Key Information Requirements for Process Audits – an Expert Perspective

M. Schultz, N. Mueller-Wickop, M. Nuettgens

School of Business, Economics and Social Sciences
University of Hamburg
Max-Brauer-Allee 60
D-22765 Hamburg
{martin.schultz | niels.mueller-wickop | markus.nuettgens}@wiso.uni-hamburg.de

Abstract: In the audit domain it is agreed that a comprehensive understanding of business processes is crucial for the effectiveness and efficiency of internal and external audits on financial reporting or regulatory compliance. However, a review of current modeling methods revealed that domain specific concepts are not comprehensively supported and only little empirical research has been performed on what modeling concepts are required to support an understanding of business processes from an audit perspective. For this reason, we conducted 17 semi-structured expert interviews to reconstruct key concepts of the audit domain especially focusing on process audits. As a result we present twelve relevant audit concepts and their relations in a concept map. Unlike for concepts, the expert understanding of concept relations was quite diverse. We interpret this result as an indication of complexity for the topic in focus. The presented concept map is a first step towards a domain specific modeling language.

1 Introduction

Nowadays it is widely recognized that auditors play a crucial role in preventing accounting scandals like Enron 2001, MCI WorldCom 2002, Parmalat 2003, Satyam 2009, HRE 2011 or Olympus 2011. Inadequatily conducted audits can result in unprecedented business turbulences with corporate fraud and possible bankruptcy. In order to cope with increasing data volume, auditors focus on the audit of business processes [Be97] [Ru03] [Ru06]. This approach is based on the assumption that well-controlled business processes lead to correct preparation, presentation and disclosure of financial statements. For this reason, the auditing of business processes is also required by international audit standards like ISA 315.81: "the auditor should obtain an understanding of the information system, including the related business processes, relevant to financial reporting (...)" [IFAC10]. Consequentially, increasing attention on this topic in academia can be recognized. Researchers with different backgrounds are working in the broad field of information systems support for the audit domain. Diverse foci are set: from automated tool support to basic business process modeling guidance. A constantly evolving range of IS-based approaches can be observed (see section 2).

Our research project is located within the process mining domain with an explicit focus on audits of business processes which are linked to the financial statements or effect the regulatory compliance of a company. To support business process auditors in the best possible way, inter alia, we evaluated process modeling methods with respect to their suitability for process audits. As a first step in our research project we intended to survey requirements from literature. To our surprise no comprehensive empirical requirements engineering could be found. Most papers dealing with the topic of audit requirements are devoted to requirements derived from abstract audit standards or resulted from a discourse with *single* experts not explicitly describing the applied research method. To our best knowledge there are no papers dealing with the topic of audit concept requirements engineering. Since, "*it is widely acknowledged within the software industry that software engineering projects are critically vulnerable when these activities (editor's note: requirements engineering) are performed poorly*" [ICS05, Chapter 2], we expanded our research agenda to include an empirical requirements engineering.

The research and results presented in this paper form a first step of a broader study on the requirements of auditors for business process modeling and audits. Following the approach of Ahlemann and Gastl [AG07] for the construction of an empirically grounded reference model, we conducted semi-structured expert interviews as a first step to capture expert's domain knowledge and collect initial empirical data. Against this background the contribution of the paper is twofold: on the one hand we present a rigor collection of information requirements for the audit domain in terms of relevant concepts. On the other hand the identified concepts are set into relation forming a conceptual model which characterizes the audit domain while neglecting technical aspects of implementation [Fr07]. Thus, we chose a concept map to depict our conceptual model as summarizing result of this paper. The next phase of our study will be a quantitative survey of audit concepts incorporating the results of this paper combined with an exhaustive literature review. This multi-method approach will set a rigor basis for the development of a domain-specific audit modeling language or the proper adoption of an existing one. The major benefit of such a modeling language was stated in all of our interviews: more effective and efficient execution of process audits. Primary stakeholders of this research are internal and external auditors. Additional stakeholders include - but are not limited to - process owners, risk managers, the board of directors and the audit committee.

The next section describes related research. This is followed by the introduction of the applied research method including qualitative data analysis. In section four our research results are presented. All concepts and their corresponding relations are listed and explained by expert statements. Furthermore, a concept map illustrates our results graphically. The paper closes with a conclusion and implications for future work.

2 Background and Related Research

All big audit firms consider process audits as an integral part of their present year-end audit approaches [St12, p.13] [Be97]. Audit standards also enforce an in-depth analysis of the organization's operations [Ia09]. In business process modeling literature audit-

related concepts are mainly discussed from a risk management or compliance perspective. The paper of Rosemann and zur Muehlen [RZ05] is among the first to consider the concept *risk* in the business process modeling context. As existing modeling notations like ER, UML, Petri Nets or IDEF do not explicitly cover risk-related information they provide taxonomies and modeling techniques to embed risks in process models. These taxonomies present a supplement to a business process meta model consisting of *organizational goals*, *organization*, *process structure*, *information systems* (IS), and *data* [Zu04]. A meta model with related concepts is described in the UML class diagram notation by Karagiannis [Ka08] and suggested as an extension to an existing enterprise modeling approach [KMS07]. In addition this meta model comprises the concepts *account*, *control objective*, and *control*. Likewise, Strecker et al. [SHF11] considers an existing enterprise modeling approach and investigate its potential to support audit risk assessment. Domain specific terminology is conceptualized as an enhancement for the modeling approach. With their domain model for *internal controls* Namiri and Stojanovic [NS07b] introduce similar concepts. Moreover, they mention *recovery action* and specific types of controls like *IT general controls* and *application controls*. Jakoubi et al. [JTQ07] present an approach for risk-aware process modeling which introduces a separate modeling layer for *threats* and corresponding *counter measures*. These are linked to activities on the process model layer. However, all conducted research work mentioned before is mainly based on a review of relevant literature, standards and frameworks (e.g. COSO). Domain experts are not comprehensively involved.

With a strong focus on compliance Sadiq et al. [SGN07] present a modeling approach for *control objectives* using a specialized modal logic and a corresponding process model annotation. Their aim is to cope with complex *compliance requirements* of business processes at design time in a formalized manner. Related approaches are provided by Lu et al. [LSG08] and Governatori et al. [GMS06] [Go09] which help to test or measure the compliance of a business process model against a set of directives and rules. Namiri and Stojanovic [NS07a] develop another formalized definition of business process compliance which is based on the concepts *business process*, *risk*, *control* and *balance sheet account*. Earlier approaches use petri nets to formally model and evaluate *controls* within business processes for audit purposes [PP97] [CL03]. Goedertier and Vanthienen [GV07] describe a declarative approach for process modeling to capture the semantics of *internal and external regulations* with the help of business rules.

Based on a review of auditing literature and corresponding standards Carnaghan [Ca06] identified modeling concepts relevant for process level audit risk assessment like *process objectives*, *risks*, *controls* and *financial statement line items* (accounts), to name only a few. A number of commonly used business process modeling notations (e.g. UML, EPC, BPMN) were evaluated regarding their support of these concepts. This review revealed that no notation covers all identified concepts. Especially *controls* and linkages between different concepts were difficult to map to the modeling notations [Ca06]. Although providing a comprehensive list of audit relevant modeling concepts [Ca06] pointed out that only little empirical research has been performed on what modeling concepts are needed to support an understanding of business processes from an audit perspective. Regarding the related work mentioned above this appraisal holds true. Especially more

complete semantics of these modeling concepts and reasonable ways for combining the information needed are seen as fruitful areas for further research [Ca06].

3 Research Method

The presented study uses an expert interview approach. The decision for expert interviews was based on the following characteristics:

1. The semi-structured nature of the interviews enable the interviewees to think about core concepts in a new way and link their experiences and perceptions [KB04], as well as to talk about new ideas and perspectives.
2. Expert interviews enable us to learn without preoccupation about the requirements experts have for process audits.
3. The authors are highly familiar with process audits. Therefore drawing up a guideline in advance was possible [Pf09, p.459].
4. According to Trinczek semi-structured interviews are the best choice when inter-viewing managers. This is because managers are generally in the position to ask questions rather than being asked. A guideline supports the special interview situa-tion with managers in the best possible way [Tr09].
5. The results of expert interviews based on a guideline are already semi-structured and hence easier to analyze [Se97, p.13].

3.1 Expert Interview Conduct

17 process audit experts were interviewed throughout a five-month period (January 2012 to May 2012). Table 1 describes this sample in brief detail. Each interview lasted approximately 30 minutes up to one hour. We identified experts following the purposeful sampling approach by Patton. He lists different strategies. We decided to combine type five "*Typical case sampling: Illustrates or highlights what is typical, normal, and average*" and six "*Stratified purposeful sampling: Illustrates characteristics of particular subgroups of interest; facilitates comparisons*" [Pa90 p.182]. We are aware of the possible shortcomings of the sampling strategy proposed by Patton. Kaya and Himme state that: "*(…) the subjective judgment of the researcher about what is considered "important" or "typical" is to be considered*" [KH07, p.81]. This argument is countered by the perennial working experience of the authors.

The sampling population was defined according to the following two criteria: first, the individual had to be highly familiar with process audits: persons having work experience in the business process audit domain of more than five years met this requirement. This relatively low threshold seemed necessary because of the corporate structure of audit firms and internal audit departments: auditors are working on an operative level for around six years. By reaching the managerial level, the involvement in the operative execution of business process audits decreases rapidly and a high level understanding becomes more important. Both expert groups are essential for our research. For this reason around half of the interviewees are working on an operative level and therefore have a relatively short work experience of at least five years. Whereas experts working

on a managerial level had at least seven years of work experience. The second criterion was the experts' employer: either one of the top five auditing firms (Big 4 (Deloitte, Ernst&Young, KPMG and PwC) and BDO) or internal audit departments of international companies. This requirement is based on the assumption that comprehensive process audits are generally more often performed in bigger companies.

Expert ID	Background	Interview Conduct	Duration	Expert ID	Background	Interview Conduct	Duration
Expert 1	Operational	Face-to-Face	36 min	Expert 10	Operational	Face-to-Face	35 min
Expert 2	Operational	Face-to-Face	53 min	Expert 11	Operational	Telephone	48 min
Expert 3	Management	Face-to-Face	66 min	Expert 12	Management	Face-to-Face	50 min
Expert 4	Management	Telephone	88 min	Expert 13	Operational	Face-to-Face	54 min
Expert 5	Operational	Telephone	50 min	Expert 14	Management	Telephone	34 min
Expert 6	Operational	Face-to-Face	30 min	Expert 15	Management	Telephone	63 min
Expert 7	Operational	Face-to-Face	40 min	Expert 16	Management	Face-to-Face	39 min
Expert 8	Management	Face-to-Face	64 min	Expert 17	Management	Face-to-Face	40 min
Expert 9	Management	Face-to-Face	46 min				

Table 1: Summary details of the sample interviewed

The country of origin was not defined as a selection criterion; nevertheless all experts in this survey are German. This fact is not likely to have any influence on the conducted research, since international standards and internal international company guidelines force auditors to use the same approach worldwide [IIA12] [IFAC10]. Furthermore, gender specific aspects are knowledgeably excluded. Only a few publications are available covering the difference in interviewing female and male experts [Ab09][Li09]. Other gender specific attributes are fully neglected. To our knowledge none of the mentioned aspects have as yet been fully researched, thus we excluded them.

A target list of process audit experts from internal audit departments and top five audit firms was created and all experts were contacted via email. The guideline was pilot-tested with two persons from two different Big 4 audit firms. A face-to-face or telephone interview was then set up. Telephone interviews were conducted taking into account the suggestions from Christmann [Ch09]. All interviews were held with two researchers, one taking the lead, the other assisting to keep the interview flowing and taking notes. The guideline supported this intention with its open question design (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: Please think of an ideal world: Which information do you need for a process audit?*
>
>   a. *Which information do you need as "input" information?*
>   b. *How do you process this information?*
>   c. *Which information is provided as a result?*

Exhibit 1: Expert interview guideline questions

In total five of the 17 interviews were conducted by telephone. Differences in quality between face-to-face and telephone interviews were not expected [Ro76] and could not be noticed by us. The first guideline question was designed to get the interview started and get information about the experts background. The following two questions were designed to learn about the relevant process audit concepts and their relations.

3.2 Data Analysis

All but one interview were recorded and transcribed using the software F4. Expert 4 refused to be recorded. Therefore we had to take notes, which resulted in a significantly longer duration of the interview. The notes were complemented by a protocol from memory directly written after the interview. Audit concepts and their relations were coded according to the method suggested by Myers [My09, p.167]. We also took Strauss and Corbin [SC90] and further explanations in [Ke05] into account. "*Codes are tags or labels for assigning units of meaning to the descriptive or inferential information compiled during a study*" [My09, p.167]. The coding was done in MAXQDA. Following a bottom-up approach all inferences were derived only from the transcribed interviews, not taking into account known audit concepts from literature and work experience. In a first step one author coded a sample of transcripts and built up a code book as suggested by Ryan and Bernard [RB00]. This was validated by a second author. Differences were discussed and eliminated. Afterwards all interviews were independently coded by two authors, both of whom are knowledgeable in terms of data coding. Only marginal differences were noted. In case of a discrepancy between the results a joint coding was done. Following this, a content analysis as a quantitative method for analysing qualitative data was performed. According to [My09, p. 172] this analysis seeks to apply statistical techniques to a coded text. In our case we counted the occurrence of concepts and their relations in the expert interviews. These numbers are used to identify key concepts and relations. Both results are depicted in a comprehensive concept map.

4 Analysis and Research Findings

In this section we present audit concepts and their relations mentioned by our experts. At this stage it is not our intention to provide complete semantics for each concept. This would be beyond the scope of this paper. Our focus is to point out which concepts are considered most relevant for process audits. The absolute majority of the experts highlighted exactly the same audit concepts. In the following all concepts are described in detail especially focusing on their relations. For this purpose we intentionally use citations to minimize the influence of our interpretation on the expert statements.

4.1 Concepts and Relations

Controls: *Controls* were one of the most frequently mentioned concepts in our interviews. Not only because of their frequent occurrence but also due to the number of relations to other concepts, controls seemed to be among the most important concepts. All 17 experts agreed about the purpose of controls: "*controls contrast with risks (...). The auditor needs to assess to which degree the controls mitigate the identified or supposed risks*" (ex. 12). Experts stress that "*(…) only identified key controls get tested. Those are the significant controls*" (ex. 13). They further distinguish between "*(…) manual and automated controls in information systems*" (ex. 2). Automated controls were especially highlighted in the context of "*application controls, access rights, security, etc*" (ex. 4). Furthermore, "*it is important how the control is embedded in the*

organization, which departments are affected, who is control owner, who is accountable, who is responsible and who executes the control" (ex. 15). Besides their organizational embedding, the integration of controls in business *processes* was frequently mentioned: "*A process audit is mainly a controls audit, the process is just a link between controls*" (ex. 14). This is mainly because *"controls are (just) process activities"* (ex. 3).

Process: As expert 3 stated: "*activities in companies can result in an accounting transaction - buying goods for example: the transaction would either be the order, the goods receipt, the invoice receipt or the payment. The latter three trigger postings on different accounts also called financial statement line items (FSLI). As a whole these in turn compose the financial statements*" (ex. 3). This relation between processes and the financial statements is seen by nearly all experts. The relation was mostly stated when explaining how the scoping of processes is done: "*Basically what I do is going backwards: starting from the financial statements I assess which processes post on my material FSLI in scope*" (ex. 8). Along with this approach the idea of Major Classes of Transactions (MCOTs) was mentioned by four experts. These MCOTs describe *"(…) different variants of processes, e.g. a process has different inputs and therefore different process branches are run through. Let me give you an example: the feed-in remuneration[1] heavily depends on whether you run photovoltaics, a thermal power plant or wind power plants. The accounting system will automatically differentiate between these cases*" (ex. 2). Process Key Performance Indicators (KPIs) represent one specialty. They were just highlighted by experts working as internal auditors.

Organization: As described in section "controls", nearly all experts emphazised the importance of *organizational* aspects and *controls*. Due to the association of controls and processes, experts correspondingly set *processes* and the *organizational structure* in relation. However, the number of occurrences of this relation was rather low most probably because of the higher importance of controls. It is commonly accepted that even nowadays, different departments and therefore employees are involved in diverse roles in processes and controls. Hence, organizational aspects are also important from an audit perspective. Analogous to controls, "*persons responsible and/ or accountable for processes, are so-called process-owners*" (ex. 7). The importance is not least based on the fact that "*staff works in processes and executes transactions. These transactions result in financial entries and then end up in the financial statements*"(ex. 3).

Risk: Again all experts named the concept of *risk* as one of the most important. But within this concept some rather different perspectives were described. On the one hand audit risks (detection, control and inherent risk) and on the other hand risks referring to the three COSO objectives categories (Operations, Financial Reporting, Compliance, old COSO Cube of 1992) [CO92] were mentioned. "*The audit risk is defined as the risk that material misstatement is not detected*" (ex. 9). This risk can be broken down into the following: "*the inherent risk describes material misstatement of FSLI, (...) the next stage is the control risk, namely the risk that misstatement will not be prevented or detected by the entity's internal controls. The last risk is the detection risk, namely the risk that we (as auditors) won't detect this misstatement*" (ex. 14). "*Using the COSO model, there*

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[1] compensation for electricity fed into the grid

are ultimately three types of risk: first, the risk of misstatement in financial disclosure, second, the compliance risk, i.e. violations of legal requirements, last there are business risks that do not affect your financial statements directly, or violate any laws, but might make you buy over-expensive goods. External auditors generally don't care about it, but it is eventually harmful for your business" (ex. 2). Additionally, we would like to present one-risk subcategory in detail - interfaces. They were repetitively mentioned in the context of risk. "*You could discuss risk in the context of interfaces (...). Especially if you have different IS (...) the audit can get pretty complicated (...), in other words interfaces also pose considerable IS risks*" (ex. 12).

Financial Statements: 16 out of the 17 experts described *financial statements* as one of the key concepts. The only expert not mentioning financial statements in the interviews was from an internal audit department responsible for process audits with a strong focus on performance and compliance. Thereby, the strongest relation was to *risks* and *processes*, as indicated in the following example: "*Account groups included in the financial statements and the FSLI themselves have an inherent risk of misstatement in respect of the company's net assets, financial position and results of operations (…). This inherent risk has to be addressed in our audits. By applying controls in his processes the client already addresses this risk (...). We have a risk assessment upfront each audit, just to evaluate the risks on financial statement basis. Depending on the easiest way of auditing each FSLI in scope, we decide how to proceed. Mostly a controls audit (process audit) does make sense*" (ex. 14). Again, this statement reflects the frequently stated view that processes "fill" the financial statements. A further mentioned link of the concept financial statements is to *IS*. "*There are no middle or big companies preparing their financial statements without the support of IS. (...) For this reason every auditor has to ask himself how the financial statements are produced, viz. data storage, software, information systems, etc. supporting this process have to be taken into account*" (ex. 3). Another expert states that "*financial statements have to be IS based in the future in different countries because of legal requirements, like the German "E-Bilanz"* (ex. 8).

Information Systems (IS): In the description of the procedures of a process audit 16 experts mentioned *IS* as one of the key concepts which need to be assessed at the beginning of each process audit. The following concepts were mentioned in this context: "*Beginning with the scoping, the identification of audit relevant processes, organizational aspects like responsibilities, and supporting IS are most important*" (ex. 2). Thus, "*ideal process audits consider both aspects: IS and human interaction*" (ex. 8). A further facet of IS lies in its relation to *data*: "*IS play an important role when it comes to audit evidence. Nowadays most of the documents are stored digitally*" (ex. 1). Besides the pure data (storage), "*IS are also supporting processes*" (ex. 11). It should also be noted that it is important "*where the data is stored, where this data is first recorded, so to say - which information system is the first one -, how does the data get aggregated, processed and reported*" (ex. 15). "*This data-flow is always driven by IS. At least I haven't seen anything different in ages*" (ex. 3).

Materiality: 14 experts pointed out the importance of *materiality* as means to focus only on areas with significant *risks* and the corresponding business *processes* during financial

audits. "*Materiality threshold is applied to the financial statements to identify significant FSLI and business transactions. Business processes affecting these significant FSLI are categorized as significant and should be subject to a process audit*" (ex. 4). "*This is done upfront during the scoping phase*" (ex. 2).

Audit Objective: 13 experts mentioned *audit objective* as a concept which can broadly be seen as an overarching goal of process audits. "*Which objective is striven for is up to the context the process audit is performed in*" (ex. 9). In general, depending on the subject of the audit diverse "*(…) risks are identified which need to be addressed during an audit*" (ex. 14). To cope with these risks the overall audit objective is broken down into audit objectives on a more detailed level referred to by the experts as assertions or control objectives. "*Within a financial audit the objective (…) is to provide assurance that business transactions which ran through the business processes throughout the financial year are correctly recorded in the financial statements*" (ex. 9). "*What is meant by correctly recorded is divided into a number of assertions. Five assertions are mapped to each balance sheet item: completeness, existence [and occurrence], valuation, rights and obligations as well as presentation and disclosure*" (ex. 14). "*To give an example: if we look at accounts receivables - there is a risk of loss. The corresponding assertion would be the valuation of receivables, e.g. there might be a control implemented that every seven days the CFO checks the aging structure of the receivables and decides for which open item to follow up. This control supports the assertion that receivables are correctly valued*" (ex. 14). "*Some audit companies do not distinguish between audit objective and assertions at all*" (ex. 4). "*Audit objective and assertions are used synonymously*" (ex. 14) in the context of financial audits.

Comparable to assertions "*a control objective is basically an intermediate level between control and risk. A control objective is derived from a risk and a related control in fact addresses the control objective*" (ex. 9). "*It is opposed to the risk and tries to mitigate the risk*" (ex. 16). "*Generally, there are several controls addressing the same control objective*" (ex. 14). An example for a control objective can be "*(…) to comply to legal requirements*" (ex. 13). Besides assertions which are closely linked to the financial statements three experts also mentioned a standard set of audit objectives related to data processing in business processes and supporting *IS*. "*In a process completeness, accuracy, validity, and restricted access need to be addressed by controls to ensure a sound processing and transfer of information*" (ex. 2).

Standards and Regulations: As an origin for audit objectives domain-specific frameworks (e.g. COSO), accounting standards, audit standards, generally accepted accounting principles (GAAP), legal requirements (e.g. Sarbanes Oxley Act), and company specific guidelines were mentioned by the experts. Standards in terms of "*policies and procedures guide the execution of processes and controls*" (ex. 10). "*Therefore a comprehensive process documentation ideally contains internal and external policies and procedures which are relevant for the process itself and included controls*" (ex. 10). "*Standards also guide an audit of a process*" (ex. 14) as "*specific audit procedures are obligatory due to audit standards*" (ex. 5). In this way "*audit standards operationalize the area of discretion for the auditor*" (ex. 4). Also domain-specific frameworks have a remarkable impact. "*If we have a look at the goals of COSO*

- efficient and effective operations, accurate financial reporting and compliance with laws and regulations – this is what a system of controls should look like. This of course affects our approach, e.g. which controls are relevant" (ex. 4).

Business Objective: "*In general processes support business goals and auditors also have specific expectations regarding business processes. Upstream to an audit the business environment of an auditee e.g. industry, competitive situation is analyzed to identify specific risks and areas exposed to high risks*" (ex. 3) and "*industry-specific processes*" (ex. 7) as well as "*target figures of a process*" (ex. 13). "*The question is what the company wants to achieve with this process and which minimum requirements need to be met by the process with respect to the overall business objectives*" (ex. 9).

Data: Any kind of *data* which is produced by *processes* and processed manually or stored in *IS*, like documents, records and vouchers are also of relevance for conducting a process audit. "*For an auditor it is interesting how the data flow of a process is defined: where is information generated, where is it used resp. which information is necessary to perform a process activity especially control activities*" (ex. 9). At first "*data and documents are used to get an understanding of a process during a walkthrough of each process step*" (ex. 13). "*For example a purchase transaction - we look at the flow of the data from the first entry of a purchase order to a goods receipt and finally a corresponding invoice*" (ex. 14). "*Each process activity has input and output data*" (ex. 10) "*this can be used as evidence for the operation of a control and a process*" (ex. 9).

Audit result: The *audit result* for a *control* is twofold. "*Controls are assessed regarding their design effectiveness and their operating effectiveness*" (ex. 9). "*Design effectiveness answers the question: is the control properly designed and implemented to support the addressed control objective?*" (ex. 4). In a second step "*it has to be assessed if the control was performed as described regularly throughout the audit period. This is called operating effectiveness*" (ex. 2). The operating effectiveness is tested "*(…) based on a sample approach. System reports, documents and system configuration for past business transactions of this process are examined to determine if the control has been performed as designed*" (ex. 9). "*Design effectiveness not only refers to controls but also to the process level. All controls of a process can be perfectly designed but significant risks - the process is exposed to - are not mitigated. In this case there is an issue with the process*" (ex. 15). Hence, when conducting process audits auditors need a comprehensive view of controls on the model layer as well as on the instance layer. The former is necessary to test the design effectiveness, the latter is needed for the operating effectiveness testing of controls.

4.2 Concept Map

A *concept map* is a graphical representation where nodes represent concepts and links connecting nodes reflect relationships between concepts [ST08]. It is a tool to organize and symbolize knowledge [NC08][Za11]. This mapping technique is generallly used to elicit cognitive structures that individuals or groups used to interpret a specific domain [ST08]. Siau and Tan emphasizes that concept maps help to design complex structures and externalize expert's knowledge [ST08]. They list several examples in the IS

development domain using this mapping technique e.g. for conceptual modeling or technical communication. In our context concepts can be considered as key terms of the process audit domain derived from the expert interviews. Against this background the identified concepts and their relations are depicted in a concept map shown in Figure 1.
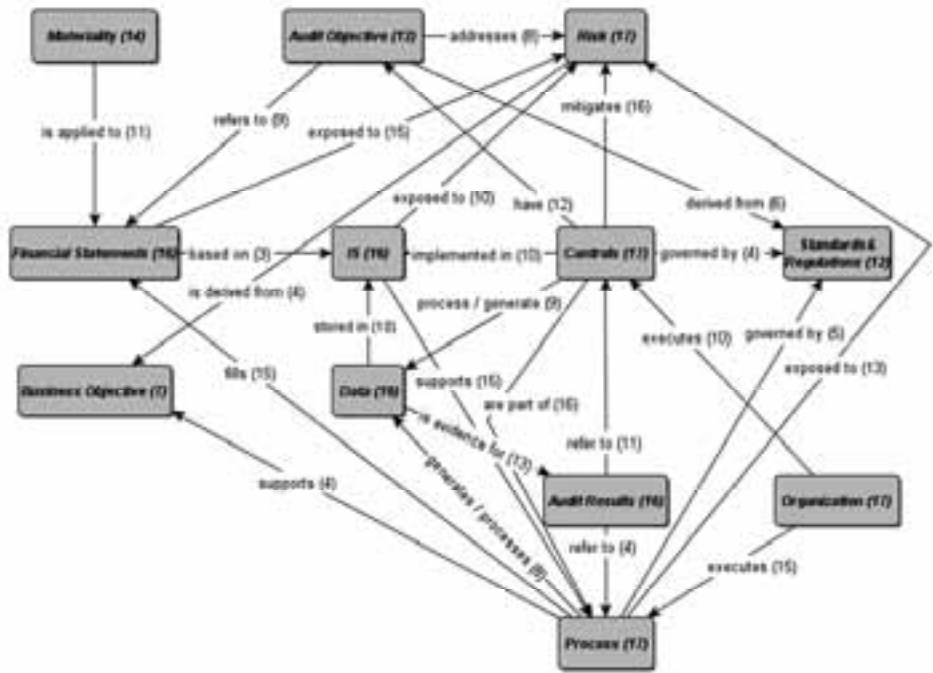

Figure 1 Concept map for audit relevant information

As a final step we provided the aggregated results including the concept map to the experts for review. Only minor remarks were given as feedback. In general the experts agreed with all concepts and their relations presented in this paper.

5 Conclusion and Future Research

We conducted semi-structured expert interviews with 17 domain experts from big audit firms and internal audit departments of international companies to reconstruct key concepts of the audit domain especially focusing on process audits. These interviews were transcribed and independently open coded by two of the authors. Subsequently all concepts were set into relation based on the expert statements. The contribution of the paper is twofold: key information requirements for process audits were conceptualized. These concepts were then set into relation and presented in a concept map. Our work was motivated by the lack of empirically grounded requirements engineering.

As a result of our analysis we identified the key concepts *processes*, *controls,* and *risks*. They were mentioned by all experts and have the most relations to other concepts. But also the remaining concepts: *organization, financial statements, IS, audit result, materiality, data,* and *audit objective* were stated by at least three-quarter of the experts. Only *business objectives* and *standards and regulations* were mentioned less. As said in section "2 Background and Related Research" the concepts process, business objective, organization and, information systems mentioned by the experts are already considered in existing enterprise modeling approaches. As suggested by Strecker et al. [SHF11] and Karagiannis [Ka08] research work done in this area can be also be applied to the audit domain. In addition more domain-specific concepts like a*udit objective, risk* and *control* turned out to be beset with diverse meanings. This needs to be considered when modeling these concepts.

However, we also had some unexpected findings especially regarding the relations. The number of mentioned relations broadly varies from three to 16. We interpret this unequally distribution as a strong indication of complexity for the topic in focus. Particularly the relations between "*standards&regulations and controls"* (four), "*process and business objectives*" (four), „*risk and business objective"* (four), "*process and audit result"* (four), and*"financial statements and IS"* (three) were only rarely referred to. The only differences between internal and external auditors we noticed was the usage of process KPIs and the weight shifted away from financial statements related risks to business risks.

Based on our results different future research opportunities arise. The most obvious to us is a further investigation in the topic of audit concepts. Due to the qualitative nature and according shortcomings of interviews, we' would like to verify our results by expanding our research with a quantitative approach. In this context, a comparison of research already conducted with our results would be meaningful. Another possible research action might be the creation of an ontology. Last but not least the incorporation of our results into a domain specific data model and domain specific modeling language could be one of the next logical steps.

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