Enterprise Architecture Documentation: Current Practices and Future Directions

Abstract. Over the past decade Enterprise Architecture (EA) management matured to a discipline commonly perceived as a strategic advantage. Among others, EA management helps to identify and realize cost saving potentials in organizations. EA initiatives commonly start by documenting the status-quo of the EA, whereby the respective management discipline analyzes this so-called current state and derives intermediate planned states heading towards a desired target state of the architecture. Several EA frameworks describe this process in theory. However, during practical application, organizations struggle with documenting the EA and lack concrete guidance during the process. To underline our observations and confirm our hypotheses, we conducted a survey among 140 EA practitioners to analyze issues organizations face while documenting the EA and keeping the documentation up to date. In this paper we present results on current practices, challenges, and automation techniques for EA documentation in a descriptive manner.

Keywords: Enterprise Architecture (EA), automated EA documentation, Survey

1 Introduction

Organizations are challenged with increasing complexity of their IT-landscapes through rapidly changing market requirements and globalization. At the same time, information technology (IT) is shifting from a modest service provider to an enabling driver for new business models. Organizations require solutions for the management of these challenges and therefore need to adapt their IT management practices [1, 2]. Enterprise Architecture (EA) and the corresponding management function are promoted to improve the alignment of business and IT, to realize cost saving potentials, and, at the same time, to increase availability and failure tolerance [3–5]. An EA model covers business as well as IT aspects to provide a holistic view of an organization and supports decision makers with relevant information. Thereby, development and maintenance of an EA rely on sound and up to date information on the organization's architecture. EA models typically embody infrastructure components, business applications, business processes, and the relationships among them [6]. Gathering respective information entails a large amount of work. Our experiences from several industry projects show that enterprises easily have several thousands of applications.

11th International Conference on Wirtschaftsinformatik,
27th February – 01st March 2013, Leipzig, Germany

Due to the large variety of these artifacts in an EA, respective EA documentation endeavors are regarded as both, time consuming and cost intensive [7, 8].

Existing research efforts in the EA documentation field are very scarce. Several publications mentioned the problem of EA data collection in practice. These are elaborated in detail in the following section. However, empirical evaluations on the application of EA documentation in organizations are necessary to obtain an overview of the current practices and challenges organizations face when documenting their EA. Ongoing research projects with our industry partners confirmed our assumption that organizations struggle documenting the current state of the EA. These observations build the starting point for the research conducted in this paper.

Main contributions in this paper are findings from a survey with 140 organizations from Canada, Germany, Great Britain, India, New Zealand, South Africa, Switzerland, USA, and others. The survey targets the current EA documentation processes applied in organizations and challenges interwoven with the EA documentation. Our findings are used to validate identified challenges from literature. These findings also include the organization of teams that perform the documentation and the applied EA documentation strategies. In addition, we provide resilient statistics on the use of automation techniques in organizations as a foundation for ongoing research efforts in this field [9].

The contribution of this paper is threefold. First the results can be used to derive future research directions in the documentation of EA information. Second, we provide an empirical basis of the currently applied techniques for EA documentation in organizations especially regarding automated data collection and compare these findings against literature. Third, we validate several research hypotheses for EA documentation that target to better understand the success factors of EA documentation.

The remainder of this paper is structured as follows. After discussing related work, the research methodology of the survey is described including the research hypotheses followed by a description of the empirical basis. The paper continues with a section on the current practice of EA management in organizations wherein statistics are illustrated in regard to the state of the EA management function of the participating organizations. Subsequently, findings on the documentation of EA information are presented in detail and compare with existing literature. After that, the key findings are presented and our research hypotheses are verified. The paper concludes with an outlook on future research challenges towards automated EA documentation.

2 Related Work

Several efforts in EA research literature have targeted the identification of challenges in the EA practice. Lucke et al. conduct an extensive EA literature review to identify current issues of the discipline [10]. Major findings in their study are a “lack of governance in EA projects” since it is challenging to manage a “plethora of stakeholders”. Typically, EA takes place across multiple organizational units and the coordination thereof is also challenging. Other social aspects such as mismatched communica-

tion during collaboration and group specific languages are cited by Lucke et al. They also detail how a different understanding of requirements is challenging, especially when different roles are involved.

In line with Lucke et al., Buckl et al. [11] detail the supply and demand perspectives modeling enterprise architects and users in information consumer and provider roles respectively. In [12], Raadt et al. speak of an "ivory tower" syndrome when too complex models are implemented describing the real world rather abstract. This also refers to the social aspect of different groups with different background knowledge. In addition, Lucke et al. highlight that a shared understanding is crucial for a successful EA endeavor and exemplify that not having a shared vision, or if the wrong vision is shared, "you may create a good architecture for the wrong business". Lack of experienced architects and missing resources are also mentioned. Lucke et al. further claim that there is insufficient support by current EA tools, especially when it comes to the collection and maintenance of "this diverse collection of entities".

Kaisler et al. [7] published a practitioner paper describing problems experienced in EA management with a focus on technical and modeling aspects rather than social aspects. Other issues are described by Chuang et al. in [13] ranging from difficulties to get the buy-in from stakeholders over discussions about budgeting EA to an ownership problem of an EA endeavors since these are often seen as IT initiatives.

In [14], Franke et al. presented a survey among 168 EA practitioners. The authors focus on companies located in Central Europe and presents information on how long companies apply EA management and how business/IT alignment is perceived since then. They further show results illustrating how business and IT concerns are met. However, the survey rather focuses on the big picture of EA management than on the in EA documentation.

When focusing on EA documentation, Lam [15] and Shah [16] describe people tend to use specific tools to produce models for different purposes. The same holds true for maintaining them, such that, from a knowledge management perspective, EA often ends up with "poor documentation" of EA information or rationale of decisions [10]. Hauder et al. [17] exemplify some of these problems by a hands-on approach employing two operative systems. They further provide a literature study, and seek to synthesize related problems into four categories, namely data, transformation, business & organizational, and tooling challenges.

Several authors also describe documentation of relevant EA information. In [18], Schekkerman highlights that required information "may not exist or may not [be] accurately represented". In this case he advises the EA team should "develop a strategy to create the needed documentation" and store it into an EA repository. A more detailed guide is given by Hanschke [19]. She highlights the ongoing characteristic of the EA documentation process, introduces data types and involved roles during the "data provision process". In [20], Ernst introduces a pattern-based approach that captures methods, information, and visualizations found in EA management practice. Ernst's pattern-based approach highlights the documentation of design rationale, i.e., selection of best-practice patterns. Above outlined approaches remain rather abstract when it comes to issues in the EA documentation process.

Recent research efforts have focused on automation mechanisms to improve EA documentation. The research group around Farwick et al. [21] also outlines problems with EA documentation. As a reaction to an error-prone and time-consuming process, they seek to take EA documentation one step beyond the status quo using automation mechanisms [22]. Farwick et al. aim to EA information out of productive systems, e.g. via monitoring tools, crawlers, and sniffers. In [23], Buschle et al. implement a similar idea using a vulnerability scanner. In [9], Buschle et al. take the automated EA documentation to productive IT environments. They analyze a productive Enterprise Service Bus (ESB) and show to which extend data therein covers information of an EA model. In particular, the coverage of the ArchiMate model is illustrated. Grunow et al. [24] investigate such a data sources concerning data quality aspects with a focus on EA information.

To the authors' best knowledge, up till now, an extensive survey on the state-of-the-art of EA management focusing on EA documentation does not exist.

3 Research Methodology

According to Hevner et al. [25], design research artifacts have to be assessed from both perspectives, a scientific knowledge base to prove *rigor*, and practical applicability to prove *relevance*. After a decade of "application in the appropriate environment" certain problems with EA management and in particular EA documentation issues seem to have a common source such that we should be able to make "additions to the knowledge base" refining the design artifact of the EA documentation process.

In this vein, our first step is to evaluate current EA documentation practices used in industry. Thereby, our target is to improve theories, methods, and frameworks applied for EA documentation. In order to elicit the current practices and to validate our hypotheses regarding documentation, we started a global explorative survey analyzing the status-quo of EA documentation processes.

From our experience in industry projects we compiled a set of questions that target to elicit the current practices and challenges in EA documentation. In addition, we added questions on the usage of automation techniques. The survey was filled out by three researchers in the field of EA not involved in this research and adapted according to their suggestions. The final version of the questionnaire was published as an online survey available for 14 days. Over 1100 survey invitations were sent by e-mail to EA related experts. The expert list was compiled during EA projects we performed with industry partners in recent years. In addition, the survey was announced in well-known online forums on Xing[1], LinkedIn[2], and Ning.com[3] that are related to EA or strategic IT management topics.

[1] http://www.xing.com (Group *Enterprise Architecture Management*), last accessed: August 8th 2012.

[2] http://www.linkedin.com (Group *The Enterprise Architecture Network*), last accessed: August 8th 2012.

[3] http://enterprisestewards.ning.com, last accessed: August 8th 2012.

In addition to the evaluation of the current practices in EA documentation, we formulated four research hypotheses to validate our observations from practice:

Hypothesis 1.	*Documentation of the EA is a major challenge for EA initiatives in organizations.*
Hypothesis 2.	*Efficiency and effectiveness of EA documentation depends on the team organization.*
Hypothesis 3.	*EA documentation requires an adequate tool support.*
Hypothesis 4.	*Automation techniques decrease the effort of EA documentation.*

Above outlined hypotheses are evaluated and discussed based on our data set in Section 7. Respective data set is described in the following section.

4 Description of the Empirical Basis

We received 179 answers in total with participants from, e.g., Canada, Germany, Great Britain, India, New Zealand, South Africa, Switzerland, and USA. 39 participants dropped out during the questionnaire or answered on behalf of the same organizations resulting in 140 completed answers for the evaluation. Table 1 illustrates the distribution of the industry sectors of the organizations in the survey. Finance is the largest sector with 30% followed by IT, Technology with ~19%, and Communications and Government with ~8% respectively.

Table 1. Industry sector of organizations

Industry Sector	n	% of all
Finance	42	30.00%
IT, Technology	27	19.29%
Communications	11	7.86%
Government	11	7.86%
Education	8	5.71%
Manufacturing	8	5.71%
Transportation	8	5.71%
Services	6	4.29%
Retail	5	3.57%
Health Care	5	3.57%
Agriculture	2	1.43%
Construction	2	1.43%
Other	5	3.57%

Table 2. Participants by job title

Job Title	n	% of all
Enterprise Architect	73	52.14%
Enterprise Architect Consultant	26	18.57%
Software Architect	9	6.43%
Project Manager	6	4.29%
CTO	5	3.57%
IT Manager	5	3.57%
Business Analyst	3	2.14%
CIO	3	2.14%
Software Developer	3	2.14%
CFO	1	0.71%
Software Development Manager	1	0.71%
Other	5	3.57%

In order to receive valuable information we targeted participants working in EA management or related fields in the industry. Table 2 illustrates the participants divided by job title. The largest groups in our survey consist of Enterprise Architects with ~52% and Enterprise Architect Consultants with ~19%. The consultants were asked to accomplish the survey with respect to a specific customer. Among the participants are also ~6% in an upper management position (CxOs) as well as Project Managers, Software Architects, and Software Developers. In addition, we asked the participants

on their individual working experience in EA management and the experience of the organization with EA management. The majority of participants have experience in EA management of 4 years or less and only very few organizations have more than 10 years of experience in this field. As a result and in line with [1] this confirms that EA management is still a young topic for organizations with only few very experienced professionals and organizations.

5 Enterprise Architecture Management in Organizations

In this section we provide results from the first part of the survey with general questions on EA management in organizations including results on the modeled state and EA challenges organizations are faced with. Results are discussed against the background of current EA literature. The organizations were also asked on the applied frameworks and tools. Due to space limitations these results are not shown in detail.

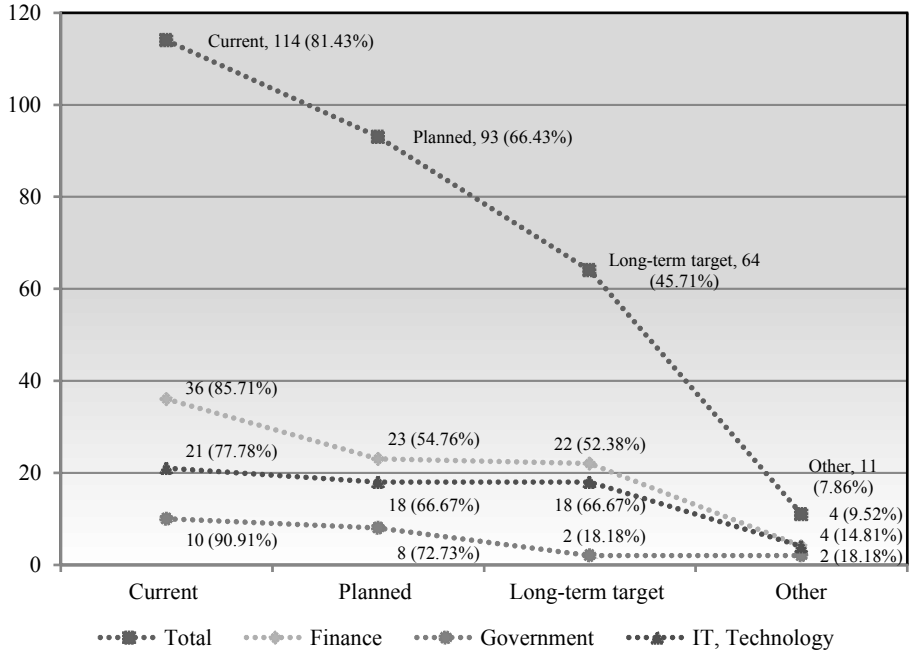

Fig. 1. Modeled state of the EA management function in organizations

Enterprise Architecture Management Function. The information on the EA contains infrastructure components, business applications, business processes, and their relationships. An EA endeavor commonly comprises the current state of the EA, derives multiple planned states, and heads towards a long-term target state [26]. Thereby, it typically starts with the documentation of information to capture the current

state of the EA [27] as the foundation for the alignment of future states. In our survey, the participants were asked to classify their organization according to the currently modeled state of their EA. Fig. 1 illustrates the modeled states in total for all industry sectors and individually for the sectors Finance, Government, and IT, Technology. The results indicate differences in the modeled states of the EA management functions. While 45.71% of the organizations model a long-term target state in total, the majority of the Finance (52.38%) as well as the IT, Technology (66.67%) sector have this long-term target state modeled in their organization.

Key Challenges in Enterprise Architecture Management. EA research literature lists many positive effects that implementation of an EA function can have on organizations information technology success [28]. However, recent literature suggests that these benefits can only be realized if a certain maturity of the EA function is achieved [29, 30]. On their way towards a higher EA maturity level (see also [5]), organizations struggle with a variety of challenges that reduce the overall perceived success of an EA endeavor [7, 10]. The first part of our survey aimed at getting an explorative picture of the most important challenges that EA teams are facing. The participants were asked to select the key challenges they are facing in their EA effort, with multiple selections possible. In addition, it was possible for the participants to give detailed descriptions of the rationale behind their selections and to add other challenges that were not present for selection. Fig. 2 shows the results of this question. The first striking result is that only a small percentage of the participants (7.14%) stated that they are not facing any specific challenge. This is a strong indicator that most organizations still struggle with the implementation of EA despite the wide availability of EA frameworks (cf. Foundations and Related Work), best practices collections [19, 20], tools [31] and the increasing experience of practitioners.

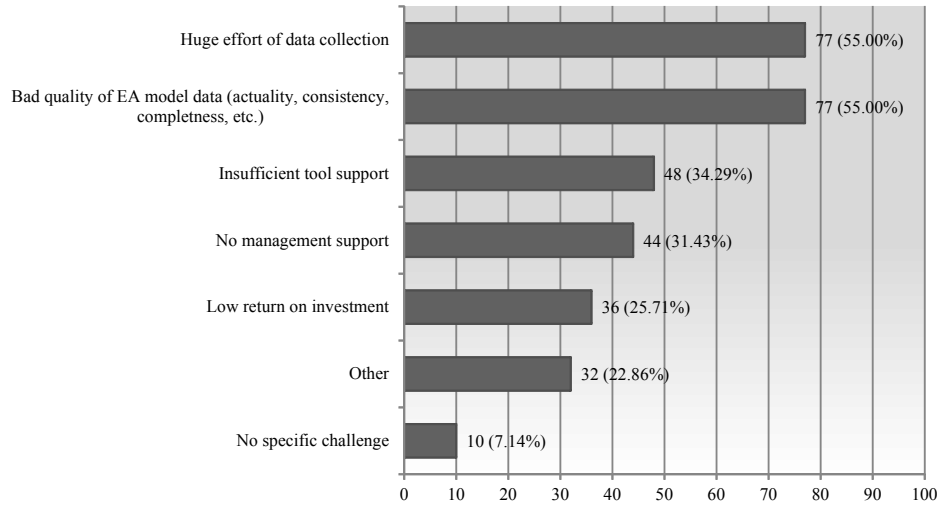

Fig. 2. Key EA challenges organizations are facing

The two most frequently selected challenges are concerning the effort of EA data collection and the quality of the resulting model. Both were selected as one of the key challenges by 55% of the participants. This supports our findings of a recent survey as well as interviews with practitioners [8] and other literature [10], which indicated that the amount of manual EA documentation labor is a major issue in today's organizations. However, it needs to be mentioned that the title of the survey indicated the topic of automated EA documentation. This might have led to a bias that directed practitioners who have problems with their data collection process to take the survey. Less participants mentioned insufficient tool support as a key challenge (34.29%). Tool support has been identified as one of the key challenges in the literature [7, 10]. However, the recent years have brought improvements to the maturity of EA tools [31]. 31.43% of the participants selected "No management support" as one of their key EA challenges. This has also been identified by various publications on EA challenges [7, 10]. The results of our survey indicate that the management support differs by industry sector. The numbers vary from e.g. 18.18% in the government sector to e.g. 50% in the transportation sector. The Finance, Insurance, Real Estate sector almost resembles the mean with 33.33%. These numbers show that still about one third of the EA initiatives are struggling to get management support that is important to realize real changes in organizations in the first place. A reason for this might be the perceived low return on investment (ROI) of EA initiatives. Still 25.71% of the participants selected this as a key issue. Several of the respondents also explicitly mentioned the difficulty to measure the ROI in the optional "Other" field of the question. Additionally mentioned challenges were the difficulty to motivate the EA effort, which is also linked to perceived low ROI, as well as the complexity and the rapid change of the real world architecture. The existence of data silos and missing tool integration were also mentioned several times. This is another indicator that better tool support can improve the overall EA documentation.

6 Current Practice of Enterprise Architecture Documentation

In order to grasp the current practices of EA data collection and challenges organizations face, we asked several question regarding the team structures, collection processes, and data collection triggers. The answers show that manual data collection is still prevailing, and the maturity of most data collection processes to keep the EA model up-to-date is generally low.

Team Organization. First, we asked the participants about the team organization for the data collection (cf. Table 3). About 46% stated that EA data is collected by a central EA team that gathers the data from the stakeholders in the organizational units and existing documentation. About 42% of the surveyed individuals answered that data is collected by both, a central EA team as well as federated teams that work in the organizational units. A small fraction of ~2% stated that data is only collected from stakeholders in other organizational units. 35 participants declaring a centralized

team also stated a large effort of the data collection. 38 participants declaring a 'hybrid' team organization also stated a large effort of the data collection. Hence, we cannot identify a link between participants that stating large efforts for the data collection with a particular EA team organization.

Table 3. How are the teams for the EA data collection organized?

Team Organization	n	% of all
Collected by central EA team	64	45.71%
Both, collected by centralized and federated teams	59	42.14%
Collected by stakeholders in other organizational units (federated EAM)	14	10.00%
I don't know	3	00.02%

Maturity of Data Collection Processes. One of the most striking findings of our survey is the result regarding the EA data collection process that can be seen in Table 5. Only 23% of the participants state that they have a reference process description that guides the collection of EA data to keep the EA model up-to-date and 71% stated that they have no such process description. This implies that data is collected in an ad-hoc manner. Given these figures, we argue that many organizations may improve the data collection efficiency with clearly defined processes describing the responsibilities, actions and action triggers.

Data Collection Strategy. In another series of questions we tried to elicit the actual practice of collecting EA data that are shown in Table 4. We asked the participants to describe how current EA data collection is organized and performed in their organizations. In addition, we wanted to know how many of them have a dedicated and specified process description for the collection in their organization. It can be seen that the typical practice for 76% of the participants is to manually inspect the content of existing applications and databases. The approaches that include interaction between people (physical or virtual) are applied less frequently. These are interviews with stakeholders (68%), interactive modeling in workshops with stakeholders (~53%) as well as questionnaires (~37%). Interestingly, ~35% of the participants replied that the data they use for manual entry in an EA tool is partially collected automatically.

Table 4. How is the manual EA data collection organized? (Multiple choices were possible.)

Type of Collection	n	% of all
Manually from applications/DBs	95	76.00%
Manually via interviews	85	68.00%
Manually modeled in workshops	66	52.80%
Manually via questionnaires	46	36.80%
Partially collected automatically	44	35.20%

Table 5. Does your organization have a dedicated and specified process description for the data collection?

Process Available	n	% of all
No	99	71.00%
Yes	33	23.00%
I don't know	8	6.00%

Data Collection Triggers. In order to keep the EA model in-sync with the reality, enterprise architects have to be aware of changes that affect the EA. Table 6 shows the result of our question that targeted the evaluation of triggering events that initiates

a manual update of the EA model. As expected, most architects rely on periodic checks with key stakeholders that provide data on specific parts of the architecture (55.71%). Further, organizations use the following triggers: acquisition of new products (44.28%), new application releases (42.86%), project completion (42.86%), and the introduction of new processes (39.29%). Note that these triggers have the limitation that they rely on very good communication of the architects with the responsible stakeholders possibly across different organizational units. Obviously, in cases where this communication is hindered updates might be delayed. The opposite direction of communication from the data providers to the architects is less common with 32.86%. This could be attributed to the problem of providing benefits for data providers in the EA context [32]. 21.43% of the participants stated that they have been confronted with mergers and acquisitions that have led to an update of the EA model. It is obvious that such massive changes to the EA should lead to manual changes of the EA model. The low number for this trigger likely stems from that fact that not all participating organizations went through a merger or acquisition since they introduced the EA function. The two least mentioned triggers refer to technical assistance of triggering. Only 17.14% stated that their data collection process is supported by a ticketing or task list system that allows triggering tasks for other stakeholders, although this has been recommended by literature from practice [19, 33]. Even fewer organizations leverage change event triggers from information systems like project completion events from project management tools (13.57%).

Table 6. What are triggering events for updating contents of your EA model? (Multiple choices were possible.)

Triggering Events	n	% of all
Periodic checks by enterprise architects with data providing stakeholders	78	55.71%
Acquisition of new products (applications, hardware, etc.) trigger model updates by enterprise architects	62	44.29%
New application releases trigger model updates by enterprise architects	60	42.86%
Project completion/inception triggers EA update process	60	42.86%
Introduction of new business processes trigger model updates by enterprise architects	55	39.29%
Data providers contact the enterprise architects on changes in the real world Enterprise Architecture	46	32.86%
Mergers & Acquisitions trigger model updates by enterprise architects	30	21.43%
A ticketing/task list (application) is used to manage EA change requests by different stakeholders	24	17.14%
Change in external tool automatically triggers manual update task (e.g. project completion in project management tool)	19	13.57%

Data Collection Challenges. Since the majority of organizations mention a huge effort of data collection and bad quality of the EA model data as key challenges in their organizations, the specific data collection challenges are of interest. Fig. 3 gives an overview of the major data collection challenges. The largest amount (62.14%) of organizations struggle to collect data in their organization since it is regarded as very time consuming. This confirms the findings presented in [8] and [7] that data collection is a time consuming task. This finding goes in hand with the fact that the data is often difficult to acquire (49.29%). It can be assumed that frequently changing requirements are a major issue for organizations. Many of them also struggle with the actuality of the EA model since 44.29% rate this quality as insufficient. This assump-

tion is strengthened with the fact that 27.14% mention that the real world EA changes too quickly to synchronize the EA model. Only a very small part of 4.29% stated that they face no specific challenges.

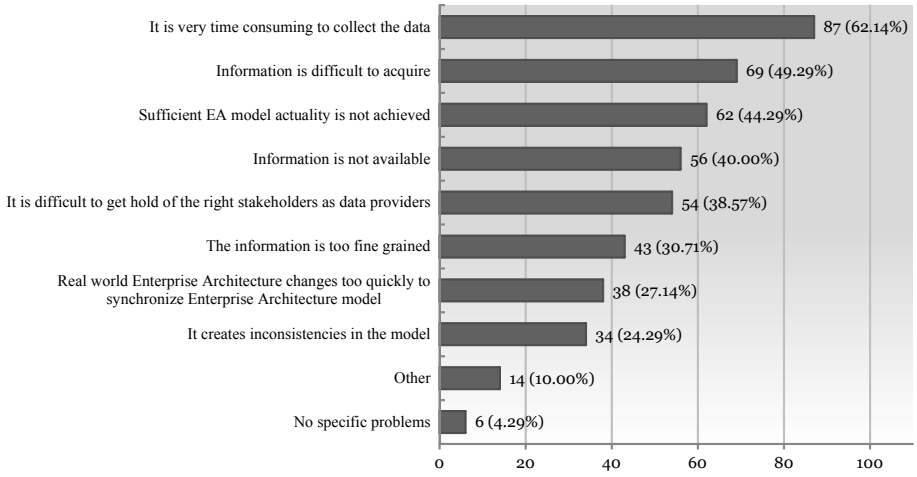

Fig. 3. Organizations' EA documentation challenges

Automated Data Collection. The survey presented in [34] indicated that about one fourth of the survey participants use automation mechanisms in order to update their EA tool. The survey at hand, with a much larger dataset supports this finding with 19.29% of the participants stating that they use some form of automation to update their EA tool (cf. Table 7). The majority of the participants rely on the manual input of collected EA data.

Table 7. Has your organization implemented some form of automated update mechanism for your EA tool?

Automation	n	% of all
No	91	65.00%
Yes	27	19.29%
I don't know	2	1.43%
No EA tool in use	20	14.29%

Table 8. How is automation technically implemented in your organization? (Multiple choices were possible.)

Implementation	n	% of all
Excel Import	12	27.27%
Relational Database Import	9	20.45%
CSV Import	8	18.18%
SOAP Web Service Interface	5	11.36%
XML Import	5	11.36%
REST Web Service Interface	4	9.09%
XMI Import	0	0.00%
I don't know	1	2.27%

Of the 27 respondents who apply automated updates the majority make use of file import mechanisms of their EA tool. The mentioned file types are Excel (~27%), CSV (~18%) and XML (~11%). A much smaller part makes use of web services (SOAP ~11%, REST ~9%) to collect external data. Table 8 summarizes all import mechanism currently applied in the organizations for automating EA documentation.

This supports the findings of Matthes et al. that most EA tools only support the simple non-recurring import from files such as Excel, XML, or CVS [31].

7 Discussion and Key Findings

As presented in Section 5 our survey shows organizations face diverse EA challenges. One of the key challenges seems to be the EA documentation. This goes in line with our first hypothesis (cf. *Hypothesis 1* in Section 3) such that our empirical basis confirms that the majority of EA initiatives struggle with the EA documentation in adequate quality. In our data set ~77% (n=108) participants stated that they either have to apply a huge effort in collecting data or their data is of bad quality.

We also provide empirical ground for *Hypothesis 2* and are able to state that federated EA teams struggle less with the collection EA data in adequate quality than centralized teams. To analyze this and the following hypotheses we applied a *chi square goodness of fit test*. To do so we evaluated whether federated teams and mixed teams are struggling with bad quality and data collection effort of their EA model in as many cases as centralized teams (cf. Table 3). Here the frequencies for participants not struggling with bad EA model quality are 11, 28, and 24, respectively. These numbers indicate that federated teams struggle less with bad EA model quality. In fact, the null hypothesis can be rejected, based on our data set with $\chi(1)^2 = 10{,}428, p = .015 (p \leq .05)$. Thus, we can confirm that federated teams perform better in keeping the quality of EA models high. In terms of data collection effort we calculated a similar result. In this case we tested whether federated team struggle as often as centralized teams with the data collection effort. Here the frequencies are *federated*=10, *both*=21 and *centralized*=29 where no huge effort in data collection was indicated. These numbers again indicate that federated teams perform better with data collection. The goodness of fit test resulted in $\chi(1)^2 = 9{,}730, p = .021 (p \leq .05)$. Thus, we can again reject the null hypothesis and state that federated teams struggle less with the data collection effort. This supports the use of federation for EA data collection as proposed by Fischer et al. [35].

Referring to *Hypothesis 3,* we can state that a successful EA documentation endeavor requires an adequate tool support. In this case we received significant results correlating cases where inadequate tool support and the time consuming nature of EA data collection was reported. Of the 48 participants reporting insufficient tool support, 39 (~%81) also reported the time consuming nature of EA data collection and of the 92 participants that do not report inadequate tool support, 54 (~%58) report high data collection effort. Our null hypothesis in this case states that as many participants state time consuming nature of data collection as inadequate tool support. The goodness of fit test allows us to reject this null hypothesis with $\chi(1)^2 = 7{,}195, p = .007 (p \leq .05)$. Thus, we can state the effort of data collection depends on adequate tool support.

In *Hypothesis 4* we stated that the use of automated data collection techniques decreases the effort of EA documentation. Here our null hypothesis states that partici-

pants who have implemented automated data collection mechanisms and those who have not equally complain about the time consuming nature of EA documentation. Of the participants 91 who have not implemented automation 64 (~70%) complain about the time needed to collect the data. In the 27 cases where automation has been applied only 12 (~44%) complain about this. This indicates that automation actually has a positive effect of the collection time. The goodness of fit test results with $\chi(1)^2 = 6{,}086,\ p = .014 (p \leq .05)$. Thus, our empirical results confirm the use of automated EA data collection mechanisms reduces the effort of manual collection.

Revisiting the results of the survey, we can state that the data collection is still a major problem in most organizations. Besides organizational issues, low maturity of data collection processes and missing tool support for automated data collection seems to be the root source. Thus, our observations go in line with Hauder et al. [17].

We argue that in the light of the results of this survey, means for reducing the amount of manual EA documentation labor have to be researched. Referring to our research methodology, we are targeting to improve the artifact of the EA data collection process with this survey as a starting point. Promising research directions are the use of automated data collection mechanisms and the use of tools that guide the manual data collection processes with tasks and automated data collection triggers.

8 Conclusion and Outlook

The documentation of EA information is to a large extent neglected in existing EA frameworks and literature from research and practice making this task difficult for organizations. This paper presents the current practices and future directions for EA documentation with findings from an international survey among 140 EA organizations. The findings of the survey draw a picture of the current practices and challenges in EA management with regard to EA documentation and applied automation mechanisms. The presented results show that many organizations struggle with keeping the quality of their EA models high and that documentation processes have a low maturity in general. We showed that federated teams, appropriate tool usage, and automation techniques have a positive effect on the efficiency of EA documentation efforts.

In our future work, we will particularly investigate means for team collaboration and automation mechanisms to improve EA documentation. We will address organizational challenges and technical challenges for automation support. In line with Buschle et al. [9], Hauder et al. [17], and Grunow et al. [24] , further research could also analyze particular data sources of operative IT environments for automated EA information. With such information, respective tool support could improve automated data collection and thus facilitate EA documentation initiatives.

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