

The Enterprise Architecture (EA) Practice – An Analysis of Organisational Contexts for Suitable EA Implementation Models

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Abstract: Enterprise Architecture (EA) is an industry practice that coordinates enterprise change efforts for maximum benefits realisation. EA achieves this goal by converging business strategies with investment efforts (e.g., IT investments). This article examines the EA practice and models of EA adopted by organisations. An analysis of the EA practice as implemented in a vertically integrated energy company – The Nigerian National Petroleum Company Limited (NNPC Limited) was also done to showcase some challenges that face EA implementation. The paper further highlights the merits and demerits of the various EA Models. The study leveraged focused interview sessions with EA Subject Matter Experts (SMEs) working in NNPC Limited and the working experience of the researchers in the EA field to come up with a matrix to guide enterprises in selecting suitable EA implementation models based on their business. The research found that different EA models suit different enterprises based on the organizational context and characteristics. The article concludes by recommending a transition path for NNPC Limited which has already implemented EA but may need to change the implementation model to realise more benefits from the practice. This research is primarily intended for industry applications but also finds relevance for academic purposes.

Keywords: Enterprise Architecture; EA models; EA domains; domain architecture; change management; enterprises; business ecosystem.

1. Introduction

Enterprise Architecture (EA) is a “conceptual blueprint that defines the structure and operation of organizations” [1]. This blueprint is an output of the EA practice, that involves the “analysis, plan, design and implementation of enterprise analysis for successful business strategy execution” [2]. Gartner, a leading information technology industry advisory, views Enterprise Architecture (EA) as a holistic approach to managing change implementation in a bid to achieve the strategic vision of enterprises [3]. EA captures the business context of the enterprise and seeks to maximize the objectives of the enterprise through the deployment of appropriate strategies, practices and technologies that support the achievement of the organization’s business aspirations.

EA approaches business objectives realization by first understanding the purpose and aspirations of the enterprise, and the activities that the organization need to carry out in a bid to achieve its set objectives; Such activities are referred to as the Business Capabilities. Enterprise Architects practise EA by designing blueprints (roadmaps) for how an organization can achieve business objectives with optimal investment in people, practices and technologies in alignment with the identified business capabilities. The way organizations implement EA is referred to as the 'EA implementation model' or simply the 'EA model'. This EA operationalization is done along certain dimensions referred to as 'EA Domains'.

This article presented studies done by James Lapalme [4] as he arrived at three broad schools of thought that underpin the EA practice in most organisations and refers to them as 'EA Models'. This article further classifies enterprises into three major types: small, medium and large enterprises; with different scopes of operations and regulatory

environments. The study then creates a matrix to suggest suitable EA models for each enterprise type based on the enterprise's characteristics. The major finding of the research is that EA models are not a 'one-style-fits-all' for all enterprise types but rather require an in-depth analysis of each enterprise for its business context before implementing any EA model.

2. Materials and Methods

Data used within this research was qualitative, drawing majorly from published materials referenced throughout the article, subject matter experts' review, feedback, and experiential knowledge of the authors in the field of Enterprise Architecture.

3. Enterprise Architecture Domains

Enterprise Architecture domains are the components that are foundational to the implementation of the EA practice in an organization. It encompasses the description of architectural models, governance mechanisms, and transition plans necessary to ensure that stakeholders work together toward common business goals and objectives. EA domains are the legs on which the EA stool stand. EA can be broadly categorized into two domains: the Business Domain and the Information Technology (IT) Domain. These domains contain 'Architectures' which define the range of activities done within each domain. The Business Domain comprises the Organizational- and Business- Architectures while the IT Domain comprises the Application-, Data / Information-, Technology-, and Security- Architectures. These architectures work in tandem to provide the necessary support for fulfilling the company's strategic objectives [5].

- a. Organizational Architecture
- b. Business Architecture
- c. Application Architecture
- d. Data Architecture
- e. Technology Architecture
- f. Security Architecture

3.1 Organizational Architecture

Organizational architecture covers all aspects of a business that may not have a direct bearing on the operations of the business, but rather the intangible assets of the business including its vision, mission, core values, strategies, and the definition of its organizational units [6]. It also considers the external environment of the enterprise and the factors that impact the definition of the enterprise's vision and business purpose. Such factors include the government, stakeholders/shareholders, regulators, and consumers of the enterprise's products.

3.2 Business Architecture

Business architecture is the bedrock for all other enterprise architecture domains. It explains the operating model, organization, operational practices, and information flow of the enterprise [7]. Business architecture is a crucial component of Enterprise Architecture (EA) that serves as the link between Organizational Architecture and the business operations of the enterprise. It establishes connections within the functional structure of the enterprise by defining business services, business information, strategies, objectives, processes, organizational structure, roles, responsibilities, and their interrelationships. The business architecture plays a fundamental role in articulating the requirements for

information systems and technologies essential for the execution of the enterprise's business activities [8].

3.3 Application Architecture

Without specifying the technology vendor to be used, application architecture represents applications and their interactions that allow data management and the automation of business processes [6]. This architecture identifies, defines, and organizes activities for capturing, manipulating, and managing business information to support mission operations, as well as the logical dependencies and relationships between business activities. This creates a framework to meet the information architecture's requirements for specific information. It employs its components to acquire and process data, to enable automation and procedures directed to information systems that support information flows, and to produce and distribute information following the architecture's and standards' requirements.

The application architecture components refer to specifications, requirements, applications, modules, databases, and procedures, and also define the approaches to the development of information systems.

3.4 Data Architecture

As defined in the Data Management Body of Knowledge, Data Architecture “describes how enterprise data should be organized and managed” in line with enterprise strategy and business architecture [9]. Technically, it describes the structure of enterprise data assets (both logical and physical) and management resources. It includes data models, definitions, flows, etc. [10].

3.5 Technology Architecture

Technology Architecture “describes the logical software and hardware capabilities that are required to support the deployment of business, data, and application services”. It comprises IT standards, infrastructure, middleware, etc. [11].

This architecture details the operational characteristics, capabilities, and how they are interconnected, encompassing both hardware and software components as well as communication systems.

Furthermore, technology architecture is responsible for overseeing the design, development, implementation, and enhancement of the enterprise's technology infrastructure. This encompasses application hosting, network management, security, and telecommunications, with the goal of delivering value to the organization's business operations [5].

3.6 Security Architecture

The security architecture is focused on securing organizational data [12]. It describes the key principles, procedures, and controls for data security to effectively manage enterprise risks associated with information and information technology [13]. The goal of this architecture is however to protect all the enterprise assets and not just the technology. Overall, it ensures the alignment of security needs to business needs and context [14]. The security architecture has overlapping concerns with every other architecture area because enterprise security is a global concern.

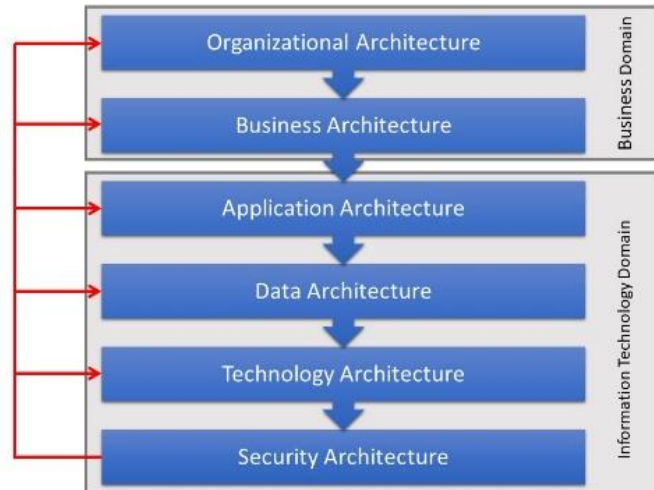


Figure 1: EA Domains and Architectures

4. EA Application Areas

All organizations, irrespective of their industry, age, past, or size can leverage EA to realize their current and future objectives. The EA practice addresses business concerns including but not limited to the following:

S/N	Architecture Domain	EA Application
1.	Organizational Architecture	<ul style="list-style-type: none"> a. Compliance – with EA, organizational relationships are clearly outlined with critical value streams prioritized to ensure all external regulatory and internal compliance requirements are easily identified and managed [15]. b. Mergers and acquisitions – EA offers a unique platform for x-raying possible points of integration between organizations that intend to merge for business purposes. Also, possible business capabilities not required in the new enterprise are easily highlighted with the help of EA.
2.	Business Architecture	<ul style="list-style-type: none"> a. Innovation management – EA makes it possible to easily identify business areas where new thoughts, technologies and practices can optimize strategy and operations and effectively captures these opportunities as ‘future state architectures’ for implementation. b. Change management – EA supports this by clearly showing components of an enterprise that can be impacted by change efforts and providing guidance on how to manage such change efforts for minimal disruption to business flow.
3.	Application Architecture	<ul style="list-style-type: none"> a. Digital transformation – EA provides enterprises an opportunity to visualize its business landscape and to quickly identify areas where changes can be made to optimize enterprise performance leveraging digital technologies [15]. b. Application portfolio rationalization – The holistic view of the application landscape provided by EA enables organizations to leverage shared services and economies of scale where applicable; thereby minimizing cost and streamlining their application portfolio.

4.	Data Architecture	<ul style="list-style-type: none"> a. Data governance – the EA practice through its Data/Information Domain, supports the proper classification and management of data with laser focus on data streams that are most valuable to the enterprise value streams [15]. The resulting improvements in data management also leads to a reduction in data management costs. b. Knowledge retention – EA helps to recommend capabilities and systems for capturing and retaining useful business knowledge through its Data/Knowledge Domain practices. This is vital to creating continuously learning organizations [15]. c. Decision making – data architecture improves the usability of data (i.e., data comprehensiveness and consistency) and allows the organization to get more information and insights from the data which enables more informed business decisions to be made.
5.	Technology Architecture	<ul style="list-style-type: none"> a. Landscape rationalization - EA helps to minimize duplication of existing technologies as well as accelerate the discovery of fit-for-purpose technologies identified by business needs.
6.	Security Architecture	<ul style="list-style-type: none"> a. Data security/risk management – the EA practice helps to give a clear understanding of data and information management procedures within the organization as well as highlight possible risk areas for proper handling and mitigation [15].

Table 1: Contribution of EA Domains to the Enterprise Business Processes

5. Enterprise Models for EA

The EA practice has been implemented in various organizations with different world views as to the function the organization perceives EA to serve. A decent job of curating and categorizing these perceptions of EA was done by James Lapalme [4] as he arrived at three broad schools of thought which underpins EA practice in most organisations. We have adopted and presented these as well as inputs on some of the merits and demerits of the system from experiential knowledge of the EA practice.

5.1 Model 1 – EA for IT Architecting

This model of EA practice perceives EA chiefly as a means of aligning IT investments with defined business strategies. The Enterprise Architect seeks keenly to focus the IT architecture on responding to some sets of defined business strategies and capabilities. Common activities include rationalizing the application landscape to remove duplication, and defining automation roadmaps for implementation by organizational units. This model of IT typically views EA as an IT function.

5.1.1 Merits

- a) Organised IT landscape with less duplicity of efforts across the enterprise.
- b) Optimal value realisation from IT spends.
- c) Rationalised IT investment in various initiatives.
- d) Production of high-quality models and planning scenarios for IT in a bid to support attainment of set business objectives.

5.1.2 Demerits

- a) Possibility of aligning IT investments with non-viable business strategies.

- b) Risk of 'digitising manual processes' rather than 'automating optimised processes.'
- c) Difficulty obtaining business owners' buy-in as IT investments are viewed more as costs than as a value add.
- d) Does not account for socio-cultural and political realities of organisations, hence its recommendations often become unfeasible to implement in the enterprise.

5.2 Model 2 – EA for Enterprise Integrating

This EA implementation model takes a broader approach by crafting the enterprise vision and strategies first, and afterwards seeks the collaboration of each organizational unit in defining what strategies, capabilities and tools to provide in achieving the defined enterprise goals, including IT. This model addresses the challenge of isolating business strategy from EA strategy by putting all organisational units in perspective during the business strategy development process. EA in this case will usually reside in the business strategy development hub of the organization.

5.2.1 Merits

- a) Continuous systems-thinking on an enterprise scale.
- b) Convergence of all enterprise strategies in a synergy towards a shared common purpose (i.e., little alignment efforts for different strategies by different organisational units).
- c) Less need for business owners' buy-in to IT investments (if and only if the business owners' are part and parcel of the enterprise strategy definition).

5.2.2 Demerits

- a) Little awareness of external ecosystem of the enterprise, including the socio-economic, and socio-political aspects of the enterprise on a continuous basis.
- b) Little opportunity for technology to influence the business strategy itself.
- c) Difficulty getting buy-in from business owners on EA recommendations (if the organisational strategy hub is isolated from the organizational units).

5.3 Model 3 – EA for Enterprise Ecosystem Adaptation

This EA model views the entire enterprise as one component of a larger ecosystem of enterprises, governments, markets and individuals. Thus, EA is a vehicle for achieving enterprise-in-environment co-evolution. The EA practice not only seeks to define enterprise strategies but also to influence the external environment through awareness and recognition of the interplay between the sub-systems within the ecosystem. EA is therefore perceived as a tool for innovation and continuous organisational agility, managing change at scale. EA in this case is driven by the top leadership of the organisation.

5.3.1 Merits

- a) Internal and external awareness of the enterprise ecosystem.
- b) Improved organisational agility with better response to changes and opportunities.
- c) Convergence of socio-economic and socio-political influences with enterprise strategies.
- d) Opportunity of the enterprise to consciously influence the business ecosystem through targeted business strategies.

5.3.2 Demerits

- a) Difficulty in implementing the model across all organisational units and the environment.
- b) Challenges in entrenching agility in the enterprise to accept multiple paradigm shifts in strategy formulation and execution approaches.

Below are figures describing the three major enterprise models for EA:

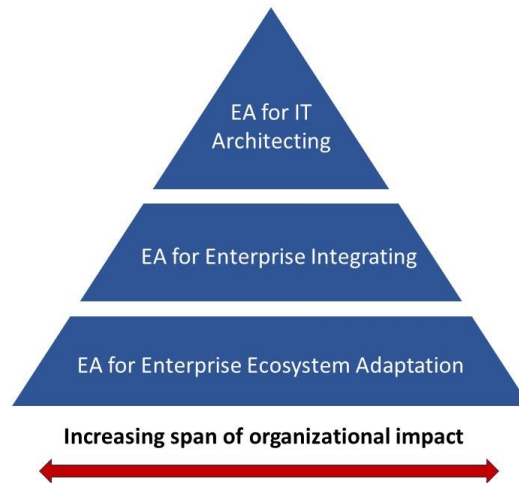


Figure 2: EA Influence and Impact Matrix

6. Enterprise Architecture Frameworks

An enterprise architecture framework defines the building blocks of how to establish and practice EA in an enterprise. It recommends the methods, operational models, approaches, and mechanisms for tracking EA value to the enterprise. Broadly, four (4) frameworks exist albeit not exhaustive nor prescriptive in themselves as organizations are at liberty to implement the whole or parts of different frameworks. The four major frameworks include:

6.1 The Open Group Architecture Framework (TOGAF®)

TOGAF (The Open Group Architecture Framework) is a comprehensive standard that provides expanded guidance and how-to materials to help organizations operate efficiently across different scenarios, including agile enterprises and digital transformation efforts. It strikes a balance between common universal concepts and detailed configuration options, making it adaptable to various enterprise architecture needs.

The framework consists of two key components: the TOGAF Fundamental Content, which covers core concepts and practices, and the TOGAF Series Guides, which offer advice on configuring the Fundamental Content. TOGAF's structure focuses on delivering valuable guidance to architects, supporting their stakeholders and organizations in achieving the best possible enterprise architecture. [16]

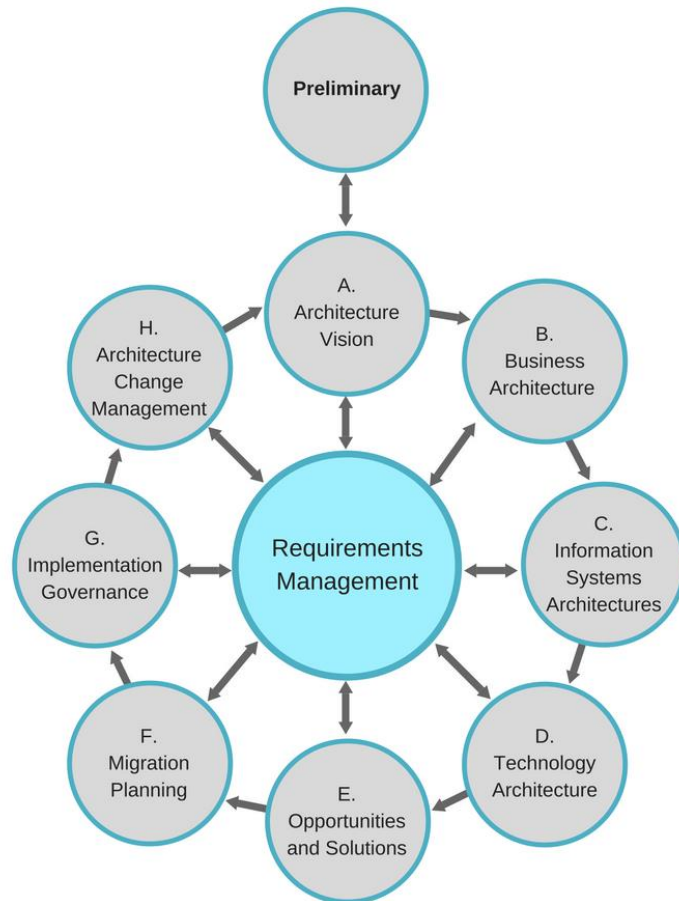


Figure 3: The TOGAF Architecture Development Method. Source: [17]

6.2 The Zachman Framework

This framework provides a comprehensive way to describe complex concepts and has been empirically observed in the architecture of various complex products like buildings and aeroplanes. The Zachman Framework™ is typically represented as a 6x6 matrix, with the communication interrogatives as columns and the reification transformations as rows. The cells at the intersections of these categories constitute the complete set of descriptive representations applicable to any object, particularly in the context of enterprise architecture.

The Zachman Framework models an enterprise by addressing six questions: What, How, Where, Who, When and Why did this happen, in terms of six different roles: Planner, Owner, Designer, Builder, Subcontractor, and Functioning Enterprise. The Zachman Framework is a popular approach for developing Enterprise Architecture. The Framework is a simple, logical structure that aids in the organization of the Enterprise's information infrastructure and provides numerous benefits in aligning technology with business goals [18].

	What	How	Where	Who	When	Why
Scope						
Business Model						
System Model						
Technology Model						
Detailed Representations						
Functioning Enterprise						

Figure 4: The Simplified Zachman Framework. Source: [19]

6.3 Federal Enterprise Architecture Framework

The Clinger Cohen Act of 1996 mandated that all US Federal Agency CIOs establish and implement an integrated architecture to enhance the value and mitigate the risks associated with their IT projects. To achieve this, the Federal Enterprise Architecture Framework (FEAF) Version 1.1 was introduced by the US Chief Information Officers (CIO) Council in 1990. The primary goal of FEAF was to facilitate the seamless integration of diverse architectural structures found in various Federal agencies. This integration aimed to improve customer and public access to information by making it more efficient, faster, and cost-effective [20].

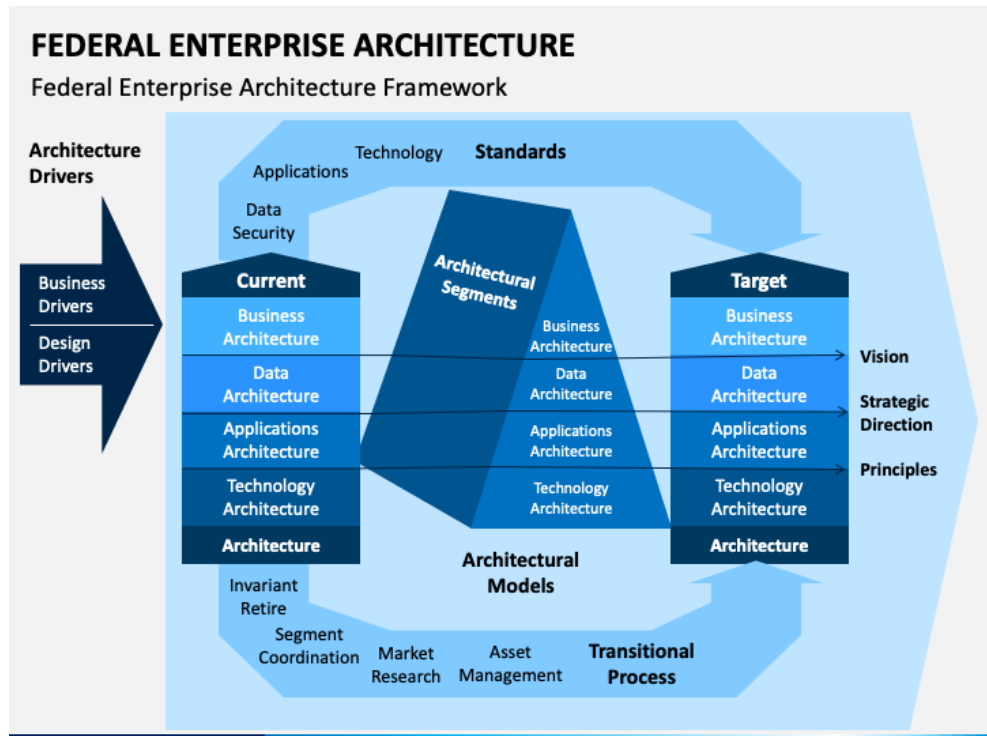


Figure 5: The Federal Enterprise Architecture Framework. Source: [21]

6.4 Gartner

Gartner is a provider of research and advisory services for IT businesses which perceives Enterprise Architecture (EA) as an ongoing process that entails evaluating the current architectural state, establishing goals for creating a future state, and continuously overseeing the entire portfolio of an organization. In Gartner's view, EA functions primarily as a strategic endeavour rather than an engineering discipline. Its purpose is to construct a unified enterprise view that aligns with an organization's business requirements [20].

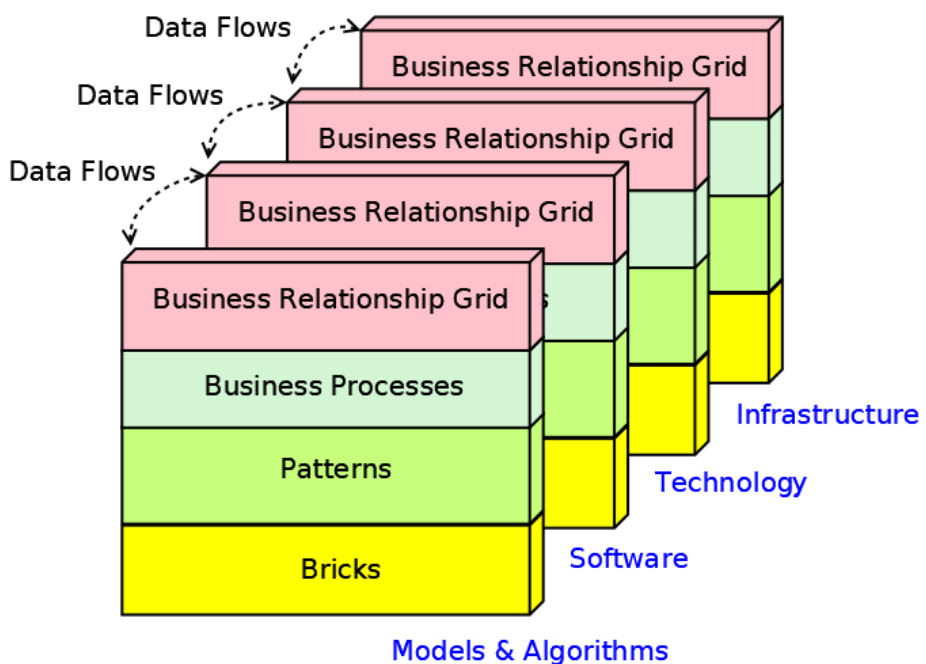


Figure 6: The Gartner Enterprise Architecture Framework. Source: [22]

7. EA Models for different Enterprise Types

Different kinds of enterprises having different business objectives operating within unique environments and having distinct leadership and organisational structures have varied peculiarities. Thus, in choosing a suitable EA model for implementation, the enterprise context should be carefully considered. The authors recommend the implementation of enterprise architecture models that could work best for each situation.

The authors present the matrix below as a basis for further analysis of suitable EA models for enterprises:

S/ N	Organisation Type	EA Model	EA Residence	Reason
1	Monolithic enterprise having a single business objective with a single industry regulator (i.e., small sized enterprises with less business ecosystem complexity).	EA for IT Architecting	IT function	More opportunity to consolidate IT investments to quickly deliver set business objectives for the organisation
2	Multi-subsidary enterprises with single regulatory obligation such as a group holding company with multiple business objectives but with a single industry regulator (i.e., medium sized enterprises with moderate business ecosystem complexity). E.g., horizontally integrated companies.	EA for Enterprise Integrating	Enterprise business strategy and planning function	Multiple business units need coordination of objectives but there is low to medium external stakeholder management requirements
3	Multi-subsidary enterprise with multiple regulatory obligations (i.e., large sized enterprises with high business ecosystem complexity). E.g., vertically integrated enterprises.	EA for Enterprise Ecosystem Adaptation	Enterprise Executive Leadership function	High need for managing business ecosystem stakeholders

Table 2: EA Models for different Enterprise Contexts

The figure below shows the area of coverage in an enterprise for each EA Model described and the possible actors that EA team members interface within the course of carrying out their functions in an enterprise.

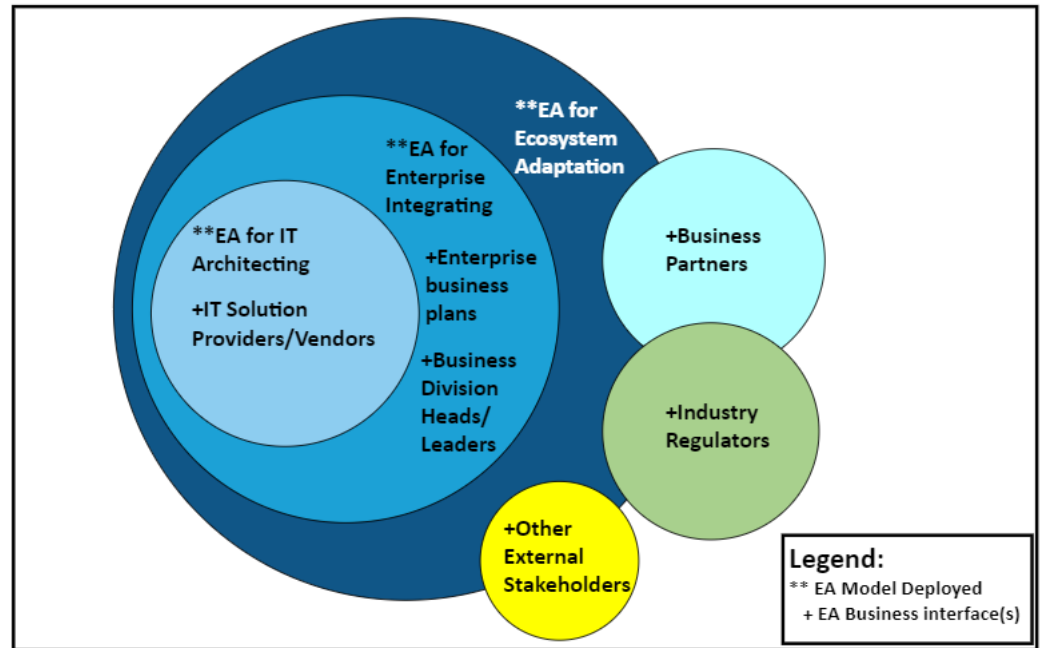


Figure 7: EA Implementation/Deployment Models and Interfaces with Business Actors

7.1 Other Key Considerations in Establishing an EA Practice

Depending on the enterprise context, the following factors also need to be considered in establishing an EA practise:

1. **The enterprise maturity level** – enterprises with low maturity levels in handling strategy formulation and IT investments coordination require co-location of the EA and the enterprise business strategy function while more mature enterprises may explore separation of the two.
2. **The cost of setting up EA practice (i.e., human, material, and intellectual resource costs)** – enterprises operating on lean budgets may explore consolidation of the EA function with other business planning functions while organisations with higher interests in reaping EA benefits at scale may have distinctive EA functions at relevant business units.
3. **The EA framework adopted** – bespoke arrangements may be made on selecting suitable components from any of the EA frameworks as none is necessarily prescriptive. However, care needs to be taken to capture the essential components of frameworks relevant to the organisation’s context.

8. EA in NNPC Limited

The Nigerian National Petroleum Company (NNPC) Limited is a vertically integrated National Oil Company (NOC) with operations across the upstream, midstream, and downstream sectors of the oil and gas industry in Nigeria. The company has several business units across these value chains with each having unique business mandates and aspirations. As a group holding company, NNPC Limited attempts to maximise the overall bottom line of the subsidiaries within the group by setting overarching business strategies and targets for the various entities through its corporate strategy and

sustainability unit. These targets are then cascaded to all businesses to craft bespoke strategies on how to meet them.

8.1 Features of the NNPC Limited as an NOC

1. The company is State-owned.
2. Its business units are decentralized, with each having a business leader that reports to the group's senior management.
3. Each business unit has an independent organisational structure with an IT function in each.
4. The company is commercially driven with a focus to maximise profitability but with a responsibility to guarantee energy security for the Nigerian State.
5. Some business entities within the group have the primary responsibility of making profits while others exist to provide value-adding services to profit making businesses.
6. The company operates within a highly sensitive socio-political environment.
7. The company deals with multiple partners, vendors and service providers who have different business objectives, aspirations, operating models and tools.
8. Subsidiaries within the company are in multiple geographical locations within Nigeria and outside Nigeria.

8.2 EA Implementation in NNPC Limited

The Information Technology (IT) is the service unit in NNPC that is responsible for delivering and managing information and technology (I&T) services across the NNPC Limited enterprise. It delivers enterprise IT services to all the NNPC Limited subsidiaries and develops group-wide governance mechanisms through policies, procedures and guidelines for the delivery of I&T services across NNPC Limited.

The IT function also provides I&T services that are shared across all subsidiaries of the company. The 'EA Project' which established EA as a business function in NNPC was conceived as an IT initiative in the year 2019, hence, EA resides within the Corporate Information Technology service unit. However, apart from the Corporate IT division, subsidiaries of the company also have IT functions that serve as primary business partners for IT needs that are subsidiary-specific and do not cut across the entire enterprise. These subsidiary IT functions do not have established EA units.

The purpose of establishing EA was to improve business efficiency by entrenching business process automation and consolidating IT investments across the company. The EA practice is primarily applied for business process automation. Relevant automation blueprints/roadmaps are developed for all business entities within the company and presentations are made to the various business leaders on the expected benefits of EA should its recommendations be adopted in the various businesses.

The EA practice in NNPC Limited had firm footings in the Business and Applications Architecture practices. It had peripheral recommendations on the Technology and Security Architectures. The project leveraged TOGAF as the reference framework during implementation.

8.3 Operating Model of EA in NNPC Limited

NNPC Limited implements 'EA for IT Architecting'. The EA function is centralised at the Corporate Information Technology (IT) Service Unit and saddled with the responsibility of architecting for the entire NNPC Limited enterprise. The EA function engages with business units to first understand their business mandates and aspirations, and then develops blueprints accordingly. These blueprints are signed-off by Business Leaders as an agreement to implement them. The EA monitors and reports on this implementation by the BUs. The blueprints also serve as inputs to the IT strategy. The EA Team reports to the Chief Technology Officer who is accountable for administering IT for the entire enterprise.

8.4 Challenges of EA

Organizations face various operational and strategic challenges in the EA practice. Some EA challenges include:

8.4.1 Management Buy-in

- Lack of buy-in from business leaders due to limited understanding of the role of EA in the enterprise.

8.4.2 Funding Gaps

- The perception of EA as an IT responsibility instead of a business responsibility results in low commitment to finance the implementation of EA recommendations.
- Insufficient funding to implement EA recommendations at scale.

8.4.3 Human Resource Gaps

- Inadequate EA human resources to cover all business units across the enterprise.

8.4.4 Technology Gaps

- Insufficient tools to develop and maintain EA Artifacts.

8.4.5 Governance Gaps

- Insufficient defined processes / procedures for leveraging EA.
- Inadequate structured methodologies and quality practices for carrying out business operations.
- Detachment of EA from the enterprise strategy development process.
- Challenges ensuring compliance with EA guidelines and recommendations by business leaders.

9. Discussion

EA as a practice is maturing steadily across enterprises. The authors recommend that enterprises evaluate and reevaluate their contexts as may be necessary at time intervals to determine the suitable EA model for maximum benefits realization leveraging the presented matrix (i.e., Table 2) in this article for EA model selection.

Companies in a similar situation as the NNPC Limited should also consider a refresh of the EA implementation with a focus on reestablishing the EA function as an "Enterprise Integrating" function that would be resident in the Corporate Planning and Sustainability division of the company in the first instance as a transitory step.

Subsequently, upon further maturity, the EA practice in such companies can be migrated and used as an “Enterprise Ecosystem Adaptation” mechanism that would be driven by the company’s top leadership team.

The authors recommend further research in the areas of EA implementation in start-up companies to understand the impact of beginning an enterprise with the EA practice in place from the onset.

10. Conclusions

EA is a beneficial practice in companies especially when implemented appropriately. The implementation approach of EA in organisations has largely been based on organisations’ perception of the possible benefits from EA. During implementation, EA resources often encounter challenges around adoption of EA recommendations by the business and in justifying the need for further investments in EA. Most of these challenges stem from the model of EA being implemented and the location of the EA function within the organisation’s structure.

This study presented the context within which different EA models may flourish and laid out other factors worthy of note in establishing an EA practice in an enterprise. It also examined the EA practice in the Nigerian National Petroleum Company Limited (NNPC Limited), highlighting some challenges experienced in implementing EA in a large multi-subsidiary company such as NNPC Limited. It recommended how the EA practice can be refreshed in a company like NNPC Limited in a two-step transition. The article also presented a matrix to guide the selection of EA models based on enterprise context.

11. Author Contributions:

Iyata A. Adikpe conceptualized the study, planned, and administered the research process. He also contributed to drafting the original manuscript of the article. Furthermore, he served as the primary investigator that provided guidance on the data, and visualisations used within the article.

Aisha A. Garba engaged the Enterprise Architecture Subject Matter Experts in NNPC Limited and corresponded with them in collating their feedback to the original manuscript. She also contributed to drafting the original manuscript. In addition, she prepared some of the visualisations and tables used within the article.

Fatima Z. Ali reviewed the manuscript and provided relevant input and additional information that improved the quality of the research. She analysed and analysed the context provided in the NNPC Limited case study and contributed to improving the information on EA in NNPC Limited. Furthermore, she generated some of the visualisations and tables used within the article.

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