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ENTERPRISE ARCHITECTURE MANAGEMENT FROM A KNOWLEDGE MANAGEMENT PERSPECTIVE – RESULTS FROM AN EMPIRICAL STUDY

Victoria Struck
Technische Universität München, Germany, victoria.struck@yahoo.de

Sabine Buckl
Technische Universität München, Germany, sabine.buckl@in.tum.de

Florian Matthes
Technische Universität München, Germany, matthes@in.tum.de

Christian M. Schweda
Technische Universität München, Germany, schweda@in.tum.de

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Victoria Struck, victoria.struck@yahoo.de
Sabine Buckl, sabine.buckl@in.tum.de
Florian Matthes, matthes@in.tum.de
Christian M. Schweda, schweda@in.tum.de
Technische Universität München, Germany

Abstract

Within the context of EAM numerous approaches proposed by researches exist. Still, it is not easy for companies to choose the most suitable one from the multitude of architecture frameworks and methods. Additionally trends in the global economy and the resulting pressure on the part of competitors force companies to introduce more effective management processes. As a consequence, EAM faces the similar challenge as that of knowledge management that is identifying, collecting and maintaining process-specific information in an efficient way.

This research article addresses the aforementioned challenge by identifying weaknesses of existing approaches to enterprise architecture management and proposing future areas of research. Thereby, the future research topics are identified in two steps. Firstly, an extensive literature analysis from a knowledge management perspective derives hypotheses on possible fields for improvement and future research. These hypotheses are evaluated according to their relevance in practice in an online survey conducted among enterprise architecture management practitioners from companies belonging to various industry branches in Europe.

Keywords: Enterprise architecture management, knowledge management, future research topics, empirical study

1 INTRODUCTION

Trends as globalization, downsizing, rapid change, and perhaps the most important one- the necessity of developing a company's sustainable competitive advantage have considerably increased the importance of knowledge management (KM) in organizations in comparison with the past (Pearlson and Saunders, 2004). While products and services become more complex, competitors can hardly be prevented from copying or even exceeding the products and processes in terms of quality and price (Pearlson and Saunders, 2004). Therefore, the only way for companies to retain their market leadership is being superior in terms of efficiency, quality, and creativity, which means acting better and faster and consequently assimilating knowledge at a more rapid way than competitors do (Pearlson and Saunders, 2004). Since companies are likely to position themselves on basis of the expertise they possess, the significance of knowledge, as a corporate asset rises steadily (Davenport and Prusak, 2000). In this regard, the main goal of KM is making an organization aware of the knowledge it possesses so that it can make the most effective use of it (Bennet and Bennet, 2003). "Effective knowledge management creates sufficient internal and external transparency and supports employees in their knowledge-seeking activities" (Probst, 1998). Therefore, most KM initiatives in organizations imply one of the following aims- making knowledge visible, developing a knowledge intensive culture, or building a knowledge infrastructure (Davenport and Prusak 1998).

Further, globalization and fierce international competition increase complexity of business transactions and speed up the rate of change in business models (Fischer et al., 2007). Additional pressure coming from numerous regulative frameworks as well as growing dependency on the information technology (seen as enabler of new products and processes) force companies to focus on the alignment of their corporate structures (i.e. organizational structures, processes, information systems, and technologies) with the strategic goals (Fischer et al., 2007). Enterprise architecture (EA) management provides a commonly accepted means to guide this alignment (Lankhorst 2009).

According to the term definition of ANSI/IEEE Std 1471-2000, architecture is "the fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principles guiding its design and evolution" (IEEE; 2000). In this context, EA follows an integrated approach describing the fundamental structure of an enterprise and supporting transformation, since it offers "a holistic perspective of as-is as well as to-be structures and processes (Fischer et al., 2007). The term EA management (EAM) can therefore be defined as "a continuous and iterative process controlling and improving the existing and planned information technology (IT) support for an organization. The process not only considers the IT of the enterprise, but also business processes, business goals, strategies, etc. are considered in order to build a holistic and integrated view on the enterprise. The goal is a common vision regarding the status quo of business and IT as well as of opportunities and problems arising from these fields, used as a basis for a continually aligned steering of IT and business" (Ernst et al., 2006). According to Hafner and Winter (2008) an application architecture "serves as a transparent communication and design / evolution platform between the various IT stakeholders (e.g., application development sponsors in business and application developers in IT)". Consequently Buckl and Schweda (2009) point out that information collection, communication, and exchange are important constituents of both EAM as well as those of KM. Still, up to Buckl and Schweda (2009) no research has been carried out to analyze EAM from a KM perspective to contribute to a more profound understanding of EAM.

While Buckl and Schweda (2009) focus on a theoretical discussion on the topic, this paper discusses the findings from an empirical study on the EAM function from a KM perspective conducted among EA practitioners. The goal of the research is to verify hypothesis derived from literature (see Section 2) from a practitioner's perspective. The investigation is carried out by means of an empirical study in form of an anonymous online questionnaire. The findings are presented in Section 3 and future areas of research are discussed in the final Section 4.

2 LITERATURE ANALYSIS

Based on a literature analysis of KM approaches (cf. Section 2.1) and of existing EAM approaches from a KM perspective (cf. Section 2.2), hypotheses are derived in Section 2.3, which form the basis for our subsequent considerations on future research areas in the context of EAM.

2.1 Analysis of KM approaches

In order to compare EAM activities to those of KM, Buckl and Schweda (2009) analyze how diverse KM approaches apply to the context of EAM and then chose the most suitable one for further investigations. "While there is no single "right" model of knowledge management, there is a simple criterion for evaluating any model: how useful is it in relation to a chosen question?" (Probst, 1998).

From this point of view, the first KM model that comes into consideration is that by Turban et al. (2004), since it unites KM activities noted by most sources on KM (cf. Davenport and Prusak (2000) (*generation, codification* and *coordination, transfer*); Pearlson and Saundes (Pearlson and Saunders, 2004) (*generation, capture, codification, transfer*); Ford (2003) (*generation (creation and acquisition), codification, transfer, application/use*); Kayworth, Leidner (2003) (*creation, storage, transfer, use*)). The *knowledge management system cycle* by Turban et al. (2004) comprises six steps (*create, capture, refine, store, manage, and disseminate knowledge*) cyclically repeated over time. The cycle emphasizes that knowledge is dynamically refined over time and therefore reflects changes taking place in the environment (Turban et al. 2004).

The first step "*create knowledge"* implies creation of new knowledge by means of doing things in a new way or further know-how development. While speaking about knowledge creation, one can also differentiate between *knowledge generation* through original knowledge creation within an organization, or *acquisition* of existing knowledge from an external source (Ford, 2003). In this context, Holsapple and Joshi (2002) make also a distinction between *acquiring* units of knowledge from external environment with the purpose of their further use in an organization and *generating* knowledge by means of processing knowledge units already existing at an organization. Nonaka and Takeuchi (1995) additionally differentiate between acquisition of *tacit* and *explicit* knowledge and propose correspondingly four models of knowledge creation based on the interplay of those two types (*socialization*, *externalization*, *internalization*, and *combination*).

The second step of the cycle -"*capture knowledge*"- implies identifying knowledge as relevant and representing it in an appropriate way (Turban et al. 2004). Knowledge capturing is particularly important with regard to tacit knowledge, since it is kept in minds of employees and is therefore difficult to be transferred into a codified form Davenport and Prusak (2000). Subsequently, new knowledge is to be placed in context ("*refine knowledge*") and stored ("*store knowledge*"). While being stored, knowledge is transferred in a reasonable format and is made accessible to those in an organization who need it (Turban et al. 2004). Storing knowledge is an important step in a KM process and is sometimes also referred to as "*organizational memory"* (Alavi and Leidner, 2001), because organizations on the one hand acquire knowledge and on the other hand lose track of the knowledge acquired (that is forget). "Organizational memory includes knowledge residing in various component forms, including written documentation, structured information stored in electronic databases, codified human knowledge stored in expert systems, documented organizational procedures and processes, as well as tacit knowledge acquired by individuals and networks of individuals" (Alavi and Leidner, 2001).

Subsequently, the knowledge stored should be kept up to date ("*manage knowledge*") and regularly reviewed to ensure the knowledge unites stored are relevant and correct. The final step of the cycle is "*disseminate knowledge"*, which means that "individuals develop, create, and identify new knowledge or update old knowledge, which they replenish into the system" (Turban et al. 2004).

The KM system cycle by Turban et al. (2004) is rather universal since it comprises the KM activities mentioned by most of established KM researchers (cf.: Davenport and Prusak, 2000; Pearlson and

Saunders, 2004; Ford, 2003; Holsapple and Joshi, 2002; Alavi and Leidner, 2001) as well as due to its iterative nature. According to Schekkerman (2004), an Enterprise Architecture "relates organizational mission, goals, and objectives to business tasks, activities and relations and to the technology and IT infrastructure required to execute them". This definition shows that identification of goals is an essential activity for EAM. At the same time, Lehner, Wildner, and Scholz (2008) speak about the importance of setting goals and strategies for the success of KM at an organization. And Rus and Lindvall (2004) additionally admit that many of the KM implementations failed because companies did not determine their goals and strategy before implementing KM systems and therefore finally managed documents instead of valuable knowledge. The KM system cycle (Turban et al. 2004), however, does not explicitly mention the activity of defining goals and objectives and as a result does not suite perfectly for being used as the only reference for further research in the context of EAM.

An alternative sequence of partial KM processes, proposed by Smith and McKeen (2003) (*collect, identify, create new knowledge, use knowledge, recycle experiences and lessons learned, leverage*) does include a step for sorting out relevant knowledge. Nonetheless, it implies that goals and scope decisions take place after knowledge has already been collected. This process sequence is, however, hardly applicable to EAM, where goals rule the whole process from its very beginning (Schekkerman, 2004).

Probst (1998) proposes an alternative KM model developed in a close dialog with practitioners. The KM model consists of tightly interconnected building blocks representing interdependent activities, which are arranged in two cycles (see Figure 1). The inner cycle comprises building blocks of *knowledge identification*, *acquisition*, *development*, *distribution*, *preservation*, and *use;* whereas the outer cycle additionally includes *knowledge goals* and *knowledge measurement* (Probst, 1998).

Knowledge goals align the rest of building blocks and are to be regarded within each KM activity. *Normative* knowledge goals are aimed at creating a "knowledge sensitive" corporate culture that fosters effective knowledge management. *Strategic* knowledge goals "determine the desirable competence portfolio for the future and are therefore an extension of the company's traditional planning processes" (Probst, 1998). Thus, strategic goals are first of all concerned with the future knowledge needs of the company. Defining normative and strategic goals obviously makes sense only if they are fulfilled. *Operational* goals for that reason serve to assure that normative and strategic goals "will be translated into action" (Probst, 1998).

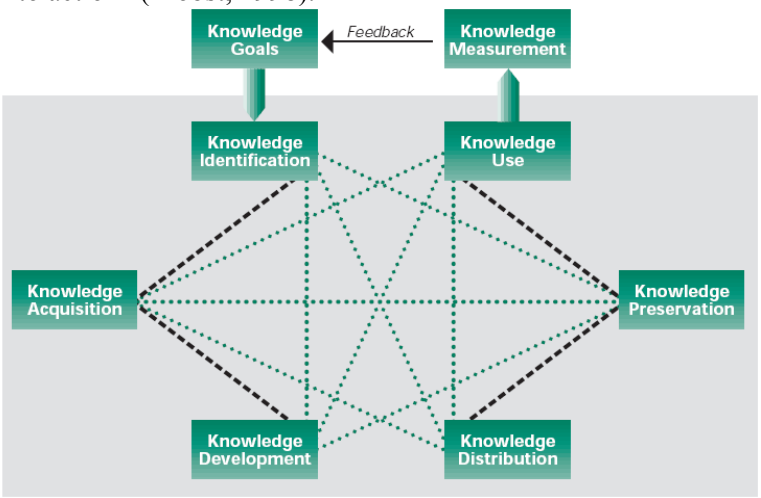

Figure 1. The building blocks of knowledge management (Probst, 1998).

The *knowledge identification* building block concerns discovering which knowledge and expertise are available within the company and which exist outside (Probst, 1998). This step needs to be carried out before making investments in development of new know-how. Knowledge maps can be used as an effective tool supporting knowledge identification within an organization, but at the same time personal communication among employees should not be neglected (Probst, 1998).

Since it may be difficult for companies to provide the complete know-how needed via in-house knowledge resources, the *knowledge acquisition* block considers obtaining critical capabilities through knowledge markets. Probst (1998) distinguishes four main import channels of knowledge. The first one is acquiring knowledge held by other firms that means via takeovers or joint ventures. The second option is less expensive and deals with using stakeholders (e.g. customers) for supplying new ideas about products and services. Thirdly, organizations can employ experts, either as full-time staff members or temporarily. And the fourth opportunity deals with acquiring knowledge products as software or patents, which develop their properties via human action (Probst, 1998).

The next building block is *knowledge development* and concerns management activities aimed at producing new internal and external knowledge on both - individual and collective level. One form of collective knowledge development is, for example, identification of the lessons learned at the end of each project with the purpose to pass this experience to colleagues. The block of *knowledge distribution* regards not only sharing knowledge across the company, but also the rules deciding upon access rights and levels of detail available to certain employee groups. And it is noteworthy that "efficient knowledge distribution can generate not only time and quality advantages, but a direct rise in customer satisfaction" (Probst, 1998).

Similar to the concept of organizational memory in Alavi and Leidner (2001), the *knowledge preservation* block deals with preserving valuable knowledge after it has been acquired or developed. An effective way to prevent knowledge losses is incorporating regular storage of usable facts into the knowledge base, so that they could be accessed in the future (Probst, 1998). The main purpose of KM is according to Probst (Probst, 1998) "the productive deployment of organizational knowledge in the production process", that is *knowledge use*. The *knowledge use* building block emphasizes the importance of knowledge use after it has been acquired, distributed, and preserved. Furthermore, knowledge use doesn't result from mere knowledge preservation, it needs to be encouraged and finally provide a real benefit to the users.

The biggest challenge of KM is represented in the last building block- *knowledge measurement*, since no standardized indicators or measurement processes for knowledge assessment exist. Measurement approaches used in each company usually reflect its normative, strategic, and operational dimensions and can be based on the earlier defined knowledge goals, provided those have been appropriately and unambiguously formulated.

If one compares the two modes – the *KM system cycle* of Turban et al. (2004) and the KM building blocks of Probst (1998), many similarities can be registered. Thus, the *knowledge creation* and *capture* activities (Turban et al. 2004) are enclosed in the *knowledge acquisition* block (Probst, 1998). The *knowledge refinement* and *management* (Turban et al. 2004) are contained in the *knowledge development* block (Probst, 1998), whereas the *store* activity (Turban et al. 2004) corresponds to the *preservation block* (Probst, 1998) and *dissemination* of Turban et al. (2004) coincides in its meaning with the *use* building element.

Finally, the only building blocks of the model by Probst (1998) which are not explicitly mentioned by Turban et al. (2004) are *knowledge goals* together with *knowledge identification* resulting from those and *knowledge measurement* assessing the degree of success of the whole process and consequently providing feedback for the goals set in the new process iteration. Against the background of this comparison, it is of interest to trace to what degree these activities are present in the academic EAM approaches as well as in the application by practitioners.

2.2 Analysis of KM activities with respect to EAM

While comparing activities of different EAM approaches to the KM model by Probst (1998), Buckl und Schweda (2009) provide a mapping of the KM building blocks to the application domain of EAM. According to their interpretation of the building blocks, *knowledge goals* define in the context of EAM what knowledge concerning EA is needed, or in other words- knowledge concerns of the EAM. This interpretation of knowledge goals has an additional meaning, while considering different stakeholders involved. Those can probably not be interested in the architecture itself, however in the impact it has

on their concerns (Lankhorst, 2009). Therefore, EA knowledge goals can also be defined with respect to the architecture stakeholders they address. The *knowledge identification* building block can be defined within the context of EAM (Buckl and Schweda, 2009) as an activity of discovering and determining EA related information sources (e.g. external consultancy partners), which can be later combined during the *knowledge acquisition* stage to produce a best-of-breed EAM solution for the company. *Knowledge development* can be "translated" into the EAM perspective as a process of generating new knowledge while making decisions and plans (e.g., target application landscape) concerning EA (Buckl and Schweda, 2009). *Knowledge distribution* block can be mapped to the activity of communicating EA related knowledge to the stakeholders involved in other enterprise-level management processes, as project portfolio management, for example. In contrast, to the knowledge *use* activity, the *distribution* block focuses on making stakeholders aware of the available EA information/ knowledge and sharing it according to the access rights assigned to various employee groups. *Knowledge preservation* according to Buckl and Schweda (2009) refers to storing EA knowledge so that long-term availability and accessibility can be ensured to the stakeholders. *Knowledge use* can be understood as actual daily use of the preserved EA knowledge items by employees within different enterprise-level management processes. And finally, the *knowledge measurement* activity assesses whether the initially defined architecture goals have been appropriately considered by the EAM (Buckl and Schweda, 2009).

There exist numerous frameworks to EAM. Generally speaking, a framework represents a detailed method providing guidance on how to describe architectures (Minoli, 2008). However, frameworks typically do not provide guidance on how to construct or implement a certain architecture (Minoli, 2008). The fact, that frameworks usually focus on different architecture aspects but do not describe processes or single activities in detail, makes the comparison between KM and EAM rather complex.

One of the most commonly used frameworks after individually developed ones is The Open Group Architecture Framework (TOGAF, The Open Group 2009) (Minoli, 2008). TOGAF "provides the methods and tools for assisting in the acceptance, production, use, and maintenance of an enterprise architecture. It is based on an iterative process model supported by best practices and re-usable set of existing architecture assets" (The Open Group, 2009). Since TOGAF provides an extensive set of methods, it qualifies well for a comparison with the selected KM activities.

An essential constituent of TOGAF is a tested and repeatable process for developing an enterprise-wide architecture- the Architecture Development Method (ADM). During the *preliminary phase* of the ADM cycle, the scope, constraints, and expectations for a TOGAF project are set as well as references to business goals, business principles, and business drivers (*knowledge goals*). Additionally this phase includes identification of stakeholders, their requirements, and priorities (*knowledge identification*); definition of the architecture framework and methodologies; selection and implementation of supporting tools and other infrastructure elements (*knowledge acquisition*). The first iteration of the architecture development cycle is initiated by the *architecture vision phase*. At the end of this phase, an architecture vision is developed, which comprises baseline and target (business/ data/ application/technology) architecture visions (*knowledge development*). The following phases of *business architecture*, *technology architecture*, and *information systems architecture* concern development of architecture at these three levels and deliver in each case baseline and target architectures including gap analysis (*knowledge development*). The knowledge development activity is also present in most of the subsequent phases of the ADM. The *opportunities and solutions phase* comes as next and is the first phase directly concerning implementation. It performs the initial implementation planning and groups implementation projects into transition architectures. A detailed implementation and migration plan is performed during the migration planning phase in consideration of cost and benefit analysis as well as business value of each project. This phase also includes documentation of the lessons learned (*knowledge preservation*). The *implementation governance phase* provides architectural oversight for the implementation, issues architecture contracts and ensures that the implementation projects conforms to the architecture. Here, the scope and priorities for deployment are to be confirmed with development management (*knowledge distribution*, *use*). The final phase of the ADM cycle is *architecture change management*. It is responsible for a continual monitoring and change management process, making sure the architecture satisfies the needs of the

enterprise and maximizes the value of the architecture to the business (*feedback of knowledge management to knowledge goal-setting*). This phase also underlines the importance of taking into account stakeholder interests. Therefore, it implies definition of special viewpoints, matrices, and views of the enterprise architecture model. Those artifacts are needed to ensure that the architecture has been communicated to and understood by all the stakeholders. At the same time, it also allows the stakeholders to verify if the enterprise architecture initiative truly addresses their concerns (*knowledge distribution*, *use*, and *measurement*). A process of managing architecture requirements takes place continuously throughout the whole ADM circle. The requirements management phase is a process whereby enterprise architecture requirements are" identified, stored, and fed into and out of the relevant ADM phases" (The Open Group, 2009) (*knowledge measurement*).

The analysis of the TOGAF ADM cycle shows, that this framework incorporates various knowledge management activities to a different degree. Thus, knowledge *goals*, knowledge *identification* and *development* are considered in a more detail and more often, than the activities of knowledge *acquisition*, *distribution*, *use* and *measurement*. Meanwhile, the activity of knowledge *preservation* is not directly addressed as well as that of knowledge *use*.

2.3 Hypotheses

Based on the aforementioned considerations on EAM from a KM perspective, we derive hypothesis for future research in the area of EAM. In order to evaluate the importance of the different hypotheses these need to be evaluated according to their relevance in practice. The hypotheses derived from the preceding literature analysis are listed in Table 1. The hypotheses are numbered and a mapping to the corresponding activity of the KM cycle of Probst (1998) is performed in the last row.

	Hypothesis	**Corresponding Activity**
1	Identification of EA scope and goals is an important phase of the EAM process.	*Defining goals*
2	Identification of possible EA related information sources is a usual EAM process at organizations.	*Knowledge identification*
3	The scope of information channels used to acquire EA knowledge at organizations is limited.	*Knowledge acquisition*
4	Development of EA knowledge is a well-established sub-process of EAM at organizations.	*Knowledge development*
5	A thorough definition of tools and techniques for supplying stakeholders with relevant EA artifacts and communicating EA information in general is of low importance at companies.	*Knowledge distribution*
6	Preservation of EA knowledge in an accessible format and making it available within an organization is a constituent of the EAM process at an organization.	*Knowledge preservation*
7	Knowledge items, generated within EAM are regularly used in other enterprise-level management processes.	*Knowledge use*
8	Measurement of goal-fulfillment in the field of EAM is neglected at organizations.	*Knowledge measurement*

Table 1. Research hypotheses.

3 EMPIRICAL FINDINGS FROM AN INDUSTRY STUDY

In order to falsify the hypotheses derived from practice and to evaluate the relevance of the hypotheses 1-8 an empirical study was carried out in form of an online questionnaire. The target audience of the online questionnaire are practitioners, which work in the area of EAM. Invitations were distributed via different communities for enterprise architects, like LinkedIn, Xing, and Goolge groups. The survey was conducted between March 15th 2010 and April 15th 2010. The total *participation rate* is 121 respondents, of which 56 participants completed the survey. Thus, the *dropout rate* is about 53%. More than half of the respondents come from Germany (53,6%), further 10,7% come from USA. Most of the survey participants are employed in the finance branch (30,4%), manufacturing (12,50%), government (8,9%), and utilities (7,1 %). Nearly 52% of respondents have been working in the area of EAM for 1-4 years, the tenure of approximately 29% is 5-10 years and more than 10% possess above 10 years of experience in the area of EAM. What concerns the current occupation, the majority of the survey participants are enterprise architects (more than 64 %) followed by IT architects (app. 20%).

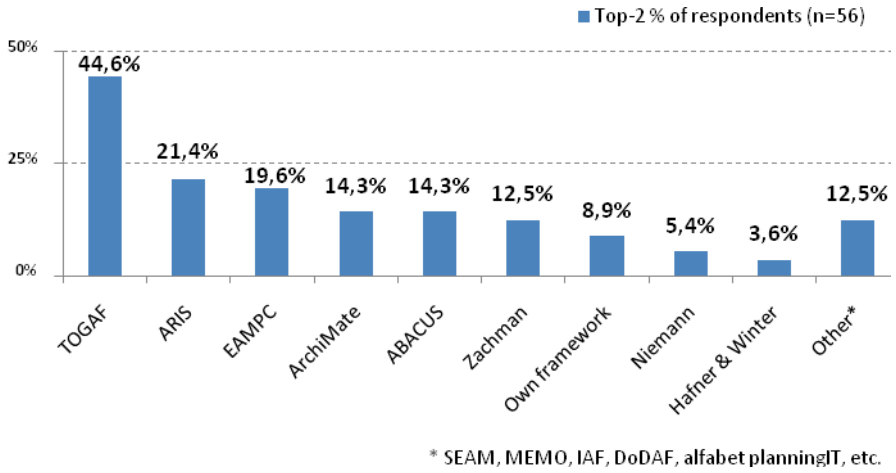

Figure 2. Influence of EAM approaches.

Speaking about the study population, it is necessary to mention that the sample size itself is relatively small. Meanwhile, the sample distributions by industry branch, site location, and tenure are quite proportional and do not contain any particular bias. Additionally, the overrepresentation of enterprise and IT architects in the sample is an intended effect, because they belong to the target respondent group of the survey. From this point of view, the survey sample can be considered as representative.

Regarding the respondents' EAM environment, most state that TOGAF influenced the organization specific approach of their company at most, as depicted in Figure 2 ("Top-2" sums up the two positive items of the five point Likert scale evaluation, while "n" stands for the total number of responses).

In order to find out whether identification of EA scope and goals is perceived as important at companies (*Hypothesis 1*), respondents were asked to choose activities carried out at their enterprise. All of the listed activities (except for the definition of the detail level) yielded majority of positive responses (see Figure 3). For this reason, *Hypothesis 1* can be considered as approved.

Similarly, about 51,8% of respondents indicated that EA relevant stakeholders are usually identified and kept records of at their company (as opposed to nearly 43% of negative answers). Additionally about 68% of participants confirmed (vs. app. 27% neglected) that their enterprises as a rule identify and document EA information sources (e.g. tools and people).

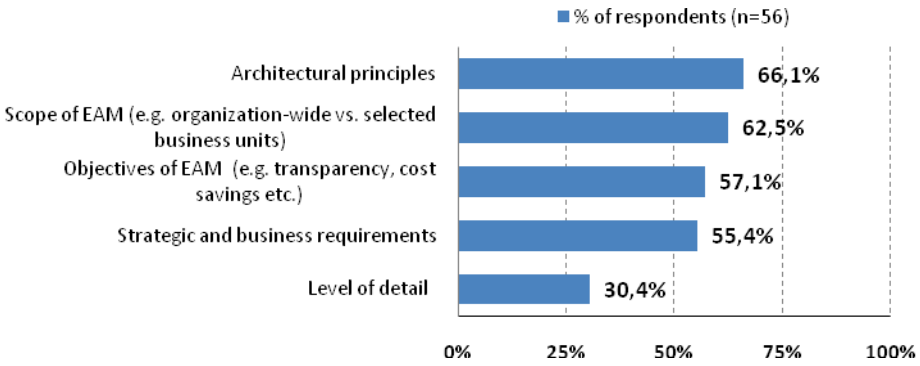

Figure 3. Definition of EA related goals at companies.

Due to the majority of positives answers *Hypothesis 2* cannot be rejected. Nevertheless, the proportion of negative answers is also considerable; therefore a larger sample size is needed to corroborate the hypothesis indeed.

The next hypothesis to be discussed concerns the scope of information channels used for acquisition of EA knowledge at companies. In this case, the term "information channels" can be treated as the number of different EAM approaches consulted during the development of the company's own architecture framework, external knowledge sources in form of consultancies as well as internal sources, i.e. company's employees.

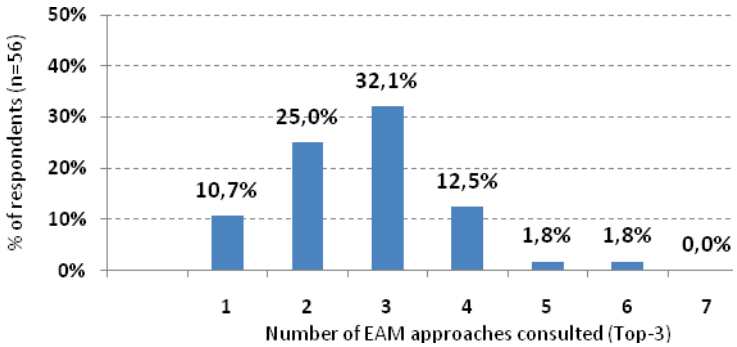

Figure 4. Number of EAM approaches that influenced company's own approach.

Most respondents (app. 79%) state that the EAM solution utilized at their enterprise was tailored to company's needs by company's internal specialists only. Further, only about 54% of participants specified that external specialists, as for example consultancies, helped in customizing their EAM solution, while about 41% did not use any help from external sources at their company. Finally, the total number of various architecture frameworks and approaches that influenced the company's current EAM approach was analyzed (see Figure 4). For this purpose, the top-3 evaluations of the Likert scale, i.e. the two positive items and the neutral one have been taken into consideration. In this case the neutral scale point was not disregarded, because it still denotes a certain degree of positive influence, on the contrary to the two negative scale items, although not as strong as that of the two positive Likert scale items. According to the survey, most companies (see Figure 4) consulted two or three additional EAM approaches while developing that of their own. Summing up, *Hypothesis 3* can be approved, because most companies tend to use their internal specialists as the core knowledge source and in general consider only some of the possible alternative solutions, what probably helps companies to protect themselves from some kind of "information overload", provided the few solutions focused upon perform well.

As next, *Hypothesis 4* regarding development of EA related knowledge at an enterprise is considered. Since knowledge development is quite an abstract process taking place each time architecture plans are reviewed or new EA related artifacts are produced, it is difficult to assess what proportion of time within an EA process employees explicitly devote to knowledge development. For this reason, the

general quality of EA related knowledge (that means knowledge captured in a tangible format, or in other words *explicit* knowledge) at companies has been evaluated (see Figure 5). According to the respondents, EA related information is not updated regularly (only 32,1% consider information timeliness to be appropriate). Similarly, presentation of EA related information and its scope mostly need further improvement. Consequently, one comes to the conclusion that the process of knowledge development including its further capture, storage, and availability needs to be improved at most organizations. Therefore, *Hypothesis 4* is to be rejected.

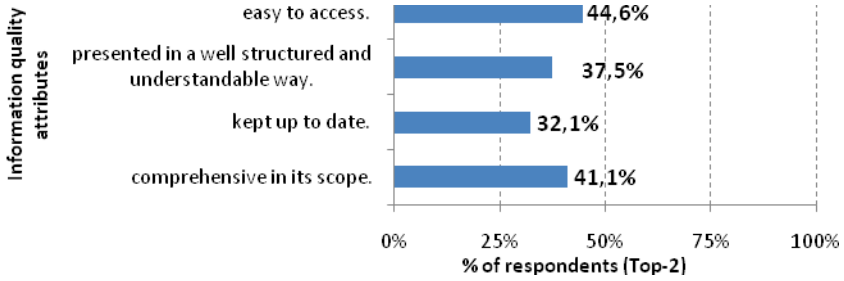

Figure 5. Assessment of EA-related information quality at companies.

Hypothesis 5 concerns the activity of knowledge distribution and deals with the definition of tools and techniques for effective supply of stakeholders with relevant EA information (the notions of information and knowledge are used here synonymously). Speaking about EA information distribution in general, most respondents replied that EA information distribution is not explicitly defined (app. 39,3%) at their company, however is practiced in a satisfactory manner. Further, 25% of participants in each case responded that the distribution activity is either well-defined, but no practiced as that, or neither defined nor practiced. And merely 10,7% consider the aspect both well-defined (e.g. in terms of channels to be used, timing, and responsibilities) and practiced according to the definition.

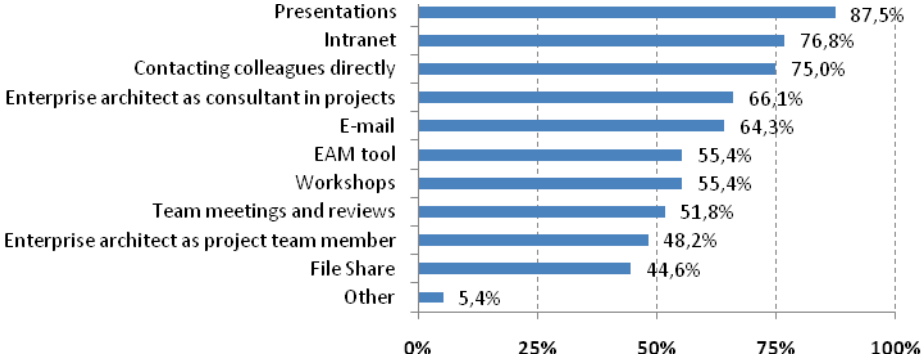

Figure 6. Communication channels.

Figure 6 additionally illustrates communication channels used at companies for supplying target stakeholders with EA information. Except for Intranet, person-to-person communication (either direct or via E-mail) is the dominating channel for providing knowledge and information. While communicating important facts, such as new architectural principles and plans, for example, the main purpose is that recipients take notice of the message. According to the survey, the check if information distribution was successful is mostly carried out in form of quality gates (55,4%), whereas such measures as request for a prompt feedback (28,6%) or any other form of acknowledgement (app. 18%) are far less popular. According to these facts, *Hypothesis 5* can be considered as confirmed.

Hypothesis 6 deals with knowledge preservation or put in the study context- with storing EA data in an accessible format. Most respondents state that their companies use special EAM tools in order to create visualizations and reports (app. 68%), communicate EA information (66%) and finally capture EA information in general (62,5%). What concerns the manner of collecting and maintaining EA data, in most cases it is carried out manually (73,2%) as compared to a semi- automated (50%) or an automated way (8,9%). In terms of responsibilities, collection and maintenance of EA data is

accomplished both centrally by an EA department (62,5%) and locally by divisions (58,9%). Speaking about the transformation of *tacit* EA knowledge into its *explicit* form, only 37,5% of the survey participants confirm that lessons learned are documented and further communicated (vs. app. 52% of negative responses) and solely about 41% state that the list of best practices for EAM is being compiled and extended at their company (vs. about 52% of negative answers). On basis of these responses, *Hypothesis 6* can only be accepted with respect to the storage of EA artifacts (or *explicit* knowledge); however it must be rejected regarding the capture and preservation of *tacit* knowledge.

An important question contained in *Hypothesis 7* is whether architecture knowledge generated in course or the EA process is used in other enterprise-level management processes. According to the respondents, the association is at its strongest between EAM and strategy and goals management (55,4%), followed by project management (48,2 %) and project portfolio management (48,2). Speaking about demand management, 62,5 % of survey participants deny any interconnection between that and EAM at their company. The association is realized at most enterprises in form of consultancies by enterprise architects (67,9 % of respondents), sometimes as quality gates (44,6%), and seldom as handover of prefilled documents for completion (23,2%). Merely 5,4% of respondents confirmed there is a higher project budget available in case an enterprise architect takes part in a project. As a consequence of these results, *Hypothesis 7* is obviously to be rejected.

Since most of the theoretical EAM approaches do not pay much attention to the assessment of the degree of goal-fulfillment, *Hypothesis 8* is an important key to understanding whether the literature analysis matches the situation in the praxis. Some of respondents confirmed that performance measurement of the EAM function is performed at their company on demand (25%) or annually (19,6%). However, most of the survey participants state that at their companies neither degree to which the goals set for EAM have been achieved (58,9%), nor adherence to architectural principles and regulations (62,5%), or stakeholder participation and acceptance (62,5%) are measured. Therefore, no results of performance measurement can be used at companies for improving their EAM in the future as a rule (73,2%). Based on the evaluation of results, *Hypothesis 8* can be approved.

4 CONCLUSION AND PROSPECTS

The goal of this research paper is the identification of future areas of research in the context of EAM from a KM perspective. Therefore, hypotheses are derived from an extensive literature analysis and evaluated according to their relevance in practice. The background for an empirical study is created in the first part of the article, which discusses the process peculiarities of KM and offers in conclusion a set of relevant KM activities applicable for the assessment. Subsequently, the selected activities are defined in the context of EAM and test hypotheses for an empirical study are deduced. Further, the paper presents an evaluation of the hypotheses based on the findings form an online questionnaire.

The first significant finding of the executed study is that identification of knowledge goals is not only considered important by KM and EAM researchers, but also is perceived as essential by EAM practitioners. Further, the survey outcomes show that the process of documentation, preservation, and communication of *tacit* knowledge, as for example, best practices and lessons learned is as compared to *explicit* knowledge (e.g., EAM artifacts) insufficient and needs to be effectively improved or established at most companies. Additionally, the study provides insights into the realization of association between different enterprise-level management processes. According to the survey participants, the degree of association is at strongest between EAM and strategy and goals management or project (portfolio) management, while communication with other enterprise-level management processes is almost missing. Finally, the survey outcomes confirmed the literature analysis findings regarding the activity of KM. Most enterprises do not focus on assessing performance of the EAM function, despite the fact that they could considerably benefit from it.

Summing up, the empirical study carried out within the context of the research makes a contribution to the understanding of EAM realization at enterprises and creates a background for future investigations in the field of EAM. An interesting task for further research could be the conduction of another survey among EAM practitioners with a larger sample size in order to gain a better degree of

representativeness. Additionally, some methods of KM concerning knowledge communication and preservation (e.g. implementation of EAM-related knowledge repositories) could be adopted to the needs of EAM practitioners and introduced in partner companies as an empirical experiment.

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