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Factors Influencing Communication and Collaboration in Enterprise Architecture Development

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Abstract

Communication and collaboration in Enterprise Architecture (EA) development have always been challenging. This paper contributes to the field of EA by investigating the factors that influence communication and collaboration in EA development. Data was collected from 14 large organizations in various industries regarding their EA development. Adopting the grounded theory method, we identified 20 factors that influence communication and collaboration in EA development and further categorized them into social, technical, internal, and external. Moreover, we analyzed and theorized the relationships between the factors to realize how they influence each other. Analyzing five organizational documents, we provide recommendations to improve communication and collaboration in EA development.

1. Introduction

Enterprise Architecture (EA) development projects encounter different challenges, and not all of these projects end with success [26]. Challenges like the lack of establishing proper EA governance [13], lack of shared understanding [24], lack of leaders' trust [2], organizational politics [6], no management support [11], EA artifacts being outdated and of low quality [20], sabotaging the EA development by giving wrong information [21], and communication and collaboration challenges [3, 6, 13] have been identified. Thus, it is not surprising to see that 66 percent of EA projects did not fulfill the expectations of surveyed organizations [26]. It is argued that this is because EA practitioners still look at EA as something that is related to the IT functions of the organizations and little attention has been paid to the social aspect of the EA [30].

EA introduces a significant change to the organization and change may bring considerable resistance. The manner in which EA is developed

(design and implementation) significantly affects the perception and behaviour of the stakeholders in EA development [3, 21]. Therefore, the social and human behaviour in EA development should be considered carefully in order to improve the stakeholders' ability to adapt and accept the changes. Recent studies have for example highlighted the psychological content of collaboration (e.g. knowledge, emotions, will, body language) [31]. Based on the recent findings lack of communication and collaboration was also proved to be the most critical obstacle in EA development [3]. In all of the phases of the EA development, vivid communication with stakeholders is indispensable and critical [5], and it is argued that failing to establish communication is a major challenge in an EA development [14].

The broader aim of this Straussian grounded theory (GT) study was to investigate the factors that influence communication and collaboration in EA development. We interviewed 20 enterprise architecture professionals from 15 large organizations for this study. The interviewed organizations were selected from different industries and all of the interviewed organizations had adopted EA. In addition, 9 organizational documents from 5 organizations regarding their EA development were utilized in this study. As a result of our GT study, a classification of factors that influence communication and collaboration was identified (Figure 1). This classification shows how social, technical, internal, and external factors influence communication and collaboration in EA development.

The contribution of this study is threefold: First, as a result of our GT analysis, we found that social issues are more critical in initiating communication and collaboration during EA development comparing to technical ones. Second, by using the GT method to develop this classification we contribute to the literature on the factors that influence communication and collaboration in EA development. Third, we show the relationships between the identified factors to see how they influence each other and we provide

recommendations to improve communication and collaboration in EA development.

This paper is organized as follows: first, the background of this study is presented, and then in the next section the research process is described. After presenting the findings there will be a discussion and theoretical and practical contributions of this study. The conclusion and future research are presented in the last section.

2. Theoretical background

Our literature review focuses on earlier studies in two areas that we considered relevant to our research problem: 'Enterprises as 'living things' and 'communication and collaboration in EA projects'.

2.1. Enterprises as 'living things'

EA is referred to as a holistic management of information systems (ISs) in organizational approaches [27, 29]. It describes how different entities in an organization, such as systems, processes, organizations, and people, work together as a whole to reduce costs and respond to new business opportunities [27]. Taking all of the architecture of the entire enterprise into consideration, all enterprise entities, such as systems, stakeholders, relationships, dependencies and business strategies, can be architected in an EA effort [10].

Enterprises as 'living things' [10], means that they need to be (re-) architected constantly to achieve their necessary agility, alignment, and integration. This constant (re-) architecting of the enterprise brings a significant change to the organizations and EA stakeholders may show resistance to the change. The stakeholders want the organizations to revert to the equilibrium of the past therefore, they may intentionally sabotage the EA development by giving wrong information to the architects [21]. This issue can be facilitated through an effective EA governance. However, according to [13], one of the most pivotal challenges of EA is implementation ability and governance in EA development which according to [3] this issue has roots in a lack of communication and collaboration in EA projects.

Reviewing the literature, it was realized that communication and collaboration play important roles in EA projects [5, 6, 12, 13, 14, 20, 24]. On the one hand, from the literature, we identified communication and collaboration as the most cited benefits of EA development [29] and on the other hand communication and collaboration have been regarded as the most challenging factors in EA development [3, 9, 23]. Perhaps the ubiquitous nature

of communication and collaboration and its relevance to human behaviour is the answer to these challenges [3, 21]. According to [18], the most important characteristic of an EA is that it provides a holistic view of the enterprise. In order to provide this holistic view of the enterprise, information from different unrelated domains of the enterprise is required. In the current practice of architecture descriptions, different domains of the enterprise speak their own language and use their own techniques and tools, therefore, communication and collaboration across these domains are severely impaired.

2.2. Communication and Collaboration in EA projects

The issue of communication and collaboration in EA development has not been studied attentively. Communication has mentioned as a major concern in the three schools of thoughts in EA development [19]. In the enterprise IT architecting or the first school of thought in EA, communication between architects and members of the organization has been identified as one of the key challenges in EA development. In the enterprise integrating or the second school of thought in EA, communicating the systemic dynamics and their meanings for design purposes by the architects is challenging. In the third school of thought or enterprise ecological adoption, communication skills have mentioned as one of the most important skills in EA development in order to encourage discussion and collaboration between various sectors to elaborate on the enterprise strategy.

The individual skills and behaviour of architects have been highlighted to be important aspects of communication in the context of EA [25]. Furthermore, empirical observations indicate that poor workplace talk causes inefficiencies, errors, and an inability to interact [4].

Collaboration can be defined as '*an activity that leads to an emergent result, which takes place alongside an act of communication within a group that has a mutually beneficial relationship*' [31]. In literature, collaboration has been defined as lasting relationships and a strong commitment to a common goal [17]. The relationship between communication and collaboration can be realized from [32] study in which they mentioned, communication precedes collaboration, or as [8] mention, communication creates an organization in which it is easy to produce collaboration.

3. The research case and methodology

The broader aim of this study was to understand the factors that influence communication and collaboration in enterprise architecture (EA) development. The investigated companies (14) were large and varied from governmental organizations (4) to different industrial organizations (banking industry (2), consulting industry (2), cement industry (1), automotive industry (5), with sizes from 600 to 35,000 employees (Table 1). All of these organizations had finished at least one round of EA development from pre-development to post-development, and six of them were in the stage of updating their EA. An exploratory, interpretivist and qualitative strategy using grounded theory (GT) was

Table 1. Case organizations and interviewees information

Case	Industry	No. of employees	No. of interviews	Roles of interviewees
A	Governmental organization	1,500	1	CIO
B	Banking industry	800	1	CIO
C	Consulting industry	2,000	1	Project manager
D	Governmental organization	20,000	1	IT manager
E	Cement industry	720	1	CIO
F	Consulting industry	600	1	Project manager
G	Governmental organization	10,000	3	CIO Head of systems analysis and design Head of business process development
H	Automotive industry	9,700	3	CEO R&D director Head of business process development
I	Automotive industry	35,000	1	CIO
J	Automotive industry	11,000	2	CIO Head of R&D
K	Automotive industry	1,570	1	CIO
L	Banking industry	1,000	2	Head of software development IT manager
M	Automotive industry	1,600	1	Head of systems analyze & design
N	Governmental organization	1,860	1	IT manager

conducted in order to identify the factors that influence communication and collaboration in EA development.

The data was analyzed by adopting the interpretivist paradigm [7], and GT techniques [28]. All of the interviews were transcribed to text format and then analyzed with Atlas.ti, which is a qualitative data analysis tool. In addition, the organizational documents were imported to Atlas.ti for analysis. Based on ‘open coding’ and ‘axial coding’ principles from the GT method [28], datasets were analyzed upon collection.

The first step was to open-code the interview transcripts, all of which were read, and words, sentences, and paragraphs were conceptually labeled through constant comparison [28]. Then, conceptually similar ones were grouped to form categories and subcategories using theoretical comparison [28]. For instance, “Organizational Culture” and “Knowledge about EA” are the examples of the first level of coding (open coding). Open coding is defined as “*the analytic process through which concepts and categories are identified and their properties and dimensions are discovered in data*” [28]. In this step, more than 300 codes were generated. After grouping similar open codes, (e.g. ‘Lack of personnel’s’ knowledge about EA’ and ‘Lack of managers’ knowledge about EA’, grouped into a higher level group named ‘knowledge’) we reached to 20 factors (see figure 1) that can influence communication and collaboration in EA development. In the next phase of the analyses, we aimed to find the relationships between the identified factors. This phase in grounded theory is called axial coding [28]. Furthermore, we categorize these factors into four main categories of internal, external, social, and technical.

4. Findings

This section presents the findings of our main categories. The emergent categories (internal, external, social and technical) demonstrate the importance of the factors that influence communication and collaboration in EA development. Based on our analyses we realized that each of the identified factors could be categorized into the combination of either internal or external and social or technical: internal-social, internal-technical, external-social, and external-technical. In the following sections, we will describe the identified factors (20 in total and they are bolded in each section).

In this paper, external communication and collaboration are referred to as the interaction

between organization and external parties and environments, such as customers, agencies, shareholders, government, suppliers, vendors, and consultants. Factors influencing external communication and collaboration could be either technical or social. Internal communication and collaboration happen within the organization and we categorized them into technical and social. Technical communication is communication and collaboration happen between systems, databases, processes, and infrastructure of the organization. Social communication and collaboration happen between people inside the organization.

4.1. External/Technical factors

This category consists of factors, which are related to the technical aspects of the organization's external environment. Usually, external factors are the ones that the organizations do not have any control over them. The old **IT infrastructure of the country** was identified as a problematic issue in Case C as it *'hindered the communication and collaboration between organizations and the outside world'*. Moreover, as IT Manager of Case L mentioned *'the old infrastructure of the country did not have the potential to support high technologies which were proposed as the results of EA project'*. In addition, the old IT infrastructure of the country, delayed the EA development project in Case L as their professional EA consultants were located in other cities and they did not have a high-speed Internet connection to communicate and collaborate effectively from distance.

Technological advancements were pointed out by most of the interviewees as a factor that can improve the quality of communication and collaboration in EA development. The personnel can collaborate in the EA project through electronic platforms (mentioned by Cases I, J, and N), share their knowledge (mentioned by Cases C, F, J, M, and E), and acquire information regarding the EA development. However, due to the old infrastructure of the country sometimes organizations could not fully benefit from these technological advantages.

4.2. Internal/Technical factors

This category consists of different intra-organizational factors, which are related to the technical aspect of the organization. Internal factors are the ones that organizations can influence them by taking appropriate strategies. Organizations should provide an appropriate **IT infrastructure** before embarking on EA. Software, hardware, networks, databases, and other related equipment are examples

of IT infrastructure. Regarding this issue, the interviewee from Case C mentioned that *'having an old infrastructure, establishing communication between different Information systems and departments was challenging in the beginning of the EA development project'*.

It is crucial that employees have access (**information accessibility**) to the required information regarding the EA development. Having access to the required information can reduce personnel's resistance to change. The interviewee from Case L mentioned that they had created a section in their internal portal in which the personnel follows the news and information about the ongoing EA project. Similarly, a wiki was developed in Case H in which all of the personnel could read, edit, share information, and learn from each other.

Up to date organizational **documents** influence the processes of EA development. The interviewees of Cases A and G stated that keeping the documents up to date is not easy but it increases the maturity of the organization and prevents chaos. The organizational documents facilitate communication between architects and personnel and between different roles and departments in the organizations, as they can better understand each other. The CIO of Case A mentioned that *'due to the outdated organizational documents what is really happening in the organization is different from what it should have happened based on organizational documents'*. Furthermore, the documents should be understandable, for instance in Case M the result of EA development was not effective for the organization because *'the documents produced by the EA team were not understandable by developers'*.

As mentioned several times by our interviewees they would face fewer problems in EA development if their organizations were mature. Cases K and A, improved their organizational **maturity** level by enhancing the intra-organizational integration and investing in improving their documentation.

Intra-organizational integration was mentioned by the interviewees from Cases A, B, E, F, G, H, K, and M as their major goal to initiate the EA development in order to reduce costs, improve business processes, and eliminate redundancies. Here integration means organizational integration in four levels of databases, systems, processes, and strategies. Integration has a direct relationship with communication and collaboration within an organization. Moreover, the process of EA development in cases that had some levels of integration between systems in their organizations, such as Cases B, C, F, and G was less agonizing.

Organizational structure is another factor that influences communication and collaboration in EA development. An organization should be structured in a way that gives enough authority to the unit in charge of EA. For example, the CIOs of Case G mentioned that *'it is crucial that the CIO is directly placed under the CEO in order to get more support, especially for the big projects like EA development'*. However, in most of the interviewed organizations, CEO and CIO did not have direct communication and collaboration regarding the EA development and that brought some difficulties. In most of the organizations, communication between CIO and CEO happens indirectly and through mid-level managers and removing these mid-level managers in order to directly communicate and collaborate with the CEO was not easy to accomplish due to change resistance. We realized that organizational structure affects organizational culture in long-term.

4.3. Internal/Social factors

This category of factors includes social and intra-organizational factors that influence communication and collaboration in EA projects.

In Cases B and G personnel got used to the old procedures, therefore, they did not like to change their habits, and they resisted to change and *'jeopardized the EA project by giving wrong information to the EA team'*. Moreover, different **cultures** in different departments and divisions caused issues regarding communication and collaboration. For example, the CIO of Case J mentioned that *'the organizational culture in [division x] was very different from the culture of [division y]. During EA development different culture of divisions caused difficulties as personnel in [division y] did not believe in the positive changes that EA development would bring'*. Furthermore, the CIO of Case J mentioned that *division y* still resists to the changes that are happening as the results of EA development, *'because EA has reduced their independency in decision making and they were not motivated at all to collaborate with us'*. The difference in organizational culture between divisions in Case J was obvious as *division y* was merged with the organization a few years ago. This issue can be rooted in different organizational structures that two organizations had before the merger.

Case I started five years ago to develop EA with the help of an EA consultant from another country but due to several organizational and political reasons, their collaboration failed and later they continued to develop EA internally. The CIO of Case I pointed out that *'although our collaboration with the foreign EA consultant was unsuccessful but the*

positive point of this effort was that our organizational culture changed and the road to developing EA in future was facilitated as we succeeded at that time to reach to a common point between different units that we need EA to be developed'. Case I's initial unsuccessful EA development attempt affected the organizational culture and increased their knowledge of EA and consequently, they believed in their abilities (self-efficacy) and triggered their motivation to continue EA development internally.

The personnel of Case I communicate and collaborate effectively during EA development, as they reached a common goal and believed in themselves that they could develop EA internally. The high **self-efficacy** in Case I modified their culture and improved their adaptability with the changes that EA brought to the organization. Similarly, Case H believed that they are capable of developing EA without EA constant help. They believed that *'they know their organization better than anyone else does'* and with this high self-efficacy they initiated the EA development and they were successful.

Almost all of the interviewees mentioned the importance of **knowledge** in EA development. For instance, the CIO of Case A mentioned that when developing the EA, the *'personnel should have reached a level of maturity and knowledge that they could collaborate with the EA consultant and could provide accurate and correct information about the processes'*. However, they were faced with the *'immaturity of the personnel'*, which caused a delay in the data gathering and interview sessions, making these processes take *'longer than what was expected'*. Moreover, the Project Manager of Case C pointed out that *'If the personnel does not get enough knowledge about EA development and how EA will benefit them, they will resist adopting the EA and endanger the project'*. In Case E, the personnel did not have enough EA knowledge, and the EA team and personnel could not communicate efficiently. The Head of Systems Analysis and Design in Case G pointed out that the *'academic background of the high-level managers is in social sciences'*; therefore, they did not have any knowledge of EA, IT or industry, and they could not understand the results or benefits of EA and *'convincing them of the usefulness of adopting EA'* for the organization was difficult.

Climate is a short-term phenomenon created by the current leadership. The following examples are indications of how **organizational climate** could influence communication and collaboration in EA development. In Case A, high-level management did not pay enough attention to the EA and *"they*

preferred to do their everyday routine tasks” and when personnel saw that management is indifference towards EA project they were reluctant to collaborate with the project. Furthermore, the CIO of Case A talked about the management’s attitude towards the personnel and how their attitude could demotivate personnel’s collaboration with the EA project: “we have a lot of challenges even to meet the managers, we should be careful not to say anything that might offend them. [...] because then they will not even say hello to you and it is in this situation that you will think ‘is it really worth it to put this much energy on this project’ and then you lose your motivation.”

When personnel sees the **commitment and involvement** of the high-level manager towards the EA project, it **motivates** them to collaborate more. As mentioned by the CIO of Case A, when high-level managers did not show support for the EA project, the *‘personnel’s performance decreased and they lost motivation’*. Similarly, in Case L due to the constant change of management and lack of management support, people lost their motivation to collaborate with the project and consequently, no innovation occurred in the organization and the organization lost its competitive edge as time passed. We realized that monetary rewards could trigger personnel’s motivation to communicate and collaborate in EA development. The CIO of Case B mentioned that they should have had considered *‘a rewarding system or performance assessment in order to motivate the personnel to collaborate better during EA development’*.

According to the Project Manager of Case C, the CIO of Case G, and the CEO of Case H, sometimes during the EA development, their personnel gave wrong or inaccurate information to the EA consultant because they were afraid of losing their jobs. This situation is an indication of the low **quality of work life** (QWL) in those organizations that hindered communication and collaboration of personnel in EA development.

Case B started to develop EA without explaining to the personnel about what is EA and how it will affect their jobs and how they are going to develop it. Consequently, Case B was not able to gain their personnel’s **trust**, which results in personnel dissatisfaction. Furthermore, the interviewee from Case A mentioned that *‘sometimes it seemed that the EA consultant did not want us to know how they are progressing or what steps they are taking to develop EA [...] because they wanted us to be dependent on them in future [...]’*. In such situations, the personnel lost their trust and collaboration with the EA consultant became difficult. In Case G the personnel was worried about losing their jobs, as they did not

trust their managers who tried to ensure them about their job security. The personnel tried to *‘jeopardize the EA development project by giving wrong information to the EA team’*.

4.4. External/Social factors

This category consists of factors, which are related to the social aspect of the organization’s external environment. In Case M due to the problematic communication and diplomatic relationship of the government with the world (**Political issues of the country**), the ERP vendor refused to sell its product to this company and the company could not develop the result of EA as it was planned. **Change in government** was mentioned by Cases G and J that imposed difficulties on 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”* and often the priorities of the new leader is not the same as the previous leader and usually the EA project terminates.

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 (**Government’s policies and laws**) in governmental organizations. It was stated that in governmental organizations *“there are managers, ministers, and a president who impose rules and restrictions on the organization”*. Case J faced with a situation in which laws contradict 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 country were against this EA result.

The CIOs from Cases A and J respectively 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 stage, as they could not communicate their organizational strategies and goals to the EA consultant. The CIO of Case J mentioned lack of professional EA consultant (**EA consultant’s experience**) as one of the major obstacles that hindered collaboration in EA development. In addition, the EA consultant of Case G was inexperienced with amateur members. This situation faced the EA project with difficulties as it took *“much longer than expected”* to finish and they *“almost failed”*. Moreover, the CIO of Case A mentioned the importance of EA consultant being innovative and self-driven in order to promote collaboration.

5. Discussion

Our final step was to build relationships between the identified factors in the different categories of communication and collaboration in EA development (see section 5.1 and figure 1). We will present our theoretical integration in the light of the previous literature in section 5.2 and practical contribution will be discussed in section 5.3.

5.1. Relationships between factors influencing communication and collaboration in EA development

The main contribution of this paper (Figure 1) shows how this final step allowed us to theorize about how communication and collaboration factors (20) and categories (internal, external, social and technical) were linked to each other.

Based on our analyses, it was realized that *political issues of the country (government)* with the western countries affect the technology transfer as

organization, we realized that documentation improves organizational maturity and assists in *intra-organizational integration*. It was realized from the analyses that *changes in government* will change the *policies and laws*, which can affect the *organizational structure*. It was realized that change in the government usually causes changes in the management level of the organization and change in the management level not only bring modifications to the organizational structure but also causes to lose new manager's commitment and involvement in the project.

Managers' *commitment and involvement*, and their support of the EA project are important factors that *motivate* personnel to communicate and collaborate on the EA project. Without complete managers' support, the EA project doomed to failure. Managers should have enough knowledge of EA to understand the necessity of EA development for the organization. It is the job of enterprise architects to provide managers with enough information, and rational about the necessity of EA.

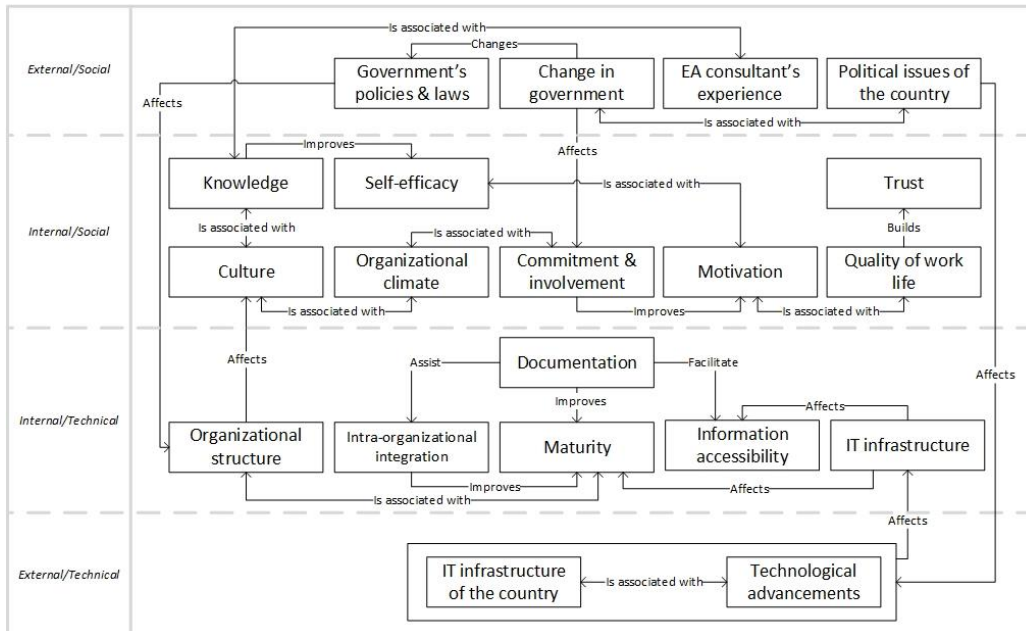


Figure 1. Relationships between identified factors in different levels of communication and collaboration in EA development

political sanctions of the country banned the foreign companies from doing any trade with the country including companies that had required technologies to improve the *IT infrastructure*.

When the IT infrastructure of the organization is not up to date, the *maturity* of the organization from the technology point of view is questionable. Considering the important role of documentation in recording all the actions happening inside an

High *self-efficacy* is when an individual perceives that he or she is good at something, regardless of being true or not and it was realized from the data that knowledge improves self-efficacy, which is associated with the personnel's *motivation* to communicate and collaborate with the EA project.

When employees are motivated enough to communicate and collaborate in the EA project, then it improves the quality of work life (*QWL*) and vice

versa. QWL improves when employees *trust* the employer that they will not lose their job if they share their jobs' descriptions with the EA team. Without *trust*, the information transferring through communication and collaboration would be unreliable or wrong.

Table 2 present a summary of findings by discussing the relationships between categories. We understand from the table that the external/social category of factors is the most influential category which usually being neglected in EA efforts.

Table 2. Summary of findings

Category	Code	Relationships
External/ Technical	IT infrastructure of the country, Technological advancements	-Affected by External/Social -Affects Internal/technical
Internal/ Technical	IT infrastructure, information accessibility, documentation, integration, organizational structure, maturity	-Affected by external/ technical and External/Social categories
Internal/ Social	Culture, knowledge, self-efficacy, organizational climate, commitment and involvement, motivation, QWL, trust	Affected by External/ Social and internal/ Technical categories
External/ Social	Government's policies and laws, change in government, EA consultant's experience, political issues of the country	Affects all the categories

It is also worth mentioning that the identified factors and their influence on communication and collaboration are different in various industries. For instance, the effect of government-related factors, such as political issues of the country, change in government, and change in government's policies on communication and collaboration in EA projects are severer in governmental organizations than non-governmental ones. In addition, we realized differences in taking the internal/technical aspect of communication and collaboration more seriously in the manufacturing organizations comparing with the governmental and/or non-manufacturing ones. For instance, the interviewees from manufacturing organizations were more concerned about the integration, structure, maturity, and documentation in their organizations.

5.2. Theoretical integration

In this section, we compare our findings with the literature. The social aspect of communication and collaboration seem to be more critical in the EA

development, which also has been emphasized in the literature by [16], who concluded that the next generation of the survived enterprises will be consist of people able to communicate efficiently and effectively. Our findings share commonalities and extend the list of findings of [22], who studied the factors that hinder effective collaboration in EA.

Based on our findings the technical aspect of communication and collaboration were influenced mostly by the external/social factors, such as political issues of the country. [14] confirms this finding of ours by highlighting that most of the EA development challenges are rarely technical but political, project management, and organizational. In EA development, governance is an essential element which empowers people, defines the structure and set communication rules and protocols [33]. The critical role of organizational structure as a part of EA governance in the success of EA development has been mentioned in many studies [20, 22]. Similarly, in this study, we also described how organizational structure could influence communication and collaboration in EA development.

A successful EA implementation requires constant communication and collaboration across different levels and functions in an organization [12]. The important role of culture in EA effectiveness from the communication point of view has been mentioned in [9], which also confirms our findings regarding the influence of culture in communication and collaboration in EA development. Establishing a shared understanding among EA stakeholders in enterprise transformation enables and supports collaborative efforts [1]. This is in line with our findings that adequate knowledge of EA among stakeholders can improve communication and collaboration by providing a shared understanding of EA and its benefits for the personnel.

Lack of EA effectiveness is partly because of the problematic interaction between architects and other stakeholders. Successful EA development requires planning, training, and communication along with other elements, and training should be carried out not only during development but also in the EA initiatives [5]. According to [15], lack of semantics between humans and systems to understand each other has caused communication problems in EA development and prevented enterprises from implementing integration and collaboration, which is also in line with our findings regarding the importance of intra-organizational integration in communication and collaboration in EA development. In this regard, to solve the communication problems [15] have proposed an ontology-based EA.

This study has brought new insights to the EA field by investigating the factors that influence communication and collaboration in EA development. Regarding the technical aspect of the identified factors, it was interesting to see how the external/social factors, such as political issues of the country with the world and change in government can significantly affect the IT infrastructure of the country as well as the organization and hinder communication and collaboration in EA. Although there are several studies stating the importance of culture [23], knowledge [20], and commitment and involvement [5] in EA development, however, no research has really paid attention to the factors in organizational behaviour science that influence the communication and collaboration in EA development. We identified factors, such as organizational climate, motivation, quality of work life, self-efficacy, and trust that have not been studied in the context of EA before. With this study, we extend the body of knowledge and introduces more factors that influence communication and collaboration in EA development.

5.3. Practical contribution

In the second round of data collection, emails were sent to the interviewees and their EA documents were requested to get additional information regarding communication and collaboration in EA development. We received nine different documents (329 pages) about the EA development project from five organizations (Cases A, G, I, K, and L).

Analyzing the documents, we identified approaches that the organizations' EA team had suggested in order to improve communication and collaboration in EA development. We categorized these approaches into social and technical. Regular meetings, internal wiki, e-collaborative services, seminars and webinars, online courses, and establishing a virtual EA team are the social approaches to improve communication and collaboration in EA development. Technical approaches including developing business intelligence, up to date and detail organizational documents, developing a common portal or a master page, improving reporting systems, establishing EA governance, and improving standardization. Based on the data from organizational documents this article proposes three suggestions in order to improve communication and collaboration in EA development: (1) high-level managers should show their support and commitment toward the project, (2) personnel should have enough information about the project, (3) considering rewards and compensations

for the employee who participates in the project to improve their motivation.

6. Conclusion

Focusing on the communication and collaboration in EA development, the paper presents different factors and their influence on communication and collaboration in EA development in various industries. Moreover, this study presents approaches and suggestions to improve communication and collaboration in EA development.

This study has some limitations, as it only investigated organizations from one country; therefore, a generalization of these results should be made with caution. Moreover, we interviewed only 20 individuals, and we received only nine EA-related documents from five out of 17 organizations. Therefore, we were not able to double-check the interviewees' statements with what had been actually documented during their EA development. The documents that we received from the five organizations (Cases A, G, I, K and L) revealed more information and increased our understanding of the process of EA development in those cases. Our findings partly converge with the existing literature but also increase the understanding of communication and collaboration in EA development. The findings of this study not only contribute to the field of EA but also can be useful in the context of complex ISs' projects in large enterprises. In turn, this study advances the theoretical and empirical understanding of factors influencing communication and collaboration in EA development. Future research in this area must investigate more deeply these organizational behaviour factors that influence communication and collaboration in EA development. This benefits both the academia and industry by providing an accurate and pragmatic perspective. Furthermore, we will continue this study by moving to the next level of coding (selective coding) in GT to identify the core category and generate a theory.

7. References

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