ORGANIZATIONAL FACTORS INFLUENCING ENTERPRISE ARCHITECTURE MANAGEMENT CHALLENGES

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Abstract

Continuous business, technical, and regulatory changes constantly force organizations to transform. Enterprise Architecture Management (EAM) is a means to plan, conduct, and coordinate these complex transformations. It provides a holistic view, a common vocabulary, and a solid decision base for enterprise transformation planning. And yet, with issues like a decoupling between requirements and final results, a long delivery period, or unappreciated value, the discipline of EAM is not immune to domain-specific challenges. While literature from an academic and practitioner authorship acknowledges these issues, the actual occurrence, pervasiveness, and degree of relevance from an industry standpoint remains unclear. More precisely, the question whether, how, and to which extent organizational factors like an organization's size or its experience in EAM exert influence on these challenges has not been answered on empirical basis yet. This paper is set out to clear up this nebulous state by means of an expert survey among 105 industry experts located in 10 different countries. The results underline the situational character of the management discipline with respect to challenges it is confronted with.

Keywords: enterprise architecture management, challenges, organizational factor, survey.

1 Introduction

Undoubtedly, Enterprise Architecture Management (EAM) has established itself as a valuable means to plan, coordinate, and guide continuous transformations of today's organizations. Assuming a holistic stance, EAM covers all dimensions of an enterprise (business, application, information, data, and infrastructure aspects), fosters the usage of common language, and provides a consistent decision base in order to ultimately align business and IT (Aier, Riege, and Winter, 2008).

The discipline considers an organization in a systemic sense putting an enterprise on a level with a software-intensive system. In doing so, EAM focuses on the stringent management of an Enterprise's Architecture (EA) which is commonly (Buschle et al 2012; Farwick, et al. 2012; Roth et al. 2013) defined as "the fundamental organization of a system [the enterprise] which is embodied in its components, their relationships to each other and the environment, and the principles guiding its design and evolution" (ISO/IEC, 2007).

The embracing nature of an EA coupled with the constantly changing environment its management takes place in, gives rise to a number of severe challenges. As an example, EAM might suffer from a symptom literature calls 'ivory tower syndrome' (van der Raadt, Schouten, and van Vliet, 2008) describing the situation where there exists a disparity of stakeholders' requirements and delivered EA products. Practitioners (e.g., Ambler, 2008) as well as academics (e.g., Lucke, Krell, and Lechner, 2010) are well aware of this and further issues and continue to make them explicit in conference publications, journal articles, whitepapers, and books. In turn, industry experts (e.g., Niemann, 2006) likewise to researchers (e.g., Aier, 2012, Buckl, 2011) continue to emphasize the situational character of the discipline pointing out, that the design and implementation of an EAM considerably relies on

the influence of organizational factors like the size of the enterprise or its experience and know-how in the domain.

However, to the knowledge of the authors of this paper, there is no empirical study to the present day, which sheds light on EAM challenges, and the way they are influenced by organizational factors. More precisely, the subsequent questions remain open:

- Which EAM challenges mentioned by literature really emerge on a broad-scale in industry?
- What challenges organizations struggle the most?
- Whether and how do organizational factors exert influence on these challenges?

To answer these questions, we set up an online-based questionnaire inviting international experts in the domain of EAM to share their thoughts in their area of work.

The remainder is structured in the following way: as a start, we peruse EAM literature for common challenges the sources mention. Section 3 points out the research approach we applied when surveying experts from industry. The key results of the survey are presented in Section 4 and discussed in Section 5. The paper finishes with a short summary of our findings and a recommendation of topics, which should be tackled by researchers in the future.

2   Challenges in Enterprise Architecture Management

Literature with an academic as well as industrial background describes different challenges EAM is commonly confronted with in enterprises.

Based on a database-driven literature review on critical issues in enterprise architecture, Lucke et al. point especially to the lack of experienced architects, missing management commitment, problems for the EAM team in understanding the actual requirements, insufficient tool support, as well as rapidly changing environmental conditions as main challenges for EAM. Furthermore, they call the reader's attention to problems arising with EAM scoping, stakeholder coordination and communication, as well as complexity especially when it comes to modeling (Lucke, Krell, Lechner, 2010).

An issue frequently perceived in EAM is the decoupling of actual requirements on the one hand and delivered outcome on the other. As one consequence, Van der Raadt et al. speak of the 'ivory tower' syndrome leading to situations where too complex EA models possessing a wrong level of abstraction (van der Raadt, Schouten, and van Vliet, 2008). Focusing on the modeling process itself, Ambler characterizes this decoupling with an anti-pattern called 'modeling for the modeling's sake' (Ambler, 2008). Referring as well to the domain of patterns, Buckl et al. apply the notion of an over-sized EA model (Buckl et al., 2009) when speaking of models which contain elements not really required, i.e., are actually beyond demands of any stakeholder. While the phenomenon of over-modeling is also observed by (Armour, Kaisler, Lieu, 1999), the issue of over-scoping has been pointed out by (Lucke, Krell, and Lechner, 2010). In addition, Chuang and van Loggerenberg, 2010 warn against the imminent danger of architectural work isolation. According to the authors, enterprise architects tend to operate and communicate in silos instead of being in close and ongoing communication with the stakeholders.

Another challenge pertains to the long time dimension: starting and fostering an EAM function has to be considered as mid- to long-term investment. While the practitioner Niemann speaks of a break-even point of three months on average (Niemann, 2006), Ross estimates that an organization requires between two and six years to entirely absorb the cultural and technical changes caused by the introduction of EA management (Ross, Weil, and Robertson 2006). By accentuating that it often takes years to make significant (but oftentimes immeasurable) progress in the discipline mostly on global scale only, Schmidt and Buxmann share this opinion in their journal article (Schmidt and Buxmann, 2010). The two authors go even one step further by considering this delay in tangible results as an important reason for the legitimization problem of EAM. It is in many cases the stakeholders who expect an ROI

much earlier than the discipline is eventually able to deliver (Chuang and van Loggerenberg, 2010, Lam, 2004). Both, missing legitimization and late delivery, often translate into only little value stakeholders assign to a discipline, whose benefits they do not immediately understand. As a result, the maintenance of stakeholders' acceptance becomes a challenge (Schmidt and Buxmann, 2010).

The issue of cost-intensive gathering, maintaining, and disseminating of EA information is discussed in detail by Buckl et al., 2011. The researchers acknowledge the high amount of time and money needed to capture relevant data usually spread across different data sources (e.g. CMDBs, process modeling tools, excel spreadsheets) with varying data quality. For the authors, it is first and foremost the initiation process of EAM that imposes considerable investments. Information sources have to be identified and assessed before the data can be collected and stored by means of dedicated software. Unfortunately, a lack of understanding on the part of the stakeholders combined with alternating requirements slow down the first steps towards an organizational EAM capability.

Under the firm heading 'lack of EAM governance structures' insufficiently defined roles and responsibilities in the domain of EAM are reported by Lam (Lam, 2004). The issue of unclear role schemes is aggravated by the fact that the groups EAM includes are often committed to different jargons meaningful to their business units (Dreyfus, 2007). As a consequence, these different groups struggle to communicate in a common language. Additionally, literature remarks that EAM suffers from a lack of a shared vision (Armour, Kaisler, and Liu, 1999). The same authors criticize that a deliverable describing the architecture is outdated before it is even complete and accentuate the discipline is many times understood as a project instead rather than a continuous process. Given that the associated task can be reoccurring and sometimes tedious there may be a lack of commitment and focus on the part of the stakeholders and EA information providers whereas the latter is required to describe the current or future state of the organization's EA (Buckl et al., 2011).

In particular the high number of involved parties can lead to incomplete stakeholder involvement or buy-in (Armour, Kaisler, and Liu, 1999). In the worst case, this reluctance of stakeholders can turn into their unavailability (Nakakawa, van Bommel, Proper, 2010), a development that takes place in particular if the architectural activities have been already preceded by expensive but unsuccessful EAM endeavors (Chuang and Loggerenberg, 2010). Other challenges arising in the context of stakeholders are conflicting interests (Schmidt and Buxmann, 2010) manifested in hidden stakeholder agendas (Nakakawa, van Bommel, and Proper, 2010), resistance due to fear of losing status of ownership (Chuang and Loggerenberg, 2010), as well as local optimization thinking, bypassing attempts of architecture review board decisions, ad hoc EAM demands, and incomprehension of the organizational consequences of their individual demands (Lucke, Krell, Lechner, 2010)

Focusing on the EAM team, thus the architects performing the EAM tasks, literature notes that especially the IT personal of the team is often much too technical in focus and therefore does not speak the language of business (Espinosa, Armour, and Boh, 2009) or thinks in terms of business value (Mannmeusel, 2012). Moreover, the EAM team runs the risk of completely ignoring the business model, remains uninformed regarding the underlying business goals, and neglecting the organizational changes their work brings along (Chuang and van Loggerenberg, 2010). Another issue consists in the team's striving for perfection, a phenomena which is called 100% syndrome by Nakakawa et al., 2010. Finally, the team responsible for EAM sometimes lacks of understanding the business requirements (Lam, 2004), ignores them completely (Lucke, Krell, and Lechner, 2010), or produces deliverables whose benefits are too abstract and therefore not understandable for the receiving stakeholders (Espinosa, Armour, and Boh, 2010).

3 Research Methodology

Given the limited empirical results on EAM challenges and its practical relevance to industry, an exploratory survey across multiple countries and industries has been conducted. The first aim was to obtain a clearer picture on which challenges mentioned by studied literature today's organizations are

actually facing. Additionally, the survey captured the professional background of the participants reflected in several organizational factors. In this sense, the second aim consisted in the examination of relations between these factors and the occurring challenges. Our research hypothesis is that the following seven analyzed organizational factors influence EA challenges. These are: *Region, Industry Sectors, Company Size, Experience, Framework, Modeled State, and Team organization.*

We compiled an online questionnaire to determine the background and to elicit the current challenges in EAM. This extensive, but non-exhaustive list of typical EAM issues covers challenges in above presented related work. After designing the questionnaire, we performed a pre-test consisting of its completion by three independent and non-related researchers. The questionnaire was afterwards optimized according to the researchers' feedback and suggestions. The final version of the questionnaire has been published as an online survey available for 21 days between October and November 2012. In order to receive relevant information we targeted participants working in EAM or related fields in the industry. In total, we sent over 1100 survey invitations via e-mail. The list of recipient experts has been compiled during past EAM projects we performed with industry partners in the course of the last 8 years. In addition, the survey has been published in the two online forums Xing[1] and LinkedIn[2], announcing them as topics related to EA or strategic IT management.

Upon survey closure, we received input from 178 survey participants. We identified duplicate answers by the enterprise's name such we filtered datasets from the same organization resulting in 105 completed answers for the evaluation, i.e., a dropout quote of ~41%.

Industry Sector	n	%
IT Consulting	24	22.86%
Finance	18	17.14%
IT Products and Services	9	8.57%
Public Service	8	7.62%
Telecommunications	6	5.71%
Production and Manufac.	6	5.71%
Education	5	4.76%
Management Consulting	4	2.86%
Transport/Logistics	3	2.86%
Health Care	2	1.90%
Other	20	19.05%

Table 1. Industry sectors of organizations

Job Title	n	%
Enterprise Architect	54	51.43%
IT Architect	15	14.26%
Consultant	12	11.43%
Business Architect	6	5.71%
CxO	6	5.71%
IT Operations	3	3.86%
Software Engineer	1	0.95%
Other	8	7.62%

Table 2. Participants by job title

Unsurprisingly for an online survey initiated in Germany, 61 (~58%) of the participants have their country of employment in Europe. 18 (~17%) work in the USA and 26 (~25%) are employed in other countries having less than 10 responding participants. Table 1 illustrates the distribution of the industry sectors of the participating organizations. The IT consulting sector is the largest with 24 (~23%) participants. We asked consultancies explicitly to answer on behalf of one particular EAM engagement at a client. The second largest industry sector is finance with 18 (~17%), followed by the IT products and services sector with 9 (~9%). Table 2 depicts the participants divided by job title. The largest groups consist of Enterprise Architects with ~51% followed by IT Architects ~14%. Among

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the participants are also ~6% in an upper management position (CxOs) as well as Consultants, Business Architects, and Software Developers. In addition, we asked the participants on their individual working experience in EAM and the experience of the organization with EA management. The average experience in EAM for participants is 6.7 years, whereas the average for the organizations is 5 years. This confirms that the management discipline is still a young topic for organizations with only few very experienced professionals and organizations.

Above outlined hypotheses are evaluated and discussed in Section 5 based on the presented data set. We apply Pearson's chi-square (χ^2) test to validate dependencies among respective dimensions and challenges in our data set. A p value of 0.1 (or 0.05) means that there is a 10% (or 5%) probability that any deviation from expected results is due to chance only.

4 Analysis of Challenges and Organizational Factors

For any EAM challenge we identified in studied literature, we asked the participants to rate it using a five point Likert scale (1=strongly disagree to 5=strongly agree). For the analysis, we aggregated strongly agree and agree, and strongly disagree and disagree leaving us with three options per answer (agree, neither, disagree). The questions were not mandatory such that we excluded participants not responding to a question from below analyses.

4.1 Enterprise Architecture Management Challenges in Practice

Table 3 illustrates the ten challenges organizations currently face most according to our survey results. Led by ad-hoc as well as unclear demands, EAM endeavors often encounter unclear business goals. A possible reason might be a frequently changing organizational environment also rated as one of the most pressing issues.

	Agree		Neither		Disagree		No response	
Challenge	**n**	**%**	**n**	**%**	**n**	**%**	**n**	**%**
Ad hoc EAM demands	89	89,90%	6	6,06%	4	4,04%	3	3,03%
Unclear business goals	84	84,85%	11	11,11%	4	4,04%	3	3,03%
Hard to find experienced enterprise architects	82	87,23%	8	8,51%	4	4,26%	8	8,51%
EA demands unclear for EAM team	74	75,51%	13	13,27%	11	11,22%	4	4,08%
Enterprise environment changes too quickly	70	71,43%	9	9,18%	19	19,39%	4	4,08%
Conflicting interests among stakeholders	69	74,19%	15	16,13%	9	9,68%	9	9,68%
EAM team focuses primarily on IT	67	67,68%	9	9,09%	23	23,23%	3	3,03%
Reluctant information providers	62	64,58%	14	14,58%	20	20,83%	6	6,25%
Unavailable stakeholders	49	51,04%	26	27,08%	21	21,88%	6	6,25%
Late valuation of EAM through stakeholders	47	51,09%	26	28,26%	19	20,65%	10	10,87%

Table 3. Ten most relevant challenges in EAM according to the organizations

As expected, the discipline faces a lack of experienced enterprise architects available on the job market. Another challenge is conflicting interests among stakeholders that include 'common good' vs. 'local optimization'. Often originated in IT, the work of the EAM team, i.e. the architects in charge of the architectural work, is still perceived as being primarily IT focused. The information gathering process recently been addressed by many researchers (Buschle et al. 2012, Farwick et al. 2013, Grunow et al. 2012, Hauder et al. 2012, Roth et al. 2013). The surveyed experts also highlighted that a particular challenge consists in the reluctance of information providers and unavailable stakeholders. The former group does not want to provide information about the architecture for different reasons. The participants broadly confirmed late valuation of the discipline. Remarkably, half of them answered that this is still a challenge EAM implementations face.

Our main objective within the analysis of the survey is not only to show challenges organizations currently face, but additionally point to notable aspects of organizations (cultural, organizational, etc.) apparently exerting an influence on these challenges. Those influencing factors could be either positively, such that challenges do not occur that frequently, or negatively, such that they occur very frequently under certain circumstances. For our objective, we filtered our data set, i.e. we scoped our analysis to challenges where at least 15% of the organizations agree to face this challenge while at least 15% disagree.

Challenge	Agree		Neither		Disagree		No response	
	n	%	n	%	n	%	n	%
Enterprise environment changes too quickly	70	71,43%	9	9,18%	19	19,39%	4	4,08%
EAM team focuses primarily on IT	67	67,68%	9	9,09%	23	23,23%	3	3,03%
Reluctant information providers	62	64,58%	14	14,58%	20	20,83%	6	6,25%
Unavailable stakeholders	49	51,04%	26	27,08%	21	21,88%	6	6,25%
Late valuation of EAM through stakeholders	47	51,09%	26	28,26%	19	20,65%	10	10,87%
Outdated EAM results	35	37,63%	23	24,73%	35	37,63%	9	9,68%
No understanding of benefits	31	31,31%	34	34,34%	34	34,34%	3	3,03%
Over-sized and difficult EA models	33	33,67%	24	24,49%	41	41,84%	4	4,08%
EAM team does not meet right level of abstraction	26	27,08%	24	25,00%	46	47,92%	6	6,25%
EAM takes place in ivory tower	17	17,53%	13	13,40%	67	69,07%	5	5,15%

Table 4. Challenges for further analysis with at least 15% agreed and disagreed

Table 4 shows the resulting challenges that the remainder of this paper focuses on. Note, that the overlap with the ten most relevant challenges in EAM has been highlighted. Even though many organizations are currently confronted with these issues, there are obviously some businesses, which have means to prevent them. In the subsequent analysis, we are going to focus on these issues.

Further challenges that are approximately equally distributed in terms of agree/disagree and therefore in the scope of our analysis are: outdated EAM results and no understanding of the benefits of EAM.

More organizations disagree experiencing the challenge of over-sized and difficult to understand EA models as well as EAM teams, which do not meet the right level of abstraction. Notably, a majority of participants do not feel that EAM happens in an ivory tower, thus being disconnected from the rest of the organization.

In the following presentation of our analyses, we focus on differences of at least 20% of a particular characteristic $c=${*% agree, % neither, % disagree*} of an analyzed dimension *d* of an organizational factor[3] $F=${*Region, Industry Sectors, Company Size, Experience, Framework, Modeled State, Team organization*} of an enterprise with respect to the above presented subset of challenges. More formally, we filtered above defined subset (cf. Table 4) by $\{\forall d \in F \; \exists \, c \in d \mid [\max(c) - \min(c)] \geq 20\%\}$. In order to retain statistical significance, we only examine dimensions of these factors where at least 20 participants answered. Where appropriate, e.g., for the size of an organization, we clustered data into groups such that this criterion is met.

4.2   Influence of Organizational Factors

The influence of organizational factors on EAM challenges is summarized in Table 5. Challenges that correlate with an organizational factor are highlighted. In the following the influence for every organizational factor is explained in detail.

4.2.1   Region

Given our dataset and above criteria, we split only by two regions, USA and Europe. For our analysis the degree of freedom is 2. ~58% of all European participants experience the challenge that their enterprise environment changes too quickly. Only ~24% of the participants working for an US organization experience this issue. However, the null hypothesis cannot be rejected ($p = 0.424 > 0.1$) and thus there is no statistical significant prove that this challenge depends on that organizational factor.

Surprisingly, only ~6% of the US firms are confronted with an over-sized and difficult to understand EA model whereas in Europe, this problem seems more precarious (~35%). The null hypothesis can be rejected ($p = 0.095 < 0.1$) and thus there is statistical relevance proving that this challenge depends on the organizational factor region.

Benefits of EAM are not understood by ~24% or the US organizations whereas ~32% in the EU. The null hypothesis can be rejected ($p = 0.018 < 0.05$) and thus there is statistically highly significant prove that that this challenge depends on that organizational factor.

4.2.2   Industry Sector

We focus on specific sectors namely, public service, IT products and services, and finance. For our analysis the degree of freedom is 4.

The finance sector does not seem to be too much concerned about quick changes of the enterprise environment. Only ~44% face this challenge. In contrast, ~63% of the public service organizations and even ~88% of the organizations within the IT products and services sector experience changing environments as a problem for EAM. The null hypothesis can be rejected ($p = 0.076 < 0.1$) and thus there is statistically significant prove that this challenge depends on that organizational factor.

Outdated EAM results are a serious challenge for ~38% of the public organizations, ~50% in the financial sector, and ~63% in the IT products and services sector. The null hypothesis can be ed ($p = 0.041 < 0.05$) and thus there is statistically highly significant prove that this challenge in fact depends on this organizational factor.

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[3] In line with (Mintzberg 1979, 1980) and (Aier, 2012) we seek to analyze organization specific configurations.

~13% of the organizations in the IT products and services sector do not understand the benefit of EAM, ~28% in the financial industry, and ~37% in the public service sector. The null hypothesis cannot be rejected ($p = 0.110 > 0.1$) and thus there is no statistically significant prove that this challenge depends on that organizational factor.

Late valuation is a challenge ~44% of all organizations in the finance sector struggle with, 63% in the IT products and services sector, and ~63% of all organizations in the public services sector. The null hypothesis cannot be rejected ($p = 0.110 > 0.1$) and thus there is no statistical significant prove that this challenge depends on that organizational factor.

4.2.3 Size of the Company

We focus on the size of the organization in terms of number of employees. To stick to above detailed criteria for our data analysis, we clustered by 1-1,000 employees for small and medium sized enterprises (SMEs), 1,001-30,000 employees for mid-sized enterprises (MSEs), and 30,001 and more employees for large-scale enterprises (LSEs). For our analysis the degree of freedom is 4.

EAM focuses primarily on IT is experienced by ~63% of all MSEs as a challenge, ~62% of all LSEs, and ~47% of all SMEs. The null hypothesis can be rejected ($p = 0.047 < 0.05$) and thus there is statistical highly significant prove that this challenge depends on that organizational factor.

Organizational Factor \\ Challenge	Region	Industry sector	Size of the company	Years of experience	EA framework	Modeled state of the EA	Team organization
Enterprise environment changes too quickly	0.424	0.076	0.300	0.785	0.154	0.235	0.697
EAM team focuses primarily on IT	0.969	0.707	0.047	0.758	0.959	0.364	0.457
Reluctant information providers	0.933	0.638	0.947	0.012	0.734	0.029	0.719
Unavailable stakeholders	0.559	0.261	0.552	0.967	0.487	0.675	0.048
Late valuation of EAM through stakeholders	0.380	0.110	0.420	0.694	0.496	0.958	0.500
Outdated EAM results	0.684	0.041	0.397	0.441	0.660	0.074	0.272
No understanding of benefits	0.018	0.110	0.931	0.511	0.191	0.300	0.711
Over-sized and difficult EA models	0.095	0.322	0.543	0.337	0.626	0.276	0.539
EAM team does not meet right level of abstraction	0.457	0.711	0.989	0.258	0.838	0.994	0.753
EAM takes place in ivory tower	0.337	0.522	0.341	0.496	0.948	0.314	0.785

Table 5. Correlations for EAM challenges and organizational factors

Late valuation of EAM through stakeholders is seen as a challenge by ~52% of all MSEs, ~51% of all LSEs, and ~38% of all SMEs. The null hypothesis cannot be rejected ($p = 0.420 > 0.1$) and thus there is no statistical significant prove that this challenge depends on that organizational factor.

~44% SMEs face the challenge of outdated EAM results, ~33% MSEs and ~32% LSEs also are faced with this challenge. The null hypothesis cannot be rejected ($p = 0.397 > 0.1$) and thus there is no statistical significant prove that this challenge depends on that organizational factor.

~22% of all LSEs experience the challenge that EAM takes place in an ivory tower. Also ~19% of all SMEs and ~14% of all MSEs agree facing this challenge. The null hypothesis cannot be rejected ($p = $ ed ($p = 0.341 > 0.1$) and thus there is no statistical significant prove that this challenge depends on that organizational factor.

4.2.4 Years of Experience

We focus on the number of years an enterprise has experience in EAM. For this organizational factor, we clustered our dataset by two categories, i.e. with 0-3 as well as more than 3 years of experience. For our analysis the degree of freedom is 2.

~75% of enterprises with less than 3 years of experience struggle with reluctant information providers, while only ~49% of the organizations more experienced in EAM face this issue. The figures highlight that the lack of motivated information providers represents a general but nonetheless very critical challenges in particular for nascent EAM endeavors. The null hypothesis can be rejected ($p = 0.012 < 0.05$) and thus there is statistical highly significant prove that this challenge depends on that organizational factor.

4.2.5 EA Framework

EA frameworks have been extensively discussed in research by academia and practitioners (Aier, 2012). These frameworks, e.g. TOGAF (The Open Group, 2011), or Zachman (Zachman, 2004) are supposed to guide an organization by handing best-practice methods, models, viewpoints, giving guidance to identify your stakeholders, etc. For our analysis, we grouped into three categories, i.e. TOGAF, Zachman, and no specific framework that is applied. In total, we asked for 14 prominent EA frameworks (Buckl and Schweda, 2011). However, aforementioned ones are the dominating EA frameworks in our dataset. For our analysis the degree of freedom is 4.

A striking result is that ~45% of the organizations using an EA framework are faced with the challenge that the benefits of EA are unclear, i.e. the stakeholders do not understand the benefits. In contrast, organizations that do apply an EA framework face this challenge less (~26% TOGAF, ~23% Zachman). The null hypothesis cannot be rejected ($p = 0.191 > 0.1$) and thus there is no statistical significant prove that this challenge depends on that organizational factor.

~86% of the organizations employing Zachman as an EA framework face the challenge of a rapidly changing organizational context. In comparison ~75% of the organizations applying TOGAF, and about half of the organizations (~55%) that do not use a specific EA Framework also face this challenge. The null hypothesis cannot be rejected ($p = 0.154 > 0.1$) and thus there is no statistical significant prove that this challenge depends on that organizational factor.

~34% of all organizations using TOGAF are faced with the challenge of an over-sized information model. Also ~36% organizations that use Zachman and ~36% that do not apply any specific framework are faced with this challenge. The null hypothesis cannot be rejected ($p = 0.626 > 0.1$) and thus there is no statistical significant prove that this challenge depends on that organizational factor.

4.2.6 Modelled State of the EA

We asked the participants whether they modeled the current, planned, or target state of the EA. For our analysis the degree of freedom is 4.

~80% of all enterprises that modeled the target state experience the challenge of reluctant information providers, ~60% of enterprises modeling the current state and only ~55% of enterprises modeling the planned state experience this challenge. The null hypothesis can be rejected ($p = 0.029 < 0.05$) and

thus there is highly statistical significant prove that this challenge depends on that organizational factor.

~44% of the enterprises modeling the current state experience the challenge of outdated EAM results, ~40% of the organizations modeling the target state do agree having this challenge, and only ~19% modeling the planned state experience this challenge. The null hypothesis can be rejected ($p = 0.074 < 0.1$) and thus there is statistical significant prove that this challenge depends on that organizational factor.

An over-sized information model is a challenge for ~40% for all organizations that modeled the current state. ~33% that modeled the long-term target state and ~23% of all organizations that modeled the planned state of the EA also face this challenge. The null hypothesis cannot be rejected ($p = 0.276 > 0.1$) and thus there is no statistical significant prove that this challenge depends on that organizational factor.

4.2.7 Team Organization

In the last dimension, we focus on the organization of the EA team. For the analysis, the identified dimensions are: centralized, federated, and decentralized. The degree of freedom is 2.

The kind of team organization seems to have no dramatic impact on the challenges the organization is faced with. Within our data set, there is only one deviation greater than 20%. A federated approach seems to have less unavailable stakeholders, since only ~31% face this challenge whereas organizations with a decentralized approach, or a centralized approach face this challenge in ~56% of the cases respectively. The null hypothesis can be rejected ($p = 0.048 < 0.05$) and thus there is statistical highly significant prove that this challenge depends on that organizational factor.

5 Discussion

The presented results emphasize the relevance of challenges mentioned by literature in industrial practice. Challenges organizations struggle most are ad hoc EAM demands, unclear business goals, lack of experienced architects on the job market, demands unclear for EAM team, and the enterprise environment that is changing too quickly. While the most enterprises agree with some challenges (cf. Table 3), there exists a subset of EA challenges (cf. Table 4) enterprises have different opinions on. These opinions originate from different backgrounds, i.e. different organizational factors. In above presented analysis, we focused on dimensions of organizational factors that have a strong influence on the presented challenges.

In case of the region an organization operates we identified two challenges that are influenced. When comparing organizations from the USA and Europe, the challenge over-sized and difficult to understand model as well as no understanding of EAM benefits vary to a large extend. Organizations from the USA struggle less with these challenges. Depending on the industry sector an organization acts in, they are more or less challenged by a rapidly changing enterprise environment and outdated EAM results. The public as well as the IT products and services sectors are confronted with an enterprise environment that changes more rapidly. Organizations from the IT products and services sector also struggle more frequently with outdated EAM results. EAM teams of large organizations are also stronger focused on IT rather than the business compared to organizations with less employees. When dividing organizations by their experience with EAM further differences in the challenges they face become apparent. Organizations more experienced with EAM struggle less with reluctant information providers. No statistically relevant deviations in the challenges could be identified for organizations applying different frameworks. Given the limitations of our dataset, we were only able to investigate TOGAF and Zachman. Influence on the reluctance of information providers could also be shown with regard to the modeled state of the organization. A modeled target state in the organizations came along with a higher reluctance of the information providers. At the same time the modeled state of an organization has an influence on the challenge of outdated EAM results. Organizations having a centralized

or decentralized EAM teams are confronted more frequently with unavailable stakeholders compared to federated teams.

Above presented differences in the challenges organizations face highlight the need for EAM configurations tailored according to specific factors of the organization. In line with industry experts (e.g., Niemann, 2006) and researchers (e.g., Aier, 2012, Buckl, 2011) we argue that the design and implementation of an EAM relies on the influence of these organizational factors. As a starting point for the empirical validation of the proposed framework (e.g., Buckl, 2011) this paper lays the ground for further studies.

6   Outlook

Besides an overview of EA challenges from literature, we provide the ten most frequent of these challenges enterprises currently are faced with. We systematically filtered the results to essential parts of the dataset such that we could relate these EA challenges to organizational factors. As a result we provide implications of seven organizational factors on EA challenges these organizations are faced with.

Within our survey we explicitly asked for challenges that were revealed from an extensive literature study. Due to a non-exhaustive list of challenges the results of the survey might include a potential bias. Our results are limited to the presented dataset. Further research needs to show that the relation between organizational factors and challenges holds true for a larger empirical basis. Given the findings presented in this paper, current approaches that target to adapt EAM to the organizational context can benefit from the identified results. These approaches could be used to overcome the challenges that depend on the organizational factors we found.

7   Acknowledgement

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