Analyzing Task and Technology Characteristics for Enterprise Architecture Management Tool Support

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***Abstract*—Adequate tool support for Enterprise Architecture (EA) and its respective management function is crucial for the success of the discipline in practice. However, currently available tools used in organizations focus on structured information neglecting the collaborative effort required for developing and planning the EA. As a result, utilization of these tools by stakeholders is often not sufficient and availability of EA products in the organization is limited. We investigate the integration of existing EA tools and Enterprise Wikis to tackle these challenges. We will describe how EA initiatives can benefit from the use and integration of an Enterprise Wiki with an existing EA tool. Main goal of our research is to increase the utilization of EA tools and enhance the availability of EA products by incorporating unstructured information content in the tools. For this purpose we analyze task characteristics that we revealed from the processes and task descriptions of the EA department of a German insurance organization and align them with technology characteristics of EA tools and Enterprise Wikis. We empirically evaluated these technology characteristics using an online survey with results from 105 organizations in previous work. We apply the technology-to-performance chain model to derive the fit between task and technology characteristics for EA management (EAM) tool support in order to evaluate our hypotheses.**

***Keywords*-Enterprise Architecture Management, Enterprise Wiki, tool support, collaboration**

I. Introduction

Organizations are challenged by rapidly changing business requirements and external drivers that compel them to adapt to these new challenges [1], [2]. EA and its respective management functions are promoted as means to overcome these challenges and gain strategic advantages over market competitors by increasing flexibility of IT, identifying and realizing cost-saving potentials, increasing availability and failure tolerance, etc. [3], [4]. EA endeavors typically involve the construction of EA models as well as analysis of these models in order to achieve these goals [5], [6], [7]. Besides the structured information captured in models, the EA also comprises a large variety of other business and IT artifacts that are not linked to these constructed models appropriately. We argue that a better interlinking of these artifacts with the constructed models will increase the availability of EA products and improve the utilization of tools for EA management. In a recent study, Niemi et al. [8] identified ten EA quality attributes from a Finnish public sector organization. One of their striking findings was the lack of research on the quality attribute availability of EA products. They mentioned that a great deal of architecture relevant information is located in documents that are not necessarily easily accessible to everyone. Some of these artifacts might have been created in projects and are located in workspaces not accessible to other stakeholders at first. Even models in a central repository are often not open to all stakeholders due to restrictions or unfamiliarity of stakeholders with the tool. One of the suggestions they identified in their study was to share EA products, for example in the organizations intranet, with notifications about new architecture information.

Aier et al. [9] revealed long-term success factors for EA management (EAM) that go beyond formal structure and processes. These factors, e.g. training, communication, intensified EA representation in projects, are currently not supported in EA tools that are developed to support architects with the formal architecture models and related processes. In this paper we investigate to which extend Enterprise Wikis can fill this gap in the EA domain. Organizations are increasingly using these Enterprise Wikis as a new way of business communication that can result in highly productive and collaborative environments [10]. In this sense, our goal is not to replace existing tools for EA, but rather extend their capabilities with solutions already largely adopted in practice.

We build upon a practitioner survey that we conducted to provide the foundation for the integration of Enterprise Wikis and specialized tools for EA [11]. Within this survey 105 experts from the EA domain provide valuable knowledge on this issue. Over 93% of the organizations think that the use of a Wiki in addition to another EA tool used for structured data can be useful, while 60% of the organizations are planning to use a Wiki for EAM in future. We also found that about 34% use solely an EA tool for structured data in their organization, while another 35% use a Wiki and an EA tool separately. About 5% of the organizations already integrated a Wiki and an EA tool solution. These findings emphasize the need for a better integration of unstructured information for modeling tools in practice. We expect that tool solutions integrate these capabilities in future to improve the collaboration among stakeholders and increase the availability of EA artifacts. This paper is a first step towards a better integration of these tools.

Main contribution of this paper is an analysis of task and technology characteristics of Enterprise Wikis and specialized EA tools. These characteristics are retrieved from a practitioner survey we previously conducted and task characteristics that are retrieved from EA process of a German insurance organization. According to the model presented by Goodhue et al. [12], we investigate whether an integration of Enterprise Wikis and EA tools can improve utilization and performance. Therefore, we elaborate the following research questions in this paper:

- *RQ 1: What are technology and task characteristics for EAM tool support?*
- *RQ 2: How can Enterprise Wikis and EA tools be integrated in a practical setting?*
- *RQ 3: What are possible challenges for this approach experienced in practice?*

After revisiting related work, the paper concludes with the research methodology that was applied to derive the utilization and performance of the proposed solution. In the following, we describe the task and technology characteristics for EA tool support that we retrieved from industry in detail. These characteristics are compared to EA tools and Enterprise Wikis. We conclude with a summary and a discussion of the main findings.

II. Related Work

Braun et al. [13] describe in general the basic requirements any EA tool should meet (meta-model based repository with visualization capability) and strongly advocate the use of a professional tool for any organization. They find that EA is evolving into an active concept that supports business systems design, i.e. to contribute to the analysis and proactively support the optimization of business strategies, organizational structures, business processes, information flows, application structures as well as the underlying information systems [13]. An adequate EAM tool would thus have to support the development, storage, communication respectively presentation and enhancement of all relevant enterprise architecture artifacts [13]. Yet, the requirements focus on representation and management of structure data, which we consider to be only a fraction of information used in EAM. In this paper we refer to the definition of Braun et al. where an EA tool comprises structured information about the EA.

As EAM is a knowledge-intensive management discipline, quite some research has been done on how the chosen EA framework and tool support can support the key challenges of knowledge management. Buckl et al. [14] and Lucke et al. [15] discussed this topic on the basis of the knowledge management cycle of Probst (cf. Probst et al. [16]). They both find that knowledge management is affected by the choice of EAM approach and that most approaches show weaknesses in the distribution and preservation of knowledge. The latter goes well in line with the finding of Niemi et al. [8] that the EA quality attribute availability has not received any significant attention so far.

Niemi et al. [8] conceptualize in total ten quality attributes for judging the quality of an EA approach and its tool support. Six of them are concerned with EA products and four on EA services. In their literature research they found most of these quality attributes defined in different contexts, however never all of them together as a comprehensive quality measure. The one attribute they did not find at all is availability of EA products. They validated those attributes with 14 semi-structured interviews based on a case study approach with experts from an organization with five years of EA experience.

Farenhorst et al. [17] present a case study creating and using a Wiki for the EA department of a large organization with little or no experience in Wiki usage as an alternative to a dedicated EA tool. They find that if properly introduced the strengths of a Wiki solution outweighs its weaknesses, with key strengths in online communication, managing non-architectural knowledge, collaboration support and integrating knowledge and communication needs of other functions within the company. The dedicated tools fared better in modeling and retrieving architectural knowledge concepts. The lacking out-of-the-box support for these concepts within a Wiki solution needs to be compensated by specifically developed and introduced plug-ins, templates and enriched meta-data. Further general advantages of the Wiki identified are its support for integration with other tools, its intuitive interface and low learning curve.

The only attempt already described in literature to integrate a Wiki with a visualization tool was published by Hirsch et al. [18]. They present and evaluate three prototypes for a Visual Wiki used only in the academic context, combining Thinkmap visualization software with three different kinds of Wikis: freebase, Confluence and MediaWiki. The respective Wiki is enhanced with a visual representation of its knowledge space used to navigate and organize the knowledge space. The three Visual Wikis differ in the way the graphical representations are mapped to the textual Wiki content in the consistency between textual contents and graphical representation of the knowledge space (two-sided, one-sided, no consistency). Furthermore, in a survey with 14 participants they asked how much the visual component improved the respective original Wiki with regards to the search, creation, organization, and distribution of knowledge. For all four tasks the participants stated an increased usefulness compared to the respective Wiki by itself, with the biggest improvements for organization and search (which are key elements for the availability quality attribute, see above).

For a subsequent paper Su et al. [19] built a software architecture documentation tool (KaitoroBase) within the Visual Wiki Thinkbase. The tool supports non-linear navigation and visualization of software architecture documents created using the Attribute-Driven Design. It does not require the use of a specific Architectural Description Language within the documents. It combines a graph-based interactive visualization of the high-level structure of the topics (nodes) in a software architecture document and their relations (edges) with detailed documents attached to each of these elements.

Event though related work addresses an integration of Wikis with other tools, e.g., for Software Architecture documentation, there is no research available investigating this approach for EAM to the best of the authors knowledge.

III. Research Methodology

In order to analyze tool support for EA in organizations, we apply the technology-to-performance chain model proposed by Goodhue et al. [12]. In their model, they use both technology and task characteristics to derive the task-technology fit. In addition, the skills of the EA stakeholders working with the tool solution have an influence on the overall performance. Based on these characteristics the performance impact as well as the utilization of the tool is derived, i. e. a better task-technology fit leads to improved overall performance and utilization. This task-technology fit describes to which extent technology assists an individual in performing the tasks. We apply the technology-to-performance chain model on tool support for EAM to evaluate our approach. Fig. 1 illustrates how we applied this model for our analysis in this paper.

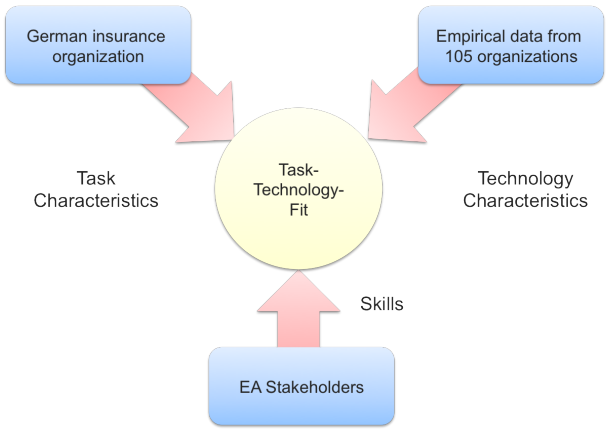

Fig. 1. Applied model for the analysis of tasks and technologies [12]

Task characteristics are actions performed by individuals that rely to some extent on certain aspects of information technology. The task characteristics in this paper are retrieved from 27 EA processes that we identified from the EA department of a German insurance organization. From these processes we selected in a first step eight core processes by removing processes that have a low level of maturity in the organization or encompass same requirements for tool support. Among them are processes to document the current state of the EA, create and plan transformation roadmaps, development of to-be architectures, analysis of as-is and to-be architecture, as well as development of a functional data model. These eight core processes where used to identify task characteristics that need to have adequate tool support. In total seven task characteristics were identified from the EA processes in the organization. Section IV describes the evaluated task characteristics in detail.

The technology characteristics are defined as tools that used by individuals to solve their tasks. In previous work we conducted a practitioner survey with 105 organizations to evaluate the technology characteristics of Enterprise Wikis and specialized tools for EAM [11]. We evaluated nine typical EAM scenarios and asked the domain experts, which tool better fulfills these scenarios in their organization. Five of the evaluated technology characteristics are better supported in the EA tool according to the experts. Table I summarizes these findings with characteristic that is assigned to the appropriate tool according to our empirical findings in [11]. Among these are scenarios are the annotation of visualizations, simulation of EA decisions, analysis of EA information, and management of the EA model. The scenarios that are better supported by the Enterprise Wiki are definition of terms, references to EA documents, documentation of guidelines, and evaluation of external requirements. Having this empirical dataset from a profound number of organizations allows us to derive generic technology characteristics for these tools.

IV. Task Characteristics for EAM tool support

The management of an EA in an organization typically comprises a set of foundational activities. Every activity consists of a set of processes that are instantiated with a different level of detail depending on the maturity of the EA initiative in an organization. We identified Fig. 2 summarizes these activities in the following categories:

- *Develop & Describe:* Includes processes for the development of current, planned and target states for the EA of an organization as well as the definition of architectural principles and guidelines.
- *Communicate & Enact:* Processes for the communication of EA artifacts and results in the organization. This activity also contains processes to ensure the compliance with architectural principles.
- *Analyze & Evaluate:* This activity is responsible to assess to current state of an EA and perform gap analysis between current and respective planned states.

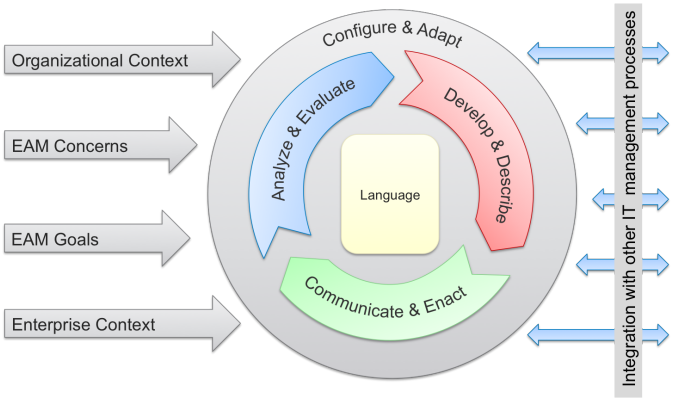

Fig. 2. Overview of the foundational EAM functions in an organization [20]

We collected a set of processes from the EA department of a German insurance organization that were used to derive

Tool	Assigned Technology Characteristic	Description
EA tool	Definition of terms	Provides a common terminological basis in an organization consisting of a list of terms with informal descriptions.
	Providing references to EA relevant documents	References to documents that contain relevant information for the EA. Examples for EA relevant documents are strategy documents, executive board presentations, or governmental regulations.
	Document guidelines and FAQs	Guidelines and FAQs published by Enterprise Architects are distributed to stakeholders.
	Annotating visualizations	Visualizations can be annotated with additional detail or background information on the elements of the EA.
	Discussion of business and EA requirements	Discussion about requirements are preserved with with unstructured information that is linked to the elements in the EA model.
Enterprise Wiki	Import, edit, and validate EA information	Data collected with spreadsheets or from productive systems in the organization are imported. This includes the required data transformation and validation capabilities.
	Analyze EA information	Analysis is typically performed by various visualizations that are preconfigured and customized to the information demand of decision makers.
	Simulate impacts of EA decisions	Simulations are used to compare alternative EA decisions based on predefined assessment criterias.
	EAM activities and workflows	Workflows and activities support architects and stakeholders with the documentation of the EA or the approval of artifacts.

TABLE I
TECHNOLOGY CHARACTERISTICS FOR EA TOOLS AND ENTERPRISE WIKIS THAT WERE REVEALED IN [11]

the task characteristics used in the following. Among these EA processes are for instance collection and maintenance of EA data, definition of architectural standards and principles, enforcement of compliance. We selected a set EAM processes from these initially collected processes that are very important for the execution of a successful EA initiative. Based on the process description in this organization we derived required task characteristics for the adequate tool support. In the following we describe these task characteristics in detail:

A. Capture the current EA

The current enterprise architecture at its core usually consists of information systems supporting business entities like business processes, business functions, business units and products. Those information systems are realized using technical components and operated on infrastructure elements. Interfaces between information systems document the functional information flow based on business objects. Thus, the current EA is usually highly structured data of the entities of the EA and their interelations, eventually augmented by additional attributes. This task characteristic requires forms and interfaces for the acquisition of EA data from information providers or existing information systems in the organization. The actual collection of this data can be performed manually or automated in part [7], [21], [22], [23]. Since the knowledge about the EA is distributed over many departments in an organizations this task often involves many stakeholders.

B. Approve the current EA

As capturing the current EA is a distributed activity involving many stakeholders, eventually coordinated by central enterprise architects, the approval of the current EA is a crucial activity to ensure acceptance and buy-in of IT and business stakeholders. Yet, no one wants to be faced with endless lists of the infrastructure operated or the business processes supported. Instead, comprehensive and focused visualizations with the elements of the EA to approve are required [22]. Those visualizations can then be signed-off or updated by the IT and business representatives. Furthermore, those visualizations give first insight into the power of structured EA data by combining and displaying the knowledge of different domains. The approval can then be done using out-of-EA-tool processes like paper forms or in-EA-tool capabilities like tasks [22].

C. Develop EA information model

In the first two tasks above it was assumed that the current EA is modeled into an already existing information model. Practice demonstrates that there is often a common understanding of core elements of the EA information model. Those core elements are the information systems, technical components, infrastructure elements, business processes or business functions, and potentially business units and products. Yet, depending on the actual demands those elements may not be sufficient respectively necessary for a particular organization. Thus, there might be more elements required, e.g. interfaces, business objects, projects, objectives and goals, domains, etc. Secondly, these elements have relations among each other, resulting in a network of information about the elements of the EA that needs to be developed. Thirdly, the elements and the relations between them may be augmented by attributes that provide additional information for the elements and relations. This information model by itself is highly structured data and the development of this information model is typically done by enterprise architects.

Function	EA task characteristic	Description
Communicate & Enact	Approve the current architecture	The captured current EA is approved by stakeholders to ensure the correctness of the documented information.
	Approve the target architecture	The developed target architecture of the organization is approved by stakeholders.
	Documentation of a dedicated data model	Elements of the EA model are developed depending on the actual information demand.
	Approve transformation roadmap	The defined transformation roadmap is approved by business and IT.
Develop & Describe	Capture the current EA	Document the required information for the EA model from existing information systems or stakeholders.
	Define transformation roadmap	Definition of a transformation roadmap to close the gap between the current and target state of the EA.
	Track implementation of target EA	Monitoring of the transformation roadmap implementation by documenting changes of the current state.
Analyze & Evaluate	Development of the target architecture	Develop the future state of the EA as guideline for projects and the transformation roadmap.

TABLE II
EA TASK CHARACTERISTICS FROM A GERMAN INSURANCE ORGANIZATION USED IN THE TASK ANALYSIS

D. Develop the target EA

The target state of an EA is a guideline for projects and change throughout the enterprises IT and business landscape. Often creating the target state of the EA is a creative process with many meetings, discussion and information exchange, mostly just guided by the business and IT strategy. This process requires endorsement of corporate management and support of various stakeholders in the organization. While the resulting target EA usually is highly structured data, the process to develop the target EA requires for more flexibility and creative freedom than highly structured tools usually provide. Instead, tools focusing on unstructured information better support the creative discussions and information exchange during development of the target EA.

E. Define roadmap to reach target EA

Usually comparing the current with the target EA yields gaps in the current situation of an organization. To close those gaps in an efficient and effective manner, the defined measures to close them require proper planning. The outcome of the plan would be the roadmap to reach the target EA. In practice there is not a single plan, but multiple plans exist in parallel. This holds true for the definition phase of the plans as well as for the execution of the plans. Delays and changes in projects demand for continuous reaction on the plans of the EA. To support the process of definition and tracing the roadmap to reach the target EA, tools shall support simulations and the impact of different plans. As the current as well as the target EA is highly structured data, the simulations can utilize this structure and provide rather analytic results.

F. Approve target EA roadmap

While the definition of the roadmap to reach the target EA is primarily coordinated and partly executed by the enterprise architects, successful implementation of the roadmap depends on broad buy-in from business and IT through an approval of the target EA roadmap. Appropriate tool support for this task requires capabilities to communicate and coordinate the approval of the involved artifacts for the target EA roadmap, e.g., EA visualizations and transformation plans. Practices commonly applied in this process are the annotation of visualizations and informal descriptions captured in presentation and documents. The actual confirmation of these artifacts could be support with an approval workflow to automate this task.

G. Track implementation of target EA

Implementation and execution of the roadmap to reach the target EA shall be closely monitored. In such long-term activities, it is most likely that project requirements change over time due to external drivers. Those changes must be reflected with the EA to understand the impact and to define compensating measures. Otherwise, the goals connected with the target EA will be failed. Appropriate tool support to perform this task needs to monitor the implementation by continuously document the change of the current EA and compare it with the target EA. Result artifacts for this task are usually captured informally in documents rather than in the EA model.

V. FITTING TASK AND TECHNOLOGY CHARACTERISTICS

In the following we compare the previously derived task and technology characteristics. Table III summarizes our findings based on the classification within a German insurance organization as well as project experience from consulting projects into primary (P) and secondary (S) support. The primary support describes which technology characteristic is foremost necessary for the given task, while the secondary support is not necessarily mandatory to solve the task. Based on this fit between the task and technology characteristics one particular tool is select as leading tool for this task. As expected the tasks related with the documentation of structured information, i.e. capture and approve the current EA and define roadmap

Technology / Task Characteristics	Capture the current EA	Approve the current EA	Document EA model	Develop the target EA	Define roadmap to reach target EA	Approve target EA roadmap	Track implementation of target EA
Definition of terms	S	S	P	S	S	S	S
Providing references to EA relevant documents	S	S	P	P	P	P	P
Document guidelines and FAQs	S	S	P	S	P	S	S
Discussion of business and EA requirements	S	S	S	P	S	S	S
Annotating visualizations	S	P	S	P	P	P	P
Import, edit, and validate EA information	P	P	S	S	S	S	S
Analyze EA information	S	S	S	P	P	S	P
Simulate impacts of EA decisions	S	S	S	S	P	S	S
EAM activities and workflows	P	P	S	S	S	P	S
Leading tool for task	EA tool	EA tool	Wiki	Wiki	EA tool	Wiki	Wiki

TABLE III
MAPPING CHARACTERISTICS DIVIDED INTO PRIMARY (P) AND SECONDARY (S) SUPPORT

to reach target EA, is a domain of classic EA tools while tasks focusing on the more creative activities of target EA development, roadmap definition and tracking implementation of the roadmap is more the domain of Enterprise Wikis with its focus on unstructured data. Yet, what can also be seen is that neither tool excels in the technology characteristics required for a single task. This situation was expected from our survey documented in [11], where a technology characteristic is not solely assigned to one group of tools but just a dominant assignment. Consequently, in Table III we summarize the findings into a leading tool for task, being aware that optimal tool support consists of at least an integration of Enterprise Wiki with EA tool.

VI. Discussion

The mapping between the task and technology characteristics in the previous section revealed that tool support for EA could benefit from a larger adoption of Enterprise Wikis. In particular, the development of the EA and the tracking of the to-be implementation can benefit from Wiki support. During the case study at the German insurance organization the domain experts emphasized some aspects of our approach. One expert mentioned that it would be desirable in this organization to disengage requirements manager in the initial phase of a project. He recommended connecting project documents that describe the solution architecture with the integrated Wiki and EA tool solution. This step could disengage solution architects since it is not necessary to model the architecture in a modeling tool at this point. Another expert mentioned that the linking between the EA tool and relevant documents would be very useful since many requirements that are important for EA decisions are located in these documents.

However, the experts raised security concerns that might come along with the integration of the Enterprise Wiki and the EA tool in their organization. Not all documents or unstructured information content that is interlinked with the EA tool should be accessible to everyone in the organization. While the utilization of the currently applied tool is perceived to be very low, an integration of the Enterprise Wiki could raise new problems through easier access possibilities and an increased scope of users. While this is desired to achieve a higher transparency about the EA in the organization, confidentially of the information needs to be sustained.

The practitioners interviews led by Niemi et al. [8] give a few other hints where introducing a Wiki might improve the situation. Concerning the EA quality attribute granularity an interviewed architect stated that formalized information in the model properties is not quite enough. He requested more prose-style text to describe what the model is all about [8]. We expect the introduction of a Wiki to simplify the integration of such additional explanatory documents to the central model. This should also help answer the seemingly contradictory concern of another interviewee that stated the production of huge amounts of text instead of utilizing the EA framework. He mentioned that if one just does not understand the sequence and interdependencies of the views in the framework but adds 2-3 pages of text and a lot of different graphs that do not follow the notation of the EA meta-model for each view, it clearly indicates that the use, meaning and nature of EA as a planning tool has not been understood at all. Then the architecture document is produced just for its own sake [8]. As a Wiki is easier and more open to use for multiple users, it also should support correctness of the EA products through increased update frequency. EA products are not updated regularly become erroneous when the organization and its plans change. [8]. The increased direct involvement of multiple stakeholder groups through the Wiki could increase usefulness as it ensures that every product should have a purpose. It was seen that to accomplish this goal, the EA team should not be a separate island in the organization [8]. A Wiki could also help with methodology and EA tool training in the organization in order to help stakeholders to utilize some of the more advanced features of the EA tool [8]. Lastly for the awareness attribute the EA service customers should obviously be aware of the services available, the conditions on which they are offered, and their best practices and potential benefits. [8].

The results presented in this paper lay the ground for further research and support practitioners with the integration of Enterprise Wikis in their EA tools. We expect tool vendors to adapt these solutions and integrate more support for unstructured information content and collaboration in their solutions to increase the availability of EA products in organizations.

VII. Conclusion

Currently available tools for EAM are focused to support architects with formal structure and processes neglecting the collaborative effort necessary to develop and plan the EA. At the same time empirical studies revealed that organizations are increasingly utilizing Enterprise Wikis to support their EA initiatives. Research on the availability of EA products in the organizations is also very scarce and many organizations struggle with low utilization of their tool solutions in practice. In this paper we analyzed task and technology characteristics of EA tools and Enterprise Wikis for EAM to tackle the aforementioned challenges. Our long term goal is to increase the performance of tools for EAM by incorporating unstructured information and enhance the collaborative effort required to develop and maintain the EA using Enterprise Wikis.

We applied a model for technology-to-performance chain on previous empirical findings and a case study from a German insurance organization. In our approach we aim at integrating specialized tools for EAM and Enterprise Wikis to increase the availability of EA products and facilitate collaboration. We found that existing tools for EAM can benefit in a variety tasks from an integration with Enterprise Wikis for this particular organization. These tasks were retrieved from real world EAM process and mapped with the empirically ascertained technology characteristics. Based on this tools the tasks were assigned to a leading and a supporting tool. In future work, we plan to develop an implementation of the presented approach and perform further case studies in organizations to validate this solution in practice.

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REFERENCES

[1] S. Aier, B. Gleichauf, and R. Winter, "Understanding enterprise architecture management design–an empirical analysis," in *Proceedings of the 10th International Conference on Wirtschaftsinformatik WI*, vol. 2, 2011, pp. 645–654.

[2] J. Ross, "Creating a strategic it architecture competency: Learning in stages," *MIS Quarterly Executive*, 2003.

[3] P. Weill and J. W. Ross, *IT Savvy: What top executives must know to go from pain to gain*. Harvard Business School Press, 2009.

[4] J. W. Ross, P. Weill, and D. Robertson, *Enterprise architecture as strategy: Creating a foundation for business execution*. Harvard Business Press, 2006.

[5] S. Kurpjuweit and R. Winter, "Viewpoint-based meta model engineering," in *Enterprise Modelling and Information Systems Architectures–Concepts and Applications, Proceedings of the 2nd International Workshop on Enterprise Modelling and Information Systems Architectures (EMISA07), St. Goar, Germany*, 2007, pp. 143–161.

[6] T. Sommestad, M. Ekstedt, and P. Johnson, "A probabilistic relational model for security risk analysis," *Computers & Security*, vol. 29, no. 6, pp. 659–679, 2010.

[7] S. Roth, M. Hauder, M. Farwick, R. Breu, and F. Matthes, "Enterprise architecture documentation: Current practices and future directions," in *Proceedings of the 11th International Conference on Wirtschaftsinformatik WI*, 2013.

[8] E. Niemi and S. Pekkola, "Enterprise architecture quality attributes: A case study," in *System Sciences (HICSS), 2013 46th Hawaii International Conference on*. IEEE, 2013, pp. 3878–3887.

[9] S. Aier and J. Schelp, "A reassessment of enterprise architecture implementation," in *Service-Oriented Computing. ICSOC/ServiceWave 2009 Workshops*. Springer, 2010, pp. 35–47.

[10] A. P. McAfee, "Enterprise 2.0: The dawn of emergent collaboration," *Management of Technology and Innovation*, vol. 47, no. 3, 2006.

[11] M. Fiedler, M. Hauder, and A. W. Schneider, "Foundations for the integration of enterprise wikis and specialized tools for enterprise architecture management," in *Proceedings of the 11th International Conference on Wirtschaftsinformatik WI*, 2013.

[12] D. L. Goodhue and R. L. Thompson, "Task-technology fit and individual performance," *MIS quarterly*, pp. 213–236, 1995.

[13] C. Braun and R. Winter, "A comprehensive enterprise architecture metamodel and its implementation using a metamodeling platform," *Desel, Jörg; Frank, Ulrich*, pp. 24–25, 2005.

[14] S. Buckl, F. Matthes, and C. M. Schweda, "Future research topics in enterprise architecture management–a knowledge management perspective," in *Service-Oriented Computing. ICSOC/ServiceWave 2009 Workshops*. Springer, 2010, pp. 1–11.

[15] C. Lucke, M. May, N. Kratzke, and U. Lechner, "How do system and enterprise architectures influence knowledge management in software projects?–an exploratory study of six software projects," 2009, p. 69.

[16] G. J. Probst, "Practical knowledge management: A model that works," *PRISM-CAMBRIDGE MASSACHUSETTS-*, pp. 17–30, 1998.

[17] R. Farenhorst and H. van Vliet, "Experiences with a wiki to support architectural knowledge sharing," in *3rd Workshop on Wikis for Software Engineering (Wikis4SE)*, 2008.

[18] C. Hirsch, J. Hosking, J. Grundy, T. Chaffe, D. MacDonald, and Y. Halytskyy, "The visual wiki: A new metaphor for knowledge access and management," in *System Sciences, 2009. HICSS'09. 42nd Hawaii International Conference on*. IEEE, 2009, pp. 1–10.

[19] M. T. Su, C. Hirsch, and J. Hosking, "Kaitorobase: Visual exploration of software architecture documents," in *Proceedings of the 2009 IEEE/ACM International Conference on Automated Software Engineering*. IEEE Computer Society, 2009, pp. 657–659.

[20] S. Buckl, F. Matthes, and C. M. Schweda, "A method to develop ea modeling languages using practice-proven solutions," in *Advances in Enterprise Engineering V*. Springer, 2011, pp. 91–105.

[21] M. Buschle, M. Ekstedt, S. Grunow, M. Hauder, F. Matthes, and S. Roth, "Automated enterprise architecture documentation using an enterprise service bus," in *AMCIS*, 2012.

[22] S. Roth, M. Hauder, and F. Matthes, "Facilitating conflict resolution of models for automated enterprise architecture documentation," in *Nineteenth Americas Conference on Information Systems*, 2013.

[23] M. Farwick, R. Breu, M. Hauder, S. Roth, and F. Matthes, "Enterprise architecture documentation: Empirical analysis of information sources for automation," in *46th Hawaii International Conference on System Sciences (HICSS), Maui, Hawaii*, 2013.