Towards inter-organizational Enterprise Architecture Management - Applicability of TOGAF 9.1 for Network Organizations

Completed Research Paper

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ABSTRACT

Network organizations and inter-organizational systems (IOS) have recently been the subjects of extensive research and practice. Various papers discuss technical issues as well as several complex business considerations and cultural issues. However, one interesting aspect of this context has only received adequate coverage so far, namely the ability of existing Enterprise Architecture Management (EAM) frameworks to address the diverse challenges of inter-organizational collaboration. The relevance of this question is grounded in the increasing significance of IOS and the insight that many organizations model their architecture using such frameworks. This paper addresses the question by firstly conducting a conceptual literature review in order to identify a set of challenges. An EAM framework was then chosen and its ability to address the challenges was evaluated. The chosen framework is The Open Group Architecture Framework (TOGAF) 9.1 and the analysis conducted with regard to the support of network organizations highlights which issues it deals with. TOGAF serves as a good basis to solve the challenges of "Process and Data Integration" and "Infrastructure and Application Integration". Other areas such as the "Organization of the Network Organization" need further support. Both the identification of challenges and the analysis of TOGAF assist academics and practitioners alike to identify further research topics as well as to find documentation related to inter-organizational problems in EAM.

Keywords

Network organization, Enterprise Architecture Management, inter-organizational challenges, TOGAF 9.1, EAM framework, inter-organizational EAM

INTRODUCTION

In today's volatile and global markets only those companies that can adapt to changed environmental conditions can prevail against competitors. These conditions include empowered customers (e.g. crowdsourcing and Open Innovation) who demand efficient and effective services that make loosely coupled organizations necessary. But other factors also encourage businesses to cooperate with diverse market participants to achieve a strong and wide-ranging network. Interestingly, such networks and their organization were considered important as early as 1994 when it was predicted that they would form the "next generation businesses": "but perhaps the firms of the future will be relatively small entities, organized around tightly woven core competencies [...]" (Jarvenpaa and Ives, 1994).

Given the importance of those networks the main aim and research question of this paper is to discover how a given Enterprise Architecture Management (EAM) framework can support an inter-organizational network. Therefore it is important to identify the main challenges that arise when establishing and running a network organization. Hence, in a first step common challenges must be identified according to the literature. The literature search is focusing on journals named in the AIS Senior Scholars' Basket of Journals in order to draw challenges of high relevance (scientific quality and audience). At least these most commonly named challenges must be solved by an EAM framework for an effective support. Therefore, in a second step these challenges must be

matched to an EAM framework. The analyzed framework, we are using in this paper, is The Open Group Architecture Framework (TOGAF). We have chosen TOGAF not only because it is one of the most extensive, widest and reliable EAM frameworks (e.g. Josey, 2011; Tang, Han, and Chen, 2004) but also because TOGAF itself mentions the potential in using an architecture framework in the case of multiple enterprises (The Open Group, 2009, Part I - Introduction). To that end, this paper presents the result of a conceptual literature review with the focus on network organizations and EAM.

The field has received a lot of attention as indicated by the high number of publications (e.g. Banker, Chang, and Kao, 2010; Kravets and Zimmermann, 2012; Liere, Vervest, Konsynski, and Holland, 2010) in the high number of relevant journals and conference proceedings. However, the question of how to use EAM frameworks in Business Ecosystems and especially in network organizations has not yet been sufficiently addressed and a review of existing literature has not yet been conducted.

The remainder of this paper is structured as follows: The next section defines both, network organizations and TOGAF, and the motivation of research in this domain. Section 3 presents the methodology for this review. Section 4 is the review of existing literature presenting the challenges identified. Section 5 analyzes how well the EAM framework TOGAF addresses the challenges. This paper concludes by presenting the results, a discussion about them and their limitations.

THEORETICAL BACKGROUND

This section defines a network organization and the importance of investigating issues involving it. A short introduction to Enterprise Architecture Management is also given and the framework of our choice, TOGAF, is motivated.

Network Organizations and Business Ecosystems

Network organizations can be classified as a subgroup of Business Ecosystems, which are defined as a group of companies "[...] that interacts and shares a set of dependencies as it produces the goods, technologies, and services customers need." (Zahra and Nambisan, 2012). In addition, a special characteristic of network organizations is them "[...] possessing some form of organization in terms of structure of membership, activities, definition of roles of the participants, and following a set of governance principles and rules" (Camarinha-Matos and Afsarmanesh, 2008). The topology of network organizations can have different forms as presented in (Camarinha-Matos and Afsarmanesh, 2008): Sequential processing is realized with a "supply chain" network in which partners are connected serially in a chain that follows the value-chain. A "star topology", in contrast, has a dominant member in the center of the network which the partners use as a communication hub or strategic center. Nonhierarchical organized partners form a "meshed network" in which they communicate in a peer-to-peer fashion.

Regardless of how the topology is designed, establishing such a network raises several questions, such as how to model and organize information flow, how to facilitate knowledge sharing or how to maintain intellectual property rights. These challenges can be approached by employing a set of rules for the participants. One popular method to establish a set of rules is to use a framework. "A framework is a generic design solution to a certain problem or a certain domain. The framework describes the different design elements involved in the solution, as well as their relations." (Oeberg, 1998). These kinds of reference models can help to solve the challenges of inter-organizational networks by providing best practices, an accepted mind set, universal applicability, reusability, and a standardized modeling language which provides a set of constructs and rules (Fettke and Loos, 2006, Chapter 1). Thus, a viable strategy is to use Enterprise Architecture Management frameworks in order to build and run a network organization. An EAM framework is a skeletal structure that defines suggested architectural artifacts and their relations to each other and typically involve "[...] a reference enterprise architecture, a methodology for planning and implementation, instruments and guidance for conceptualizing and documenting enterprise architecture, as well as a common vocabulary or glossary." (Basten and Brons, 2012)

The Open Group Architecture Framework (TOGAF)

According to Niemann (2005) Enterprise Architecture Management (EAM) is a process which leads to an Enterprise Architecture. It aims to combine both business- and IT-architecture to ultimately improve efficiency of IT and lower their costs. Several frameworks exists to facilitate EAM (like ARIS (Scheer, 1998), TOGAF (The Open Group, 2009), or the Zachmann-Framework (Zachman, 1987)). Generally, EAM frameworks document, plan and analyze both the existing Enterprise Architecture as well as the one that is to be built. To that end, the frameworks facilitate measures to uncover and reduce redundancy, increase consistency and leverage potential to reuse infrastructure.

Journal Name	Papers Analyzed	Relevant Papers
European Journal of Information Systems	30	13
Information Systems Journal	6	2
Information Systems Research	5	0
Journal of AIS	10	0
Journal of Information Technology	5	4
Journal of MIS	3	2
Journal of Strategic Information Systems	0	0
MIS Quarterly	9	3

Table 1: Number and sources of relevant papers

While many EAM frameworks exist, we concentrate on The Open Group Architecture Framework (TOGAF) for the following reasons. TOGAF 9.1 is an Enterprise Architecture Management framework (EAM) incrementally evolved by "The Open Group". It provides methods and supporting resources to improve business efficiency by building suitable Enterprise Architectures (The Open Group, 2009). First published in 1995, TOGAF is today available in version 9.1 and is "used by the world's leading organizations to improve business efficiency" and is also "the most prominent and reliable enterprise architecture standard" (Josey, 2011). It is still actively developed by over 400 members of The Open Group. The list of members includes big global companies like IBM and Oracle. We chose TOGAF not only because it is one of the widest and most extensive frameworks for EAM (Tang et al., 2004), but also because it is freely accessible and well documented. Additionally, TOGAF itself claims that "Large corporations and government agencies may comprise multiple enterprises, [...] and there is usually great potential for gain in the use of a common architecture framework" (The Open Group, 2009, Part I - Introduction), suggesting that TOGAF is conscious of the needs of network organizations.

METHODOLOGY

This section presents our research methods and shows our approach to answering the research question stated in the first section.

The general method used is the conceptual literature review referred to in (Webster and Watson, 2002). We searched articles and papers from the top journals according to the senior scholars' basket of journals provided by the Association for Information Systems (Members of the Senior Scholars Consortium, 2011) in order to locate the relevant literature and challenges with high impact.

For each journal, we searched its database using the keywords "Global Network Organization", "Challenge", "Global Network", "Architecture", "Inter-organizational". The number of results per journal suggests, that the *European Journal of Information Systems* is the most relevant in the research field of network organizations. The results are shown in table 1. The table shows the number of papers we analyzed per journal. Some of them either did not contain challenges or considered them too broadly. The final column shows the papers from which we were able to extract challenges.

The queries used are quite generic and did indeed identify many potentially interesting articles. Hence the journals were reviewed by at least two researchers to obtain all relevant articles. In total we classified 24 articles in 5 journals published between 1994 and 2012. The papers originate either in Central Europe or the USA and were all written in the English language. We reviewed the articles in the result set to identify the most named challenges and stopped after we could not obtain further unique ones. Therefore each analyzed article was read by at least two of the current researchers. Overall we found 37 differentiable challenges. In a creative teamwork we used the method of clustering (Rico, 1983) to categorize these challenges to make them manageable and to obtain a higher level view of domains. In total 6 categories arose by clustering the challenges regarding their characteristic and scope.

With these challenges in mind, we analyzed the relevant parts of the TOGAF 9.1 documentation (The Open Group, 2009) and matched them with the found challenges. Thus, the question of the applicability of TOGAF for network organization can be answered.

CHALLENGES

After reviewing and analyzing the relevant papers a variety of challenges were identified. The challenges and their categories are listed in table 2. On closer inspection the different challenges could be linked to similar goals, therefore, we grouped these items to form six types of challenges. These categories were established to have a better focus for analyzing TOGAF with regard to its applicability to network organizations. The categories will be described and the individual challenges for each category will be listed.

Governance

Governance is a vital and complex task even within a single organization. It is even more complex when maintaining a collaboration network consisting of several nodes. In our literature review we found multiple issues concerning governance.

According to Provan and Kenis (2008) there are three kinds of governance, namely "governance by participants", "governance by a lead organization" and "governance by a network administrative organization". Markus and Bui (2012) discuss the challenges these forms of governance face within inter-organizational coordination hubs, such as the investment challenge. Given that members of the network are legally autonomous, the question arises regarding which member of the network should conclude agreements with third parties such as service providers. Konsynski and Tiwana (2004) discuss the question of how decision rights apportionment is adjusted within inter-firm networks. They further discuss whether IT investments should follow the "big-bang" approach or whether they should be incremental. Risks and risk management, including potential conflict between members of the network, is treated in (Kumar and Dissel, 1996). Banker et al. (2010) discuss in their study the question of "Who owns the IT". IT decisions affect the firm's production as well as the economic outcome. In inter-organizational collaboration the party who owns the IT influences the decisions about the IT. Further important challenges are the distribution of intellectual property rights (Jarvenpaa and Ives, 1994) and management of shared controls (Liere et al., 2010) and responsibilities (Markus and Bui, 2012).

Infrastructure and Application Integration

A further challenge identified is how to link infrastructure and applications between the different business partners. Collins, Ketter, and Gini (2010) describe the need for the flexible integration of technical infrastructure to reach a temporary business goal. This includes a quick and dynamic connection to the network as well as a quick disconnection when the cooperation is complete. Agility of the network is essential for efficient interaction in network organizations and to react fast to new business opportunities. To be able to do that, the structure of the network must be well understood and the interfaces of the different network actors must be considered. Standardized data formats need to be established (Loebbecke, 2007). Daniel and White (2005) expand this challenge to the need for a quick linkage of information systems and technology between the business partners. With the implementation of an IOS network organizations are able to enhance their competitive advantage on the market (Rodon and Sese, 2010). This is especially relevant for supply chains and long-term cooperation and can support the objective to integrate processes or data exchange. In their study the authors identified four different developments for effective information system linkages: adoption of common ERP systems, web services, e-hubs or enterprise portals. These systems and technologies will allow more dynamic collaboration and should be considered in the strategic decision of managers.

Process and Data Integration

Challenges included in this category refer to the problem of managing business processes, information and data within network organizations. The business processes need to be integrated by the companies forming a network organization (Yen, Farhoomand, and Ng, 2004). Volkoff, Strong, and Elmes (2005) discuss more broadly the integration of processes and data with enterprise systems within different kinds of business relationships. Depending on the autonomy level and different functional areas between the organizations the handling of process integration (e.g. standardized processes and best practices) and data integration (e.g. shared databases of common standardized data) become a bigger challenge (Yen et al., 2004). But also data management, especially the validation of data, is considered as a challenge (Pramatari, Evgeniou, and Doukidis, 2009). As a related challenge the amount of data was identified as having too much data can impede using it (Gasson, 2006). Konsynski and Tiwana (2004) refer to process modularization and loose coupling as vital abilities of inter-firm networks. In addition they elaborate on the swarm intelligence and self-organizing capability of such networks.

Organization of the Network Organization

Another field of challenges we found is the organization of the network itself. That is, how fundamental questions such as how to enter and exit the network or how to build and manage inter-organizational connections are decided. Vervest, Preiss, Heck, and Pau (2004) describe smart business networks and their ability to quickly connect and disconnect. These issues of inter-organizational connections were also identified by Konsynski and Tiwana (2004) as mentioned in the previous paragraph.

Social Issues

In network organizations people with different cultural backgrounds and different corporate cultures have to work together. Effective communication and collaboration, even in geographically separated teams, are recognized challenges related to social issues. We found many articles stating problems such as understanding each other (Majchrzak, Rice, Malhotra, King, and Ba, 2000) or cultural diversity (Cousins, Robey, and Zigurs, 2007). Complex challenges such as the problem of sharing knowledge (Kotlarsky and Oshri, 2005) or developing trust between people (Cousins et al., 2007) are also typical issues for network organizations. Other challenges are the problem of equal access to information (Tsatsou, Elaluf-calderwood, and Liebenau, 2010) and the transformation of the social structure (Rodon and Sese, 2010) .

Strategy

We also found articles that referred to problems related to the strategic decisions a network organization has to make. These problems range from the question of integration with or separation from partners (Loebbecke, 2007) to balancing the tradeoffs between costs and benefits and protect core competencies (Wamba and Chatfield, 2009). In addition, the network organization itself needs an overall strategic concept to achieve operational alignment (Ibbott and Keefe, 2004) and efficiency (Malhotra, Gosain, and El Sawy, 2005).

CAPABILITY OF TOGAF 9.1 TO COPE WITH INTER-ORGANIZATIONAL CHALLENGES

The previous section presented six categories we grouped the 37 identified challenges into. The next step of our research question is to assess how an EAM framework supports the business to meet these challenges. We present our results regarding our research question and answer the question whether TOGAF supports network organizations. We illustrate the findings by means of a table, followed by an explanation of these findings.

Table 2 lists the challenges we found and the categories associated with each challenge. In the next column, the sources which referred to the challenge are listed. A sample sentence illustrates what the challenge actually means, and finally, a reference to a section in TOGAF, if any, is given, provided that section addresses the relevant problem. If a challenge is not addressed by TOGAF directly, but can be solved by general features of frameworks (like common mindset or language), the term “meta-level” is used.

Governance Concerning governance in networks, TOGAF provides support, mainly in part three of the ADM. Within this part, subsection 21 comprises guidelines on secure architectures. Subsection 24 is used to identify stakeholders, to analyze their influence and to model their relationship. It provides a holistic view of concerns, powers and communication flow. With a stakeholder analysis, all parties of the network will be involved in the planning of the architecture. Hence it helps architects to address the *shared control* challenge and, if performed thoroughly, provides answers to questions concerning the ownership of IT and decision making. Within the implementation of an architecture project, subsection 31 provides guidelines to identify, assess and mitigate risks. In addition to this, risk management is also treated in part two 16.4.3 (Manage Risks). Hence TOGAF is suitable for *taking care of points of failure*.

Challenge	Source	Sample	TO-GAF
Governance			
Ownership of IT	(Banker et al., 2010)	"However, the way an organization's own IT can affect the organization with which it is collaborating remains an open question." (Banker et al., 2010)	Part III 24
Selection of investment type	(Markus and Bui, 2012; Provan and Kenis, 2008)	"Because they are based on technology, ICHs involve myriad issues that require legal formalization: multiyear financial commitments to IT products and services providers (e.g., hardware leasing agreements, software licenses, support relationships).' '(Markus and Bui, 2012)	
Decision rights apportionment	(Konsynski and Tiwana, 2004)	"As information access migrates, so does the interest in allocation of decision rights and decision authorities." (Konsynski and Tiwana, 2004)	Part III 24
Management of shared control	(Liere et al., 2010)	"The pervasive use of information network technology such as the Internet makes 'process linking' and 'shared control' key challenges for effective networked information systems." (Liere et al., 2010)	Part III 24
Precaution against failures	(Arnold et al., 2010; Kumar and Dissel, 1996; Pramatari et al., 2009)	"For large IT systems connecting many other systems (possibly from many organisations), the points of possible failures increase exponentially, requiring extra technical and management care before broader roll-out." (Pramatari et al., 2009)	Part II 16.4.3, Part III 21, Part III 31
Warranty, liability, responsibility	(Markus and Bui, 2012)	"The centrality of technology in ICHs raises issues of liability and intellectual property rights, for which formal governance can provide protection." (Markus and Bui, 2012)	
Intellectual property rights	(Jarvenpaa and Ives, 1994)	"Creating the right values, norms, and behaviors regarding information sharing is one of the great challenges facing the transformation to the network form." (Jarvenpaa and Ives, 1994)	
Infrastructure and Application Integration			
Establishment of standardized data formats	(Loebbecke, 2007)	"In this research, content provision beyond the necessities of EDI required industry-wide harmonization of data standards for various output formats." (Loebbecke, 2007)	Part II 10.4.1, 10.4.2, 11.4.1, Part III 29
Implementation of IOS	(Rodon and Sese, 2010)	"[. . .] implementation of inter-organizational information systems (IOIS) poses many challenges to IOIS management in terms of adoption and use." (Rodon and Sese, 2010)	Part II 10, 11.4
IOS linking	(Daniel and White, 2005)	"The ability to form appropriate inter-organisational information systems linkages has been recognised as a key requirement for the effective operation of such relationships." (Daniel and White, 2005)	Part II 15
Flexible integration of technical infrastructure	(Collins et al., 2010)	"[. . .] requires flexible integration of technical infrastructure on an as-needed basis to support both business processes and managerial decisions." (Collins et al., 2010)	Part III 22

Challenge	Source	Sample	TO-GAF
Process and Data Integration			
Process standardization	(Rodon and Sese, 2010; Volkoff et al., 2005)	"The proliferation of inter-organizational business data and process standardization initiatives (e.g. CIDX, RosettaNet, ebXML) and the subsequent implementation of inter-organizational information systems (IOIS) (e.g. Elemica, E2open, Inttra) poses many challenges to IOIS management in terms of adoption and use." (Rodon and Sese, 2010)	Part II, 7.4
Process linking	(Liere et al., 2010)	"The pervasive use of information network technology such as the Internet makes 'process linking' and 'shared control' key challenges for effective networked information systems." (Liere et al., 2010)	Part II 8.2.3, 8.4
Process coupling	(Konsynski and Tiwana, 2004)	"Effective market practice includes attention to loose coupling and relevant modularization, a separation of knowledge sharing from process roles, increased visibility of operations across partnering organization, heterogeneity retention, and a self-organizing swarm architecture." (Konsynski and Tiwana, 2004)	Part II 8.2.3, 8.4
Process modularization	(Konsynski and Tiwana, 2004)	"Thus, loose coupling and process modularization strike a balance between the individuality and autonomy of network member firms and the ethic of the collective network." (Konsynski and Tiwana, 2004).	Part II, 8.4
Integration of business processes	(Arnold et al., 2010; Yen et al., 2004)	"Connecting the two companies required integration not only of technical systems but also of business processes." (Yen et al., 2004)	Part II, 8.4
Integration of process and data	(Daniel and White, 2005; Volkoff et al., 2005)	"[. . .] while invariably referring to integration of both processes and data as a core characteristic, rarely defines it." (Volkoff et al., 2005)	Part III, 29
Proliferation of inter-organizational business data	(Rodon and Sese, 2010)	"The proliferation of inter-organizational business data and process standardization initiatives [. . .] poses many challenges to IOIS management in terms of adoption and use." (Rodon and Sese, 2010)	Part III, 29
Data management and validation	(Pramatari et al., 2009)	"Efficient data management and validation mechanisms are crucial to ensure information quality which in turn is crucial for instilling trust in people towards any decision support system." (Pramatari et al., 2009)	Part II 10.2.1.1, Part III, 29
Avoidance of information overflow	(Collins et al., 2010; Gasson, 2006)	"[. . .] they produced too much information to be captured on a flowchart." (Gasson, 2006)	

Challenge	Source	Sample	TO-GAF
Organization of the Network Organization			
Entering and exiting the network	(Collins et al., 2010; Liere et al., 2010)	"[…] in highly dynamic business networks the capability to quickly connect network actors (businesses) is essential to enable fast response times and greater variety when new opportunities arise. […] the need for a 'quick disconnect' when the business transaction is over, otherwise open network connections can create undesirable information flows." (Collins et al., 2010)	
Inter-organizational connections	(Arnold et al., 2010; Konsynski and Tiwana, 2004; Vervest et al., 2004)	"[…] focus on improving intraorganizational connections through tightly coupled information systems is critical to agility and performance." (Arnold et al., 2010)	
Social Issues			
Common understanding	(Majchrzak et al., 2000)	"The challenge of sharing knowledge or simply understanding each other." (Majchrzak et al., 2000)	meta-level
Knowledge sharing	(Arnold et al., 2010; Kotlarsky and Oshri, 2005; Majchrzak et al., 2000)	"The importance of knowledge sharing for collaborative work has already been established in past studies." (Kotlarsky and Oshri, 2005)	meta-level
Equal access to information	(Tsatsou et al., 2010)	"Trust in knowledge is a measure of confidence expressed in terms of symmetric access to information." (Tsatsou et al., 2010)	
Development of trust	(Cousins et al., 2007)	"Several studies of virtual teamwork show that it is difficult for distributed team members with no prior relationships to develop trust." (Cousins et al., 2007)	meta-level
Cultural diversity and conformity	(Cousins et al., 2007)	"Cultural differences included pace of life, cordiality, and manners." (Cousins et al., 2007)	meta-level
Effective and efficient inter-firm communication	(Konsynski and Tiwana, 2004)	"The demand for efficient and effective inter-firm coordination is no longer a desired condition, but essential for competitive position." (Konsynski and Tiwana, 2004)	meta-level
Communication between geographically separated teams	(Warkentin and Beranek, 1999)	"These teams are geographically distributed and communicate via computer-mediated communication systems (CMCS), and may never or rarely meet face-to-face." (Warkentin and Beranek, 1999)	
Transformation of social structure	(Rodon and Sese, 2010)	"We contend that because an IOIS may transform the social structure of the inter-organizational context […] so certain contradictions between aspects of the old and the new social structure may emerge." (Rodon and Sese, 2010)	meta-level
Exchange of collaborative information	(Arnold et al., 2010; Malhotra et al., 2005)	"Instead of focusing on and making sense of rich information exchange, enterprises involved in cruncher configurations may be preoccupied with the exchange of coordination information. Consequently, they fail to sense the changing market environment due to lack of rich information exchange." (Malhotra et al., 2005)	
Sticky socialization	(Malhotra et al., 2005)	"A significant challenge is that enterprises, over time, develop sticky socialization patterns with entrenched partners and these may be very resistant to change […], making them vulnerable to opportunistic behavior." (Malhotra et al., 2005)	meta-level

Challenge	Source	Sample	TOGAF
Trust between IOS	(Ibbott and Keefe, 2004)	"Trust has been shown by many researchers to be an important factor in the success of interorganizational systems (IOS)." (Ibbott and Keefe, 2004)	meta-level
Strategy			
Integration vs. separation	(Loebbecke, 2007)	"Obviously, a major challenge was the trade-off between competence-based islands and integrated solutions." (Loebbecke, 2007)	
Balance of benefits and costs at the firm level	(Malhotra et al., 2005; Wamba and Chatfield, 2009)	"Costs for change efforts may be borne disproportionately by the weaker partners." (Malhotra et al., 2005)	Part II 14.4.2, 14.4.4
Achievement of operational alignment	(Dreiling et al., 2006; Ibbott and Keefe, 2004)	"Although there is an established body of research on alignment, there remains a considerable lack of research on actual methods that help achieving operational alignment within the field of Information Systems." (Dreiling et al., 2006)	Part II 8
Achievement of operational efficiency	(Malhotra et al., 2005)	"Collaborative information (broad ranging and high quality) appears to be instrumental in the creation of new knowledge for the receiving organization, while coordination information is largely related to the achievement of operational efficiency between supply chain partners." (Malhotra et al., 2005)	

Table 2: Inter-organizational challenges and matching TOGAF sections

Infrastructure and Application Integration The four challenges identified within this category are addresses by TOGAF. *Implementation of IOS* and *Establishing Standardized Data Formats* are handled likewise in part two of the ADM, namely in phases C and G. Divided into two parts "Data Architecture" and "Application Architecture" phase C provides support to develop the target data and information structure aligned to the business architecture explained in phase B. By steps 10.4.1 respectively 11.4.1 (Select Reference Models, Viewpoints, and Tools) IT architects are encouraged to choose models and tools which are suitable to identify data and application resources in a holistic manner. Developing a baseline description of the current data architecture in step 10.4.2 (Develop Baseline Data Architecture Description) helps to define the goals of the future architecture. This should take into account the concerns of all stakeholders, i.e. all members of the network. Having established such a baseline makes it possible to evolve a common future architecture by conducting step 10.4.3 (Develop Target Data Architecture Description). The same activities are described for the application architecture in 11.4.2 (Develop Baseline Application Architecture Description) and 11.4.3 (Develop Target Application Architecture Description). Within these steps building blocks are defined to an extent that stakeholder concerns are satisfied. To ensure this, step 10.4.7 respectively 11.4.7 (Conduct Formal Stakeholder Review) recommends the final review by all stakeholders. That means a final acceptance is achieved. *Flexible Integration of Technical Infrastructure* are treated in Part three of the ADM. It provides guidelines and techniques that should be used to conduct the ADM cycle. In step 22 (Using TOGAF to define and Govern SOAs) technical standards and guidelines are presented to evolve a service oriented architecture (SOA). In the first step SOA entities and its interdependencies are identified. This is done to outline business process relationships and provide a baseline for the integration of business processes. Afterwards technical issues and modeling techniques are demonstrated. Therefore we can state, that this part helps enterprises to integrate its infrastructure.

Process and Data Integration Several challenges within this section are addressed in TOGAF 9.1 by the Architecture Development Method (ADM) cycle. Initially phase A is used to define the scope of the architecture development. It helps to define stakeholders and different viewpoints as well as motivate business architects to evolve a common vision. By performing steps 7.4.2 (Identify Stakeholders, Concerns, and Business Requirements), 7.4.3 (Confirm and Elaborate Business Goals, Business Drivers, and Constraints) and 7.4.10 (Identify the Business Transformation Risks and Mitigation Activities), network organizations can identify their different stakeholders (in our context these are nodes within the network) and provide a holistic view towards the diverse concerns the collaboration raises. TOGAF advises that the business goals and strategy be defined within the organization as well as

constraints that must be dealt with. Subsequently, phase B supports organizations to assemble its vision and to develop the target business architecture by presenting an approach towards business process modeling. The architecture defined then describes on a higher level how an enterprise has to operate to follow its strategy and to achieve business goals. Steps that should be considered in this context are 8.4.1 (Select Reference Models, Viewpoints, and Tools), 8.4.3 (Develop Target Business Architecture Description) and 8.4.7 (Conduct Formal Stakeholder Review). By defining boundaries and interdependencies between services and functions in this way, an enterprise can encourage integration of processes between its organizations. With a formal stakeholder review (step 8.4.7) the acceptance of such business architecture is ensured within the complete network. By analyzing this phases we can deduce, that TOGAF addresses the challenges *Process Linking, Process Coupling, Process Modularization, Integrating Business Processes*.

In respect of *data management* and *proliferation of inter-organizational business data*, part III, 29 (Interoperability Requirements) provides guidelines to define and establish interoperability to achieve these goals. Enterprise architects should first categorize and define interoperability of different levels (e.g. business, information, technical) to achieve a common language. Following interoperability requirements can be modeled, for instance by a Business Information Interoperability Matrix. They should also be refined to determine the degree of interoperability.

Organization of the Network Organization TOGAF provides no specific instructions for the organization of the network organization. Using the meta-level of a framework, organizations can identify standards and a common language which can lead to an easier connection in the network. However TOGAF does not provide specific instructions or methods on how to enter and exit the network or how to manage the interorganizational connections. Further research should be conducted to analyze whether TOGAF can be extended to include this or whether other frameworks exist, which can help to address the challenge of organizing the network organization.

Social Issues As TOGAF is a framework which provides a common understanding and language for diverse members, Social Issues, which accompany collaboration between network organizations, are addressed on a meta-level. In TOGAF, for example, a shared vocabulary and structure is provided by the *Architecture Repository*. But in fact, this is not a specific advantage of TOGAF, as reference models and frameworks help to create a common mind-set and language in general. We call it the meta-level of TOGAF. Specific problems like *communication between geographically separated teams* or *establishment of equal access to information* are not addressed by TOGAF. Social issues are quite an interesting research topic and raise further questions. We will not consider them in our examination, since our scope is limited to TOGAF's specific capabilities.

Strategy Phase F of the ADM is about transferring the baseline architecture to the new evolved target architecture. This is done incrementally by processing work packages. In order to prioritize such work packages, step 14.4.2 (Assign a Business Value to Each Work Package) helps to estimate the business value of each package in the project. These values can then be used in step 14.4.4 (Prioritize the Migration Projects through the Conduct of a Cost/Benefit Assessment and Risk Validation) to evolve a migration plan based on benefit. In our strategic challenges, we identified the necessity to *balance trade-offs between benefits and costs at the firm level*. TOGAF helps businesses to address this requirement.

RESULT

Using the information obtained when we matched challenges to TOGAF in the previous section, this section condenses the information into a more concise result.

The information obtained during our research suggests that TOGAF 9.1 is applicable in some areas of the network challenges while at the same time being inappropriate in others. Since TOGAF is an EAM framework, it is not surprising that it supports enterprises with respect to *Process and Data Integration* and *Infrastructure and Application integration*. Process steps as well as guidelines and techniques are presented to support the development of a common architecture. Regarding *Governance*, TOGAF provides a holistic approach towards stakeholder management. It is therefore suited to address challenges about decision rights and shared control. Challenges in the category *Strategy* are addressed by phase B of the ADM and in particular by phase F.

However, our analysis of the TOGAF documentation shows that it does not provide solutions regarding the *Organization of the Network Organization*. Having established such a network, the framework does not provide support of managing inter-organizational connections, either. Likewise, there are no guidelines or approaches on how to establish TOGAF itself in an enterprise, let alone in diverse enterprises of a complex network. Since these are severe issues in inter-organizational networks, one can state that TOGAF

must be improved in this area to fulfill its own aspiration. Social Issues, especially the inter-organizational communication and collaboration, are only supported by TOGAF on a meta-level. A framework can give a common language and a set of rules which members of the network can follow. This is subject to further research as well as to practitioners such as the members of The Open Group.

LIMITATIONS

We assume the methodology presented in this paper is sufficiently straight forward to analyze different EAM frameworks, but we are aware that our study is, as all studies are, subject to limitations. Firstly, the results presented in this paper are obtained from a rather limited review with 24 papers analyzed. The search terms were very generic and returned a long list of results out of which the papers mentioning challenges in network organizations needed to be found. While we argue that finding a list of challenges does not require an extensive review, it is clear to us that the more papers are analyzed, the better will be the picture of the challenges in network organizations. In addition to that, our search was confined to top journals and did not include conferences proceedings. We also did not consider challenges found outside the scientific community despite the fact that TOGAF is well established in many big companies. So a practical view on gaps of TOGAF is missing. It remains open whether searching more broadly will further enhance the set of challenges. Furthermore, the challenges of network organizations could be different to challenges, which apply to Business Ecosystems whose challenges we expect to be more on the basis of informal relationships. Secondly, the term "challenge" may not be used consistently among different authors. Thus, different authors may come to a different conclusion than us after reviewing the papers mentioned in this literature review. Therefore, we analyzed each paper by at least two persons to mitigate this risk. Finally, we wish to clarify, that our conclusions are the result of our interpretations. However, we argue that frameworks are always subject to interpretation due to their generic character.

CONCLUSION

This paper presented the results of our conceptual literature review relating to challenges in network organizations. We searched articles in the most relevant journals using broad keywords to find a range of challenges related to network organizations. From these results, we analyzed 24 papers and found 37 significant challenges which we grouped into six categories. Relevant parts of TOGAF were analyzed and we attempted to assess out how well TOGAF handles each challenge.

Our result suggests that TOGAF 9.1 provides support in the area of *Process and Data Integration* and *Infrastructure and Application Integration*. With its generic but holistic view on different stakeholder viewpoints, it helps to model common business processes and to integrate mutual IT with standardized data architecture. It also addresses several challenges in the category of *Governance*. In Identifying stakeholder responsibilities and control functions, TOGAF 9.1 helps to assess the risk within network nodes. It provides an approach towards decision rights apportionment and treats the question regarding intellectual property rights. At the strategy level, TOGAF 9.1 helps to balance tradeoffs between benefits and costs by providing methods to measure the value of work packages.

However, our results suggest that TOGAF 9.1 is not well suited to manage network organizations regarding the organization of the network and its operating business. We did not find any relevant parts of the framework which provide solutions regarding management of the inter-organizational connections of the network or how and by whom the framework itself is enforced. *Social Issue* challenges are only addressed on a meta-level (by providing a common mindset and language). Nevertheless, TOGAF 9.1 provides adjuvant advices for network organizations.

Consequently, further research is required to evolve extensions to TOGAF 9.1 which will address these challenges and establish an inter-organizational EAM. It should also to be assessed whether other EAM frameworks, such as the Zachman-Framework or ARIS, handle network organizations and Business Ecosystems well. Based on our findings, however, our hypothesis is that other EAM frameworks are also too narrow in their scope and that they could take advantage of improvements in the area of facilitating Business Ecosystems. If so, both researchers and practitioners will have to agree upon a suitable extension of these frameworks. In addition to that, the enforcement of EAM frameworks and EAM itself in networks organization is an open research question. Therefore, this paper provides a substantial step to establish EAM and their frameworks in network organizations and is a starting point for future research.

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