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MODELING CONCEPTS FOR PROCESS AUDITS – AN EMPIRICALLY GROUNDED EXTENSION OF BPMN

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Abstract

It is widely acknowledged that a comprehensive understanding of business processes is crucial for an effective and efficient audit of a company's financial reporting and regulatory compliance, especially in light of the recent major financial scandals. In an attempt to improve the support of business process auditors, we conducted 17 semi-structured expert interviews to obtain deeper insights into their information requirements. We identified six audit concepts suggested by these experts to be graphically represented in process models. Five out of these six audit concepts are already included in existing modeling languages or enterprise modeling approaches. Only Financial Statement Line Items (FSLI) have not yet been considered. For this reason, this paper proposes an empirically grounded BPMN extension for modeling FSLI in business processes.

Keywords: Process Audit, Audit Concepts, BPMN Extension, Expert Interview

1 Introduction

The majority of countries worldwide require annual audits by law. The importance of audits is demonstrated by widely recognized cases of corporate fraud and bankruptcy including Enron (2001), MCI WorldCom (2002), Parmalat (2003), Satyam (2009), HRE (2011), and Olympus (2011). Auditors played a central role in these major accounting scandals. Process audits are an integral part of current audit approaches designed to cope with ever increasing audit-relevant data volumes based on the assumption that well-controlled business processes lead to correct preparation, presentation, and disclosure of financial statements (Bell, 1997) (Ruhnke, 2006). Annual audits focus on business processes that affect the financial reporting or the regulatory compliance of a company (Stuart, 2012, p. 13). Therefore, the International Standards on Auditing (ISA) 315.81 require that: “(...) the auditor should obtain an understanding of the information system, including the related business processes, relevant to financial reporting (...)” (IFAC, 2010, p. 267). The management and modeling of processes are well researched, as are corresponding methods and tools. But little attention has been paid to specific requirements of the audit domain. Addressing this gap, the general objective of the research project is to identify ways to improve the auditors’ support when they are conducting process audits. This involves – as in all projects – comprehensive and rigorous requirements engineering. However, information requirements of the audit domain have been only partially examined (Carnaghan, 2006). For this reason, Schultz et al. interviewed 17 audit experts on information requirements for process audits (Schultz et al., 2012). The coding process revealed twelve general audit concepts in total. Thereby, an audit concept constitutes information about real world objects relevant for process audits. These twelve audit concepts have not yet been fully evaluated with respect to their most helpful representation form. This constitutes a gap, especially for process audits, as stated by Carnaghan: “Existing research establishes that the form of information representation does affect auditor and accountant decision-making” (Carnaghan, 2006). Alencar et al. found that diagrams lead to better performance on an audit tasks in most cases (Alencar et al., 2008). Thus, a graphical representation of business processes that focuses on the needs of process auditors would appear to be important. Closing this gap by focusing auditors’ information requirements and especially their representation in business process models is the research focus of this paper. The results presented here form the second step in a broader study on the information requirements of business process auditors.

(Ahlemann and Gastl, 2007) proposed the underlying approach and established a framework for the construction of an empirically grounded reference model. The contribution of this paper is threefold:

1. Expert perspectives on the most reasonable representation of audit relevant concepts in process models.
2. A selective comparison of identified representation requirements to already conducted research.
3. A BPMN extension incorporating these results - especially focusing financial statement line items (FSLI) as an extension of BPMN.

The remainder of this paper is structured as follows: The next section introduces the methods used to conduct and analyze the semi-structured expert interviews. This is followed by the presentation of the research findings. The subsequent mapping of audit concepts to different representation forms is explained by citing expert statements. Section four presents the BPMN extension followed by the description of an exemplary business process model. Section 6 evaluates the proposed extension. The paper ends with a conclusion and implications for future research.

2 Expert Interviews – A Qualitative Approach

2.1 Conduct of Expert Interviews

(Ahlemann and Gastl, 2007) suggest choosing semi-structured expert interviews as a qualitative method for explorative research. This recommendation was followed for a number of reasons:

1. Trinczek mentions that semi-structured interviews are the method of choice when consulting managers (Trinczek, 2009). This applies to the majority (10/17) of the experts.
2. Expert interviews allow the interviewees to think about audit concepts and their representation in an open way, not necessarily bound by their current work practice. This approach offers the opportunity to link the experts' experiences and perceptions with new ideas. Additionally, the influence of the interviewers' preconceptions is minimized.
3. Due to their semi-structured nature, results of these guideline-based interviews are quite consistent (Myers, 2009, p. 124) and therefore rather easy to analyze (Seidemann, 1997, p. 13).
4. As a necessary precondition for guideline-based interviews the authors are highly familiar with process audits (Pfadenhauer, 2007, p. 459).

In the period from January 2012 to May 2012, we conducted these 17 interviews each approximately lasting between 30 minutes to an hour. The "point of saturation" (Stebbins, 2001, p. 27), where basically no increase of new insights could be noticed anymore was reached by interviewing 17 audit experts. The last three interviews did not generate new knowledge. Every interview had two main parts: the first part aimed at identifying relevant audit concepts. These audit concepts are: Audit Result, Audit Objective, Business Objective, Controls, Data, Financial Statement, Information Systems (IS), Materiality¹, Organizational Aspects², Process Flows, Risk and Standards (Schultz et al., 2012). The second part focused on the improved representation of these audit concepts. The selection of domain experts was made in the same way for both parts: using the purposeful sampling approach described by Patton for the selection of experts. A combination of type five "Typical Case Sampling" and six "Stratified Purposeful Sampling" were used (Patton 1990, p. 182). The interview strategy was identical in both parts. The guideline included "upkeep" and four core-questions all of which were open questions. All interviews were conducted by two researchers – one taking the lead and the other assisting to keep the interview flowing and taking notes. The guideline questions were selected to support the goals of the research (see Exhibit 1).

Q1: Please introduce yourself, directing particular attention to your professional career.

Q2: What is your understanding of a process audit, and how do you describe the execution?

Q3: Which possible information representations in the context of a process audit can you think of in general?

Q4: Which representation would you choose for each of the audit concepts identified earlier?

Exhibit 1: Expert interview guideline questions

2.2 Data Analysis

All interviews except one were recorded and transcribed using the software F4. We reported the findings from the remaining one case from memory as it is common in expert interviews. The main objective of the interviews was to identify all reasonable representation forms and the most supportive representation form for each of the audit concepts. All results were coded according to the method suggested by Myers. "*Codes are tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study*" (Myers, 2009, p. 167). Following a bottom-up approach, we derived all codes only from the transcribed interviews not taking into account known representation forms from literature or work experience. As suggested by (Ryan and Bernard, 2000) one researcher coded a sample of transcripts and built up a code book. This was validated by a second researcher. Differences were discussed and settled. Hereafter, all interviews were independently coded by two researchers, both of whom are knowledgeable in terms of data coding. Only marginal

¹ "Information is material if its omission or misstatement could influence the economic decisions of users taken on the basis of the financial statements" ISA 320 (International Federation of Accountants (IFAC), 2010).

² Any organizational unit, e.g. department, role, employee

differences were noted. Joint coding was done in case of a mismatch between the results. MAXQDA was used to support the coding process.

3 Results and Analysis

In the first step, this paper presents all the representation forms mentioned by the experts. All previously identified audit concepts are assigned by the experts to these representation forms in the second step. A comparison of already conducted research to the presented findings is then carried out. It should be noted that the experts mentioned a number of different audit concepts in the first part of the interview. The total number of assignable audit concepts per expert varies from nine to twelve. However, this does not influence the results of the second part of the analysis because audit concepts not mentioned by an expert in the first part are not of interest to the expert for process audits. Hence, a representation is not needed for concepts not identified in the first part of the interview. The research results are presented as direct quotes from the expert interviews in order to minimize the influence of the interviewers' interpretation.

3.1 General Representation Forms

The experts listed a number of possible representation forms, namely: (flow-) charts, tables / control matrices, and narratives. However, the selection of audit concepts for each of these representation forms was not homogeneous. The overall result is well summarized by one of the experts: "Flow charts are graphical representations (...). Of course, these are extremely helpful for those who are not familiar with the process in focus because it's intuitive, but usually a textual representation cannot be completely replaced. Therefore, a graphical process flow and textual representation is necessary. To what extent the textual representation is in "prose" or in a more structured way like tables or control matrices (...) depends on the approach of the auditor. In general, a more structured approach, or at least the more structured the representation is the easier the processes are to understand – but maybe that's my personal preference. In case of doubt I would clearly prefer a graphical representation in combination with a control matrix over narratives." (Ex.9). Moreover, a combination of different representation forms for audit tools was often mentioned: "we use a IS based audit documentation tool providing different templates for diverse audit steps" (Ex. 14).

3.2 Graphically Represented Audit Concepts

The following expert statements provide examples of why experts require specific audit concepts to be graphically represented. They are sorted in descending order from the most to the least mentioned audit concepts. Some audit concepts were rarely chosen to be graphically represented. This paper only considers audit concepts which were mentioned by more than 50% of the experts. These are process flows, organizational aspects, controls, data, financial statements, and information systems. For an overview see Table 1. This approach was supported by the fact that all audit concepts selected by less than 50% had very high percentages in other representation forms (especially the so-called control-matrix, for an example please refer to (Chamber and Rand, 2011, pp. 56)).

	Expert 1	Expert 2	Expert 3	Expert 4	Expert 5	Expert 6	Expert 7	Expert 8	Expert 9	Expert 10	Expert 11	Expert 12	Expert 13	Expert 14	Expert 15	Expert 16	Expert 17	Total
Process Flow	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	x	17
Organizational Aspects	x	x	x	x	x		x		x	x	x	x	x	x	x	x	x	15
Controls	x	x	x	x		x	x		x	x	x	x	x	x		x	x	14
Data	x				x		x		x	x	x	x	x	x	x	x	x	12
Financial Statements			x	x	x	x	x	x		x	x	x				x	x	11
Information Systems (IS)		x	x	x			x		x	x	x	x		x	x		x	11
Risks	x	x									x	x			x		x	6
Audit Results	x																	1
Materiality											x							1
Standards													x					1
Business Objective																		0
Audit Objective																		0

Table 1. Number of experts requiring audit concepts to be graphically represented

The process flow was the only audit concept selected to be graphically represented by all 17 experts. They all agreed on using graphical process descriptions as a basis for their business process audits: “(...) the best way to model processes is actually a flow chart (...): firstly and most important, you need single process steps (...)” (Ex.4). The importance of this representation is further emphasized because “nowadays it is commonly accepted that a business process description - single steps in a chronological manner - without graphical elements doesn’t make much sense.” (Ex. 12). The main reason for a graphical representation is an improved overview: “In general a flow chart with single process steps is the method of choice in order to gain an initial impression when conducting a process audit” (Ex. 5).

Organizational Aspects were the second most mentioned audit concept. In this context, not only organizational units such as departments but also single individuals responsible or accountable for certain process steps were included in this concept by the experts. In total, 15/17 experts stated they would like organizational aspects to be graphically represented. Especially “who is doing what, how often and who is following up, who reviews the work, etc.” (Ex. 16). Additionally, some experts mentioned, that “(...) an organizational view would help to understand the company and operational structure. This could be implemented by swim lanes and / or flow charts” (Ex. 15)

The next most mentioned audit concept was Controls. These were mentioned by 14/17 experts. The absolute majority (13/14 experts) refers to so-called key controls when speaking about controls (for a definition see (IIA, 2008)). The main reason for the integration of controls into the business process modeling is, “to know who is executing the control, where the control is located in the process flow and if the whole process monitored resp. reviewed. (...). Only key controls should be included in the business process model” (Ex. 16). Particularly, “control evidence should be integrated in flow charts. Thus, you can see which control is executed in which step, by whom and which evidence is given” (Ex. 2). Further, graphically represented controls should be “linked with the control matrix” (Ex. 6).

12/17 experts preferred data to be illustrated graphically. They noted: “the work flow – from the initial data recording to the final payment – is very interesting because our clients still have a lot of manual controls and therefore the information who is dealing with which data would be time saving, when it comes to controls testing. The presentation of the document trails would save a lot of time” (Ex. 14). For example, “in the Order-to-Cash cycle there is a control called 3-way-match. If we would know how this control is implemented (manual or automatic) respectively which documents could be used as control evidence – it would save a lot time” (Ex. 17).

An audit concept closely related to data are the financial statements or financial statement line items (FSLI) – “ultimately, financial postings are a kind of data. They are the basis for financial statements” (Ex. 7). Nevertheless FSLI were most often mentioned in conjunction with activities: “firstly, I would be more than happy if activities, having an influence on FSLI, would be highlighted. For instance if

there are five activities and three have no financial impact at all, I want to be able to easily identify the two important activities. This information would be very useful for me as an auditor” (Ex. 3). The information about whether an activity not only has an impact on the FSLI, but “transaction volumes on a value basis are also of great interest. For example, there is a 1000 € order every day (annual total of 365.000 €) or just once a year (1000 € in total). Obviously there is a significant difference. From my point of view, this should be included in the flow chart” (Ex. 16). Including transaction volumes would also offer yet another possibility. “A critical case in business process audit prevails if the auditor does not know if 80% or just 20% of the overall volume are processed by a certain process. As of now you can’t really know based on the documentation we have” (Ex. 17). The inclusion of transaction volumes would apparently close this gap. In total eleven of the 17 experts suggested that FLSI be represented graphically.

Along with FLSI, 11/17 experts preferred a graphical representation of Information Systems (IS). These were often mentioned together with organizational aspects, “it seems important to know who is in charge of the process but also which IT-system supports a certain activity as well as a general overview over the IS landscape linked with processes” (Ex.9). Interfaces as well as organizational aspects were frequently mentioned in combination with IS. The underlying coding includes interfaces in the audit concept of risk. Thus, “a flow chart should also include the supporting IT-systems for the activities, moreover, the interfaces between IT-systems have to be marked” (Ex. 15).

3.3 Comparison with previous Research

Because of the objective of this paper to improve the support of auditors when conducting process audits, we conducted a pivotal literature review (see (vom Brocke et al., 2009)) focusing on graphical representations of the six audit concepts described above. We were able to identify work for five out of the six audit concepts. Only financial statements have not yet been incorporated into a business process modeling language. A few noteworthy examples of previously described graphical representations for audit concepts are listed below.

The concept of controls has been extensively researched. Particularly worthy of mention is the work of Strecker. His research not only focuses on the presentation of audit relevant concepts but also on their semantics (Strecker et al., 2010a), (Strecker et al., 2011). He established a broad and essential basis for the understanding of controls in business process modeling languages. Furthermore, Strecker investigated the topic of (IS) risk (Strecker et al., 2010b). Inter alia, he establishes the link to the audit domain. Rosemann and zur Muehlen did not directly link their work with the audit domain. However, they focused on the integration of risk into business process models (Rosemann and zur Muehlen, 2005). Organizational aspects and process flows as well as the concept of data are integrated in most enterprise architecture models and some business process modeling languages. Prominent examples are the MEMO Framework (Frank, 2002), the ARIS Framework (Scheer, 2000) and Adonis with a SOX reporting extension (Karagiannis et al., 2007). Modeling languages that contain all three concepts include the Business Process Modeling Notation (BPMN) (OMG, 2011), the Event Driven Process Chain (EPC) (Keller et al., 1992), the Integrated Definition (IDEF) (Menzel and Mayer, 2006) and others. Additionally, some researchers have extended existing business process modeling languages, for example (see (Korherr and List, 2007)) to support organizational aspects on a more detailed level. Information systems are also included as a major concept in most enterprise modeling approaches.

However, the integration of financial accounts has only been discussed once in literature (vom Brocke, 2011). This publication forms a first step and a basis for the work presented here. However, it remains on an abstract level, incorporating the concept of accounts into a combined meta-model of ARIS and REA. Therefore, the following section proposes an extension to BPMN meta-model including modeling instructions and an example for the missing concept of financial statements

4 Meta-Model-Extension with FSLI

For the implementation of the interview results into a business process modeling language, the classic “make or buy” decision came up: “make” (=develop) a new one or use an existing one. It was decided to extend an audit concept as most concepts are already included in existing and well-established business process modeling languages. The languages considered in (List and Korherr, 2006) were evaluated for their extensibility, present distribution, their recent speed of dissemination, as well as their worldwide usage. The latter aspect was considered especially important in the light of internationally standardized audit procedures. Ultimately, choosing BPMN is based on it being one of the fastest spreading business process languages (Recker, 2010) (zur Muehlen and Recker, 2008). Ko et al. even state, that “(...) of the standards, UML AD and BPMN are currently the two most expressive, easiest for integration with the interchange and execution level, and possibly the most influential in the near future” (Ko et al., 2009, p. 754). Moreover, “UML AD is increasingly losing favor with practitioners (...). This is mainly due to industry’s growing consolidation of BPMN as the de facto standard for BP modeling” (Ko et al., 2009, p.756). While these quotes are only the opinions of single researchers, the constantly increasing usage of BPMN cannot be denied.

The design of BPMN is based on the following five basic categories of elements: Flow Objects, Data, Connecting Objects, Swim lanes, and Artifacts. For a detailed description see (OMG, 2011, pp. 27). Beyond these elements BPMN also offers an extension mechanism. It is embedded in the MOF-based BPMN meta-model (OMG, 2006). According to the BPMN 2.0 standard this allows adopters to specify an extended meta-model and still be BPMN-compliant. *Figure 1* depicts the class diagram of the BPMN extension mechanism.

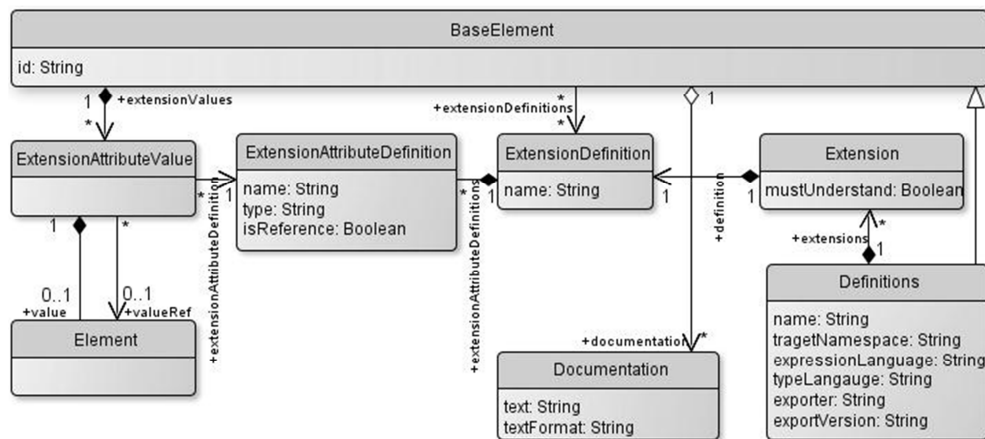


Figure 1. BPMN Extension Mechanism (OMG, 2011)

We use this extension mechanism to extend BPMN with the audit concept of FSLI. This is achieved by employing the extension method and tool support offered by Stroppi et al. after consulting one of the authors (Stroppi, 2011). As Strecker states, “a perspective should, as far as possible, correspond with the abstractions, concepts and (visual) representations known and meaningful to the targeted (group of) stakeholders” (Strecker, 2011, p. 13). Therefore, to retain the notation of accounts with debit, credit, and balances used by most accountants worldwide (Ellerman, 1985), the proposed extension follows this scheme. Accounts as a grouping of account entries corresponding to the credit and debit side are represented by an extension of the class group. These extension classes have additional attributes and modified modeling elements. The latter is described at the end of this section. The meta-model adds attributes to the elements according to their usage in the accounting domain. Accounts have a name (attribute: `accountName`), have a unique identifier (attribute: `accountNumber`), are either involved in open item accounting or not (attribute: `isOpenItemAccount`), and are either profit and loss or balance sheet accounts (attribute: `isPnLAccount`). Furthermore, accounts always have one debit and one credit side. Debit and credit include none to many account entries. As mentioned by one of the experts, account entries are a kind of data; therefore, an account entry will be

represented by data objects indicating the number and the total number of aggregated entries. The meta-model implements AccountEntry as a child class of DataObject including the attributes number (= number of account entries on this debit or credit side of an account posted by the process in focus), and amount (= value of the account entry/entries). In addition, the meta-model adds a credit and debit balance for the quick recognition of the transaction volume for each account. It is a child class of annotation and has the attribute sumOfBalance and isDebitBalance. A graphical overview of the described classes is shown in Figure 2. Bright colored classes are original BPMN 2.0 meta-model classes whereas dark colored classes are extension classes. For reasons of simplicity the meta-model only shows cardinalities of the newly added classes. For a complete overview of the BPMN meta-model please refer to (OMG, 2011).

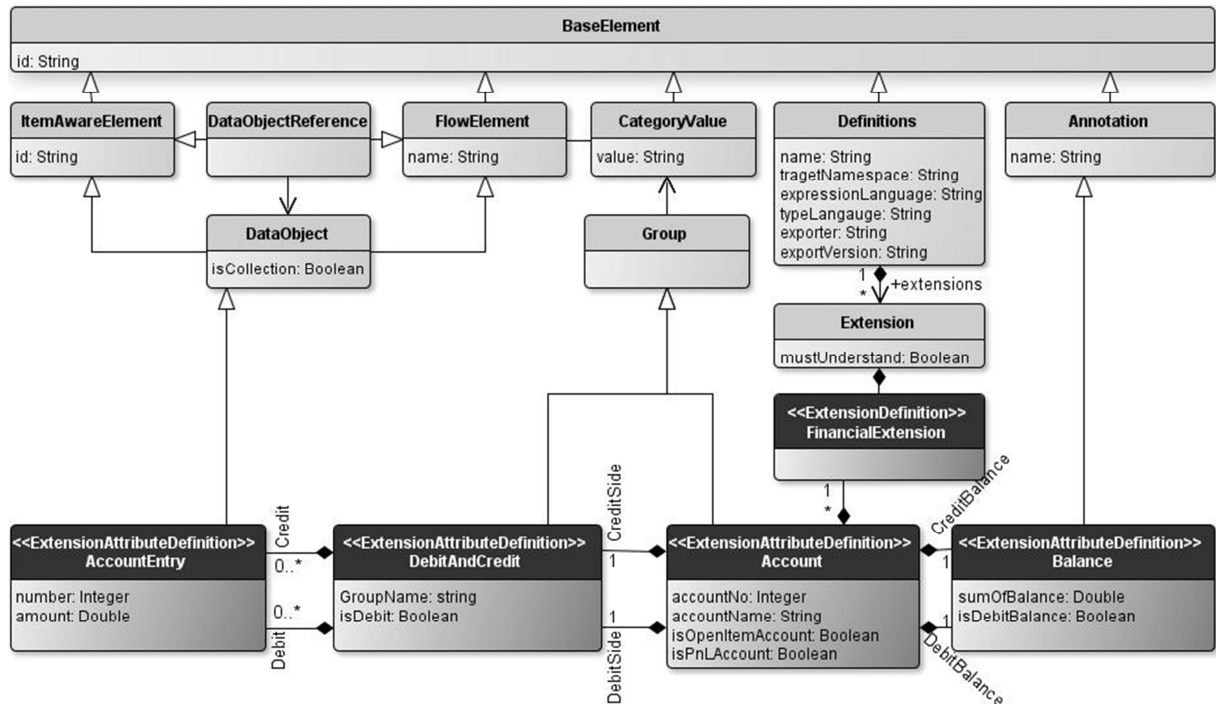


Figure 2. Extended Meta-Model

When extending BPMN diagrams, the same look-and-feel should be preserved. “Thus the footprint of the basic flow elements (Events, Activities, and Gateways) MUST NOT be altered” (OMG, 2011, p. 44). For this reason, the presented BPMN extension adapts symbols already used. For a list of all extended elements please refer to Table 2.

Related Element	Symbol	Description
"The Group object is an Artifact that provides a visual mechanism to group elements of a diagram informally."	<div> <div>AccountNo PnL AccountName</div> <div>AccountNo BS AccountName</div> </div>	Account Based on the attribute <i>isPnLAccount</i> each account displays if it is a profit and loss account (PnL sign in the top right corner) or a balance sheet account (BS sign in the top right corner). Furthermore, depending on the value of the attribute <i>isOpenItemAccount</i> , the frame of an account is either dotted (= account is involved in open item accounting) or continuous (= account is not involved in open item accounting)
	<div>Debit Credit</div>	Credit / Debit The debit and credit groups have no attributes. Exact one of each group is always part of an account.
"Text Annotations are a mechanism for a modeler to provide additional information (...)"	<div>amount</div>	DebitBalance / CreditBalance The <i>DebitBalance</i> and <i>CreditBalance</i> annotations are associated to one debit or credit group. All amounts of the corresponding <i>AccountEntries</i> are summed up and displayed by the annotation.


"The primary construct for modeling data within the Process flow is the DataObject element."		AccountEntries AccountEntries always display the attributes <i>number</i> and <i>amount</i> . The first attribute represents the number of items included in the displayed item. Amount displays the total sum of amounts of included items.
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Table 2. Modified BPMN Elements

5 Application Example

For better understanding, a sales process can be used as an example. This example is taken from a Big4 audit firm's training documentation and was extended with the newly proposed elements. The process model is shown in Figure 3. The process consists of the two activities: 1. "Create Billing Documents" and 2. "Post Incoming Payments". Both of the activities have a financial impact. They trigger a debit and a credit posting (debit to credit). In this particular case, the activity "Create Billing Document" triggers a credit posting on the account "Revenues" (account number 800000). Because it is a profit and loss account the account is tagged with "PnL". The same activity posts the offsetting debit posting to the account "Account Receivables" (account number 140000). Because it is a balance sheet account the account is tagged with "BS". The amount of both postings is 72,890.40 €. Moreover, the frame of the two accounts display that the account "Revenues" is not involved into open-item-accounting, whereas the "Account Receivables" account is. The activity "Post Incoming Payments" posts the clearing entry of the debit posting on this account and the debit offsetting entry to this entry on the account "Bank" (account number 113109). The amount of both is 72,890.40 €. As can be seen by the frame lining of the "Bank" account, this account is involved in open item accounting and represents a balance sheet account.

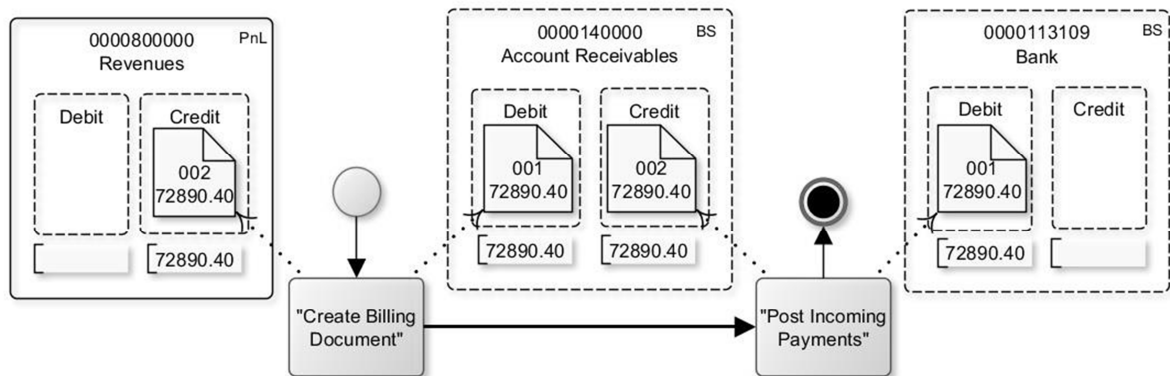


Figure 3. Example Purchase to Payables Process

The example shows the following two main advantages as suggested and confirmed (see Section 6) by the interviewed experts:

1. All accounts posted to by the process are evident
2. Activities with a financial impact are visible

Furthermore, the following information is evident when aggregating all process instances:

3. The transaction volume of each process on each account is visible
4. All processes posting to a certain account are visible

6 Evaluation

The evaluation of a designed artifact is essential in design science research (Peppers, 2012) and a wide variety of evaluation methods exist. The choice made here is based on the framework for evaluation in design science research proposed in (Venable et al., 2012). Having a socio-technical artifact that is potentially relevant for diverse stakeholders and seeking for a summative evaluation of the artifact the

choice of a naturalistic ex post evaluation strategy is appropriate. The evaluation design consists of more than one method. As a first step, the 17 interviewed experts were consulted with a questionnaire based survey. The questionnaire inquired on the following characteristics: 1) completeness (artifact comprises all relevant information in context of process models), 2) suitability for the audit domain (artifact fits to a mutual understanding of an account in the audit domain), 3) usability (improvement compared to currently used representation of account related information in conjunction with process models) and 4) perceived added value of the artifact. For each characteristic, the questionnaire offered a statement and asked the expert to evaluate it on a five-option Likert-Scale along with a detailed narrative description of their assessment.

The survey shows that the experts assessed the artifact preponderantly positive with respect to all four characteristics. Regarding completeness, the experts mentioned a few aspects that could be added to the notation (indicator for active/ passive accounts, distinction between profit and loss accounts, ledger type of the account, chart of account, and currency of the account entries). The next evaluation cycle will consider these suggestions, as they only represent minor changes. Their immediate integration is not immediately beneficial as in the next step a more comprehensive analysis is planned to discover the balance between the provided information and the related cognitive load of information processing. Referring to the characteristic “usability”, two experts stated that a distinction between account types based on different colors might not be practical in daily routine. In an early version of the artifact, accounts involved in open item accounting were colored orange. This has been changed. The experts emphasized improved linkage between business processes and related financial accounts that results in a better understanding of the applied accounting procedures when asked for the perceived added value of the artifact.

This evaluation constitutes an explorative first step. From a very rigorously point of view, the results of the evaluation cannot easily be generalized, because this study and proposition holds for our group of experts only. However, it forms a valid first step towards a broad evaluation. The next evaluation cycle for the BPMN extension will evaluate specific characteristics in more detail. Start point will be the application of the usability framework for modeling languages proposed by (Schalles et al., 2011).

7 Conclusion and Future Research

The goal of this research was to improve the support of process audits by using graphical representations of processes. To achieve this goal, 17 semi-structured expert interviews were conducted to obtain insight into the requirements for the graphical representation of audit concepts. As a result, six audit concepts that these experts required graphical representation for were identified. These six audit concepts are: process flows, controls, data, organizational aspects, information systems, and FSLI. We then reviewed existing business process modeling literature focusing on these identified audit concepts. Only the concept of FSLI had not yet been integrated into a modeling language. Hence, we proposed a BPMN extension for the addition of FLSI into a well-established and broadly known modeling language. We used the extension mechanism required by BPMN and extended the BPMN meta-model with new child classes of already existing elements. It is notable that nearly all experts emphasized the financial impact of processes by linking processes to FSLI. In order to satisfy this requirement, activities were linked to account entries in the presented BPMN extension.

The contribution of this paper is threefold: First, experts’ perspectives on the requirements for the improvement of graphical representation of audit concepts are presented. Second, a selective comparison of these expert identified requirements to already conducted research is shown. Third, a BPMN extension incorporating these results is proposed.

There are might be a number of possible limitations of this work, which we are aware of. Above all, an exhaustive evaluation is (as yet) missing. However, the evaluation of both – the representation requirements and the BPMN extension – will be in the next phase of this study. The latter will be evaluated by applying Schalles et al. framework for the usability of modeling languages (Schalles et al., 2011). The representation requirements will be evaluated by an exhaustive semi-quantitative

survey, questioning a large number of stakeholders such as internal and external auditors along with process owners, risk managers, boards of directors, and audit committees. Furthermore, it is recognized that the proposed BPMN extension alone is not fully sufficient for auditors - other audit concepts need to be included as well. The aggregation of models including the proposed BPMN extension also poses special difficulties. This is because accounts are a special kind of node in the sense of aggregation algorithms. This paper is an important step towards meeting these challenges.

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