Enterprise Architecture: Enabling Digital Transformation for Healthcare Organization

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Abstract

This paper examines the role of Enterprise Architecture (EA) in facilitating digital transformation for healthcare organisations, considering the expanding demand for a comprehensive blueprint to leverage information technology in achieving long-term strategic goals. Through a review of pertinent EA literature, this study investigates the applicability of EA and the Architecture Development Method (ADM) from TOGAF in healthcare. The article emphasises the benefits of employing TOGAF ADM as a proven EA methodology, which provides a systematic and precise step-by-step process for capturing an organisation's current and future states and identifying gaps between them. By adopting TOGAF ADM, healthcare organisations can employ decision-making and management analytic tools to expedite digital transformation. The primary objective is to develop a robust EA framework that facilitates the seamless transition from the existing baseline architecture to the desired target architecture while also addressing any identified voids. In addition, TOGAF ADM plays a crucial role in identifying areas where governance mechanisms may be absent, thereby enhancing alignment with system requirements, objectives, and stakeholder engagement. This research ultimately demonstrates the significance of Enterprise Architecture in facilitating digital transformation within the healthcare industry. By implementing TOGAF ADM, healthcare organisations can utilise EA to improve their operational efficiency, strategic decision-making, and overall performance. The study illuminates the critical role of enterprise architecture (EA) in designing and developing an effective healthcare architecture, enabling organisations to navigate the complexities of the digital landscape and leverage technology to meet their evolving requirements and aspirations.

Keywords: *Architecture Development Method, Enterprise Architecture, Healthcare, TOGAF*

1. Introduction

Healthcare organisations in most developed nations are characterised by dispersed organisational divisions and IT solutions. In contrast to other institutions, healthcare presents a unique challenge due to its complexity and the active interaction between stakeholders, including patients, administrative staff, nurses, and physicians. It has been demonstrated that integrating information technology into the day-to-day operations of hospitals increases their effectiveness and efficacy [1].

Enterprise Architecture (EA) is being implemented in many healthcare organisations as more businesses implement digital transformation and comprehend the benefits of aligning their IT strategy, technology, and procedures with their overall business objectives. EA is a discipline and practice that aims to improve the

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administration and operation of complex healthcare organisations and their information systems [2, 3]. Numerous researchers have demonstrated that EA facilitates digital transformation in healthcare organisations [4]. It has the capabilities of adapting appropriate tools for decision-making and management analysis [5], designing and constructing the architectural[6], creating a prominent EA framework based on its implementation and characteristics[7], and providing completed architecture development from the current baseline condition to the target architecture [2], identifying the gaps between it and assisting in identifying the absence of a governance process[5], and lastly, enhancing the architecture development process.

2. Concepts of Enterprise Architecture

Enterprise Architecture (EA) is a compilation of procedures, tools, and structures necessary to develop an effective and consistent enterprise-wide IT architecture to support enterprise business functions. EA is also frequently described as a master plan that offers a comprehensive view of the enterprise as a system of systems. EA is utilised by organisations of all sizes and scopes, from small enterprises to federal agencies[1]. In enterprise transformation processes, it is challenging to reconcile bottom-up and top-down perspectives. However, the strategic mandate of enterprise architecture can vary depending on the organisation's level of abstraction. The most important aspect of EA is that it provides an all-encompassing view of the business, allowing the company to be optimised rather than just individuals[2]. To attain this level of quality, it is necessary to employ methods that all involved parties from diverse domains can comprehend.

EA strives to assist organisations in developing a more efficient operating model to enhance the quality of service they provide to their clients and generate the highest service quality compared to their competitors. EA's primary objective is to provide an integrated, long-term perspective of the enterprise's processes, systems, and technological infrastructure so that diverse initiatives can align with its capabilities and contribute to its growth. Additionally, it seeks to consolidate and repurpose IT systems and services [3, 4]. The evolution of technology will inevitably increase the IT landscape's complexity. Consequently, EA has become a significant priority for healthcare organisations and is crucial for bridging the essential changes in company strategy and business processes[5]. Its application has multiple advantages for businesses.

Business and IT can be better aligned and utilised more effectively and flexibly; these are two of the most well-known benefits of enterprise architecture. It focuses predominantly on complexity management and enables standardisation and consolidation of organisational units and components. Streamlining organisational structure and internal relationships also increases the organisation's transparency, which aids management in making more informed decisions. By ensuring that business requirements and IT deployment are accurately aligned, EA enables the healthcare organisation to provide better service through enhanced IT alignment. Combining stability and adaptability, good architectural practice enables a business to innovate and adapt by promoting stability and adaptability.

A competent EA should provide a static enterprise overview and a change-supporting mechanism to enable the healthcare organisation to achieve business-IT

and strategic alignment[6]. This can be accomplished by maintaining the EA up-to-date and adaptable.

When determining which framework to use, an organisation must select and implement a framework that corresponds with the primary objectives of its business strategies. Common EA frameworks include The Open Group Architecture Framework (TOGAF), Zachman, and the Federal Enterprise Architecture Framework (FEAF)[7-9]. Control Objective for Information and Related Technology (COBIT) is a less prevalent framework used in information technology governance to assist businesses in increasing productivity, reducing costs, and enhancing cybersecurity[10]. Consequently, it became a challenge for organisations to select and implement the most suitable one, ensuring that it meets their requirements and achieves their objective. Based on the literature review, this study will concentrate solely on the TOGAF-ADM Framework, the most generic framework in the healthcare organisation.

3. Methodology

TOGAF is the most prevalent framework for corporate architecture. The Open Group's TOGAF framework is based on the TOGAF Architecture Development Method (ADM). It was established in 1995 based on the enterprise architectural reference model TAFIM developed by the Department of Defence. According to a recent survey, eighty per cent of the global 50 companies and sixty percent of the fortune 500 use TOGAF to coordinate their corporate architecture. TOGAF applies to all types of organisations with any degree of architecture because it is highly adaptable and can be adapted to meet the needs of various businesses. TOGAF is compatible with various organisational techniques and frameworks [1]. TOGAF ADM is a nine-phase, iterative procedure that helps organisations establish and govern EA through an incremental approach. As depicted in Figure 1, the favoured method for architectural development is a phase-based, cyclical process. Iteration occurs both within and between each phase.

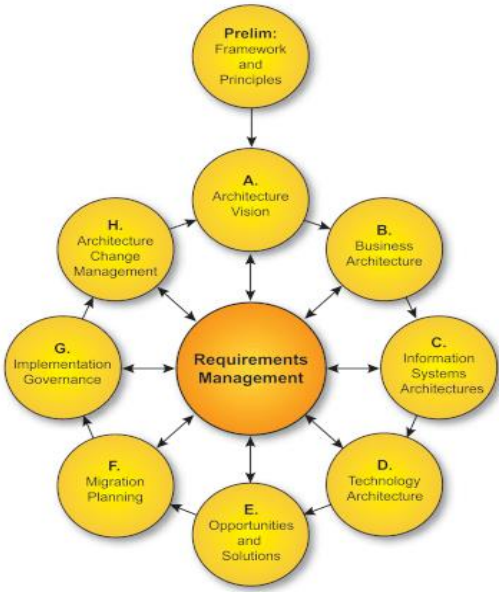

Figure 1: Architecture Development Cycle

A highlight of the aim for every phase is provided in Table 1 below.

Table 1: TOGAF ADM phases

Phase	Description
Preliminary Phase	Describes the setting up and starting tasks necessary to develop architectural capabilities, such as customising TOGAF and defining architectural principles.
Phase A	Setting the project scope, constraints and expectations, validating the business context and creating an "Architecture Vision" document.
Phase B	Explains how a business architecture supporting the architecture vision needs to be developed.
Phase C	Describes the creation of data architecture or an information systems architecture.
Phase D	The creation of technology architecture is described.
Phase E	The key objectives of this phase are gathering all the architectural components that need to be converted and comparing potential implementation strategies for the target architecture while considering applicability and practicality.
Phase F	Explains how a thorough implementation and migration plan was developed to transition from the current architecture to the target architecture while including the indicated objectives.
Phase G	It is assumed that a group of architects working on active projects will adopt "architecture governance.". The results of Phase G are solutions that are implemented following the provided architecture.
Phase H	Develops change management practices for the latest architecture.
Requirements Management	Requirements management of every phase (A-H) validation based on business requirements.

4. Results and Discussions

EA was crucial to optimising their healthcare organisation's digital transformation and strategy. Adapting suitable tools for decision-making and management analysis may significantly impact healthcare organisations, including the achievement of hospital objectives, through the management of healthcare. Due to the complexity of operations, it is not easy to manage resources and enhance services in the healthcare industry, despite the desire for improvement.

Consequently, [2-4] have utilised EA to investigate healthcare's process view and modelling. In their research, the authors have designed an EA approach to accomplish healthcare-IT alignment and provide insight into a hospital's use of the EA framework to improve healthcare management flow. In addition to functioning as a tool for planning, enterprise architecture illustrated the flow, distribution, and exchange of information at various levels, and its strategic aspects facilitated decision-making. It also provided the framework for enhancement plans and facilitated performance analysis.

TOGAF ADM is the most prevalent EA framework for devising and constructing the architecture for digital transformation, which most researchers employ in their studies. A case study by Romai Lidyawati et al. [5] is one of the studies employing TOGAF for digital transformation in healthcare organisations. The case study was conducted in the Indonesian district of Kampar. According to their study, the TOGAF ADM methodology consisted of four preliminary phases: Information

System Architecture, Architecture Vision, Business Architecture, and Technology Architecture.

Atefehsadat Haghighathoseini et al. [6] conducted one of the most recent studies on enterprise architecture; they designed the EA solution for an Iranian university hospital. The top 17 enterprise frameworks were chosen based on two implementation dimensions and germane attributes. Five criteria were chosen for this endeavour based on input from experts. Based on these criteria, the top five frameworks were chosen. Using the opinions of experts and the Delphi technique, a questionnaire was developed to assess the significance of these characteristics. The results indicated that hospitals could utilise TOGAF. The research created an 8-level, 11-component Hospital Enterprise Architecture Modelling for an Iranian hospital by modifying TOGAF, which was subsequently implemented in additional Iranian hospitals.

Abba Suganda Girsang [7] developed an EA plan using a case study of Dharmas Cancer Hospital as inspiration. This investigation provided Dharmais extensive architectural work, ranging from the current baseline to the desired architecture. Due to the lack of healthcare organisations, this study aims to resolve many hospital-related issues. Lack of knowledge to utilise IT as a tool for competitive advantage, lack of business user ownership, lack of alignment between business strategy and IT strategy, and poor IT operation performance. This study provided Dharmais with comprehensive architecture work, from the current baseline condition to the desired architecture. In his investigation, he determined that TOGAF helped identify the lack of a governance process at Dharmais. In conjunction with Dharmais' internal research, this study has developed a successful Architecture Governance scheme by optimising existing units to expand the Quality Committee's responsibilities. In addition, they divided the IT Installation Unit's responsibilities and reorganised the interaction between extant units to enhance the Dharmais governance process.

In addition to developing a new EA framework, some authors examine the need to alter and update a Healthcare Information System and identify changes, requirements, and risks. In her paper, she employs a case study to illustrate the efficacy of modelling techniques such as ArchiMate [8]. Using the O-DA, the authors also evaluate the efficacy of the quality assurance service for building architecture. She uses the Analytic Hierarchy Process to determine the most suitable hospital enterprise architecture framework via group consensus. The ultimate result of the options' absolute weight demonstrates that the TOGAF framework has the greatest absolute weight among decision-making alternatives and, as a result, has the highest rank. According to this author, establishing a functional healthcare information system using frameworks such as TOGAF can simplify and expedite all complex procedures. This is one of several strategies for enhancing the system, requirements, and goals, facilitating the creation of the architecture, and identifying potential stakeholders.

5. Conclusion

Due to the extensive interactions between stakeholders, the health sector is among the most complicated industries. Consequently, information technology is necessary to enhance the effectiveness and efficacy of a hospital's operations.

However, attaining strategic business objectives through implementing information technology is typically difficult. Consequently, it is essential to use Enterprise Architecture Techniques to establish a baseline architecture, identify goal architectures, identify gaps, and use gaps as problem-solving recommendations to achieve strategic business objectives via IT. Enterprise Architecture provides a more comprehensive view of the organisation's objectives. It is a management tool that allows management to evaluate the organisation's performance to enhance the business's condition. EA enables performance evaluation and provides a foundation for enhancement plans. Enterprise architecture describes information circulation, distribution, and exchange at multiple levels. As a tool for creating enterprise plans for organising health care, EA makes it simpler for stakeholders to make decisions by providing a conceptual view of the enterprise.

This study also demonstrates how TOGAF ADM can be utilised to implement enterprise architecture in the healthcare industry. Using the TOGAF-ADM methodology to design the enterprise architecture of this information system produced an architectural model that conforms to the vision of the healthcare industry and applies to other organisations with comparable business processes. This enterprise model's modelling of the information system architecture results in the transition from manual to automatic performance enhancement. This study also demonstrates how TOGAF ADM can improve healthcare customer satisfaction. There are currently numerous EA frameworks on the market. Nevertheless, TOGAF ADM is the most popular framework in the healthcare industry due to its emphasis on processes and its adaptability to integrate artefacts and methods most suitable for the healthcare industry. The vast majority of researchers in related disciplines concurred.

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