Cape Peninsula
University of Technology

A METRIC MODEL FOR MEASURING THE VALUE OF ENTERPRISE ARCHITECTURE IN DEVELOPING COUNTRIES

by

MONICA NEHEMIA

Thesis submitted in fulfilment of the requirements for the degree

Doctor of Philosophy: Informatics

in the Faculty of Informatics and Design

at the Cape Peninsula University of Technology

Supervisor: Prof Tiko Iyamu

Cape Town Wellington
May 2023

DECLARATION

I, Monica Nehemia, declare that the contents of this dissertation/thesis represent my own unaided work, and that the dissertation/thesis has not previously been submitted for academic examination towards any qualification. Furthermore, it represents my own opinions and not necessarily those of the Cape Peninsula University of Technology.

Monica Nehemia	30 July 2023
Signed	**Date**

ABSTRACT

Many organisations across the world are challenged by factors of change, which manifest from different events such as technological innovations, global trends and introduction to new business processes. Some of these factors influence the alignment between business activities and its information system and technology (IS/IT) solutions. Many government organisations do not have a holistic view of their environments, which makes alignment between IS/IT and business processes difficult towards providing consistent solutions for changing needs. Such organisations have deployed enterprise architecture (EA) to manage these challenges. EA is used to manage and regulate business activities and its associated IS/IT solutions towards the attainment of its organisational goals.

However, many developing countries, particularly on the African continent, are increasingly challenged with the implementation of EA because they are not able to establish and assess the value. This is due to lack of standard metrics that can be used to measure the value of EA. As a result, many governments' institutions are losing out from the benefits that the implementation of EA offers. The lack of a metric model to measure the value of EA hinders some governments' institutions in their attempts to employ the concept, for the purpose of improving service delivery. The aim of the study is to propose a solution through a metrics model, which can be used to measure the value and benefits of EA within governments' institutions in developing countries.

The study followed the interpretivist stance, which was supported by the qualitative method. The research design was the case study, with the government of Egypt and the government of Ghana. Data collection was documentation about EA of these government's environments. The sociotechnical theories, Activity Theory (AT) and the Dimension of Change (DS) of the Structuration Theory (ST) were used to underpin the study. Data from the two cases were gathered and analysed, separately guided by AT, whilst DS was used to interpret the findings. Based on the interpretation, an enterprise architecture metrics model (EAMM) was developed.

ACKNOWLEDGEMENTS

I wish to thank:

- First and foremost, my supervisor, Prof Tiko Iyamu. Thank you for believing in me, and thank you for lifting me up when I was down, thank you encouraging me when I wanted to give up, thank you for the joy of learning and empowering. Thank you for being my Mentor, teaching me the art of listening, the heart of sharing knowledge and the ability to do what I never thought I am capable of doing. It was a privilege and honor to be supervised by you.

- To all my children, Vanyenga, Haaveshe, Etuna, Mweneni, Ndaomba and Fransie, thank you for your support, understanding and love. Thank you for making motherhood simpler when I was required to be a student. You put my conscious at ease during the course of my studies. As I always said, this is for you.

- Ndina, “My Ma se Kind”, thank you for being my rock, I know that I can conquer and face anything with you by my side. We did this one Sis.

- Thank you Dr. Irja Shaanika. You are a precious gem.

- I would also like to thank all my family and friends, who supported and encouraged me through this journey. Umuntu ngumuntu ngabantu.
- HTA

DEDICATION

This thesis is dedicated to my Ancestors, my parents, Tate Omo Fransiscus and Meme Ndishilange Erica. I will always miss you.

TABLE OF CONTENTS

CHAPTER FOUR: RESEARCH METHODOLOGY

CHAPTER FIVE: CASE OVERVIEW

CHAPTER SIX: DATA ANALYSIS

CHAPTER SEVEN: THE ENTERPRISE ARCHITECURE METRICS MODEL

LIST OF FIGURES

LIST OF TABLES

CHAPTER 1:

INTRODUCTION

1.1 Introduction

Organisations are continuously faced with various types of challenges such as adapting to global changes, and coexistence of infrastructures, which affect its operations. According to Plataniotis, De Kinderen and Proper (2014), many organisations across the world are challenged by factors of changes, which manifest from events such as acquisitions, mergers, technological innovation and introduction of new business processes. Some of the factors influence the alignment between business activities and its information system and technology (IS/IT) solutions. In addition, some organisations do not have a holistic view of their environments, which makes alignment between IS/IT and business processes difficult towards providing consistent solutions for changing needs. Shaanika and Iyamu (2015) claim that the deployment of IS/IT alone does not guarantee success in an organisation, hence the use of enterprise architecture (EA). The authors further claim that EA is used to manage and regulate business activities and its associated IS/IT solutions towards the attainment of its organisational goals. In addition, the implementation of EA is the means of getting a holistic view of an organisation (Buckl, Matthes, & Schweda, 2010).

EA can be viewed from different angles, which can be attributed to its enterprise-wide and holistic nature. From one angle, Tamm *et al*. (2011) refer to EA as the model and documentation tool that is used to describe a high-level view of an enterprise's processes and IT systems, their interrelationships, and the extent to which these processes and systems are shared. From another angle, Safari, Faraji and Majidian (2016) argue that EA is a strategic tool that can be used to govern and manage business process, information value, application and technology deployment. However, these documents should not only elaborate on what architectural documents should include, but it should also educate how to operationalise the EA programs (Bui, 2017). Irrespective of the angle EA is viewed, the concept is geared towards benefits.

EA implementation is a set of activities that ultimately aim to align business objectives with IS/IT artefacts in an organisation (Nygard & Olsen, 2016). Aier (2014) resonates that an

organisation that has implemented EA effectively enjoys a stable and flexible environment, which are significant benefits. Other benefits that can arise from implementing EA include reduced operating costs, improved project execution and increased alignment between business and IS/IT (Buckl *et al.,* 2010).

The popularity of EA in the private sector have motivated governments to develop EA in order to establish a holistic view of government operations (Klischewski, 2014). EA is of significance to governments because of its efforts to deploy internet government services, with the aim to make it citizen-centric and produce results based on the need of the market (Saha, 2010). Countries such as South Africa (Van Zijl & Van Belle, 2014), Ghana (Kaushik & Raman, 2015), Kenya (Katuu, 2018) and Egypt (Mohamed, Galal-Edeen, & Hassan, 2013) are but some of the governments in developing countries that have developed EA. The development and deployment of the government enterprise architecture (GEA) has been associated with benefits such as change management, budget optimisation, complexity management and IS/IT portfolio management (AlSoufi, 2012).

EA implementation is questioned and interrogated, as their benefits are not easy to scrutinise (Tamm, *et al.,* 2011). It is imperative to establish a basis for EA assessment that can guide a systematic, neutral way to measure and determine whether the deployment of the EA achieves its objectives in an organisation (Karimi, Sharafi, & Dehkordi, 2014). Another challenge in determining the benefits of the EA is in its vast nature, which many of the current assessment models are not able to cover because of their specific focus (Nikpay, Ahmad, & Kia, 2017). Thus, organisations including governments are still faced with the challenge to realise benefits derived from the implementation of EA (Bakar, Harihodin, & Kama, 2016).

1.2 Clarification of Terms:

This section provides clarification for some of themterms used in the proposal as follows:

i. Enterprise Architecture – the architecture of information, business, application and technology in an organisation
ii. IS/IT – information systems and information technology
iii. Metrics –strategic and operational tools that are used for measuring
iv. Value – technical and business benefits

1.3 Research Problem

Many countries develop and implement EA primarily to improve on service delivery, which are intended to ultimately add value to their activities. This includes, to bridge the gap between services and IT solutions, govern processes, and manage the deployments of IS/IT artefacts in an environment.

However, many developing countries, particularly in the African continent are increasingly challenged with the implementation of EA because they are not able to establish and assess the value. This is due to lack of standard metrics that can be used to measure the value of EA. As a result, many governments' institutions are losing out from the benefits that the implementation of EA offers. The lack of metrics to measure the value of EA continue to pose challenges for many governments in developing countries. This problem manifests in both technical (IS/IT solutions) and non-technical (such as process and governance) perspectives, which make it difficult to detect the areas that require improvement or further development in attempts to reducing risk and complexities. Consequently, the lack of a metric model to measure the value of EA hinders some governments' institutions in their attempts to employ the concept, for the purposes of improving service delivery. This is further discussed in the literature review section.

As a means to mitigating against the challenges associated with measuring the value of EA within governments institutions, an empirically driven metrics model is needed. The aim of the study is therefore based on this premise.

1.4 Research Aim

The aim of the study is to propose a solution through a metrics model, which can be used to measure the value and benefits of EA within governments' institutions in developing countries.

1.5 Objectives

Based on the aim, the following objectives were formulated:

i. To examine the factors that influence EA implementation within governments' institutions in developing countries. This is to understand the rational as well as expectation of implementating the concept of EA in an environment, which can be used to establish metrics
ii. To examine and establish how EA is practiced in governments' institutions in developing countries. This is to determine the factors that influence the benefits

and value of the concept, in order to establish metrics. This includes gaining an understanding of the impact which roles, organisational structure, process and rules have on EA practice.

iii. Based on the findings from the above objectives, a metric model will be developed.

To achieve the aim and objectives of the study, questions were articulated. The next section presents the research questions.

1.6 Research Questions

How can a metric model be used in measuring the value and benefits of EA in governments' institutions of developing countries?

1.7 Sub Questions

In answering the main question, it is essential to first answer the following questions:

- What are the factors that influences EA implementation in governments' institutions in developing countries? How can these factors be used to develop a metric model?
- How is the EA practiced in governments' institutions in developing countries? How can these processes be used to develop a metric model?

CHAPTER 2:

LITERATURE REVIEW

2.1 Introduction

A literature review was conducted based on the aim of the study, which is to develop a metric model that can be used to measure the value of enterprise architecture (EA) in developing countries. The review is presented in four main sections, starting with the introduction to the chapter, information technology for government service delivery; enterprise architecture in governments, enterprise architecture metrics.

2.2 Information technology for government service delivery

Organisations deploy information systems and technology (IS/IT) in their environments to improve and support business processes. Meriyem, Adil and Hicham (2015) emphasise that one of the main factors of IS/IT is its ability to assist organisations in achieving their business goals and objectives. The IS/IT solutions are thus critical to organisations including individuals in different ways (Jairak, Praneetpolgrang, & Subsermsri, 2015). Frogeri, Pardini, & Cunha (2020) argue that IS/IT is a critical factor for the success or failure of organisations, including government organisations. Consequently, IS/IT solutions have over the years become pervasive, at the same time important in different aspects of organisations, including government administrations. Due to its importance, some government administrations and agencies are investing substantially in IS/IT solutions (Mithas & Rust, 2016). Some investments in IS/IT solutions can be justified by organisations' need to automate business operations. Stair and Reynolds (2013) postulate that IS/IT solutions are often deployed to automate processes.

IS/IT is present in the environment of many organisations through the deployment and use of its solutions (computing artefacts). Iyamu and Kekwaletse (2010) define computing artefacts as a structured composition of software and hardware that provides computer services, support and maintenance. Computer services are needed for different purposes such as operational activities (Iyamu & Kekwaletse, 2010), strategic objectives (Abdeladi, Khan, & Khan, 2014) and competitiveness in their industry (Safari, Faraji, & Majidian, 2016). The introduction of IS/IT in organisations is associated with many benefits such as the effectiveness and efficiency of activities (Muladi & Surendro, 2014).

Through IS/IT solutions, innovation is enhanced to create value in government administrations. Even though organisations are subjected to different factors that can bring about change, IS/IT must be flexible to follow the strategy of the institution (Benkhayat, El Manouar, & Sadok 2015). It is imperative that IS/IT is deployed to satisfy organisational needs. Many organisations and individuals have claimed to experience the benefits and convenience of IS/IT deployment (Mago, 2015). However, this has not been achieved with ease. According to Verma and Chandra (2016), IS/IT is complicated, unique and a challenging commodity to deploy, especially without the basic infrastructure. The successful deployment of IS/IT is thus supported by factors such as skill sets, business alignment, and frameworks such as enterprise architecture (EA), through the optimisation of processes, events, and activities of business and technologies.

The deployment and use of IS/IT solutions in government administrations are associated with different kinds of complexities, such as governance of technologies and integrations of processes. This affects the strategic needs and service delivery of many governments' administrations and agencies, particularly in developing countries. This has a significant impact on the sustainability and stability of the organisation's operations, allowing government organisations to maintain stability and have a holistic view due to the constantly evolving nature of IS/IT (Al-Kharusi, Miskon, & Bahar, 2017). It is potentially detrimental if IS/IT solutions are not planned and applied appropriately to ensure optimisation and success (Firmansyah & Bandung, 2016). The use of IS/IT solutions influences how organisations interact with their stakeholders as well as their adaptation to business processes in offering effective and efficient services (Yujie and Xindi, 2010). Regardless of the role of IS/IT, the deployment and use of IS/IT should be an enabler for the government to deliver services to its citizens.

Another critical challenge in the deployment and use of IS/IT solutions is the structure of an environment. The organisational structure of many governments' administrations is not always straightforward. Saha (2010) argues that governments' environments are characterised by a distributed structure with autonomous strategies and processes, which are managed centrally. The structure fragments the deployment and use of IS/IT solutions, which sometimes leads to duplication and lack of alignment with the strategic intent of the organisation. This necessitates a governance approach, which brings about change in an environment.

Change is one of the factors associated with complexities in government organisations that are faced with challenges associated with IS/IT implementation and use. External factors such as a change in political agenda, global change and demands for better services from government stakeholders can have an impact on the public institution's operations. The frequent changes and emergence of new technologies and innovations (Hashem et al., 2015) are but some of the challenges faced by government organisations. Consequently, these changes are challenging to manage (Lnenicka & Komarkova, 2019). Challenges hamper government organisations to operate more efficiently and effectively, as they can further affect efforts to provide better, prompt and cost-effective services to citizens (Hashem et al., 2015). The changes that IS/IT is exposed to make it challenging to manage. EA has the benefit of overcoming the challenges associated with the constantly changing trends in IS/IT (Lnenicka & Komarkova, 2019).

Stakeholders of government are the citizens, business community, and government administrations just to mention a few. According to Iyamu (2015), it is the organisation's stakeholders that determine the deployment of IS/IT solutions. This is to align with the need for better service delivery and to avoid the isolation and misalignment of services. As alluded to by Castelnovo (2012), the need for better services is established through public sector transformation by enabling IS/IT service delivery transformation and organisational transformation. Hence, government administrations of some countries have established a digitisation plan primarily to deliver improved service to its stakeholders (Liimatainen, 2008). Castelnovo (2012), further claims that improved service delivery cannot be achieved without a transformation. Developing countries such as Ghana are using IS/IT to improve services to their people (Mensah, 2016), hence many governments are exploiting the benefits associated with IS/IT to offer better services to their stakeholders.

Government administrations in many countries continue to deploy IS/IT solutions in the different areas of their services, toward growth and sustainability (Haes & Grembergen, 2016). Governments are deploying IS/IT solutions that are integrated with different government offices (Liimatainen, 2008), which allow governments to offer effective and efficient services and ease of access to information for their stakeholders. For example, the government of Ghana's objective in deploying IS/IT is to increase productivity in its

operations and service delivery, and improve information sharing among all government organisations and its stakeholders (Mensah, 2016). Despite the efforts, business initiatives and computing environments continue to encounter challenges (Al-Kharusi et al*.,* 2017) in many government administrations. Many organisations implement EA as a method to represent a holistic view of their environments, manage change, address complexities, reduce risks, and achieve their business objective (Marosin & Ghanavati, 2015; Saha, 2010).

2.3 Enterprise Architecture in governments

The popularity of EA in the private sector motivates governments of many countries to develop the concept to establish a holistic view of government operations (Klischewski, 2014). This emanates from the purported benefits associated with the deployment of EA in organisations. In recent years, records show a proliferation of some governments adopting EA in their computing environmens (Shaanika & Iyamu, 2018). Some countries on the African continent such as South Africa (Van Zijl & Van Belle, 2014), Ghana (Kaushik & Raman, 2015), Kenya (Katuu, 2018), and Egypt (Mohamed, Galal-Edeen, & Hassan, 2013) have in recent years embarked on the development and implementation of EA. One of the common motivating factors for some governments in developing EA is the governance of information, processes, and technology solutions toward the realisation of return on investment.

2.3.1 Definition of EA

Enterprise architecture is an approach used by organisations to guide strategy development and strategy execution based on the organisational processes, IS/IT systems, people, organisation structure and business processes (Bakar & Hussein, 2018). Despite the popularity of EA, its definition is not universal, meaning there are different definitions of the concept. Some of the common definitions are presented and discussed in this section. The purpose is not to compare the definitions, but primarily to put the focus of this into perspective. Some of the definitions have been around for over two decades, but they remain relevant today.

Nieman's definition (2006) focuses on EA as a form of combined and coordinated plans that represents the business and IT platforms, in past, current, and future states. However, Nieman's definition lacks the articulation of the resources needed to achieve the goals of EA. Nygard and Olsen (2016) refer to EA as a holistic view of an organisation,

emphasising the interaction between business and IT. This definition seems to be more operational. This means that it lacks the strategic aspect of business and IS/IT in the organisation as well as the methodology on how to achieve that. Bakar and Hussien (2018) define EA as the methodology that links strategy development to strategy execution, achieved with the deployment of IS/IT, the organisation's structure, business processes and human resources. Either way, EA can be summarised as a strategic mediator between business and IS/IT, using different means and resources. Niemi and Pekkola (2017) postulate that EA can be regarded as a taxonomy, a methodology or a masterplan, or all three combined for an organisation's purposes.

The current definitions as presented above seem to miss one aspect or the other. This explains why some organisations employ EA from various viewpoints, making points of reference and comparative analysis rare. Some of the definitions are also considered vague. This makes it difficult to apply any of the definitions to this study. Otherwise, there will be gaps in this study. To avoid that, a definition is formulated in the context of this study as follows: EA is defined *as a structure of plans and documents that covers the strategic and operational aspects of the organisation such as processes, business functions and technology, using different means of resources to achieve the vision of the organisation.* This definition enables extensive coverage towards achieving the objectives of this study. Most importantly, it can be used as a common frame of reference by governments of countries deploying or intending to deploy the concept.

2.3.2 Purpose for deploying EA

For some organisations, including government enterprises and administration, the aim of using EA is to regulate and ensure that IS/IT solutions and accompanying business processes are geared towards the attainment of goals and objectives (Shaanika & Iyamu, 2015). Managing IS/IT has been a challenge for many organisations, and this is attributed to factors such as a change in business needs, cost-effective integration of systems and replacement of technology. Due to the challenges of the misaligning ICT plans, and the need for consistency, the government of Kenya established the government enterprise architecture general guidelines and plans in 2016. Iyamu (2017) argues that with EA, IS/IT can be managed better. According to Seppanen, Heikkila and Liimatainen (2009), change is better managed to ensure continued stability and flexibility within the organisation through EA. Even though change is one of the main reasons for using EA in organisations, many other factors drive the concept. Al-Kharusi, Miskon and Bahari (2017) resonate that

the main driving factor for the use of EA is the complexities of IS/IT operations as well as the business and IS/IT alignment. In addition, the prominence of EA is based on the premise that organisations can develop strategies that can be incorporated into existing procedures and IS/IT (Yu, Strohmaier, & Deng, 2006). Consequently, the organisation will experience minimal disruptions in its operations.

Saha (2010) posits that EA can be used as a methodology that can provide holistic visibility of the government processes that are fragmented and isolated to consolidate processes that are beneficial to all stakeholders. The process of holistic integration is established through a transformation that involves all aspects of an organisation (Castelnovo, 2012). Thus, the government enterprise architecture (GEA) is used as a strategy to support the administrative transformation process that leads to e-government (Liimatainen, Hoffmann, & Heikkila, 2007). The government of South Africa deploys a government-wide enterprise architecture (GWEA) in 2009 to establish an ICT standardisation in all departments (Makovhololo & Ruxana, 2017). EA is considered significant by governments of many countries in their efforts to deploy e-government in providing services to the communities (Saha, 2010). EA is regarded as a reform strategy, using IS/IT as the driving element for administrative changes and transformation (Hjort-Madsen, 2007). Furthermore, Luisi (2014) opines that EA represents a top priority for managing IS/IT solutions.

Increasingly, IS/IT solutions are deployed for the realisation of some governments' strategic visions. EA is promoted as a critical means to transform and digitise government services (Hjort-Madsen & Pries-Heje, 2009) to support the national vision. Kaisler, Armour and Valivullah (2005) articulate the vision as the establishment of a technical infrastructure that can provide interoperability between government operations and services at different levels. These levels can be defined as the different stakeholders of the government such as citizens, local governments, and business communities. The new technical trends advocate benefits that drive governments to consider these technologies. The management and governance of technological advancements such as cloud computing, access to open data, data integration and shared services in the government sector drive the significance of government enterprise architecture (Janssen, Flak, & Saebo, 2013).

2.3.3 Enterprise architecture frameworks

Zachman first introduced the concept of EA more than three decades ago (Zachman, 1987). Since then, EA has remained a subject of discourse and continues to gain popularity in computing and business reengineering. The popularity of EA has seen a proliferation of many EA frameworks (EAF) over the years (Bui, 2017). There are a few different definitions of EAF as with EA itself. EA framework is defined as a set of models, principles, and methods used to implement EA (Cameron, 2015). Mohamed et al. (2012) defined the EA framework as an abstract structure of what the EA should contain and how to create a mechanism for it to operate. This is another justification for the EA definition formulated and presented above. It encompasses all areas of the concept. An EA framework is thus critical for the development and implementation of EA. Along the same lines, Bui (2017) resonates that "EA frameworks offer principles, models, and guidance to help one establish an EA program" (p. 122). The importance of an EA framework is manifested in the fact that the development and implementation of EA are executed according to the guidelines of the selected framework (Lagestrom et al., 2011).

More than ninety EAFs have been recorded in the literature (Kaisler & Armour, 2017). The proliferation of frameworks could be attributed to the fact that many have been challenged to describe and apply EA in specific ways (Hinkelman et al., 2016). Hence the establishment of frameworks that are designed to serve a specific industry or sector. However, most of these frameworks have not lasted in the industry, and only four dominant frameworks are still actively used: the Zachman framework, The Open Group Architecture Framework (TOGAF), Federal Enterprise Architecture Framework (FEFAF) and Gartner EA Processes (Simon, Fischbach & Schoder, 2014; Qurratuaini, 2018). Organisations are faced with the responsibility to choose from the selection of EA frameworks because the EA frameworks are diverse in terms of design, functionalities, and benefits (Bui, 2017). Each framework has its recommendation on how to structure and establish the EA documentation and other related information for the establishment and practice of EA in the organisation (Kotusev, Singh & Storey, 2017).

2.3.3.1 *Zachman Framework*

A Framework for Information Systems Architecture was Zachman's initial publication that created the popularity of EA in the IS/IT field (Zachman, 1987). The publication's focus was initially only on information systems, guiding how to resolve complexities associated with information systems (Iyamu, 2019). Information systems were strictly viewed and treated from a technical perspective and management thereof was more technical-oriented, without the consideration of the effects of humans in the deployment and use of information systems. However, the Zachman framework introduced the basic elements of how organisations should be organised, which included the pivotal role of humans in information systems (Iyamu, 2019). The main objective of the framework was to consolidate IS/IT establishment in organisations, the planning, documentation and processes for the organisation.

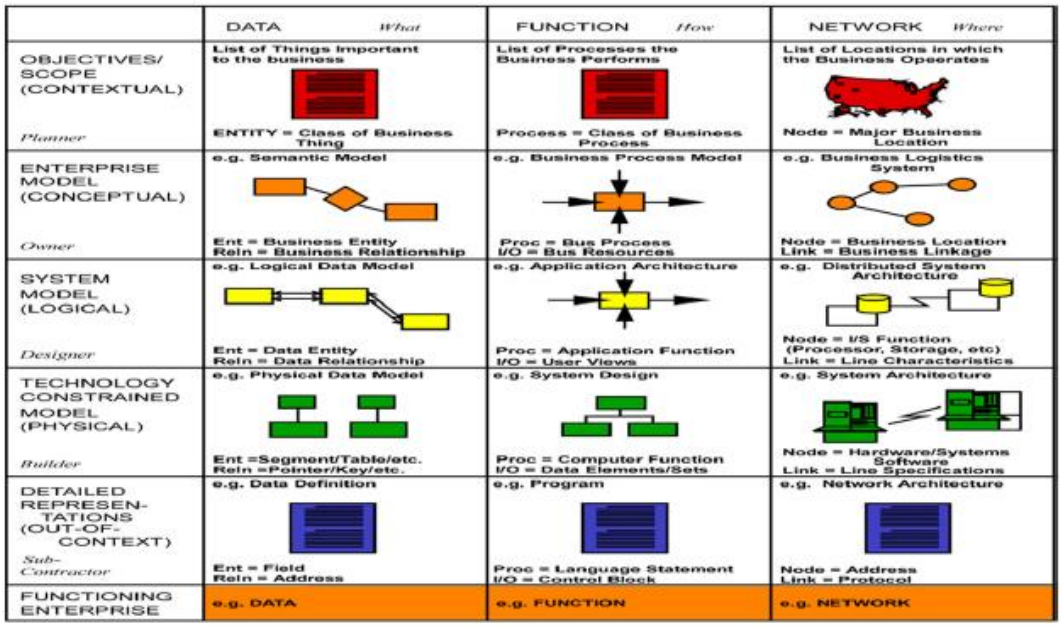

Figure 2.1: Zachman Framework for Enterprise Architecture (Zachman, 1987)

Zachman framework is referred to as an ontology of elements in an organisation (Harkai, Cinpoeru & Buchmann, 2018). Each element is described in detail and also how they interrelate with other elements, hence referring to it as a descriptive framework (Abbas et al., 2018). The framework is referred to as the '*Zachman Framework*' for EA (Lapalme et al., 2016), as depicted in Figure 1 below. The framework is made up of a combination of rows and columns. The rows represent the human perspective, describing those involved

in the model, whilst the columns are for the description of elements that define the area of interest of each perspective (Abbas et al., 2018).

The Zachman framework is considered favourable for use because of its intensive focus on the alignment between business objectives and IS/IT solutions (Nogueira et al., 2013). Through the framework, organisations can coordinate an integration between the different elements and apply proper change management (Fritscher & Pigneur, 2015). This is achieved through the process of including all the different elements in the organisation such as processes, technology, and humans. Through integration, a holistic deployment and management of IS/IT are made possible. The integration process involves identifying all elements and the interrelationship between humans, processes and technology (Espadas et al., 2008). However, the Zachman framework is not immune to challenges. According to Rouhani et al. (2015), the Zachman framework has a shortcoming in the area of alignment and documentation of the different elements. They further claim that even though the framework executes documentation well in theory, it is not the same as in practice. This has affected its adoption by many organisations, including government administrations and enterprises.

2.3.3.2 The Open Group Architecture Framework (TOGAF)

Members of The Open Group who work in the Forum Architecture initially introduced The Open Group Architecture Framework (TOGAF), which was then further developed by the US Department of Defence (The Open Group, 2009). According to the Open Group, TOGAF is a tool that can be used to guide the development of various architectures in an organisation with the ultimate objective to design IS/IT using methods and standards (Iyamu, 2019). Through TOGAF, EA is applied by following a process of five iterative steps such as “documenting the current state, describing the future state, analysing the gaps, developing the roadmap, and implementing it” (Kotusev, 2018, p 324).

The concept of TOGAF is made up of two main components: the architecture content framework (ACF) and the architecture development method (ADM) (Kotusev, 2018). The results from both the ACF and ADM are considered the principal elements of TOGAF (The Open Group, 2009). The criticality, steps, and results from both AFC and ADM are described comprehensibly (Kotusev, 2018). ACF contains EA artefacts which organisations are expected to align to (Kotusev, 2018), as shown in Figure 2. The ADM

framework, on the other hand, is referred to as the lifecycle for the development of EA (The Open Group, 2009). Additionally, ADM is also described as a tool used for the customisation of EA based on the business needs of the organisations (Wahab & Arief, 2015). The representation of ADM is shown in Figure 2:

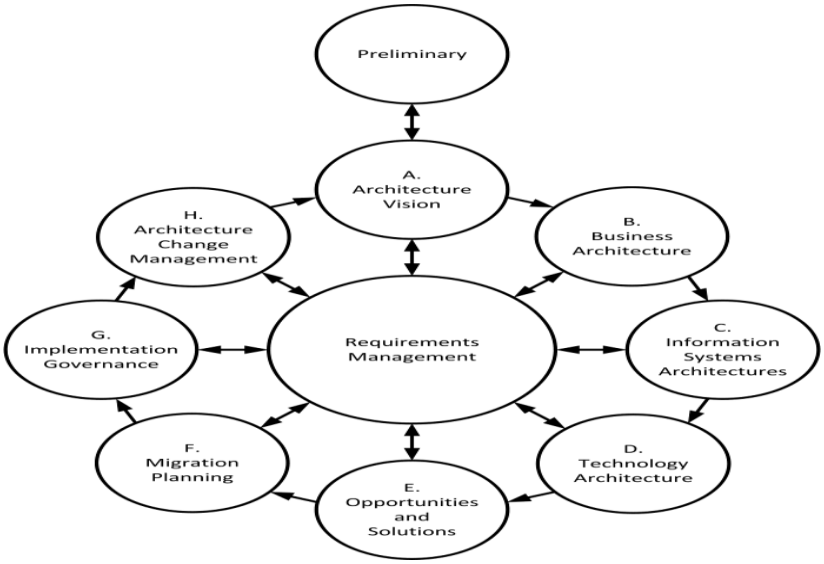

Figure 2.2: ADM (The Open Group, 2009)

Architects have complained about the difficulties associated with the implementation of ADM and ACF, arguing that they are too rigid and impractical to implement (Kotusev, 2016). Another shortcoming of the TOGAF is its inability to ensure acceptance of the solution architecture after implementation (Kriouile & Kriouile, 2015). Additionally, in its general nature, TOGAF fails to specifically define the particular deliverables that result at the end of the process (Tao, et al., 2017).

2.3.3.3 Federal Enterprise Architecture Framework (FEFAF)

The Federal Enterprise Architecture Framework (FEFAF) was established in 1999 after the enactment of the Clinger-Cohen Act OF 1996, and the main objective of the act is to improve operations and IS/IT spending by minimising wastage (Caruso, 2019). The Act made it compulsory for the United States Federal government to develop a common architecture that can improve the deployment and use of IS/IT in all agencies (Bellman & Rausch, 2004). The objective of the FEAF is to guide the development and deployment of

EA in the federal government by establishing common standards and processes amongst all government, profit, and non-profit making organisations (Akkasi & Shams, 2008). Government organisations can benchmark with the FEAF for strategic planning, change management and how to provide stability and consistency for services delivered to its stakeholders (Caruso, 2019). Consequently, the FEAF has become a building block that motivated other governments such as the government of Finland to develop its own Finnish National EA framework (Liimatainen, Hoffmann & Heikkila, 2007). Likewise, the government of Egypt used a customised version of FEFAF for the implementation of EA (Mohamed, Galal-Edeen, & Hassan, 2013).

FEAF consists of different reference models. These models are intended to facilitate communication amongst different organisations to eliminate duplication of investments and gaps and identify opportunities for better collaboration (Johnson, 2015). As supported by (Caruso, 2019), there is a considerable interdependency between these models. FEAF consists of five reference models established to better manage and leverage IT portfolios. The reference models are listed as follows: Performance Reference Model, Business Reference Model, Service Component Reference Model, Technical Reference Model, and Data Reference Model (Johnson, 2015). Figure 3 below illustrates the different reference models.

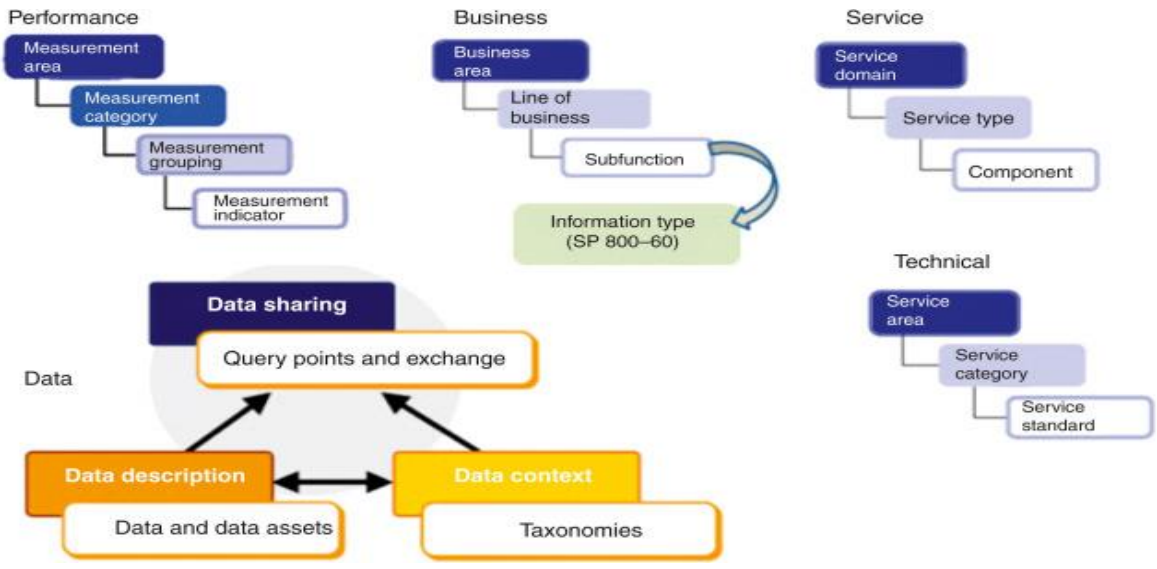

Figure 2.3: Structure of the five reference models (Johnson, 2015)

Collectively, the five reference models comprise the FEAF to outline the important components of FEA in a standardised and coherent way.

2.3.3.4 Gartner EA Processes

Gartner, an IT research, and consulting organisation developed the Gartner Enterprise Architecture Model which consists of a Gartner EA process Model and a Gartner EA Framework (De Vries, 2010). The Gartner EA Process is focused on the development of the EA process and migration (Ansyori, Qodarsih & Soewito, 2018), whilst the Gartner EA framework is concerned with the association of the different EA domains such as the EA business domain, the EA information domain, the EA technical domain and the EA solution domain (De Vries, 2010). Even though the EA framework and EA process models have different components and values, they are best used together (Bittler & Kreizman, 2005).

Gartner believes that EA is more a strategy than an engineering discipline that focuses on the target to be achieved (Tupper, 2011). Gartner also refers to EA as a non-stop process of assessing the current state of the architecture, planning for the desired future state and managing the entire programme during the process (2005). This process is achieved by employing the EA process model that assesses the constant changes in the internal and external environments that can impact the future of the organisation (Bittler & Kreizman, 2005). Figure 4 below shows the EA process model.

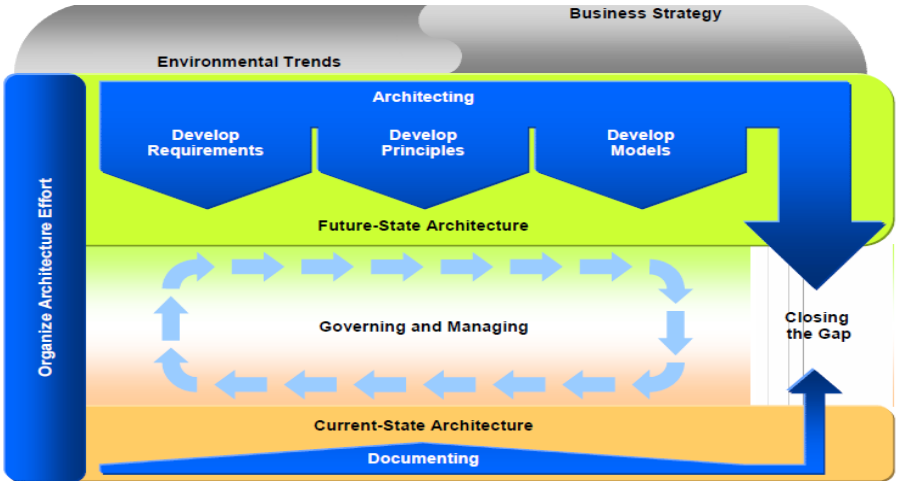

Figure 2.4: Gartner EA Process Model (Gartner, 2005)

The Gartner EA process model is used by organisations as a guide for developing EA (Bittler & Kreizman, 2005). The model represents a logical process to follow. The process model supports the continuous management of the EA process, done iteratively and in multiple phases (Al-Nasrawi & Ibrahim, 2013). The Gartner methodology is practical and flexible as long as the process used achieves its objective (Rijo, Martinho, & Ermida, 2015).

2.3.4 Enterprise architecture domains

EA consists of domains, which include enterprise business architecture (EBA), enterprise information architecture (EIA), enterprise applications architecture (EAA), and enterprise technical architecture (ETA) as shown in Figure 5 (Chalmeta & Pazos, 2015). The deployment (development and implementation) of the concept is carried out through the domains. This means that the EA activities are deployed through the domains in accordance with the adopted framework (Safari, et al., 2016). Through the EA domains, clear visibility is established on all aspects of the organisation. EA domains are used to deploy the aim and objective of the organisation (Niemi & Pekkola, 2013). Through the domains, technical and non-technical components of organisations are structured distinctively (Shaanika & Iyamu, 2018).

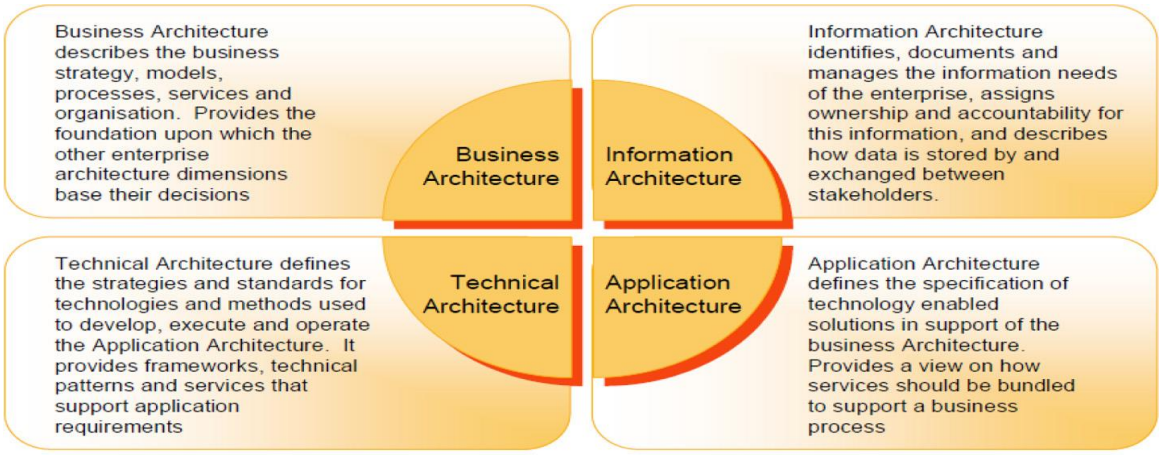

Figure 2.5: Enterprise Architecture Domains (Aziz, 2005)

Even though the domains are interrelated, the development and implementation of each domain are done independently (Shah & El Kourdi, 2007). As explained by Niemi and

Pekkola (2017), each domain is uniquely structured. What makes it unique are the distinguished deliverables and the defined procedures, tools, and structures of each domain (Iyamu, 2017). Every domain is structured to focus on a specific aspect, having its specific deliverables (Iyamu, 2018).

2.3.5 Challenges and value of EA

The implementation of EA ostensibly adds value to organisations (Niemi & Pekkola, 2016), and it is because of its purported and expected value that organisations invest in it (Rodriques & Amaral, 2010). As highlighted by Becker, Widjaj and Buxmann, (2011), value is the positive results experienced from the objectives and intention of investment. Plessius, Steenbergen and Utrecht (2019) define value as the variance between what has been invested and the benefits achieved. However, there is a limited understanding of how EA produces value; this is due to the challenge of quantifying the value of the concept in an environment (Schelp & Stutz, 2007). One of the basic added values derived from the use of EA is insight (Tamm et al., 2011) because, through that, an organisation can position itself better. Some organisations or governments' administrations that have a holistic view of their operations and interrelated activities can derive value from the deployment of EA.

The EA value is viewed from various perspectives by organisations and government enterprises. Rodriques and Amaral (2010) highlighted value from two points: (1) organisations should be able to appreciate the benefits of the EA initiatives and understand their risks, and (2) it should be integrated with all the different value expectations from the stakeholders. This allows an organisation to define how EA can achieve the expected values. Many organisations are facing the challenge to show proof of the value derived from EA (Cameron, 2015). In addition, many publications have failed to articulate the value of EA (Kaisler & Armour, 2017). This could be because EA benefits are mostly not articulated or supported by empirical evidence (Niemi & Pekkola, 2016). On the other hand, Shanks et al. (2018) reason that the value of EA is not determined in itself, but indirectly through the ability to provide advisory services enabled by the importance of EA. Evidently, it has been a challenge to prove the value derived from the implementation of EA (Foorthuis et al*.,* 2016).

The challenge of determining the value of EA could emanate from the implementation thereof. Organisations deploy EA to mitigate IS/IT-associated challenges and to reap EA

benefits. However, many organisations including government organisations are challenged to achieve the potential benefit and derive value from the implementation of EA (Al-Kharusi, Miskon & Bahari, 2017). According to the literature, the challenges to the successful implementation of EA persist. Many organisations are still faced with the implementation of EA (Rouhani et al., 2015). According to Iyamu (2013), it is difficult to find an organisation that has successfully designed, developed, implemented and institutionalised the EA concept. Supporting this are Gong and Janssen (2019) who claim that the EA field is facing a credibility challenge. The challenges associated with the success of EA implementation can vary from organisation to organisation because there is limited insight into which EA elements result in value (Foorthuis et al., 2016).

2.4 Enterprise architecture Metrics

Measurements are used to determine the different levels of accomplishments. According to Razafimampianina et al. (2015), measurement relies on the concept of a metric, making it an integral part of a measurement tool. Furthermore, a metric puts a measure in perspective (Razafimampianina et al., 2015), such as measuring the efficiency and effectiveness of the EA deployment in government organisations. Neely, Gregory and Platts (2005, p. 1220) define a metric as a tool that can be used to "quantify both the efficiency and effectiveness of actions", used to assess different elements such as processes, activities, and products in the practice of EA. According to Bhat, Reschenhofer, and Matthes (2015), there is a lack of a definition for the EA metric. In this paper, the term EA metric refers to the measurement of progress and expected deliverables from EA structures, which can be executed objectively or subjectively.

The EA metrics aim to monitor the performance and value of EA in organisations and government organisations. Initially, metrics are defined for goal setting and progress monitoring so that corrective measures can be applied if need be (Mithas & Rust, 2016). EA metrics are further used to communicate the performance of the organisation to all stakeholders and to address the gaps to improve performance. According to Bhat et al., (2015), EA metrics are intended to support the planning and control of structural and behavioural aspects of EA.

A metric comprises different measurement steps: defining the measure, the procedure, how the measure will be executed, identifying the stakeholders engaged in the

measurement process and the origin of the information or data (Cameron, 2015). In addition, the EA metric consists of a Key Performance Indicator (KPI) that is aligned with the activities of EA (Bhat, Reschenhofer & Matthes 2015). A KPI is important because it provides fast and concise feedback on the performance being measured (Peral, Mate, & Marco, 2017). Bhat, Reschenhofer, and Matthes cited Popova and Sharpanskykh (2010) on a framework they designed to address the structure of the goal, the structure of the KPI and the inter-relationship between them. The framework describes the KPI with attributes including the *name, definition, type, timeframe, scale and threshold*. The attribute *type* refers to the unit (continuous or discreet) that measures the KPI. The attribute *timeframe* captures the extent that KPI is defined, while *scale* refers to the unit of measurement. The *threshold* KPI is defined with a cutoff value. Matthes et al (2012) introduced a standardised KPI structure allowing for general structure elements and specific organisation elements. The general structure elements and specific organisation elements of a KPI are presented below in Table 1.

Table 2.1: Organisation-specific structural elements

Property	**Description**
Measurement frequency	The time interval between two measurement points
Interpretation	Description of how the calculated value should be interpreted (good, acceptable, or bad)
KPI consumer	The persons who are interested in the value of the KPI
KPI owner	The person responsible for the KPI
Target value	The KPI values to be achieved while targeting the target value
Planned values	A KPI can be assigned to one or more EA layers
Tolerance values	The allowed deviations from planned and target values
Escalation rule	Steps to be taken when the target EAM goal is achieved

There is a perception that there is a lack of measurement metrics in the EA management field (Grunow et al., 2012). However, some of the organisations that have used metrics to determine the value of EA have relied on common metrics that did not yield favourable results. This is because different organisations have different value sets that need different kinds of measures (Cameron, 2015). According to Aier (2014), research has proven that IT solutions including EA assessments in practice are mostly done unsystematically. Consequently, metrics are gaining popularity in practice to support the evaluation of EA and their evolution (Hauder et al., 2013). The use of metrics enables organisations to

make strategy-driven decisions that are established on the holistic view of EA goals within the environment (Nikpay, Ahmad & Kia, 2017).

2.4.1 Review of Existing EA metrics

Different studies in the field of EA have developed metrics models to evaluate the benefits, value, or outcomes of EA. However, these models do not contain all the evaluation for all the EA artefacts (Aier & Schelp, 2010). Due to these shortcomings, existing EA evaluation models are based on specific segments of EA (Aier, 2014).

Example 1

Filet, van de Wetering and Joosten (2019) conducted a study to develop metrics for monitoring the coherence between the different EA artefacts that guide the business/IT alignment. To achieve this objective, they developed an EA model derived from the ArchiMate modelling language. The EA model was designed with structured rules, which represent the quality of the alignment factors. These rules make up part of the metric to calculate the overall alignment score of an EA model. The other part of the metric is set on the number of violations against each rule, which indicates any infringement on the alignment rule. A high number of violations will negatively affect the overall score of the alignment. The metric to determine the alignment percentile was based on the number of violations divided by the number of alignment pairs. The metric calculation is first based on a single rule and then combined to find the overall percentile alignment. Below is the formula to calculate the percentile of a single rule:

$$Rule\ Aligment\% = 1 - \#violations \div MaxValue(\#pairs\ in\ antedent, 1)$$

Many existing EA valuation models have shortcomings (Nikpay, Ahmad, & Kia, 2017), which affect the efficiency to evaluate EA comprehensively. This model of metrics also has a shortcoming because it does not address or consider any human factors that can impact the alignment. The actor-network theory (ANT) posits that both human and non-human actors have a bearing on the success of any network, including the EA measurements (Latour, 1987). The calculation of the number of violations in this model does not consider the fact that violations can be caused by humans. This model thus lacks the influence of human factors, also referred to as end-users. Hence, both humans and non-humans interact and cooperate to achieve a specific goal (Afarikumah & Kwankam, 2013), such as the measurement of business/IT alignment.

Example 2

Private and government organisations are subject to changes that can affect the operation of an organisation adversely. Consequently, the business and IS/IT environment need to be modified to mitigate the effects of the changes. As such, Busch and Zalewski (2018) developed a tool for evaluating the modifiability of enterprise artefacts due to the impact of possible changes in an organisation. The evaluation method was adapted from one of the existing Software Architecture Analysis Methods (SAAM). Furthermore, the process of evaluating the modifiability was developed according to the enterprise architecture represented in the ArchiMate language.

This evaluation method is referred to as the Enterprise Architecture Modifiability Analysis Method (EAMAM), which measures the extent that architecture can be modified and adapted to changes. The evaluation process allows for the engagement of all stakeholders, as they identify possible scenarios of changes that can impact the organisation's future. The different scenarios are scrutinised, prioritised, and thereafter mapped to the different architecture elements. The evaluation is further conducted over six phases. The figure below shows the EAMAM analysis procedure.

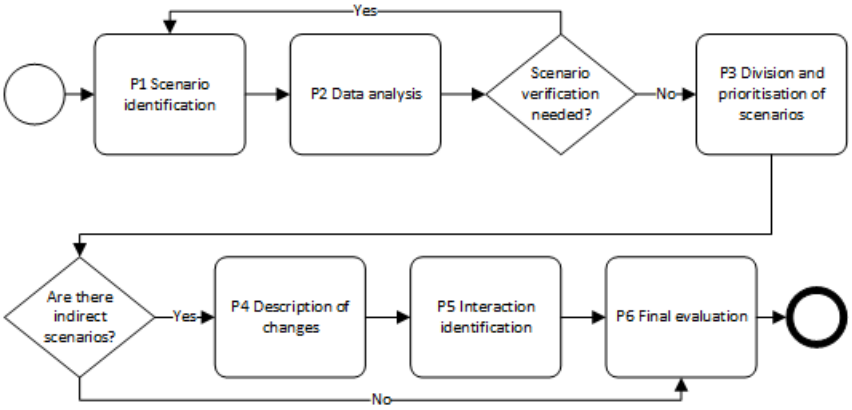

Figure 2.6: EAMAM method analysis procedure

The first phase is when the different scenarios are established and used to determine the modifiability of the architecture. Next is the second phase, the data analysis phase, where critical information is shared about the evaluation. The scenarios found in phase one are analysed to establish their relevance to the architecture they are associated with. In the

third phase, scenarios are grouped and prioritised accordingly. Scenario prioritisation is based on the stakeholder's perception, which is accomplished through a voting process by the stakeholders. Furthermore, scenarios are also grouped into indirect and direct scenarios. Direct scenarios are known by the organisation and do not need any modification, while indirect scenarios are the ones not known and need architectural modification. Phase four deals with the description of changes, whereby the direct scenarios describe how the implementation will be done. As for the indirect scenarios, a description of the changes, how they will be implemented, and the resources required are documented accordingly. Phase five is where the interaction between the scenarios is determined because multiple scenarios can contribute to one architecture element. In the last phase, the final evaluation is done. All scenarios need to be reconsidered to ascertain their relevance to the organisation.

Changes can have detrimental effects on an organisation if not well prepared. For example, Al-Kharusi et al. (2017) reiterate that changes that affect organisations unveil complexities that have an impact on business processes, hence the importance of a tool such as the EAMAM. However, there is a shortcoming with the EAMAM. Stakeholders are the ones who determine the possible scenarios that can affect the organisation negatively. There is no indication of how objective this process is. The fact that stakeholders are the ones to determine scenarios reveals a vulnerability to the evaluation process. Not only are the scenarios established on the subjectivity of the stakeholders, but the prioritisation of scenarios is also based on a voting process by the stakeholders, which are processes that are prone to human errors due to subjectivity. Scenarios should be mapped to objective measures that can increase the probability of the changes occurring. The prioritisation of the scenarios should also be objective.

A conclusion made from a study by Aier and Schelp (2010), many of the EA valuation models are mostly unreliable and disunited. Fritscher and Pigneur (2015), reason that not much focus has been given to the measurement and evaluation of EA. In the same vein, governments are also challenged to evaluate the value of GEA (Liimatainen, 2008). Hence, this paper has realised a gap to establish a metric model that can evaluate the value of EA. In the absence of proper measuring models, organisations will not be able to realise the desired value from EA (Nikpay, Ahmad, & Kia 2017).

2.5 Summary

Organisations rely on IS/IT to improve their business operations. Similarly, government administrations in many countries continue to deploy IS/IT solutions in the different areas of their services, toward growth and sustainability. Even though the deployment of IS/IT brings organisational benefits, it is also associated with many challenges. These challenges range from the governance of technologies, integrations, and processes, to mention a few. Complexities such as these can affect the strategic needs and service delivery of many government administrations, particularly in developing countries.

Business initiatives and computing environments continue to encounter challenges in many government administrations. The concept of EA is often implemented as a method to represent a holistic view of environments, manage change and address complexities in many government organisations. The popularity of EA in the private sector motivates the governments of many countries to develop the concept to establish a holistic view of government operations. Enterprise architecture is an approach used by organisations to guide the strategy development and strategy execution based on the organisational processes, IS/IT systems, people, organisation structure and business processes. However, many organisations are facing the challenge to show proof of the value derived from EA.

From the literature review so far, EA metrics are used to monitor the performance and value of EA in organisations as well as government organisations. The use of metrics enables organisations to make strategy-driven decisions that are established on the holistic view of EA goals within the environment. Metrics are gaining popularity in practice to support the evaluation of EA and their evolution. However, there is a perception that the EA management field lacks measurement metrics. Two examples of existing EA metrics models were analysed, whereby the shortcomings of these metrics were highlighted.

CHAPTER THREE:

THEORETICAL FRAMEWORK

3.1 Introduction

This chapter presents the theoretical framework on which the data analysis and interpretation are based. As shown in Figure 3.5. The theoretical framework is a complementarity of activity theory (AT) and the dimension of social change (DS) of the structuration theory (ST). The development of the theoretical framework is informed by the objective of this study, which dictates the selection of the sociotechnical theories, AT and ST.

This chapter is divided into six main sections. The first section introduces the chapter. In the second section, the concept of underpinning a study using theories is discussed. Sections three and four covers AT and DS as sociotechnical theories, respectively. Based on these sociotechnical theories, a theoretical framework is developed and presented in the fifth section. The chapter is summarised in the sixth section.

3.2 Underpinning Theory

Based on the aim, which is to propose an EA metrics model, a sociotechnical theory, AT and ST were selected to underpin the study. The two theories are discussed in sections 3.3 and 3.4, respectively. The last decade has witnessed a surge of theories used to examine information systems (IS) studies (Dwivedi et al., 2019).

Sociotechnical theories are used to support the data analysis and interpretation process which is conducted subjectively. This enhances rigour in IS research that commonly employs the interpretivist approach for data analysis (Walsham, 1995), which is based on the fact that reality is constructed on individual perception and interpretation that is regarded to be subjective (Cuthbertson, Robb, & Blair, 2019). However, the interpretive approach has a shortcoming because it does not have a formula and is not guided by clear rules and activities (Lawrence, 2010). Iyamu (2021) further claims that underpinning theories provides guidance from data collection to data analysis. AT and DS are complementarily used based on the aim and objectives of the study. Similarly, in contributing to the use of sociotechnical theories for IS research, Nehemia-Maletzky, Iyamu and Shaanika (2018) proposed the complementary use of AT and actor-network

theory (ANT) to guide qualitative data analysis. The complementary use of AT and DS will develop a theoretical framework to underpin this study. The theoretical framework (Figure 3.4) presented in this chapter represents a formula in that it provides step-by-step guidelines for analysing the data and interpreting the findings, as presented in chapters 6 and 7, respectively.

3.3 Activity Theory

Activity theory (AT) is a social theory that was developed by Lev Vygotsky, Alexei Leont'ev and Luria from Moscow State University (Bhattacherjee, Davis, & Hikmet, 2013). The theory emphasises human interactions within a social setting (Goncalves, Correira & Cavique, 2017), and it is referred to as a framework that outlines the interpretation and analysis of human activity (Bhattacherjee, Davis, & Hikmet, 2013). Activity in the theory refers to purposeful activity with repeated actions that contribute towards the achievement of its goals (Leont'ev, 1981). Activity does not mean the same in AT and the English vocabulary. In AT, activity denotes a high-level term that implies more significance and meaning (Hasan & Kazlauskas, 2014). Primarily, the theory attempts to comprehend how relationships consciously influence action in an activity (Kaptelinin & Nardi, 2006), which makes it appropriate for conducting analyses to gain insight into why things happen in the way that they do (Iyamu, 2021).

Thus, the main principle of AT is about the undertakings of human efforts, referred to as activity, which entails six components as shown in Figure 3.1. According to Karanasios (2018: 136), "activities are object-oriented, meaning that the most important element of the activity is the object upon which the subject acts to achieve a desired outcome". The object is the driving force and motivation for an action to be carried out, which establishes an activity. Bhattacherjee, Davis and Hikmet (2013), define activity as a structure of actions, influenced by intentional interaction between subject and object (Carvalho, et al., 2015). The subject (human) undertakes a structure of activities to resolve an issue (object), using tools (instruments) to achieve a desired outcome (Kuutti, 1995).

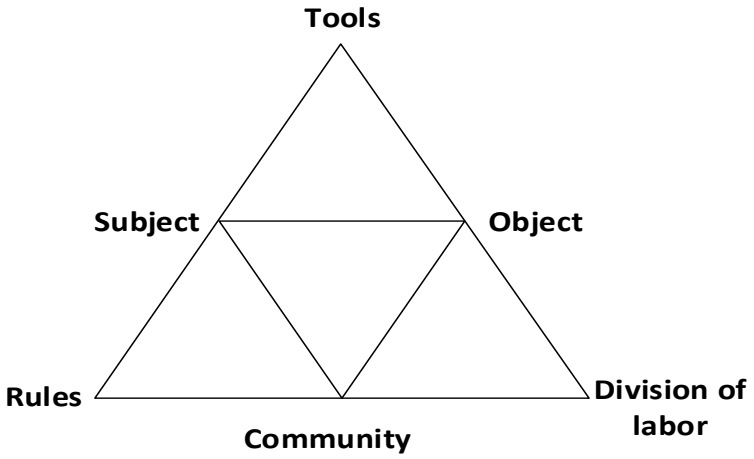

Figure 3.1: The Activity System Model (Engeström, 1987)

Consciousness is defined as the display of a human being's capacity for attention, recollection, learning, analysis, consideration, and imagination (Kaptelinin & Nardi, 2006); and AT is based on human consciousness and the interpretation of consciousness (Hasan et al., 2017). Thus, an activity is only undertaken by an actor with consciousness, a human being who acts on an object (Karanasios, 2018). Before an action is performed, it is planned in consciousness within a model (Moawad, Liu, El-Helly, 2013). An object, on the other hand, can be anything that poses a problem or point of interest for the activity, and this object justifies the establishment of an activity (Spinuzzi, 2011).

The object can be anything tangible, intangible or a human being (Kaptelinin & Nardi, 2006). A subject can initiate an activity to alter an object, and to achieve its objective; tools are used as mediators for the activity. Hasan and Pfaff (2012), describe a tool as anything tangible or intangible, used to mediate an activity between a subject and an object. Tangible tools can refer to items such as machines and instruments, whilst intangible tools can refer to procedures, languages or a law. Without tools, subjects will not be able to achieve their objectives towards the object. The community and circumstances surrounding the study will determine the kind of tools to be used, and these tools can range from processes, rules, signs, instruments, technology, and laws of an organisation (Er, Kay, & Lawrence, 2010).

AT considers social elements such as the community, rules and the division of labour, which all have a bearing on an activity (Engeström, 1987). A community is an

establishment of a group or individuals that share the same interest through the object that interacts with the subject (Karanasios, 2018) because of the common objective, an activity is created by the participants in the community (Foot, 2001). Rules refer to the norms and processes that control the activities within a community (Engeström, 1987), where these rules and norms can positively or negatively affect the activity (Moawad, Liu, El-Helly, 2013).

In addition, these rules and norms can be explicit or implicit defining what is acceptable or not (Karanasios, 2018). Activity is initiated to achieve an output, and according to Karanasios (2018), an output is a result of labour and a group of labour, which are divided by roles and hierarchical structures through the division of labour. According to Siemonova (2017), the division of labour is the roles and responsibilities of people in a community. Division of labour in AT is perceived as the categorised roles and responsibilities of an individual partaking in an activity (Nehemia-Maletzky et al*.,* 2018). In addition, the division of labour dictates the division of power and status within a community (Tobin, Milne & Plakitsi, 2013).

In AT, an activity has a structure that defines how the activity happens at three concurrent hierarchical levels (Kaptelinin & Nardi, 2006). These levels of multiple actions are intended to transform an object (Bhattacherjee, Davis, & Hikmet, 2013). The first hierarchical level is the purposeful activity, followed by the goal-oriented action and lastly the supporting operations (Leont'ev, 1981). The hierarchy of activity is shown in figure 3.2 below.

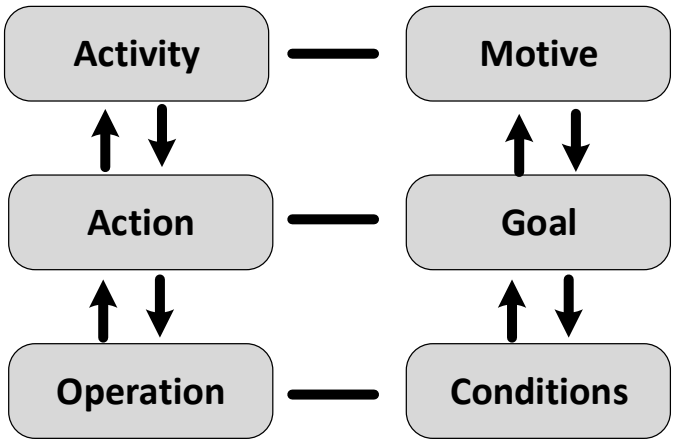

Figure 3.2: The activity hierarchy (Leontiev, 1981)

The top level of the hierarchy refers to activities established by a subject that has a motive directed to an object (Carvalho et al., 2015). The motive of the subject is to transform or attain an output from the object. In the second level, activity is accomplished by a series of actions even though some actions are not directly related to the motive (Devan & Squire, 2012). Although actions from the subject are purposely intended to achieve an output from the object, some of the subjects could initiate activities unconsciously about the motives. The last hierarchical level is referred to as operations, which can be iterative actions established by rules and done unconsciously (Carvalho et al., 2015).

Activities in the hierarchical levels are not solid but can change due to different factors. According to Peachey (2010), a change can occur at the hierarchical level, attributed to a change in an activity that is caused by a change in the subject's motivation or skills. Activity is thus dependent on the subject's motivation and consciousness, which can change. In addition, activity is affected by societal and circumstantial factors in the activity system (Siemonova, 2017), which can be dynamic.

The interaction between the subject and object is not direct but mediated by the tools (Goncalves, Correira, & Cavique, 2017), which can be external or internal tools (Bhattacherjee, Davis, & Hikmet, 2013). In addition, as much as tools are regarded as enablers, they can also be an inhibitor because the capability of the tool can empower or limit an action accordingly (Kuutti, 1995). The community that the subjects belong to influences their activities through rules set in that community (Er, Kay, & Lawrence, 2010), and these rules are a set of conditions that expect conformance, defining how and why subjects may act (Goncalves, Correira, & Cavique, 2017). Hence, the actions of the subjects are not independent of their community, and the interpretation of actions cannot be separated from the socio-culture of the community (Bhattacherjee, Davis, & Hikmet, 2013). During analysis, a community is used as a lens to comprehend how subjects having different backgrounds come up with a solution or new knowledge (Engestrom, 2001). Furthermore, it is used to understand the different perspectives and interactions that take place between the subject and the community (Engestrom, 2001). It is the explicit or implicit rules from the community that actually govern the subjects (Er, Kay, & Lawrence, 2010). Explicit rules are standardised practices whilst implicit rules are norms or informal practices (Er, Kay, & Lawrence, 2010).

The AT was specifically chosen for this study to assist the researcher to uncover the activities undertaken during the implementation of EA in an organisation. The theory is most appropriate for the study because of its capability to provide an understanding of why and how actors carry out activities, using various tools in an environment (Crawford & Hasan, 2006). Thus, AT helps to analyse the activities of the individuals and groups involved in the deployment of EA. This includes the reason or motivation behind the actors' participation in the activities of EA deployment in their environments.

AT has in the last two decades increasingly gained popularity in the field of IS (Ahmad, Akhbariee, & Hafizuddeen, 2013). The theory has been applied in IS studies from various viewpoints to examine activities and episodes. According to Hashim and Jones (2007), AT is used to underpin the complex challenges of human activities in IS studies. Ahmad, Akhbariee and Hafizuddeen (2013) discussed the use of AT to investigate the requirement for android applications. Shaanika and Iyamu (2015) used AT to determine the factors that influence the development of EA. Makovhololo et al. (2017) employed AT to study and understand the impacts of communication in healthcare systems data analytics. Holen, Hung and Gourneau (2017) adapted AT as a conceptual framework to examine the implementation of a one-to-one laptop initiative in a rural high school. However, AT is short in examining structure, change, and relationship. Thus, the dimension of change is combined with AT to examine the objectives of the study comprehensively and holistically.

3.4 Structuration Theory: Dimension of change

Structuration theory (ST) was developed by Anthony Giddens, a British sociologist, to address unusual social problems at the time (Posseborn & Pinsoneault, 2005). ST focuses on an agent (or agency), structure, the recursive interaction, and the relationship that exists between them (Giddens, 1984). It is on this basis that the theory provides an understanding of how social structures have been established and produced and reproduced through agents' interactions and actions (Vyas, et al., 2017).

Agency and structure are the main tenets of ST, and according to Giddens, agency and structure have an indispensable relationship (Klesel, et al., 2015) as they are co-dependent without priority of importance between each other (Meneklis & Douligeris, 2010). Agency refers to the pattern of people's actions, as opposed to a vehicle that is established to fulfil

people's intent (Posseborn & Pinsoneault, 2005). Giddens (1989) explains that an agent is a human being who is defined to be knowledgeable, responsive, and acting with a purpose (Sarason, Dean & Dillard, 2006), whilst a structure is rules and resources which help shape a social system (Giddens, 1979). Structure enables and at the same time constrains human actions within a social system (Vyas, et al., 2017).

Structure can expedite an activity using tangible resources such as computers or funds or intangible resources such as knowledge and culture (McPhee & Canary, 2016). Giddens describes resources as the means of exercising authority that can affect transformation (Klesel, et al., 2015). The premise of ST is based on the analysis of the establishment and re-establishment of social activity in a social setting (Posseborn & Pinsoneault, 2005). However, an agent needs rules and resources to be able to execute activities (McPhee & Canary, 2016), even though they execute activities according to the limitations set by the existing structures (McPhee & Canary, 2016). Giddens resonates that no study or analysis of a structure's properties can be executed without the consideration of the agent's knowledgeability (Giddens, 1984).

Structuration is not constant, because social behaviours change over time and must be replicated even though the result stays the same (Rose & Scheepers, 2001). Through this evolution, Giddens notes a process of identifying emergent regularities of social practice and periods of marked societal change (Tungela, Mutudi & Iyamu, 2018). A period is defined as the changes that are sequentially executed through several activities with a defined beginning and end (Giddens, 1984). One of the main tenets of structuration theory is the dimension of social change. The dimension of social change consists of four components origins, trajectory, momentum, and type, as shown in Figure 3.3. The components are most suitable for interpreting the dynamism that the deployment of EA in an environment entails.

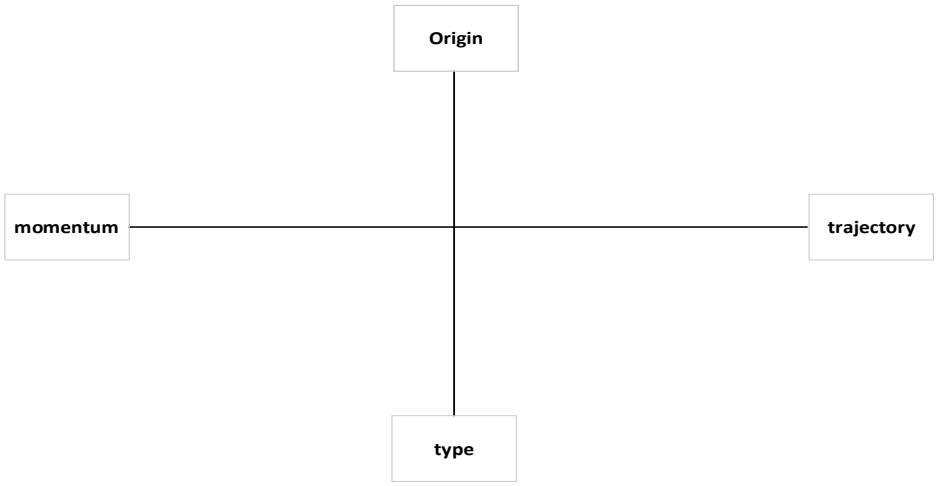

Figure 3.3: The dimension of social change

Origin – this is used to address the start of an episode (Giddens, 1984). This component focuses on investigating and evaluating the source of an episode, which can include the historical aspects (Tungela et al., 2018). This helps to gain an insight into how requirements were gathered, leading to the deployment of EA. This includes an understanding of how certain actions were triggered in EA deployment.

Type - refers to the description of the kind of episode. This component exposes the influence which change has on an environment, from both negative and positive viewpoints (Giddens, 1984). From the dimension of change perspective, type involves an episode, such as the distinctive roles and responsibilities of actors in deploying EA in government environments.

Momentum - This component refers to the rapidity at which change occurs in an environment (Çam & Kayaoğlu, 2014). From a structuration perspective, Giddens (1984) associates this component with specific episodic forms. This component helps to gain a deeper understanding of how change occurs in the deployment of EA in government environments.

Trajectory - is about the course or direction of the social change (Boje et al., 2017). This enables focus on the deployment of EA. Through this component, the collaborative effort of the actors in the deployment of EA was successfully interpreted.

Similar to AT, ST has gained considerable popularity in the field of IS (Puron-cid, 2013). This is because of the theory's purported benefits of creating critical and reflective thinking in IS research (Ma, 2010). Supporting this argument, Veenstra et al. (2014) suggest that the field of IS has used structuration theory to gain a better understanding of the development, deployment and application of IT artefacts and solutions. Iyamu (2020) used the dimension of social change to guide the analysis in a study to determine the role of e-government in healthcare services.

The motivation to use ST in this study is to analyse the interactions between humans and the structures they operate in, in which elements such as power, characteristics, perspectives, and social systems are discussed (Ma, 2010). ST enables this research to achieve its objectives by determining how EA is practised and understanding the factors that influence the benefits and value of EA within government environments.

3.5 The theoretical framework

The two socio-technical theories, AT and ST that underpin the study, as discussed above, were combined to form the theoretical framework. According to Varpio et al. (2020), a theoretical framework is based on the use of concepts such as theories to form a building block of a study. As shown in Figure 3.4, the theoretical framework provides a structured sequential guide for the analysis of the data and interpretation of the findings. Thus, the theoretical framework is divided into phase 1 and phase 2, for analysis and interpretation, respectively. The process of employing a theoretical framework increases the rigour of the study.

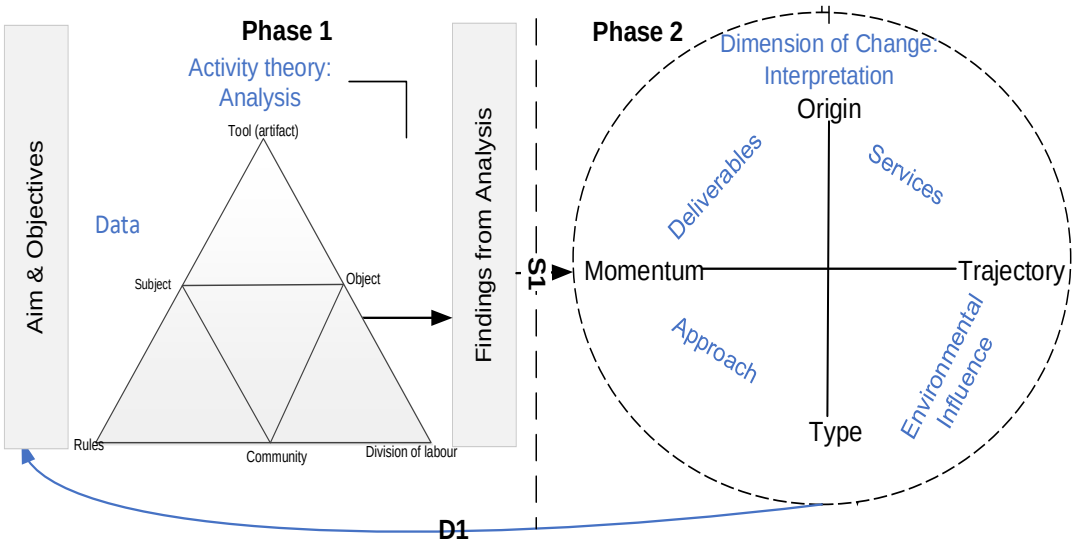

Figure 3.4: Analysis and Interpretation Process

As shown in the theoretical framework, there is no conflict or confusion in the use of the two theories, AT and ST in the study. Complementarity of theories has been demonstrated by other studies such as Nehemia-Maletzky et al. (2018), Iyamu and Roode (2012), and Atkinson and Brooks (2003). There is a boundary, indicated with a line (S1), between two phases: Phase 1 and Phase 2. Each phase has its distinctive focus but complementarily achieves the aim of the study, which is to develop a metrics model for EA.

Phase 1 employs the activity theory, which consists of four components, and focuses on the analysis of the data. As depicted in Figure 3.4, it is guided by AT in which the hermeneutics approach is employed for analysis. Individually, the two cases, Egypt and Ghana, were analysed using the AT model (see Figure 3.1), which has six components: tools, subjects, rules, community, objects and division of labour (Engeström, 1987)). This means that each of the components was used as a lens to examine the development, implementation, and practice of EA in the individual case studied. Findings from each of the cases were combined for interpretation purposes, towards achieving the objectives of the study.

Phase 2 employs the dimension of change, which consists of four components, origin, type, momentum, and trajectory. The phase focuses on the interpretation of the findings from the analysis. In the interpretation process, the primary focus is on services,

environmental influence, approach, and deliverables in the development, implementation, and practice of EA. This helps to gain a collective understanding of the dimension of change that happens in the deployment of EA in government environments. As the arrow (D1) in Figure 3.4 indicates, the results obtained from the interpretation were used to achieve the aim of the study, which is to develop a metrics model that can be used to measure the value and benefits of EA to an organisation.

3.6 Summary

In summary, a theoretical framework was designed to underpin this study. The theoretical framework was designed using two socio-technical theories, AT and DS (of ST), to sequentially guide the data analysis and interpretation of findings. The theoretical framework was divided into two phases 1 and 2, to avoid conflict and confusion. Additionally, the distinctive focuses of each of the phases provide clarity on which theory comes first in the order of use. In the next chapter, 4, the methodology applied in the study is discussed.

CHAPTER FOUR:
RESEARCH METHODOLOGY

4.1 Introduction

This chapter presents and discusses the methodology that was applied in this research. Cecez-Kecmanovic and Kennan (2018) define research methodology as an umbrella of logical enquiry of a study. The research methodology consists of philosophical assumptions, approaches, methods, and techniques. The selection of the methodology was based on and guided by the research aim; which is to propose a solution through a metrics model that can be used in measuring the value and benefits of EA within government institutions in developing countries.

The methodology applied in this study is discussed, which is structured into seven main sections. The first section covers the philosophical assumption. The second section covers the research approach, and the third section discusses the research methods. This is followed by the fourth section, which is about research design, and the fifth section discusses data collection. The sixth section presents the data analysis, and thereafter, the chapter is concluded in the eighth section.

4.2 Philosophical assumption

The experiences and perspectives of a researcher influence the researcher's view of reality, and this perception of reality is referred to as the philosophical assumption. Saunders, Lewis and Thornhill (2009) define philosophy as the development of knowledge and the nature of that knowledge. Cresswell (2013) defines philosophy as a researcher's use of concepts and beliefs that structure research. Consequently, the activities of research are not independent of a researcher's belief. Antwi and Hamza (2015) assert that the choice of a research paradigm guides the research activities. Klakegg (2016) posits that it is a challenge to separate the assumptions and beliefs of a researcher from the research activities.

The philosophical assumption of the researcher is referred to as the research paradigm (Cresswell, 2013). The research paradigm represents the way a researcher comprehends and interprets reality, understands what is there to know, and how this knowledge can be acquired (Abdul & Alharthi, 2016). The research activities are executed within the framework of the selected paradigm. Furthermore, the research will maintain and follow the assumptions, beliefs, and values of the chosen paradigm (Kivunja & Kuyini, 2017).

A research paradigm consists of ontology, an epistemology that informs the methodology, and axiology (Klakegg, 2016), and all are interdependent in research (Aliyu *et al.,* 2014). The choice of a paradigm is influenced by a particular ontology, epistemology and axiology (Nguyen, 2019). This study is viewed from both ontological and epistemological points, considering the axiology and research methodology.

4.3 Ontology

A researcher undertakes a study depending on the assumption of what the researcher knows. The nature of this knowledge is referred to as ontology (Walliman, 2017), which is also known as the study of existence (Klakegg, 2016). Furthermore, ontology describes how things exist and how things work (Alhassan, 2018), and with ontology, researchers can articulate what they believe is reality. According to the researcher's belief of what reality is, researchers can establish the research problem, the reason it is important and how it can be resolved to add to existing knowledge (Nguyen, 2019). In addition, a researcher can articulate the truth that exists on a specific research subject (Al-Saadi, 2014).

Objectivism and constructivism are the two ontological stances (Al-Saad, 2014). The ontological stance of this research is constructivism, which is viewed from the fact that: EA does exist; it is a reality that there are government institutions; and there are people who apply the concept of EA differently. However, some of the things that are not known include: how the EA is applied in various government institutions. In recent years, there has been increasing interest by governments of many countries in deploying the EA (Shaanika & Iyamu, 2018; Dang & Pekkola, 2017). Even though there is much attention on the concept of EA measurement, there are no tools or models to carry out the activity. Hence the claims that there is a shortcoming with measurement metrics in the management of EA (Grunow et al., 2012). Similarly, Kurek, Johnson and Mulder (2017), claim that there is a shortage of standardised accepted EA measurement metrics. According to Aier (2014), literature has proven that IS solutions and EA measurements are conducted sparsely, meaning that only certain artefacts of EA are measured and a holistic measurement is not executed.

4.4 Epistemology

Researchers seek knowledge to validate their research, which is referred to as epistemology. Epistemology is defined as the theory of knowledge that is known to be true or known not to be true (Klakegg, 2016). What is defined as knowledge can be confirmed through epistemology (Cresswell, 2013). Through epistemology, researchers have a choice to select knowledge (Gray, 2013), decide the way knowledge can be acquired (Walliman, 2017), and how it should be studied. Epistemology tries to comprehend what it means to have knowledge (Alhassan, 2018).

Researchers can establish confidence in the knowledge gathered because it has an impact on the process of revealing knowledge through investigation (Kivunja & Kuyini, 2017). Epistemology seeks to establish what the relationship is between the researcher and the known (Scotland, 2012). There are different epistemological stances (Al-Saadi, 2014), such as positivism, interpretivism, constructivism, critical realism and pragmatism to mention a few. However, positivism and interpretivism have been the most popular stances used for epistemology (Gray, 2019). This study adapts interpretivism as the epistemological stance.

Epistemology in IS research is characterised by the means of gathering knowledge, which is the process of creating knowledge by interpretivism (Goldkuhl, 2012). Information systems research is acquired by drawing conclusions that are established on the subjectivism of the researcher. Hassan, Mingers and Stahl (2018) echo that from an epistemological view, the term social construction was established, which in turn became the accepted view of reality in IS research studies. However, epistemology is not only restricted to interpretivism, but literature has also revealed IS studies based on positivism.

Epistemology has been applied differently in various IS studies. Abbasi, Sarker and Chiang (2016), used interpretivist epistemology to research the effects of big data in IS. Likewise, epistemology was used to reveal the factors that highlight the decision-making behaviour that is based on data in IS (Dobbe et al., 2018). Even though it is believed that IS study is based on interpretivist epistemology, Kante, Chepken and Oboko (2018) used positivist epistemology to measure the causal relationships between variables in an IS system. This was done by applying structural equation modelling which is a statistical analysis technique.

4.4.1 Positivism and Objectivism

Positivism is respectively the epistemological and ontological stances, both based on objectivity and evidence of research (Al-Saadi, 2014). The inquiry of positivism is not based on the assumptions of the researcher, but on scientific inquiry and empirical evidence (Gray, 2019). The researcher deals with the research objectively and is factual with results that are based on absolute facts of the research phenomena. Furthermore, positivism holds the fact that realities already exist in the phenomena to be studied; they only need to be revealed (Crotty, 1998). The discoveries are independent of the researcher's view and opinions, meaning that there is only a single truth about the phenomena. The premise of positivism is derived from natural sciences for human knowledge and uses research methods and techniques similar to natural sciences (Al Saad, 2014)

4.4.2 Interpretivism

Interpretivism is grounded on the premise that reality is based on the view and perspective of the researcher. Alhassan (2018) postulates that there are multiple realities based on an individual's truth. Researchers thus view reality through the experiences and views of the participants of the research (Thanh & Thanh, 2015). Since the reality of the research is based on the perspective of the researcher, different realities can be derived from the same subject being studied. According to Scotland (2012), interpretivism rejects the notion that there is only a single reality and asserts that facts are based on subjective perceptions.

Based on the aim of this research, the interpretivism and constructivism stance was selected. Government organisations from different countries deploy EA differently; consequently, experiences and perspectives of EA will be subjective to each country.

4.5 Axiology

Axiology is defined as the ethical consideration that the researcher needs to take into account during the planning of the research (Kivunja & Kuyini, 2017). The consideration should be about the researcher upholding the moral value and not harming the human participants in the research (Pearlson & Saunders, 2013). The researcher needs to define, assess, and understand the different elements in the research that needs to be regarded

for ethical reasons. Nguyen (2019) asserts that axiology is the consideration of various elements such as the participants, the viewers and the data to which the outcome of the research will be reported.

4.6 Research Approach

The research approach refers to the various sources of knowledge. The source of knowledge depends on the philosophical assumption of the researcher. The different approaches are abductive, inductive, and deductive (Bryman & Bell, 2015). However, inductive and deductive approaches are regarded as the most popular (Awuzie & McDermott, 2017).

4.6.1 Deductive Approach

Deductive approach is derived from the positivist perspective, and is associated with scientific studies (Saunders Lewis & Thornhill, 2009). The deductive approach develops a theory from the collected data that is subjected to factual testing. The aim of the deductive approach is for the researcher to confirm or reject a theory by testing and presenting evidence accordingly (Ritchie et al., 2013). The flow of information for the deductive approach is from the top-down approach. This means that the deductive approach is used where knowledge is applied from a general to a specific argument (Ary, 2013).

In deductive research studies, IS research using experiments uses theories to derive a hypothesis (Constantinides, Chiasson & Introna, 2012). This is conditioned in deductive research studies. Hassan, Mingers and Stahl (2018) posit that the deductive approach is popular in IS research, emanating from the practice of using hypothetical deductive analysis to provide scientific evidence. In other words, scientific and mathematical means are used to test the theory. A hypothetical deduction is the confirmation of a theory by using empirical content and experiments (Bendassolli, 2013). The conclusion found on a deductive approach is limited to its findings and cannot imply its reasoning from similar references (Hassan, 2011). To evaluate the success of an automotive system by IS users, Roky and Al Meriouh (2015) used the deductive hypothetical approach to analyse the quantitative data collected.

4.6.2 Inductive Approach

The inductive approach concerns the process of building theory through research activities on a phenomenon to draw a conclusion (Ritchie et al., 2013). An inductive approach aims to gather a theory from data, unlike the use of data to test a theory (Al-Saadi, 2014). Along the same lines, Antwi and Hamza (2015) explained that the justification of the inductive approach is that a researcher cannot make a conclusive reasoning from objective or empirical research. It is against this background that the inductive approach is referred to as theory-building research (Bhattacherjee, 2012). The inductive theory is derived from the interpretivism stance and is qualitative research that follows a bottom-up approach (Cresswell, 2013).

The use of the inductive approach is prominent in IS research studies. Fleischmann and Ivens (2019) used an inductive approach to determine the impact of trust from the users' and customers' perspectives on blockchain adoption. The inductive approach was used to build a theory from empirical data collected from case studies. In another research, Sanchez-Puchol, Pastor-Collado and Borrell (2017), used the inductive approach to construct a unified IS model for higher education institutions. The model was inductively derived from Hrabe and Buchalcevova (2011), Application Architecture Reference Blueprint Model. In the same manner, Timm, Klhos and Sankuhl (2018) used existing inductive methods to derive a Reference EA model.

As the inductive approach is concerned with building a theory, this research chose the inductive approach. The data collected from the case studies were analysed and used to build a theory from the case studies. The result and findings were used to build an EA metric model for government organisations.

The gaps identified in the existing EA metrics models by Filet, van de Wetering and Joosten (2019) and Busch and Zalewski (2018) discussed in chapter two were used to guide the construction of a new theory. The known facts from these cases serve as the premise for using the inductive approach. According to Hayes, Heit and Swendsen (2010), the inductive approach is about the use of existing facts to suggest a possible new case. In addition to the identified gaps from the existing EA metric models, the findings from the case studies of this research will be used to build a general theory about EA metrics in governments.

4.7 Research Methods

The selection of the research methods, techniques and the establishment of the knowledge from the research is influenced by the philosophical assumption of the researcher (Cecez-Kecmanovic & Kennan, 2018). There are three main research methods, quantitative, qualitative and mixed method. Davies and Hughes (2014) posit that quantitative and qualitative are the popular research methods used, with mixed-method as the other option. Mixed-method is a method that is characterised by tenets of both qualitative and quantitative research methods (Venkatesh, Brown, & Bala, 2013).

4.7.1 Quantitative methods

Quantitative methods are defined as the collection of numerical data and the use of statistical software to seek clarification and correlation among the data collected (Silverman, 2015). The methods are associated with positivist epistemology (Yilmaz, 2013), which deals objectively with data. The quantitative method produces objective results based on the collection and analysis of mathematical and statistical data (Bambale, 2014). Surveys, laboratories and questionnaires are some of the tools used for quantitative data collection. Furthermore, the quantitative method is defined as the empirical research of a phenomenon using statistical or mathematical data (Basias & Pollalis, 2018). The focus of the quantitative research method is to deduce a reason from tested and verified results.

Quantitative methods are often used in IS research to obtain numerical or statistical data, which can be from various sources. Quantitative tools such as field experiments are used in IS research, using different variables for testing purposes. The researcher can observe the behaviour of the variables in their natural setting with other variables involved (Queirós, Faria & Almeida, 2017). A variable is anything that can be measured and manipulated, which can be a characteristic or property of something or a human being (Apuke, 2017). Osterlind et al. (2013) conducted a quantitative study to measure EA evaluation. The measurement is used to provide a numerical representation of choice for stakeholders to make objective decisions. Quantitative methods are used to measure the behavioural aspect of IS itself, meaning the components of an IS system. In addition, it can also be used to provide statistical data about a system to guide decision-making in organisations.

The use of the quantitative method will not be appropriate for this study because the objective is not to collect and analyse numerical or statistical data. This is backed by

Queirós, Faria and Almeida (2017), who declare that quantitative methods are appropriate for studies that collect quantifiable data. The objective of this research is to get opinions, perspectives and shared experiences from the participants. The choice of the research method is motivated by the research questions (Borrego, Douglas & Amelink, 2009). None of the research questions intends to collect quantifiable data thus rendering the quantitative method inappropriate for this study.

4.7.2 Qualitative methods

The qualitative method is defined as an in-depth description of a scenario, making use of theoretical concepts and creating meaning that is interpreted subjectively (Silverman, 2015). Its main focus is on the interpretation of reality that cannot be quantified (Queirós, Faria & Almeida, 2017). The qualitative method is not concerned with numerical data (Hammarberg, Kirkman, & Lacey, 2016), but it is a method that relies on subjective data collection and analysis. The qualitative method is based on interpretivism, which is associated with subjectivity (Yilmaz, 2013). The qualitative method is also referred to as the research of people's perceptions and experiences (Finaly, 2011). Hence, its focus is on the personal opinion, understanding and viewpoints of the participants (Cope, 2014). The aim is to understand the social reality of people (Finaly, 2011).

A researcher using the qualitative method does not regard reality as fixed but tries to comprehend the participants so that a distinctive case can be established based on the experiences and views of the participants (Frost, 2011). As further explained by Queirós, Faria and Almeida (2017), the qualitative method is focused on the comprehension and rationale of the dynamics of social interactions. Thus, the qualitative method was employed to comprehend the activities, opinions, views, and experiences of the participants involved in the government's EA deployment.

The choice of using qualitative study is further motivated by the claim of Borrego, Douglas and Amelink (2009) that the research method is dependent on the research questions or research objectives. The two objectives of this research, which are to determine the factors that influence the deployment and use of EA and how EA is practised in government organisations both did not yield numerical or statistical data. The objective of the qualitative method is to build an understanding of a scenario under study based on the personal views, opinions and experiences of the participants (Kornbluh, 2015).

The use of the qualitative method is increasing in IS studies. Along the same lines, Walsham (2018) resonates that the qualitative method is popular in IS studies because of the association between technology and humans. This is because IS does not operate on its own but it is affected and relies on human activities and processes (Iyamu & Shaanika, 2018). Qualitative methods have been used in various IS research studies. Iyamu (2018) used the qualitative method to propose a guide on how to implement EA in an organisation using the Zachman framework. Tungela, Mutudi and Iyamu (2018) applied the qualitative method to investigate the role of e-government in healthcare.

4.7.3 Mixed method

In addition to the quantitative and qualitative methods, is the mixed method. It is a combination of quantitative and qualitative methods (Nguyen, 2019). One of the benefits of utilising the mixed method is the ability to get the best from both quantitative and qualitative methods (Assinger & Morrow, 2013). The mixed method is used in complex research that has a core and supplementary element to be solved simultaneously (Morse, 2016). The strength of each method will bring effective conceptualisation to the processes and results.

However, this research assumed the qualitative method, primarily because a theory was developed, which will be based on the analysis of participants' views, opinions, and experiences (Kornbluh, 2015). In addition, the method allowed the researcher to interrogate existing content to determine the factors that influence EA value and benefits, and the manner that EA is implemented in organisations.

4.8 Research Design

The research design refers to the approach and context within which the study is conducted in achieving the aim and objectives (Cresswell, 2014). There are different types of research designs, including case studies, grounded theory, ethnography and surveys (Williams, 2011). The most popular method used is the case study (Yazan, 2015), which is defined as an empirical investigation of a phenomenon within its real-life context (Godwin & Potvin, 2017). Benefits such as getting multiple sources to reveal the complexities in their entirety (Yazan, 2015), and the revelation of different subjects from a specific setting, organisation or people (Gray, 2013), have been associated with case study research design.

A total of 6 African governments are known to have adopted GEA. These are Nigeria, Rwanda, Uganda Ghana, Kenya, Egypt, and South Africa. Two of these countries Ghana and Egypt were used as cases in the study. The countries were selected for two reasons. First, the literature suggests that these are the countries that have successfully developed and implemented EA. Second, access to information is critical in conducting the study. Information about EA of other countries was either not available or not accessible, which was different with Ghana and Egypt.

4.9 Data collection

Different tools and techniques are used for data collection. The qualitative method has several techniques such as interviews and questionnaires (Gray, 2013) and documentation (Bowen, 2009). Data collection for this research was based on the documentation technique as the primary source of data.

Various reasons were recorded why existing documents can be the preferred choice of data collection. Vaismoradi et al. (2013) stress that some researchers make use of existing documents because the approach is less exposed to subjective interpretation, but rather to a more abstract interpretation. With existing documentation, a researcher can cover a broader scope of information and countries. In the same way, Bowen (2009) posits that data collection through existing documents is attractive due to the availability of much documentation. According to Yin (2003), documents provide a wide range of coverage, offered over different timeframes, different events and cases.

The use of documentation for this research was motivated by the fact that the case studies (countries) are geographically widely apart, and for this reason, it is not economically viable for the researcher to travel to these countries to collect data through interviews. Documentation is also supported by the availability of a broader scope of documents, as mentioned by Bowen (2009).

4.9.1 Criteria for the data collection

Firstly, EA documents from Egypt and Ghana were collated from google and scholastic databases. The documents from Google were predominantly the national and strategic documents of EA from each country, where most of them are not peer-reviewed publications. The scholastic databases were used to search peer-reviewed EA documents

of these countries. The keyword strings used for the search were Egypt, Ghana, Africa, government enterprise architecture and public sector enterprise architecture.

Firstly, the search criteria for collecting documents were formulated:

i. EA strategic documents include the requirements, investment, and benefits. These documents were to analyse the rationale for deploying EA in government organisations.
ii. The roles of individuals involved in the development, implementation, and practice of EA. This revealed the activities and resources used for the deployment and practice of EA.
iii. The search criteria for the year of publication of each country's EA national documents were set to no limit. This was to maximise the collection of documents because publication of national documents is restricted and publication from each country can span over different timeframes that are challenging for the researcher to assume. Hence, this makes it difficult for the researcher to determine the scope of years to be as a criterion.

Secondly, existing peer-reviewed documents of EA were collected from the scholastic databases in accordance with the content. The criteria set were as follows:

i. Documents published between 2010 and 2020 were the main focus. According to Iyamu, Nehemia-Maletzky & Shaanika (2016), this is to have a spread of historical views from the perspectives of consistency, meaning, and challenges associated with the concept. The researcher had the benefit of capturing the latest concepts and results from related research conducted.
ii. Documents with content about the EA development, implementation, practice, and post-implementation activities that happened. This allowed the researcher to assess empirical studies on the activities related to EA.
iii. Documents based on benefits and value derived from the deployment of EA, as well as the challenges experienced. The researcher found useful information and attributes relating to benefits and challenges from empirical studies, which were used in the design of the metric model.

iv. In addition to the above, any other documents related to the development or implementation of the EA were collected. The researcher captured additional information that was not found in previously collected documents.

4.9.2 Source of data

The keywords string for the search were enterprise architecture in government, public sector, and enterprise architecture implementation. The databases used include Google Scholar; AIS Electronic Library; ACM Digital Library; IEEE Xplore; and Science Direct – Elsevier. The above databases and search engines were selected and used in searching for literature for two main reasons: (1) they are primarily focused on studies in the field of Information Systems, Information Technology, and Enterprise Architecture; and (2) the university (CPUT) subscribe to these databases, which make them easily accessible.

A total of 69 documents were collected and used as data. The primary focus areas were development, implementation, and practice as shown in Table 4.1. The researcher had a challenge collecting more documents that are relevant to EA for the selected countries. This is an indication that there is a gap in the academic literature in Africa for GEA. The data is comprehensively coded in chapter 6.

Table 4.1: Collected Data

Factor	Description	Egypt	Ghana	Total
Development	Development refers to the design of the current architecture in the organisation with all its related artefacts, processes and challenges used to build the to-be architecture of EA (Al-Kharusi, Miskon & Bahari, 2017). The documents that were collected are related to or focused on the development of EA in the context of the country. This includes policy, technical design, requirements, and procedural documents.	8	6	14

Implementation	The implementation of the EA is an iterative process through which plans involving designs, systems, processes, and technology platforms are actioned (Dale & Scheepers, 2020). The documents collected indicate the plans for the EA implementation. The implementation of EA is deployed through organisational structures, of both business and IT units.	14	25	39
Practice	The EA is practised through its domains (business, information, application, and technical). The practice is often based on best practices from both technical and business units (Bui, 2017). The practices often lack measurement, which makes it difficult to assess the value.	9	7	16
Total		**31**	**38**	**69**

As shown in the above table, the data is arranged under the main factors and countries (cases). This is primarily to ease analysis by structuring documents according to their relevance. Document analysis was used for the analysis and interpretation of textual data, which was followed by highlighting categories, patterns, and themes (Assarroudi et al., 2018).

4.10 Data analysis

Data analysis is a very significant process that involves the identification of emerging issues through documented data and trying to interpret and derive sense from that data (Grbich, 2012). New insights can be gained through data analysis (Gray, 2013) and the outcome of data analysis determines the fulfilment of the research objectives Flick (2013). As mentioned before, this study used interpretivism for data analysis which is the construct of reality through the subjective understanding of the researcher (Kroeze, 2012). Data analysis was done interpretively using the documents, which is referred to as document analysis.

Document analysis is a technique that is used in document analysis based on which findings

are reached and conclusions are drawn (Blaxter, 2010). Even though document analysis is popularly known to be used complementarily with other research methods, it can also be used as a stand-alone method in research (Bowen, 2019). In using the document analysis technique, a pattern was followed, which is the hermeneutics approach. Boell and Cecez-Kecmanovic (2014) refer to hermeneutics as a methodological approach to the analysis of literature, which helps to establish a deep comprehension of the phenomenon.

Hermeneutics is an approach that is associated with qualitative methods. The approach focuses on historical texts and past experiences of the participants, to understand the subject matter under study (Ramsook, 2018). This is emphasised by Boell and Cecez-Kecmanovic (2014), that the core of hermeneutics is the interpretation and understanding of literature. In the use of hermeneutics, analysis is conducted through repetitive cycles, in interpreting and gaining a deeper understanding of the literature in the interest of the subject matter (Kurnia, Linden & Huang, 2019).

Using hermeneutics, the researcher could interpret and develop an understanding of the rationale that led to the development of EA in government enterprises in Africa. The rationales were established from historical texts and documented experiences. The coding of the data is described in detail in chapter four.

The sociotechnical theory, activity theory (AT), used as a lense to guide the data analysis, The lenses guide the use of the interpretivist approach in which hermeneutics was employed for analysing the data and interpreting the findings. Detailed information about AT and ST is provided in chapter two and the conceptual framework is presented in chapter 3. The theories are used particularly to focus on three fundament areas of the analysis, as follows:

1. The activities and events that happen in the processes of developing, implementing, and practising EA in government enterprises in Africa.
2. The roles and responsibilities of various actors in the development, implementation, and practice of EA in government enterprises
3. How the events and actors' roles shape and influence the EA within the environments of government enterprises in Africa.

AT and ST were applied through detailed steps, and as alluded to by Iyamu (2020), the

steps used for analysis and interpretation are by identifying and aligning data to each tenet of AT and ST. Through this process, the different tenets of AT and ST were used to determine the factors that influence the value of EA within government environments.

4.11 Units of analysis

The unit of analysis will be applied with reference to the structure for conducting the analysis. Neuman (2011, p. 69) defines the unit of analysis as “The units, cases, or parts of social life that are under consideration”. They are key to developing concepts through the use of data analyses. Data analysis can be done holistically, or it can be clustered in smaller portions which are referred to as a unit of analysis (Bengtsson, 2016), It thus refers to the analysis of the specific object (Kumar, 2018).

Based on this study, the unit of analysis is established on the research objectives. The first objective is to examine why EA is implemented within government institutions, and the unit of analysis will be the scope of EA. The second objective is to examine and establish how EA is practised in a government institution, and the second unit of analysis will be the activities in the deployment and use of EA. Through the unit of analysis, the research conclusion will be established (Kumar, 2018).

4.12 Summary

The chapter highlighted the technical activities undertaken to conduct the research. The research was established from the research philosophy, followed by the research methodology and the different research techniques. Through the philosophical assumption, the study was established on interpretivism. The rest of the chapter echoed the associated philosophical assumption, inductive approach, qualitative research strategy, and case study for the research design. documentation was used for data collection and document analysis for the data analysis.

CHAPTER 5:
CASE OVERVIEW

5.1 Introduction

The objective of this chapter is to give an overview of the selected case studies. This chapter explains the preparation of the data for analysis. The sociotechnical theory, activity theory (AT) and Structuration theory were used for data analysis, and before that, the document analysis was used for the preparation of data as mentioned in chapter three.

The chapter is divided into three main sections. The first section is the introduction, followed by the classification of the data and coding thereof. This is then followed by an overview of each of the cases, which are the following countries: Egypt and Ghana. This chapter is then concluded in section three.

5.2 Data and classification

Documentation is associated with the benefit of amassing diverse data (Koyuncu & Kılıç, 2019), and it is thus imperative that the data is organised, described, and prepared for the ease of data analysis. Document analysis was used as the process that involves the reduction of unstructured data by selecting the data that applies to the research questions (DeCuir-Gunby, Marshall & McCulloch, 2011). This was done by iterative reading, skimming, and interpretation (Bowen, 2019). The quantity of the documents was reduced from a total 155 to 69.

In addition, data classification was used to arrange data in manageable sections of context, grouped according to a specific criterion (Xu et al., 2017). The classification criterion is generalised, even though aspects of the data are diverse (Vaismoradi et al., 2016). Classification allows data to be logically arranged in such a way that it makes it easier to analyse (Kirilenko & Stepchenkova, 2016). The label of each class guides the analysis of the attributes in each section.

5.3 Case study overview

As discussed in chapter three, the following four countries were selected as the case studies; Egypt and Ghana. These countries were selected because these governments

have developed and deployed enterprise architecture. Each country was treated as a case and labelled as Case #1, Case #2, Case #3, and Case #4 respectively.

5.3.1 Egypt: Case one

Egypt is an African country that is geographically located in the North. After Nigeria and Ethiopia, Egypt is the third most populous country in Africa (CIA, 2018). According to Internet world statistics (2019), Egypt had an estimated 46,92% internet users. The demand for better services for their citizens is one of the main priorities of African governments (Chima & Kasim. 2018), and countries such as Egypt invested in ICT to provide effective and efficient services for their citizens. Since the early 1960s, the country has invested in ICT infrastructure, to make it one of the country's main economic players (Eidin, Megahed & Attia, 2020). The private and public sectors collectively invested in the infrastructure to establish the ICT sector. Consequently, through the investment in ICT infrastructure, Egypt became one of the early adopters of e-government in Africa, established with a clear strategy (Klischewski, 2014). The national strategy was established in collaboration with stakeholders from both the public and private sectors (Kamel, 2010).

The growth of the ICT sector in Egypt resulted from the continued commitment and efforts for ICT development in the country. This is highlighted by Kamel (2010), who stated that Egypt is one of the countries that pushed its national ICT strategy from its inception to its successful deployment. The government created the Ministry of Communication and Information Technology (MICT) in 1999, which developed a national plan on how to establish an ICT sector in Egypt to promote ICT activities that could contribute to the economy of the country (Rahman, 2011). Different projects were initiated thereafter, and consequently, successes associated with the establishment of MICT were recorded (Klischewski, 2014). In its continued effort to drive ICT through e-governance, the Egyptian Government Enterprise Architecture Framework was introduced in 2006 (Ministry of State for Administration, 2006). The aim of the framework was to ensure proper collaboration amongst government institutions' projects as well as other stakeholders.

The documents collected were classified by development (DEV), implementation (IMP) and practice (PR). The classification was based on research questions to ensure that the objective of the research is achieved. After the classification of the documents, coding was

done for ease of reference. The coding was designed for the first letters to represent the country, followed by the data classification, and the last is the number of the document. All documents from Egypt that are related to EA development were coded as EPDEV01. The first two letters represent the country name EP for Egypt, which is followed by the data classification DEV for development, it is then concluded with the number of the document, 01, according to the quantity. A total of 8 documents were classified.

The same data coding will be used for all the other countries, with the only difference being the code of the country, GH for Ghana and EP for Egypt. The framework for data classification and coding for Egypt is presented in the table below.

Table 5.1: Egypt: Case1

#	DATA CLASSIFICATION	DATA DESCRIPTION	SOURCE	DATA CODE	TOTAL # OF PAGES
1	EA Development	Egyptian Government Enterprise Architecture Frameworks (EGEAF)	Ministry of State for Administrative Development (2006)	EPDEV01	25
2		OECD e-Government Studies: Egypt 2012	OECD (2012)	EPDEV02	250
3		Can e-Government Adopters Benefit from a Technology-First Approach? The Case of Egypt Embarking on Service-Oriented Architecture.	Klischewski and Abubakr (2010)	EPDEV03	17
4	EA Implementation	From E-Government Strategy to Services: Challenges of Inter-	Klischewski (2014)	EPIMP01	11

		organisational IT Governance in Egypt			
5		Towards Adoption of Government EA: The Cases of Egypt and Syria	Mohamed, Galal-Edeen, Hassan (2013)	EPIMP02	10
6	EA Practice	Egyptian Government Enterprise Architecture Frameworks (EGEAF)	Ministry of State for Administrative Development (2006)	EPPR01	25
7		Enterprise Architect	Naukrigulf EA vacancy (2022)	EPPR02	3
8		Enterprise System Architect	Scholarship (2022)	EPPR03	3
Total					344

5.3.2 Ghana: Case two

Ghana is geographically located in the West of Africa, neighbouring Ivory Coast, Burkina Faso and Togo. According to Internet world statistics (2020), Ghana has a population of approximately 31 million as of 2020, with 39% internet users. The government of Ghana realised its need to prioritise investment in ICT to support development in the different social, economic and political sectors (Adarkwah, 2020). Hence concerted efforts were planned to establish policies and activities to support the establishment of ICT in the country. This made Ghana one of the first countries in Africa to reform its ICT sector by establishing the needed policy and regulatory framework to develop the ICT sector (Boateng, 2012). The Ministry of Communication was mandated as the institution to initiate projects that can accelerate the policy deployment of ICT and government information (Agboh, 2017). Through this effort, the Information and Communication Technology for Accelerated Development (ICT4D) policy framework was established, which defines the

government's vision for exploiting innovation and advancement in the different sectors of the country (Tchao et al., 2017).

ICT4D emerged from Ghana's quest to transform the country into an information and knowledge-based country which is driven by its society (Arthur-Nyarko & Kariuki, 2019). Through the ICT4D, the government of Ghana developed and adopted e-government in 2003. This was followed by the e-government strategy in 2005 and the deployment of e-government strategies in 2008 respectively (Osei-Kojo, 2017). The objective for the development of the e-government project is to accelerate the development of ICT and related services to support businesses and government communication applications (Ewurah, 2017). Just like its fellow developing countries in Africa, Ghana focused on investing in ICT and telecommunication technologies to increase the ICT penetration rate and support e-government initiatives (Tchao et al., 2017).

Even though there are benefits to the deployment of systems through e-governance, there are also known challenges. The Ghana Government Enterprise Architecture (GGEA) was developed in 2008 to mitigate challenges associated with e-governance deployment in government ministries, departments, and agencies. The two main objectives of the GGEA are to support strategic development and investment and to guide and support the system's activities and engagement (GGEA Assessment Framework, 2009). The deployment of e-governance in Ghana experienced challenges that emanated from systems deployed by the different ministries in isolation. Consequently, optimal benefits from the information in the different systems were not realised (e-GIF, 2009). The Ghana e-government interoperability framework was developed in 2009 to manage and achieve interoperability amongst these different systems, and it was established under the ambit of the GGEA. "The e-GIF is a set of policies, technical standards, and guidelines covering ways to achieve interoperability of public-sector data and information resources, ICT, and electronic business processes". Furthermore, the GGEA Assessment Framework was developed to assess the maturity and effectiveness of EA in ministries, departments, and agencies in the public sector.

The documents collected for Ghana are listed in the table below. A total of 10 documents were collected, and as mentioned before, the documents are coded with the abbreviation of GH for Ghana, development (DEV), implementation (IMP) and practice (PR).

Table 4.2: Ghana: Case 2:

NUMBER	DATA CLASSIFICATION	DATA DESCRIPTION	SOURCE	DATA CODE	TOTAL NUMBER OF PAGES
1	EA Development	Ghana e-government Interoperability Framework	National Information Technology Agency (2009)	GHDEV01	99
2		Ghana Health Service Enterprise Architecture	Ministry of Health (2009)	GHDEV02	162
3		Enterprise Architecture in Healthcare and Underlying Institutional Logics: a Systematic Literature Review of IS Research	Ajer (2018)	GHDEV03	14
4		Understanding what is happening in ICT in Ghana	Frempong (2012)	GHDEV04	55
5		Ghana Government Enterprise Architecture	Ministry of Communication (2009)	GHDEV05	45

5	EA Implementation	Ghana government enterprise architecture implementation plan	Ministry of Communication (2009)	GHIMP01	14
6		Ghana government enterprise architecture assessment framework	Ministry of Communication (2008)	GHIMP02	15
7		Overview of E-government Adoption and Implementation in Ghana	Mensah (2016)	GHPR03	12
8	EA Practice	Enterprise Architect-MTN	Hot Jobs Ghana (2020)	GHPR01	5
9		Government Enterprise Architecture Consultancy Services	Ministry of Communications and Digitalisation (2019)	GHPR02	3
10		Overview of E-government Adoption and Implementation in Ghana	Mensah (2016)	GHPR03	13
TOTAL NUMBER					392

OF PAGES					

5.4 Summary

This chapter presented the two governments that were chosen as case studies. An overview of the government's IT background was presented with the objective of EA and how it was structured. The structure revealed how the implementation of EA can be significantly achieved in the government. Documents associated with EA and the strategic objectives of IS/IT were collected for each country, classified, and coded respectively for each case.

CHAPTER SIX:
DATA ANALYSIS

6.1 Introduction

Data was collected based on the aim of the study, which is to develop a metrics model that can be used to measure the value and benefits of EA in government institutions. The process of data collection is comprehensively discussed in Chapter 4. The data is arranged and classified in Chapter 5. This chapter deals with the analysis of the data. In achieving the aim of the study, the hermeneutics approach is employed in the analysis, guided by activity theory (AT), as depicted in the conceptual framework in Chapter 3. The findings from the analysis are interpreted using the dimension of social change of structuration theory (ST). AT and ST are covered in Chapter 3, while the hermeneutics approach is discussed in Chapter 4. The processes of analysis and interpretation are guided by the conceptual framework in Chapter 3 and repositioned in Figure 6.1.

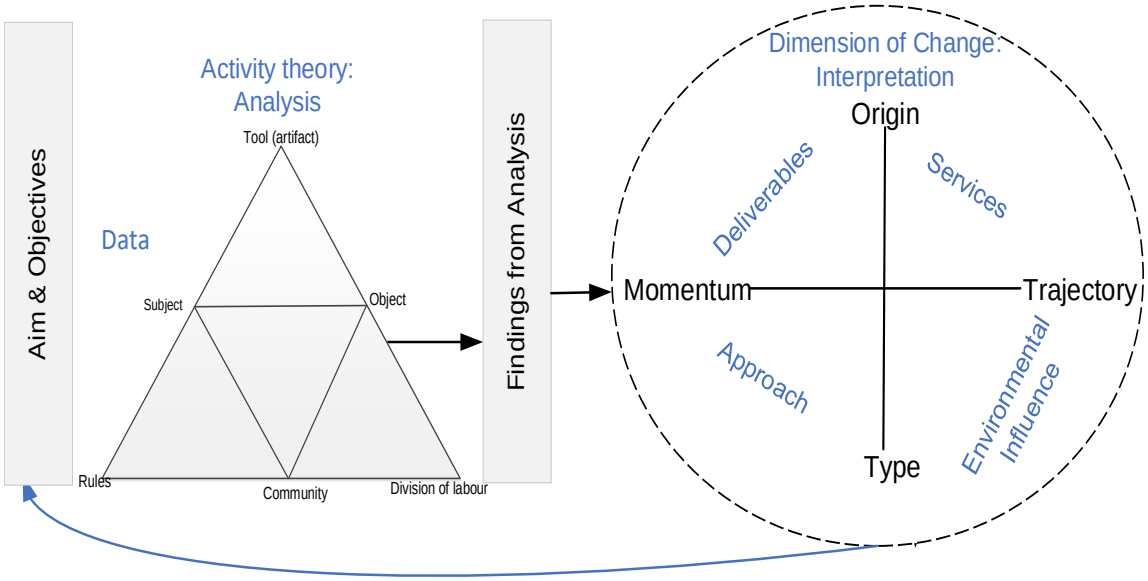

Figure 6.1: Analysis and Interpretation Process

The chapter is organised into 4 main sections. The first section is the introduction., followed by an overview of the analysis. In the third section, the analysis is presented case by case, covering two cases: Egypt and Ghana. The chapter is concluded in section 4.

6.2 Overview of analysis

As explained in Chapter 4, data were collected from two countries, Egypt and Ghana. Each of the countries is assigned a codename EP and GH respectively, and labelled as Case #1 and Case #2. The data collected are classified into three categories, Development, Implementation, and Practice, which are assigned the codenames DEV, IMP, and PRT, respectively. For each of the cases, the data (documents and pages) are assigned numbering from 01 to n^{+1}, as shown in Chapter 4. For ease of referencing, a format is formulated, consisting of case name, data classification (document) and page and line numbering. For example, EP-DEV01,1:5 means Egypt (Case #1), number 1 of EA development documents, page 1, line number 5.

6.3 Data Analysis: Activity Theory

The AT was applied through detailed steps, and as alluded to by Iyamu (2020), the steps used for analysis are by identifying and aligning data to each tenet of AT. Through this process, the different tenets of AT, tool, subject, object rules, community and division of labour were used to determine the factors that influence the value of EA within each case. Thus, the focus is on three fundamental areas: (1) the activities and events that happen in the processes of developing, implementing, and practising EA in government enterprises; (2) the roles and responsibilities of various actors in the development, implementation, and practice of EA in government enterprises; and (3) how events and actors' roles shape and influence EA within the environments of government enterprises. In the context of the analysis, deployment refers to development, implementation and practice.

6.3.1 Egypt: Case #1

As mentioned before, Egypt is presented as the first case in the study. A comprehensive description of the background of Egypt is done in Chapter 4. Using the six tenets of Activity Theory, the analysis is presented as follows:

Activity theory: Tools

In the AT, tools are referred to as mediating artefacts, meaning anything that can be used to execute an action in an activity (Nehemia-Maletzky, Iyamu & Shaanika, 2018).

Thus, tools can be technical or non-technical. Technical tools refer to software, hardware (personal computer, server), network, database, and non-technical tools include documentation, process, information and people. Each tool, from technical and non-technical perspectives, plays a vital role in the deployment of Egypt Government Enterprise Architecture (EGEA). This includes defining the EA approach, the processes involved, and the allocation of tasks. In its roles, they seek to assist in fulfilling one of the main objectives of EA, which is to promote synergy between business (government) goals and information technology (IT) solutions in an environment. It is within this context, the Egyptian government explains that *"EA relates more broadly to the practice of business optimisation"* (EP-DEV01,4: 30-31).

The deployment of EA is done using any of the different EA frameworks, as explained in Chapter 2. The deployment of the EGEA employs the concepts defined in two different frameworks. In one of the working documents, it is explained that the EGEA *"is mostly influenced by the integrated architecture framework (IAF) and the federal enterprise architecture framework (FEF)",* (EP-DEV01,3: 484-485). Based on these frameworks, the guiding principles are defined towards the deployment of the EGEA. The deployment is divided into phases, such as planning, defining and execution. Although the planning phase of the EGEA development is highlighted in a document: *"requirements document followed by a design/development plan"* (EP-DEV01,21: 897), however, the tools used are not known or clearly explained.

Other tools from technical and non-technical domains are identified. From the technical perspective, the tools include *internet connectivity, operating systems, infrastructure software, application servers and database systems"* (EP-DEV01,6: 130-154). The non-technical tools are *"strategy maps, goals, corporate policies, business processes, data models: conceptual, logical and physical as well as organisational models"* (EP-DEV01,6: 111-128). Each of these tools is critically important in the deployment of the EGEA. However, not all the tools are used or applied in all the stages of deployment (development, implementation, and practice).

Activity *theory: Subject*

In computing, tasks such as the definition, planning and implementation of an activity are always initiated and executed by humans (actors), which is referred to as subject in AT.

These tasks result from the consciousness of human actions (Karanasios, 2018), which concludes that an activity can only be undertaken by a human being or a group (organisation) of people. This means that a subject executes an activity with a clear objective and outcome. Many tasks are involved in the deployment (development, implementation, and practice) of EA within the Egyptian government environment. The focal subject defines, assigns, and manages the activities in each of the steps in the deployment of EA.

The Ministry of State for Administration (MSAD) is positioned to manage projects, such as the EGEA, on behalf of the government. The MSAD is considered strategic because it manages or governs the administration of projects from a central point. As explained in one of the government documents, MSAD "*has delegated powers from the Prime Minister and derives its budget from the Prime Minister's Office*" (EP-DEV02, 81: 3823). It is on this basis the EGEA is developed by the "*MSAD Working Group approach"* (EP-DEV01,12: 468).

Within the MSAD, there are various contributors (or stakeholders) to the development of the EGEA. The contributors are in three categories; IT units, government administrators, and politicians. The IT units include software developers, systems analysts, project leaders, an integrated product team, and an enterprise architecture team. The politicians include ministers and directors, while the government administrators are executive management and other administrative personnel. As detailed in one of the documents, the executive management is tasked with the responsibility of managing the strategic objectives of each of the government units to support the EGEA (EP-DEV01,14: 544-560). The structure of the stakeholders weighs more on the non-IT personnel. Consequently, the non-IT stakeholders hold the power to determine the direction and processes in the development of the EGEA. By implication, the organisational structure is a determinant of the output from the EGEA.

There exists a working group tasked to define, develop and implement the EGEA. One of the focuses of the working group was to choose a "*framework that is customised to the Egyptian government environment and recommend the organisational development environment"* (EP-DEV01,12: 469-479). However, there seems to be a contradictory view on what EGEA should address. The contrast manifests from the differences of opinion

about the way GEAF is implemented. According to an extract from a detailed report, "*the EGEA does not seem to be comprehensive, nor directly reflected in the MSAD work plan on administrative development* (EP-DEV02, 81: 8823-8826). Despite the power of authority bestowed on the Minister and executive management, activities and processes were confusing and challenging. The confusion can be attributed to the role of the organisational structure, which constitutes more of those who lack the expertise, to develop and implement EA.

Activity theory: Rules

Rules in AT refer to the guiding principles of an activity, as well as implicit or explicit rules that can enable or inhibit an activity. According to Engeström (1987), rules refer to the norms and processes that control the activities within a community. Rules can be any laws, regulations, or policies that govern an organisation. The deployment of the EA framework is developed and implemented with guidance from the framework chosen. This means that the development, implementation, and practice thereof are subjected to the rules of the organisation and framework.

The activities involved in the development and implementation of EA for the government were established on *"the standardised operational guidelines and Rules to follow for employing the Enterprise Architecture in a real-world environment"* (EP-DEV01,4: 23-25). To warrant the success of its deployment, EA guidelines need to be followed to ensure the successful implementation. Thus, criteria or critical success factors (CSF), as rules, were required, to guide the development and implementation of the EGEA. The CSF can be supported by the description that *"the framework will provide a rigorous taxonomy and ontology that clearly identifies what processes a business performs and detailed information about how those processes are executed"* (EP-DEV01,6: 83-85). However, this did not exist in Egypt while EGEA was being deployed (developed and implemented). Consequently, these have huge implications for the monitoring, measurement and assessment of EGEA functions and value in the environment.

One of the critical implications is that it is difficult to know whether the activities conform and how they conform to the processes defined by the framework. As a result, it is difficult or impossible to measure the value of EGEA to the government administration.

To ensure adherence to the rules of the activities, the law and control measures need to be enforced, which is governance. As explicitly stated in one of the policy documents, governance is the means "*applied in various strengths from strongly enforced policies to more subtle means such as the agreement and declaration of IT principles"* (EP-DEV01,7: 169-171).

Activity theory: Community

In AT, a community is defined as a group of actors who share similar interests towards producing an object (Karanosis, 2018). Examples of a community are a workplace, a group of IT specialists, or architects assembled to develop and implement EA. Also, there can be different communities within a Community. This helps to detail the structure and define areas of focus and specialisation within an environment. it began with the government, which is a community with a common purpose, to provide services to its citizens. Thus, the EA Community is within the IT Community, which is within the larger community, the organisation.

In addition to interest, individuals were selected to join the EA community in Egypt based on two factors, expertise and organisational structure. Expertise determines a person to be listed as a community member, because of the specialised nature of the group. The other determinant factor is that members are enlisted based on the power vested in the position that they hold. For example, the IT manager is responsible for IT-related matters; government administrators focus on activities and administrative processes of the government; and the minister is authorised to oversee government projects in the country.

Service delivery in the government is subjected to business operations that are supported by IT activities, such as the deployment of EA. As a result, there are two communities; a business community and an IT community. Business actors have a community to execute business operations independently, whilst the IT employees belong to the IT community. The IT communities support and manage technical systems used by the business communities. To ensure successful government operations, the two communities work closely to ensure that business and IT operations are aligned. This is supported by one of the main EA objectives which is *"to ensure that business strategy and IT investments are aligned"* (EP-DEV01,4: 37-39). The employees from the government ministries were also

part of various communities that manifested from the four architectural domains namely: business, application, information, and infrastructure (EP-DEV01,6: 111-153).

The different communities were not independent of each other but collaborated to ensure government services were provided efficiently through the implemented systems. Through collaboration, the various communities share information about the different activities and processes they are mandated to carry out. Thus, the role of collaboration becomes critical to avoid overlap and lack of focus. In the development of EGEA, a community of executive management is identified because this group of executives from different organisations has the same function to oversee the strategy execution of their organisations. These are the "*Ministerial Technical Offices in ministries, Board of Directors in service organisations, Board of Directors in economic organisations and the main Bureaus in governorates"* (EP-DEV01,14: 550 - 560). Each sector, ministry, or department also represents a community on its own. For example, all staff members from the different ministerial technical offices form a technical community because they share similar technical interests and activities. These communities are not independent of each other; they all form part of the bigger community, which is the government.

Activity theory: Division of Labour

Division of labour refers to the distribution of tasks and activities for execution to achieve a common objective (Nehemia-Maletzky et al*.,* 2018). The tasks and activities are defined and allocated to actors by expertise (skills) and experience.

Governments have a distributed structure, an approach to ensure that tasks are appropriately allocated to ministries and agencies in providing services to society. Certain ministries have specialised functions, such as the group (community) of finance experts, which is referred to as the Ministry of Finance. The Ministry of Finance has the function to oversee the budget and expenditure of finances in the deployment of the EGEA. As explained in one of the strategic documents, *"the function of the Ministry of Finance in the deployment of EGEA is primarily to ensure the budget is not overspent"* (EP-DEV01,13: 553-554).

At the time of this study, MSAD was the central ministry that set the framework for administrative development in the country using ICT solutions (EP-DEV02,52: 2132-

2134). ICT solutions such as email, extranet, and electronic data interchange were used to enable and support various activities, events, and processes. Primarily, this was to transform government administration towards service delivery, as stipulated in the "*2010-2012 Administrative Reform Work Plan" (*EP-DEV02,52: 2132-2134). The *Reform Work Plan* was inclusive of the EGEAF. This is indicative of the power bestowed on MSAD's task to execute EGEAF on behalf of the government. The MSAD *derives its budget directly from the Prime Minister's Office, which confirms its autonomous power* (EP-DEV02, 81: 3823).

The executive management of each government administration was entrusted with the task to oversee the strategic vision of their respective jurisdictions, to ensure responsibility and accountability in the development and implementation of EGEAF. This includes the formulation of requirements and the selection and deployment of ICT solutions for enabling and supporting the various strategic directions in the country. Thus, the requirements cover both technical and non-technical functions. As a result, the formulation or gathering of the requirements was supposed to be inclusive of ICT specialists and non-ICT specialists. This was not always the case. This could be attributed to the domineering MSAD, which results from the power bestowed on it to "*perform leadership, deployment, and execution of functions"* (EP-DEV01,14: 568 - 569)

The development and implementation of EA can be complex, as was in Egypt, with the deployment of the EGEA. Hence, it is critical to employ services and specialised skills such as EA's domain experts and project managers. The identification of skills is defined and based on requirements of the EGEAF to effect successful development and implementation. The domain experts and project managers are *assisted by systems analysts to build the Enterprise Modelling, which forms an integral part of* EGEAF (EP-DEV01,21: 895-896). The primary goal was to *"implement the EGEAF, which provides a framework to guide ministries' strategy and operations* (EP-DEV01,19: 843-845).

Activity theory: Object

In AT, an object refers to the aim and rationale for undertaking an activity (Spinuzzi, 2011). Thus, an object can be anything tangible (such as staff members) or intangible (e.g., knowledge), technical (e.g., computer system and EA) or non-technical (such as processes and governance), which is problematised and justified, to provide a solution.

The government of Egypt invested in ICT to reform its public service delivery to its stakeholders; "*however, it struggles to improve performance and services in critical and essential areas, such as telecommunications infrastructure, human capital, and implementation capacity (*EP-DEV02,15: 472-474). These were challenges that justified the government's action to identify EGEAF as an object. As explained in the policy document, an EGEAF was selected and customised to respond rapidly to changing needs and improve the efficiency and effectiveness of service delivery (EP-DEV01,12: 477).

The EGEAF as an object was aimed at enabling and supporting the activities and functions of the different organisational structures of the government, which consists of about 32 units (EP-DEV02,46: 1866-1864). Another factor that made the EGEAF very critical was that each unit had its distinctive deliverables in *the areas of Business, Processes, Technology and People Objectives* (EP-DEV01,4: 15-16). Each of these areas had its requisites which necessitate unique requirements to fortify their technical and non-technical functions. An understanding of these elements, in which the EGEAF is aligned with organisational structures, deliverables of units, and individual requirements makes the process holistic steps. Through these steps, the EGEAF as an object can be achieved.

Each business unit of the government's administration was subjected to scrutiny and assessment, for optimisation and improvement of efficiency and effectiveness purposes. This includes *enterprise management, financial management, and business processes* (EP-DEV01,15: 609-610). The assessment required mechanisms such as the measure of critical success factors to determine levels of effectiveness and return on investment. In practice, the processes and mechanisms must be documented. Documented processes serve as 'living artefacts', on which the enforcement of adherence and compliance are based.

Additionally, each government's administrative unit represents a specific business function, supported by corresponding ICT solutions (systems and technologies). As of the time of this study, the objective of the EGEAF did not dictate the ICT solutions to be deployed in each government unit. As clearly stated in the policy document, *"no particular ICT solution is recommended to governmental units. Also, there was no one-size-fits-all solution"* (EP-DEV01,18: 782-783). However, since the preservation of data was critical, each organisational structure and unit was expected to have an ICT system that

is *a Data Warehouse (DW). This is to enable and ensure that data from 24 hours to 2 years old*" is saved and can be restored or retrieved for business use (EP-DEV01,18: 785-786).

6.3.2 Ghana: Case #2

Activity theory: Tools

The deployment (development, implementation and practice) of EA is achieved using different tools and approaches such as framework. Also, the tools and approaches entail several steps or stages, such as vision, gathering of requirements, and identification and training of personnel. Through the different stages, planning is regarded as one of the most critical stages that can ensure the success or failure of activities in the development, implementation and practice of EA. Within an activity, Tools are considered the mediating artefacts that provide a link between the actors (subject) and the end goal (object). From AT perspective, tools can be anything, such as documents, signs, or physical elements. Thus, in the deployment of the Ghana Government Enterprise Architecture (GGEA), tools were essentially critical.

The government of Ghana initiated the EA process that was based on documents. The documents were based on a readiness assessment conducted in its environment. The readiness assessment focused on *"gaining an understanding of the business of Government, enabling technologies and their maturity levels"* (GH-DEV05,5: 187-188). The purpose of these documents was to "*provide a consolidated understanding of the business processes and systems that were currently in use at the various ministries, departments, and agencies" (MDA)* (GH-DEV05,6: 344-346). Documents contain the outcome from the planning stages, which were used as tools to guide how EA can be developed, implemented, and practised. In addition, the documents were referred to as Architecture Reference Models, which are "*designed to facilitate cross-MDA implementation of technology services through the use of common vocabulary, standards, reusable application components and a shared infrastructure*" (GH-DEV05,18: 570-572).

However, the documents were developed based on the subjective reasoning of a group of individuals' knowledge. This means that there was no framework employed to guide the development of the government's EA. Currently, there exist many EA frameworks, which include the Gartner, Forrester, and Zachman frameworks (Iyamu, 2018; Bui, 2017;

Lapalme et al., 2016). The existence of numerous EA frameworks makes selection crucial, to ensure suitability within context and relevance. Thus, it is important to have a tool (criteria) defined by requirements for selecting the most suitable framework for organisational purposes. Documents as a tool can be referenced or used to influence or alter EA deployment activities, from both technology and business perspectives.

Tools can be classified to be tangible or intangible, with each being equally important for the development and implementation of EA. Tangible tools such as technologies, which include *"infrastructure and application systems*", were identified as one of the primary focuses of the GGEA, for the transformation of vision purposes (GH-DEV05,6: 223-224). The transformation initiative is based on the premise of using tools such as the internet and other technologies for the modernisation of services (GH-DEV05,8: 300-302). The intangible tools include processes that were required for the attainment of the future state of Ghana's administration. This is critical because "*MDAs are constantly obliged to improve their business processes"* (GH-DEV05,9: 335), to advance effectiveness and efficiency in improving service delivery.

Activity theory: Subject

A subject is defined as a human being, or humans grouped for a specific task in an environment such as an organisation. Also, a subject is referred to as an actor. In an environment, a subject initiates an activity with a purpose. Usually, a subject is not stagnant, but is always active and evolves to invent or produce outcomes within context (McMichael, 1999). A group of individuals within the Government of Ghana initiated EA to enable transformation by the government using technology. The aim for deploying "*an Enterprise Architecture framework is to enable better technological decision-making, more effective prioritisation and superior program management*" (GH-DEV05,5: 159-161).

The government consists of several ministries, each with a specific mandate and deliverables. The development of the GGEA is shared by the Ghana ICT Directorate (GICTeD) and the Ministry of Communication (MoC). The MoC was mandated to develop the EA programs. The GICTeD was responsible for in-scoping GGEA for the *ministries, departments, and agencies (MDA),* based on which requirements were gathered and development undertaken. Thus, requirements were gathered from the various ministries, departments, and units of the government. The implementation plan of the GGEA was

designed "*to define the concrete steps to be taken by the Government of Ghana (GoG) through GICTeD to implement the recommendations provided in the GGEA report* "(GH-IMP01,4: 5-6).

This means that the activities of GGEA were centralised. Thus, actors within the MoC were tasked with the responsibility and accountability in the GCEA programme development. The *"MoC was supported by the other ministries, departments, and agencies (MDAs) of the government*" (GH-DEV05,5: 191). Subsequently, MDA personnel were assigned tasks in the GCEA deployment. These tasks were defined in the implementation report with "*concrete steps to be taken by the Government of Ghana (GoG) through GICTeD to implement the recommendations provided in GGEA report"* (GH-IMP01,4: 5-6). However, the lack of an EA framework to guide the implementation is making this plan ineffective. This means that the formal approach or framework that guided the process is not effective. This has negative implications in measuring deliverables because certain tasks might have been allocated to people that were not the most appropriate.

EA is a very specialised discipline and, therefore, requires highly skilled personnel. In Ghana, the objective includes "*building a comprehensive business-driven blueprint for the entire Government*" (GH-DEV05,6: 193-194). EA is a blueprint that defines the current state in relation to the desired state that covers *infrastructures, utilities, systems, and processes to enable and support the administration and service delivery of the government* (GH-DEV05,6: 215-217). Despite EA's wide coverage that includes information and business design and management, the GGEA focuses on operational ICT solutions. Primarily, this could be attributed to two factors, lack of know-how and not applying an existing EA framework to guide its deployment. Hazen et al. (2014) argue that training and know-how enhance the use of EA and mediate actors' relationship with the performance of EA in an environment.

The roles of the GICTeD and MoC including the MDA were distinctive in the implementation of the GGEA. Thus, employees (actors) were heavily relied upon to execute tasks and avoid duplication or overlap. This makes skillsets important in allocating tasks based on the in-scope. Thus, it is crucial to employ the organisational structure that streamlines the activities of individuals and groups from GICTeD, MoC and MDA perspectives.

Activity theory: Rules

Rules enact governance which are used to regulate activities (Baguma, 2019). Thus, the enforcement of rules influences the success or failure of an activity. There was no governance *to support and oversee the formulation, valuation, and implementation of ICT projects* (GH-DEV05,5: 183-184). Primarily, this was a motivating factor for the development of GGEA. Consistency and standardisation can be achieved through rules, which enable and guide the management of ICT projects.

Formal rules are referred to as explicit and those that are informal as implicit rules (ref). Explicit rules are obligatory. The implicit rules are continually applied, and they become norms, accepted, and propagated in the organisation. Subsequently, both implicit and explicit sets of rules manifest and become organisational culture. As part of the efforts to ensure the success of EA implementation, a "*cultural change in which decisions for ICT investments will be driven by business imperatives, and the GGEA that defines the architecture principles, reference models and standards*" is expected (GH-DEV05,5: 172-174). The government of Ghana (GoG) recognises the impact which organisational culture can have on the GGEA. Hence, it was important to manage the culture and its perceived outcome.

EA is about governance, and it entails guidelines that need to be followed to create synergies between business goals and ICT solutions. A *Governance Model was necessary because it guides the decisions in each activity of the architecture, which includes ICT priorities and project formulation* (GH-DEV05,8: 293-295). Also, a governance model is required to ensure consistency in the management and formulation of policies to guide the use of ICT solutions, in advancing *service delivery to citizens* (GH-DEV05,12: 429-431). Therefore, the policies are an integral part of the EA, which ensures that rules are adhered to. Thus, the MDA is the custodian of Governance through which compliance with GGEA is measured (GH-DEV05,9: 329-334).

Activity theory: Community

In this context, the community comprises different individuals who share the same objective and a common goal (Hu, Nisbet, & Chang, 2022). A community can further be described as a group of individuals who have aligned interests to deliver a specific service

or task. In the development and implementation of the GGEA, different communities were involved. The communities were both internal (to the government) and external. Some of the internal communities included MDA, MoC, GICTeD and ICT specialists. Some of the external communities included ICT vendors who provided services and supplied ICT solutions to the government. Although the focuses of the communities were different, there was a common goal, which was to contribute to the development and implementation of the GGEA.

In this context, the government is viewed as a community which consists of individuals, to deliver EA (GGEA). Also, within the boundaries of the ministries of the government, problems can be defined, various tools can be used, several rules can be set, and solutions can be achieved. The government of Ghana (GoG) have sub-communities that consist of "*over 150 MDAs*" (GH-DEV05,8: 308). The sub-communities are established to "*implement specific services defined in its mandate to citizens and businesses*" (GH-DEV05,10: 376-377). Each sub-community has its own rules and mediating tools that are backed by its mandate to deliver specific services to other communities.

Also, citizens form a community to receive common *services delivered* by the MDAs (GH-DEV05,11: 407-408). There are 'pockets' of services that are enabled by ICT solutions and delivered to the citizens (GH-DEV05,19: 629-631). In delivering the services using ICT solutions, the GoG have a community of technical (ICT) experts that execute the tasks, a "*technology-driven transformation"* of the way MDAs operate (GH-DEV05,5: 157-158).

Business units of the government are a community that provides "*the business function of the GoG*" (GH-DEV05,20: 677-678), which is further defined as the purpose of government operations and services. It is upon this premise, of the business function, that ICT is used as the mechanism for the GoG to achieve operational efficiency. This is expedited by the ICT team, which is another community consisting of ICT experts responsible for the planning, installation, and support of ICT systems in the government. Moreover, the government relies on different stakeholders to support its objectives, such as the "*13 ISPs currently providing Internet and WAN services to the MDAs* "(GH-DEV05,17: 551). The Internet service provider (ISP) forms part of a community of third-party suppliers of ICT services. Such suppliers provide specialised services that the government cannot provide

themselves. The different communities are interdependent, each having activities defined by its mandate for a common goal.

Activity theory: Division of Labour

An activity consists of several tasks, which are executed by the expertise and inputs of different individuals or groups. The allocation of the tasks is referred to as the division of labour in AT. Hu, Nisbet and Chang (2022) define division of labour as the way tasks are horizontally arranged whilst the vertical division represents the power and status that are associated with the allocation. Division of labour is based on skills, and/or negotiations or preference. The GoG divides EA development and implementation activities among its structures for better management and control. The Ghana ICT Directorate (GICTeD) is responsible for the "*in-scoping of the EA, which defines the various tasks for the MDAs"* (GH-DEV05,8: 188-189).

The development of the GGEA is also shared by the Ministry of Communication, which together with the support of the MDAs is responsible for the development of the EA programme, which builds a comprehensive business-driven blueprint for the entire Government (GH-DEV05,5,6: 191-194). However, each MDA is tasked with the development of its own implementation strategy. This is because each MDA has its own unique culture, challenges and ICT systems, making it imperative that each MDA has the mandate to develop and execute its own strategy. In addition, each MDA has established a Working Group to ensure the adoption of the GGEA (GH-DEV05,20: 599-600).

Activity theory: Object

An object is the point of interest that motivates an activity to happen. According to Hu, Nisbet and Chang (2022), the object is defined as the problem space at which an activity is directed. The object can be tangible or intangible, and the purpose of the activity is to transform it towards an outcome that will achieve the goal of the activity. In the context of GoG, the outcome is the GGEA, which this study examines. The GGEA is intangible; however, the associated documentations are tangible. The GGEA was initiated, purposely for the standard deployment of ICT solutions, to advance service delivery in the country.

Global technological advancement and trends have exposed citizens to a point of expecting better services. Consequently, "*more citizens are realising the benefits of ease*

of access to information and services by Government" (GH-DEV05,8: 302-303). However, this has been a challenge for the GoG to deliver improved services due to factors such as "*the lack of interoperability and the absence of robust information-sharing between government's Departments and Agencies, which have led to very disparate systems"* (GH-DEV05,12: 436-438). Hence, the *MDAs are constantly compelled to improve their business processes to fulfil obligations to citizens' service delivery expectations* (GH-DEV05,9: 335-336). This increases the need to ensure a successful implementation of the GGEA.

In resolving the problem that could hinder the object (GGEA), the *government requires a technology-driven transformation to advance how the MDAs operate* (GH-DEV05,5: 157-158). However, there is confusion, in that transformation is understood differently by various actors and groups. Some uphold that transformation should not be technology-driven but business driven. This view is based on the credence that technology is an enabler that is established on the premise of citizens' needs and demands. The confusion creates a gap that has the potential to derail an outcome. The confusion or gap exists because of the lack of an EA framework. According to Iyamu (2018), fundamentally, EA frameworks are a holistic approach for coordinating deliverables and mapping IT solutions with the goals and objectives of an organisation.

EA was most appropriate to address some of the hindering challenges and create a successful outcome. The deployment of EA *facilitates the enhancement of collaboration between MDAs, the government, and citizens* (GH-DEV05,5: 161-162). In addition, the deployment of EA reflects the *change in applying know-how (skillsets), the design of business processes, the effectiveness of organisational structure, and the enactment of governance in advancing service delivery* (GH-DEV05,8: 303-305). *Thus, the GGEA is considered a transformation initiative in the Ghanaian environment, and its implementation is aimed at enabling the modernisation of the MDAs, which focuses on improving services to the citizens* (GH-DEV05,8: 300)

6.4 Summary

The data collected from the two case studies, the government of Egypt and the government of Ghana, was analysed in this chapter. The analysis is guided by socio-technical theory, Activity Theory (AT). The use of the different tenets of AT revealed the

factors that influence the development, implementation, and practice of EA in the governments, respectively.

CHAPTER 7:
THE ENTERPRISE ARCHITECTURE METRICS MODEL

7.1 Introductions

This chapter presents the findings from the data analysis conducted, which was presented in Chapter 6. As explained in the chapter, the findings from both cases were presented separately and later combined for interpretation. This chapter focuses on the interpretation of the findings, by using a subjective approach and guided by the dimension of change of the structuration theory. The interpretation aimed to identify the factors that influence enterprise architecture within the government environment. From the interpretation, an enterprise architecture metrics model (EAMM) based on empirical evidence is developed, which can be used to measure the value and benefits of EA within government institutions.

The chapter is structured into four main sections. The first section presents and discusses the findings from the data analysis presented in the previous chapter, 6. The second section discusses the interpretation of the findings. The third section presents and discusses the metrics model, and the last section summarises the chapter.

7.2 Interpretation of the Findings from Data Analysis

In transforming an environment or using EA as an episode to transform an organisation, there are some fundamental factors. Empirically, the factors have been revealed from the analysis of the data from the two cases, the government of Egypt and the government of Ghana using AT, as presented in Chapter 6. As shown in Figure 7.1, 5 factors were revealed by the governments of Egypt and Ghana, respectively. The factors are baseline components for measuring the usefulness, contribution, and value of EA to an organisation. However, the factors do not operate in a vacuum; rather, they are influenced or are a manifestation of actions for social change. From the structuration theory perspective, social refers to a legal institution that operates routinised practices by agents, within time and space (Iyamu, 2021). A social institution only exists because humans constantly perform activities within it (Giddens, 1984).

From different angles, the factors are found to critically influence the deployment and practice of EA. The findings from the first case, the government of Egypt, are as follows: (1) *IT Governance;* (2) *Critical success factors;* (3) *Organisational structure;* (4)

Framework selection; (5) *Enterprise Requirements.* In the second case, the government of Ghana, the influencing factors are *(1) Readiness assessment*; (2) *Selection criteria*; (3) *Organisational Requirements*; (4) *Governance*, and (5) Return on investments.

Data from the two cases were gathered and analysed separately. However, to ensure consistency and uniformity, the same set of objectives guided the data collected. Also, the same technique was applied in the data analysis. The data collection and analysis are discussed in detail in Chapter 3. The findings from the two cases are different, with some corroborations between them. To avoid duplication, and disparity, and ensure cohesion, towards achieving the aim of the study, the findings from both cases are mapped, as shown in Figure 7.1. Irani et al. (2014) explain how mapping in IS studies is used to visualise the aspects of knowledge that are relevant to the phenomenon.

The mapping followed a two-step approach: First, to consolidate the findings from the two cases. Caiza et al. (2019) argue that mapping is used to identify reusable factors or elements in information systems. Second, to bridge the existing gap. Mapping helps to identify existing gaps (Franco, Hirama & Carvalho, 2018), as in the two cases used in this study. As shown in Figure 7.1, similar or related factors were mapped against each other. The remainder was added to bridge the gap from each case's perspective.

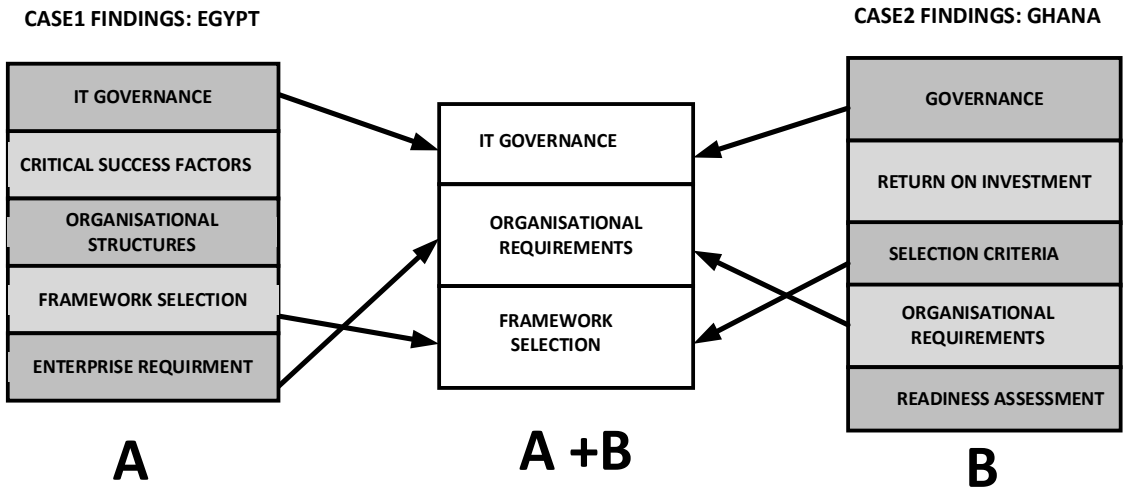

Figure 7.1: Mapping the factors of the two cases

For better clarity purposes, Figure 7.1 is divided into three phases, A, B, and A+B, meaning that in the process of mapping, A and B were first listed, sequentially. From the mapping, seven factors were collated as the main influence in the deployment and practice in government environments. This means that three of the factors have similar meanings. The factors are IT *governance, organisational requirements, and selection of framework,* which are tagged A+B in Figure 7.1. The other factors are A: critical success factors, and organisational structure; and B: return on investment and readiness assessment. The seven factors are interpreted using the dimension of the social change model, discussed in Chapter 3. The interpretation is to ascertain the criticality and how the factors influence the deployment and practice of enterprise architecture in governments of countries on the African continent. The interpretation leads to the development of a government enterprise architecture metrics model.

To gain a deeper understanding of the factors, which include how they manifest or influence, interpretation is conducted. The dimension of social change from the perspective of structuration guides the interpretation, as shown in Figure 7.2. How the dimension of social change relates to this study is discussed in Chapter 3. Additionally, how analysis and interpretation connect using Activity theory and the dimension of social change, respectively, is diagrammatically shown in Chapter 6, Figure 6.1.

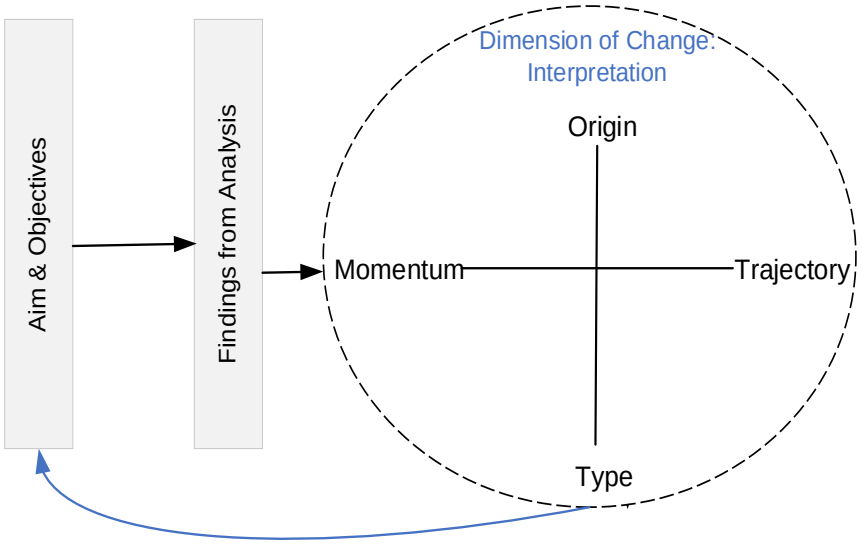

Figure 7.2: Interpretation of findings (adapted from Dimension of social change, 1984)

An understanding from Giddens' (1984) positioning of social change is that: (1) Origins: the time-space distantiation of the social systems is critical, to intertwine the different modes that are involved in a developmental process; (2) Type: indicates extensity and intensity of change within an environment. An intensity or extensity can disrupt or reshape an existing alignment of an institution. This means that a process or activity can be enabled or constrained, which determines the type of outcome that is reached; (3) Momentum: is about the rapidity with which change happens, in relation to an activity. Also, the duration at which the enablement or constraint occur is deterministic to the outcome of the events, in the deployment or practice of EA in an environment; and (4) Trajectory: is concerned with the direction in which change occurs in an institution. The direction can be determined by the power in the relationship between the focal agents.

7.2.1 Information Technology Governance

Governance refers to the institutionalisation of decision-making, by establishing policies, standards, and guidelines in an organisation. Johns (2021) defines governance as the establishment of processes and regulations within an organisation. This is implored in the manner and structure in which decisions are made, directives are established, and activities are executed, to fortify the deployment and practice of EA within a government environment. Thus, IT governance is applied in organisations to maintain consistency and uniformity of IT solutions and operations (Borja et al., 2018).

The relevance and usefulness of IT governance have long been identified in both practice and academia. The longevity of IT governance relevance and usefulness depends on the trajectory, which is important to have a cohesive direction when deploying EA. According to Sambamurthy and Zmud (1999), IT governance is the structure of authority for strategic IT activities. Fundamentally, this makes the origin of IT governance critical in the deployment of EA. From implementation and practice perspectives, Miyamoto (2021) emphasised that IT governance is the strong rule that enforces control over the deployment of infrastructure, use of IT solutions, and key activities of IT and business domains of an organisation.

Thus, IT governance is critical if the deployment and practice of EA are to be successful in an organisation. However, the success of EA deployment is influenced by time and space. According to Del-Shamarran (2022), the time and space distantiation of Giddens follows a trajectory known to the community (refers to EA specialist in this study). Additionally, some of the factors why IT governance is associated with many benefits, include the meticulous structure of decision-making and operations, which enhances the alignment between IT and the business (Wiedenhöft, Luciano & Pereira, 2020). As revealed in the analysis, structure and alignment are essential to the deployment and practice of EA within government environments.

7.2.2 Organisational requirements

Organisations consist of different business and IT units, each having a specific mandate that contributes to the mission and vision of the organisation, which are transformative in nature. Thus, for the deployment and practice of EA to support and enable an organisation (government environment), it must be based on requirements that can transform the current into the future. This means the transformation must be of a specific type, which Giddens (1984) describes as indicative of how extensive and intensive the change occurs. Zondani and Iyamu (2021) asserted that effective business solutions and initiatives are established on the premise of organisational requirements.

However, these organisational requirements are not always constant, as they are influenced by internal and external factors, which make them critical factors in the deployment or practice of EA. Also, the requirements consist of the needs and objectives of the IT (technical) and business (non-technical) units. The technical covers technology solutions, including database, software and hardware. While the non-technical consists of business logic, information management, and process (Iyamu, 2022). The technical and non-technical requirements define the type of change that drives the dimension of social change. It is based on the organisational needs and requirements that EA is implemented across an organisation (or environment). The demand for better services and the introduction of technology to drive innovation and provide effective and efficient services are influenced by the type of change, which shapes and reshapes events.

The requirements are therefore considered enterprise-wide (organisational) because it covers all spheres of an environment, as supported by the domains of EA. It is on the premise and perspective of this wide coverage that the non-technical requirements are considered the building block of the technical requirements in an organisation. The technical requirements are the IS/IT-related systems used to support organisations to achieve their business goals (Meriyem, Adil & Hicham, 2015). Inadvertently, organisations rely on these IS/IT platforms that are deployed to support the organisational requirements (Tamm, Seddon, & Shanks, 2022). However, this reliance established a requirement for organisations to have a holistic view of their business and technical requirements, with the advent of the deployment of EA to align business requirements with the IS/IT deployed in the organisation (Iyamu, 2015). Consequently, there are different EA frameworks established to cater for various organisational requirements (Bakar et al., 2019).

7.2.3 Critical success factors

Critical success factors (CSFs) are factors that can impact the success of a project or programme. Trad (2019) defines CSFs as a group of key performance indicators (KPIs) that are associated with a feature or a project. Trad further explains that the KPIs of the CSF are enumerations that are quantifiable and mapped to a weighting score. CSFs are identified elements that are necessary for the positive or beneficiary outcome of a project. This does not happen in a vacuum; it is influenced by or depends on human action in their deterministic trajectory (Del-Shamarran, 2022). CSFs are important, primarily because they are used to identify factors of value and risks, which helps group factors into categories of essentiality, necessity, and perils. These factors need to be identified, monitored, and measured to ensure the success of a project or activity, such as the deployment or practice of EA.

CSFs and KPIs are established and defined in such a way that the set targets are achieved, ultimately determining the direction of change, from current to future activities within the government institutions. Importantly, CSFs can be employed at different stages of a project or activity. Also, CSFs enforce the quality and sustainability of a process, iteratively. EA is both a project and process, which makes CSF crucial in its lifetime in an environment (Iyamu, 2022). The stages or activities that make EA a project include planning, development, and implementation. Often, the CSFs consist of unknown and widely known factors that need to be given priority to ensure that the success of a project

is not compromised or put at risk. However, CSFs need to be identified to suit the need of the organisation, which is usually a tedious task.

7.2.4 Return on investment

Organisations invest resources in IT solutions purposely to gain positive returns. Lal *et al.* (2020) define return on investment (ROI) as the link between the investment made and the profit derived from that investment, which is used as a reference point. The deployment or practice of EA requires investment from both technical (e.g., software and hardware) and non-technical (such as process and skill set) perspectives. The ROI can be tangible or intangible. There is a challenge in assessing, qualifying and quantifying the tangibility of investment against returns in the deployment and practice of EA.

The tangible ROI can be the financial gains that can be quantified easily; however, this is not the case for intangible ROI. Intangible ROI can be regarded as system reliability or customer satisfaction (Ahmad *et al.*, 2022), which does not seem to have been clarified, specifically, in the deployment and practice of EA. Kaske, Kugler and Smolnik (2012) opined that there is a challenge with the metrics used to quantify intangible ROI that are nonfinancial. The ROI has been identified as one of the main benefits that can be derived from the deployment of EA in an organisation (Iyamu, 2015). Also, the process of quantifying the value derived from EA deployment has been challenging for many government institutions, as revealed in the data analyses. Quantification of EA value depends on how it is employed, which makes a change to generate momentum (speed) of events, processes, and activities from both IT and business units in an institutional transformation.

7.2.5 Readiness assessment

The deployment of any system or process encompasses both technical and non-technical contributions, which creates a solid foundation and holistic view of the solution. It is thus imperative that an assessment is conducted on the readiness of critical solutions in an environment. Readiness is an organisation's preparedness to adapt to change (Hussein et al., 2019), and the readiness assessment is the systematic examination to determine an organisation's ability to cope and sustain the planned change, with the main objective to identify the strengths, weaknesses, opportunities, and potential challenges (Pirola, Cimini & Pinto, 2019). Therefore, it is fundamental to conduct an assessment of the

readiness of EA in any government environment, as revealed in the cases used in this study.

The extent and context of the readiness assessment can reveal the complexity of the transformation the government institution has to do. This, in turn, can give an insight into the projection of the time and space required to effect change in the deployment of EA. Dimension of change refers to time and space as momentum, which is the speed of events and activities (Iyamu, 2021). The rate at which change can happen provides an insight into what can be undertaken and how rapidly EA can be deployed in government-wide institutions. Hence, the readiness assessment determines the outcome and practice of EA.

Assessment of readiness from both technical and non-technical perspectives is required to ensure the successful deployment and practice of EA in government environments. This helps to identify and manage risks at various levels of the processes in the deployment or practice of EA. Therefore, readiness assessments must be conducted before implementing EA, to gain a deeper understanding of the environment-associated resources and domains' strengths and weaknesses. Inadvertently, documentation is one of the bases used for readiness assessment, including technical drawings, scope requirements, resources, and processes.

7.2.6 Organisational structure

The organisational structure plays a critical role in the deployment of information systems, which are composed of human resources with specific skills and expertise to support business operations. Zondani and Iyamu (2021) defined organisational structure as the hierarchical structure of employees in an organisation. The organisational structure illustrates employees' roles and responsibilities as well as the flow and channel of information in an organisation, which is crucial in the deployment and practice of EA. The development and implementation of an organisational solution such as EA are carried out within the structure of roles and responsibilities, which are defined according to the employees' skill sets.

The importance of the roles and responsibilities in the deployment and practice of EA propel power relationship between the employees. Sekgweleo and Iyamu (2022) explain

how power is inherent in different positions and used to diffuse activities and processes of IT solutions. In Structuration Theory, power is viewed as the ability to make a difference (Giddens, 1984). Along the same line of argument, Iyamu (2015) postulates that the role and responsibility of an employee in an organisational structure are associated with the power to make a change. Therefore, employees can use their power to enable or constrain the development and implementation of EA, which makes organisational structure critical. Humans are agents of change as they have the power to enable or constrain the changes that are introduced by the deployment of EA. In relation to the dimension of social change, the organisational structure is a type, which has both the extensity and intensity to propel change in the organisation (Giddens, 1984). It is through the organisational structure that the government institution can be reshaped to establish EA.

7.2.7 Selection of EA Framework

There are many EA frameworks, such as the Gartner Inc., Federal Enterprise Architecture (FEA), The Open Group Architecture Framework (TOGAF), and Zachman Framework (Iyamu, 2022). The frameworks are used to develop and implement EA in an organisation. A framework represents a blueprint of the various objects and their interconnection. According to Cameron (2015), the framework is used to define components such as modality, concept, and principles in deploying EA in an organisation. Some of the frameworks are designed for specific purposes, and others are generic and must be customised to fit an organisation. Thus, each framework has strengths and weaknesses that need to be understood before its selection. However, selecting a framework is not easy due to the uniqueness of each organisation. As a result, there is a need for selection criteria to guide and inform the selection of a framework for the deployment and practice of EA.

In the dimension of social change, type is a mechanism of intensity for change in the environment. Thus, the choice of an EA framework should provide the intensity of change for the transformation of IT and business activities of an institution. Also, the EA framework must have the capacity to reshape the operations and alignment of the government institutions to its vision. Tungela et al. (2018) explain how origin and trajectory help to ferment alignment between units and subjects, which is also critical to EA deployment.

Thus, due to the existence of many frameworks, it is necessary and crucial for organisations to develop selection criteria. The selection criteria enable an organisation to set business and technology boundaries, associate value, consider the return on investment and strategic alignment in selecting a framework. Thus, the selection criteria ensure the appropriateness of the framework to guide the deployment and practice of EA. Therefore, the criteria should consist of both technical and non-technical factors that are critical for the successful deployment and practice of EA in an organisation. Deploying EA without a framework can be challenging as the benefits of EA might not be realised due to the development and implementation of EA not being guided properly. The development of EA is critical and if not guided properly, the whole process is deemed to fail.

7.3 The Enterprise Architecture Metrics Model

As discussed in chapters 3 and 4, data were collected from the two cases, Egypt and Ghana. The data were analysed, interpreted, and presented in Chapter 6. The findings from the analysis are interpreted and presented above. The interpretation affirms the factors revealed by the study, to develop an EA metrics model. The factors are as follows: *IT governance, organisational structure, readiness assessment, organisational requirement, return on investment, critical success factors and EA framework selection.* The interpretation review confirmed that these factors are of strong influence in government environments, therefore can be used as the main measurement criterion for measuring EA. This study does not suggest that these are the only factors for measuring the value of EA. However, there are two fundamental strong points: in the context of this study, these factors are the most appropriate, from strength and relevance perspectives; and the empirical nature of the study allows the factors to be generalised towards developing a model.

As shown in Figure 7.3, the Metrics Model provides a visual representation of influencing factors in the deployment and practice of EA to determine usefulness and value. Thus, the factors are the parameters for measuring EA in an organisation's context and relevance. From the interpretation, an enterprise architecture metrics model (EAMM) is developed to measure the value and benefits of EA within government institutions. The EAMM is made up of three phases of inter-relationships and interconnectedness between the different factors.

Enterprise Architecture Metrics Model

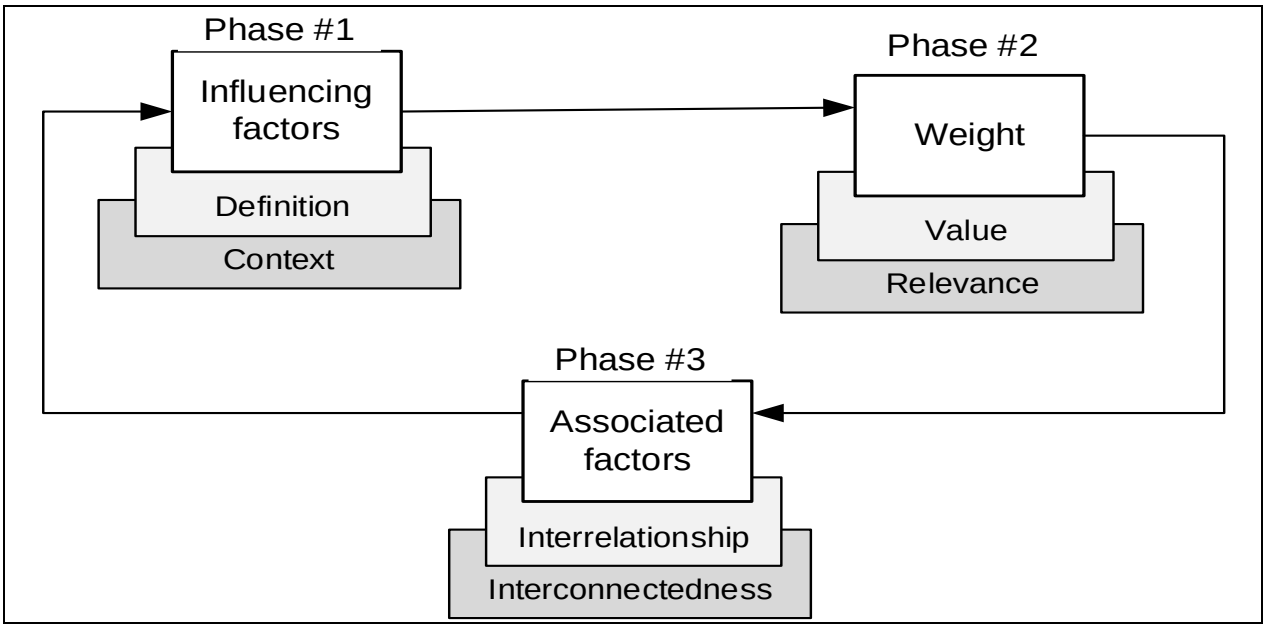

Figure 7.3: Enterprise Architecture Metrics Model (EAMM)

Phase #1: at this phase of the EAMM, the factors that influence the measurement of EA in government environments are defined within context. The influencing factors are interconnected with value and relevance that determine the weight of each factor. This process is conducted in the second phase (phase #2) of applying the EAMM, as shown in Figure 7.3. The influencing factors are mapped against the weighting criterion, in the third and final phase of phase #3, of applying the EAMM in an organisation. Phase #3 represents the associated factors that make up the EAMM. The three phases are each explained in detail, in the remainder of this section.

7.3.1 Phase #1: Influencing Factors

Phase #1 of the model (EAMM) consists of the factors that influence the value factors which are the findings derived from the analysis and interpretation as discussed in section 7.2. These factors are critical for the EAMM as it is the core building block of the EAMM. The influencing factors are summarised in Table 7.1 below which is expanded further by interrogating each factor with the prefix of what, who, why, how, and when, to better enhance the understanding of what the factors represent.

The definition and representation of the prefixes are explained as follows:

i) What: it provides a brief definition of the factors that influence EA in the deployment and practice of EA in an environment.
ii) Who: defines the accountability of actors' role in the deployment and practice of EA in an environment.
iii) Why: explains the motivation and objective of why these factors are necessary, useful, or valuable in the deployment and practice of EA in an environment.
iv) How: explains the modality or the process of the factors that can be executed for the deployment and practice of EA.
v) Where: defines and specifies the area (unit) within the organisation that is most appropriate for each of the factors, to exalt value, relevance, and usefulness.
vi) When: is periodical; it refers to the time frame in which a factor (or factors) is most appropriate in the deployment and practice of EA in an organisation.

In Table 7.1, the content of each cell is briefly defined. The definition is based on the contexts of the cases (Ghana and Egypt governments' environment) used in this study. This means that the factors can be redefined or amended in the context of a different organisation that attempts to employ the metrics.

Table 7.1: EA Influencing Factors

Factor	What	Who	How	Why	When	Where
IT Governance	The institutionalisation of decision-making for IS/IT in the organisation	Accounting officers, Executive Directors and Directors of different Ministries	By establishing the EA framework, supported by policies, guidelines and standards for the deployment and use of IS/IT in the organisation.	To standardise the planning, development, and use of IS/IT, that is aligned with the business needs of the organisation	A permanent EA framework that supports the IT/Business initiatives in the organisation	All ministries and government agencies
Organisational Requirement	Technical and non-technical requirements of a business to fulfil its organisational mandate and vision	Accounting and executive officers who are mandated to oversee the strategy execution of the organisation	EA to guide the definition and development of the business and technical requirements	Requirements needed for the transformation of the organisation from current to future state. Organisational needs to stay relevant in order to support the strategy of organisation in	After the periodic establishment of a new strategy, that is influenced by internal or external factors	All ministries and government agencies

Factor	What	Who	How	Why	When	Where
				the volatile markets.		
Critical success factors (CSF)	CSFs are defined indicators that are associated with the success of an initiative.	Accounting officers, Executive Directors and Directors of different Ministries	Defining key performance indicators as CSF, to ensure the successful deployment of EA. These identified factors will be monitored and measured to ensure success.	CSF is necessary for a positive or beneficial outcome of the deployment of EA.	After the successful development of the organisation's strategy	All ministries and government agencies
Return on investment (ROI)	The tangible and intangible link between the investment made and the profit derived from that investment is used as a reference point. It is one of the main benefits derived from the deployment of EA.	Accounting officers, Executive Directors and Directors of different Ministries	Tangible ROI can be quantified through financial gains, but it has been proven difficult to quantify non-tangible ROI with the deployment of EA.	ROI serves as an indication of the efficacy of the financial investments made in the deployment of EA. This efficacy can be translated into financial gains indicating profitability or intangible gains that are hard to quantify.	After the successful deployment of EA, the assessment of the benefits needs to be quantified.	All ministries and government agencies
Readiness assessment	Readiness assessment is an assessment conducted to determine an organisation's adaptability to a proposed change.	Accounting officers, Executive Directors and Directors of different Ministries	It is a systematic investigation to determine an organisation's ability to cope and sustain the planned change associated with the deployment of EA.	The main objective is to identify the strengths, weaknesses, opportunities, and potential challenges that can impact the adaptation of EA	It is conducted before the deployment of the EA.	All ministries and government agencies
Organisational structure	It is a hierarchical structure of human resources with specific skills and expertise to execute business processes	Accounting officers, Executive Directors, Directors, business and IT employees	Roles and responsibilities are defined according to the employee's skill sets, to support the development	Humans are agents of change and employees' roles, and responsibilities represent the flow and	An organisational structure that is responsive to change is always required.	All ministries and government agencies

Factor	What	Who	How	Why	When	Where
		of different Ministries	and implementation of EA.	channel of information that is crucial for the deployment of EA. Employees hold the power to enable or constrain the deployment of EA.		
Selection of EA framework	A framework is a blueprint that guides the definition of components such as modality, concept, and principles.	Accounting officers, Executive Directors and Directors of different Ministries	Setting a selection criterion that is based on the organisation's needs, as the EA framework will be customised to fit the specific needs of the organisation.	EA frameworks are designed for a specific purpose, each having specific strengths and weaknesses that need to be understood to best support the transition of the organisation	It is conducted during EA implementation planning.	All ministries and government agencies

Table 7.1 presents a description of what each cell should contain within the context of an environment (organisation). In executing or fulfilling the task, a template should be formulated for each of the influencing factors. This means that the description guides the formulation of the templates. Thereafter, weight is assigned to each of the influencing factors, which is the second of the three-phase approach. However, phases # 1 and 2 can be performed in parallel.

7.3.2 Phase #2: Measurement Weight

Phase #2 presents weight that can be used to measure EA in the organisations used in the study (see Table 7.2). According to Iyamu (2022), weight provides fundamental criteria that can be used to assess EA value. In the Table, numeric values are assigned from 1 to 5. The numeric values are used as an assessment and are defined below. The method used in calculating the weight value is adapted from a study by Iyamu (2022). The study, which is to assess the value of EA in organisations, developed the EA assessment

metrics based on business indicators that were identified as stimuli to an organisation's activities

Table 7.2: Influencing Factors Weight Value

#	Influencing Factor	5	4	3	2	1	Weight
1	IT Governance						
2	Organisational Requirement						
3	Critical success factors (CSF)						
4	Return on investment (ROI)						
5	Readiness assessment						
6	Organisational structure						
7	Selection of EA framework						

The assessment metric is defined in numeric value as follows: *5 = Very Good, 4 = Good, 3 = Sufficient, 2 = Inadequate, and 1 = Foundation*. The weight assigned to each factor is guided by the definition and context of the factor as contained in Table 7.1 (Phase #1). Once all the influencing factors have been scored (or assigned) with weight, it is then calculated (summed up). The total is used to provide the final (Phase #3) assessment of EA's current status, in the organisation. This concluded metric score will be applied in phase #3 with the associated factors.

The numeric value (score) is calculated as follows: *Very Good = 21-25; Good = 16-20; Sufficient = 12 -15; Inadequate = 8-11; Foundation = 0-7*.

7.3.3 Phase #3: Weight metrics associated factors

Phase #3 covers the associated factors that are related and connected to the weight metrics. Each influencing factor is re-defined by the level of operations or gaps at a specific level of the weight metric. The re-defined influencing factors are referred to as the associated factors, which are explained in Table 7.3, according to each weight metric

Table 7.3. Weight metric-associated factors

Weight Score	IT Govern-ance	Organisational structure	Readi-ness assess-ment	Organisa-tional require-ment	Return on invest-ment (ROI)	Critical success factors (CSF)	EA frame-work selection
Foundation (0-7)	There is no standardised IT governance structure that guides IT/IS decisions in the organisation. No EA framework or policies to guide the activities of IS/IT deployment	The organisation lacks the expertise and skills of EA to plan and manage the deployment of EA in the organisation	The organisation's adaptability to the transformation and introduction to EA is not defined, nor is it known	There is no formal process for collecting requirements from the business units. No existing document of EA domains supports the process of requirement	The expected benefits from EA deployment are not recorded. There is no evidence of ROI on the deployed IT/IS.	There is no defined CSF for the development and deployment of EA	There is no evidence of any EA framework that guides the establishment of EA in the organisation
Inadequate (8-11)	The organisation has adapted EA to support IT governance, however, staff members are not aware of it	Some staff members have the skills and knowledge of EA. However, there is no centralised structure to manage the EA activities	The organisation's adaptability to change according to the EA guidelines is known, but not documented and followed constructively in the organisation	The different business units' requirements are known but executed through haphazard business processes	EA is deployed in the organisation with known benefits and expectations to be delivered	Critical success factors are defined but poorly articulated, they are not realistic and aligned to realise EA	The organisation has adapted EA but has not chosen a specific EA framework to guide its deployment
Sufficient (12-15)	The organisation has adapted EA to support IT governance, and staff members are aware of	There is a centralised division that is responsible for the planning and deployment of EA, but the processes are	The organisation's adaptability to change according to the EA guidelines is	The different business units' requirements are known and followed through	EA is deployed in the organisation with well-defined benefits expected. However,	Critical success factors are defined for either the development of EA or the	The organisation has adapted EA, and has chosen a specific EA framework

	it, but guidelines and procedures are not followed, and are thus not practised	not well-defined and implemented	documented but not followed constructively to guide activities in the organisation	implicit business processes but are not defined and documented through the different EA domains	expected benefits might be misrepresented because there is no proof of ROI or it takes too long for the organisation to realise ROI.	deployment of EA	to follow, but does not follow the guidelines of the EA framework for its successful deployment
Good (16-20)	There is a standardised structure of IT governance based on the EA deployed in the organisation. IT decisions are made according to the guidelines of the framework.	There is a centralised division that is responsible for the planning and deployment of EA, with skilful and expert staff members	The organisation's adaptability to change according to the EA guidelines is documented and implemented to guide activities in the organisation	The different business units' requirements are defined, documented, and translated through the explicit business processes that span the different EA domains	EA is deployed in the organisation with well-defined benefits that are attainable, with ROI that can be proven	Critical success factors are defined for both EA and the deployment	The organisation has adapted EA, has chosen a specific EA framework and is following the guidelines of the EA framework for the successful deployment of EA
Very good (21-25)	The deployment of EA to establish standardisation of IT governance is continually maintained and updated to support the vision of the organisation. The process is iterative.	There is a centralised and hierarchical division that is responsible for the planning and deployment of EA, with skilful and expert staff members that constantly update the documents, monitor change and manage the practice of EA	The organisation's adaptability to change according to the EA guidelines is documented and successfully implemented, this process is however constantly adjusted because it can be influenced by internal and external factors	The different business units' requirements that are defined and documented and represented through the explicit business processes that span the different EA domains can change according to changes in business requirements. The organisation has defined	EA is deployed in the organisation with well-defined benefits that are attainable, and ROI that can be proven. Iterative processes are in place to redefine ROI according to new benefits that emerged.	Critical success factors are defined for both the development and the deployment of EA. There is a documented process to redefine CSF to keep the process relevant.	The organisation has adapted EA, has chosen a specific EA framework and is following the guidelines of the EA framework for its successful deployment.

				change management processes to re-adjust business processes according to changes in business requirements.			

The weight metric with associated factors is adapted from Iyamu (2022), who defined factors according to the operational level that correlates with the value of the weight metric. Even though the study by Iyamu (2022) is similar, the main difference between the weight metric of these two studies is on levels because Iyamu's study is based on one of the domains of EA, business architecture (BA), whilst this study is more holistic as it covers EA rather a single domain. The other difference is the context of the study; where the associated weight metric is based on private organisations, this study focuses on the government (public) environment. The private and public enterprises are uniquely different in many aspects, such as organisational structure, types of service, service delivery, and clientele.

7.4 Summary

As presented in this chapter, seven factors from the two cases used in the study were found to influence the deployment and practice of EA in government enterprises. The dimension of social changes of structuration theory is used to guide the interpretation of the findings. Based on the interpretation, an EA metric model is developed, which was the aim of the study.

CHAPTER 8:
CONCLUSION AND RECOMMENDATION

8.1 Introduction

This chapter concludes the study, which represents the summary and recommendations. The objective of this chapter is to indicate how the aim and objectives of this study was achieved, which was conducted in a qualitative of nature. The data was collected through documentation, analysed using the activity theory and the researcher interpreted the findings with the consideration of the dimension of change, structuration theory. The recommendation of this study is influenced by the results of the findings and the study.

The chapter is structured into six main sections. The chapter is introduced in the first section, followed by the evaluation of the aims and objectives in the second section. The third section presents the contribution of this study, followed by the recommendation and consideration of future studies in section four and five respectively. The chapter is concluded in section six.

8.2 Aim and Objectives

The deployment of EA in Africa has been a challenge for many governments, as benefits associated with the deployment of EA cannot be quantified. This emanates from the challenge to appreciate EA because governments cannot assess the value of EA, which is caused by a lack of standardised metrics to assess the value of EA.

The aim of the study is to propose a solution through a metrics model which can be used to measure the value and benefits of EA within governments' institutions in developing countries, as explained in chapter 1. This aim was achieved with the design of an EA metrics model (EAMM) as presented in chapter 7.

The research was based on the governments of Egypt and Ghana as case studies, which is covered in chapter 5. The government of Egypt deployed EA in 2006 and Ghana in 2008, which is assumed to be the first governments to have deployed EA in Africa. Data

collection of these two cases were based on EA-related documentation such as EA policy, and EA implementation. The initial process of document preparation was document analysis, which involved the reduction of unstructured data by selecting the data that is applicable to the research. This was further processed through means of iterative reading, skimming and interpretation, to prepare the documentation for data analysis. The data analysis was done with the guidance of a sociotechnical theory, Activity Theory (AT). Data analysis is discussed in detail in chapter 6.

Findings from the analysis were identified and subjectively interpreted, using the dimension of social change of the structuration theory in chapter 7, which led to the development of the EAMM. The EAMM comprises of 3 phases, the first phase is about the establishment and definition of the factors that influences the measurement of EA in the government environment. Phase 2 interconnects the influencing factor's value with relevance to determine the weight of each factor. The last phase, phase 3, maps the influencing factors against the weighting criterion, which represents the associated factors that makes up the EAMM.

In support of the research aim, three objectives were formulated to achieve the aim of the study, as highlighted in Chapter 1.

Research objective1: To examine the factors that influence EA implementation within governments' institutions in developing countries. This is to understand the rational as well as expectation of implementing the concept of EA in an environment, which can be used to establish metrics.

The same objective was set for the two cases, which guided the data collection as discussed in chapter 3. Data from the two cases, Egypt, and Ghana, were gathered and analysed separately, and underpinned by the socio-technical theory, activity theory (AT) as discussed in chapter 6. The use of the different tenets of AT revealed the factors that has an influence on the development, implementation, and practise of EA in the governments respectively, which was subjectively identified.

Five factors were revealed from the government of Egypt and the government of Ghana, respectively. The findings from the government of Egypt, are as follows: (1) *IT*

Governance; (2) *Critical success factors;* (3) *Organisational structure;* (4) *framework selection;* (5) *Enterprise Requirements.* From the second case, government of Ghana, the revealed factors were*: (1) Readiness assessment*; (2) *Selection criteria*; (3) *Organisational Requirements*; (4) *Governance*, and (5) return on investments. The findings from the two cases are different, with some corroborations between them. To avoid duplication, disparity and ensure cohesion, towards achieving the aim of the study, the findings from both cases were combined and concluded. From different angles, the factors are found to critically influence the deployment and practice of EA.

To gain a deeper understanding of the rational and expectation of implementing the concept of EA in an environment; or how they manifest or influence EA deployment, subjective interpretation was conducted. The interpretation was guided by the dimension of social change from the perspective of structuration theory. The interpretation is covered in chapter 7.

Research objective 2: To examine and establish how EA is practiced in governments' institutions in developing countries. This is to determine the factors that influence the benefits and value of the concept, to establish metrics. This includes gaining an understanding of the impact which roles, organisational structure, process, and rules have on EA practice. The data analysis also revealed the way EA is practised in the government of Egypt and Ghana.

EA practice in the government of Egypt

The deployment of EA in the government of Egypt is based on the integrated architecture framework (IAF) and the federal enterprise architecture framework. This means that the planning, definition, and execution of EA is guided by these frameworks. The framework guides the ministries and government agencies' strategy and operations. The deployment of the Egyptian government's enterprise architecture (EGEA) is placed under the ambit of the Ministry of State for Administration (MSAD), to manage the deployment of EGEA on behalf of the government. MSAD is an extension of the office of the president.

The development of EGEA nationally, is driven by a committee of executive management from the different government organisation, who are all mandated to oversee the strategy execution of their organisations. Similarly, each sector ministry or government agency also has a committee of executive management on an organisational level to deploy EGEA.

Even though such a structure can enhance better planning by defining the area of focus and specialisation in each organisation, it can easily mislead the deployment process of EGEA because the ministry is the focal actor and not the architecture, which can derail the successful deployment of EGEA.

The organisational structure of the government has a strong impact on the successful deployment of EA, because the non-IT stakeholders holds the power to determine the direction and processes in the development of EGEA, which can be detriment to the successful deployment of EGEA in the government. A contradictory view of the deployment of EGEA was highlighted.

Even though there is a guiding document how to execute the activities of EGEA deployment, this guideline has certain shortcomings, such as a detailed taxonomy of critical success factors (CSF) that can be used to monitor, measure, and assess the EGEA functions and value in the environment. This shortcoming further has implications on determining whether the activities defined conforms to the processes defined by the framework.

EA practise in the government of Ghana

The government of Ghana deployed EA with the main objective to transform Ghana public services. However, with the existence of different EA frameworks to select from and guide the deployment of EA, the government of Ghana does not have an EA framework. The lack of an EA framework to guide the deployment of EA can pose many challenges for the successful development, implementation, and practise of EA, which can make the deployment process unsuccessful and the value monitoring and assessment ineffective.

Due to the absence of an EA framework, the Ghana government enterprise architecture (GGEA) is based on the development of readiness assessment documents referred to as the Architecture Reference Models (ARM). The ARM is focused on the standards, definition, and implementation of technology solutions. In support of the EA deployment, a Governance Model exists to guide the ICT activities and its formulation. This concludes that Ghana government enterprise architecture (GGEA), is mostly focused on operational ICT activities.

The development of the GGEA is shared by Ghana ICT Directorate (GICTeD) and the

Ministry of Communication (MoC). The GICTeD is responsible for the development of GGEA by scoping the requirements from all the ministries, departments, and agencies (MDA), meaning that the scope for the EA development is centralised. However, the implementation is the responsibility of MoC, with the task to oversee the implementation of GGEA in the MDAs. Subsequently, the GGEA implementation is achieved by assigning tasks, roles, and activities to personnel in MDA for the implementation of GGEA. These roles and tasks are guided by an implementation report based on recommendation provided by the GICTeD.

In addition to the GICTeD, MDA and MoC defined as stakeholders for the deployment of GGEA, ICT vendors who provide services to the government, are external stakeholders who also form part of the stakeholders involved in the deployment of GGEA. Although the mandate of each stakeholder was different, the aim was to contribute to the deployment of GGEA, with the focus on ICT enhancements.

8.3 Evaluation of the study

A metric model to measure the value of EA in developing countries was investigated in the context of Africa. The title of the study, a metric model for measuring the value of EA in developing countries, is appropriately phrased and reflects the problem statement. The title is further cascaded in the aim, and objectives of the study as discussed in chapter 1. This the alignment between the topic, problem statement, aim and objectives, is evidence of the alignment presented in the study, and premise that there is no disconnect.

Government organisations in African countries have deployed IS/IT artefact to improve operations and deliver effective and efficient services to its citizens. Many governments are challenged with the selection, deployment, use, and management of IT infrastructure or solutions. These challenges have motivated governments to develop and deploy EA in their environments and to mitigate these challenges and associated risks. Egyptian and Ghanian governments, have both deployed EA to mitigate challenges and improve the operations in its institutions.

Data was collected through documentation. National documents such as policy, implementation, and guideline documents related to EA were collected from each country, as explained in chapter 4. These documents were predominantly collected from the

government's websites, with peer reviewed articles sourced from scholastic databases. A total of 69 documents that represents the data, were collected with the primary focus areas of development, implementation, and practice of EA. This was to ensure that the data collected will respond to the objective of the study, which is very critical for the success of the study.

Due to the nature of national documents, all documents were considered regardless of the year of publication. This was in support with the hermeneutics approach used to appreciate the context and history of the data. Ramsook (2019) alluded that the hermeneutics approach focuses on historical texts, and past experiences with the main objective to appreciate the subject matter under study. The data collection process revealed that there is not much peer reviewed articles about EA of the two countries. The data analysis begun in July 2022 and was concluded in September 2022.

The interpretivist epistemological stance was used and supported by the qualitative method with the case study design. In chapter 3, the sociotechnical theories, Activity Theory (AT) and the Dimension of Change (DS) of the Structuration Theory (ST) were used to underpin the study. AT was used to guide the analysis of the data, whilst DS was used to interpret the findings. Based on the interpretation, an enterprise architecture metrics model (EAMM) was developed.

Many African governments are faced with the challenge to optimally manage the deployment and use of IS/IT in their institutions. Consequently, these governments adapt EA to mitigate these challenges. However, many of these government institutions are increasingly challenged with the implementation of EA. Furthermore, these institutions cannot establish the value of EA, as this challenge emanates from a lack of standard metrics that can be used to measure the value of EA. The enterprise architecture metrics model (EAMM) will be used to measure the value and benefits of EA within government institutions.

8.4 Contribution of the study

This section discusses the contribution derived from this study. The contribution highlights the value and inputs this study presents to the society, which is two-fold, the academic and the industry society. Academic contribution is represented by the theoretical and methodological segments, and the practical contribution is to the IS industry. Two

governments in developing countries were used as case studies, the government of Egypt and the government of Ghana. The contribution from this study is presented, as follows:

8.4.1 Theoretical contribution

This study realised that there is a gap of diverse literature about the use of EA in African governments. Studies about the use of EA in African governments is not very common compared to literature about EA in private organisations. Therefore, this study contributes to the body of knowledge, and the advancement of EA in African governments. The theoretical contributions are also appreciated and the findings from the case studies are each unique because of the heuristic consideration of the case studies.

The socio-technical theories: activity theory (AT) and dimension of social change (DS) from structuration theory were used as a lens for data analysis and interpretation of findings respectively. The application of socio-technical theory continues to be a challenging concept for both upcoming and experienced researchers. What is more challenging is the use of more than one theory in a single study. During the time of this study, literature on the application of Activity Theory and Dimension of social change in one study could not be found. Therefore, this study contributes to the body of knowledge in the application of socio-technical theories, more importantly on the use of AT and dimension of social change complimentarily. Guided by AT, factors were mutually concluded for both governments.

To gain a better understanding of the factors, interpretation was done to ascertain the criticality how these factors influence the deployment and practise of EA in governments, on the Africa continent. The dimension of social change, was used to guide the interpretation of the findings. The interpretation led to the development of a government enterprise architecture metrics model (EAMM). This study contributes to the use and advancement of AT and DS for IS studies.

8.4.2 Practical contribution

The study followed the case study as the research design. The case studies, the government of Egypt and the government of Ghana, allowed the researcher to collect data

about its real environment. The findings were subjectively derived from the analysed data, which is a representation of the gaps and strengths in the environments. From the data, it was evident that the decision such as the EA framework and the supporting structures for its deployment, are very critical for the successful deployment of EA.

Practically, this study can serve as a reference for the government of Egypt and the government of Ghana, to assist with self-evaluation and fill the gaps where there is oversight. This can assist EA to mature to the next level in these governments. There is a gap of EA studies in developing countries, with most studies focused only on ministerial level and not the government holistically. The results from this study can be used by other developing countries to guide the development and use of EA. Managers and other stakeholders can use the study findings as a basis to make decisions towards the development and implementation information systems in their computing environments. Researchers can use this study as a practical guide how to use AT and DS as a lens.

8.4.3 Methodological contribution

From a methodological perspective, this study followed interpretivist case study approach. The intepretivist case study approach enabled the researcher to study enterprise architecture within the African government context. This allowed the researcher to gain a rich and deeper understanding of the development and implementation of IS across developed governments.

Additionally, the primary contribution from the methodological perspective is the application of documents as data collection technique. The documentation technique is mostly overlooked and thus in most studies is likely be used as a supplementary tool for data collection. Therefore, this study demonstrates how the technique may be used to achieve study objectives. The metrics model was also designed through a step-by-step process driven by qualitative methods. The data collection process was documentation on each case, and the development of the model is informed by the data which were derived from the data analysis and findings from the interpretation. This process is grounded on subjective perspectives, which established the conclusion of the study. The contribution is for researchers to be able to use AT as a lens with document analysis. Based on the objective of this study, a theoretical framework was presented as a framework to underpin this study. This framework is the complementarily use of AT and DS, with outlined

sequence of activities. The framework is a formula that can be used as a practical guide how to use AT for data analysis and DS for interpretation of the findings.

8.5 Recommendation

From the analysis, findings, and interpretations, gaps were identified in the development and implementation of Enterprise Architecture. Recommendations for filing the gaps are discussed as follows:

A guiding Enterprise Architecture Framework

As revealed in the study, in some case governments implemented enterprise architecture without a framework. It is every important to have an enterprise architecture framework to guide the development and implementation of the enterprise architecture project. The lack of an enterprise architecture framework make it challenging for the development team to assess and determine the quality and effectiveness of the process they are implementing. On the market various frameworks are found, thus it is advisable to select a guiding framework that is aligned to the computing environment and organisational goals.

Enterprise Architecture Readiness Assessment

Before the implementation of the Enterprise Architecture, governments are advised to conduct a readiness assessment to determine to what extent they are ready to implement their EA. In most cases, the government organisations embarked on the journey of enterprise architecture development without taking a stock of all the required resources to make the process a success. By conducted a readiness assessment, the government enterprise identifies their weakness and strength and thus work on filling the identified weakness.

Once Off Project

An enterprise architecture should not be viewed as a once off project. Government enterprises are advised to continually keep updating their enterprise architecture and ensuring it is aligned to the organisational strategic goals. Most of the government projects are left to collect dust after their implementation. However, organisations evolve and thus the need to keep up with these changes. Enterprise architecture should not be viewed as a solution to all organisation challenges but rather as a management approach that requires organisation dedication and resources to function accordingly.

8.6 Future Studies

The study primarily focused on the development of the metrics model, which can be used to measure the value and benefits of EA within governments. However, future work could be expanded to focus on evaluating the developed model. The model is not evaluated and thus remains as a theoretical contribution. There is a critical need to evaluate all factors that form part of the model in order to determine the extent to which they impact the deployment of enterprise architecture. Evaluating the model would increase its practical usefulness and thus government enterprises will have empirical evidence on how they can employ the model in their computing environments.

8.7 Summary

This chapter is a windup of the thesis chapters. Some governments in developing countries are faced with the challenge of quanitifying the value associated with the deployment of EA. Through the chapters, the objective of the find the factors that can be used to design an EA metrics model (EAMM). The data collection of the two cases was documentation, which was subjectively anlaysed with the heuristic aspect. The data from each case was individually analysed, guided they the Activity Theory as the lens.

The findings from the two cases were collated and interpreted,using the Dimension of Social Change, of the Structuration Theory. These findings are the factors that influence EA implementation within these two cases, which are the building block of the EAMM. The EAMM is a contribution to the body of knowledge, because the two government can use this study as a benchmark to improve the deployment of EA, in order to derive value from it. Similarly, government institutions intending to deploy EA can use this study as a benchmark to ensure the successfully deployment of EA.

The study developed a theoretical framework using the activity theory and dimension of social change. The thesis introduces the use of the two theories in the same study, which continues to be a challenging concept for both upcoming and experienced researchers. The study is recommending a future study to tests the EAMM.

REFERENCES

Abbas, W. F., Ismail, S. H., Haron, H. & Hariri, W. N., 2018. Enterprise Integration of Employee Onboarding Process Using Zachman Framework. *International Journal of Engineering & Technology,* 7(4.31), pp. 45-51.

Abbasi, A., Sarker, S. and Chiang, R.H., 2016. Big data research in information systems: Toward an inclusive research agenda. *Journal of the Association for Information Systems*, *17*(2), p.3.

Abdeladi, K., Khan, U. & Khan, P., 2014. Driving business value through an effective IT strategy development. *In Computing for Sustainable Global Development (INDIACom), 2014 Conference on ,* pp. 561-563.

Abdul, R. A. & Alharthi, K., 2016. An introduction to research paradigms. *International Journal of Educational Investigations, 3(8):51 -59*

Adarkwah, M.A., 2020. "I'm not against online teaching, but what about us?": ICT in Ghana post Covid-19. *Education and Information Technologies*, pp.1-21.

Advance Africa. 2021. Kenya Airways Head Enterprise Architecture & Solution Design Jobs in Kenya. https://www.advance-africa.com/kenya-airways-head-enterprise-architecture-solution-design-jobs-in-kenya.html

Agboh, D.K., 2017. An Assessment of Ghana's global E-government UN ranking. *Morgan State University*, pp.1-17.

Ajer, A.K.S., 2018. Enterprise architecture in healthcare and underlying institutional logics: A systematic literature review of IS research. In *PACIS 2018 Proceedings-Opportunities and Challenges for the Digitized Society: Are We Ready?: Pacific Asia Conference on Information Systems (PACIS 2018)*.

Arthur-Nyarko, E. and Kariuki, M.G., 2019. Learner Access to Resources for eLearning and Preference for E-learning Delivery Mode in Distance Education Programs in Ghana. *International Journal of Educational Technology*, *6*(2), pp.1-8.

Afarikumah, E. & Kwankam, S., n.d. Deploy actor-network theory to analyse telemedicine implementation in Ghana. *Science Journal of Public Health,* 1(2), pp. 69-76.

Ahmad, N.A.N., Akhbariee, N.I. and Hafizuddeen, M., 2013, March. Requirements analysis of android application using activity theory: A case study. In *2013 International Conference of Information and Communication Technology (ICoICT)* (pp. 145-149). IEEE.

Aier, S., 2014. The role of organisational culture for grounding, management, guidance and effectiveness of enterprise architecture principles. *Information Systems and E-Business Management,* 12(1), pp. 43-70.

Aier, S. & Schelp, J., 2010. A Reassessment of Enterprise Architecture Implementation. *Service-Oriented computing. ICSOC/ServiceWave 2009 workshop,* pp. 35-47.

Akkasi, A. & Shams, F., 2008. Presenting A Method for Benchmarking Application in the Enterprise Architecture Planning Process Based on Federal Enterprise Architecture Framework. *In 2008 3rd International Conference on Information and Communicatijon Technologies: From Theory to Applications,* pp. 1-6.

Alfaraj, H. & Qin, S., 2011. Operationalising CMMI: integrating CMMI and CoBIT perspective.. *Jouranl of Engineering, Desing and Technology 9(3),* pp. 323-335.

Al-Kharusi, H., Miskon, S. & Bahari, M., 2017. Alignment Framework in Enterprise Architecture Development. *Twenty First Pacific Asia Conference on Information Systems, Langkawi Island, Malaysia,* 16-20 July .

Al-Nasrawi, S. & Ibrahim, M., 2013. An Enterprise Architecture mapping approach for realizing e-government. *In 2013 third International Conference on Communications and Information Technology (ICCIT),* pp. 17-21.

AlSoufi, A., 2012. Bahrain national enterprise architecture framework: a platform toward a GCC EA Initiative. *GSTF Journal on Computing (JOC),* 2(1).

Al-Saadi, H., 2014. Demystifying Ontology and Epistemology in research methods. *Unpublished doctoral research thesis), University of Sheffield, UK. Retrieved July*, *17*, p.2019.

Alhassan, M., 2018. *Enterprise architecture driven design of an artefact to support strategic Information Technology decision-making of Small Enterprises in Nigeria and South Africa* (Doctoral dissertation, University of Cape Town).

Aliyu, A. A., Bello, M. U., Kasim, R. and Martin, D., 2014. Positivist and non-positivist paradigm in social science research: Conflicting paradigms or perfect partner. *Journal of Management and Sustainability,* 4(79).

Ahmad, S., Kumar, S., Kumar, M., Kumar, R., Memoria, M., Rawat, A. and Gupta, A., 2022, May. The Importance Of Quantifying Financial Returns On Information System (IS) Investment For Organizations: An Analysis. In *2022 International Conference on Machine Learning, Big Data, Cloud and Parallel Computing (COM-IT-CON)* (Vol. 1, pp. 197-200). IEEE.

Ansyori, R., Qodarsih, N. & Soewito, B., 2018. A systematic literature review: Critical Succes Factors to Implement Enterprise Architecture. *Procedia Computer Science,* Volume 135, pp. 43-51.

Antwi, S.K. and Hamza, K., 2015. Qualitative and quantitative research paradigms in business research: A philosophical reflection. *European journal of business and management*, *7*(3), pp.217-225.

Apuke, O.D., 2017. Quantitative research methods: A synopsis approach. *Kuwait Chapter of Arabian Journal of Business and Management Review*, *33*(5471), pp.1-8.

Ary, D., Jacobs, L., Sorensen, C. and Walker, D., 2013. *Introduction to research in education.* s.l.: Cengage Learning.

Assarroudi, A., Heshmati Nabavi, F., Armat, M.R., Ebadi, A. and Vaismoradi, M., 2018. Directed qualitative content analysis: the description and elaboration of its

underpinning methods and data analysis process. *Journal of Research in Nursing*, *23*(1), pp. 42-55.

Asogwa, B. E., 2013. Electronic government as a paradigm shift for efficient public services. *Library Hi Tech,* 31(1), pp. 141-159.

Atkinson, C., & Brooks, L., 2003. StructurANTion: A theoretical framework for integrating human and IS research and development. *In the Proceedings of the ninth Americas Conference on Information Systems (AMCIS),* Tampa, FL, USA, August 4-6, *2003.*

Awuzie, B. and McDermott, P., 2017. An abductive approach to qualitative built environment research. *Qualitative Research Journal*.

Baguma, R., Bagarukayo, E., Namubiru, P., Brown, C. and Mayisela, T., 2019. Using WhatsApp in Teaching to Develop Higher Order Thinking Skills--A Literature Review Using the Activity Theory Lens. International Journal of Education and Development Using Information and Communication Technology, 15(2), pp.98-116.

Bakar, N., Harihodin, S. & Kama, N., 2016. Assessment of Enterprise Architecture Implementation Capability and Priority in Public Sector Agency. Procedia Computer Science, Volume 100, pp. 198-206.

Bakar, N. A. A. & Hussien, S. S., 2018. Association of People Factors with Successful Enterprise Architecture Implementation. *International Journal of Engineering & Technology,* 7(4.31), pp. 52-57.

Bakar, N.A.A., Yaacob, S., Hussein, S.S., Nordin, A. and Sallehuddin, H., 2019. Dynamic metamodel approach for government enterprise architecture model management. *Procedia Computer Science*, *161*, pp.894-902

Bambale, A. J., 2014. Research methodological techniques as a model for qualitative studies in social sciences.. *British Journal of Economics, Managements & Trade,* 4(6), pp. 862-879.

Barhoumi, C., 2015. The Effectiveness of WhatsApp Mobile Learning Activities Guided by Activity Theory on Students' Knowledge Management. *Contemporary*

Basias, N., and Pollalis, Y., 2018. Quantitative and qualitative research in business & technology: Justifying a suitable research methodology. *Review of Integrative Business and Economics Research*, *7*, 91-105.

Becker, A., Widjaja, T. & Buxmann, P., 2011. Value potentials and challenges of services-oriented architectures. *Business & Infromation Systems Engineering,* 3(4), pp. 199-210.

Bellman, B. & Rausch, F., 2004. Enterprise Architecture for e-government. *In international Conference on Electronic Government.*

Bendassolli, P.F., 2013, January. Theory building in qualitative research: Reconsidering the problem of induction. In *Forum Qualitative Sozialforschung/Forum: Qualitative Social Research* (Vol. 14, No. 1).

Bengtsson, M., 2016. How to plan and perform a qualitative study using content analysis. *Nursing Plus Open*, *2*, pp.8-14.

Benkhayat, A., El Manouar, A. & Sadok, H., 2015. Firm business strategy and IT strategy alignment: A proposal of a new model. *In 2015 Xth International Scientific and Technical Conference "Computer Sciences and Information Technologies (CSIT),* pp. 172-178.

Bhat, M., Reschenhofer, T. & Matthes, F., 2015. A Moded-Based Approach for Retrospective Analysis of Enterprise Architecture Metrics. *In International Conference on Enterprise Information Systems.*

Bhattacherjee, A., 2012. *Social science research: principles, methods, and practices.* s.l.:s.n.

Bhattacherjee, A., Davis, C. & Hikmet, N., 2013. Physician Reaction to Healthcare IT: and Activity-Theoretic Analysis. *In 2013 46th Hawaii International Conference on System Sciences,* pp. 2545-2554.

Bittler, R. S. & Kreizman, G., 2005. Gartner Enterprise Architecture Process: Evolution 2005. *G000130849,* pp. 1-12.

Blaxter, . L., 2010. *How To Research.* 4 ed. Berkshire, GBR: McGraw-Hill Education.

Boateng, M.S., 2012. The role of information and communication technologies in Ghana's rural development.

Boell, S.K. and Cecez-Kecmanovic, D., 2014. A hermeneutic approach for conducting literature reviews and literature searches. *Communications of the Association for Information Systems*, *34*(1), p.12.

Boje, D.M., Baca-Greif, H., Intindola, M. and Elias, S., 2017. The episodic spiral model: a new approach to organizational processes. *Journal of Organizational Change Management*.

Borja, S., Kim, K., Yoon, H. and Hwang, J., 2018, August. IT governance effectiveness and its influence on innovation product and process. In *2018 Portland International Conference on Management of Engineering and Technology (PICMET)* (pp. 1-8). IEEE.

Borrego, M., Douglas, E.P. and Amelink, C.T., 2009. Quantitative, qualitative, and mixed research methods in engineering education. *Journal of Engineering education*, *98*(1), pp.53-66.

Bowen, G. A., 2009. Document analysis as a qualitative research method. *Qualitative research journal,* 9(2), pp. 27-40.

Buckl, S., Matthes, F., &Schweda, C., 2010. Conceptual models for cross-cutting aspects in enterprise architecture modelling. Distributed Object Computing Conference Workshop (EDOCW) 2010 14th IEEE International, 245 – 252

Bui, Q., 2017. Evaluating Enterprise Architecture Frameworks using essential elements. *Communications of the Association for information systems,* 41(1), pp. 121-149.

Busch, N. R. & Zalewski, A., 2018. Enterprise Architecture Modifiability Analysis. *In Towards a Synergistic Combination of Research and Practice in Software Engineering,* pp. 119-134.

Bryman, A. & Bell, . E., 2015. *Business research methods.* 4 ed. USA: Oxford University Press.

Caiza, J. C., Martín, Y. S., Guamán, D. S., Del Alamo, J. M., & Yelmo, J. C. (2019). Reusable elements for the systematic design of privacy-friendly information systems: A mapping study. *IEEE Access*, *7*, 66512-66535.

Çam, T. and Kayaoğlu, M., 2014. Social change from the perspective of some prominent contemporary sociologists. *Journal of International Social Research*, *7*(34).

Cameron, B. H., 2015. Methods for Defining and Analysing Key EA Performance Metric. *Cutter Consortium, the Business & Enterprise Architecture Executive Report,* 18(2).

Caruso, M. J., 2019. Strategies to Improve Adoption of the Federal Enterprise Architecture Framework. Dissertation of Doctorate studies in Information Technology, Walden University, USA.

Carvalho, M. et al., 2015. An activity theory-based model for serious games analysis and conceptual design. *Computers & education,* Volume 87, pp. 166-181.

Castelnovo, W., 2012. An architecure drivne methodology for transforming from fragemented to connected government: Acase of local government in Italy. *In Enterprise Architecture for Connected E-Government: Practices and Innovations,* pp. 350-373.

Cecez-Kecmanovic, D. and Kennan, M.A., 2018. The methodological landscape Information systems and knowledge. *Research Methods*, p.127.

Chalmeta, R. & Pazos, V., 2015. A step-by-step methodology for enterprise interoperability projects. *Enterprise Information Systems,* 9(4), pp. 436-464.

Chege, S.M., 2013. Top IT Management Concerns in Kenya. *Globalization*, *5*(27).

Chima, P. and Kasim, U., 2018. Public-private partnership as a strategy for e-governance funding in Africa: The gains and the pains. *International Journal of Public Policy and Administration Research*, *5*(2), pp.37-47.

CIA, 2018. Word Fact Book. [Online] Available at: https://www.cia.gov/library/publications/the-world-factbook/geos/eg.html [Accessed 20 09 2020]

CIPESA. 2015. ICT in Governance in Kenyan – Policies and Practice CIPESA ICT Research Series No. 06/15. https://cipesa.org/?wpfb_dl=200 [28 February 2022]

Constantinides, P., Chiasson, M.W. and Introna, L.D., 2012. The ends of information systems research: A pragmatic framework. *Mis Quarterly*, pp.1-20.

Cope, D. G., 2014. Methods and meanings: credibility and trustworthiness of qualitative research. *Oncology nursing forum,* 41(1), pp. 89-91.

Crawford, K. & Hasan, H., 2006. Demonstrations of the Activity Theory Framework for Research in Information Systems.. *Australian Journal of Information Systems,* Volume 13, pp. 49-68.

Cresswell, J., 2013. Philosophical assumptions and interpretive frameworks. *Qualitative inquiry and research design: choosing among five approaches. Los Angeles: Sage Publications*, pp.15-41.

Cresswell, J. W., 2014. *Research design: qualitative, and mixed methods approaches (4th ed).* Thousand Oaks: Sage Publications.

Crotty, M., 1998. *The foundations of social research.* London: Sage.

Cuthbertson, L. M., Robb, Y. A. & Blair, S., 2019. Theory and application of research principles and philosophical underpinning for a study utilising interpretative phonomenological anayis. *Radiography.*

DeCuir-Gunby, J.T., Marshall, P.L. and McCulloch, A.W., 2011. Developing and using a codebook for the analysis of interview data: An example from a professional development research project. *Field methods*, *23*(2), pp.136-155.

Del-Shamarran, N., 2022. Why Society Change: Anthony Giddens's Structuration Theory and Time-Space Distanciation. *Dekonstruksi*, *7*(01), 183-195.

Dale, M. and Scheepers, H., 2020. Enterprise architecture implementation as interpersonal connection: Building support and commitment. *Information Systems Journal*, *30*(1), pp.150-184.

Dang, D.D. and Pekkola, S., 2017. Systematic Literature Review on Enterprise Architecture in the Public Sector. *Electronic Journal of e-Government*, *15*(2).

Davies, M. B. and Hughes, N., 2014. *Doing Successful Research Project: Using Qualitative or Quantitative Methods.* China: Palmgrave MacMillian.

DeCuir-Gunby, J.T., Marshall, P.L. and McCulloch, A.W., 2011. Developing and using a codebook for the analysis of interview data: An example from a professional development research project. *Field methods*, *23*(2), pp.136-155.

Department of Public Service and Administration. 2012. Public Service Corporate Governance of Information and Communication Technology Policy Framework. https://www.gov.za/sites/default/files/gcis_document/201409/cgictpolicyframework.pdf

Department of Telecommunication and Postal Services. 2017. National e-government strategy and roadmap. Government of South Africa. Available from: https://www.gov.za/sites/default/files/gcis_document/201711/41241gen886.pdf [1 March 2022]

Devan, B. & Squire, K. D., 2012. Activity thoery in the learning technologies. In: *Theoretical foundations of learning environments.* New York: Routledge, pp. 242-267.

De Vries, M., 2010. A framework for understanding and comparing enterprise architecture models. *Management Dynamics: Journal of the Southern African Institute for Management Scientists,* 19(2), pp. 17-29.

Dobbe, R., Dean, S., Gilbert, T. and Kohli, N., 2018. A broader view on bias in automated decision-making: Reflecting on epistemology and dynamics. *arXiv preprint arXiv:1807.00553*.

Duffy, G. and Bowe, B., 2014. An analysis of consistency in, and between, ontology, epistemology and philosophical perspective as contained studies of the first year

experience. *In 2014 IEEE Frontiers in Education Conference (FIE) Proceedings,* pp. 1-7.

Dwivedi, Y.K., Rana, N.P., Jeyaraj, A., Clement, M. and Williams, M.D., 2019. Re-examining the unified theory of acceptance and use of technology (UTAUT): Towards a revised theoretical model. *Information Systems Frontiers*, *21*(3), pp.719-734.

Engeström, Y., 1987. *Learning by Expanding: An Activity-Theoretical Approach to Developmental Research.* Helsinki: Orienta-Konsultit.

Engestrom, Y., 2001. Expansive learning at work: towards an activity theoretical reconceptualisation. *Journal of Education and Work,* 14(1), pp. 133-156.

Er, M., Kay, R. & Lawrence, E., 2010. Information Systems and Activity Theory: A case study of Doctors and Mobile Knowledge Work. *In 2010 Seventh International Conference on Information Technology: new Generation,* pp. 603-607.

Eriksson, P. and Kovalainen, A., 2015. *Qualitative Methods in Business Research: A Practical Guide to Social Research. 2nd ed.* s.l.:SAGE.

Espadas, J., Romero, D., Concha, D. & Molina, A., 2008. Using the Zachman Framework to achieve Enterprise Integration based-on Business Process Driven Modelling. *In OTM Confederated International Conferences" On the Move to Meaningful Internet sysems",* pp. 283-293.

Ewurah, S.M., 2017. The concept of eGovernment: ICT policy guidelines for the policy makers of Ghana. Journal of Information Security, 8(2), pp.106-124.

Fassinger, R. and Morrow, S.L., 2013. Toward best practices in quantitative, qualitative, and mixed-method research: A social justice perspective. *Journal for Social Action in Counseling & Psychology*, *5*(2), pp. 69-83.

Filet, P., van de Wetering, R. and Joosten, S., 2019. Enterprise architecture alignment.

Firmansyah, C. M. & Bandug, Y., 2016. Designing an enterprise architecture govenment organisation based on TOGAF ADM and SONA. *IN 2016 International Conference on Information Technology Systems and Innovation (ICITSI),* pp. 1-6.

Fleischmann, M. and Ivens, B., 2019, January. Exploring the role of trust in blockchain adoption: an inductive approach. In *Proceedings of the 52nd Hawaii international conference on system sciences*.

Flick, U. ed., 2013. The SAGE handbook of qualitative data analysis. Sage.

Foorthuis, R., Van Steenbergen, M., Brinkkemper, S. & Bruis, W. A. G., 2016. A theory building study of enterprice architecture practices and benefits. *Information Systems Frontiers,* 18(3), pp. 541-564.

Foot, K., 2001. Cultural-historical activity theory as practice theory: Illuminating the development of conflict-monitoring network. *Communication Theory,* Volume 11, pp. 56-83

Franco, E. F., Hirama, K., & Carvalho, M. M., 2018. Applying system dynamics approach in software and information system projects: A mapping study. *Information and Software Technology*, *93*, 58-73.

Frempong, G. 2012. Understanding what is happening in ICT in Ghana. https://researchictafrica.net/publications/Evidence_for_ICT_Policy_Action/Policy_Paper_4-Understanding_what_is_happening_in_ICT_in_Ghana.pdf

Frimpong, J., Lazarova, S. and Gaymerah, A.S., 2019. Anti-corruption Instrument and Economic

Giddens, A. 1984. The constitution of society: Outline of the theory of structuration. Berkeley, CA: University of California Press.

Godinez, M., Hechler, E., Koenig, K., Lockwood, S., Oberhofer, M. and Schroeck, M., 2010. *The art of enterprise information architecture: a systems-based approach for unlocking business insight*. Pearson Education.

Grbich, C. (2012). Qualitative data analysis: An introduction. Sage.

Growth: Evidence from SADC Member States. *Journal of Finance and Economics*, *7*(1), pp. 14-22.

Fritscher, B. & Pigneur, Y., 2015. A visual approach to business IT alignment between business model and enterprise architecture. *International Journl of Information System Modeling and Design (IJISMD),* 6(1), pp. 1-23.

Frogeri, R. F., Pardini, D. J. & Cunha, G. R., 2020. Information Technology Governance in a Higher Education Institution: An IT Professional's Perception Analysis. *International Journal of Human Capital and Information Technology Professionals (IJHCITP),* 11(1), pp. 31-46..

Frost, N., 2011. *Qualitative research methods in psychology: Combining core approaches*. McGraw-Hill Education (UK).

Gantz, S. & Maske, S., 2014. *The Basics of IT Audit Practical Information.* s.l.:Elsevier Inc..

Gartner, I., n.d. Gartner Enterprise Architecture Process: Evolution 2005. *Stamford: Gartner*

Gatobu, D. and Maende, C., 2019. Drivers of strategic alliances growth in the Kenya telecommunication industry: A case of Safaricom Limited. *International Academic Journal of Human Resource and Business Administration*, *3*(6), 71-92.

Giddens, A. 1979. *Central Problems in Social Theory*. London: Macmillan

Giddens, A. 1984. The constitution of society: Outline of the theory of structuration. Berkeley, CA: University of California Press.

Giddens, A., 1989. A reply to my critics. In: *Social theory in modern societies: Anthony Giddens and his critics.* Cambridge: Cambridge University Press.

Godwin, A. & Potvin, G., 2017. Pushing and pulling Sara: A case study of the contrasting influences of high school and university experiences on engineering agency, Identity and participation. *Journal of Research in Science Teaching,* 54(4), pp. 439-462.

Goldkuhl, G., 2012. Pragmatism vs interpretivism in qualitative information systems research. *European journal of information systems*, *21*(2), pp.135-146.

Gonçalves, A., Correia, A. and Cavique, L., 2017, June. Developing anti-bribery organization system based on quantitative pair-wise information an approach based on activity theory. In *2017 12th Iberian Conference on Information Systems and Technologies (CISTI)* (pp. 1-6). IEEE.

Gong, Y. & Janssen, M., 2019. The value of and myths about enterprise architecture. *International Journal of Information Management,* Volume 46, pp. 1-9.

Gray, D. E., 2013. *Doing research in the real word.* s.l.:Sage.

Gray, D.E., 2019. *Doing research in the business world*. Sage Publications Limited.

Grunow, S., Lenk, M. & Roth, S., 2012. KPIs fur die strategische Business/IT Alignment-Quantifizierung. *Informatiktage,* pp. 219-222.

Haes, S. D. & Grembergen, W. V., 2016. Enterprise Governance of Information Technology: Achieving Alignment and Value, Featuring COBIT 5.

Hammarberg, K., Kirkman, M. and Lacey, D., 2016. Qualitative research methods: When to use them and to judge them. *Human Reproduction,* 31(3), pp. 498-501.

Harkai, A., Cinpoeru, M. & Buchmann, R. A., 2018. Repurposing Zachman Framework Principles for "Enterprise Model"-Driven Engineering. *In ICEIS,* Volume 2, pp. 682-689.

Hasan, H. & Kazlauskas, A., 2014. Activity theory: Who is doing what, why and how.

Hasan, H. & Pfaff, C. C., 2012. An activity theory analysis of corporate wikis. *Information Technology & People,* 25(4), pp. 423-437.

Hasan, H., Smith, S. & Finnegan, P., 2017. An activity theoretic analysis of the mediating role of information systems in tackling climate change adaption. *Information Systems Journal,* 27(3), pp. 271-308.

Hassan, N.R., 2011. Is information systems a discipline? Foucauldian and Toulminian insights. *European Journal of Information Systems*, *20*(4), pp.456-476.

Hassan, N.R., Mingers, J. and Stahl, B., 2018. Philosophy and information systems: where are we and where should we go?.

Hashem, I. A. T. et al., 2015. The rise of "big data" on cloud computing: Review and open research issues. *Information Systems,* Volume 47, pp. 98-115.

Hashim, N. H. & Jones, M. L., 2007. Activity theory: A framework for qualitative analysis.

Hauder, M., Roth, S., Schulz, C. & Matthes, F., 2013. Current tool support for metrics in enterprise architecture management. *In Proceedings of the DASMA Software Metrik Kongress.*

Hayes, B.K., Heit, E. and Swendsen, H., 2010. Inductive reasoning. *Wiley interdisciplinary reviews: Cognitive science*, *1*(2), pp.278-292.

Hesse-Biber, S.N. and Leavy, P., 2010. *The practice of qualitative research*. Sage.

Hinkelman, K. et al., 2016. A new paradigm for the continous alignment of business and IT: Combining enterprise architecture modelling and enterprise ontology. *Computers in industry,* Volume 79, pp. 77-86.

Hjort-Madsen, K., 2007. Institutional patterns of enterprise architecture adoption in government. *Transforming Government: People, Processes and Policy,* 1(4), pp. 333-349.

Hjort-Madsen, K. & Pries-Heje, J., 2009. Enterprise architecture in government: Fad or future?. *In 2009 42nd Hawaii International Conference on System Sciences,* pp. 1-10.

Holen, J.B., Hung, W. and Gourneau, B., 2017. Does one-to-one technology really work: An evaluation through the lens of activity theory. *Computers in the Schools*, *34*(1-2), pp.24-44.

Home Affairs Vacancy 2022. Home Affairs Specialist Enterprise Architecture Job Vacancies in Pretoria.https://home-affairs.vacanciesjobs.co.za/home-affairs-specialist-enterprise-architecture-job-vacancies-in-pretoria/ [1 March 2022].

Hot Jobs Ghana. 2022. Jobs in Ghana. https://hotjobsghana.com/mtn-ghana-job-vacancy-manager-enterprise-architecture-jobs-in-ghana/ [1 March 2022].

Hrabe, P. and Buchalcevova, A., 2011. The Application Architecture Reference Model Blueprint. *Systémová Integr*, *1*, pp.84-92.

Hu, C.Y., Nisbet, G. and Chang, Y.C., 2022. Responding to change in a medical student rural community service: Insights from activity theory. Medical Education, 56(11), pp.1086-1095.

Hussein, S.S., Mahrin, M.N.R., Maarop, N. and Bakar, N.A.A., 2019, March. Content Validation of an Enterprise Architecture (EA) Readiness Assessment Instrument. In *Journal of Physics: Conference Series* (Vol. 1196, No. 1, p. 012047). IOP Publishing.

ICT Authority. 2016. Government ICT Standards. https://cms.icta.go.ke//sites/default/files/2022-02/General-guiding-principles-1-1.pdf

Internet World Stats. Usage and Population Statistics 2019. [Online] Available at https://www.internetworldstats.com/africa.htm#eg [Accessed 20 09 2020]

Irani, Z., Sharif, A., Kamal, M. M., & Love, P. E., 2014. Visualising a knowledge mapping of information systems investment evaluation. *Expert Systems with Applications*, *41*(1), 105-125.

Iyamu, T., 2013. Underpinning theories: order-of-use in information system research. *Journal of Systems and Information Technology,* 1(3), pp. 224-238.

Iyamu, T., 2015. *Application of Underpinning Theories in Information Systems.* Victoria: Heidelberg Press, Australia.

Iyamu, T., 2015b. *Enterprise Architecture: From concept to implementation.* s.l.:Heidelberg Press.

Iyamu, T., 2017. Understanding the Complexities of Enterprise Architecture through Structuration Theory. *Journal of Computer Information Systems, 59*(3), 287-295*..*

Iyamu, T., 2018. Implementation of the enterprise architecture through the Zachman Framework. *Journal of Systems and Information Technology,* 20(1), pp. 2-18.

Iyamu, T., 2019. What are the implications of theorising the enterprise architecture?. *Journal of Enterprise Transformation,* pp. 1-22.

Iyamu, T., 2020. Examining E-government enabling of E-health service through the lens of structuration theory. *International Journal of Sociotechnology and Knowledge Development (IJSKD)*, *12*(3), pp.26-40.

Iyamu, T., 2020. A Case for Applying Activity Theory in IS Research. *Information Resources Management Journal (IRMJ)*, *33*(1), pp.1-15.

Iyamu, T. 2021. Applying Theories for Information Systems Research. *London: Routledge*. https://doi.org/10.4324/9781003184119

Iyamu, T. & Adelakun, O., 2008. The Impact of Non-Technical Factors on Information Technology Strategy and E-Business. *Proceedings of the 12th Pacific Asia Conference on Information Systems,* pp. 1214-1222.

Iyamu, T. & Kekwaletswe, R., 2010. Importance of the distinction between information systems and information technology. *In 2010 2nd IEEE International Conference on Information Management and Engineering ,* pp. 324-348.

Iyamu, T. (2022). Enterprise Architecture for Strategic Management of Modern IT Solutions (1st ed.). *New York: Auerbach Publications*. DOI:10.1201/9781003268420

Iyamu, T., 2015. *Enterprise Architecture: From concept to implementation.* s.l.:Heidelberg Press.

Iyamu, T., & Roode, D. 2012. The Use of Structuration Theory and Actor Network Theory for Analysis. *International Journal of Actor-Network Theory and Technological Innovation*, *9*(4), 217-228.

Iyamu T., Nehemia-Maletzky, M. & Shaanika, I. 2016. The overlapping nature of Business Analysis and Business Architecture: what we need to know, *The Electronic Journal Information Systems Evaluation*, 19 (3), 169-179.

Iyamu, T. and Shaanika, I.N., 2018. Challenges in collecting qualitative data for information systems studies. In *Encyclopedia of Information Science and Technology, Fourth Edition* (pp. 4480-4489). IGI Global.

Jairak, K., Praneetpolgrang, . P. & Subsermsri, P., 2015. Information technology governance practices based on sufficiency economy philosophy in the Thai university sector. *Information Technology & People,* 28(1), pp. 195 - 223.

Jairak, K. & Praneetpolgrang, P., 2013. Applying IT governance balanced scorecard and *Management & Computer Security ,* 21(4), pp. 228-249.

Janssen, M., Flak, L. S. & Saebo, O., 2013. Government architecture: Concepts, use and impact. *Proceedings of the 12th IFIP WG 8.5 International Conference (EGOV 2013),* pp. 135-147.

Johns, F., 2021. Governance by data. *Annual Review of Law and Social Science*, *17*, pp.53-71.

Johnson, L., 2015. *Security Controls Evaluation, Testing, and Assessment Handbook.* s.l.:s.n.

Johnston, M.P., 2017. Secondary data analysis: A method of which the time has come. *Qualitative and quantitative methods in libraries*, *3*(3), pp.619-626.

Kaisler, S. & Armour, F., 2017. 15 Years of Enterprise Architecturing at HICSS: Revisiting the Critical Problems. *In Proceedings of the 50th Hawaii International Conference on System Sciences.*

Kaisler, S. H., Armour, F. & Valivullah, M., 2005. Enterprise architecting: Critical problems. *In Proceedings of the 38th Annual Hawaii International Conference on System Sciences,* pp. 224b-224b.

Kamel, S., 2010, October. The evolution of the ICT sector in Egypt–Partnership4Development. In *International Business Information Management Association (IBIMA) Conference on Innovation and Knowledge Management in Twin Track Economies: Challenges and Opportunities*. International Business Information Management Association (IBIMA).

Karimi, M., Sharafi, M., & Dehkordi, M. N., 2014. A new approach based on genetic algorithm for prioritizing quality scenarios in enterprise architecture evaluation. *International Journal of Computer Science Engineering (IJCSE),* 3(01), 21-31

Kante, M., Chepken, C. and Oboko, R., 2018. Partial least square structural equation modelling use in information systems: an updated guideline in exploratory settings. *Kabarak Journal of Research & Innovation*, *6*(1), pp.49-67.

Kaptelinin, V. & Nardi, B. A., 2006. *Acting with Technology: Activity theory and interaction design.* Cambridge(MA): The MIT Press.

Kapur, R., 2018. Research Methodology: Methods and Strategies.

Karanasios, S., 2018. Towards a unified view of technology and activity: the contribution of activity theory to informations system's research. *Information Technology & People,* 31(1), pp. 134-155.

Kaske, F., Kugler, M. and Smolnik, S., 2012, January. Return on investment in social media--Does the hype pay off? Towards an assessment of the profitability of social media in organizations. In *2012 45th Hawaii International Conference on System Sciences* (pp. 3898-3907). IEEE.

Katuu, S., 2018. The Utility of Enterprise Architecture to Records and Archives Specialists. *In 2018 IEEE International Conference on Big Data (Big Data),* pp. 2702-2710.

Kaushik, A. & Raman, A., 2015. The new data-driven enterprise architecture for e-healthcare: Lessons fromt the Indian public sector. *Government Information Quaterly,* 32(1), pp. 63-74.

Kirilenko, A.P. and Stepchenkova, S., 2016. Inter-coder agreement in one-to-many classification: fuzzy kappa. *PloS one*, *11*(3), p.e0149787.

Kivunja, C. and Kuyini, A.B., 2017. Understanding and applying research paradigms in educational contexts. *International Journal of Higher Education*, *6*(5), pp.26-41.

Klakegg, O. J., 2016 . Ontology and Epistemology. In B. Pasian (Ed.), Designs, Methods and Practices for Research of Project Management (p. 520). Routledge.

Klesel, M., Mokosch, G. & Niehaves, B., 2015. Putting flesh on the Duality of Structure: the case of IT Consumerization.

Klischewski, R., 2014. From e-government strategy to services: challenges of inter-organisational IT governance in Egypt. *In Proceedings of the 8th International Conference on Theory and Practice of Electronic Governance,* pp. 190-199.

Klischewski, R. and Abubakr, R., 2010, January. Can e-government adopters benefit from a technology-first approach? The case of Egypt embarking on service-oriented architecture. In *2010 43rd Hawaii International Conference on System Sciences* (pp. 1-10). IEEE.

Kornbluh, M., 2015. Combatting Challenges to Establishing Trustworthiness in Qualitative Research.

Kotusev, S., 2016. *The Critical Scrutiny of TOGAF.* [Online] Available at: http://www.bcs.org/content/conWebDoc/55892 [Accessed 27 02 2020].

Kotusev, S., 2017. Conceptual model of enterprise architecture management. *International Journal of Cooperative Information Systems,* 26(03), p. 1730001.

Kotusev, S., 2018. TOGAF-based Enterprise Architecture Practice: An Exploratory Case Study. *Communications of the Association for Information Systems,* 43(1), pp. 321-359.

Kotusev, S., Singh, M. & Storey, I., 2017. A Framework Free Look at Enterprise Architecture. *Journal of Enterprise Architecture,* 13(1), pp. 15-21.

Koyuncu, I. and Kılıç, A.F., 2019. The use of exploratory and confirmatory factor analyses: A document analysis. *Egitim Ve Bilim*, *44*(198).

Kriouile, H. & Kriouile, A., 2015. Towards services-based enterprise architecture for cloud computing-opened information systems. *Journal of Computers,* 10(3), pp. 195-203.

Kuutti, K., 1995. Activity Theory as a Potential Framework for Human-Computer Qualitative research in Psychology, 12(4), pp. 397 - 414.

Kroeze, J. H., 2012. Postmodernism, Interpretivism, and Formal Ontologies. In: *Research Methodologies, Innovations and Philosophies in Software Systems Engineering and Information Systems.* s.l.:British Cataloguing, pp. 41-62.

Kumar, S., 2018. Understanding different issues of unit of analysis in a business research. *Journal of General Management Research*, *5*(2), pp.70-82.

Kurek, E., Johnson, J. and Mulder, H., 2017. Measuring the value of enterprise architecture on IT projects with CHAOS research. *MSCI, Orlando, USA*.

Kurnia, S., Linden, T. and Huang, G., 2019. A hermeneutic analysis of critical success factors for Enterprise Systems implementation by SMEs. *Enterprise Information Systems*, *13*(9), pp.1195-1216.

Interaction Research. In: *Context and Consciousness: Activity Theory and Human Computer Interactions.* MA: MIT Press, pp. 17-44.

Lagestrom, R., Sommestad, T., Buschle, M. & Ekstedt, 2011. Enterprise architecture management's impact on information technology success. *In System Sciences*

Lal, B., Ismagilova, E., Dwivedi, Y.K. and Kwayu, S., 2020. Return on investment in social media marketing: Literature review and suggestions for future research. *Digital and social media marketing*, pp.3-17. *(HICSS), 2011 44th Hawaii International Conference, 4-7* January. Kauai, HI, pp. 1-10.

Lapalme, J., Gerber, A., Van der Merwe, A., Zachman, J., De Vries, M. and Hinkelmann, K., 2016. Exploring the future of enterprise architecture: A Zachman perspective. Computers in Industry, 79, pp.103-113.

Latour, B., 1987. *Science in Action: How to Follow Scientists and Engineers Through Society.* Cambridge: Havard University Press.

Lawrence, J., 2010. The factors that influence adoption and usage decisio in SMEs: evaluating intrpretive case study research information systems. *The Electronic Journal of Business Research Mehtods,* 8(1), pp. 51-62.

Leont'ev, A. N., 1981. The problem of activity in psychology. In: *The Concept of Activity in Soviet Psychology.* New York(NY): Sharpe, pp. 41-68.

Liimatainen, K., 2008. Evaluating benefits of government enterprise architecture. *In 31st Information Systems Research Seminar in Scandinavia.*

Liimatainen, K., Hoffmann, M. & Heikkila, J., 2007. Overview of Enterprise Architecture work in 15 countries. *Ministry of Finance, State IT Management Unit, Research reports 6b.*

Lnenicka, M. & Komarkova, J., 2019. Developin a government enterprise architecture framework to support the requirements of big and open linked data with the use of cloud computing. *International Journal of Information Management,* Volume 46, pp. 124-141.

Luisi, J., 2014. Pragmatci enterprise architecture: Strategies to transform information systems in the era of big data. *Waltham: Morgan Kaufmann.*

Ma, L., 2010. Theory and Education: A case of structuration theory.

Mago, B., 2015. Adoption of Green Information Technology for Sustainable Development in Context of UAE. *2015 International Conference on Developments of E-Systems Engineering (DeSE),* pp. 265-269.

Makovhololo, M. L. & Ruxana, L. N., 2017. Use of DOI to establish the effects of GEWA implementation: a case of South African gvoernment.

Makovhololo, P., Shaanika, I.N., Sekgweleo, T. and Okigui, H.H., 2017. Use of Activity Theory to comprehend the impacts of communication barriers in healthcare data analytics. International Journal of Computer Science and Information Security (IJCSIS), 15(9).

Mapuva, J.W.M., 2014. The SADC regional bloc: What challenges and prospects for regional integration? Law, Democracy & Development, 18 (1), pp. 22-36.

Marosin, D. & Ghanavati, S., 2015. Measuring and managing the design restrictions of enterprise architecture (EA) principles on EA models. *In Requirements Engineering and Law (RELAW), 2015 IEEE Eighth International Workshop,* pp. 37-46.

Matthes, F., Monahov, I., Schneider, a. & Schulz, C., 2012. EAM Catalog v 1.0. *Technische Universitat Munchen.*

McCaffrey, G., Raffin-Bouchal, S. and Moules, N.J., 2012. Hermeneutics as research approach: A reappraisal. *International Journal of Qualitative Methods*, *11*(3), pp.214-229.

McMichael, H., 1999. An activity-based perspective for information systems research. In *10th Amsterdam Conference on Information Systems. In proceedings*.

McPhee, R. D. & Canary, H. E., 2016. Structuration theory. *The International Encyclopedia of Communication Theory and Philosophy,* pp. 1-15.

Mensah, I.K., 2016. Overview of E-government Adoption and Implementation in Ghana. World Academy of Science, Engineering and Technology, International Science Index 109, International Journal of Social, Behavioral, Educational, Economic, Business and Industrial Engineering, 10(1), pp.61-72.

Meneklis, V. and Douligeris, C., 2010. Bridging theory and practice in e-government: A set of guidelines for architectural design. *Government Information Quarterly*, *27*(1), pp.70-81.

Mensah, I. K., 2016. Overview of E-government Adoption and Implementation in Ghana. *World Academy of Science, Engineering and Technology, International Science Index 109,* 10(1), pp. 61-72.

Meriyem, C. A. S. & Hicham, M., 2015. IT Governance otology building process: example of develpoing audit ontology. *International Journal of Computer Techniques,* 2(1), pp. 134-141.

Miyamoto, M., 2021. Information Technology Governance of Japanese Companies; An Empirical Study. *Computer Science & Information Technology (CS & IT), Computer Science & Information Technology (CS & IT)*, *11*(07), pp.29-40.

Ministry of Communication and Digitalisation. 2019. Request for Expression of Interest. https://www.moc.gov.gh/downloads?page=5

Ministry of ICT, Innovation and Youth Affairs. 2018. National Broadband Strategy. https://www.ict.go.ke/wp-content/uploads/2019/05/National-Broadband-Strategy-2023-FINAL.pdf

Ministry of State for Administrative Development. 2006. Egyptian Government Enterprise Architecture Framework. Cairo, Egypt; http://www.egypt.gov.eg/english/documents

Mithas, S. & Rust, R., 2016. How Information Technology Strategy and Investments influence Firm Performance: Conjecture and Empirical Evidence. *MIS Quarterly,* 40(1), pp.223-245.

Moawad, N., Liu, K. and El-Helly, M., 2013, July. Integrating activity theory and semiotics as knowledge elicitation technique. In 2013 14th ACIS International Conference on Software Engineering, Artificial Intelligence, Networking and Parallel/Distributed Computing (pp. 137-142). IEEE

Mohamed, M.A., Galal-Edeen, G.H., Hassan, H.A. and Hasanien, E.E., 2012, November. An evaluation of enterprise architecture frameworks for e-government. In 2012 Seventh International Conference on Computer Engineering & Systems (ICCES) (pp. 255-260). IEEE.

Mohamed, M.A., Galal-Edeen, G.H. and Hassan, H.A., 2013, June. Towards adoption of government enterprise architecture: The cases of Egypt and Syria. In Proc. 13th European Conference on eGovernment (ECEG 2013), Academic Conferences Limited (p. 345).

Morse, J.M., 2016. Mixed method design: Principles and procedures (Vol. 4). Routledge.

Muladi, N. & Surendro, K., 2014. The readiness self-assessment model for green IT implementation in organisations. *In 2014 International Conference of Advanced Informatics: Concept, Theory and Application (ICAICTA),* pp. 146-151.

National Information Technology Agency. 2009. Ghana e-Government Interoperability Framework. https://nita.gov.gh/theevooc/2017/12/Ghana-eGovernment-Interoperability-Framework.pdf [28February 2022]

National Information Technology Agency. 2009. Ghana Government eGIF Implementation Plan. https://nita.gov.gh/theevooc/2017/12/e-GIF-Implementation-Plan.pdf [28February 2022]

National Information Technology Agency. 2009. Ghana Government Enterprise Architecture Framework. https://nita.gov.gh/theevooc/2017/12/GGEA-Implementation- Guide.pdf

National Information Technology Agency. 2009. https://nita.gov.gh/theevooc/2017/12/GGEA-Assessment-Framework.pdf

National Information Technology Agency. 2009. Ghana Government Enterprise Architecture Implementation Plan. https://nita.gov.gh/theevooc/2017/12/GGEA-Implementation-Guide.pdf

Naukrigulf, 2022. Enterprise Architecture Vacancy. https://www.naukrigulf.com/enterprise-architect-jobs-in-cairo-egypt-in-b-tech-7-to-10-years-n-cd-20010162-jid-070122500115

Neely, A., Gregory, M. & Platts, K., 2005. Performance measurement system design: A literature review and research agenda. *International journal of operations & production management,* 25(12), pp. 1228-1263.

Nehemia-Maletzky, M., Iyamu, T. & Shaanika, I., 2018. The use of activity theory and actor network theory as lenses to underpin information systems studies. *Journal of Systems and Informatio Technology,* 20(2), pp. 191-206.

Nieman, K. D., 2006. *From Enterprise Architecture to IT Governance-Elements of Effective IT Management.* Wiesbaden: Vieweg.

Niemi, E. & Pekkola, S., 2013. Enterprise architecture quality attributes: a case study. *Proceedings of System Sciences 46th Hawaii International Conference,* pp. 3878- 3887.

Niemi, E. I. & Pekkola, S., 2016. Enterprise architecture benefit realisation: Review of the models and a case study of a public organisation. *The Data Base for Advances in Information Systems,* 47(3), pp. 55-80.

Niemi, E. & Pekkola, S., 2017. Using Enterprise Architecture Artefacts in an Organisation

Neuman, W. L., 2011. Social Research Methods: Qualitative and Quantitative Approaches (D. Musslewhite Ed. 7th ed.). USA: Allyn and Bacon.

Nguyen, T.T.L., 2019. Selection of Research Paradigms in English Language Teaching: Personal Reflections and Future Directions. KnE Social Sciences, pp.1-19.

Nikpay, F., Ahmad, R. & Kia, C. Y., 2017. A hybrid method for evaluating enterprise architecture implementation. *Evaluating and program planning,* Volume 60, pp.

Nogueira, J. M., Romero, D., Espadas, J. & Molina, A., 2013. Leveraging the Zachman framework implementation using action-research methodology - a case study: aligning the enterprise architecture and the business goals. *Enterprise Information Systems,* 7(1), pp. 100-132.

Nygard, M. & Olsen, D. H., 2016. Enterprise architecture implementation challenges: an exploratory study of the Norwegian health sector.

Odongo, A.O., Kang, S. and Ko, I.Y., 2010, August. A scheme for systematically selecting an enterprise architecture framework. In *2010 IEEE/ACIS 9th International Conference on Computer and Information Science* (pp. 665-670). IEEE.

OECD, 2013. OECD e-Government Studies: Egypt 2012, OECD Publishing; https://doi.org/10.1787/9789264178786-en [28 February 2022]

Ogundipe, S.A., 2020. *The role of enterprise architecture in the business and information technology alignment of a public organisation in South Africa* (Doctoral dissertation, Cape Peninsula University of Technology).

Osei-Kojo, A., 2017. E-government and public service quality in Ghana. Journal of Public Affairs, 17(3), p.e1620.

Österlind, M., Johnson, P., Karnati, K., Lagerström, R. and Välja, M., 2013, September. Enterprise architecture evaluation using utility theory. In *2013 17th IEEE International Enterprise Distributed Object Computing Conference Workshops* (pp. 347-351). IEEE.

Peachey, P., 2010. The application of 'activiy theory' in the design of educational simulation games. *In design and implementation of educational games: Theoretical and practical perspective 2010,* pp. 154-167.

Pearlson, K.E. and Saunders, C.S., 2009. *Strategic management of information systems: international student version*. Hoboken, NJ: Wiley.

Peral, J., Mate, A. & Marco, M., 2017. Application of data mining techniques to identify relevant key performance indicators. *Computer Standards & Interfaces,* Volume 54, pp. 76-85.

Pirola, F., Cimini, C. and Pinto, R., 2019. Digital readiness assessment of Italian SMEs: a case-study research. *Journal of Manufacturing Technology Management*.

Plataniotis, G., De Kinderen, S. & Proper, H. A., 2014. EA anamnesis: An approach for decision making analysis in enterrpise architecture. *International Journal of Information System Modeling and Design (IJISMD),* 5(3), pp. 75-95.

Plessius, H., Steenbergen, M. & Utrecht, N. L., 2019. A study into the classification of enterprise architecture benefits.

Popova, V. & Sharpanskykh, A., 2010. Modeling organisation performance indicators. *Information systems,* 35(4), pp. 505-527.

Posseborn, M. & Pinsoneault, A., 2005. Challenges in conducting empirical work using structuration theory: Learning from IT research. *Organisation studies,* 26(9), pp. 1353-1376.

Puron-cid, G., 2013. Interdisciplinary application of structuration theory for e-government: A case study of an IT-enabled budget reform. *Government Information Quaterly,* 30(1), pp. 46-58.

Queirós, A., Faria, D. and Almeida, F., 2017. Strengths and limitations of qualitative and quantitative research methods. *European Journal of Education Studies*.

Qureshi, S., 2015. Are we making a better world with information and communication technology for development (ICT4D) research? Findings from the field and theory building.

Qurratuaini, H., 2018. Designing enterprise architecture based on TOGAF 9.1 framework. *In IOP Conference Series: Materials Science and Engineering ,* September, 403(1), pp. 012065.

Rahman, R.F.A., 2011. Analysis of ICT Diffusion in Egypt.

Ramsook, L., 2018. A methodological approach to hermeneutic phenomenology. *International Journal of Humanities and Social Sciences*, *10*(1), pp.14-24

Razafimampianina, R. M., Nouinou, S., Doukkali, A. S. & Regragui, B., 2015. A preliminary study on indicator framework for enterprise, based on COBIT 5 processes and SOA approach. *In 5th Workd Congress on Information and Communicatjion Technologies (WICT),* pp. 95-100.

Rijo, R., Martinho, R. & Ermida, D., 2015. Developing an enterprise architecture proof of concept in Portugues hospital. *Procedia Computer Science,* Volume 64, pp. 1217-1225.

Ritchie, J. et al., 2013. *Qualitative research practice: A guide to social science students and researchers.* s.l.:Sage.

Ritchie, J., Lewis, J., Nicholls, C. and Ormstons, R., 2013. *Qualitative research practice: A guide for social students an researchers.* s.l.:Sage.

Roky, H. and Al Meriouh, Y., 2015. Evaluation by users of an industrial information system (XPPS) based on the DeLone and McLean model for IS success. *Procedia Economics and Finance*, *26*, pp.903-913.

Rodriques, L. S. & Amaral, L., 2010. Issues in enterprise architecure value. *Journal of Enterprise Architecture,* 6(4), pp. 27-32.

Rose, J. and Scheepers, R., 2001. Structuration theory and information system development-frameworks for practice. ECIS 2001 Proceedings, p.80.

Rouhani, B. D., Mahrin, M. N. R., Nikfard, P. & Najafabadi, M. K., 2015. Factors that affect the effectiveness of enterprise architecture implementation methodology. *World Academy of Science, Engineering and Technology International Journal of Social, Education, Economics and Management Engineering,* 9(1), pp. 19-25.

Safari, H., Faraji, Z. & Majidian, S., 2016. Identifying and evaluating enterprise architecture risks using FMEA and fuzzy VIKOR. *Journal of Intelligent Manufacturing,* 27(2), pp. 475-486.

Saha, P., 2010. EA as platfrom for connected government: Advancing the Whole of Government Enterprise Architecture Adoption with Strategic (Systems) Thinking. *NUS Institute of Systems Sciences.*

Sanchez-Puchol, F., Pastor-Collado, J.A. and Borrell, B., 2017. Towards an unified information systems reference model for higher education institutions. *Procedia computer science*, *121*, pp.542-553.

Sambamurthy, V. and Zmud, R.W., 1999. Arrangements for information technology governance: A theory of multiple contingencies. *MIS quarterly*, pp.261-290.

Sarason, Y., Dean, T. and Dillard, J.F., 2006. Entrepreneurship as the nexus of individual and opportunity: A structuration view. *Journal of business venturing*, *21*(3), pp.286-305.

Saunders, M., Lewis, P. and Thornhill, A., 2009. *Research methods for business students fifth edition.* England: Prentic Hall Financial times.

Savela, N., Salahub, J. and Keinänen, M.M., 2018. Doing business in SADC region: Central Baltic SME Aisle for maritime and ports, ICT, automation, renewable energy and machinery in Southern African markets.

Schelp, J. & Stutz, M., 2007. A balanced scorecard approach to measure the value of enterprise architecture. *In 2nd Workshop on Trends in Enterprise Architecture Research,* pp. 5-11.

ScholarshipDb.Net., 2022. Enterprise System Architect Vacancy. https://scholarshipdb.net/jobs-in-Egypt/Enterprise-Systems-Architect-American-University-In-Cairo=5O_lKfYx7BGUYAAlkGUTnw.html?r_id=29a5efe4-31f6-11ec-9460-00259065139f

Scotland, J., 2012. Exploring the Philosophical Underpinnings of Research: Relating Ontology and Epistemology to the Methodology and Methods of the Scientific, Interpretive, and Critical Research Paradigms. *English Language Teaching*, *5*(9).

Sekgweleo, T., & Iyamu, T., 2022. Understanding the factors that influence software testing through moments of translation. *Journal of Systems and Information Technology*, 24(3), 202-220.

Seppanen, V., Heikkila, J. and Liimatainen, K., 2009, July. Key issues in EA-implementation: case study of two Finnish government agencies. In 2009 IEEE Conference on Commerce and Enterprise Computing (pp. 114-120). IEEE.

Shaanika, I., & Iyamu, T., 2015. Deployment of enterprise architecture in the Namibian government. The use of activity theory to examine the influencing factors. *The Electronic Journal of Information Systems in Developing Countries, 71* (1), 1-21.

Shaanika, I., & Iyamu, T., 2018. Developing the enterprise architecure for the Namibian government. *the Electronic Journal of Information Systems in Developing Countries , 84* (3), e12028.

Shah, H., & El Kourdi, M., 2007. Frameworks for enterprise architecture. *IT Professional , 9* (5), 36-41.

Shanks, G., Gloet, M., Someh, I. A., Frampton, K., & Tamm, T., 2018. Achieving benefits with enterprise architecture. *The Journal of Strategic Information Systems, 27* (2), 139-156.

Siemonova, B., 2017). Transactive memory system and Web 2.0 in knowledge sharing: A conceptual model based on activity theory and critcal realism. *Information System Journal , 28* (4), 592-611

Simon, D., Fischabach, K., & Shoder, D., 2014. Enterprise architecture management and its role in corporate strategic management. *Information Systems and e-Business Management, 12* (1), 4-42.

Silverman, D., 2015. *Interpreting qualitative data*. Sage.

Spinuzzi, C., 2011. Losing by expanding: corralling the runaway object. *Journal of Business and Technincal Communication, 25* (4), 449-486.

Stair, R., & Reynolds, G., 2013. *Principles of information Systems.* Cengage Learning.

State Information technology Agency. 2009. Annual Report. https://www.sita.co.za/annual-reports [1 March 2022]

Tamm, T., Seddon, P., Shanks, G. & Reynolds, P., 2011. How does Enterprise Architecture Add Value to Organisations?. Communications fo the Association for Information Systems, 28(1), pp. 141-168.

Tamm, T., Seddon, P.B. and Shanks, G., 2022. How enterprise architecture leads to organisational benefits. *International Journal of Information Management*, *67*, p.102554.

Tao, Z. G., Luo, Y. F., Chen, C. X., Wang, M. Z., & Ni, F., N., 2017. Enterprise application architecture development based on DoDAF and TOGAF. *Enterprise Information Systems, 11* (5), 627-651.

Tchao, E.T., Keelson, E., Aggor, C. and Amankwa, G.A.M., 2017, December. e-Government Services in Ghana—Current State and Future Perspective. In *2017 International Conference on Computational Science and Computational Intelligence (CSCI)* (pp. 624-631). IEEE.

Thanh, N.C. and Thanh, T. T., 2015. The interconnection between interpretivist paradigm and qualitative methods in education. *American Journal of Educational Science*, *1* (2), pp.24-27.

Thirasakthana, M. and Kiattisin, S., 2021. Sustainable government enterprise architecture framework. *Sustainability*, *13*(2), p.879.

Trad, A., 2019. The Business Transformation Framework and Enterprise Architecture Framework for Managers in Business Innovation.

The Open Group. (2009). TOGAF Version 9.https://www.opengroup.org/architecture/togaf8/ [1 April 2022]

Thirsk, L.M. and Clark, A.M., 2017. Using qualitative research for complex interventions: the contributions of hermeneutics. *International Journal of Qualitative Methods*, *16*(1), p.1609406917721068

Tobin, K., Milne, C., & Plakitsi, K., 2013. *Activity Theory in Formal and Informal Science Education.* Rotterdam, NLD: Sense Publishers.

Tungela, N., Mutudi, M. and Iyamu, T., 2018, October. The roles of e-government in healthcare from the perspective of structuration theory. In *2018 Open Innovations Conference (OI)* (pp. 332-338). IEEE

Tupper, C. (2011). Data Architecture: from zen to reality. *Elsevier*.

Vahed, A., Ross, A., Francis, S., Millar, B., Mtapuri, O. and Searle, R., 2018. Research as transformation and transformation as research. *Spaces, journeys and new horizons for postgraduate supervision*, *12*, p.317.

Vaismoradi, M., Jones, J., Turunen, H. and Snelgrove, S., 2016. Theme development in qualitative content analysis and thematic analysis. Journal of Nursing Education and Practice 2016, Vol. 6 (5) pp. 100-110

Van Leeuwen, C.A., Guo-Brennan, L. and Weeks, L.E., 2017. Conducting hermeneutic research in international settings: Philosophical, practical, and ethical considerations. *Journal of Applied Hermeneutics*.

Valor, C., Antonetti, P. and Carrero, I., 2018. Stressful sustainability: a hermeneutic analysis. *European Journal of Marketing*.

Van Leeuwen, C.A., Guo-Brennan, L. and Weeks, L.E., 2017. Conducting hermeneutic research in international settings: Philosophical, practical, and ethical considerations. *Journal of Applied Hermeneutics*.

Van Leeuwen, C.A., Guo-Brennan, L. and Weeks, L.E., 2017. Conducting hermeneutic research in international settings: Philosophical, practical, and ethical considerations. *Journal of Applied Hermeneutics*.

Varpio, L., Paradis, E., Uijtdehaage, S. and Young, M., 2020. The distinctions between theory, theoretical framework, and conceptual framework. *Academic Medicine*, *95*(7), pp.989-994.

Van Zijl, C., & Van Belle, J. P. (2014). Organisatinal impact of enterprise architecture and business process capability in South African organisation. *International Journal of Trade, Economics and Finance , 5* (5), 405-413.

Venkatesh, V., Brown, S. A. and Bala, H., 2013. Bridging the quantitiative divide: Guidelines for conducting mixed methods research in information systems. *MIS Quaterly,* 37(1), pp. 21-54.

Verma, V., & Chandra, B., 2016. Strategic information and communication technology initiatives in hospitality industry to gain sustainable competitive advantage: A framework for evaluating the response lag perspective. *In Recent Advances in Informatin Technology (RAIT), 2016 3rd International Conference on*, 646-650.

Vyas, D., Chisalita, C. M. & Dix, A., 2017. Organisational affordance: A structuration theory approach to affordance. *Interacting with Computers,* 29(2), pp. 117-131.

Wahab, I. H., & Arief, A., 2015. An integrative framework of COBIT and TOGAF for designing IT governance in local government. *In 2015 2nd International Conference on Information Technology, Computer and Electrical Engineering (ICITACEE)* , 36-40.

Walsham, G., 1995. Interpetive case studies in IS research: Nature and Method. *European Journal of Information Systems , 4* (1), 74-81.

Walsham, G., 2018. Research methodologies for information systems in the development context: a tutorial. In: Madon S, Krishna S (eds) The digital challenge: information technology in the development context: information technology in the development context. Routledge, Abingdon

Walliman, N., 2017. *Research methods: the basics.* s.l.:Routledge.

Williams, C., 2011. Research Methods. *Journal of Business & Economics Research (JBER),* 5(3), pp. 65-71.

Wang, X., & Zhou, X., 2009. Information resources planning based on enterprise architecture. . *Paper presented at the Proceedings of the International Conference on Service Operations, Logistics and Informatics (SOLI '09)*, 230-234.

Wiedenhöft, G.C., Luciano, E.M. and Pereira, G.V., 2020. Information technology governance institutionalization and the behavior of individuals in the context of public organizations. *Information Systems Frontiers*, *22*(6), pp.1487-1504.

Walliman, N., 2017. *Research methods: the basics.* s.l.:Routledge.

Williams, C., 2011. Research Methods. *Journal of Business & Economics Research (JBER),* 5(3), pp. 65-71.

Xu, X., Zheng, J., Yang, J.B., Xu, D.L. and Chen, Y.W., 2017. Data classification using evidence reasoning rule. *Knowledge-Based Systems*, *116*, pp.144-151.

Yazan, B., 2015. Three approaches to case study methods in educatjion: Yin, Merriam, and Stake. *The qualitative report,* 20(2), pp. 134-152.

Yilmaz, K., 2013. Comparison of quantitative and qualitative research traditions: Epistemological, theoretical, and methodological differences. *European journal of education*, *48*(2), pp.311-325.

Yin, R.K., 2003. Case study research: design and methods (ed.). *Thousand Oaks*.

Yu, E., Strohmaier, M., & Deng, X., 2006. Exploring intentional modeling and analysis for enterprise architecture. *In 2006 10th IEEE International Enterprise Distributed Object Computing Conference Workshops (EDOCW'06)*, 32-32.

Yujie, N., & Xindi, W., 201). Research on the matching of IT strategic planning and business strategy. *International Conference on Computer Science and Information Technology (ICCSIT), 2010 3rd IEEE* (pp. 177 - 181). IEEE Conference Publications.

Zachman, J.A., 1987. A framework for information systems architecture. *IBM systems journal*, *26*(3), pp. 276-292.

Zondani, T. and Iyamu, T., 2021. Towards an Enterprise Business Architecture Readiness Assessment Model. In *Empowering Businesses With Collaborative Enterprise Architecture Frameworks* (pp. 90-109). IGI Global.