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Enterprise Architecture Challenges and Opportunities in Higher Education Institutions: A Case Study from Saudi Arabia*

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Abstract

Enterprise Architecture (EA) practices are accepted worldwide to enable digital transformation and deal with the complexity of business and IT alignment in socio-technical organizations. It is a growing trend, and research efforts are devoted to facilitating its effective adoption in public and private organizations. However, little EA research has focused on its implementation in the higher education sector. This interpretive case study paper highlights the challenges Al-Baha University -a higher education institution from Saudi Arabia- faced while developing its EA. Al-Baha University is the first Saudi university to develop its EA according to the standards and regulations of the Digital Government Authority in Saudi Arabia. Solutions and recommendations to overcome these challenges are presented to provide insights to local and international universities on how they can deal with the challenges associated with EA implementations in this sector. These insights would also assist other organizations to ensure more effective and sustainable digital transformation journeys from an EA perspective.

Keywords: enterprise architecture; digital transformation; higher education

Introduction

Investments in information technologies and systems in Higher Education Institutions (HEIs) are increasing enormously. They are being made to acquire stakeholders' satisfaction, competitive advantage, institutional performance, financial stability, sustainability, innovation, teaching quality, and better ranking (Tsai et al, 2020; Teixeira et al, 2021). The penetration of these technologies in every aspect of HEIs has pushed for holistic digital transformation projects. Benavides et al (2020) conducted a systematic literature review of digital transformation in HEIs. They found that it is still an emerging field and that further research efforts are required to deal with the rapid changes in technology diffusion in this sector. They highlight the complex relationships between the actors involved in this technologically supported domain, which require further approaches to deal with a holistic transformation in HEIs. According to Durão et al (2019), digital transformation in organizations, including HEIs, is not about enhancing business processes and innovating new ones. Still, it goes beyond to include fundamental changes in organizational procedures and capacity.

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The alignment of business capabilities and IT resources in this sector has received little attention in the IT alignment literature compared to many other public and private sectors (Alghamdi and Sun, 2017). The assessment and realization of the added value of IT in this sector has also been challenging. Some challenging issues are associated with the actors, such as students, lecturers, and employees (Kebritchi et al, 2017). Others are related to the absence of effective policies, the lack of IT professionals (Ejiaku, 2014), and the different implementation and utilization strategies of IT projects from one HEI to another (Cloete, 2017).

Enterprise Architecture (EA) provides a holistic view of an organization, emphasizing its transformation through better alignment of business and IT to achieve strategic mission and objectives. Gartner Group (2008) defines EA as "the process of translating business vision and strategy into effective enterprise change by creating, communicating, and improving key requirements, principles, and models that describe the enterprise's future state and enable its evolution." This process is described to be endless and complicated, and its implementation is multidisciplinary (Tambouris et al, 2012). It is one of the approaches discussed in the literature and practice to provide holistic digital transformation planning in organizations, and it has been implemented in several sectors, including HEIs (Benavides et al, 2020).

The Adoption of EA practices and frameworks in HEIs has gained worldwide attention in the last decade (Bourmpoulias and Tarabanis, 2020). Benavides et al (2020) reviewed and analyzed forty digital transformation studies in HEI between 1980 and 2019 and revealed that EA is one of the digital transformation implementation methods adopted in this sector. Similarly, Meutia et al (2022) examine fifteen studies that are carried out between 2012 and 2022, which adopt TOGAF and Zachman frameworks in HEIs for ten reasons that include better planning of IT infrastructure, ensuring effective integration of systems, creating business strategy, reducing IT costs and disparities in systems development, ensuring effectiveness and efficiency in IT implementation, increasing the competitiveness of technology adoption, supporting business needs, increasing systems' performance, and achieving overall mission and objectives of HEIs. Bourmpoulias and Tarabanis (2020) reviewed more than sixty papers on EA and revealed that there is still a gap in the implementation and assessment of EA, even in advanced education systems. They also point out that EA development focuses more on the HE than primary and secondary education. They stress that EA practices have become more critical in HEIs in recent years due to their ability to provide a strategic framework that assists in better planning, business, and IT alignment and achieving strategic missions and goals.

Digital Transformation and EA in Saudi Arabia

During the last twenty years, the government of Saudi Arabia has invested massively in information technologies and digital transformation projects. The size of this investment in three years only, from 2022 to 2025, is expected to reach 25 billion dollars, according to statistics from the Digital Government Authority (DGA, 2023b). Such massive investments in digital technologies align with other remarkable initiatives and mega projects that the Kingdom of Saudi Arabia has been carrying out in recent years, all contributing towards achieving the government's strategic Vision 2030. Published statistics from (DGA, 2023b) show that Saudi Arabia is ranked second worldwide in digital competitiveness by the European Centre for Digital Competitiveness, the eleventh among the G20 for digital governance by the Japanese WASEDA, and the first in ESCWA indicator for the availability of digital services. Saudi Arabia's eGov Development Index (EGDI) ranking jumped from 105 in 2003 to 31 in 2022, with a goal to be among the top ten countries by 2030.

The DGA in Saudi Arabia is taking significant steps toward ensuring effective digital transformation implementation across different sectors and organizations. Besides managing all national digital services and change management initiatives, DGA works cooperatively with other governmental agencies to set digital transformation standards and regulations that all agencies must follow to reach a mature level of digitization. One of the regulations mandates all government agencies to establish the development of EA through the National Overall Reference Architecture (NORA) as an enabler of digital transformation. Through rigorous evaluation of the successful implementation of NORA methodology, only thirty-two agencies, since 2018, have been able to achieve EA accreditation from DGA across different sectors. Al-Baha University is the first Saudi HEI and one of these agencies that was able to accomplish this mission.

EA and NORA as defined by DGA

DGA defines EA as "a practice and a discipline for studying the current state of a government entity and creating a roadmap for transition to the target architecture to achieve alignment between the business (services and processes), information technology (data, applications, and infrastructure) and strategic objectives of the government entity" (DGA, 2023a). It is a comprehensive definition that covers the main components, the lifecycle, and the purpose of EA implementation, as described in Bernard (2006). Following the principles of the well-known EA framework of TOGAF, DGA develops the National Overall Reference Architecture (NORA). It was developed in 2016 as part of the DGA's efforts to achieve the objectives of Vision 2030 for Saudi Arabia's government sector. Following NORA methodology to develop EA would ensure that organizations in Saudi Arabia are aligned with the National Enterprise Architecture (NEA) and national action plans, facilitating a unified governmental approach towards EA practices.

The National Enterprise Architecture (NEA) is defined as "the national reference for implementing the enterprise architecture in the government sector through unified national practices, standards, methodologies, and controls to support the digital transformation in government entities to reach an integrated smart government with a unified national vision putting the citizens first" (DGA, 2023c). NORA, as one of these methodologies, assists government agencies in Saudi Arabia in developing their enterprise architecture in an accessible manner following ten main stages that guide and ensure governance in application and compatibility with government work (DGA, 2023d).

It aims to smoothly address the lack of standardization, integration, quality, and misalignment of business and IT components through systematic processes and recommendations. It also aims to give organizations an overall view of their current capabilities, allowing for better understanding, planning, and utilization of their future state. DGA offers a 376-page handbook that guides the development of EA through NORA. Each stage in the handbook summarizes its purpose and expected outcomes. Then, a detailed description of the stage with real examples is offered. The NEA team in the DGA is also reachable through multiple channels, providing support and recommendations throughout the development of EA.

Organizations in Saudi Arabia are being pushed to establish EA practices for two main reasons. First, these practices are mandatory as part of the government's digital transformation roadmap, as previously mentioned, and DGA conducts an annual review of the progress of all government agencies in the kingdom. Second, they become mandatory by the Government Expenditure and Projects Efficiency Authority, which requires all upcoming requested projects to be planned according to the outcomes of implementing EA practices.

Al-Baha University

A large segment of the annual budget in Saudi Arabia is allocated to the education sector (Abdulrahim and Mabrouk, 2020). Al-Baha University is one of twenty-nine public HEIs funded by Saudi Arabia's government. It was established in late 2006. This eighteen-year-old university spans six geographical areas covering the vast region of Al-Baha province (11,000 square km), southwest of Saudi Arabia. Its current enrolment is nearly 18000 students, with 1536 academic staff and 776 employees. It has 16 faculties, offering 9 programs for higher diplomas, 28 undergraduate programs, and 17 master programs. The number of students is increasing annually from less than 14000 in 2008 to nearly 18000 in 2023. The working team in the IT department consists of 81 males and 14 females.

Planning for the EA project at Al-Baha University started in 2016 as a mega project that would help the university develop its EA and significantly transform its provided eservices through a well-established platform that adds value to its users. After many discussions, presentations, and workshops, the top management was convinced to accept the project in 2019. Although Covid-19 has interrupted the project's progress, we have managed with the assessors from the (DGA) to complete the development of the EA in three years. In February 2023, Al-Baha University was awarded the Enterprise Architecture Certificate that is valid for two years from the DGA.

Research Methodology

This case study paper follows an interpretive research approach described by Walsham (2006). Walsham states that conducting fieldwork is essential in any interpretive study. The author is heavily involved in carrying out and monitoring the development of EA at Al-Baha University. Walsham describes the style of this involvement as an 'involved researcher' who is trying to change things in the best possible way they feel. Unlike the 'outside researcher,' the involved researcher can provide significant feedback to the project participants. An involved researcher also has

observation and participation that provide in-depth access to the complexity of issues under study, which may not be possible in interview-only studies. The in-depth involvement of the researcher in the EA development at Al-Baha University, supported by the literature, allows for the sharing of the challenges that may hinder the sustainability of the digital transformation journey in organizations.

Developing the EA at Al-Baha University was not straightforward, and highlighting the challenges and opportunities can lead to a better future understanding and implementation of EA practices in other HEIs and organizations. Therefore, this paper focuses on the following research question.

> ***Q1. What are the challenges that Al-Baha University faces in developing its Enterprise Architecture (EA), and what are the possible solutions that it considers to overcome them?***

The rest of the paper is organized as follows: a list of the challenges is introduced with possible solutions and recommendations to overcome. Then, these challenges are discussed in light of previous issues pointed out in previous EA practices. Then, a conclusion is drawn highlighting the complexity of EA practices and the importance of avoiding the challenges associated with its implementation to facilitate the digital transformation journey in organizations.

Challenges face EA development

It takes Al-Baha University three years to develop and then realize the outcomes of its EA practices. It is the minimum required timeframe by DGA to accomplish the ten stages of NORA methodology and to show some real-life practices as the outcomes of its implementation. Numerous hurdles were overcome throughout this lengthy and complex project, and resolutions were found to achieve the objectives. Being one of the EA leading team at Al-Baha University until its successful accomplishment, the author would like to share these challenges and their identified solutions, and they are organized in Table 1 to facilitate its reading.

Table 1. The challenges and identified possible solutions associated with EA development at Al-Baha University

	Challenge	Possible solutions
1	Lack of Support from top management	have them involved in high-level awareness workshops early before starting the project. We have invited a specialized team from DGA to provide a presentation to top management at Al-Baha University about the importance of Enterprise Architecture practices and their significant promising impacts on the university. Show them real-life examples of the valuable impacts of EA practices on their daily and long-term work.
2	Lack of stakeholders' involvement	You must initially specify internal stakeholders at the university and then find the most suitable way to approach each to cooperate in this large project. Previous studies show all possible stakeholders who may affect or be affected by the digital transformation practices in HE (Benavides et al, 2020). Design and implement awareness workshops, focusing on key stakeholders who will affect or be affected by the EA practices. Design and implement an awareness campaign that spreads key messages about EA, such as what it is and its benefits. Having good social skills is essential in approaching departments at the university. Employees are usually busy and pressured. Remember, it is a prerequisite to understand stakeholders' challenges to devise a relevant solution for enterprise architects (Nakakawa et al, 2010).
3	Poor awareness of the benefits of EA in the middle of the project	Increase awareness workshops. Use different channels to spread awareness messages. Deliver awareness workshops to key managers who would influence others. Do not forget to implement your EA awareness plan, as you may not have time for it once the EA tasks are overloaded.

4	Lack of qualified EA team	If possible, recruit experts in EA. This would save you precious time. Train and qualify the current team. Gradual training works. You may push some team members to get more professional training while the remaining team continues due tasks. Make the most use of the current team. Avoid utilizing IT people only to do all EA tasks; the whole project will then be IT-oriented! The team must be aware of related resources that guide the development of the EA at the institution. For instance, they must know the details of the institution's strategic plan and NORA methodology very well. Once the team is chosen, establish working plans and priorities and have the team agree on communication channels. To achieve the long-term and intense requirements of the EA development project, a high level of commitment, transparency, and cooperation is required and expected from the team members. Avoid changing the team members once the outcomes are positive.
5	Which development approach to follow	The EA's top-down and bottom-up development approach works smoothly with us, but you may prefer either based on your scope and goal of EA.
6	Resistance to change	Have stakeholders involved in planning and re-engineering business processes to meet strategic goals. Consider their input and opinions. Activate change management plan. Activate supporting regulations by top management. Get in touch with each department (in peacemaker mode) and point out the positive aspects of EA and the value of its implementation in their daily work. You may need to use the top management support card with departments that are not cooperating, but make it the last choice.
7	Low budget	Ask for funds from top management. It is the only option in such a public government institution, and it works once they are convinced.
8	Need for accurate data	Support any initiative to enhance current data at the institution. Continuous updates of generated artefacts.
9	Management of the working team	Set up an internal platform to manage the whole project (team, tasks, learning resources, and generated artefacts). You should clearly specify the scope of the EA at your institution based on the allocated budget, time, and resources and then manage the tasks accordingly.
10	EA tool	Procure a suitable tool that supports your long-term, transformational project according to your EA scope and available budget. Gartner (2023) provides a comparative report of 15 EA tools from which you can choose. Talk to a reliable provider. They may offer access to a free proof-of-concept version of their EA tool until you allocate a budget. Use an open-source EA tool such as ArchiMate.
11	Continuous governance	Ensure the influential role of the governance committee as EA outcomes would affect the whole institution. Ensure and follow accountability and responsibility for specified tasks with the EA team. Revisit the artefacts and update them accordingly. Have the team trained very well on how to effectively use the EA tool. Prepare a set of templates to help you standardize how you analyze each department's data and business processes. Ensure continuous mappings between your institution's reference architectures are carried out regularly.

12	Structure of EA office	Ensure that the EA office is linked to or reports to decision-makers and strategy planners at your institution. Being under less authorized departments would negatively affect its transformational role.
13	Legacy systems in the IT department	Find suitable ways to integrate these systems with new systems to achieve organizational goals. Ensure that any proposed IT projects aim to close the gaps identified through the development of the EA.

Discussion

Enterprise architecture aims to provide organizations with agility to cope with changes, better business-aligned IT, and improved decision-making. However, the distinctive nature of HEIs represents a challenge to effective EA implementation and alignment of business capabilities with IT resources. EA as an enabler of digital transformation has been studied in HEIs from social, organizational, and technological perspectives (Benavides et al, 2020). In these institutions, the culture differs and even differs occasionally from one school to another within the same institution (Pirani and Salaway, 2004). Decision-making is also shared, and courses and research activities are delivered independently. This puts a lot of pressure on enterprise architects to deal with the peculiar nature of these institutions. However, having a standardized approach to developing EA in organizations in one country or across one sector would facilitate its development. This is what the DGA in Saudi Arabia, through NORA, has done by standardizing the approach towards EA development across the government agencies. According to Simon et al (2013), the lack of a shared understanding of EA, and the inconsistency of some available methodologies are among the challenges that hinder the successful implementation of EA practices. We do not only support a unified approach to EA practices across sectors but also support having a national EA board committee to discuss the challenges, opportunities, and advancements of its practices. This would facilitate the successful future implementation of EA practices and avoid repeating the same mistakes that occurred in similar organizations.

Top management support is essential in the efforts towards the effective development of EA in organizations. According to Lucke et al (2010), the rapidly changing environments, poor management support, lack of expertise in the field, inadequate supporting tools, and the difficulty that EA teams face in understanding the requirements are among the top challenges that face EA management. At Al-Baha University, it took nearly three years to convince the top management to fund and establish the EA project. The unawareness of the benefits of EA and being the first HEI in Saudi Arabia to carry out this rare project according to the DGA standards and regulations have made it challenging to make this decision promptly. However, with gradually planned awareness workshops and the support we found from the DGA, we convinced the top management to make the right decision about establishing this project. Once top management believes in the project, financial and managerial support will be provided to facilitate the activities of EA development. Approval of many relevant steps, committees, documents, and standards during the project can also be obtained from top management's support.

The lack of EA expertise is still evident; it is considered one of the main problems that affects EA adoption in public sector organizations (Dang et al, 2017a; Abd-Elwahab et al, 2023). In HEIs, this problem can even be more severe if these institutions lack expertise in designing, implementing, and managing complicated technology infrastructure. Luckily, Al-Baha University had a leading team and governance committee with specialists in EA, digital transformation, data science, strategic planning, IT security, and IT infrastructure. This assists in achieving the objectives of EA development while ensuring agility, flexibility, and improved collaboration and management by proposing an integrated framework that considers all aspects and units of the university. Having a good understanding of the institution's strategic plan and its current business and IT capabilities among EA core team members helps derive the outcomes of the transition plan that leads to the future state of the institution.

In terms of EA self-learning materials that can boost the skills of the EA working team, they are available online starting from the early theoretical work of Zachman (1987) until the latest research and practices of EA across different sectors such as public (Dang and Pekkola, 2017b), health (Olsen, 2017; Júnior et al, 2020), education (Olsen, 2017; Ajer and Olsen, 2018), etc. The open-access work of the TOGAF standard also provides guidelines and methods that facilitate the standardized development of EA through best practices (TOGAF, 2022). However, since all Saudi agencies must follow the standards and regulations of the DGA to develop their EA, more training materials and workshops are required to meet the increasing needs across different sectors in the country. Although the current version of NORA handbook supports having a holistic planning approach to EA adoption and explains the basic steps for developing the current structure of business, applications, data, and technology in the government entity according to the reference models for each of them, it is not easy for non-experts to understand and implement.

The focus on CIOs and IT departments carrying out EA practices is another mistake many organizations make. A study carried out in 2016 addressed the challenges that face effective implementation of EA practices in eight Norwegian universities (Olsen and Trelsgård, 2016). The challenges include insufficient support from higher management, focus on technology only rather than the EA, disagreement on where the focus should be placed, a small IT team that focuses on daily activities only rather than on the strategical view of the institution, insufficient qualified personnel, immaturity of EA in the HE sector, and the focus on CIOs only in these institutions to lead the EA initiative. EA leadership must stay away from both IT managers and IT focus. A team at an executive level must lead this significant project to realize the benefits of business transformation and effective strategic planning (Langenberg and Wegmann, 2004; Buckl et al, 2009; Tamm et al, 2011). At Al-Baha University, the EA core team reports to the e-transformation committee, whose members are the university's top management plus the CIO. Although the CIO is on both the team and committee in Al-Baha University case, his role in convincing top management about the requirements of the EA core team was significant. We acknowledge it is not the best practice, yet we have managed to make the most of it.

Conclusion

Enterprise Architecture has become increasingly important for organizations implementing digital transformation initiatives. The rapidly changing business and IT environments and the need to align the operations in organizations with strategic planning have also contributed to the increasing interest in enterprise architecture. EA promises a high-level view of organizations that would ensure business-aligned IT, more agility and flexibility to cope with changes, standardization of business and IT architectures, and avoidance of duplicated systems. Higher Education Institutions (HEIs) are not exceptional, and the peculiar nature of these institutions requires special attention to the practices of EA in this sector. This paper presents the challenges that can hinder the successful development of EA in these institutions, along with possible solutions and recommendations to avoid them. Then, a discussion with a view of previous studies that have shared some or similar issues is provided.

EA practices are never easy. The EA core team should believe they will help the institution throughout the successful implementation of the EA project. The outcomes of the project will then be surprising. Highlighting and sharing such challenging issues that face EA's successful implementation and how to overcome them within different sectors would open future research opportunities to support successful practices. Many HEIs and other public organizations in Saudi Arabia are currently carrying out their EA projects, and this paper can be significantly important to them. Once many of these institutions accomplish their EA projects, a need for managing the EA progress in the education sector might emerge as one group. This can lead to better IT spending in the sector, more agility to cope with changes, more innovative approaches to designing and managing a unified technology infrastructure, better data integration and usability, and improved collaboration and communication among these institutions.

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