Future Research Topics in Enterprise Architecture Management – A Knowledge Management Perspective

Sabine Buckl, Florian Matthes, and Christian M. Schweda

Technische Universität München, Institute for Informatics,
Boltzmannstr. 3, 85748 Garching, Germany
{sabine.buckl,matthes,schweda}@in.tum.de
http://www.systemcartography.info

Abstract. Identifying, gathering, and maintaining information on the current, planned, and target states of the architecture of an enterprise is one major challenge of enterprise architecture (EA) management. A multitude of approaches towards EA management are proposed in literature greatly differing regarding the underlying perception of EA management and the description of the function for performing EA management. The aforementioned plurality of methods and models can be interpreted as an indicator for the low maturity of the research area or as an inevitable consequence of the diversity of the enterprises under consideration pointing to the enterprise-specificity of the topic. In this paper, we use a knowledge management perspective to analyze selected EA management approaches from literature. Thereby, we elicit constituents, which should be considered in every EA management function from the knowledge management cycle proposed by Probst. Based on the analysis results, we propose future research topics for the area of EA management.

Keywords: EA management function, knowledge management.

1 Motivation

Knowledge is often referred to as an competitive advantage for enterprises in todays ever changing market environment. Thereby, this advantage does not only refer to knowledge about the environment, e.g. competitors, future trends and technologies, but also to knowledge about the internal make-up and processes of an enterprise. This internal make-up forms the management body of enterprise architecture (EA) management. EA is thereby understood as the "fundamental conception of a system [enterprise] in its environment, embodied in its elements, their relationships to each other and to its environment, and the principles guiding its design and evolution" [9]. The goal of EA management is to enable the enterprise to flexibly adapt via business/IT alignment [1].

Typical application scenarios of EA management are inter alia strategic IT planning, process optimization, and architecture reviews of projects [1]. Thereby, one major challenge of EA management is to foster the communication between

A. Dan, F. Gittler, and F. Toumani (Eds.): ICSOC/ServiceWave 2009, LNCS 6275, pp. 1–11, 2010.

the involved stakeholders, e.g. the project director, the standards manager, and the enterprise architect in the case of an architecture review process. Thus, the task of EA management is to support decision making, via providing the required information in an appropriate form to the respective stakeholder. According to Matthes et al., EA management can be defined as "a continuous, iterative (and self maintaining) process seeking to improve the alignment of business and IT in an (virtual) enterprise. Based on a holistic perspective on the enterprise furnished with information from other enterprise level management processes [e.g. project portfolio management] it provides input to, exerts control over, and defines guidelines for other enterprise level management functions" [2]. The definition underlines the importance of information exchange for EA management. Likewise, typical tools providing support for EA management provide functionalities like *import, editing of data, creating visualizations,* or *communication and collaboration support* [10] also emphasize this aspect.

Similar to EA management, knowledge management (KM) is concerned with managing the "cooperation's knowledge through a systematically and organizationally specified process for acquiring, organizing, sustaining, applying, sharing, and renewing both the tacit and explicit knowledge of employees to enhance organizational performance and create value" [5]. Although the importance of information gathering, communication, and exchange for EA management is discussed repeatedly in literature about EA management(cf. [3,6,11,14]), no attempt has been performed to analyze and enhance existing EA management approaches from a KM perspective. Derived from this research gap, the article answers the following research questions:

> How do existing EA management approaches address KM aspects of EA management? Which future research topics for EA management can be derived from a KM perspective?

The article firstly gives an overview on KM theories and selects the one of Probst (cf. [13]) as basis for future discussions (see Section 2). In Section 3 a KM perspective on EA management is established and used to assess prominent EA management approaches. The analyses' findings are used in Section 4 to outline areas for future development of EA management.

2 A Model for Knowledge Management

Academic research has brought up quite a few different models for knowledge management, which differ in respect to the perspective, they take on this management area. We revisit two prominent models for knowledge management and decide on the one most useful for answering above research questions. The criterion of usefulness and purposefulness is according to Probst [13] a simple but effective one for selecting an appropriate model of knowledge management, as the following quote of Probst subsumes:

> While there is no single "right" model of KM, there is a simple criterion for evaluating any model: how useful is it [for] a chosen question?

Against above research questions, the KM models of Nonaka and Takeuchi (cf. [12]) and Probst (cf. [13]) are analyzed. In line with Holsapple and Joshi [8] we notice that these models, similar to most KM models, are *descriptive*, i.e., help to understand and explain KM phenomena. In this respect, they can be used in this paper, as the addressed research questions are concerned with understanding EA management from a KM perspective.

Nonaka and Takeuchi (cf. e.g. [12]) take an actor-centric perspective on KM. They identify four kinds of *knowledge conversion* activities that take place during knowledge creation in an organization. These are *socialization*, *externalization*, *combination*, and *internalization*. The activities are called *conversions* there, as they "convert" knowledge between different types, namely between *tacit* and *explicit* knowledge on the one hand, and between *individual* and *collective* knowledge on the other hand. In this framework of knowledge types, the activity of *socialization* converts knowledge of one entity to collective knowledge of a group. During *externalization* tacit knowledge is converted to explicit knowledge, codified in a knowledge representation. Explicit knowledge is in the *combination* activity combined by an individual into new knowledge. Finally, explicit knowledge is converted to tacit knowledge of an individual during the *internalization* activity. The model of Nonaka and Takeuchi (cf. [12]) can be used to understand how individuals act during knowledge creation in an organization and allows for a sociologic perspective on KM processes. This perspective is nevertheless only of minor interest in respect to the questions from Section 1.

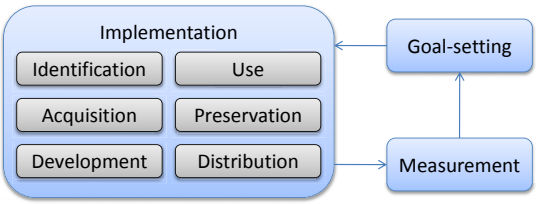

Fig. 1. The KM cycle of Probst (cf. [13])

The KM cycle of Probst as presented in [13] consists of several *building blocks* for KM, reflecting typical activities that are carried out to avoid knowledge problems. As the cycle forms on the one hand a comprehensive model for KM and is on the other hand explained in very detail, it is subsequently sketched to provide the basis for the KM perspective on EA management. The KM cycle actually consists of the following two cycles, of which Figure 1 gives an overview:

- an *outer* cycle consisting of *goal setting*, *implementation* and *measurement*
- an *inner* cycle detailing the implementation activity into the sub-activities of *identification*, *acquisition*, *development*, *distribution*, *preservation*, and *use*

Knowledge identification is concerned with determining the knowledge that exists in an organization, and relating this knowledge to the one existing in the

organization's environment. The activity increases transparency of knowledge, and may help to identify redundant as well as missing knowledge. *Knowledge identification* can, if the number of knowledge sources to process is abundant, resort itself to *critical* knowledge as defined in the activity of *goal setting*.

Knowledge acquisition accounts for the fact that due to the growth of overall knowledge an organization is not capable to build up and maintain all needed know-how. Therefore, knowledge is imported over different *import channels*:

- acquisition of companies holding the corresponding knowledge
- stakeholder participation, e.g. by involving the customers of the organization
- counseling by experts that contribute to the organization's knowledge
- acquisition of knowledge products that foster the development of new knowledge (does not directly improve the organization's knowledge)

Knowledge development produces new knowledge on individual and collective level in a creative process, which can only to a very limited extent be discussed from a management perspective. Multiple sociological and psychological theories center around this activity and may be appropriate to study the process more in-depth. Linking back to the level of organizational KM and organizational development, e.g. an *atmosphere of trust* in the organization is regarded as a prerequisite to effective knowledge development.

Knowledge distribution means making knowledge available across the organization. Put in the words of Probst, as stated in [13], *knowledge distribution* is about the critical questions of ***Who*** *should know* ***what****, to* ***what level of detail****, and* ***how*** *can the organization support these processes of knowledge distribution?* These questions account for the fact that not everyone needs to know everything, as in contrast information overload might be as detrimental as a lack of information. Concerning the activity of knowledge distribution, the role of supporting tools and techniques should neither be underestimated nor overestimated. Useful and broadly accepted tools, and widely employed techniques can help to facilitate in the same ways as dysfunctional tools and not well adopted techniques can hamper effective *knowledge distribution*. As user acceptance is crucial for a tool or technique being an effective distribution facilitator, many organizational and non-technical issues have to be concerned regarding *knowledge distribution*.

Knowledge use forms the actual purpose of KM and refers to the application of knowledge in the production process of an organization. In respect to the later focus on EA management, which is no production process, the above statement can be reformulated as follows: *knowledge use* refers to the application of knowledge in the purpose-generating process of an organization. Here again, tools and techniques can be applied as facilitators; this is not surprising as especially in knowledge-intensive processes the borders between distribution and use are sometimes unclear. Notwithstanding, *knowledge use* should explicitly be accounted for, as the *goal setting* activity purposefully targets the use activity.

Knowledge preservation is concerned with avoiding the loss of valuable and purpose-relevant expertise in an organization. While tacit knowledge is more often subject to loss, e.g. due to an expert leaving, also explicit knowledge has to be preserved. Probst refers to outdated storage systems as *dead storage systems*,

colloquially stating that a storage system, which is not longer maintained, may cause knowledge loss as well as a leaving expert. Techniques and tools used for knowledge distribution can also be helpful for knowledge preservation.

Complementing the inner cycle of *knowledge implementation*, two more activities that constitute an embracing and sustainable KM are introduced below.

Goal-setting, i.e., the development of knowledge goals, establishes a conceptual framework for organization-specific KM. The knowledge goals determine which capabilities should be built on which level. Different levels of abstraction in respect to the formulation of goals can be distinguished. Most important for the subsequent considerations are the levels of *strategic knowledge goals* and *operational knowledge goals*. While the former goals describe a long-term vision of the knowledge portfolio of the organization, the latter goals operationalize the vision, i.e., translate it into action. Making the knowledge goals explicit is regarded highly important for controlling the evolution of the KM.

Knowledge measurement is concerned with measuring to which extent the knowledge goals have been fulfilled during the *implementation* activity. As knowledge is an intangible resource, indicators and measurement processes are hard to establish. To some extent the operational knowledge goals can be formalized that they can help to objectively assess certain aspects of KM. Nevertheless, a commonly accepted way to measure knowledge has yet not been established, such that managers concerned with KM activities have to rely on their subjective perception of goal fulfillment. Additionally, surveys on user satisfaction with knowledge access in distinct areas, which reflect certain knowledge goals, may be helpful during *knowledge measurement*.

3 Analyzing Existing EA Management Approaches from a Knowledge Management Perspective

Preparing the subsequent analyses of prominent EA management approaches from a KM perspective, the KM model of Probst [13], more precisely its building blocks, are mapped to the application domain of EA management. To ground the mapping solidly in the application domain of EA management, the outer cycle's activities of KM are mapped first, starting with the *implementation* activity. This activity can be identified with the core of EA management, i.e., with the "continuous process seeking to improve the alignment of business and IT in a (virtual) enterprise". This part of the definitional statement towards EA management (cf. Section 1) sketches the main goal of the implementation of EA management, but does not provide further details on the implementation. These are later discussed along the activities from the inner cycle. Continuing with the activities from the outer cycle, both *knowledge measurement* and *goal-setting* can be identified with the aspect of "self maintenance" of the EA management process. More precisely, an effective and continuous EA management, established as a management function within an enterprise, must define the share of the overall architecture of the enterprise that it covers. This can be understood as goal-setting, i.e., defining which knowledge about the architecture is needed;

multiple EA management approaches target this topic. The knowledge measurement closes a feedback loop by assessing to which extent the knowledge goals could be attained. Put in the EA management terminology, the measurement activity assesses, if the architecture concepts defined during goal-setting have adequately been considered during EA management. This provides input for revisiting the knowledge goals, if albeit a good coverage of relevant architecture concepts, an increased alignment between business and IT could not be achieved.

Above considerations on EA management from a KM perspective partially neglect process-related aspects of EA management. To some extent this narrow focus is broadened by diving into the details of *implementation* activity, but the focus in this paper lays on the knowledge and information aspect of EA management not on the process aspect thereof. The sub-activities of the building block *implementation* can be mapped as follows to the domain of EA management. During *knowledge identification* possible sources of information about the EA are identified. These sources may be both people, as e.g. business or enterprise architects, but also documentation tools. *Knowledge acquisition* relates to activities as EA management counseling by consultancies, more detailed with incorporating best-of-breed EA-related solutions into the EA knowledge of the company. In the context of EA management, *knowledge development* can refer to planning and decision activities, where additional knowledge about the EA is created. *Knowledge distribution* maps to the EA management activity of communicating architectural knowledge, i.e., as information on current and planned architectures, to people involved in other enterprise level management functions, as e.g. project portfolio management. In this vein, *knowledge preservation* can be understood as storing this architecture knowledge in a way that interested stakeholders can access it. Additionally, preservation is also concerned with making accessible not only the most recent architectures, but also former plans and documentations. Finally, *knowledge use* can be identified with management activities in the enterprise-level management functions that access the architecture knowledge for deciding, planning, executing, or measuring. Based on the KM perspective on EA management existing approaches to EA management originating from academia and practice are detailed and discussed subsequently.

A well-known approach to EA management is *The Open Group Architecture Framework (TOGAF)* [14], whose main constituent is the *Architecture Development Method (ADM)*, which describes a cyclic project-oriented process for EA management. In the ADM each EA management project starts with the *preliminary* phase, which defines the project's scope and reach (**knowledge goal-setting**) and decides on other frameworks and tools to be utilized (**knowledge acquisition**). The preliminary phase is followed by the *architecture vision* phase in which future states of the EA are developed (**knowledge development**). The current state of the EA is documented in three distinct phases, which focus on different parts of the architecture – the *business architecture* phase, the *information systems architecture* phase, and the *technology architecture* phase. Although information has to be gathered and consolidated in these phases, TOGAF only addresses the challenge of **knowledge identification** via a *stakeholder*

management. Means and methods how to draw knowledge e.g. from tools, already in use, are not referred to. Based on the current and future states of the EA, the *opportunities and solutions* phase develops plans for the evolution, which are decided upon an detailed during the *migration planning* phase. The migration plans are subsequently realized in the *implementation governance* phase, in which other management functions, e.g. project portfolio management, are provided with knowledge to support decision making (**knowledge use**). Finally, the phase *architecture change management* assesses the quality of the developed architecture and handles change requests. Although this phase partially incorporates **knowledge measurement**, important aspects of this KM activity are not considered, e.g. a continuous improvement of the overall process. Whereas the task of **knowledge distribution** is indirectly mentioned in the some phases of the ADM, see e.g. the objective "confirm the transition architectures [...] with relevant stakeholder" [14], methods and means how to conduct this task are not further detailed. Similarly, the challenge of **knowledge preservation** does not form a focal point of TOGAF. Viewpoints to communicate architectural knowledge are textually described but no further explanation how a specific stakeholder can access and use the information are given.

The *Enterprise Architecture Management Pattern Catalog (EAMPC)* [4] was developed at the Technische Universität München and contains a collection of best practice methods, visualizations, and information models for EA management. The intent of the EAMPC is to support EA practitioners in the concern-driven development of an enterprise-specific EA management function. Concerns represent typical problems, which occur in the context of managing an EA, for instance, "Which business processes, if any, are suitable candidates for outsourcing?" [4] The concerns contained in the EAMPC address the different areas, e.g. business process support management and application landscape management. The topic of application landscape management is concerned with evolution aspects (**knowledge development**). In order to use the EAMPC, the enterprise under consideration has to select the appropriate concerns (**goal-setting**). Based from the selected concerns, the according *methodology patterns (M-Patterns)* addressing the concerns can be derived. Within each M-Pattern one or more *viewpoint patterns (V-Patterns)* are referenced. These V-Patterns describe how the information, which is necessary to address the concern, can be visualized and presented to the involved stakeholders (**knowledge preservation**). A description of the corresponding information including the types of elements, their attributes, and relationships to each other is given in the *information model patterns (I-Patterns)*, which are referenced by V-Patterns. Methods and means to gather the according information are described as part of the solution description of the M-Pattern (**knowledge identification**). The M-Pattern further described required governance structures, roles, and responsibilities. Thereby, the links to other enterprise-level management functions, as e.g. the project portfolio management, are discussed and the type of relationships, ranging from information provision to enforcing, is described (**knowledge distribution** and **use**). Methods for assessing the performance of

an EA management function (**knowledge measurement**) and for **knowledge acquisition** are not described in the EAMPC.

Niemann presents an approach to EA management organized in the phases *document, analyze, plan, act*, and *check* [11]. According to Niemann, the objective of EA management is to support an enterprise in "doing the right thing right, with minimal risk" [11]. The approach provides a standard information model and does hence not account for enterprise-specific **goal-setting**. The model consists of three submodels for the business, application, and systems architecture. Information about the current state of these architectures is gathered in the *document* phase. Whereas the description of the document phase emphasizes on *what* should be documented and *how* it should be documented (**knowledge preservation**, the question *where* to gather the respective data from (**knowledge identification**) is only briefly sketched. Based on the results of the *document* phase, the *analyze* phase assesses certain architectural properties, e.g. heterogeneity, complexity, or costs. Based on the the analyses' results, future plans for the EA are derived, evaluated, and decided upon in the *plan* phase (**knowledge development**). The developed roadmap is realized in the *act* phase, in which EA management influences demand and portfolio management as well as program and service management functions (**knowledge usage**). The *check* phase analyzes key performance indicators for the EA that may influence marketing for EA management, which is according to Niemann one key success factor. Marketing methods are described on a very abstract level (**knowledge distribution**) [11]. The performance measurements described by Niemann mostly target the EA, whereas only one measurement – the *architecture management scorecard* – measures the EA management function itself [11]. Although other frameworks and tools for EA management are mentioned in [11], a combination with such approaches is not described (**knowledge acquisition**).

In [7] Hafner and Winter derive a process nodel for architecture management from three case studies. The model consists of four phases: *architecture planning, architecture development, architecture communication,* and *architecture lobbying.* One activity of the *architecture planning* phase is the identification of strategic requirements. This activity may in line with [6] be understood as defining the share of the enterprise that should be considered by the EA management (**goal-setting**). For each area-of-interest in the EA the corresponding stakeholders should be identified (**knowledge preservation**). A process and involved roles for **knowledge identification** in the architecture planning phase are described in [6]. During planning, the current architecture is further assessed, architecture principles are revised, and the future states of the EA are updated (**knowledge development**). Whereas the *architecture planning* phase focuses on strategic aspects, *architecture development* focuses on operational aspects. Main activities of this phase are to identify and manage further requirements as well as piloting, developing, and integrating architecture artifacts. *Architecture communication* is concerned with identifying relevant stakeholders and communicating architecture artifacts (**architecture distribution**). The phase *architecture lobbying* targets aspects like assistance for running projects via consultancy, which

is a part of knowledge dissemination (**knowledge use**) aiming to influence and control projects. Whereas assessment and analyses of different states of the EA are discussed in the process model of Hafner and Winter [7], a process phase to analyze the EA management function itself (**knowledge measurement**) is not decsribed. The possibility to complement the process model with other external resources, e.g. frameworks, (**knowledge acquisition**) is also not discussed.

4 Proposing Topics for Future EA Management Research

Table 4 summarizes the results of the literature analysis from Section 3, preparing a discussion on common strengths and weaknesses of the analyzed approaches. Three of the four approaches analyzed provide a "standard" reference method for EA management (cf. [7,11,14]). These "one-size-fits-it-all" methods contain generic goals for EA management, as architecture roadmapping and transformation planning. TOGAF additionally mentions the importance of enterprise-specific goals, but does not provide exemplary ones [14]. The EAMPC in contrast lists typical EA management concerns, which can be used to support the **goal-setting** for an enterprise-specific EA management function. The absence of concrete goals might explain the lack of methods for assessing and **measuring** the EA management function itself, which is a common weakness of most of the analyzed approaches. From this weakness, we derive a first topic for future research: *Operationalizing knowledge goals for EA management.* While existing approaches currently focus on general tasks of EA management, typical goals are of interest in order to derive the necessary knowledge demands. Via the selection of the relevant goals, an enterprise can configure the reference method according to its specific demands. Accordingly, methods and means for assessing and measuring the achievement of these goals can be developed on explicit goals. They lay the foundation for an EA management governance method.

Identifying, gathering, and maintaining knowledge about the EA is a challenge, which is only recently addressed by isolated approaches (cf. [6]). As the analyzed EA management methods do not detail on how to **acquire** and incorporate knowledge from other sources, is limited. Therefore, future research should focus on the *integration of existing EA management approaches* instead

Table 1. A KM perspective on existing EA management approaches

	[14]	[3,4]	[11]	[6,7]
Goal-setting	◑	●	◑	◑
Measurement	○	○	○	○
Identification	◑	◑	○	◑
Acquisition	◑	◑	○	○
Development	◑	◑	●	●
Use	◑	●	●	◑
Preservation	○	◑	◑	◑
Distribution	◑	◑	◑	◑

of developing the wheel over and over again. Additional guidance on how to accomplish this integration, e.g. via openly configurable EA management reference methods needs to be developed and researched. From a KM perspective, common strengths of the analyzed EA management approaches are the **development** and **use** of knowledge. All these approaches provide means and methods to develop future states of the EA and evolution roadmaps. Nevertheless, these means and methods are mainly approach-specific and cannot be reused in other approaches. Future research should be focused on interoperability of the methods.

Although the analyzed approaches agree that the enterprise is a complex socio-technical system, only one approach [14] details on the aspect of human stakeholders and their involvement in EA management. Therefore, the **distribution** of knowledge is often discussed by referring to the related management processes, e.g. project portfolio management, without explicating stakeholders involved. Similarly, the **preservation** of knowledge is only mentioned as a challenge, which should be addressed via EA management tools. Future research could target the establishment of a more systematic stakeholder model for EA management together with a structured approach to describe the corresponding viewpoints. Additionally, the topic of knowledge preservation class for techniques that help to access and compare past (planning) states of the EA.

Above analyses showed that some KM activities are only partially addressed by current EA management approaches. Future research may concentrate on these activities in two ways, namely by *theorizing* explanations for the lower importance of the activities or by *improving* the support for the activities. In-depth analyses of successful EA management approaches from a KM perspective help to pursue both directions. The analyses may show that the activities are actually not considered relevant, as companies perceive them adequately addressed. In this case, proven practice methods for distributing and preserving EA knowledge could be documented to complement the existing EA management approaches in literature. If in contrary, a lack of adequate support is discovered, KM models may be used to improve existing EA management approaches. Especially the *operationalization of knowledge goals* seems to be a promising way to improved stakeholder-specific knowledge distribution and preservation.

References

1. Aier, S., Riege, C., Winter, R.: Unternehmensarchitektur – literaturüberblick stand der praxis. Wirtschaftsinformatik 50(4), 292–304 (2008)
2. Buckl, S., Ernst, A.M., Lankes, J., Matthes, F., Schweda, C.M.: State of the art in enterprise architecture management 2009. Technical report, Chair for Informatics 19 (sebis), Technische Universität München, Munich, Germany (2009)
3. Buckl, S., Ernst, A.M., Matthes, F., Ramacher, R., Schweda, C.M.: Using enterprise architecture management patterns to complement togaf. In: The 13th IEEE International EDOC Conference (EDOC 2009), Auckland, New Zealand. IEEE Computer Society, Los Alamitos (2009)
4. Chair for Informatics 19 (sebis), Technische Universität München. Eam pattern catalog wiki (2009), `http://eampc-wiki.systemcartography.info` (cited 2010-02-25)

5. Davenport, T.H., Prusak, L.: Working Knowledge: How Organizations Manage What They Know. Harvard Business School Press, Boston (1998)
6. Fischer, R., Aier, S., Winter, R.: A federated approach to enterprise architecture model maintenance. In: Proceedings of the 2nd International Workshop on Enterprise Modelling and Information Systems Architectures (EMISA 2007), St. Goar, Germany, October 8-9, pp. 9–22 (2007)
7. Hafner, M., Winter, R.: Processes for enterprise application architecture management. In: Proceedings of 41st Hawaii International International Conference on Systems Science (HICSS-41 2008), Waikoloa, Big Island, HI, USA, January 7-10, p. 396. IEEE Computer Society, Los Alamitos (2008)
8. Holsapple, C.W., Joshi, K.D.: Description and analysis of existing knowledge management frameworks. In: 32nd Hawaii International International Conference on Systems Science (HICSS-32 1999), Waikoloa, Big Island, HI, USA, vol. 1, p. 1072. IEEE Computer Society, Los Alamitos (1999)
9. International Organization for Standardization. Iso/iec 42010:2007 systems and software engineering – recommended practice for architectural description of software-intensive systems (2007)
10. Matthes, F., Buckl, S., Leitel, J., Schweda, C.M.: Enterprise Architecture Management Tool Survey 2008. Chair for Informatics 19 (sebis), Technische Universität München, Munich, Germany (2008)
11. Niemann, K.D.: From Enterprise Architecture to IT Governance – Elements of Effective IT Management. Vieweg+Teubner, Wiesbaden (2006)
12. Nonaka, I., Takeuchi, H.: The Knowledge-Creating Company. Oxford University Press, Oxford (1995)
13. Probst, G.J.B.: Practical knowledge management: A model that works. Arthur D Little PRISM (1998)
14. The Open Group. TOGAF "Enterprise Edition" Version 9 (2009), `http://www.togaf.org` (cited 2010-02-25)