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Veröffentlicht in:
Multikonferenz Wirtschaftsinformatik 2012
Tagungsband der MKWI 2012
Hrsg.: Dirk Christian Mattfeld; Susanne Robra-Bissantz

Braunschweig: Institut für Wirtschaftsinformatik, 2012

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Abstract

In this paper we re-appraise a categorization scheme for enterprise architecting issues. Based on practitioner interviews we determine, whether the problem areas suggested by the categorization scheme cover actual problems encountered in practice. Our appraisal leads to a slight refinement of the scheme but shows that in general the scheme is applicable to real-life enterprise architecting. This means the proposed model can act as a map signaling potential pitfalls in enterprise architecting as well as a roadmap for enterprise architecture education needs and research directions.

1 Introduction

The Office of Management and Budget describes Enterprise Architecture (EA) as “explicit description and documentation of the current and desired relationships among business and management processes and information technology” [17]. A main aspect of EA is its adoption as a management instrument to support planning, decision making and control tasks and to achieve successful business-/IT-alignment [23]. EA is seen as a means to achieve a successful organizational transformation process towards a flexible IT which properly support business requirements [6].

Extant literature shows that EA practice suffers from a number of challenges and problems [4, 8, 10, 13]. These problems exist in different stages of the architecting process and in many cases are related to either modeling tasks, management tasks or both. Lucke et al. propose a categorization scheme of EA issues, which captures results of a literature review on the enterprise architecting process [13]. Applications of this model include but are not limited to helping practitioners to self-assess their EA efforts and find possible vulnerabilities; guiding selection of learning objectives in a problem-oriented curriculum design approach (cf. [19, 22]) for EA education or support human resources activities by defining a skill-set required for enterprise architects.

[†] We gratefully acknowledge the cooperation of our interviewees without whom we had not been able to investigate the practical applicability of the EA issues categorization scheme.

The paper at hand is concerned with an assessment of the practical applicability of the model by conducting expert interviews. EA practitioners are asked about the challenges they are facing in their daily work life and best practices they adopt to cope with these challenges.

The paper is organized as follows. Section 2 provides the theoretical foundations for this work. Section 3 describes our research approach. In section 4 we describe the findings of the interviews; section 5 provides a cross-interview summary. Section 6 discusses implications of our findings regarding the categorization scheme. Section 7 concludes this paper.

2 Theory

Enterprise architecting is “a continuous process involving the creation, modification, enforcement, application, and dissemination of different results. This process should be in sync with developments in the environment of the enterprise as well as developments internal to the enterprise, including both its strategy and its operational processes” [18]. A number of EA frameworks and process models exist (e.g., [1, 2, 5, 7, 16, 20, 21, 24, 25]), to guide the enterprise architect in the steps to be taken from the creation of architecture descriptions (i.e., collections of work products used to describe an architecture [9]) to the implementation of the target EA. These frameworks and process models help the enterprise architect to fulfill its enterprise architecting tasks. Nevertheless, a number of challenges and issues are encountered in this process. An important step for an organization to solve these issues and master the challenges is to know them and to know whether the organization has related weak spots. Like the famous Chinese military strategist Sun Tzu said: “Know your enemy and know yourself and you can fight a hundred battles without disaster” [11]. A number of authors have investigated the issues arising throughout the EA process [4, 10, 13], highlighting possible research directions and room for improvements.

A recent publication proposes a classification scheme based on an extensive literature review [13]. The purpose of this categorization scheme (cf. Figure 1) is to gain a better understanding of the problem areas encountered during EA efforts.

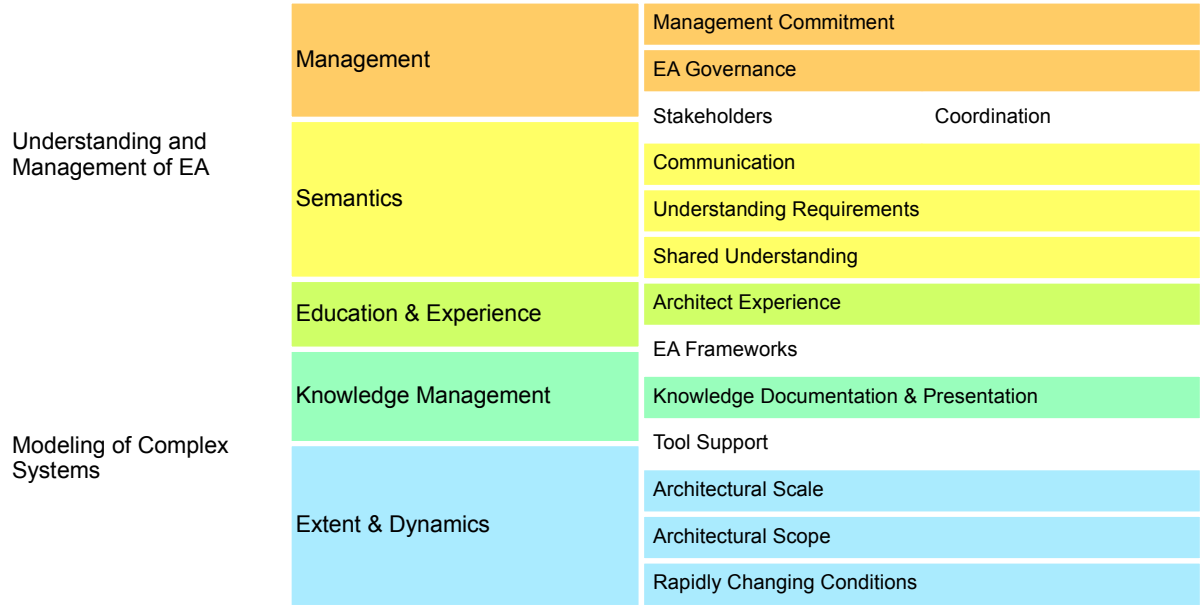

Figure 1: EA issues categorization scheme (cf. [13, 14])

The depicted scheme describes 14 problem areas, which issues occurring during enterprise architecting might belong to. These are defined and underlined by examples in [13] and [14]. The 14 problem areas are grouped into five higher-level categories: management, semantics, education & experience, knowledge management and extent & dynamics. These five categories represent topical areas important to enterprise architecting and can be seen as skill areas important to an enterprise architect. According to the categorization scheme, enterprise architecting issues on a high level are related to either management aspects or more technical modeling aspects. The remainder of this paper is concerned with assessing the practical applicability of the classification scheme based on expert interviews in a large German corporation.

3 Research Method

We seek for empirical validation of the categorization scheme by conducting expert interviews (cf. [3, 12]) with EA practitioners. Our research question is, which challenges EA practitioners deal with in their everyday work and whether the categorization scheme covers these problem areas.

Our overall research approach is depicted in Figure 2. The categorization scheme was developed on the basis of an extensive literature review (cf. [13, 14]). Detailed information on the research method adopted can be found in the respective publications. With this work (framed with a dashed line in Figure 2) we seek for empirical validation of the proposed categorization scheme by interviewing EA practitioners in a large corporation in the automotive industry about issues they experience in their work. We investigate, whether named issues fit into the categorization scheme. The research team consisted of one doctoral student and five master level students of Information Systems.

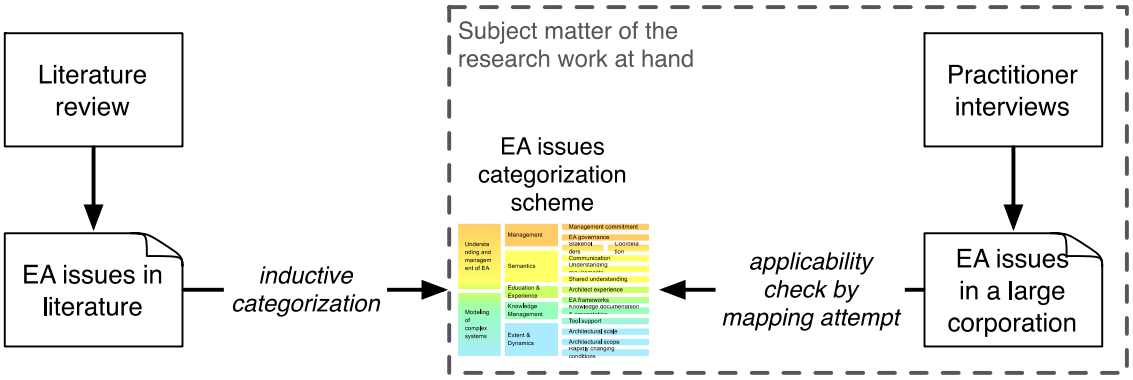

Figure 2: Overall research approach

We chose to conduct interviews in a large corporation (> 50.000 employees), since our assumption is, that EA issues emerge in a wider spectrum, the larger the investigated organization. We asserted, that all interviewees are EA practitioners by checking their corporate roles. Additionally we asked them about their perception of EA to make sure a common point of view exists, on what the field of EA is about. The interviews were open-ended; question asking was semi-structured, which is considered reasonable for expert interviews [12]. Interviews started with a short introduction followed by a part used to set the scene. This part contained questions about the EA process the interviewee's involvement in this process.

The main topic area of the interviews was, what issues the interviewees experience and how they master predominant challenges. Question asking about challenges always was referred to the EA process the interviewee described in the “Set the Scene” part of the interview. Table 1 illustrates our guiding questionnaire.

Introductory questions	
	What’s your current position in the organization?
	What activities are part of your position?
Set the scene	
Achieving a common understanding	What’s your definition of „EA“? What does EA mean for you?
	What does your organization use EA for?
	What are subject matters and goals of your EA undertakings?
Enterprise Architecting process	What steps is your EA process comprised of?
	What activities take place during these steps?
Interviewee’s role in EA undertakings	What is your role during EA undertakings?
	What steps are you involved in?
Challenges in EA undertakings	
Challenges in EA undertakings	Please report about a current or recently completed EA undertaking. What challenges did you encounter?
	Are there key challenges?
	Do you encounter repeating challenges across EA undertakings?
Solution statements for encountered challenges	Do you have solution statements for the challenges you encounter?
	Do you know about solution statements of other organizations?

Table 1: Guiding questionnaire for practitioner interviews

Table 2 exhibits overall information about the interviews. The investigated corporation’s organizational structure exhibits a separation of the IT department into cross-cutting and project-related IT. Two interviewees work in project-related IT, two work in cross-cutting IT and one interviewee works in a project coordination role but has a history in the cross-cutting IT department.

Interviewee	**Interviewer**	**Interviewee’s role**	**Date**	**Duration**
Interviewee A	Freter, Lucke, Müller	Project leader (IT)	25.03.10	2h 42min
Interviewee B	Freter, Lucke, Müller	Project-related IT; formerly cross-cutting IT	22.04.10	2h 13min
Interviewee C	Freter, Lucke	IT project coordination	23.04.10	1h 52min
Interviewee D	Freter, Lucke, Müller	Cross-cutting IT	20.05.10	1h 38min
Interviewee E	Diefenbach, Lucke	Cross-cutting IT	27.05.10	1h 34min

Table 2: General information about conducted interviews

A test-interview with a fellow EA practitioner was conducted in preparation to the five interviews. All interviews were audio-recorded and transcribed. Each transcript was analyzed by one student and the doctoral student in separation of each other. Transcript contents were processed line by line using a spreadsheet application. Content analysis was done according

to the approach described by Mayring (cf. [15]). Interview statements were paraphrased, generalized and categorized, each in a separate column of the spreadsheet. During the categorization step, statements indicating EA issues were assigned one of the 79 codes identified in the literature review that led to the definition of the categorization scheme under consideration (cf. [13]). This way interview statements were put in relation to one of the 14 problem areas defined by the categorization scheme. In the case of coding conflicts or uncertain categorization steps, a group discussion was held to discuss and search agreement on the code to be related to an interviewee's statement. After the analysis of individual interviews, a cross-interview analysis on the fit of EA issues and the categorization scheme was conducted.

4 Results of the Interview Analysis

This section presents the EA issues described by the interviewees and discusses their mapping to the classification scheme. Table 3 gives an overview on problem categories, which described issues belong to. A cell containing an 'x' means the interviewee (i.e., the column) mentioned one or more issues belonging to the respective problem area (i.e., the row). No 'x' being present in a cell means the interviewee did not mention issues related to the respective problem area.

Problem area	**A**	**B**	**C**	**D**	**E**	**Overall**
Management commitment	x	x	x	x	x	5
EA governance	x	x	x	x	x	5
Stakeholders	x	x		x		3
Coordination			x		x	2
Communication	x	x	x			3
Understanding requirements	x	x	x	x		4
Shared understanding	x	x	x		x	4
Architect experience	x	x			x	3
EA frameworks				x	x	2
Knowledge doc. & pres.	x	x	x	x	x	5
Tool support	x	x		x		3
Architectural scale	x	x	x	x	x	5
Architectural scope		x	x	x		3
Rapidly changing conditions			x	x	x	3
Overall	**10**	**11**	**10**	**10**	**9**	

Table 3: Summary of problem areas experienced by the interviewees

Table 4 provides more detailed information on the frequency of problem areas. For each interview it exhibits how often issues belonging to a problem category have been described and the according percentage in regard to the overall issues mentioned by the interviewee. Percentages >=8% (i.e. >=ceil(1/14)) are colored orange; percentages >=15% (i.e. >=ceil(2/14)) are colored red. The results provided by Table 4 are explained in more detail in section 5 and 6. For now it just gives an overview on the frequency of mentioned issues.

Problem area	A		B		C		D		E		Total
Management commitment	2	7%	21	35%	13	28%	12	28%	12	35%	**60**
EA governance	1	3%	15	25%	5	11%	14	33%	7	21%	**42**
Stakeholders	3	10%	4	7%	0	0%	4	9%	0	0%	**11**
Coordination	0	0%	0	0%	2	4%	0	0%	2	6%	**4**
Communication	2	7%	1	2%	2	4%	0	0%	0	0%	**5**
Understanding requirements	1	3%	1	2%	4	9%	1	2%	0	0%	**7**
Shared understanding	1	3%	1	2%	2	4%	0	0%	3	9%	**7**
Architect experience	1	3%	6	10%	0	0%	0	0%	1	3%	**8**
EA frameworks	0	0%	0	0%	0	0%	3	7%	1	3%	**4**
Knowledge doc. & pres.	9	31%	5	8%	7	15%	3	7%	2	6%	**26**
Tool support	6	21%	1	2%	0	0%	1	2%	0	0%	**8**
Architectural scale	3	10%	4	7%	5	11%	3	7%	2	6%	**17**
Architectural scope	0	0%	1	2%	2	4%	1	2%	0	0%	**4**
Rapidly changing conditions	0	0%	0	0%	4	9%	1	2%	4	12%	**9**
Total	**29**		**60**		**46**		**43**		**34**		**212**

Table 4: Overview of problem areas described by the interviewees and frequency of occurrence

4.1 Interviewee A

Interviewee A works for the company since 1978. Currently he is a project leader (since 2003) of a change program aiming for an appraisal and consolidation of business processes. Issues reported by interviewee A cover 10 problem areas suggested by the categorization scheme. Main challenges described focus on tool-related issues and knowledge documentation and presentation. The processes under consideration by the change program are connecting several operating departments and elements of supporting IT; according to interviewee A a large number of different stakeholders are involved in these activities, making knowledge documentation rather difficult. Interviewee A's task is about summing up all internal interactions between places, departments and actors along production and service processes. Interviewee A stated that the EA modeling tool in use allows to easily capture arbitrary data. Unfortunately, data-retrieval and specifically stakeholder-appropriate report generation is hard to achieve. Another main problem remarked is the weak ability of interfacing between different EA tools. Within the large corporation several tools are in use and different tools are used for different tasks. Seamless import and export of data is his least expectance; a single underlying repository would be even more appreciated.

4.2 Interviewee B

Interviewee B works for the company since 2006 and currently is a project leader in a project-related IT function. In a former assignment inside the company he worked in close relationship to the cross-cutting IT function being responsible for EA; experiences made during this assignment were subject matter of the interview. Mapping the results against the categorization scheme reveals that challenges in 11 problem areas were described by interviewee B. Main challenges described are related to the problem areas of management commitment and EA governance.

In general interviewee B's experience is, that project managers' commitment towards EA is rather low. According to him, project managers often unwillingly provide personnel for EA-related activities. Transparency, potentially provided by adopting EA, seems often undesired. Additionally, cross-cutting IT's architecture authority is rather weak. Even if the EA function reveals reasonable measures (e.g., process re-design), changes are typically not initiated because responsibility and authority is not with the cross-cutting IT department. A frequently described issue is unclear objectives for the EA function. Interviewee B mentioned that no corporate-wide common definition of EA exists, setting goals the EA function shall pursue. Interviewee B's perception is, that enterprise architecting is often conducted as end in itself. Another EA governance problem described is non-compliance of projects towards EA governance rules and cross-cutting IT's EA requirements and standards.

4.3 Interviewee C

Interviewee C is an abstractor in synchronization management (i.e., coordination of projects) and works for the company since 1985. Five years ago he belonged to a group that was concerned with the conceptual design of the EA function and its establishment in the organization. Issues reported by interviewee C cover 10 problem areas suggested by the categorization scheme. Main problem categories described are management commitment and knowledge documentation and presentation.

In terms of management commitment his experiences are that managers put a high focus on costs and cost reduction. He finds cost reduction hard to prove for EA. Attempts to make clear the meaning of EA to the management level were unsuccessful. Another major problem described by interviewee C is poor documentation. Being responsible for coordination of projects' processes he regularly finds process documentation being outdated or poorly described. Especially critical is the fact that up-to-dateness is not in all cases determinable, resulting in people potentially using outdated information.

4.4 Interviewee D

Interviewee D has been working for the company for 9 years. He works in the cross-cutting IT department since 2006 and is responsible for the EA function. His main job task is to define methods and rules to achieve a consistent and coherent EA function. He also acts as an advisor for project-related IT departments regarding EA. Issues named by interviewee D during the interview can be mapped to 10 problem categories. The two predominant problem areas he has to deal with are management commitment and EA governance.

According to interviewee D project management and project-related IT often considers the EA process and rules as obstruction. The cross-cutting IT department has difficulties to prove the benefits of conducting EA efforts. As a result quick-win decisions in favor of single projects are often favored over mid- or long-term use of enterprise architecting.

EA governance issues reported by interviewee D are partly uncertain goals for the EA function and uncertainty regarding the integration of the EA process into the process of project execution. As a consequence of this, cross-cutting EA efforts are sometimes involved at a stage of a project, where no freedom of design remains. In those cases, the cross-cutting IT department does not always have the power to enforce compliance to EA rules.

4.5 Interviewee E

Interviewee E has been working for the company for 11 years in the cross-cutting IT department where his main job task is to define and manage the enterprise architecture. Issues reported by interviewee E cover 9 problem areas suggested by the categorization scheme. The main EA challenges reported by interviewee E are concerned with lack of management commitment, EA governance aspects and compliance to EA rules.

Almost half of the issues named by interviewee E are concerned with lacking management support for the corporate EA efforts. Project executives and project-related IT often regard the corporate EA function as hindering and unnecessary cost factor. The cross-cutting IT department has defined an EA framework, which the project-related IT shall use to document and analyze the impact of a project to the enterprise architecture. As interviewee E states, project executives and project-related IT do not seldomly try to circumvent the EA documentation step and EA governance rules. According to him, not in all cases the cross-cutting IT department is powerful enough to enforce EA-compliance of projects.

5 Results of the Cross-Interview Analysis

The summary of problem areas experienced by the interviewees (cf. Table 2) exhibits that every interviewee experiences issues in at least 9 up to 11 categories out of the total of 14 problem categories. We consider this an important indicator on how important it is, that an enterprise architect combines management skills as well as technical skills required for modeling complex systems.

Issues in the categories of management commitment and EA governance are mentioned disproportionately often by interviewees B, C, D and E (cf. Table 4). Interviewee D and E currently work in the cross-cutting IT department and are responsible for EA subject matters. Interviewee B currently works in project-related IT but has a history of close collaboration with the cross-cutting IT department responsible for EA. So does interviewee C who used to be an active member of the group of people who conceptually planned and started off the corporate EA function. According to these findings we conclude that management commitment and EA governance issues are typically most important for cross-cutting IT respectively a cross-cutting EA function.

Within the group of interviewees, interviewee A is one who exclusively worked and works in a project-related EA function. As introduced in section 4.1, he is concerned with a single architecture domain – also often referred to as viewpoint (i.e., processes). His area of work is preparing actual architecture descriptions needed by the cross-cutting EA function. Table 4 depicts that he does not disproportionally often mention management commitment and EA governance as issues. These issues make up only 10 percent of overall issues described by him. The most frequently mentioned issues are the plethora of stakeholders, knowledge documentation & presentation, tools support and large architecture scale. This is different from what the other interview partners stated. We conclude that for actual EA modeling tasks, management commitment and especially EA governance might be less an issue than other problem categories. The interviews with interviewee B, who also currently works in a project-related EA function, does not underline this finding of EA governance and management commitment being mentioned with a low percentage. This can be explained by the fact that in the interview he reported about his experiences made during his time in a cross-cutting EA function.

6 Implications for the Categorization Scheme of EA Issues

An important finding is that issues named during the five interviews cover all problem areas described by the categorization scheme. We argue this exhibits that the problem areas of the categorization scheme are of practical relevance to enterprise architecting.

A related question is, whether there are further problem areas of enterprise architecting, apart from those described by the categorization scheme. The answer is: we did not find any".

During the coding process not all interviewee statements describing issues could be assigned one of the 79 codes inductively developed during the preceding literature review (cf. [13]). In these cases we defined new reasonable codes describing the respective issue and discussed the possible belonging to one of the existing problem areas. All these newly defined codes have been found belonging to one of the 14 given problem areas. As a result of our work the categorization scheme is further refined in terms of what the problem areas are about (cf. Table 5). In general however, the expert interviews show, that the scheme properly covers the problem areas relevant to EA practitioners' daily work. Table 5 depicts our code refinements.

Problem area	**Refining code**
EA Governance	Lack of compliance
Management Commitment	Lacking grasp of what EA is about
	EA considered a hindrance
	Transparency brought into being by EA not welcome
Tool Support	Unsatisfying interoperability between domain-specific tools
	Unsatisfying tool standardization
	Weak reporting abilities

Table 5: Overview of refinements to problem areas

The EA governance category codes, which emerged during the literature review mainly focus on issues related to the establishment of rules for EA (cf. [13]). The interviews shed a new light on the EA governance category. Lack of compliance to existing EA governance rules is described very often by cross-cutting IT EA practitioners (i.e., interviewee D and E). They name EA governance issues related to the establishment of EA rules vs. EA compliance-related issues in a nearly 50/50 ratio (cf. Table 6).

Problem area	**Sub area**	**A**		**B**		**C**		**D**		**E**		**Total**
EA Governance	Rules	1	100%	14	93%	5	100%	6	43%	4	57%	30
	Compliance	0	0%	1	7%	0	0%	8	57%	3	43%	12
	Total	**1**		**15**		**5**		**14**		**7**		**42**

Table 6: Aspects of EA governance issues

The problem area of management commitment is refined in so far, that further reasons for a lack of management commitment are discovered. Our interviewees consider it a serious problem, that often management stakeholders have a bad or no understanding of why an EA function is needed (i.e., lacking grasp of what EA is about). It is typically these stakeholders,

who seem to consider EA as a hindrance and often try to overcome the obligations the EA function puts on them. The interviews also revealed that sometimes the transparency brought into being by the EA function and architecture descriptions created, seems to be not welcome (i.e., transparency brought into being by EA not welcome).

The problem area of tool support is not very well operationalized by the articles investigated in the preceding literature review (cf. [13]). The most concise criticism was tool support being insufficient for virtual enterprises as well as to represent system dynamics. Mostly however, tool support was plainly described as being insufficient without further attribution. Interviewees A, B and D mentioned tool-related issues; especially interviewee A could render tool-related issues more precise. Tool-standardization is described being very complicated in a corporation as large as this. Different departments use different EA tools to document architecture information, making it hard to exchange information and complicating interoperability. Especially domain-specific EA modeling tools are typically not interoperable. Another problem mentioned is weak reporting abilities of EA tools. Once it comes to presentation of previously captured information, reporting abilities are very important. The interviewees described information retrieval and generating reports and models as being very complex and time-consuming. Information retrieval often has to be specified using special query languages, which makes it very powerful but also very difficult to handle.

Our work leads to a number of more detailed definitions regarding the naming in the categorization scheme. Modified elements are presented in bold face (cf. Figure 3).

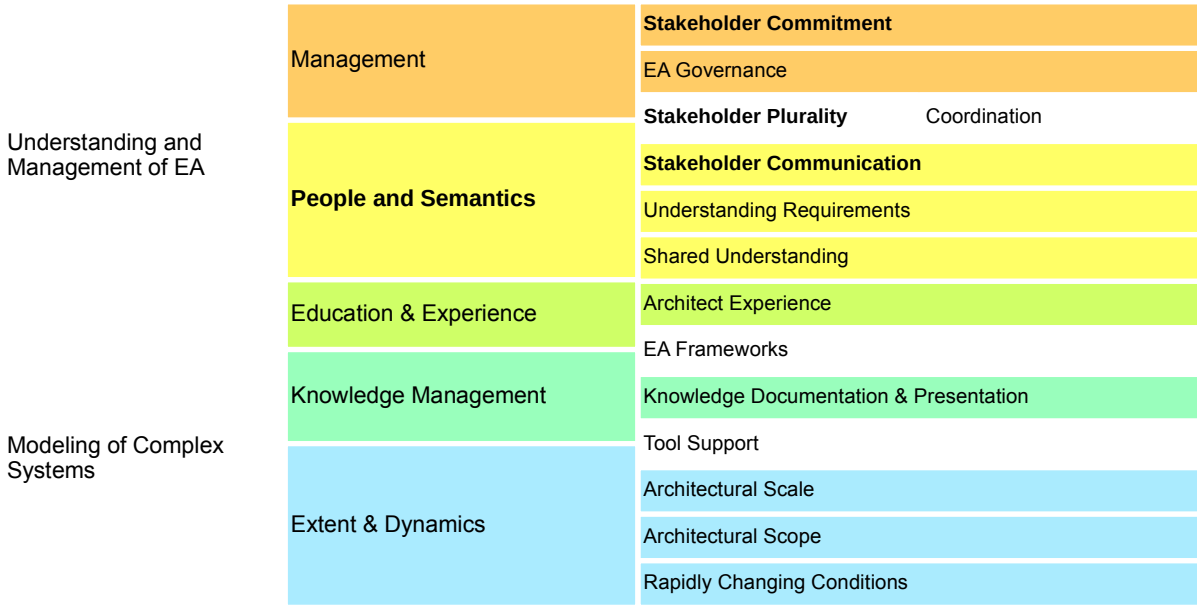

Figure 3: Refined EA issues categorization scheme as a result of the study at hand

The category of “Semantics” is renamed to “People and Semantics” to better express the covered problem areas. The problem area “Management Commitment” is renamed to “Stakeholder Commitment”. The interviews show that in most cases the problem is commitment of superiors (i.e., managers) but there are also cases where problems result from stakeholders on an operational level who refuse doing legwork to the EA function. The problem area “Stakeholders” is renamed to “Stakeholder Plurality”, to allow for a better distinction to the

other problem areas and to better express the main challenge in this area, which is the plethora of EA stakeholders the EA function has to deal with. The final change is the renaming of “Communication” to “Stakeholder Communication”. The intention behind this is to allow for a better understanding at a first glance of what this problem area is about.

7 Conclusion

With this research work we pursue the aim to appraise the practical applicability of a categorization scheme for EA issues, developed as a result of a previously conducted literature review [13]. For this purpose we led interviews with EA practitioners. According to our findings the categorization scheme provides a reasonable categorization of enterprise architecting issues. All issues named are found belonging to one of the 14 existing problem areas defined by the categorization scheme. Thus, regarding the question of completeness of the categorization scheme, we argue that it is capable of providing a good categorization frame for EA issues; for certain for the researched practitioners and corporation.

We feel this work provides a good applicability check of the categorization scheme and delivers a valuable insight into challenges of EA practitioners in their daily work. Issues described by our interviewees cover all problem areas of the categorization scheme. We therefore deem the problem areas defined by the categorization scheme as being relevant to EA practice. Our results show that enterprise architects are supposed to offer a very broad set of skills ranging from management and soft skills to more technical skills in modeling as well as using EA tools and architecture repositories.

In this study we put a focus on a qualitative insight, interviewing a rather small number of EA practitioners. Further validation would be interesting and helpful.

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