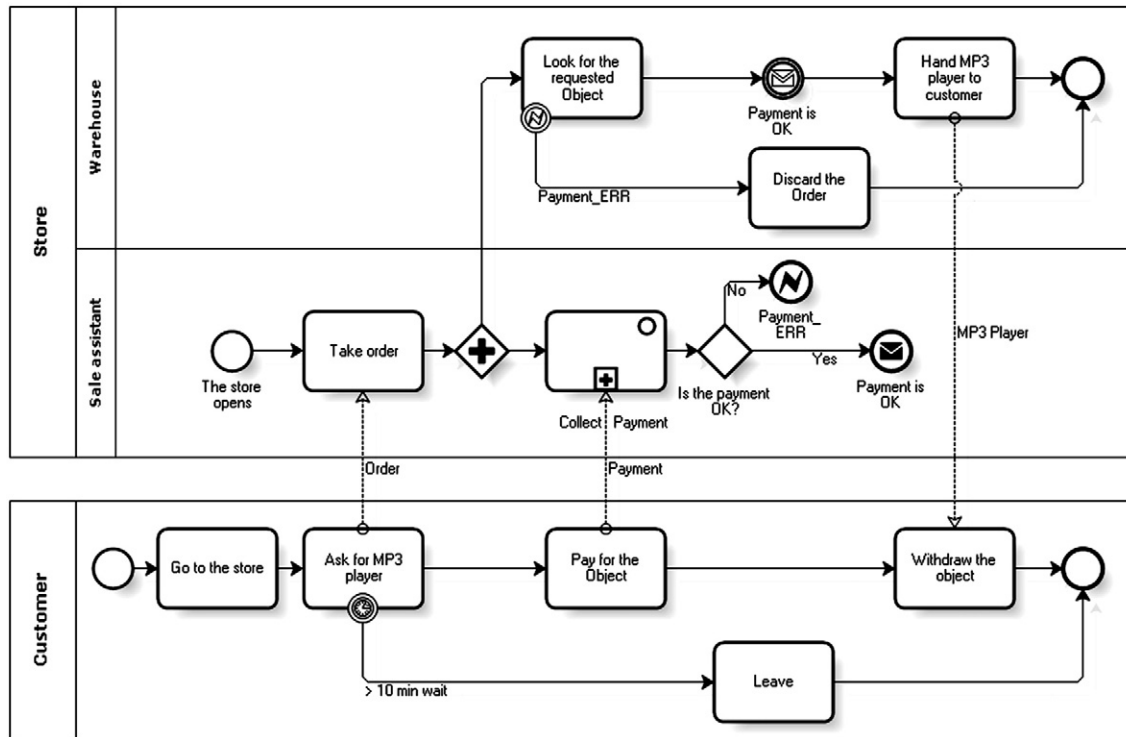


Fig. 5. One simple example process modeled with BPMN.

the relevant features and to decide upon possible corrections of the presented standard. We are aware of the fact that many other surveys have been recently published, as we mentioned in Section 2. Nonetheless, we provide a BPMN users' survey whose focus is threefold: the usage of BPMN in common contexts, the familiarity with the BPMN elements and a sight on preferred and most used BPMN tools. The intended audience of our survey was a group of BPM experts, selected from Internet forums and communities, OMG, WfMC, universities. We collected more than 30 answers, which are few in number but meaningful for the given answers. For the sake of completeness of the real scenario, we compared some results with data coming from other surveys, Internet communities, white papers. In particular we found interesting to take into consideration some LinkedIn groups dedicated to BPMN as well as the already mentioned Business Process Incubator (BPI) on-line community.

4.1. On BPMN usage

BPMN 2.0 is used by near 40% of the interviewed users, while almost 30% of them use BPMN 1.2 and 15% use a combination of both. BPMN is used mainly for documenting purposes (52%) and executing business processes (37%). Simulation of processes is quite important by itself (11%) even if in most cases simulation of processes is embedded inside execution environment. Type of processes usually modeled using BPMN are business processes and administrative procedures (booking resources, documental flow, and so on). Both of them in conjunction represent half of the collected answers (even if business processes got a score of 32.14% while administrative procedures are 17.86%). Running through the results, 12% of the interviewees use BPMN to model generic workflows while only 7.14% of them adopt BPMN to model a supply chain. Near the end of the list we found data flows (non-surprisingly, considering that “while BPMN shows the flow of data (Messages), and the association of data artifacts to Activities, it is not a data flow language” [1]), medical procedures, on-line stores procedures, environmental processes (less than 2%).

4.2. On elements attributes usage

A percentage of users between 30 and 40% consider textual labels enough – thus avoiding to specify attribute values and other properties – at least for Pools, Lanes, Flows, Conversations and Choreographies, while 40% of the interviewees add some values like timers, messages, errors to the Events and only 33% of them define scripts and rules for Gateways and Activities. It is worth noting that for Pools, Choreographies and Conversation respectively 22%, 30% and 37% of the interviewees don't care at all about attributes and properties.

4.3. On elements usage statistics

Fig. 6 shows a statistical analysis of how many elements are used to model processes users have to deal with in their everyday tasks. The graphic reveals that more than the 85% of users don't use Choreographies and Conversation diagrams. This could seem a bit strange after few months since BPMN 2.0 specifications were published. In general we can say there are no small processes with less than 10 elements defined. Indeed, the majority of the business processes (56%) have more than 25 elements. This percentage reaches 93% considering also processes with more than 15 depicted elements. Looking at all the other values, we can make some assumptions:

- almost 80% of processes have less than 5 Pools, this meaning there are few participants involved at time;
- more than a half processes use less than 5 Lanes, while another third has a number of Lanes between 5 and 10; if we merge this data with the results we have for Pools usage, we could expect processes with one or two Lanes at most for each Pool;
- more than 40% of processes have between 5 and 10 Events, even if the variance in this case is restrained; in fact, 22% of processes hold 11 to 15 events;
- with Tasks the behavior varies a lot: it is worth noting that every process has at least 5 Tasks defined, one-third has 11 to 15 Tasks, another third has more than 25 Tasks defined while the remaining

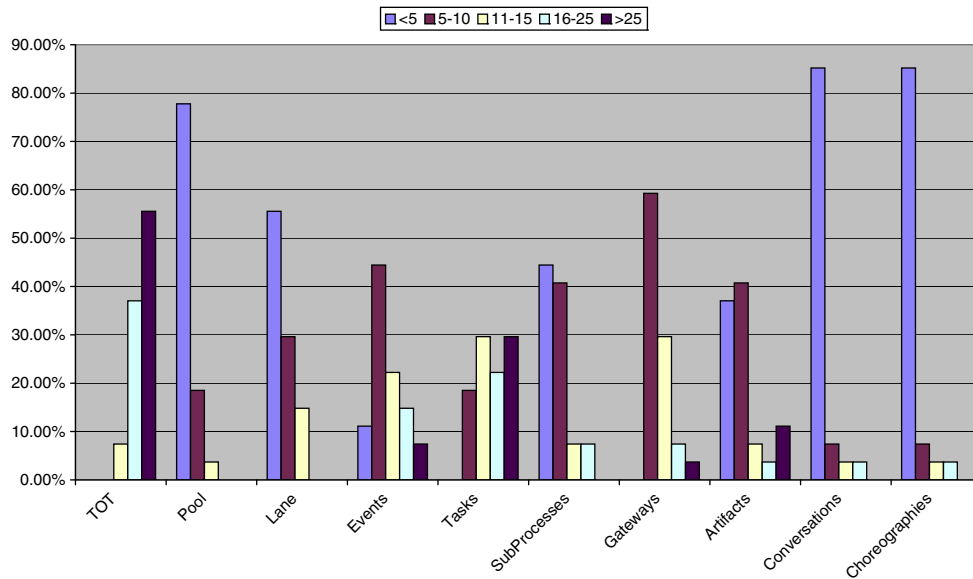


Fig. 6. Statistics of the number of BPMN elements used on average in business processes.

part is almost equally divided between 5–10 and 16–25 intervals; however more than 80% of processes have more than 11 Tasks;

- on the contrary, more than 80% of processes have less than 10 Sub-Processes, where half of those processes have less than 5 Sub-Processes
- as for the Tasks, there are no processes with less than 5 Gateways; however, almost 60% of processes have 5 to 10 Gateways defined and another 30% have 11 to 15 of them; this percentage decreases quickly for higher values
- while 11% of processes have more than 25 Artifacts defined (considering Data Objects, Groups and Textual Annotations), meaning a particular care of documentation and readability of a process, in general more than 75% of processes have less than 10 Artifacts defined.

If we compare these results with the survey made by Michael zur Muehlen and Jan Recker [43], we discover few commonalities and many differences. In their work they discovered that the six most

used BPMN elements are: Normal Flows, Task, End Event, Start Event/Event, Pool, Data-Based XOR Gateway. They call this set the “common core of BPMN”. To the contrary, there are elements that are not considered at all, like Compensation Association, Multiple End Event, Cancel Intermediate Event, Intermediate Exception, Multiple Start Event, Compensation End Event. However, it is worth noticing how 82.35% of the interviewees declare that (even if only sometimes) they are used to expand the BPMN notation with new personalized elements.

Looking at the other results of our survey, we can also delineate how much users are familiar with the BPMN 1.2 element set, especially if compared to their familiarity with the BPMN 2.0 element set. The graph depicted in Fig. 7 shows the familiarity degree of users with the BPMN 1.2 element set expressed in a range between 1 (less familiar) and 5 (very familiar). Although it would be very interesting to analyze in details all the collected results singularly, even the general picture is self-explaining and meaningful. In fact, it is possible to notice how the lines share more or less the same trend, with few

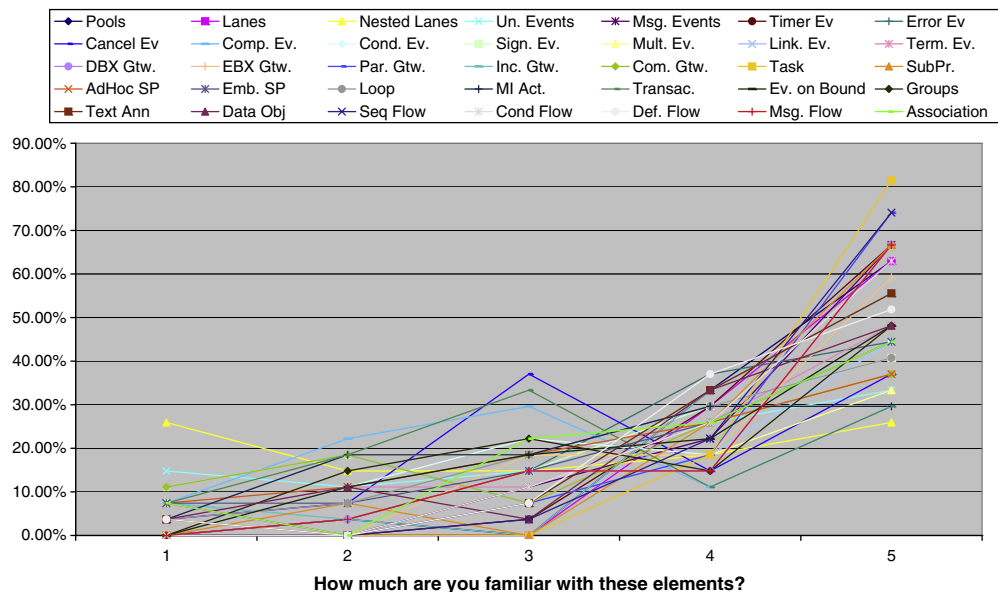


Fig. 7. Familiarity with BPMN 1.2 constructs.

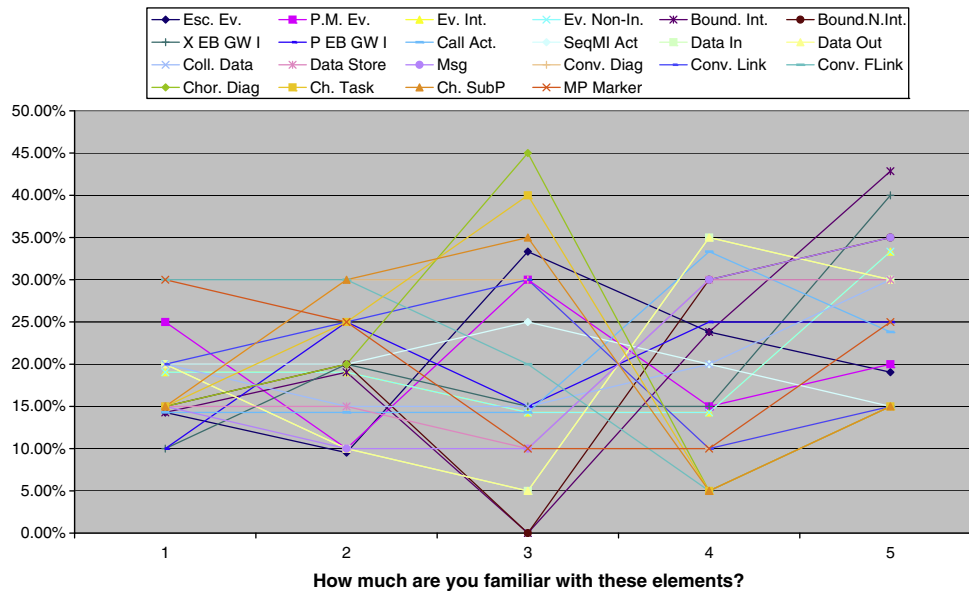


Fig. 8. Familiarity with BPMN 2.0 constructs.

people (less than 30%) having a weak knowledge of BPMN notation and the majority (from 30 to 80%) feeling comfortable with most of BPMN elements.

The only remarkable exceptions are represented by *Nested Lanes*, probably the less used constructs even because of some uncertainties about their semantics, *Cancel Events*, *Compensation Events* and *Transaction*.

If we look now the graph representing the familiarity degree of users with BPMN 2.0 constructs (see Fig. 8), we do not see the same trend. The best known element is the *Boundary Interrupting Event* while the *Conversation Forked Link* and the *Choreography Multiple Participants Markers* are the less known new elements introduced in BPMN 2.0. It is worth saying this second round of questions about BPMN 2.0 elements was shown only to those users who declared to use BPMN 2.0 in their modeling activity. Summing up, what emerges from the second graph is a widespread medium knowledge of the BPMN 2.0 elements and properties. This is certainly due to the few months that elapsed since BPMN 2.0 specifications were published and hopefully in the near future the trend representing the acquired familiarity with BPMN 2.0 elements will look like the first one.

4.4. On simulation and execution

In a section of our survey, we asked interviewees to answer few questions concerning validation of BPMN models, their simulation and execution. According to the collected answers, 56% of users think it's fundamental to work with valid models, while one out of five considers validation of models strongly connected to readability and clarity of diagrams. The 60% of interviewees use a tool with an embedded simulation environment. Half of the users are interested in simulating only flows – mainly to discover bottlenecks, deadlocks, and for exceptions handling (more than 65%) – while the remainder use to deal with complex simulation scenarios, testing also variables' values,

business rules, conditions, default paths. The latter are in fact more interested in estimating times and costs, discovering infinite cycles and understanding the behavior of the processes.

Lastly, we asked for some information related to the execution of BPMN models, a widely discussed topic nowadays. The majority of interviewees (more than 70%) execute BPMN processes on their own by using a BPM software framework like the Oracle BPM or the TIBCO AMX BPM suites (17% each). Almost 36% of the interviewees declare they execute processes to perform some automatic and repetitious procedures, while the others aim to increase performances of tasks execution, develop and execute Web-services or for audit purposes as well (14.3% each).

The last question was about the serialization format used to save, export, execute and/or share BPMN diagrams. It is worth noting how, although BPMN 2.0 has been published in January 2011, almost 40% of the interviewees use nowadays the new native XML serialization of BPMN 2.0. Instead, XPD is the preferred choice for 27% of users while WS-BPEL is used only in 9% of cases.

4.5. How good are the software tools offering BPMN support?

According to the official BPMN website there are more than 70 current implementations and 4 planned implementations.⁴ In addition, the BPI web community constantly updates a list of different software, categorized by the supported standards (both the type and the version of standards are categories, as well as language and license), with more than 60 BPMN and XPD diagramming softwares. Unfortunately the rating system offered by the BPI is not yet used as much, so it is not possible to use its ranking as representative (only 15 tools were rated at the moment we are writing, and only 4 got more than 1 rate). However, within the list there are 28 tools supporting BPMN 1.2, while only 8 supporting BPMN 2.0.

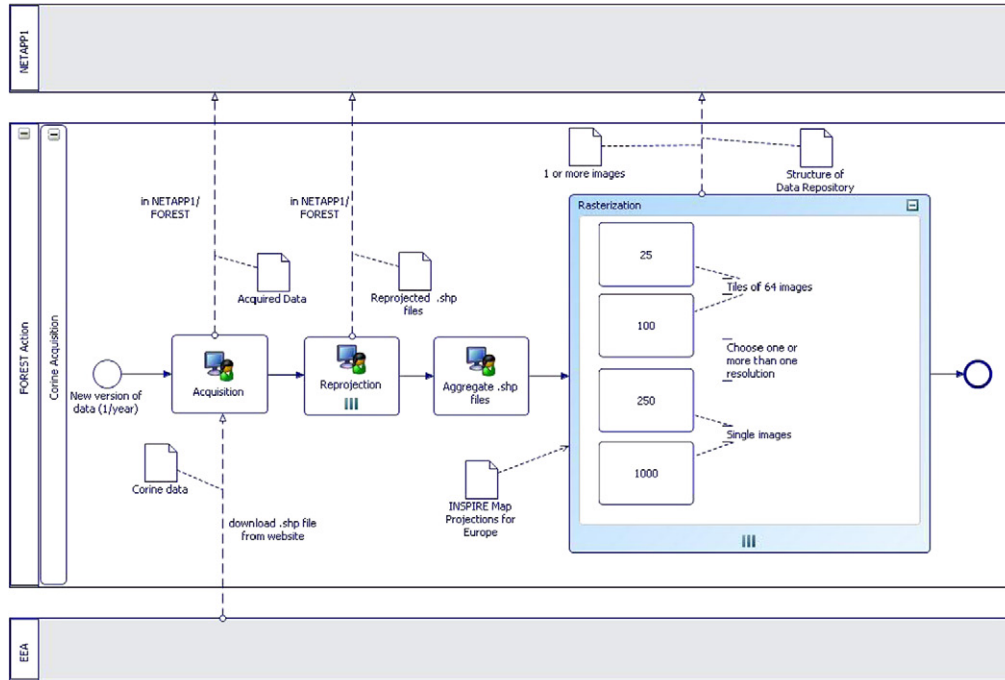
In Table 1 we compared the results obtained from the survey we published (first row on the left) and the results extracted from the answers given to an informal survey entitled *What is your favorite BPMN Modeling Tool?* conducted among the members of a BPMN group on LinkedIn and which collected more than 40 answers. The main difference is in the different audience of the two surveys: while we invited BPM(N) experts to answer our survey, the latter was a

Table 1
Preferred BPMN editor.

Our survey	LinkedIn group
BizAgi (13.21%)	BizAgi (17.07%)
Intalio (7.55%)	SparxSystem EA (9.76%)
ITP Process Modeler (7.55%)	Visual Architect BP-VA (7.32%)
Oracle BPMN Studio (7.55%)	ARIS Express (7.32%)

⁴ from <http://www.bpmn.org> (accessed May 2011)

(a) The CORINE acquisition process



(b) The NUTS acquisition process

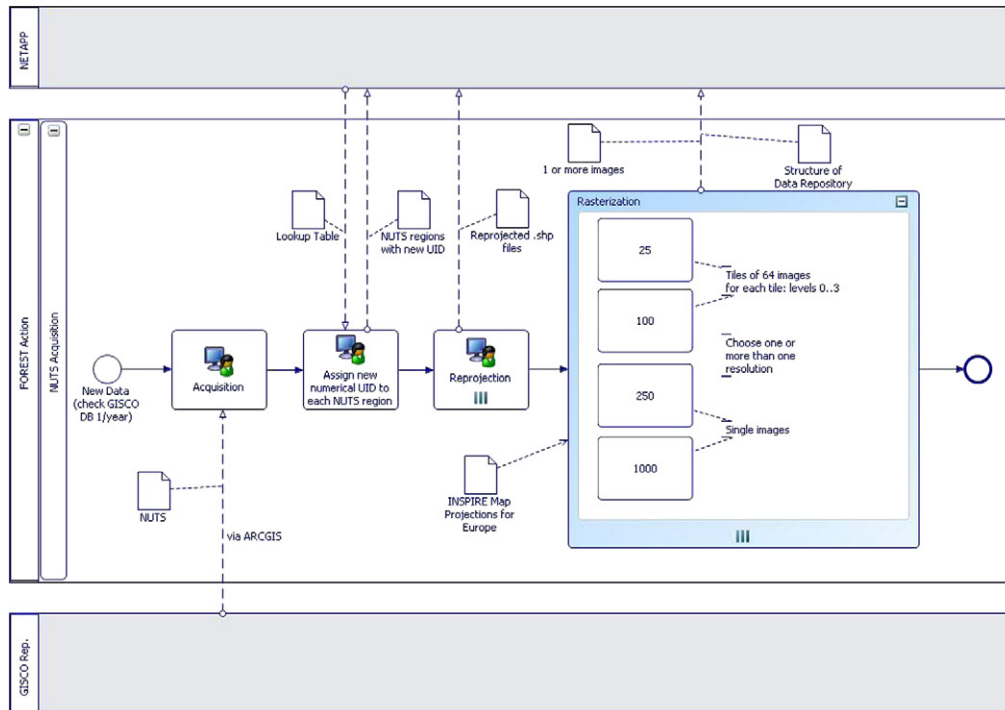


Fig. 10. Images (a) and (b) show the two processes derived from the one sketched in Fig. 9 using the paper sheet.

Studio⁵). During this stage it is possible to integrate the description given during the interview and fill most of the gaps by going through all the available documentation. Once you have a first version of the process modeled in BPMN which should be syntactically valid (refer also to Phase 1 of the methodology delineated in [36,45]) you can still

go back to the domain expert to show him the first achievement asking for further details.

After the refinement phase (refer to Phase 2 of the methodology in [36,45]), which includes also a refinement of the graphical layout of the model, the reduction of elements number, the substitution of complex and/or redundant parts of the model with simpler patterns (the Bruce Silver's book [11] is a good starting point for this), you can come to a final, clean, easily readable version of the original process (see Fig. 10).

⁵ http://developer.tibco.com/business_studio/

6. Conclusions

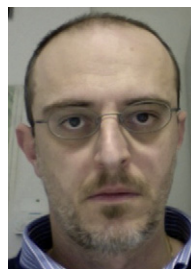
We have presented a high-level overview of the OMG's BPMN standard, focusing our attention to its relationships with other business process modeling tools and assessing how such standard has been perceived and effectively deployed by practitioners. First we introduced the basic concepts of workflow modeling and business process in order to position BPMN in the right context. Then we went through the history of the specifications from the beginning until the latest major version published in January 2011. Having placed side by side the results collected with our survey with other publicly available information – suitably filtered – we delineate a BPMN acceptance scenario, as well as usage statistics. Finally, we presented a use case currently running in a multi-cultural and multidisciplinary working environment, thus addressing many common issues in process modeling, along with the adopted solutions.

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