2010

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Journal:	*18th European Conference on Information Systems*
Manuscript ID:	ECIS2010-0335.R1
Submission Type:	Research Paper
Keyword:	Semantic modeling, Information-model visualization, Action research, Measurement models/methodologies/metrics

TRANSFERRING A DOMAIN-SPECIFIC SEMANTIC PROCESS MODELING LANGUAGE – FINDINGS FROM ACTION RESEARCH IN THE BANKING SECTOR

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Abstract

Banks need to document their business processes for multiple purposes. Hence, efficiently documenting and automatically analyzing business process models becomes increasingly important in order to achieve additional value from modeling efforts. However, recent research indicates that banks are not very satisfied with general purpose business process modeling languages. Our research indicates that there is no domain-specific modeling language, which could support the specific modeling and analysis requirements of banks. Coming from a real-life case in the banking industry, we introduce a business process modeling language using semantic process building blocks for banks.

Keywords: Semantic Process Modeling, Business Process Modeling Language, Action Research, Banks.

1 MOTIVATION AND CURRENT STATE OF THE ART OF PROCESS MODELING IN THE BANKING SECTOR

Business process modeling is important in business reorganization and management projects in all sectors and domains. Modeling is a way to capture the implicit process knowledge of an organization and to document it explicitly in a (semi-) formal way. Models can be used e.g. as a basis for decisions on IT investments, reorganizations or the selection and implementation of information systems.

The need to extensively analyze business processes for multiple purposes is currently of major relevance in the banking sector (Cocheo & Harris 2005, Harmon & Wolf 2008, IBM 2005, Papastathopoulou & Avlonitis & Indounas 2001). It has become even more important due to the financial crisis. With the shared ambition of many banks to industrialize banking processes (Drake & Hall & Simper 2009, Wilken & Maifarth & Lehmann & Ziggel & Ziganke & Borcher & Geske 2008), the need to model, document and analyze the processes in banks is omnipresent. Analysis purposes in banks include the optimization of business processes, compliance of processes with legal rules, management of (operative) risks in the processes, human resource requirements planning according to necessary capacities and skills for executing processes and product costing according to the process-oriented allocation of costs.

There are a number of general purpose modeling languages that have been developed during the last decades (Dumas & van der Aalst & A.H.M. ter Hofstede 2005). Famous examples are the event-driven process chain (EPC) (Keller & Nüttgens & Scheer 1992), the UML activity diagram (Object Management Group 200) or the Business Process Modeling Notation (BPMN) (Object Management Group 2006). They all help in documenting, communicating and analyzing activities in the company in a semi-formal way. However, with semi-formal specifications of business processes, an automated model analysis is hardly possible although the automated semantic analysis of business process models would allow significant cost saving potential contrary to manual evaluations (Blechar 2009, van Hee & Reijers 2000). It turns out that many process modeling experts in banks are not satisfied with the utility of modeling in contrast to its efforts (Becker & Weiß & Winkelmann 2010).

During a project in a bank we were faced with modeling and analyzing the core processes in order to identify IT investment and reorganization potential. Experts within the bank indicated that they were unhappy with the modeling language (EPC) that they had used so far due to high efforts in modeling, updating and analyzing of business process models. Hence, we were looking for a modeling language that would be easy to use and would support the automatic identification of various semantic issues with regard to banks.

To date, there are various research projects and prototypes that deal with pattern identification and semantic annotations of semi-formal process models as in EPC or BPMN models. For instance, Thom (2007) identifies typical block activity patterns as business functions frequently found in business processes. Iochpe & Chiao & Hess & Nascimento & Thom & Reichert (2007) discuss a suite for business processes based on the reuse of context-sensitive workflow patterns. Often, process modeling languages are linked to ontologies. For example, Lin (2008) introduces an ontology-based semantic annotation approach to enrich and reconcile semantics of process models. Thomas and Fellmann (2007) also use metadata to connect actual process models to ontologies. Those approaches need a domain ontology and a (manual) matching between business models and ontological concepts. From the bank experts' perspective, this two-step approach is very difficult to communicate and use in practice. Hence, we were looking for an easy to use language for banking purposes that allowed a modeling even for non-experts and an automated semantic process evaluation.

Thus we decided to look at existing semantic modeling languages as a basis for our modeling. Unlike syntactic modeling languages that mainly incorporate elements from the modeling language, semantic modeling languages also use elements from the domain language in order to make statements about the problem domain (Kelly & Tolvanen 2000). Thus, our first research question (RQ1) refers to the question whether it is possible to apply a semantic domain-oriented process modeling language to another domain. We address this question mainly from the perspective of transferability from a language from the public sector to the finance sector, but we also draw general conclusions with regard to transferability. As a semantic process modeling language consists of both syntactical and semantic domain elements, our second research question (RQ2) dealt with the question, which adaptations we would have to make in order to make the language work in the bank domain as well (RQ2).

In our article, we introduce and evaluate first results of adapting and applying a semantic, domain-specific modeling language to the banking domain. The paper is structured as follows: after the introduction (section 1), we introduce the bank, the determining conditions of our case and our research approach (section 2). In section 3, we discuss the basic concept and the underlying assumptions of the original language. We derive necessary changes and additions for our project in a mid-sized bank (section 4) and generalize our findings to the banking sector in total (section 5).

2 CASE DESCRIPTION AND RESEARCH METHODOLOGY

In the last years, we conducted a lot of process modeling in various domains and with various modeling languages. In one of our projects a medium-sized bank recently asked for an innovative support in its business process modeling projects. The bank followed the paradigm of continuous process improvement throughout the entire processes and thus had its own professional business process management team, which was responsible for the entire process management cycle (process strategy, process design, process implementation and execution and process monitoring). However, the bank suffered from a high effort of modeling the actual processes in the EPC notation. Experts in each department were not able to model their processes on their own and had to be supported by the process management team. Furthermore, it was not possible to conduct any sort of automatic analysis within the process models.

The bank operated a single product only – namely consumer credits for over 900 banks in Germany and Austria. At the same time it also operated over 60 subsidiary shops in different cities, which offered its credit product. It employed over 1,000 people in 2008, who together as a bank served 443,000 customers, totaling a credit volume of 4.9 billion Euros. In this setting the bank gave us the opportunity to model, analyze and optimize the frequently used and standardized core banking business processes within the production unit, the service and support center unit as well as the shared services unit of the production department. We chose to do an extensive action research project (Reason and Bradbury 2008), in which we were able to model a large part of the daily operating processes with a focus on modeling core banking business processes especially in the production department (since production processes represent the core banking processes we are focusing on). Typically, action research is an interactive reflective and iterative process of problem solving that involves organizations as well as researchers (Lewin 1946, Argyris & Putnam & Smith 1985). Hence, within our projects and expert interviews in the bank, we soon came to the conclusion that generally applicable modeling languages without any specific relation to the banking sector were not appropriate for the bank's purposes. Furthermore, it turned out that these languages did not support the economically efficient semantic analysis needs of the bank and that no suitable languages for banking purposes existed. As a consequence, we iteratively engineered a method that allowed an automated analysis of process models in the banking sector.

For the development of the semantic process modeling language we applied a problem-centered approach in accordance with Peffers & Tuuanen & Rothenberger & Chatterjee (2007). This approach addresses important unsolved problems in a unique or innovative way or solved problems in a more effective way. On one hand, we were faced with the solved (more general) problem of business process analysis and provided a solution to handle this more effectively by providing a basis for automated business process analysis with the help of an innovative artifact, whose former absence led to laborious manual or semi-automatic analysis of business processes. On the other hand, we also contributed to the unsolved (more specific) problem of automating business processes analysis in the banking sector. Coming from action research, we especially contributed to the needs of a single bank, but we believe our findings to be valid for other purposes of banking process modeling as well.

The research approach consisted of five main activities (cf. figure 1) according to Peffers & Tuuanen & Rothenberger & Chatterjee (2007). From a top level methodological perspective we utilized different research techniques in each activity to appropriately support our overall objective. The activities for identifying the actual problem and solving it by developing a semantic business process modeling language for the banking sector are as follows:

Problem Identification/Case Selection:

We cooperated with a medium-sized, specialized bank in a process management project. We soon realized a lack of semantic, automatic process analysis possibilities and modeling problems with existing languages. Experts revealed that they were not very happy with the modeling in a generic modeling language (so far, they used an extended form of the EPC).

Definition of Objective of a Solution:

As a consequence of the identified problem, we were looking for a more suitable language that supported the needs of the process management team more efficiently. We conducted extensive expert interviews and a literature analysis in order to do so.

Search for Suitable Modeling Language (Artifact):

With the help of expert interviews, literature reviews and document analyses we tried to identify a suitable modeling language that could be used in the specific banking case. However, we were not able to identify specific modeling languages that allow an efficient modeling and a suitable automatic analysis of models. Looking at other domains, we came to the conclusion that a language from the governmental sector (Becker & Algermissen & Falk & Pfeiffer 2006) may serve our purposes since it is well-suited for modeling and analysis purposes (Becker & Breuker & Pfeiffer & Räckers 2009). With regard to the bank’s processes, we expected public administration processes to be rather similar to these than to those processes of retail or industry companies, esp. since both domains belong to the service sector and involve a high amount of administrational work. Most processes were highly repetitive and linear. They were conducted in large numbers and did not have many intersections in comparison to their lengths. In many cases, the processes were highly structured, consistent and standardized due to legal obligations. Furthermore, many processes in the bank had been decentralized because of many branches that exchange documents and information among each other. Hence, we decided to try to adapt the language to our needs at the project partner’s site.

Adaptation of Modeling Language (Artifact):

To adapt the language we made an in-depth analysis of processes, applying the public sector language, which consisted of domain oriented process building blocks (PBB). Analyzing all different possible banks and their processes to provide a complete set of building blocks to describe all kinds of activities in banks seemed infeasible. Hence, Simon (2001) suggests to narrow the search process to find a satisfactory solution, i.e. satisfying solution without explicitly specifying all possible solutions. We used heuristics to select typical bank processes (the credit process is in fact the most discussed and researched process in the literature next to online banking processes), as well as asked the bank employees to give us select processes, which were complex and included many different activity types. We then adapted the modeling language to the banking sector in order to match our requirements. For the final selection and definition of building blocks we used a consensus-building approach among all modelers and analyzers to select the minimal amount of building blocks which were necessary to describe all activities in the given processes.

Generalization / Evaluation of Artifact:

The adaptation and application of the modeling language was iteratively evaluated by applying it to processes within the bank. To evaluate the adapted method for the banking sector we used three techniques common to evaluation (Hevner & March & Park & Ram 2004, Simon 1996): we used informal argumentation to build a convincing argument for our artifact's utility. We were able to base our argumentation on previous research results from PBB publications and findings in the similar domain of public administrations. In addition, we used the scenario technique when we constructed detailed scenarios for process analysis (i.e. process optimization as a specific purpose scenario for process analysis) around our developed artifact to demonstrate its utility. And we followed Peffers & Tuuanen & Rothenberger & Chatterjee (2007), who suggest to compare the artifact's functionality with the solution's objectives, as well as to use client feedback and logical proof. The later revealed that the artifact was good as there was no further need to extend the process building blocks to be able to model the tasks and analyzability was given "upfront" through the adaptation of an approach designed to fit our needs in this specific case.

3 INTRODUCTION TO THE SEMANTIC BASED PROCESS MODELING LANGUAGE

The original language strives for a flexible, efficient and simple representation of administrative processes in public administrations (Becker & Algermissen & Falk & Pfeiffer 2006). It consists of views, process building blocks and attributes (cf. figure 2). It differentiates between a process view (how is a service delivered?), a business object view (what is processed/produced?), an organizational view (who is involved in the process?) and a resource view (what resources are consumed?).

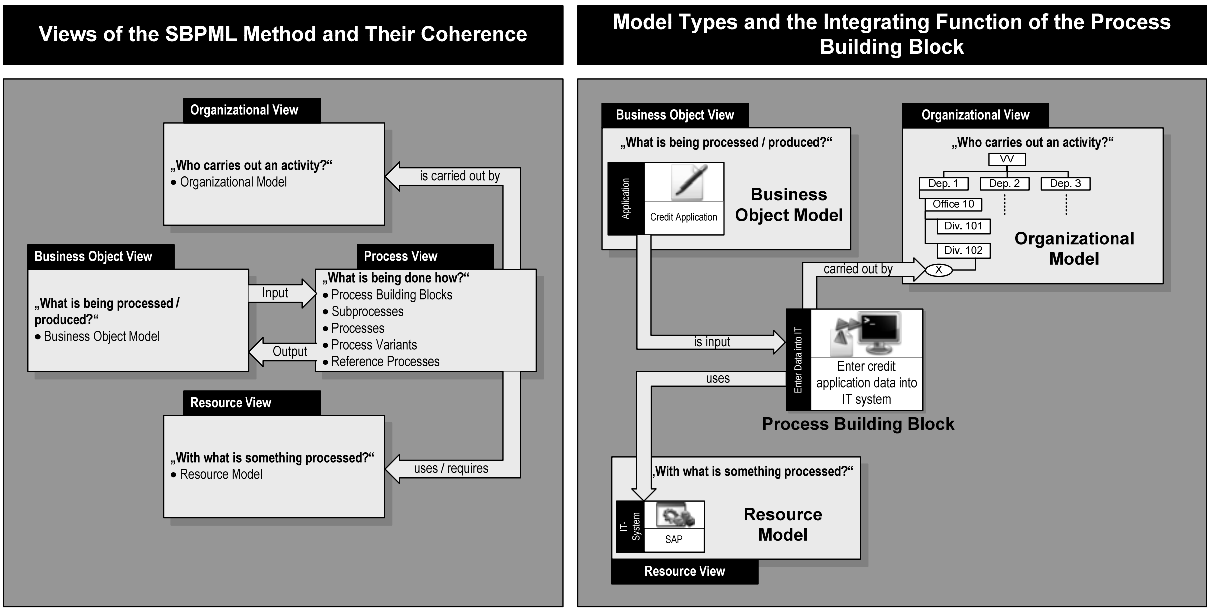

Figure 2. Views, model types and the integrating function of process building blocks

The main constructs of the modeling language are domain-specific process building blocks (PBB). They represent a certain set of activities within an administrative process and apply the vocabulary of the domain. Process building blocks are atomic, have a well-defined level of abstraction and are semantically specified by a domain concept. With process building blocks problems like naming conflicts in a model comparison are avoided, because the name of a process building block is specified by the language designer rather than the modeler (Bergener & Pfeiffer & Räckers 2009). Examples for process building blocks are "Incoming Document", "Formal Verification of a Document", "Enter Data into IT", or "Archive Document". Process building blocks belong to the process view. With the help of building blocks a sequential order of activities within an administrative process can be specified that describes the actual sequence of activities performed during one instance of a workflow.

This sequential order restricts the degrees of freedom of the modeler and simultaneously promotes the construction of structurally comparable models. As many processes are quite complex and run through several different organizational units, it is possible to define sub-processes that are conducted by just one employee. However, the strict sequence does not allow for intersections. As a solution, the language allows either the modeling of process variants that define an alternative sequence within a sub-process or the annotation of attributes that can be used to specify different cases with percentage values. Furthermore, an anchor allows for establishing connections between process building blocks in different sub-processes and variants to enable parallel process structures.

4 FINDINGS FROM ADAPTATION WITH REGARD TO MODELING

We focused on adapting the domain-specific building blocks to the bank's business processes. This goal was reached by an iterative process in which we modeled and analyzed 32 banking processes with 83 sub-processes, and 239 process variants. We did intensive interviews of more than 500 hours interview time with employees from the different departments of the bank that were involved with the execution of the analyzed business processes before, during, and after the language development and modeling as we wanted to identify different activities and from these abstract to common activity types, which resembled the original set of building blocks (also with respect to keeping a similar granularity in defining the building blocks). The interviews were coded and analyzed as described in (Gorden 1992). It soon turned out that we were not able to transfer the language to the bank's needs without at least some modifications. While we were able to map most activities with the building blocks known from the public sector, there were several specifics in the bank's business process models, which we believe are distinct to the banking sector as compared to public administrations and needed specific attention:

- Concerning the processes in the bank, we were confronted with many payment activities, as well as many verification activities and documentation activities, but also many accounting activities, which were performed by employees. As the old building blocks had two different building blocks for incoming payments and outgoing payments we merged these two closely related building blocks to one process building block named "Make / Receive Payment". We were able to differentiate incoming and outgoing payments by the introduction of a new a payment building block specific attribute, which could differentiate between an ingoing or outgoing payment. A similar optimization possibility for reducing the complexity of the building block set was given as the old building block set had two building blocks for verification activities (one for formal verification – i.e. missing fields in a document and one for verification of content – i.e. verification if claims made via an application form could be accommodated by the bank or not). Since these two building blocks are again closely related, and there was no necessity to strictly separate these activities, we also merged these two building blocks to form a more general building block with the new name "Verification of Document / Information". Similar merges were done regarding the building block "Forward Document / Information" (formerly just for company-internal forwarding), which was merged with the more general "Document / Information Goes Out" (now to external and internal parties, outsourcing this specific into a new attribute regarding the receiving party). Another merge was done regarding "Make Arrangement / Agreement" and "Perform Consultation", as making an arrangement or agreement always occurred after a consultation (no matter how short), but a consultation was not always succeeded by an agreement (only a successful consultation). Thus we merged these two building blocks and introduced a new attribute for the resulting building block, which differentiated if an agreement would follow or would not follow. Only the process building block "Record / Register" was never used in our process models, wherefore we removed this process building block from our SBPML PBB set for banks.

- The former building block “Make Inquiry” (usually via telephone) was renamed to a more general building block “Request Document / Information”, which could occur via any communication channel. To keep the communication channel information another new attribute was introduced.
- Regarding documentation activities, we had to create a new process building block since there was no adequate building block to describe this activity and this was an activity which was frequently found in the banking processes and thus justified the action of creating a new building block for the act of documenting something (the building block was named “Record / Document”).
- As accounting transactions were made almost as frequently as documentation activities and are daily business in banks, we used this to justify the creation of another new building block named “Make Accounting Transaction”, even though this could probably also be seen as a type of “Enter Data into IT” or “Edit Document / Information”.
- One other activity, which was performed sometimes and did not correspond to any existing building block but complemented the existing building block set well, was “Destroy Document / Information”, which was into the building block subset “Information Processing”.
- As typical management activities like planning, monitoring or steering were also of interest to the bank’s process documentation we had to further expand the building block set to include a high level building block under which all three activities could be subsumed. This new building block was called “Management Activity” with an attribute refinement for differentiating what type of preparation activity was performed. With this last new building block it is also possible to document and analyze management processes, which were formerly not part of the specified notation was designed to (originally it was only designed to support the modeling of core administrative / operational and support processes but not management processes).

Additional facts about the processes can be collected with the help of attributes assigned to each block. These attributes specify the properties of the corresponding building blocks in detail. For example, a possible attribute for the building block “Enter credit application data into IT system” is “Duration”. Attributes provide the core information for a subsequent process analysis. Although we will not go into detail on the numerous attributes of each building block, during the course of our project we found that we also had to change a number of attributes (11), remove several attributes specific to public administrations (17) and add new general as well as bank specific attributes (149). Starting out with 163 attributes from the original semantic business process modeling language (SBPML) for public administrations standard, we could enhance the attribute set to 316 analyzable attributes.

A first real peculiarity of the banking process activities we analyzed was that the bank tried to not only model human activities but to a certain extent also modeled IT system activities, as banks nowadays are highly IT-supported and many activities are hidden and performed solely by the IT. To not lose this knowledge the bank required to be able to model these types of activities. The difficulty was to decide how to integrate this request into our approach as it was originally only designed to support the modeling of human performed activities. Option a) was to define the IT system as an “organizational role” and to link the IT system role to the building blocks provided also for human activities. Option b) was to extend the existing building block set to include various IT system activities and option c) was to create one new building block, which would hide the complexity of IT system activities, but would yet preserve the knowledge of which processes were triggered and automatically processed by the IT system landscape. We decided against option a) as sequential sub-processes in the notation follow the “model what you do” principle and thus an employee should be able to model his own activities without knowing what the IT system does in the background. We decided against option b) as adding to many new building blocks would make the building block set to complex for use in modeling purposes and we wanted to keep it small for ease of use reasons and well-arranged. Therefore we decided for option c) and just created one new building block named “System Activity”, which would belong to the subset “Information Flows and Participation”. Thus, an employee would just model this abstract non-human activity into his process without having to know what would happen behind it and the IT department experts could use more sophisticated models like UML for defining IT processes and data flows on a lower granularity which is typically needed for IT implementations.

A second peculiarity was that in opposition to our experience from the public administration sector customer activities were included in process models because banks are very customer-oriented and also try to optimize customer activities. Since the language was defined to support only company-internal business processes, we solved this hurdle by introducing a new organizational role for customers aside from the normal internal organizational chart, which is used in the organizational view.

Finally, 25 interviews with bank employees from the specialist departments and interviews with 7 business process management experts from the BPM, auditing and organizational development departments revealed that two further activities were very common which needed to be documented within the business process models. These were creating follow-up activities (i.e. when an employee sent a document to a customer and needed a response within a specific time frame) and the application of the four-eyes principle in numerous activities. As these tasks are not very complex, but moreover usually supplement other activities we decided to integrate these facts into building block specific attributes, esp. those including document flows and client contact regarding the setting of follow-up requests and those where payments and transactions were made with respect to the four-eyes principle. The final building block set developed in the banking project can be seen in figure 3 as the central outcome of our extension based method engineering approach.

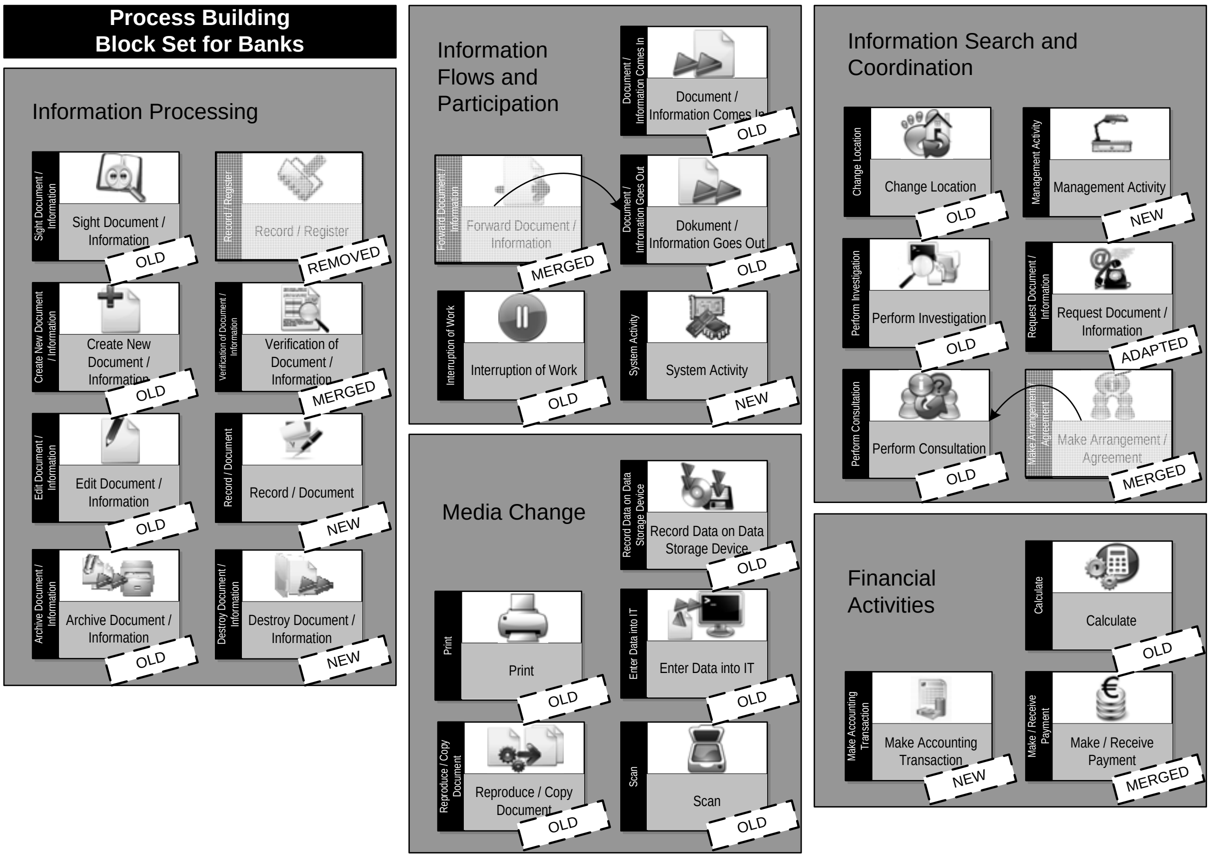

Figure 3. Proposed process building block set for the banking sector

Applying the newly designed notation we were able to model all activities and processes without the necessity of further extensions. As many banks have similar processes and other banking products and services – generally speaking – use similar activities, we argue that our banking specific building block set derived from our case study may not be complete, but is very likely a satisfying solution. We recall that an optimal solution cannot be determined within a feasible amount of time and research done, as it is not possible to look at every banking case (in particular uncovering rare special services and activities in banks, which may need different building blocks apart from those we have found in our research).

5 FINDINGS FROM ADAPTATION WITH REGARD TO ANALYSIS

To capture further information about how an activity is carried out, each building block type allows for a specific set of attributes. These attributes specify the properties of a building block in detail. For example, "Enter Data into IT" has an attribute "Duration" to analyze how much time this activity demands. Attributes are also used to establish the connection to model elements of other views. Therefore, "Enter Data into IT" has an attribute to capture the used IT systems from the resource model. Hence, attributes provide the core information for the subsequent process analysis. For example, the process "screen decendent's estate" is conducted 2,500 times a year. In total, it takes about 6 minutes processing time (cf. figure 4). If it is possible to reduce the number of telephone inquiries (now 30% to then 20%) and hence improve the processing time due to automating by 1 minute, the bank would be able to save 1.5 working days per year. As can be seen from this example the automatic analysis of the information encoded into the process models via building blocks and attributes can used to automatically calculate cost-saving potentials.

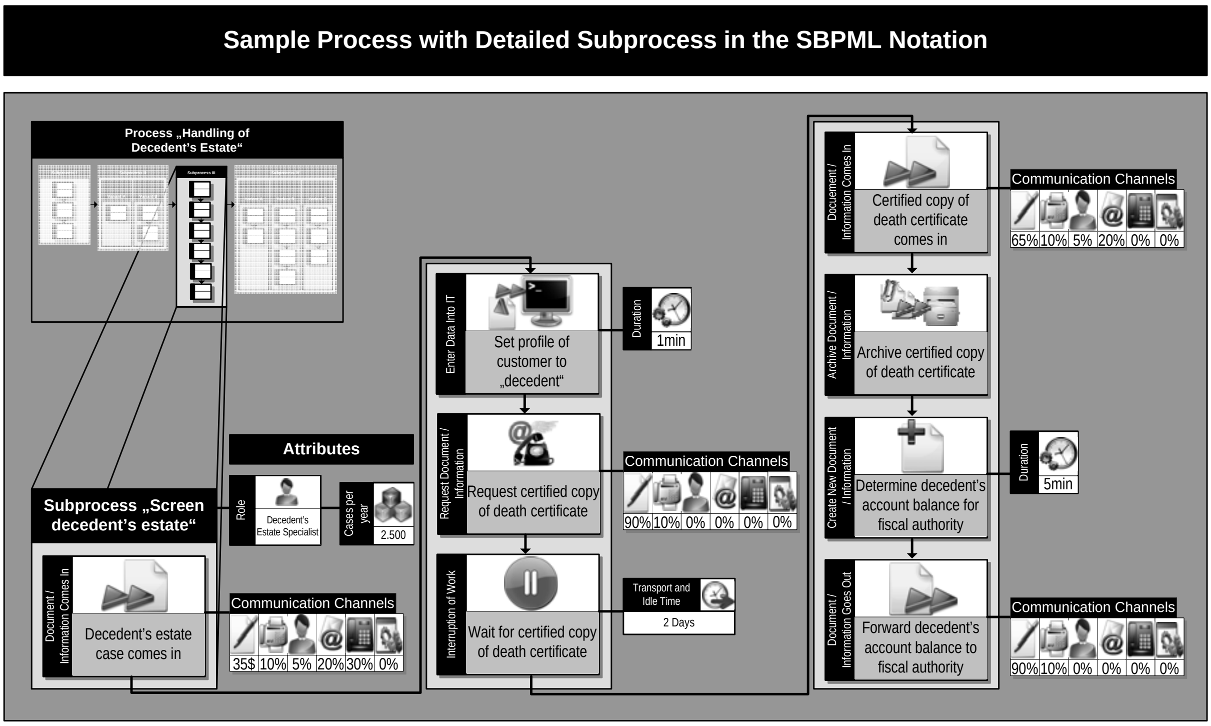

Figure 4. A sample process from the banking sector using the adapted SBPML PBBs

Furthermore, the language allows for the definition of search patterns which can be used for automatic identification of the generally identified process weaknesses (media breaks, information deficits prohibiting process execution and manual activities with potentials for automatization) (Becker & Bergener & Räckers & Weiß & Winkelmann 2010). A media break can be defined as a change of the medium used to carry information during information processing. A typical example of a media break in a process occurs when information in the form of a paper-based document (e.g. a credit application) is received by an organizational unit and then scanned and / or information from this document entered into an information system (e.g. applicant and credit data entered into core banking system) for further electronic processing (e.g. for credit assessment and documentation purposes). Assuming that a document or piece of information is processed electronically sooner or later in a process, we define the following patterns to characterize the media break weakness: a) a document or information is received / forwarded or sent non-electronically b) a document is scanned (concluding transfer of paper-based information to digital information) or printed (concluding transformation of digital information to paper-based information) or first scanned and then again printed (assuming the same underlying business object – e.g. document or piece of information) c) data is entered into IT (as the result of transferring paper outside of current IT system from another medium or even IT system).

Within the modeling case, we found many evidences for inefficiencies, manual activities and information deficits. For example, in 153 process variants we were able to automatically identify documents that came in on a traditional way (fax, email, letter). Furthermore, "perform investigation" was an indicator for information deficits in 63 cases. Manual activities such as "verification of document" may indicate inefficient manual activities (157). In total, it turned out that we were not able to automatically interpret and solve these issues but the language allowed for the automatic identification of possible process weaknesses. We have evaluated the language within the boundaries of the action research project for our defined analysis purposes. We argue that there is a high chance that it will also perform well for many but certainly not all different types of process-oriented analyses, provided that the information is modeled in a semantically analyzable way.

6 SAMPLE PROCESS RESEARCH CONTRIBUTIONS AND LIMITATIONS

In our case, we successfully applied the SBPML to the banking domain (RQ1). However, it turned out that it is not possible to do that on a 1:1 basis but that the domain specific language needs to be adapted in order to be used in the banking domain (RQ2). We were able to identify a stable set of building blocks for describing core banking processes. Although some modifications may be necessary with the continuous usage and evaluation of the modeling language in other banks, we believe that the set of building blocks is very stable already. The modeling turned out to be very simple due to the limited set of building block alternatives. As one bank employee put it "we were able to describe our processes in a structured but still very flexible way without much knowledge about process modeling rules itself". Although we did not measure the time that was needed for actually modeling processes in comparison to modeling the processes with generic modeling languages such as EPC, we observed it to be much shorter. For an actual comparison of the modeling durations of processes with the help of EPC in comparison to modeling with the SBPML notation in public administrations see Becker & Breuker & Pfeiffer & Räckers (2009). From various projects in the public administration, they came to the result that modeling with building blocks is at least three times faster than modeling with any form of EPC notation. In our project, we detected various additional advantages of the method in comparison to the existing EPC modeling approach in the bank. For example, the strictness of the building blocks turned out to be very helpful as various modeling experts participated. With EPC, distributed modeling led to variances in the process models; with PBBs for banking no variances were possible anymore.

With regard to automatically analyzing business process models we consider the method to be very valuable. The process models are especially useful for automatically analyzing IT investment decisions, for process comparisons, and for IT implementation analyses (esp. for workflow management systems and document management systems because building blocks focus on information flows and document flows) (Becker & Bergener & Räckers & Weiß & Winkelmann 2010). Furthermore, we were able to automatically derive job descriptions and required skills from the process models. It also became possible to analyze the usage of different communication channels (telephone, fax, letter, e-mail, or face-to-face contacts). With regard to compliance rules and new requirements from the financial crisis management, we were able to identify the involvement in critical decisions that actually require a four-eye principle. All of these analyses were very important to bank.

In the project, we used the original method for and adapted it to core banking processes only. Although we believe it to be transferable to other banks, we do not expect it to be usable for modeling all types of processes apart from core banking processes. So far, we did not try to model supporting processes, found in many types of businesses such as human resources, accounting, etc. Even though we concentrated on core processes only, there is also the opportunity to adapt the language to the need of support processes as these are also highly administrative, structured and repetitive. As a first start, we have only applied the building block approach to critical core processes of one bank. Expert interviews, logical reasoning and the large number of processes we have modeled so far, indicate that our adapted language is also suitable for other banks and modeling needs in banks. However, further research is needed in order to verify the practicability in general banking environments. For example, looking at a bank with a larger product base, it may be possible that not all processes can be modeled.

Domain-neutral languages have the advantage, that they can be applied universally to any type of process and activity, whereas the usage of our language is limited to the banking domain. The domain-specific PBBs offer less degrees of freedom in how to model. It is not possible to choose different abstraction levels or types of processes to be modeled. However, our approach is more sophisticated in terms of automatic syntactic evaluations of processes as well as – even more important – in terms of automatic semantic evaluations. The language offers a much higher degree of analysis possibilities due to the encapsulation of semantics in attributes and building blocks and hence, their standardization. Furthermore, with only few guidelines and a manageable set of building blocks to choose from, it turned out to be manageable for departmental experts who are not experts in process modeling. Hence, we believe our modeling language to be a valuable contribution to the body of knowledge of process modeling. As a continuation of our study, we suggest further field studies to monitor the use of our artifact in multiple projects and to derive new areas of application from these studies. We also suggest further case studies for an in-depth study of the artifact in different banking business environments and project settings regarding the type of analyses that are of interest to banks.

7 ACKNOWLEDGEMENTS

This paper was written in the context of the research project IMPROVABLE, which has been conducted by the European Research Center for Information Systems at the University of Muenster. It was generously supported by the DZ BANK Foundation. We also kindly thank our German partner bank, which continuously supported this industry-academic research collaboration scheme and actively participated in evaluating the SBPML artefact. Further, we would like to thank the bachelor students of the corresponding project seminars, without whom the large process landscape could not have been captured, modelled and analysed in the given time frame of the initial field work.

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