UNDERSTANDING OBSTACLES IN ENTERPRISE ARCHITECTURE DEVELOPMENT

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Abstract

Today’s enterprise environment is more sophisticated than ever and being able to manage this complexity is not possible without having a planned approach. Enterprise architecture (EA) has emerge as a planned approach to mitigate the organizational complexities and control the constant environmental changes. However, despite the numerous EA development step-by-step methods and approaches not all of the EA efforts end with success. In this study we aimed to identify the obstacles that endanger the EA projects. Employing the multiple case study research method we collected data from 14 large enterprises by interviewing 20 experts. In total, we identified 20 obstacles that we further categorized into four main themes. Compared to earlier literature we found five types of obstacles that have not been mentioned before: political issues of the government, EA consultant related issues, outdated organizational statutes, constant change of management, and inefficient human resource department. Further we discussed about the relationships among the identified obstacles and provide advice for managers to reduce the obstacles during EA development. Because this study is based on real world cases, provided understanding can benefit practitioners to alleviate obstacles during EA development.

Keywords: Enterprise architecture, Obstacles, Multiple case study, EA development.
1 Introduction

Enterprise architecture (EA) provides a holistic view of the enterprise business processes, information systems, and technological infrastructure to address this sophisticated environment (Jonkers et al., 2006; Kaisler et al., 2005). EA is believed to provide appropriate concepts, methods, models, and tools to facilitate business-IT alignment and integration (Vargas et al., 2014).

In academic research most of the studies have focused on developing EA frameworks and methods (Bernus and Noran, 2010; Erol et al., 2010; Fatolahi et al., 2007; Hoogervorst, 2004; Kilpeläinen, 2007; Kim et al., 2006; Lankhorst, 2013; Sowa and Zachman, 1992; Vargas et al., 2014). Also a considerable number of studies have focused on EA development issues and challenges (Isomäki and Liimatainen, 2008; Jahani et al., 2010; Kaisler et al., 2005; Lucke et al., 2010; Nakakawa et al., 2010; Seppänen et al., 2009; Ylimäki, 2008).

Despite the popularity of EA in the last decade, it is difficult to find a successfully developed EA in an organization (Iyamu, 2009). Theoretically, as a concept, EA has been well developed but in practice managers are faced with a lot of challenges to implement and manage EA in an organization (Armour et al., 2007). Not all EA implementations lead to cost and time reduction and quality improvement in the organization. To be successful in EA it is important to understand the issues that hinder EA development. Thus in this study, in addition to identifying new obstacles in EA development, we also address the obstacles after EA development; meaning the EA maintenance and update phase, which none of the previous studies had considered.

We interviewed 20 EA professionals in 14 large enterprises to identify obstacles in EA development. Inspired by Themistocleous (2004) and Lucke et al. (2010) we categorized the identified obstacles based on four themes: environmental, technical, managerial, and organizational to increase the understandability of the issues. Further, we will discuss about the recommendations and advices of management to facilitate the identified issues.

This paper is organized as follows: first, we will go through the background of this study and previous literature on EA development issues, then in Section 3 the research process is described. After presenting the findings in Section 4 we will discuss the findings in the context of existing literature in Section 5, including the relationships between identified obstacles and management advice. Finally, conclusions, limitations and future directions of research is presented in section 6.

2 EA development issues in literature

EA can be defined as an approach to manage complexity in terms of organizational structure, technology, and business by providing a holistic view of the organization (Kaisler et al., 2005; Kamoun, 2013; Niemi and Pekkola, 2013). It can also be defined as the organizing logic for business processes and IT infrastructure of a company (Ross & al., 2006). It may describe the current or “as-is” status and the target or “to-be” structures in the company and it often includes a migration plan describing how to reach the target from the current (Josey, 2011). According to Cambridge dictionary, an obstacle means “Something that blocks you so that movement, going forward, or action is prevented or made more difficult.” So we define EA obstacles as the factors that confronts the project with difficulties and loss of resources and cannot be solved easily and the risk of project termination exists.

EA frameworks and methodologies assist enterprise architects by providing guidelines through different steps of EA development (Hoogervorst, 2004; Lankhorst, 2013; Zachman, 1987). Practitioners face many challenges that need to be solved in EA development and in some cases they face obstacles that cause project termination and failure. Therefore, in order to mitigate these issues it is crucial for the practitioners to realize what challenges and obstacles they are going to face during EA development.

Lucke et al. (2010) proposed a classification of EA issues based on an extensive literature review. They describe the identified challenges by grouping them into 14 concepts and further grouped them into five categories: management, semantics, education & experience, knowledge management, and extent & dynamics.
In another study Roth et al. (2013) reported the EA challenges organizations are facing by conducting survey focusing on EA documentation. They identified “huge effort of data collection” and “bad quality of EA model data” as the most reported issues among 140 valid responses. “Insufficient tool support”, “No management support”, and “low return on investment” are the other important reported challenges.

Isomäki and Liimatainen (2008) investigated EA challenges in the Finnish government sector. They divided the most important identified EA challenges into three main categories. The most important challenges in terms of shared understanding were implementation ability, business-IT alignment, and governance. Also legislative boundaries and professionalism are structural issues that hinder an EA project. Further, they identified lack of shared IT infrastructure as an obstacle.

Other studies that have investigated EA challenges and issues include (Hauder et al., 2013; Kaisler et al., 2005; Lucke et al., 2010; Seppänen et al., 2009). We will discuss about them in section 5.2.

3 Research method

The aim of this study is to identify the obstacles during EA development projects from the practitioner perspective in large enterprises. A thematic, exploratory, and qualitative strategy using multiple case studies approach was conducted in order to identify the enterprise architecture obstacles within the selected large enterprises. In this study we analyzed our data using grounded theory techniques.

Multiple case studies provide an extensive and complementary view on EA development obstacles in large enterprises. Figure 1 illustrates our research approach. In the data collection we interviewed 20 experts. Then we analyzed the interview transcripts and extracted obstacles during EA development. Further inspired by Themistocleous (2004) and Lucke et al. (2010) we categorized the identified obstacles into 4 main themes to increase the understandability of the context of the obstacles. Comparing our findings to previous studies we identified 5 new obstacles that have not been mentioned before in literature. Also, we investigated the relationships between the obstacles, the obstacles that have influence on the others and have cause and effect relationships with each other.

Figure 1 Overview of our research approach
3.1 Data collection

We carried out 20 semi-structured interviews to collect data in the period from May to July 2015. The interviewed companies were large, with sizes from 600 to 35000 employees. We deemed semi-structured interviews to be suitable for data collection, because of the complexity of EA practice and inductive approach (Myers and Newman, 2007).

We developed the interview questions for the purpose to identify the obstacles that practitioners face during EA development in large organizations. In interviews we asked questions regarding the interviewees’ background and roles in the organization. Then we moved to questions regarding the background of EA in their organization and asked questions, such as “Can you tell us about the history behind EA development in your organization?” and “How and when did you feel that you need to develop EA for your organization?”. Then based on the interviewees’ answers we asked questions regarding the process of EA development. Based on their explanations we asked them further questions about the obstacles that they had faced in each phase of EA development. By asking “why” and “how” questions we encouraged them to elaborate more on the obstacles that they had mentioned. Employing semi-structured interview the interviewer makes sure that all the preplanned questions are covered and the interviewee can think and reflect about topic and link their experience and perception to the discussion (Lange and Mendling, 2011).

In the beginning of May 2015 we sent an email to an EA specialist group with 335 members to request from the qualified members of the group to assist us with interviews. We received 38 replies from the group members who were ready be interviewed. The interviewees were investigated beforehand to ensure about their qualification and experience. We telephoned them and explained the purpose of the interview and asked for more information about their background and their experience with EA development projects. From these 38 responses we selected 20 experts from large organizations who were intensely involved in EA development.

In the beginning we decided to conduct at least 15 interviews to ensure that we will reach to the point of data saturation mentioned by Yin (2013). According to Stake (1995), having a larger set would also help to reduce the risk of data bias and increase the reliability of the findings. Further, we reduced the risk of bias by selecting the interviewees from different industries with different kind of EA project experience (Lam, 2005).

In total we interviewed 20 experts including CEO, CIOs, project managers, IT managers, and head of related departments with the average duration of the interviews being 1 hour and 10 minutes. The main questions addressed obstacles that the interviewees faced during the EA development project, missions and goals of the project, and results and outcomes of the project.

We reached to the point of data saturation after 12 interviews. Further data did not to add any meaningful observations to what we already gained from the first 12 interviews. According to Yin (2013) we reached data saturation and the rest of the interviews’ data repeated the points that had been already mentioned previously. Table 1 presents the information about the interviewed organizations.

<table>
<thead>
<tr>
<th>Cases</th>
<th>Industry</th>
<th>Company Size</th>
<th>#of interviews</th>
<th>Roles</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>A government organization</td>
<td>1500</td>
<td>1</td>
<td>CIO</td>
</tr>
<tr>
<td>N</td>
<td>A government organization</td>
<td>1860</td>
<td>1</td>
<td>IT manager</td>
</tr>
<tr>
<td>G</td>
<td>A government organization</td>
<td>10000</td>
<td>3</td>
<td>CIO</td>
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<td></td>
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<td></td>
<td>Head of systems analyze &amp; design</td>
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<td>Head of business process development</td>
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<td>D</td>
<td>A government organization</td>
<td>20000</td>
<td>1</td>
<td>IT manager</td>
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<td>B</td>
<td>Banking industry</td>
<td>800</td>
<td>1</td>
<td>CIO</td>
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<td>L</td>
<td>Banking industry</td>
<td>1000</td>
<td>2</td>
<td>Head of software development</td>
</tr>
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<td></td>
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<td></td>
<td></td>
<td>IT manager</td>
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<tr>
<td>C</td>
<td>IT consulting Company</td>
<td>2000</td>
<td>1</td>
<td>Project manager</td>
</tr>
<tr>
<td>F</td>
<td>IT consulting company</td>
<td>600</td>
<td>1</td>
<td>Project manager</td>
</tr>
<tr>
<td>H</td>
<td>Automotive industry</td>
<td>9700</td>
<td>3</td>
<td>CEO</td>
</tr>
</tbody>
</table>
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Table 1  Information about conducted interviews and the organizations

<table>
<thead>
<tr>
<th></th>
<th>Industry</th>
<th>R&amp;D director</th>
<th>Head of business process development</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>Automotive</td>
<td>35000</td>
<td>1</td>
</tr>
<tr>
<td>J</td>
<td>Automotive</td>
<td>11000</td>
<td>2</td>
</tr>
<tr>
<td>K</td>
<td>Automotive</td>
<td>1570</td>
<td>1</td>
</tr>
<tr>
<td>M</td>
<td>Automotive</td>
<td>1600</td>
<td>1</td>
</tr>
<tr>
<td>E</td>
<td>Cement</td>
<td>720</td>
<td>1</td>
</tr>
<tr>
<td>14</td>
<td></td>
<td></td>
<td>20</td>
</tr>
</tbody>
</table>

3.2 Data analysis

We employed a coding technique based on the open coding in Grounded Theory to analyze our data (Glaser and Strauss, 1967). To analyze our data we transcribed the interviews as text and imported the texts into the Atlas.ti software that can be used for qualitative analyses.

One researcher employed the technique of open coding (Corbin and Strauss, 1990) and labeled the paragraphs and sentences based on their contexts. For instance, “Critical factor”, “obstacle” and “advice” are the examples of the first level of coding that we conducted. In this stage of analyses more than 300 codes that indicated the general ideas of paragraphs or sentences were generated. On the next step, the focus was only on the parts labeled as obstacles and more precise and meaningful phrases to each obstacle were assigned. The second level of coding with more than 90 codes that indicated different and mostly similar issues of EA obstacles had obtained. For instance, “unexperienced EA consultants”, “lack of innovation in EA consultants”, “consultants being inflexible”, and “inefficiency of EA consultants” were all grouped in on category named “EA consultant related issues”. After grouping similar issues 20 different obstacles that are presented in table 2 were established.

To increase the understandability of the identified obstacles and to be clear about their context we chose 4 themes inspired by Themistocleous (2004) and Lucke et al. (2010) for the identified obstacles in our study: environmental, technical, managerial, and organizational.

4 Results

We defined EA obstacles as the factors that confront the EA project with difficulties and loss of resources or factors that endanger the project and cannot be solved easily, which may potentially cause project termination. During our analyses, inspired by Themistocleous (2004) and Lucke et al. (2010), we identified four common themes from transcribed interviews related to the obstacles identified during EA development project: Environmental, Technical, Managerial, and organizational. Table 2 presents our proposed taxonomy of the obstacles during EA development. These are described below in detail.

<table>
<thead>
<tr>
<th>Themes</th>
<th>Identified EA obstacles</th>
</tr>
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</table>
| **Environmental**: issues related to the inter- and intra-organizational environment, such as organizational culture and experience on EA projects and issues related to vendors and consultants. | - Political issues of the government  
- EA consultant related issues  
- Outdated organizational statutes  
- Restricted rules in governmental organizations |
| **Technical**: issues related to EA tools, infrastructure, outputs, and configuration. | - Old infrastructure  
- Lack of change management tools  
- Ineffective EA outputs |
| **Managerial**: issues related to EA visions and goals, management and leadership, project team and human resource. | - Lack of management knowledge  
- Lack of management support  
- Constant change of management  
- Unable to set a common goal and understanding  
- Setting too ambitious goals  
- Unclear organizational strategies  
- Budget provision |
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| Organizational: issues related to EA training and educating personnel, communication and collaboration in the organization. |
| Organizational structure deficiencies |
| - Personnel change resistance |
| - Lack of personnel knowledge |
| - Lack of communication and cooperation |
| - Inefficient human resource department |
| - High costs of training personnel |

Table 2: Taxonomy of identified obstacles during EA development

4.1 Environmental Obstacles

4.1.1 Political issues of the government

Confusion in government was mentioned as a common obstacle in governmental organizations. Both of the CIOs from Cases A and E mentioned that “the inappropriate definition of business in the government” and “confusion in the government regarding the long term goals” affected their EA development in the initial stages. Also political changes of the country were mentioned by Cases G and J. They imposed difficulties to the organizations “for example when the government changes”. In this situation, “the government changes, the cabinet will change, the industry minister will change. Therefore, [the organization’s] boss will change”. Thus, it is so likely that the project will be terminated in the middle.

4.1.2 EA consultant related issues

The EA consultant of Case G was unexperienced with amateur members. This situation faced the EA project with difficulties as it took “much longer than expected” to finish and “almost failed”.

According to the CIO of Case A, Lack of innovation in consultant’s team is another EA development obstacle. The interviewee mentioned that “consultant team just wants to draw a diagram and to show that they have known and modeled processes” without bringing any innovation to the job, which results in consultant being inflexible. Further, the interviewee mentioned that sometimes EA consultants become inefficient in a way that “instead of consulting they were taking orders and acted like our employees.”

4.1.3 Outdated organizational statutes

Having old and forgotten statutes mentioned by the CIO from Case A to hinder their EA planning. The interviewee mentioned the statutes as an input for the EA development “which indicates the establishment goals and aims of legislator or founder of [the organization]”. However, they realized the obstacle when their EA consultant asked for these statutes and they realized that “the organizational goals and objectives were different from what organization was doing.”

4.1.4 Restricted rules in governmental organizations

According to the Head of System Analysis and Design of Case G EA development in a governmental organization is more difficult than in private organizations because of restricted rules and laws in governmental organizations. It was stated that in governmental organizations “there are managers, ministers, and president who impose rules and restrictions on the organization”. Case J faced with a situation in which laws contradict with the EA results. As a result of EA they realized that sales management in one of their divisions that should be removed. However, legislated laws of the county was against this EA result.

4.2 Technical obstacles

4.2.1 Old infrastructure

In Case C the project manager pointed out that because of having an old infrastructure they could not “reach to the expected maturity.” It was also mentioned that in this situation even sometimes “aligning with the organizational strategies is difficult”. Being function-oriented instead of process-oriented also mentioned by IT managers in Cases L and D to be “the fundamental problem with most of the organizations” and it is
necessary to “first fix this fundamental challenge to become process-oriented, then think about EA development.”

4.2.2 Lack of change management tools
Lack of change management tools mentioned by the Case M hindered an EA project. It was difficult for the EA team of the company to manage changes as they had not have any “monitoring tool”. Each unit in the company had a person who was responsible for the changes in the company, which was not acting efficiently. Further, as “the environment changes rapidly and their time was limited” lack of a tool to monitor and manage changes during EA development was challenging.

4.2.3 Ineffective EA outputs
IT Manager of Case C mentioned that their EA outputs were too abstract to be usable for systems developers. They had to interview the personnel again to get more details which “bothered both personnel and managers”. Further, Insufficient use of the EA results caused Case K not to benefit from all the potential of EA development.

4.3 Managerial obstacles

4.3.1 Lack of management knowledge
The CIO of Case G mentioned that the managers’ lack of knowledge “make it so difficult to convince them about the usefulness of developing EA”. Further, the interviewee mentioned that because of lack of knowledge the manager did not want to be “involved” in the project. Case B established a new unit for EA and assigned a manager for it. However, because the manager was unexperienced the EA effort did not succeed. Also, the representative from Case F mentioned that the management expected EA to implement a system and they wanted “real and tangible results”. However, according to Project Manager of Case F, the management must be realistic and realize that “EA must remain in architecture level and system implementation is not in the realm of EA development”.

4.3.2 Lack of management support
The CIO of Case K mentioned management unsupportiveness as a problem. It took more than 6 months to argue with the CEO of the company to convince him about developing EA. Getting the CEO’s approval and support was their “biggest obstacle”. Similarly, it was mentioned by the Case A, that “managers do not pay enough attention to EA when it is needed.” Cases K and A stated that managers just ask for the EA results without wanting to be involved in the project. However, “Managers’ supervision during the EA project motivates the personnel” as they realize that the management is also involved in the project. Further, Case M complained about the managers being unsupportive during the EA project, although they supported the project initially. Also favoritism in hiring new and unqualified personnel by the high management to be in charge of EA project hindered EA development in Case M.

4.3.3 Constant change of management
In Case C, constant change in management affected “policies and strategies of the organization”. Changes in the organization hindered the decisions that were needed in EA development. Similarly, Cases F, J, E, and M also mentioned this obstacle. In Case J, when the management changed, it was not clear that the new management “approved to continue the previous manager’s works and projects.” Therefore, during the development of a lengthy project like EA it is very probable that management changes several times during the project and the changes affect the strategies and priorities of the company. In Case M, the EA results were not accomplished, because the management changed constantly and sometimes the projects, which are initiated as the results of EA were terminated because “the new manager did not approve the project”. 
4.3.4 Unable to set common goals and understanding
The CIO of Case K stated that setting “a common desire and goal in the whole company” was their biggest obstacle. Similarly, IT Manager of Case L mentioned that “to make the fundamental of EA” in the organization depending on the level of the personnel’s knowledge “a short-term or a long-term time” is required that everyone in the organization reach to a common understanding of EA. Otherwise, EA project will be a “total failure”. Also, the representative of Case M mentioned that everyone in the organization “must want” EA to be developed.

4.3.5 Setting too ambitious goals
Setting too ambitious goals in the initial stage of EA project mentioned as an obstacle by the interviewee from Case F. In the initial stage of the EA project they were defining project goals “too ambitiously and ideally”. Thus, they faced with failure and they started again with a more realistic set of goals. Further, Case M started its EA development project with “false assumptions” because the personnel did not cooperate efficiently and costs increased as they had to “redo everything”. Thus, the EA development took much longer than what was expected.

4.3.6 Unclear organizational strategies
The CIO of Case A considered EA development as a total failure when the organization did not have a clear organizational strategy. In order to reach to the target situation the organization must know the “mission and vision” of the project with “a clear and up to date strategy”.

4.3.7 Budget provision
Too small budget is a common issue in big projects like EA development. As mentioned by the interviewee from Case F, the estimated budget was not sufficient to finish the project and “EA costs could not be paid as planned.” In another situation pointed out by IT manager of Case L, due to lack of budget in the middle of the project they could not pay all consultant fees, which affected the EA project as the consultant’s role was reduced. In Case G, “budget provision” was the biggest obstacle. The budget was too small to implement all the projects that were defined as the EA results and they were “postponed each year”. A limited budget also effects the selection of the consultant. As it was mentioned by Cases F and G, one of the important criteria in selecting a consultant was the cost.

4.3.8 Organizational structure deficiencies
The interviewee from Case B mentioned that although they have developed business processes perfectly, “sometimes business does not go on smoothly” and customers are not satisfied and in some situation they are “faced with high costs”. He continued that the reason for such obstacles is that they have a weakness in their organizational structure, which is lack of central EA governor “to determine some criteria to control the performance.” Similarly, the interviewee from Case G mentioned that their “biggest challenge” is that “there is not a central and powerful unit to govern [their] EA” after development. The interviewee pointed out that when the CIO is not directly managed by CEO, big IT projects like EA develop slower with more obstacles because “the manager of that department [which EA is a sub-set to it] does not have enough IT knowledge or resist to changes that IT brings by proposing new technologies and the CIO’s proposal might never reach to the CEO.”

4.4 Organizational obstacles

4.4.1 Personnel change resistance
In Cases G, J, and M personnel resistance to change seemed to hinder EA development greatly. Although organizations tried to convince the personnel of their job safety, they still faced resistance. The high level management should “reassure the personnel of their job safety by communicating and involving”. According to the Cases H and C, the reason for personnel change resistance is that the employees are “too attached to
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their desks and chairs”. The employees think if the processes are improved and the tasks are performed automatically, they might lose their jobs.

4.4.2 Lack of personnel knowledge

In Cases E, J, L, and A lack of personnel knowledge about EA development was a challenge. In Case E EA development took more time than planned as they needed first to learn about EA. In spite of outsourcing the EA development, Case L faced difficulties during EA project because “the organization had a very small and weak IT team”. They had heard about EA and its benefits and now they just wanted to have EA without having enough knowledge about it. The interviewee stated that when EA knowledge does not exist in the organization, “do not start the project”. The CIO of Case A stated that because of personnel’s lack of knowledge “the data gathering and interview sessions became longer than what was expected”.

4.4.3 Lack of communication and collaboration

When Case E started the EA project they were “assuming that the personnel of each unit was working with valid data”, meaning that they knew where the data came from and how exactly they should process this data. But they were wrong about this, because most of the personnel had no idea about the origin of their data, which was caused by the lack of communication and cooperation between different units and personnel. Further, Case L stated that lack of communication and cooperation between the EA consultant and the company caused project termination. In Case G, some employees felt threatened by the EA development and tried to “jeopardize” the project by giving wrong information to the EA consultant intentionally. Some of the employees wanted to “hide truth” about their processes because, “they were afraid to lose their position in the company”. Additionally, the EA consultant did not have all the company’s knowledge and therefore they could not verify the employees’ answers regarding their processes. Consequently, the architecture became flawed and some analyses had to be redone.

4.4.4 Inefficient human resource department

The CIO of Case B mentioned that although they had developed EA successfully, the personnel was unsatisfied, because the human resource department did not set up any sessions for the personnel to educate them beforehand. Forcing personnel to adopt EA instead of educating them was identified as another obstacle that may hinder an EA project. The CIOs of Cases A and K mentioned the effect of fluctuation in personnel’s motivation on the EA development process. For instance, as a governmental organization, the interviewee from Case A mentioned the difficulty of coping with higher level management. Also, the CIO of Case K stated that the personnel’s motivation affects the progress of EA project as “Sometime the employee is in a good spirit and the project progresses very well but sometimes the employee is not in the mood and then even continuing the project seems so difficult”.

4.4.5 High costs of training the personnel

Changes in the organizational structure is usually one of the EA results. Therefore, implementing the results of EA development often involves hiring and training new employees or losing the trained ones. In Cases B and M, high costs of hiring, training, and loosing personnel was an obstacle. The CIO of Case B mentioned that as a result of EA development a part of organizational structure might change and then “the problem of layoffs or job rotation of your trained personnel” will occur. Adding new functions to the organizational structure as an EA result then leads to “the issue of hiring and training new personnel”. Both situations may involve high costs. The interviewee from Case M stated that training human resources to become experts in business process development is “an investment and is expensive for the company” and when “[the trained employee] leaves the company or moves to another division” the company loses its “potential”. Therefore, as the interviewee from Case B mentioned “When you lose your trained human resource it is harmful for the organization. Because the organization is losing its knowledge and potential”.
5 Discussion

We identified 20 obstacles in EA development that we categorized into four themes: Environmental, Technical, Managerial, and Organizational. In this section we discuss the relationships between the identified obstacles. Then we compare our findings to previous studies and finally we present some recommendations based on the findings.

5.1 Possible relationships between the identified obstacles

We searched the data for possible cause and effect relationships between the identified obstacles. They are briefly described here:

- We noted that confusion in government is associated with the political changes of the country that has a direct impact on the management of governmental organizations, which results in constant change of management. Further we found out that constant change of management affects the cooperation and communication of different units. In addition, constant change of management also influences the personnel’s motivation. In a long project like EA development, management changes possibly many times and the new management does not have similar views of the project. The personnel may lose their motivation to the development if they know that management changes may also cause change of plans.

- Management support and involvement in the project raises the personnel motivation. The interviews included mentions that when managers supported the project, the personnel become more motivated and efficient.

- Lack of management knowledge and unexperienced EA consultant are two causes of setting too ambitious goals. When the management does not have enough knowledge, it may aim at unrealistic and wishful goals, which at the end of the day cannot be fulfilled. Being unexperienced, EA consultants also set unrealistic and ambitious goals in the initial stages of the project, which are hard to fulfill.

- Management support and change in management influence the EA project budget. When management changes during EA project, the new management may not be as supportive as the previous management and EA project priority will be reduced and the EA project budget will be cut. Therefore, this may cause lack of budget in the middle of the EA project. Due to the lack of budget organizations cannot update their infrastructure, therefore they cannot align themselves with their strategies.

- Unclear organizational strategies result in improper definition of EA, which may lead to lack of budget because of a wrong kind of an architecture. When the organizational strategy is not clear, organizations do not have a clear vision and mission. If the organization does not know where it wants to go and what it want to achieve, EA development will be a blurry thought. Therefore, EA will be defined improperly and the development will be started with false assumptions and following those assumptions the development ends up in a wrong architecture and waste of time and budget. Thus, if the organization wanted to compensate its loss and redo the project it so likely to face lack of budget and resources.

- When the organizational strategy is unclear, it is not possible to set a common goal and understanding in the organization. Because of lack of communication between different levels of managers and personnel, they cannot agree on a common goal and reach to a common understanding.

- When EA knowledge does not exist in the organization, the organization is unable to reach to a common goal and understanding. Reaching to a common understanding can be facilitated through personnel education and training.

- Personnel’s change resistance and their knowledge are related to each other. If the personnel had enough EA knowledge then there would be less resistance to change. Further, if the personnel have enough knowledge, communication and cooperation will be facilitated. Also, forcing personnel to adopt EA instead of educating them, aggravates personnel resistance to change.

- Similarly, lack of management knowledge is associated with lack of management support. When the management does not have enough knowledge about EA or does not have IT knowledge, it is likely that the management does not support EA development and considers it as a “luxury” project.
• Governmental organizations seem to face more obstacles during their EA development than private organizations. One reason is that governmental organizations are more restricted because of the rules and laws that are imposed by government. Also governmental organizations are highly affected by the governmental issues and changes. Another reason that the EA projects in governmental organization are more vulnerable than private sector is that personnel’s motivation in governmental organizations is lower due to lower salaries. The data suggested that people with high skills are not eager to work on governmental organizations.

• Setting a common goal and desire in the organization is also mentioned to be the determining factor in a successful EA development project. Personnel’s training and education is influential in setting the common goal and understanding among employees in the organization.

5.2 Our findings in analogy to existing literature

To compare our findings with previous research we reviewed 9 articles related to EA development obstacles (Armour et al., 1999; Hauder et al., 2013; Isomäki and Liimatainen, 2008; Jahani et al., 2010; Kaisler et al., 2005; Lucke et al., 2010; Nakakawa et al., 2010; Seppänen et al., 2009; Ylimäki, 2008). We found that 15 out of 20 identified obstacles are documented in some of these studies. The five obstacles from our findings that none of the reviewed studies mentioned were political issues of the government, EA consultant related issues, outdated organizational statutes, constant change of management, and inefficient human resource department.

Kaisler et al. (2005) have very briefly mentioned political issues in their study without any explanation. In contrary to our findings, interviewing the governmental organization sector, Seppänen et al. (2009) mentioned that their interviewees were not appreciating the fact that the government or the ministries have left the organizations free to decide for their architectural directions. However, in our study the excessive governmental interferences and limitations were seen as obstacles during the EA development.

Similarly, none of the reviewed studies mentioned EA consultant issues. Jahani et al. (2010) stated briefly that employing experienced and educated consultants was a success factor of enterprise architecture planning. Armour et al. (1999) suggest to employ good consultants that can offer expert advices, facilitate meetings and train the team. However, they did not mentioned anything about the challenges of employing the EA consultants. Also Lucke et al. (2010) pointed out “lack of experienced architects” as an issue in EA development. Nevertheless, they did not mention what they meant by architects; are they companies’ trained personnel or consultants from outside.

Constant change of management was mentioned as an obstacle even in the post-development phase, because new management may not continue the agreed EA plans. This situation was mentioned by the interviewee in Case M. Lack of budget may also hinder EA in the post-development phase. Some managers may consider EA as a luxury project and terminate the projects due to lack of budget. In Case K personnel’s motivation was also a problem in EA updates.

5.3 Lessons learned

In this section we will discuss about the lessons that management learned during EA development. This includes hopes, regrets and recommendations of managers after EA development. We discuss these issues by dividing these management advices into four categories.

I. Eliminating consultant related issues

IT Manager of Case L recommended to choose an EA consultant that is easily reachable so that the communication and cooperation will be easier. Another recommendation to eliminate consultant related issues is to choose more experienced consultant. As CIO of Case G mentioned if time goes back “[they] would have chosen the most experienced EA consultant regardless of their wage”. Additionally, stated by Head of System Analysis and Design of Case G, if she had the power to decide in consultant selection then the consultant’s resume would have been the most important factor. The consultant must have had long experience in the development of EA for large enterprises. Also the interviewee of Case G mentioned that “[she] would
have also considered the foreign consultants who are more experienced and skillful than the national consultants”.

**Getting a free pilot test from consultants to check their work quality** is another solution to eliminate consultant related issues in the future, mentioned by the Head of Business Process Development of Case G. The interviewee suggested that before making contract with an EA consultant it is necessary to ask the EA consultant to “develop a pilot version” on a small unit of the organization. In this way the organization can assess the consultant’s work.

The Project Manager of Case F pointed out that **being more restricted on timetable with the EA consultant** is one way to eliminate future challenges with consultant. As the interviewee stated, if project timetable is flexible then the “project will take much longer than expected to finish”.

II. **Eliminating change resistance issues**

The CIO of Case J suggested that in order to eliminate the personnel change resistance, the **restraining entities should be involved more in EA development**. The interviewee mentioned that if he had the chance to redo the project he would have “involved those resisting divisions more in the project, so they would have got along with EA gradually.” Similarly, the CIO of Case K regretted that he did not engaged enough with the personnel during EA development “to have a close contact” with them and to assure them about their “job safety” to eliminate their resistance.

**Educating personnel instead of just making them familiar with EA** is another way to eliminate personnel change resistance recommended by the CIO of Case G. The personnel need to understand that “EA provides an infrastructure for better development and integration”. This would have facilitate the adoption of EA and EA would have been implemented with “better quality and less resistance”.

**Tighter cooperation of personnel and EA consultant** was recommended by Cases G and F as another solution to personnel change resistance. Head of Business Process Development of Case G mentioned that if the personnel of the organization and the EA team would have had better cooperation the EA project should have been more successful and faced with less resistance. Similarly, Project Manager of Case F emphasized that “working together with the consultants and learning from them” makes the EA project more “attractive” to the personnel and eliminates their resistance to change.

Having a **powerful human resource department** can solve issues regarding personnel’s motivation, change resistance and EA adoption. For instance, CIO of Case B stated that if they had a powerful human resource department, personnel would have been more satisfied and motivated by a reward system or performance assessment.

III. **Eliminating the risk of failure**

To avoid the risk of developing a wrong architecture organizations must provide prerequisites of EA development. One of the most important thing in EA development is to plan more accurately. According to CIO of Case I, if they had the chance to start over, they would have planned the project as accurately as possible. Case I realized many times that if something is not correct in the architecture, then they need to go back to their plans and identify the “deficiencies” that caused the failure.

The CIO of Case K wished that they would have **applied a more strategic plan**. The interviewee stated that it is crucial to first train oneself to “think strategically”. Instead of just doing routine works the personnel must also be trained to think strategically to produce the “right output”.

IT manager of Case N regretted that he should have increased his EA knowledge before EA development to **provide the EA consultant more accurate data**. The interviewee stated that “more accurate data” creates “more accurate architecture” and accordingly more “added value” for the company.

According to the Head of R&D in Case J, **organizations should develop EA at the right time**. The interviewee suggested that if the organization is not ready to adopt EA, “development should be postponed”. For instance, Case J encountered severe challenges during their EA development. At the time that they started the EA project they aimed at an integration with other divisions of the company. However, the economic
situation of other divisions was fragile. Therefore, the EA project with the integration objective was challenged by the economic crises of other divisions. According to the interviewee of Case J, at that time starting EA project with those divisions was a “very wrong idea”.

Another recommendation suggested by CIO of Case B is to get consultants from EA experts outside of the company. The interviewee stated that although they are an IT-based company but “EA knowledge is different” and to develop a successful EA, at least the companies must “utilize EA specialist advices”.

The CIO of Case A suggested the IT department should directly be supervised by the CEO. IT department should be a subset that “directly communicate” with the CEO. As the interviewee stated, there should not be any “mediator” between CIO and CEO. This way the EA project will have “a strong support” in the organization.

Employing motivated and creative personnel in the EA project is suggested by CIO of Case A in order to be successful. The interviewee mentioned that if they wanted to do the EA project again, they will be more “sensitive” in selecting personnel to work in the EA team, because the team members should be “creative and eager to work in the team”. Besides, EA should not be developed focusing only on one framework or standard, it requires “element of creativity” in order to be successful.

Another element of success in EA development, mentioned by the interviewee from Case M is that people involved in EA development must have systems thinking. The interviewee pointed out that if the units who were involved in the EA project had had systems thinking they would have had less challenges during EA development.

IV. Eliminating the risk of EA to be just documents dusting in the shelves

Regular updates to EA was suggested by the interviewee of Case G as a way to “continuously utilize and improve” EA in the company. According to Head of System Analyze and Design of Case G, EA documentation should be “precise and realistic all the time”. Similarly, Head of Business Process Development of Case G, pointed out that although updating EA is a crucial task for the organization, it is not updated regularly. It is crucial to have a regular update plan for the EA. The representative of Case G recommends that there should “always” be a consultant or a strong EA team in the company to carry out the EA tasks and updates.

Usually, the results of EA development comes in the form of proposals of new projects to reach to the target situation. As suggested by Cases G and L, it can be helpful if the EA consultant participates and makes suggestions in the tender to select a vendor to implement EA results. Because the EA consultant knows what is really needed to be implemented, they can assist in selecting a vendor to implements the proposed projects.

6 Conclusions

This study identified obstacles in EA development. The study was designed as a multiple case study and it collected empirical data by conducting 20 interview sessions in 14 large enterprises. The 20 identified obstacles were categorized into four main themes, environmental, technical, managerial, and organizational. We determined five new obstacles that have not been mentioned before: political issues of the government, EA consultant related issues, outdated organizational statutes, constant change of management, and inefficient human resource department.

We also collected and presented recommendations to mitigate the obstacles. Before actually developing EA, organizations should be aware of the obstacles. Examples of recommendations include eliminating consultant related issues by carefully choosing an experienced and qualified EA consultant. Eliminating change resistance issues by more involvement of personnel, educating them, and provide a situation for both personnel and consultant to cooperate and communicate better. Eliminating the risk of project failure by planning EA project accurately from initial stage, applying more strategic plans, providing more accurate data, and choosing the right personnel.
This study can assist practitioners to understand the obstacles that they are going to face in EA development. Also, by presenting the management regrets and recommendations, this study can help the practitioners to eliminate some of the obstacles identified.

One of the limitations of this study is the limited number of individuals that were interviewed. The study could be more reliable if we had more cases. Another limitation is that the cases were selected from one country and some of the mentioned obstacles may not apply to another country. Further, all the interviewees were from the management level of the organizations. Having other stakeholders’ perspectives, such as EA consultants and personnel could clarify and explain some issues. Therefore generalization of these results should be made with caution. Further research using for example a survey on the topic is recommended to improve generalizability of the findings.

In the future we will consider also other EA project stakeholders and extend the scope of our research to other countries to increase the reliability of the research findings. Although various EA obstacles are widely addressed, not many solutions have been proposed in the literature. Therefore, in the future, studies that provide solutions to these obstacles are required.

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References


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