How Can Enterprise Architecture Frameworks be Leveraged to Support The Integration of Environmental, Social, and Governance Principles into Cloud Computing Strategies within Organisations

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Abstract

The importance of Environmental, Social, and Governance (ESG) concerns has grown significantly in recent times and is now widely regarded as a crucial aspect of organisational operations. To effectively incorporate ESG considerations into their digital transformation strategy, businesses can leverage Enterprise Architecture (EA), with a Cloud Computing (CC) strategy presenting a particularly promising avenue for this integration. In conducting this study, a literature review of twenty-two papers related to ESG, CC strategy, and EA was undertaken. This paper discusses the crucial role of implementing a CC strategy for organisations and highlights the significance of ESG considerations in cloud computing. The study also underscores the importance of EA frameworks in integrating CC strategies within organisations. However, it was evident that there is a lack of research on how EA can support the incorporation of ESG principles into an organisation's CC strategy. To address this gap, this paper recommends that companies adopt The Open Group Architecture Framework (TOGAF®[1]) model and integrate ESG components into the framework. Critical factors include CC goals and capabilities, data accessibility and storage, vendor selection, and security and risk management. The paper suggests a structured approach to incorporating ESG principles into the TOGAF® Architecture Development Method (ADM®) by focusing on the Business, Information Systems, and Technology Architecture phases. Several limitations to the study are acknowledged, including limited real-world case studies, framework coverage, and research studies on CC strategies, ESG, and EA framework.

1. Introduction

In today's business landscape, organisations are placing greater emphasis on Environmental, Social, and Governance (ESG) issues. These topics are frequently discussed in boardrooms as companies recognise the importance of a sustainable approach to economic development. There is demand for greater eco-friendliness and social responsibility. Enterprise Architecture (EA) is well-positioned to integrate ESG considerations into an organisation's digital transformation strategy (Das, 2023). EA is a popular approach that enables organisations to effectively manage complexity, change, and resource allocation toward a shared objective. Incorporating sustainability principles is an absolute necessity for organisations undergoing digital transformation to ensure future generations' well-being (Van De Wetering et al., 2021). ESG principles are gaining popularity as they have the potential to improve financial returns and risk management (GGrgen et al., 2017).

According to Mahmood & Hill (2011), companies that have integrated effective EA frameworks, such as Zachman or TOGAF® methods, are well-positioned to take advantage of benefits offered by Cloud Computing (CC). CC has significantly advanced in recent years, leveraging hosted resources, and data to be utilised for creating and provisioning more advanced services (Biswas & Giaffreda, 2014). Employing integrated EA-CC models can yield significant advantages, including decreased technology costs, response times and enhanced scalability (Bernal et al., 2016).

[1] TOGAF is a registered trademark of The Open Group.

Incorporating ESG factors into CC supported by EA frameworks is crucial for businesses to ensure long-term sustainability and profitability. Although the integration of ESG principles into CC has the potential to create positive societal impacts and sustained returns for businesses, there is currently a lack of research on the topic. In this digital transformation era, it is crucial to provide executives and decision-makers with the necessary support to make informed choices amidst the constantly evolving business and IT landscape. Therefore, the following research question is proposed: *"How Can Enterprise Architecture (EA) Frameworks be Leveraged to Support the Integration of Environmental, Social, and Governance (ESG) Principles into Cloud Computing (CC) Strategies within Organisations?"*

To address the research question, this paper has been structured as follows. Firstly, the background section provides insights into how EA can support ESG principles, while also demonstrating how CC strategies can support EA. Following this, a comprehensive literature review examines CC strategies and their benefits in modern organisations, explores ESG considerations in CC, discusses how EA can facilitate the integration of ESG principles, and illustrates its role in supporting CC strategies. Subsequently, this paper will present recommendations for addressing the research question. Lastly, the final two sections will outline the study's limitations and present its conclusions.

2. Background

Sustainability is a multifaceted issue that requires enterprises to reevaluate all aspects of themselves, including viewing sustainability as a new "rationality endeavour" in addition to financial benefits (Hoogervorst, 2009; Perdana et al., 2019). In this regard, EA is a valuable resource that can tackle a range of challenges associated with digital transformation, including strategic planning, enterprise design, governance, and facilitating enterprise-wide change in a cohesive and standardised manner (Perdana et al., 2020). Bizcon (2023) states that the implementation of EA and CC provides substantial benefits to businesses. This includes lowered technology expenses, quicker response rates, enhanced scalability, ample storage, elevated accessibility, and uninterrupted operations. CC enables greater adaptability in software and hardware solutions, harmonises business and IT strategies, and helps organisations respond quickly to market changes and customer demands (Ricotta, A., 2023; Osadhani et al., 2019). Hence, integrating ESG into CC corporate strategy is a new solution for organisations to cope with current business challenges.

2.1. 2.1 Key Terms

Environmental, Social, and Governance (ESG) Principles

The principles of ESG are an indispensable aspect of business strategy and provide a crucial framework of guidelines for businesses to maintain their long-term sustainability, ethical impact, and responsible practices (Shapsugova, 2023). In the realm of Information and Communications Technology (ICT) systems and infrastructure, adherence to ESG principles involves designing, developing, deploying, and utilising technology in environmentally and socially responsible ways. Key practices in this regard include Energy Efficiency, E-Waste Management, and Green Data Centres. Energy Efficiency aims to reduce energy consumption and enhance efficiency across the ICT lifecycle, while E-Waste Management focuses on the responsible disposal and recycling of electronic waste. Green Data Centres prioritise energy-efficient and environmentally friendly design and operation (Božić, 2023).

Cloud Computing (CC)

CC is a multifaceted phenomenon that is closely tied to a new paradigm of IT delivery and deployment. Specifically, it involves the provision of IT capabilities to customers outside of an organisation (Stanoevska-Slabeva et al., 2010). The adoption of CC strategies is continuing to grow as organisations look to increase the scalability and versatility of their businesses. Cloud computing allows organisations to shift the delivery of computing services such as applications, networks, servers, databases and infrastructure from in-house ownership to hosting by third-party cloud providers (Achar, 2022).

Enterprise Architecture (EA)

EA refers to the definition and representation of an enterprise's business processes and IT systems from a high-level perspective, including their interrelationships, and the extent to which they are shared across different parts of the organisation (Tamm et al., 2011). Besides, EA is a valuable resource for facilitating communication between business and IT stakeholders, enhancing better alignment between these two crucial areas (Kurnia et al., 2020). The primary objective of EA is to steer the growth of an organisation's information technology (IT) systems and digitised business processes that facilitate or mechanise its fundamental capabilities (Perdana et al., 2020).

3. Literature Review

3.1. CC Strategies in Today's Organisations

The adoption of CC strategies is continuing to grow as organisations look to increase the scalability and versatility of their businesses. CC allows organisations to shift the delivery of computing services such as applications, databases and infrastructure from in-house ownership to hosting by third-party cloud providers (Achar, 2022). Common CC service models including IaaS, PaaS and SaaS allow organisations to manage the application development layer without worrying about the underlying infrastructure, storage and networking (Masuda et al., 2016). The flexibility of CC models also extends to its costing. Pay-as-you go subscription models are most common, where businesses pay for resources, they use and are able to scale up and down in accordance with business growth (Buyya et al., 2009). Archar (2022) suggests that by transitioning the ownership of IT infrastructure to specialised cloud-providers, businesses are able to focus resources on strategic activities. Lucky (2009) had similar findings, emphasising how outsourcing ownership to Cloud providers who invest heavily in R&D, gives organisations access to continuous innovation, which would otherwise be costly and a barrier to entry. Organisations can also reduce capital investment in hardware and infrastructure and instead reallocate resources to value-add activities, driving greater growth and efficiency (Baliga et al., 2011). Reducing the purchasing of hardware has environmental benefits by reducing e-waste, which provides organisations with a cost saving opportunity and promotes sustainability.

3.2. ESG Considerations in CC

Although CC has changed the way organisations manage information systems and reduced the barriers to innovation, it has also introduced a myriad of sustainability considerations. As organisations rely more on cloud services to manage IT operations, the energy intensive nature of Data Centres and its environment impact has come to the forefront of ESG discussions. Lui et al. (2023) took a lifecycle assessment approach to assess the environmental impact of cloud computing. The study noted that during the full lifecycle of CC, which covers the extraction of raw materials till discarding of waste, significant environmental impact was observed. This was evident in the high levels of energy consumed to build and maintain Data Centres as well as associated emission of greenhouse gases (Lui et al. 2023). These environmental impacts are only predicted to grow as cloud providers invest in building more Data Centres. It is noted that although Lui et al. present a comprehensive methodology for assessing the environmental impact of CC, there is no clear recommendation for an approach to incorporate ESG principles into CC.

The geographically dispersed nature of Data Centres has also raised concerns regarding the fossil fuels needed to maintain the facilities (Al-Azzawi & Kaya, 2021). Other studies have highlighted the contradictions present in the e-waste debate. Although studies point to lower reliance on hardware as a source for reducing e-waste, others suggest that the continuous innovation associated with cloud services results in frequent replacement of hardware in cloud infrastructure which produces more e-waste (Baliga et al., 2011). From a social and governance perspective, studies have highlighted concerns with data privacy and ethical governance. As data volumes grow, organisations must look to incorporate ESG principles into their CC models to ensure security and sustainable use of CC (Mata-Toledo et al., 2010).

3.3. How can EA Support Integrating ESG Principles?

EA provides clarity in understanding ESG principles

Given that ESG principles are vague in nature, implementing ESG is a challenge. Despite its potential to enhance financial return, the meaningful relationship with financial performance remains unclear. Moreover, since ESG implementation provides long-term benefits, it conflicts with the organisation's short-term financial planning making it hard to obtain stakeholder buy-in (McKinsey, 2022; Shapsugova ,2023). Bernal et al (2016) implied that EA can provide a structure for incorporating various components of ESG into an organisation's vision. By closely looking at resources and understanding artefacts, organisations can make informed decisions while incorporating ESG principles within its CC strategies. This aligns with the findings that suggest CC is an integral part of EA building blocks in performing sustainable digital transformation, highlighting how EA can be perceived as the foundation for executing strategic initiatives (Hafsi & Assar, 2016; Kempegowda & Chaczko, 2018).

EA enables multi perspectives in understanding stakeholders within complex systems

EA provides a comprehensive perspective for understanding stakeholders within complex systems (Bondar et al., 2017). The Zachman Framework™[2] is known to present multiple perspectives and levels of abstraction ranging from providing contextual scope in the executive view to functional capability for users (Zachman, 2003). Considering EA while incorporating ESG principles, can help define stakeholder interest in implementing ESG and how ESG may impact them. This can minimise the difficulties while implementing ESG, as striking balance among stakeholders is challenging (McKinsey, 2022).

How is EA is Supporting CC Strategies?

The complexity of integrating CC can be moderated by comprehensive EA practices. EA can provide a clear high-level view, capturing all the components, as well as governing the interactions among dimensions. Thus, the volatility of cloud computing could be captured, and promptly managed through implementing EA. Several EA frameworks are introduced and continuously enhanced. TOGAF® provides methods ranging from design, plan, execute and govern the enterprise information architecture. This process is guided by the ADM® through the phases. The Zachman Framework is another common model which provides taxonomy through structured matrices consisting of viewpoints and abstraction (Zachman, 2003). While the Zachman Framework exhibits taxonomy, TOGAF® conveys a closed-loop process in managing the enterprise architecture (Essien, 2023). Although each framework possesses distinct characteristics, Cameron & Macmillan (2013) argue that TOGAF® is the most comprehensive framework, among others. Aligned to the comparative analysis of EA frameworks conducted by Tang et al. (2004) which investigates EA frameworks in the context of system and software engineering. Kotusev (2021) has similar findings after comparing TOGAF®, Zachman, FEAF and Gartner frameworks. Thus, it is suggested that TOGAF® would be best suited to guide the integration of ESG principles within CC strategies due to its iterative nature. Many studies emphasise the significant role of EA and CC for instance Bernal et al., (2016) propose a new EA model which incorporates CC within the technology architecture, Santikarama & Arman (2016) further investigate how EA framework can be utilised in the case of non-cloud to cloud computing migration. Both rely on TOGAF® to incorporate CC in part of its phases. Meanwhile Bondar et al. (2017) highlight the implementation of EA framework within System-of-System (SoS) architecture which include CC as the complex systems. Despite the claim that Zachman framework would be best suited for describing the SoS architecture, it is also evident that TOGAF® can be utilised due to its flexibility, adaptability, and scalability. Das (2023) provides recommendations on how EA can be utilised in incorporating ESG principles, these include integrating ESG starting from business, application, data and technological architecture. Heatmaps can be specifically chosen to prioritise areas of ESG consideration. Similarly, Lee et al. (2022) proposes an integrated approach in analysing ESG data using Artificial Intelligence specifically on Natural Language Processing to determine activities that can be labelled as ESG artefacts. Most of the aforementioned articles provide support for either the convergence of EA and CC or the exploration of EA and ESG. This suggests that evidence of the intersection among ESG, EA, and CC remains limited, highlighting the need for action to bridge this gap.

4. Recommendation

4.1. EA in Organisations Adopting CC Strategy

As addressed in the literature review section, Santikarama & Arman (2016) and Bernal et al.(2016) highlighted the suitability of the TOGAF® framework for companies integrating considerations of CC. They proposed several adaptations of the TOGAF® framework tailored to CC environments, providing a valuable starting point for companies undertaking CC strategies to address ESG factors. Their modified models consistently emphasise the importance of phases such as Business, Information System, and Technology Architecture, which serve as a baseline in this research. The following considerations are crucial for companies adopting CC strategies and should be addressed when integrating ESG components into the TOGAF® framework:

Cloud computing goal and capability: Organisations should establish a long-term cloud computing goal and strategy during the vision stage. Furthermore, the adoption of CC may require a number of adjustments to the BA, potentially leading to a shift in daily operations such as changing towards a hybrid working model and reduced reliance on physical documentation.

Data accessibility and storage: with all information being digitized and stored online, companies must enhance their capabilities for big data analysis and make informed decisions regarding data backup and storage locations.

[2] The Zachman Framework is a registered trademark of Zachman International.

Cloud computing vendor selection: Selecting a reliable CC provider is critical to maintaining the efficiency and reliability of business operations.

Security and risk management: The adoption of CC introduces cybersecurity risks, leading to a need for robust security and risk management measures. These measures should be integrated into the Information Systems and Technology Architecture domains of the TOGAF® framework to mitigate cybersecurity threats effectively.

4.2. Incorporating ESG Principles into TOGAF® ADM®

The above section of the study has established the TOGAF® ADM® (Figure.1) as the most suitable EA framework for organisations implementing CC strategies, with a particular focus on the Business, Information Systems, and Technology Architecture phases. This section of the study will primarily delve into these phases of the TOGAF® ADM® individually, followed by considerations of other phases, offering actionable suggestions for effectively incorporating ESG principles.

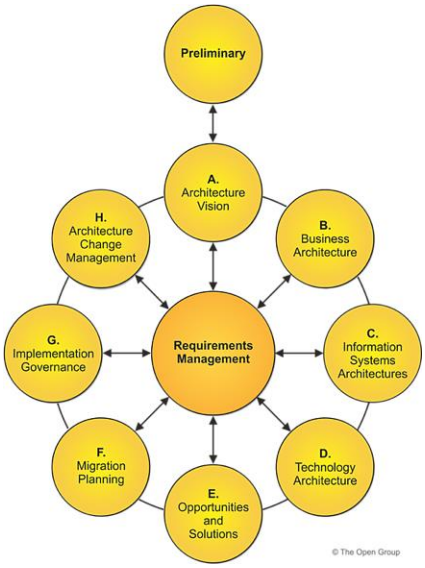

Figure 1. TOGAF® ADM® (The Open Group, n.d.)

Phase B: Business Architecture

Aligning business strategies with sustainability goals is essential for driving competitive advantage, enhancing long-term resilience, and efficiency. This illustrates the operational approach the organisation will adopt in the near future (Liao & Wang, 2021).

Define ESG Metrics and Objectives: Establish ESG metrics and objectives aligned with the organisation's sustainability goals, specifically consider the environmental impact of CC, such as energy consumption and carbon footprint, and social and governance implications related to data privacy and security in the cloud.

Incorporate ESG Considerations in Business Models: Develop business models that prioritise ESG considerations, integrating sustainability into the core operations and decision-making processes. Strategies such as maintaining cost discipline, optimising business support functions, and developing new business models to drive growth can enhance engagement, profitability, and sustainability (Liao & Wang, 2021).

Conduct ESG Gap Analysis: Identify areas where the organisation's current business architecture may fall short in addressing ESG principles, particularly in the context of CC.

Assess the ESG impacts of existing cloud infrastructure and services, identifying opportunities for improvement and optimization.

Document ESG Integration in Architecture Definition: Document the integration of ESG principles into the Business Architecture, including specific measures taken to address ESG considerations in CC strategies.

Update the Architecture Definition Document to reflect the organisation's commitment to sustainability and responsible CC practices.

Phase C: Information Systems Architecture

Data Lifecycle Management with ESG: Implement sustainable data lifecycle management practices to minimise environmental impact and promote resource efficiency. Strategies may include reducing data redundancy and optimising data storage with cloud architecture.

Address Data Privacy and Security: Incorporate ESG considerations into data privacy and security policies and procedures, prioritising safeguarding user privacy and complying with relevant data protection regulations. These may include implementing robust security measures and promoting transparency regarding data handling practices (Božić, 2023).

Integrate ESG Considerations in Application Design: Prioritise energy efficiency, resource optimization, and eco-friendly features in application development to minimise environmental impact, and conduct a social impact assessment considering factors such as accessibility, inclusivity, and user privacy to evaluate the potential positive and negative social implications of the applications.

Phase D: Technology Architecture

Green Cloud IT Infrastructure: Design IT infrastructure using products, services, and solutions with low environmental impact (Masood et al., 2019). Adopt energy-efficient hardware, Data Centres and networks to minimise carbon emissions and energy consumption (Božić, 2023).

ESG Compliance in Cloud Services: Evaluate cloud vendors based on their ESG performance and commitment to sustainability. Prioritise solutions that align with sustainability and social responsibility goals, considering ESG factors when selecting hardware, software, and service providers (Božić, 2023).

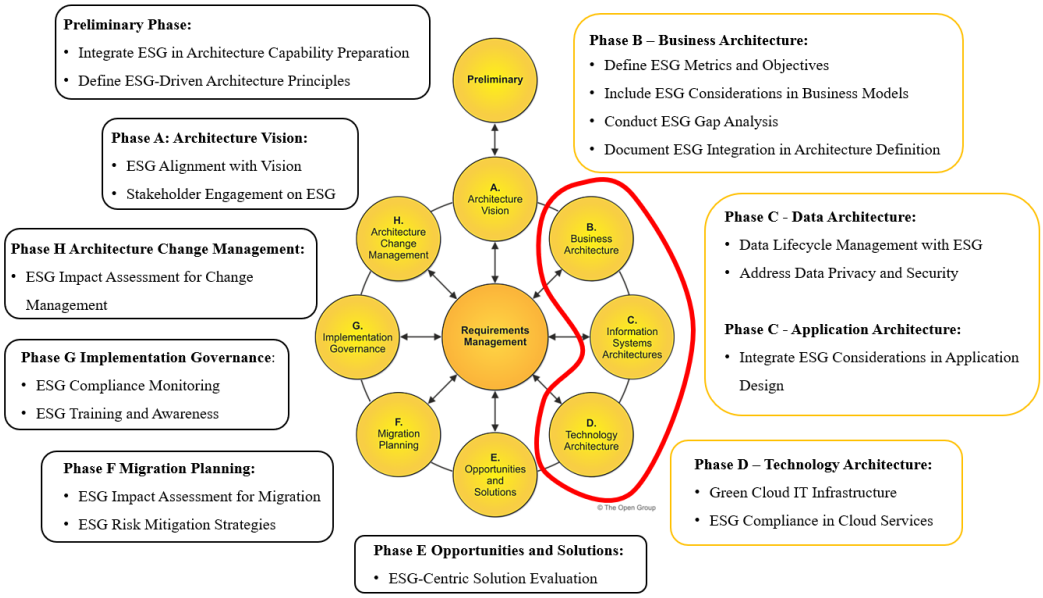

Figure 2. TOGAF® ADM® with ESG Principles and Considerations

Other Considerations in Other Phases

The Preliminary Phase

Integrate ESG in Architecture Capability Preparation: Define the scope and objectives of the Architecture Capability with a focus on promoting ESG. Identify potential ESG challenges and opportunities that need to be addressed in the architecture development process.

Define ESG-Driven Architecture Principles: Collaborate with stakeholders to define ESG-driven Architecture Principles that reflect the organisation's commitment to sustainability and social responsibility.

Phase A: Architecture Vision

ESG Alignment with Vision: Ensure that the architecture vision aligns with the organisation's ESG goals and values. Emphasise the importance of ESG in shaping the future direction of the EA.

Stakeholder Engagement on ESG: Engage key stakeholders in discussions about ESG considerations during the formulation of the architecture vision.

Phase E: Opportunities and Solutions

ESG-Centric Solution Evaluation: Evaluate potential solutions and opportunities through an ESG lens. Prioritise cloud solution vendors that offer environmental benefits, promote social equity, and adhere to ethical business practices. Consider factors such as Data Centre power efficiency, social impact, and regulatory compliance in solution selection.

Phase F: Migration Planning

ESG Impact Assessment for Migration: Conduct an ESG impact assessment as part of the migration planning process. Consider factors such as energy consumption, carbon footprint, social equity, and data privacy with cloud infrastructure in migration decisions.

ESG Risk Mitigation Strategies: Identify potential environmental hazards, social disruptions, and governance challenges that may arise during migration and implement measures to minimise their impact.

Phase G: Implementation Governance

ESG Compliance Monitoring: - Develop metrics and KPIs to track progress towards ESG goals and ensure that implementation activities align with sustainability objectives.

ESG Training and Awareness: Provide training and awareness programs to educate project teams and stakeholders about the importance of integrating ESG principles into implementation activities. Empower teams with the knowledge and skills needed to incorporate sustainability considerations into their day-to-day work.

Phase H: Architecture Change Management

ESG Impact Assessment for Change Management: Assess the potential impact of architecture changes on ESG performance and outcomes. Consider how proposed changes may affect environmental sustainability, social responsibility, and governance practices, and adjust change management strategies accordingly.

5. Limitations

While aiming to provide insights of integrating ESG principles into CC strategies using the TOGAF® framework, this study acknowledges inherent limitations.

Limited Real-World Case Studies: Availability of real-world case studies specifically examining the integration of ESG principles into CC strategies using the TOGAF® framework may constrain the literature review. Further research, such as interviews and case studies, could enhance data richness.

Limited Framework Coverage: Due to time constraints, this research compares TOGAF® and Zachman frameworks, potentially omitting other relevant enterprise architecture frameworks offering valuable insights for addressing ESG integration in CC strategies.

Limited research studies on Cloud Computing strategies, ESG and EA frameworks: While focusing on the intersection of CC, ESG, and EA, many existing studies primarily emphasise digital transformation. This research seeks to address this gap but acknowledges the challenges posed by insufficient support from relevant studies, impacting the depth and scope of findings.

6. Conclusion

This research offers a comprehensive review of how companies integrating CC strategies can incorporate ESG principles using an EA framework. Despite underdeveloped research in addressing CC, ESG, and EA simultaneously, the TOGAF® framework emerges as suitable for analysis and recommendations, focusing on the Business, Information System, and Technology Architecture aspects. Given the underdeveloped status of research in this area, this study is positioned to stimulate further academic inquiry. Future research might explore integrating AI or machine learning components within the EA framework. Considering the limited framework coverage in this research, further exploration of AI and machine learning could provide relevant insights into developing a comprehensive framework such as practical implementations in the area of cyber security, confidentiality and efficiency. Advancements in AI and emerging technologies may prompt the development of new EA frameworks, enabling companies to leverage disruptive technologies for sustained competitive advantage. Nonetheless, this research offers a unique perspective on how companies adopting CC strategies can utilise EA to meet ESG requirements. With global initiatives targeting zero carbon emissions and evolving mandatory reporting on ESG aspects, organisations are urged to integrate these considerations into their operations. Thus, this research provides guidance for companies considering the adoption of TOGAF® models and key implementation factors.

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