The Role of Business Capabilities for Future Viability in Enterprise Architecture – A Structured Literature Review

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Abstract

This paper examines the concept of future viability, or "future-proofing," in Enterprise Architecture, focusing on how enterprise architecture management (EAM) frameworks, particularly TOGAF, can help organizations build scalable and flexible systems. Future viability is crucial for ensuring IT systems can adapt to technological advances and business changes without requiring significant redesigns. The research underscores the role of business capabilities as essential components in creating modular and adaptable architectures, using tools like business capability maps to align IT systems with strategic business goals. A structured literature review highlights existing models for scalability and flexibility in Enterprise Architecture, while identifying gaps in the practical application of these models across industries. This study suggests further investigation into industry-specific applications and the development of generalized capability maps for enhancing scalability and flexibility in IT systems.

Keywords

Future viability, Enterprise Architecture, IT Architecture, Enterprise Architecture Management (EAM), TOGAF, business capabilities, scalability, flexibility, business capability maps, future-proofing, adaptability, modular IT systems

1. Introduction

This paper examines the concept of future viability, or future-proofing, in Enterprise Architecture (EA), focusing on how Enterprise Architecture Management (EAM) frameworks can help organizations build scalable and flexible systems. Future viability is crucial for ensuring IT systems can adapt to technological advances and business changes without requiring significant redesigns, a notion supported by academic literature emphasizing adaptability and agility in EA [1,2]. While industry perspectives explicitly highlight future viability as a key element of modern EA [3], academic research often embeds this concept within discussions of scalability, flexibility, and adaptability.

The research underscores the critical role of business capabilities in creating modular and adaptable architectures. By leveraging business capability models and maps, organizations can align IT systems with strategic business goals, enhancing their ability to respond to change [4]. The structured literature review presented in this paper highlights existing models and frameworks that incorporate business capabilities to improve scalability and flexibility in EA. However, it also identifies gaps in the practical application of these models across industries.

The study concludes that although future-proofing is frequently addressed implicitly in the literature through the emphasis on scalability and flexibility, there is a need for further investigation into industry-specific applications of business capabilities in EA. Developing generalized capability maps could enhance the adaptability of IT systems, ensuring their future viability. The assumption for the research presented in this paper is that future viability is no characteristic that can be achieved by design or engineering activities alone but also requires systematic and continuous management. This management activity must include the identification of organizational capabilities, required roles

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in an enterprise, continuous improvement processes, and criteria or indicators to monitor. It also has to be integrated into existing organizational management systems, like EAM. Our view is that managing future viability must be closely linked to the business capabilities of an enterprise as they represent the essential functions the enterprise is supposed to perform. The aim of this paper is to investigate how business capabilities contribute to enhancing the scalability and flexibility of EAs, thereby supporting their future viability. By examining current research, we aim to identify how integrating business capabilities can make EAs more adaptable and scalable in response to evolving technological and business landscapes.

The paper is structured as follows: Section 2 summarizes the relevant theoretical background of our work and defines important terms. Section 3 discusses the research method used for the systematic literature analysis. Section 4 presents the results of the literature analysis. Section 5 discusses conclusions and the need for future research.

2. Theoretical Background

EAM is a strategic discipline that aligns an organization's business goals with its IT systems, ensuring that the architecture is both scalable and adaptable to changing environments. EAM provides a holistic framework that aligns business processes, information systems, and technology infrastructure with the organization's strategic objectives, thereby facilitating better decision-making and enabling adaptability. One of the most widely adopted frameworks for EAM is the **TOGAF (The Open Group Architecture Framework)**, which offers standardized methods and tools for designing and managing EAs [5]. IT Architecture is often used synonymously with EA, but it is in fact a subset, focusing on the technical aspects of architecture, including software systems, networks, and hardware, and how these components support the organization's objectives [6]. In the literature review in Section 3, both terms are used to search for relevant papers, as they are closely related and complement each other, with IT Architecture contributing to the technical foundation and EAM addressing the broader strategic alignment of business and IT as mentioned in section 1.

A core concept within EAM is **business capability**. The concept originates from strategic management [7] and has been introduced to EAM to represent abilities of strategic importance. In EAM, business capabilities are defined as the organization's inherent ability to achieve specific business outcomes through a combination of processes, people, and technology. Business capabilities represent the essential functions that a business must perform, independent of how they are executed or who performs them. Integrating business capabilities into EAM allows companies to develop a modular and flexible architecture that can evolve in response to internal and external changes [8]. **Business capability maps** are frequently used within EAM frameworks to provide a visual representation of how capabilities align with IT and other business components. These maps facilitate better communication between IT and business units, as they illustrate the relationships and dependencies between business functions and the supporting IT infrastructure. This visualization helps identify gaps, redundancies, and areas for improvement, ultimately leading to a more flexible and scalable architecture [9].

Future Viability, in the sense of IT Architecture, can essentially be broken down into the characteristics of scalability and flexibility. These must be fulfilled by an architecture to meet the requirements of future business and technological developments. A future-proof system should be able to integrate new functions and technologies while ensuring stable and reliable performance [10].

Scalability and **adaptability** in terms of IT Architecture are key features of effective and future-proof EAM. Scalability ensures that an enterprise's architecture can handle increased workloads or expansions without requiring significant redesigns. TOGAF supports this by providing a structured approach to the continuous improvement of IT systems, ensuring that they remain aligned with evolving business requirements [11]. The flexibility of the architecture is critical for adapting to new

technologies and market shifts, making it easier to integrate innovations like artificial intelligence or cloud solutions [12].

In conclusion, EAM, particularly when using frameworks like TOGAF, provides organizations with the tools and methodologies to build flexible, scalable, and future-proof architectures. By focusing on business capabilities, enterprises can ensure that their IT systems are aligned with strategic goals, ready to adapt to technological advances, and capable of supporting business growth [13].

3. Research Approach

For this research a structured literature review is conducted following a qualitative approach. The main goal is to understand how business capabilities can play a role in making EA future-proof. Therefore, theoretical and practical papers are reviewed to get an understanding how EAs can be built more scalable and flexible.

3.1. Conducting a Structured Literature Review

To analyze the current state of research regarding the future viability of EA, a structured literature review is being conducted. This approach was chosen as it is specifically designed to assess published work in each research field, compare existing studies, and identify potential research gaps. To enhance this process, the traditional approach as suggested by Kitchenham [14] is slightly modified by utilizing an AI-powered search database, which allows for more comprehensive and efficient literature discovery. This method provides faster access to a broader range of sources and ensures that emerging trends and relevant studies are identified more effectively than through conventional search methods.

The first step requires the formulation of an overall research question. In exploring the field of EAM, an observation was made regarding a gap in the current research. While there is extensive literature on its present-day applications, the focus on how EAM can evolve for future viability is noticeably limited. Given the rapid pace of technological advancement, it is evident that EAs must adapt to keep pace with the ever faster changing market conditions, yet long-term strategies for this evolution are underexplored. This realization led to the need for research on how business capabilities can be leveraged to make EAs future-proof. A thorough review of the existing research will serve to highlight this gap and provide the foundation for further investigation. Based on these prerequisites, the following research question is being conducted for the paper:

How do business capabilities contribute to enhancing the scalability and flexibility of Enterprise Architectures to achieve future viability?

The literature search was conducted using the Consensus AI-powered research tool. Consensus is an AI-driven academic search engine that accesses a wide range of peer-reviewed publications across multiple disciplines. It utilizes natural language processing to interpret complex queries and provide summarized insights, enhancing the efficiency and depth of literature searches. The Consensus tool was selected for its ability to understand nuanced queries and context, enabling the retrieval of relevant and high-quality documents that might be overlooked by traditional keyword-based searches. Its AI capabilities allow for the interpretation of broader concepts and complex relationships between terms, which is essential for a comprehensive review of the interdisciplinary topic at hand.

Unlike basic keyword searches, which may rely on rigid terms such as TITLE-ABS-KEY("future viability") AND TITLE-ABS-KEY("enterprise architecture"), the AI-driven search engine understands the underlying context and logic of the query. It can interpret broader concepts, break down complex relationships between terms, and deliver more relevant, high-quality documents. This not only speeds up access to crucial sources but also ensures that emerging trends and cutting-edge studies, which might be overlooked in conventional searches, are considered. As a result, this method is superior,

providing a more comprehensive view of the field while effectively identifying gaps in the research. The search process began with the formulation of initial search queries based on the main concepts of the research question. These queries were then refined by incorporating synonyms and related terms to expand the scope and capture a comprehensive set of relevant studies.

Initial Search Queries:

1. "Future Viability of Enterprise Architecture"
2. "Future-Proofness of Enterprise Architecture"

To enrich the search and ensure thorough coverage, the following key terms, synonyms, and associated terms were identified and used:

Future Viability: Future-Proofness, Adaptability, Scalability, Flexibility

Enterprise Architecture: EA, IT Architecture, Business Architecture

Business Capabilities: Core Competencies, Functional Capabilities, Capability Mapping, Process Optimization, Strategic Alignment, Business Agility

3.2. Inclusion and Exclusion Criteria

To ensure the selection of studies that are most relevant and contribute meaningfully to the research question, specific inclusion and exclusion criteria were established.

Inclusion Criteria:

- **Relevance to Research Question:**
  Studies that investigate the role of business capabilities in enhancing the scalability and flexibility of EA.
  Papers that address future viability or future-proofing in the context of EA and business capabilities.
- **Publication Type:**
  Peer-reviewed journal articles and conference papers to ensure academic rigor and credibility.
- **Publication Date:**
  Studies published from **2005 onwards** to capture contemporary developments in technology and business environments.
- **Language:**
  Publications in **English** to maintain consistency in analysis.

Exclusion Criteria:

- **Irrelevant Focus:**
  Studies focusing on environmental sustainability or other topics not directly related to the research question.
- **Non-Peer-Reviewed Sources:**
  Editorials, opinion pieces, book chapters, and non-academic articles were excluded to maintain academic standards.
- **Duplicate Studies:**
  Duplicates identified across different search queries were removed to avoid redundancy.

Clarification on Criteria:

The inclusion and exclusion criteria were carefully defined to avoid redundancy and confusion. Each criterion serves a distinct purpose:

- **Relevance to Research Question** ensures that only studies directly addressing the key aspects of scalability, flexibility, and business capabilities in EA are included.
- **Publication Type** focuses on peer-reviewed work to guarantee the reliability of sources.
- **Publication Date** ensures that the review encompasses the most current and relevant research.
- **Language** criterion is set to English to maintain consistency and feasibility in analysis.

By separating inclusion and exclusion criteria and clearly defining them, we eliminated overlaps and potential confusion.

3.3. Screening and Selection Process

Step 1: Initial Screening

- **Title, Abstract and AI-Generated Summaries Review:**
  The titles, abstracts and AI-generated summaries provided by Consensus were reviewed against the inclusion criteria.
  Papers that clearly did not meet the criteria were excluded at this stage.

Step 2: Full-Text Assessment

- **Full-Text Retrieval:**
  Papers that passed the initial screening were retrieved in full text for a detailed evaluation.
- **Detailed Evaluation:**
  Each paper was assessed thoroughly to ensure it met all the inclusion criteria and none of the exclusion criteria.

Step 3: Final Selection

- **Selection Outcome:**
  A total of 77 papers were identified through the Consensus search. After removing duplicates and applying the inclusion and exclusion criteria, **18 papers** were selected for inclusion in the literature review. The table below is populated with the final papers represented through the corresponding number from the reference section and mapped to research relevant topics they are covering.

Table 2.
Documents mapped with search term

Search String	13	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33
Scala-bility					x	x	x	x	x	x	x	x	x						x	x
Flexi-bility	x													x	x	x	x	x	x	x
Future Via-bility	x	x	x	x	x												x			

4. Results of the Literature Review

Ionita emphasizes the importance of generating multiple architecture options that are resilient to future changes. He develops the SODA method (Scenario-Based Options for Developing Architectures), which makes it possible to design architecture options that are resilient to future changes in the business environment. The options are then evaluated quantitatively, particularly in terms of quality, cost and risk. These approaches help architects to make informed decisions and design future-proof systems [15]. Ionita's research shows that the ability to anticipate future developments is essential for sustainability.

In 2007, Brits et al. developed a conceptual framework for modeling business capabilities that helps companies to make their IT Architecture adaptable and agile. This methodology emphasizes the importance of analyzing and visualizing business processes and capabilities to support an agile EA. By clearly defining and structuring business capabilities, companies can react quickly to market changes and ensure their long-term competitiveness. Its framework includes two feedback loops that incorporate organizational and innovative feedback to ensure continuous improvement and adaptation of the IT Architecture [16].

Nowobilska et al. extend the approach of Brits et al. by analyzing the dependencies between the business capabilities and other elements of the EA, which provides a deeper insight into the structural connections and their optimization. They present a method for systematically identifying

dependencies between business capabilities and other elements of the EA. This method is based on the mapping of business units to business capabilities and the development of visualizations such as business and information ownership maps. By analyzing these dependencies, companies can better understand how their capabilities are linked and how they can adapt the IT Architecture accordingly to increase flexibility and adaptability. This approach is critical to avoid redundancy and ensure efficient use of resources [17].

Khosroshahi et al. close the circle by emphasizing the practical application of business capability maps, which serve as a visual tool to improve the efficiency and adaptability of enterprise architecture. In doing so, they show how these maps can increase the efficiency and flexibility of EA. Through interviews with 25 organizations and the evaluation of 14 use cases, it is made clear that business capability maps are experiencing increasing acceptance in practice. These maps provide a visual representation of business and IT components, enabling organizations to make better strategic decisions and quickly adapt their IT Architecture to new business requirements. The paper emphasizes that business capability maps help to close the communication gap between business and IT departments and thus improve the overall performance of the organization [13].

4.1. Scalability

Scalability is a key criterion for the future viability of EAs. It describes the ability of a system to grow or shrink efficiently to cope with changing requirements and loads. The system can integrate or remove additional resources such as processors or memory without making significant changes to the basic architecture. A scalable system keeps resource utilization per unit of capacity constant and expands the dimensions of processing, memory and connectivity without causing bottlenecks or performance degradation [18].

The performance of a system is closely linked to its scalability. A system is considered scalable if it can increase its performance in proportion to the number of resources added, such as processors. Poor scalability, on the other hand, leads to inefficient use of resources and performance problems [19]. Several factors influence the scalability of a system, including hardware architecture, application software and communication protocols. Hardware bottlenecks or inefficient software algorithms are common challenges. Solutions include improving parallelism and optimizing resource utilization [20].

Modern approaches to improving scalability include the use of hierarchical structures and load balancing across multiple nodes. Technologies such as Software-Defined Networking (SDN) and Network Function Virtualization (NFV) make it possible to use resources dynamically and efficiently, which significantly improves scalability [21]. A practical example of the successful implementation of scalability is Facebook's architecture. This platform combines horizontal and vertical scaling to serve millions of users simultaneously [22].

The scalability of EAs is crucial for the adaptability and long-term survival of companies in a rapidly changing business world. Business capabilities play a central role in this by enabling companies to design their business models flexibly and efficiently. By integrating scalable business models and utilizing advanced technologies, companies can not only expand their operational capabilities, but also strengthen their market position and promote sustainable growth [1]. In the following it is explained how the improvement of scalability can be realized using business capabilities, based on various scientific studies and practical applications.

Developing scalable business models is an essential step for companies to remain competitive in a dynamic business environment. Nielsen and Lund (2018) show that companies can achieve significant economies of scale by implementing new distribution channels, overcoming traditional capacity constraints and outsourcing capital investments to strategic partners. These approaches enable companies to realize profitable growth and adapt their business models to changing market requirements. They also emphasize the link between business capabilities and scalability. They suggest that the most successful companies are those that are able to achieve exponential increases

in revenue through scalable business models. They argue that understanding and implementing business capabilities is critical to achieving this scalability and ensuring long-term business success [23].

Another important aspect of scalability is the development of sustainable business models in hybrid organizations. Jabłoński (2016) emphasizes that a company's ability to sustain its performance in the long term is supported by a scalable business model that integrates economic and social goals. Such models enable companies to operate more efficiently and increase their capacity in line with demand, resulting in improved adaptability and performance [24]

Ashrafi et al. (2019) highlight the importance of business analytics (BA) capabilities that can increase the agility and performance of organizations through improved information quality and innovation capabilities. These capabilities are crucial to increase adaptability to market and technological turbulence and promote scalability [25].

In the field of consulting services, Werth and Greff (2018) analyze how digital technologies can contribute to the scalability of business models. They examine tools that have successfully contributed to scalability in other industries and transfer them to the consulting industry. Their research shows that digitalization and the implementation of scalable business models are crucial to increasing the efficiency and competitiveness of consulting firms [26].

4.2. Flexibility

Alongside scalability, flexibility is a key characteristic for ensuring the future viability of EAs. It describes the ability of a system to adapt quickly and efficiently to changing requirements and technologies. This characteristic includes aspects such as adaptability, integrability, configurability and modularization. Flexible EAs enable companies to continuously optimize and expand their systems without the need for extensive new developments [27].

An example can be found in the field of telemedicine: the use of loosely coupled modules and international standards such as HL7 FHIR enables high reusability and interoperability, facilitating the flexible integration of new and existing services [28].

Reconfigurable nodes also play an important role in the flexibility of future networks. Keller et al. (2010) describe an architecture that makes it possible to divide network functions into modular blocks and recombine them as required at runtime. This allows dynamic adaptation of the network nodes by combining software and hardware components [29]. Another approach to improving flexibility is the development of modular control and data transmission levels. By defining open interfaces and programmability via policies, adaptation to new scenarios or functions can be achieved with minimal cost and disruption [30].

Improving the flexibility of EAs through logical structuring by means of business capabilities is particularly useful for making companies more adaptable and resilient to rapidly changing market requirements. Business capabilities that strengthen the connection between people, processes and information enable organizations to respond more efficiently and quickly to dynamic environments and stakeholder requirements. Erol et al (2009) emphasize that the integration of IT and business goals through a well-defined EA plays a key role. This architecture aims to create a consolidated view and access to all available resources in the organization, which increases flexibility and responsiveness [31].

In addition, Kim et al. (2011) examine how IT flexibility affects an organization's process-oriented dynamic capabilities. They find that IT human resource expertise and flexible IT infrastructures improve a firm's ability to adapt and reconfigure business processes, which ultimately enhances the firm's financial performance [32]. Mikalef, Pateli and Wetering (2020) add that the flexibility of IT Architecture, supported by decentralized IT governance, promotes the formation of IT-enabled dynamic capabilities. These capabilities are crucial for maintaining competitiveness, especially in uncertain environments [33].

5. Conclusion and Future Work

The objective of this paper is to investigate how business capabilities can contribute to the scalability and flexibility of EAs regarding attaining future viability. A structured literature review, together with support by the Consensus AI-powered research tool, was performed for a fit between theoretical frameworks and practical applications. It reveals that business capabilities integrated into EA do make a great contribution in making the IT system much more scalable and flexible. With modeling and mapping, one may align the IT infrastructure to strategic business objectives for which easier responses to technological advancement and market changes are possible. Such an alignment shall indeed support the making of modular and adaptive architectures that will be required for future-proofing IT systems. It is achieved through developing scalable business models that use the business capabilities to overcome traditional constraints in capacity. Works such as Nielsen and Lund (2018) feature strategies of new distribution channels, strategic partnerships allowing exponential growth, and emphasize the importance of understanding and applying business capabilities for scaling effectively. In a related perspective, the work of Jabłoński, 2016, indicates that economic and social objectives combined in scalable business models increase the capacity of organizations to operate effectively and expand their capacities according to demand. Further flexibility is achieved through business capability modeling to bring out adaptive and modular architectures. A study by Brits et al., 2007, shows that well-defined and organized capabilities about business enable organizations to respond quickly to changes in markets with diverse demands, hence ensuring long-term competitiveness. In addition, Nowobilska et al. (2011) extend this by discussing dependencies between business capabilities and other aspects of the EA for deeper insights into structural connections that can be optimized toward ensuring high flexibility. The practical applications of these, as discussed by Khosroshahi et al. (2018), highlight how business capability maps create a basis for visual tools in enhancing efficiency and adaptability within EAs by alignment of business and IT components. The ability to answer the research question shows that business capabilities are key to increasing the scalability and flexibility of EAs and, therefore, creating viability into the future. In integrating the business capability approach within EA practices, organizations have been able to develop IT systems that are congruent not only with current strategic goals but also are flexible enough to adapt with future needs without requiring major system redesigns. This will provide for the integration of emergent technologies and positively avail appropriate responses to changes within market conditions. Such initiatives provide advantage sustenance.

These findings therefore leave room for further investigation: how these models have been implemented remains understudied; empirical works should be conducted to establish how business capability integration into EA would work in natural settings. The development of industry-specific frameworks and best practices in this regard would, therefore, be a great deal of benefit to organizations desirous of migrating from rigid traditional IT architectures into more open and modular systems. In that respect, the integration of business capabilities into EAs provides considerable scalability and flexibility that form an essential part of its viability for the future. By focusing on these elements, organizations are empowered to develop resilient IT systems that adapt to continuous change and support growth in an ever-changing technological and business landscape. needs that keep it competitive and coherent for the future.

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