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Knowledge Management support for Enterprise Architecture adoption in a Motor Vehicle and Asset Finance bank in South Africa: A Quantitative Approach

Mini-dissertation by

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Declaration

I declare that this mini-dissertation, submitted by me, is my own work, that I have referenced all the sources that I have used and that no part was previously submitted at any tertiary institution.

Innocent Gumede

ABSTRACT

Enterprise architecture (EA) has become a commonly accepted approach to help organisations transform in an orderly and foresighted manner (Perez, 2014). As a result, organisations are increasingly looking to EA to manage their complex environments. However, EA doption has been found to be difficult. This is further emphasised by Aier's (2014) caution that introducing and conforming to EA limits the design freedom of the members of the organization and literature on institutional theory indicates that such constraints have a potential to lead to significant resistance within an organisation. A survey conducted by the Rotterdam University in 2008 showed a 66% failure rate of EA initiatives, which further highlights the magnitude of the challenge.

This research focuses on finding out how knowledge management (KM) and its associated processed can be used to successfully adopt EA in a motor vehicle and asset finance bank in South Africa. It is further hoped that this study will raise the level of understanding of EA so that future EA initiatives become more aligned with expectations of the important stakeholders.

This research used a quantitative approach to obtain the EA perspectives of important organizational stakeholders that have an influence on the success of EA initiatives. Data was collected from 84 participants who were selected using a non-probability purposive sampling method. Data collection for this research was through an online questionnaire.

Some of the key findings of the research revealed that EA is well recognized and perceived to be important. In addition, EA is widely expected to integrate, standardize and/or eliminate duplication of related processes and systems. It is also expected to enable the organization to respond to changes in the outside world in an agile fashion. Business efficiency, IT and/or Business governance and Decision making are perceived as having improved as a result of EA. One of the significant barriers to successful EA adoption is that there is a poor level of knowledge sharing between members of the organization and the EA team. Five KM interventions to overcome EA adoption barriers were suggested and the findings are that increasing the level of involvement of EA users/ stakeholders in EA development is perceived to have the greatest impact.

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ACRONYMS

Acronym	Description
EA	Enterprise Architecture
KM	Knowledge Management
IT	Information Technology
ICT	Information and Communication Technology
EAF	Enterprise Architecture Framework
POPI	Protection of Personal Information
TOGAF	The Open Group Architecture Framework
AML	Anti Money Laundering
FICA	Financial Intelligence Centre Act
VAF	Vehicle and Asset Finance

CHAPTER 1: Introduction to the research study

1.1 Introduction

Companies operate in a constantly changing world and to ensure sustainability, they must also continuously transform, adapt and evolve (Saadé & Wan, 2013). The task of transforming an organization to enable it to continue exploiting opportunities is a complex one, and is further aggravated by the complicated architecture of the overall organisation (Buckl, et al., 2010a). Attempts to introduce new business processes or IT systems, usually have unforeseen consequences and potentially negative effects on the organisation's existing state of operations (Saadé & Wan, 2013). Enterprise architecture (EA) has become a commonly accepted approach to help organisations transform in an orderly and foresighted manner (Perez, 2014). To this end, organisations operating in the South African motor vehicle and asset finance industry need to be able to introduce new products and terminate non-performing ones in a timely and efficient manner. It is also vital that the supporting business processes and IT systems are transformed in a non-chaotic manner.

EA comes with a promise to "***simplify IT***" (Bente, et al., 2012). In addition, EA is considered to be a promising means to achieve and maintain alignment between the shifts in organisational strategy, business processes and an increasingly complex IT landscape (Löhe & Legner, 2014). (Pham, et al., 2013) considers EA to be "a set of artifacts and processes used to translate an organization's business strategy into an IT roadmap" with the aim to "help make the organization's business strategy happen." EA is therefore positioned to support strategic enterprise planning by establishing the best use of available information, processes and technology in fulfilling business and IT strategies.

According to (Struck, et al., 2010), the complexity of business transactions and rate of changes in the business models have increased as a result of globalisation and international competition. In the context of the South African motor vehicle and asset finance industry, which is a segment of the South African banking industry, this sector is highly regulated with legislations such as FICA, AML, and POPI adding further complexity to the banks' business processes and IT landscape. As a result, organizations in this industry, similar to organisations in other industries are increasingly looking to EA to manage their complex environments (Banaeianjahromi & Smolander, 2016).

However, EA is a highly invasive endeavour that involves interactions with all the various dimensions of an organization and it has been found to be difficult (Syynimaa, 2015). The wide scope of EA further compounds the situation as emphasised by Jahani, et al. (2010) when they pointed out that, "the cultural, humanistic, technical, structural and procedural dimensions all over the organization

are essential issues in the successful execution of enterprise architecture". The role of the members of the organisation is also emphasised by Gilliland, et al. (2015, p. 43) when they noted that, "humans are not only responsible for management of business and information exchange operations of enterprises, but modern enterprises are perceived as human-driven". Strategic initiatives such as EA therefore depend on inter alia effective human involvement. In the context of EA initiatives, Aier (2014) cautions that introducing and conforming to EA limits the design freedom of the members of the organization and literature on institutional theory indicates that such constraints have a potential to lead to significant resistance within the organisation (Aier & Weiss, 2012).

There is therefore, a need for solutions to overcome the difficulties encountered during EA implementations in order to conduct EA successfully. According to Buckl and Schweda (2009), information collection, communication, and exchange are important constituents of EA. They further point out that these are also key constituents of knowledge management (KM).

KM has been found to enable an organization to use "its collective intelligence to accomplish its strategic objectives" (Wang & Yang, 2016) as it ensures that knowledge of all kinds is created, communicated and applied to achieve business goals. It is regarded as "the process of identifying, managing and leveraging individual and collective knowledge to support the firm becoming more competitive" (Liao, 2003). Further, it has been found that KM is able to address and improve organisational culture, people issues, technical, structural and procedural elements of an organisation (Corfield & Paton, 2016).

It is against this backdrop that in this study the reseacher will investigate the integration of KM and EA for the success of EA in the context of a South African motor vehicle and asset finance bank.

1.2 Background to the problem

Financial institutions are typically comprised of various lines of business that operate in silos which then creates unwanted complexity and duplication (Premchand, et al., 2016). Invariably, over time, these institutions end up with a multitude of technologies implemented in response to changes in their operating environments. There is often a lack of interoperability and integration between these various technologies. The resultant costs, lack of agility, difficult maintenance and other considerations require these institutions to adopt enterprise architecture (EA).

Herzum in (Trinskjær, 2009) offered an EA metaphor which recognises the dynamic nature of EA, suggesting that a better metaphor for EA would be "to transform a skyscraper into a totally different skyscraper while everyone residing in the first skyscraper still lives there". He argues that EA is not only about documentation, it is also about transformation and modelling for change.

However, EA adoption is a resource intensive undertaking requiring significant investments in costs, time and effort. As a result, a poorly executed EA results in significant losses and problems for the organisation. However, successful EA implementation offers a wide range of benefits to an organisation, including reduced complexity, cost savings, more effective decision-making processes, successful delivery of transformation projects and the strategic capability arising from the better digital business platform built during the transformation (Tamm, et al., 2015).

In addition, EA provides tangible and descriptive artefacts that allow organisations to decipher their complexity and assist them to manage change. While there is no consensus on the definition of EA, one of the widely cited definitions is offered by Niemi and Pekkola (2013,), who view EA as an approach to "managing the complexity of an organization's structures, information technology (IT) and business environment, and facilitating the integration of strategy, personnel, business and IT towards a common goal through the production and use of structural models providing a holistic view of the organization" (Niemi & Pekkola, 2013). This definition captures the fundamental elements that are vital for the discussion of EA in this study. The scope covered by this EA definition, together with Jahani, et al's (2010) observation that the success of EA is impacted by the different dimensions e.g. the cultural, humanistic, technical, structural and procedural aspects of the organisation reveal that implementing EA is a complex endeavour (Deng, 2006).

Kaisler, et al. (2005) presented some of the major challenges that must be overcome in order to realise the benefits of EA. Their work was complemented by the works of (Chuang & van

Loggerenberg, 2010) which found that the challenges facing EA adoption are mostly of a non-technical nature.

In search of possible solutions to the factors hindering the success of EA initiatives, the researcher examined studies by Corfield and Paton (2016) which found that knowledge management provides appropriate practices, tools, and methods to effect changes to the culture of an organisation. In addition, Rusly, et al. (2015) emphasised that "Literature clearly suggests that implementation of KM processes infuses changes in firms, which affects employees and the firm's operation". However, in the current literature, the role of KM in supporting EA has not been explicitly studied especially focussing on the South African motor vehicle and asset finance industry.

EA at these financial institutions plays a crucial role in enabling these institutions to evolve quickly and in a foresighted manner. Premchand, et al. (2016) observed that EAs at the best of financial institutions are not always a result of choices instead they develop over time as patch work quilts while responding to the needs of the organisation. They further observed that the different lines of business at financial institutions more often than not, operate in silos which results in duplication of efforts and unwanted complexity. EA has been found to help reduce complexity and eliminate duplication of efforts. In addition, EA provides financial institutions with a comprehensive plan that enables them to evolve quickly and in an orderly manner. The success of EA initiatives is therefore vital to the continued success of organisations in this industry.

1.3 Problem statement

EA comes with a promise to reduce unnecessary complexity and enhance organisational agility, among other benefits. However, EA is highly invasive as it impacts all members of an organisation. It has also been found that establishing EA practice is a complex and cost-intensive endeavour with a low success rate (Bakar, et al., 2014; Wißotzki, et al., 2013). In fact, studies show that more than 66% of EA initiatives fail. There is therefore a need to improve the rate of success of the EA initiatives.

However, due to its pervasive nature and wide scope, the success of EA initiatives depends on many issues, involving various organisational constituencies including the culture of an organisation (Gilliland, et al., 2015; Asfaw, 2009). In addition to the human factors that influence the acceptance of EA reported in (Gilliland, et al., 2015; Asfaw, 2009), 'organisational politics' has also been found to be significant challenge facing EA (Chuang & van Loggerenberg, 2010). Wagter, et al. (2011) and Lange (2012) also regard organizational culture to be an important factor in governing organisational transformations through EA.

There is an abundance of research and advice on the use of KM to better understand and overcome people-related as well as organisational culture issues (Corfield & Paton, 2016; Rusly, et al., 2015). However, there is currently limited research investigating KM as a means of supporting EA in the South African motor vehicle and asset finance industry.

1.4 Research Objectives and Questions

EA benefits are realised through successful EA adoption which is a major and important organisational change. However, it has been found that the success of EA adoption is inhibited by significant and complex factors, such as an organisation's members and culture.

The main objective pursued in this research was to determine how knowledge management can be used to successfully adopt enterprise architecture in a South African vehicle and asset finance bank. The researcher had not found academic research on how knowledge management can be used to solve challenges encountered during EA adoption. It is further hoped that the findings of this research would increase the possibility of success for EA initiatives through the use of KM. The following research question is derived from this main research objective

How can knowledge management be used to successfully adopt enterprise architecture in a South African motor vehicle and asset finance bank?

While this research question is quite specific, it is also very complex. In an effort to manage this complexity, the overall research question has been divided into three sub questions. The secondary research objectives are defined as follows:

1. To determine the importance of EA in the motor vehicle and asset finance industry.
2. To determine the barriers to successful EA adoption in the motor vehicle and asset finance industry.
3. To determine how KM and its associated practices can be used to increase the possibility of success for EA initiatives.

Based on these secondary objectives, the following questions will be addressed

1. What is the significance of EA to the motor vehicle and asset finance industry?
2. What are the barriers to successful EA adoption in the motor vehicle and asset finance industry?
3. How can KM practices be used to increase the possibility of success for EA initiatives?

1.5 Underlying assumptions

The organisation studied in this research is the largest vehicle and asset finance bank in South Africa. This organisation has been in operation for over 50 years within the context of South Africa. The assumption here is that this organisation is the best representative of the motor vehicle and asset finance industry in South Africa. The researcher assumes that the research participants who will be completing the questionnaires are professionals who have practical experience in IT, EA, or other related fields.

1.6 Significance of the study

Conducting this study aims to contribute in two ways; the theoretical significance by adding to the existing EA and KM body of knowledge, as well as the practical significance which offers a practical steps of incorporating KM activities during EA adoption thus increasing the likelihood of successful EA adoption. The following subsections discuss both of them in greater detail.

Theoretical Significance

IT has become a key enabler for business as it enables organisations to exploit new opportunities and capabilities offered by new technologies in order to gain competitive advantage in their markets. Since EA is increasingly being used to align organisational strategy with IT strategy, its successful adoption is important to business.

However, EA adoption is fraught with difficulties, particularly human and organisational culture factors. KM promises to address and improve these human and organisational culture issues. There are various research efforts on the subject of EA, its adoption and benefits. (Lange & Mendling, 2011). Similarly numerous studies have also been conducted on KM in the context of the South African banking industry. However to the researcher's knowledge, no study has been conducted on KM as a means to support EA in the South African motor vehicle and asset finance industry. This study seeks to fill this gap in the literature.

Practical Significance

IT projects failure rate is high and organisations are not realising the business value from their investments in IT (Ross & Weill, 2011). Human and organisational culture factors play a significant role in this failure rate. KM is a field that provides effective tools and methods to influence these human and organisational culture issues. This research study aims to increase the possibility of success for EA initiatives by identifying appropriate KM activities and tools that can be applied during EA adoption.

1.7 Research limitations

This research will have the following limitations:

- A single organisation within the motor vehicle and asset finance industry was surveyed; therefore, the results might not be relevant to other organisations or industries.
- The results of this study might not be generalisable because non probability sampling was used.
- Non response bias and response bias which are common limitations of research questionnaires will apply.

1.8 Chapter overview

The research dissertation consists of seven chapters as summarised below

- **Chapter 1: Research Introduction** - This chapter provides an introduction to the research study. It also discusses the research problem, objectives, questions and significance and the assumptions.
- **Chapter 2: Enterprise Architecture -** This chapter reviews existing literature on EA to understand what it entails, its adoption, its benefits as well as the factors that affect its adoption in organisations.
- **Chapter 3: Knowledge Management -** This chapter will discuss KM and its related concepts.
- **Chapter 4: KM and EA relationship** - This chapter will discuss the relationship between KM and EA.
- **Chapter 5: The South African motor and asset finance industry -** This chapter will study the banking industry, South African banking industry as well as the motor vehicle and asset finance industry in South Africa.
- **Chapter 6: Research Methodology -** This chapter pertains to the approach adopted in designing this research study. This will be the approach used in investigating the research problem defined in Chapter 1. A justification for the chosen research approach is offered. The chosen research methodology based on available design and methodology concepts is also discussed.
- **Chapter 7: Analysis and Discussion of Findings -** This chapter is devoted to the analysis and discussion of the research findings obtained through the questionnaires that were administered to the leaders and experts in the fields of EA and IT within a South African Vehicle and Asset Finance organisation. The research objectives defined in Chapter 1 will be used in the analysis and discussion of the collected data.
- **Chapter 8: Research Conclusion** - This chapter answers the research questions. It also discussed the research paper's contributions to literature as well as the significance and implications of this study. The researcher will also provide recommendations for future research opportunities.

1.9 Conclusion

This chapter served as an introduction to the research study. It provided the background to the problem that has been identified. It also outlined the research questions and objectives that the research will concentrate on. The study investigates the role of KM in supporting EA in the South African motor vehicle and asset finance industry.

Summary of Chapter 1

The problem statement

EA offers appropriate methods, tools, frameworks and artefacts that assist organisations to reduce unnecessary complexity and enable organisational agility, among other benefits. However, there are various challenges facing EA adoption. Some of these challenges involve humans (employees) and the culture of the organisation. The organisation chosen for this study needs to determine whether the factors identified by **(Gilliland, et al., 2015)** as well as those identified by Spewak in **(Asfaw, 2009)** are hindering their EA adoption efforts.

The research questions and objectives

The main research question is the following:

How can knowledge management be used to successfully adopt enterprise architecture in a South African motor vehicle and asset finance bank?

The main objective pursued in this research is to determine how knowledge management can be used to successfully adopt enterprise architecture in a South African vehicle and asset finance bank. It is further hoped that the findings of this research would increase the possibility of success for EA initiatives through the use of KM. In an effort to manage this complexity, the overall research question has been divided into the following secondary objectives and sub questions.

1. To determine the importance of EA in the motor vehicle and asset finance industry.
2. To determine the barriers to successful EA adoption in the motor vehicle and asset finance industry.
3. To determine how KM and its associated practices can be used to increase the possibility of success for EA initiatives.

Based on these secondary objectives, the following questions will be addressed

1. What is the significance of EA to the motor vehicle and asset finance industry?
2. What are the barriers to successful EA adoption in the motor vehicle and asset finance industry?
3. How can KM practices be used to increase the possibility of success for EA initiatives?

Significance of the study

Theoretical significance:

To understand the theoretical implications of combining KM with EA in the context of the South African motor vehicle and asset finance industry

Practical significance:

To improve the likelihood of successful EA efforts in the South African motor vehicle and asset finance industry

Chapter 2 of this research study is devoted to the review of literature to understand the concepts that are fundamental to the research objectives.

CHAPTER 2: Literature Review – Part A: Enterprise Architecture (EA)

2.1 Introduction

The literature review conducted in this study is divided into four parts, each in its own chapter. The first part (Chapter 2) is devoted to EA. Chapter 3 reviews literature on KM while Chapter 4 investigates the relation between EA and KM and Chapter 5 studies the South African banking sector. Figure 2.1 illustrates the scope of the literature review conducted in this study. This chapter provides better understanding of Enterprise Architecture including its role in the context of an organisation.

The ever-changing operating environment in which organisations operate demand that organisational strategies are continuously reviewed and changed to respond effectively to these changes, and given the key role played by IT as an enabler of organisational strategy it is important that the IT strategy is constantly aligned with the organisational strategy. Enterprise architecture enables this alignment. It is important to review the existing literature in order to comprehend and better appreciate the importance of a successful EA to enterprises.

2.2 Scope of literature review on EA

The EA literature review conducted in this chapter focuses on the core constructs of EA, with the aim of answering the research questions as well as addressing this study's research objectives. Firstly, the literature review will provide an overview of EA. Against this backdrop, background information on the motivations for adopting EA will be provided followed by an illustrative sample of the definitions of EA found in literature. The purpose of discussing these definitions is to develop a deeper understanding and appreciation of the nature of EA. EA adoption and acceptance is also studied in this chapter because the adoption and acceptance of EA are essential in order for organizations to reap the benefits of EA. The EA planning together and the role of frameworks are also studied in this chapter. EA stakeholders are also discussed with the aim of determining their roles, interests and concerns.

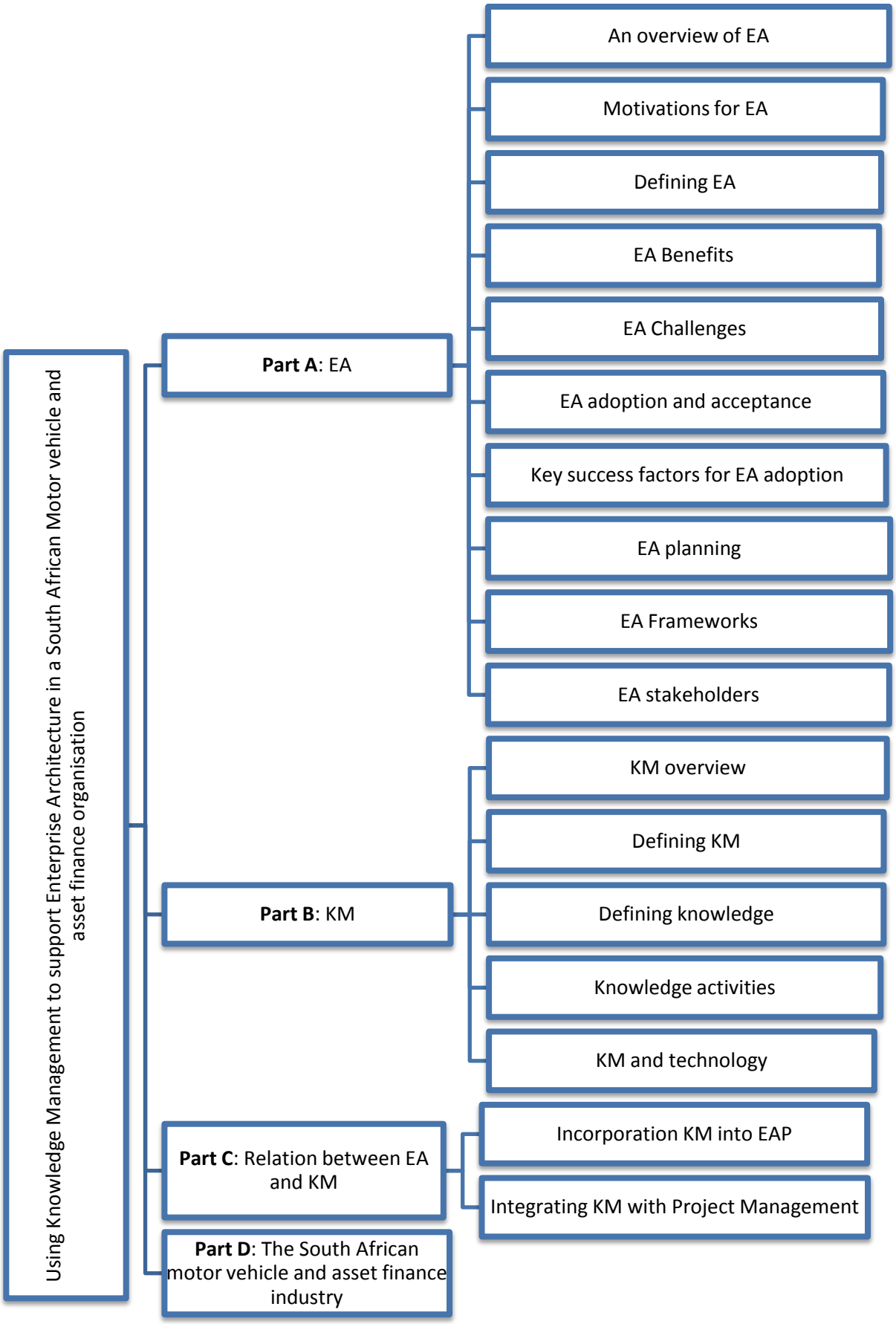


Figure 2.1: Scope of literature review

2.3 EA overview

The purpose of this section is to study the body of knowledge surrounding EA. Examining this body of knowledge will provide a better foundation for this research. The primary emphasis of this review is to understand the contemporary meanings and expected benefits of EA. This broad background of EA will enable the researcher to effectively focus the data gathering and analysis phases of this study.

Niemi (2016) pointed out that the use of EA as an overarching planning and development approach is not new. It has been in existence in the systems engineering field as a part of data modelling techniques, system analysis, and design methods since the 1970s and 1980s (Niemi, 2016). In 1987, Zachman introduced the Information Systems Architecture Framework, which is regarded as the first approach to the EA discipline (Haki, et al., 2012). He was the first to formalize these systems engineering methods as an enterprise level modelling framework (Niemi, 2016). When EA started off, it was an IT-centric function (Kryvinska, 2012). EA has since evolved as a discipline and is now considered to be providing a high-level holistic view of an organization's entire 'Business-to-IT' stack covering business processes, organizational structure, software and IT infrastructure (Aier, 2014). Additionally, EA is increasingly becoming an accepted business-IT alignment approach (Rouhani, et al., 2015).

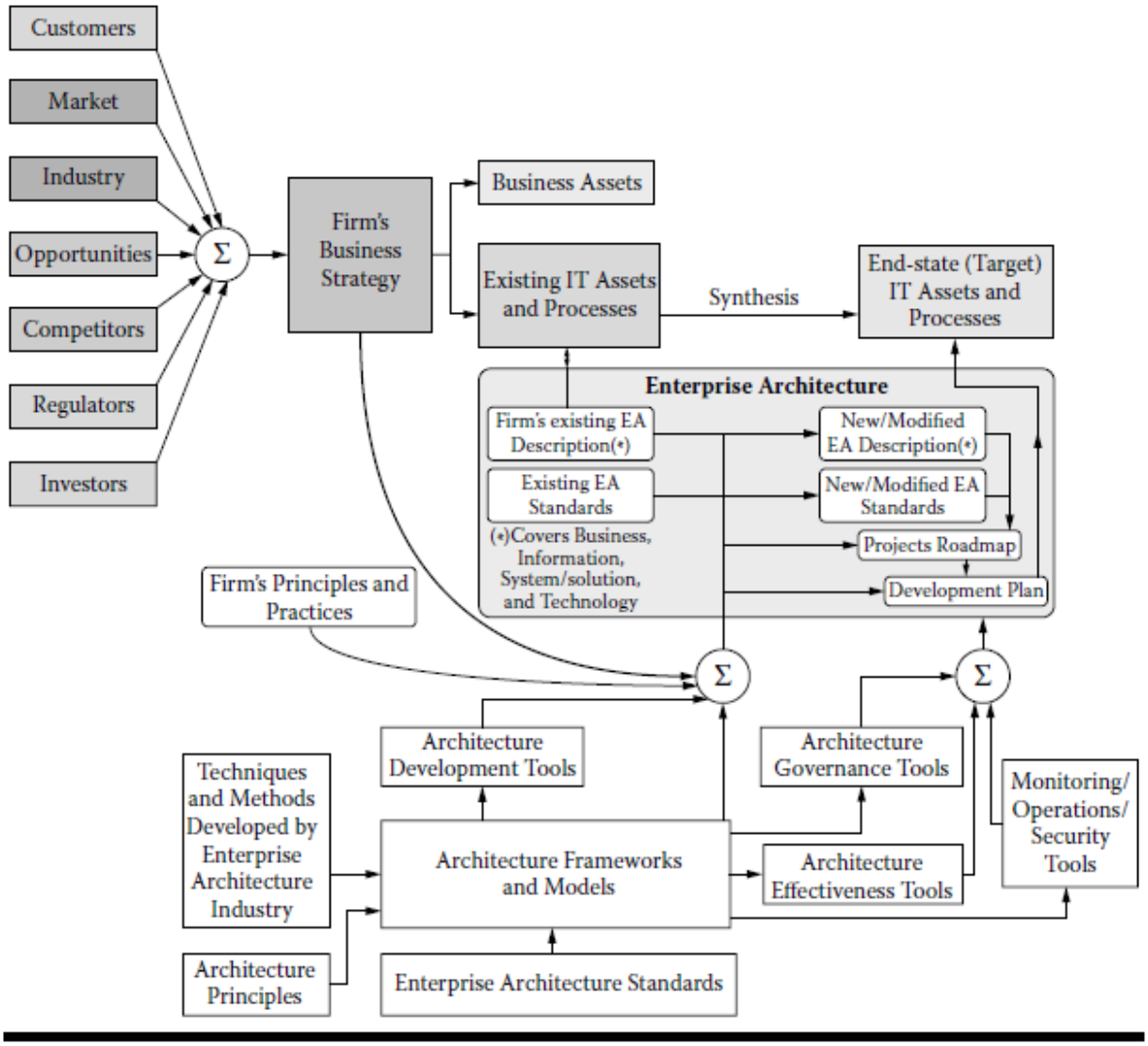
Even though the concept of EA has been in existence since the 1980's, there is still no agreement on exactly what EA is as well as what impact it has on the organisation once it has been introduced (Gilliland, et al., 2015). According to Minoli (2008), the goal of EA is the creation of a unified IT environment across the organisation with tight symbiotic links to the business side of an enterprise and organisational strategy.

Figure 2.2 depicts a macro level view of the environment as found in (Minoli, 2008). The external entities that may drive an organisation are listed on the left-hand side of the figure. These factors and entities include customers, the industry the organisation is in, the prevailing market conditions, the existing or potential opportunities, the competition, regulations, and investors, among others (Minoli, 2008). Typically an organisation has a business strategy as well as a set of business assets. It is vital for an organisation to develop an IT infrastructure that will support a future state IT environment which will enable, support and facilitate the organisation's strategy. To achieve this, organisations typically develop EAs which depict an organisation's information, systems and technology environment. Included in this blueprint are specifications of the standards relating to for

example equipment, protocols, interface standards, etc. Development of an organisation's architecture is commonly performed using industry mechanisms which include "IT industry techniques and methods to develop an enterprise architecture; architecture principles; enterprise architecture IT industry standards; IT industry enterprise architecture frameworks and models; and architecture development tools" (Minoli, 2008).

When changes to the organisation's strategy are introduced, the organisation's EA may need to be updated depending on any identified gaps. The new/ updated EA needs to consider the existing EA, IT assets, EA standards, the organisation's principles and practices, the organisation's updated or desired strategy, as well as the availability of frameworks or tools to modify the existing EA or to develop a new one. The result of this synthesis will be a new/updated EA, new/modified IT strategies, new/updated EA standards, and a roadmap identifying the IT projects necessary to execute or implement the new/modified architecture and attain the target state as well as a deployment plan. Governance, environmental-monitoring as well as effectiveness assessment are also important functions.

Figure 2.2: Macro view of the environment and of enterprise architecture (Minoli, 2008)



Despite a lack of consensus regarding EA, two major EA perspectives have been emerged, the first theme being that of EA as an artefact and the second theme being that of EA as a process. Gilliland, et al. (2015) contend that the EA-as-an-artefact perspective aims to provide a strategic holistic view of an enterprise thus enabling coherent coordination, integration and conducting of organisational activities. On the other hand, the EA-as-a-process theme focuses on EA as a methodology to describe the enterprise's current and future states and all processes and interventions to transform the enterprise from the 'as is' state to the 'to be' state. The EA as a process perspective focuses on the creation of EA products such as models, viewpoints, processes and tools.

Using EA as an organisational strategy for business execution has emerged as a third view of EA (Gilliland, et al., 2015). This perspective merges the artefact and process perspectives of EA. An organisational strategy is regarded as the "framework of choices that determine the nature and

direction" of an organisation (Brache, 2002, p. 51). Further, Brache (2002) argued that successful organisational changes are a result of identifying and integrating all the organisational variables e.g. culture, structure, processes, people and systems. In this regard, EA is seen as a strategic tool that enables organisational governance (Janssen & Lankhorst, 2009). In this context, EA is perceived to be located between strategic planning and development initiatives (Tamm, et al., 2011). Seppänen in Neimi (2016) advise that EA should not be positioned such that it seen as only an IT matter. An organisation can either establish its EA function as a dedicated function or as an EA initiative or project (i.e. development initiative) (Niemi, 2016).

On the other hand, Bernard as cited in (Trinskjær, 2009) presented a different perspective of EA in which he drew distinctions between EA as an idea and EA as a practice. As an idea, Bernard argues that EA is an approach for creating abstract views of an organisation which improves planning and decision-making. This is in line with Zachman's definition. Meanwhile, in the EA as a practice perspective, EA is viewed as a documentation method as well as a management programme (Trinskjær, 2009). As a management programme Bernard points out that EA is considered as an approach to "planning, decision-making and resource development on a general level as well as on a specific level". In this perspective, it is important for EA to be viewed as an integrated component of an organisation's general governance structure. This enables EA to participate in efforts that unite the strategic goals of an organisation, each department's goals, and uniting them with the IT projects undertaken to attain the organisational goals.

The EA management plan is essential in Bernard's approach to EA documentation. The EA management plan formulates a path from the enterprise's AS-IS state (i.e. documented current state) to the desired TO-BE (future) state. These EA elements are encompassed in a modelling framework (Trinskjær, 2009). These important dynamics further underline the holistic nature of EA.

It is also worth noting that Lapalme as well as Supérieure as cited in (Scholtz, et al., 2013) argue that EA has three main different schools of thought, each differing only marginally on the scope and purpose of EA. However, John Zachman, considered to be the father of EA, disagrees with Lapalme and Supérieure and asserts that "Architecture is Architecture is Architecture" (Scholtz, et al., 2013). This means that the principles and practices which have been proven successful in the analysis and evaluation of software architectures should be applicable during the analysis and evaluation of architectures for "systems, systems of systems, and enterprises" (Scholtz, et al., 2013).

While it is important to understand and appreciate the various perspectives of EA, it is important to note that EA primarily exists to provide a greater understanding of an organisation, by connecting the business drivers, goals, strategies, the surrounding business environment, through business processes, organisational roles and responsibilities and connecting these to the underlying IT systems that the organisation depends on (Scholtz, et al., 2013). In summary then, successful EA initiatives consider a wide spectrum of inputs from the various organisational domains. Some of these important inputs are discussed in the following sub-section

Inputs into EA

Perez (2014) pointed out that an enterprise can be viewed as a complex system which has defined boundaries and a collection of different but interdependent components. These components include members of the organisation, organizational structure, strategy, corporate culture, processes, tasks, technology and information. An organisation's enterprise architecture contains organisation-specific descriptions of these components. Moreover, an organisation is bounded by (operates within) a particular external environment, which provides different types of inputs (e.g. regulations, changes in technology, economic climate) and the organisation provides outputs (e.g. products or services) to its external environment. Enterprise architecture facilitates an orderly transformation of these inputs into outputs (Saadé & Wan, 2013, p. 317b). Similarly Tang, et al. (2004) highlighted that architectural activities typically have the following inputs.

- **Business Drivers** – EA is driven by business goals, strategies, priorities, direction, and principles
- **Technology Inputs** – EA is informed by strategic architecture direction, future architecture, emerging technology standards and systems interoperability
- **Business Requirements** – EA considers users' and functional requirements, business systems-related requirements and data requirements
- **Information System Environment** – EA is impacted by budget, technical constraints, organisational structure, resources and expertise, schedule, organisational knowledge base
- **Existing / current Architecture** – current infrastructure, standards and principles
- **Non functional Requirements** – these relate to usability, scalability, inter-operability, availability, security, manageability, reliability, performance, modifiability, and maintainability of an EA and its artefacts

In addition, based on Ross, et al.'s (2006) publication - *Enterprise architecture as a strategy,* translating business strategies into IT initiatives is based on the foundation for business execution, comprising three elements:

- **Operating model** – an adequate level of standardization and integration of organization processes being an implementation of adopted higher level organization strategies,
- **Enterprise architecture** – in this context, understood as structured business processes and IT infrastructure according to a logic, which reflects requirements regarding integration and standardization (which are the requirements of higher level strategies).
- **IT cooperation model** – a system of supervision ensuring that targets of business and technological projects are achieved.

This varied list of inputs into EA emphasize the holistic nature of EA as well as revealing that EA must not be seen as a purely IT endeavour.

The wide scope of EA as revealed in this section suggests that there is significant amount of information and knowledge exchanged between the EA team and other members of the organisation. This view is also supported by Gøtze (2013). Optimising the flow of information could therefore be beneficial to EA and KM has been found to provide this capability (Corfield & Paton, 2016; Rusly, et al., 2015). To this end, this research focuses on finding out how KM can be used to successfully adopt EA.

Organisations adopt EA for a variety of reasons and some of the commonly cited reasons for implementing EA are discussed in the following section.

2.4 Motivation for EA

In the previous section, an overview which served as an introduction to EA was provided with the aim of obtaining better foundation knowledge on EA. This section briefly examines the reasons organizations embark on an EA adoption program. The reasons examined in this section will enable the researcher to develop an effective instrument for data gathering. It will also make it possible to relate some of the findings to the existing literature.

The environment in which organizations operate is characterized by ever-increasing complexity and relentless change. There is constant pressure from forces external to the organization (e.g. customer needs and preferences, laws and regulations, economic changes, mergers and acquisitions, and technological trends) that put pressure on organisations to align their business and IT domains to enable them to respond to these environmental changes thereby enabling their continuity (Niemi, 2016).

However large financial institutions can be complex entities whose agility is impeded by a legacy of organizational structures and IT environments that are not aligned. The various lines of business operate in silos and can have conflicting interests and incentives complicating the task of aligning the organization toward a common goal instead of local optimizations (Ross, et al., 2006). Moreover, legacy IT environments that exist in large organisations are often complex and inflexible and typically incapable of facilitating the desired changes (Ross, et al., 2006). On the other hand, the lack of a clear view of the organisation's current capabilities, its processes as well as resources makes it difficult to identify the required improvements and capabilities that may support the transformation (Niemi, 2016). Niemi (2016) also notes that it has been found that the translation of the organisation's strategic direction to concrete development initiatives can be difficult. Also, when the strategy is acted upon, the implementation process is often gradual, resulting in each strategic initiative implementing its own IT solution, which in turn adds to the complexity of the IT environment (Ross, et al., 2006). This necessitates an overarching approach to facilitate organizational transformation.

In addition, Wißotzki, et al. (2013) suggest that it is beneficial for organisations to maintain up to date documentation of the complex interplay between business process and information system at all levels of the organisation (Wißotzki, et al., 2013). Without an overall view of the various complex interactions, decision makers might erroneously take incorrect decisions. EA has been found to be helpful in providing this overall view. Various researchers and authors have documented a variety of

reasons that motivate organisations to implement EA. Some of these reasons are summarised below.

According to Weinberger as cited in Wißotzki, et al. (2013), EA is typically implemented for the following reasons:

- EA facilitates achievement of the business strategy by enabling the alignment of the IT transformation to the needs of the organisation
- The ability to effectively manage and utilize information is crucial for business success as well as competitive advantage
- EA facilitates the management of stakeholder concerns that must be addressed by IT systems
- EA helps organisations manage complexity as well as changes to business and IT
- EA promotes attainment of the desirable balance between IT efficiency and business innovation
- EA promotes greater transparency and enables improved risk management
- EA helps ensure the fragmented legacy processes are optimised to an integrated environment

Additionally Jahani, et al. (2010) found that EA is often executed for the following reasons:

- EA creates harmony among the organisation's operational, information and communications technology layers.
- EA helps manage organizational change.
- EA promotes or repeats foundations of information technology and communications.
- EA helps organisations replace hesitant systems.
- EA makes it possible to plan, promote or expand information and communication systems.
- EA creates a common organizational language.

The reasons mentioned above show that the role played by EA in organisations is pivotal and is further strengthened by the fact that it is imperative for organizations to operate with greater efficiency to provide attractive services or products to their customers. Moreover, EA enables an organisation to fully understand the present and future nature of its business.

In this section the reasons organizations embark on an EA adoption program were briefly examined. The literature reviewed will contribute to the data gathering and analysis efforts.

2.5 Defining EA

Having provided an overview of EA and studied the motivations for its adoption, this section presents a synthesis of the various definitions of EA with the aim of gaining a deeper understanding and appreciation of the EA concepts. This section will reveal the nature and characteristics of EA so that the researcher develops a broad background of EA.

Owing to the fact that EA is a relatively young discipline (Boucharas, et al., 2010), even a precise definition of EA is still shrouded in controversy. It is however important for the purposes of this study, that we clarify what EA is. While there is a multitude of different definitions of EA, this study will briefly present an indicative selection of these. The selection presented here is not exhaustive nor is it systematic. It is aimed at highlighting the important aspects thus revealing the nature of EA.

In 2000, the IEEE 1471 set of guidelines for describing an architecture were published by IEEE. This set of guidelines has since become a foundation on which numerous definitions for EA are based (Boucharas, et al., 2010). This set of guidelines defines architecture as *"[…] the fundamental organization of a system embodied in its components, their relationships to each other, and to the environment, and the principle guiding its design and evolution".* And in 2013 van Gils and van Dijk (2013) noted that this definition had become a widely accepted and standardised definition for EA.

Building on the IEEE 1471 set of guidelines, Lankhorst defined EA as *"a coherent whole of principles, methods, and models that are used in the design and realization of an enterprise's organizational structure, business processes, information systems, and infrastructure"* (Andersen & Carugati, 2014). This definition reveals that EA encompasses all the domains and aspects of an organisation.

In a similar manner, Ross et al. in Boucharas, et al. (2010) define EA as "*the organizing logic for business process and IT capabilities reflecting the integration and standardization requirements of the firm's operating model. The enterprise architecture provides a long-term view of a company's processes, systems, and technologies so that individual projects can build capabilities - not just fulfill immediate needs".* The main concept contained in this definition is the integration and standardization of the organisation's core processes.

Meanwhile, Bernard as cited in Andersen and Carugati(2014) considers EA to be "[the] analysis and documentation of an enterprise in its current and future states from an integrated strategy, business, and technology perspective". Similarly, Xu (2015) suggests that enterprise architecture is a

methodology for interpreting and translating the Business Architecture and Information Architecture needs to IT.

These numerous and varied definitions of EA make it clear that EA is a broad and complex concept. The lack of consensus regarding what is EA, makes it difficult to intuitively grasp all the elements of EA and their relationships with each other. In response to this, Berg and Steenbergen's asserted that "[]...it is not so important which definition an organization adopts, but how that definition serves the purposes of the organization" (Boucharas, et al., 2010).

For the purpose of this study, the author chooses to adopt Wagter et al.'s definition in Boucharas, et al. (2010) as this study's perspective on EA. This perspective is adopted because Wagter et al.'s definition recognises EA as a management approach to promote and facilitate organisational change processes (Boucharas, et al., 2010). This is important in this study because EA adoption introduces change to the organisation. Moreover, the broad nature of this definition enables the researcher to investigate and discuss EA's different constituent elements.

To sum up the findings thus far, the definitions discussed above have shown EA to be a holistic concept. EA depicts a complete picture of an organisation making it possible to view the organisation from strategy, business and technology perspectives. In addition, it has been established that EA is both a management programme as well as a documentation method.

In this section various definitions of EA were presented with the aim of unveiling the complexities and the many nuances of EA.

2.6 EA benefits

The previous sections introduced EA and its definitions. This section highlights the added value and benefits of EA with the intention to develop a deeper understanding and appreciation of the importance of EA to organisations. The literature studied in this section will be useful in relating the research findings discussed in chapter 7.

Over the years, studies have identified some far-reaching and enterprise-wide benefits that can be achieved through the use of EA. Although it is not the intention of this study to provide an exhaustive list of the various purposes and benefits of enterprise architecture, an indicative selection of the widely researched and reported benefits of a well executed EA would contribute to the study of EA adoption. An indicative list is provided in the following paragraphs.

Various authors suggest that EA provides the riggings required to enable an organisation to achieve effectiveness (Ross, et al., 2006), agility (Bente, et al., 2012), durability (Hausman, 2011), and overall efficiency (Schekkerman, 2005). Moreover, it has also been found that EA makes it possible for organisations to coordinate the various organisational initiatives that are aimed at eliminating the existence of information islands as well as those initiatives that align the business and IT domains (Besker & Olsson, 2015; Tamm, et al., 2015; Bricknall, et al., 2006).

Ross et al. (2006) also add that EA can also clarify an organization's strategic limits regarding the initiatives the organisation has capabilities to implement. Similarly, Simon et al. in (Blomqvist, et al., 2015) acknowledge that EA enables a structured approach to the prioritization of strategic initiatives. It improves decision-making by facilitating systematic assessment of the project proposals to determine their strategic importance (Blomqvist, et al., 2015).This is consistent with Perez's (2014) assertion that enterprise architecture "promotes the belief that an enterprise, as a complex system, can be designed or improved in an orderly fashion, achieving better overall results than ad-hoc organization and design".

Boucharas, et al. (2010) conducted a comprehensive synthesis of of the EA benefits found in existing knowledge base. These benefits are similar to those found by Jusuf and Kurnia (2017) and Hafsi and Assar (2016). In the following sub-sections, these benefits are summarised.

- **Organizational Design** – I has been shown that EA is an enabler of the design and re-design of organizational structures.

- **Project Portfolio Management** – It has also been established that EA supports project portfolio management, including project portfolio planning, IT portfolio management as well as the associated investment decisions.
- **Decision Making** – It has been found that EA supports general decision-making activities and in making Sourcing decisions as well as in COTS software adoption.
- **Regulatory Compliance** - EA has been shown to facilitate regulatory compliance, both general compliance management and quality management. This is because the application of EA improves the accessibility of data required for regulatory compliance.
- **Systems Development** – It has been found that EA is helpful throughout the systems development.
- **Risk Management** – risk management has also been shown to benefit from EA.
- **IT Costs Reduction** – It has also been shown that EA supports reduction of IT costs through (i) IT consolidation achieved through the elimination of expensive, redundant technological platforms (ii) improved management of costs related to IT operations.
- **Enhancement of an organization's processes and standards -** It has been found that EA helps organizations enforce discipline, standardize and improve business processes. Moreover, in addition to EA helping to establish an organization's "foundation for execution", EA also enables organizations to consolidate and reuse their business processes as well as to integrate their process standards. In addition, EA enhances flexibility, business change, process change and agility.
- **Project Management** – It has also been shown that EA enables the various project stakeholders to communicate and collaborate in an improved manner. Moreover, it has also been found that EA is helpful in project management by helping identify and manage the various project stakeholder views. It also aids management of ambiguous project goals. Additionally, it has been found that EA makes a contribution to improved project scoping, reduction in project resources waste. EA also helps enhance the completeness as well as the consistency of the various deliverables of a project.

- **Requirements Engineering** - It has also been shown that EA contributes to the improvement of the requirements engineering process, mainly because EA makes it possible for the requirements to be elicited based on the organization's current EA documentation, which enables requirements reuse during the process of eliciting requirements. The speed of the requirements elicitation process is thus improved.

- **Enhancement of Organizational Performance** – A causal link between EA and improvements in the organization's performance has also been found. In addition, it has been found that EA contributes to improvements in organizational efficiency as well as enabling organizations to achieve operational excellence.
- **Enhancement of Organizational Communication and Collaboration** – there has also been a causal link between EA and improvements in both intra- and inter-organizational communication as well as improvement of intra-organizational trust, collaboration, as well as improving inter-organizational information sharing.

- **Enhancement of IT Management & Decision-making** - It has been shown that outcomes of EA improve the management of IS/IT as well as improving the decision-making process.

- **Increases in IT Value and Reduction of IT Costs** - It has been found that applying EA improves the IT return on investment (ROI). Additionally, the application of EA optimizes the value of IT investments. Furthermore, it has also been found that EA leads to a reduction of both direct and indirect IT costs. Direct IT costs include costs associated with applications maintenance as well as IT operations costs. Indirect costs include costs associated with IS development time, effective use and application of IT resources which have been found to improve.

- **IS & IT Consolidation, Integration & Homogeneity** - It has been found that EA makes an important contribution in the reduction of IT complexity; minimizing heterogeneity, improved interoperability as well as the clean-up of enterprise applications, shared data and the IT infrastructure. Additionally, applying EA helps consolidate technology, data, data stores, applications, and generally, the consolidation and improvements in the sharing of organizational information and data.
- **IS & IT Openness & Responsiveness** - It has been found that EA is helpful in creating a more open (i.e. improvements in data accessibility and data sharing) and responsive IS/IT domain.

- **Enhancement of IT Risk Management** – Applying EA has been found to help improve the management of IT-related risk including reducing the risk and shortening the time of delivering IT projects.

Similar benefits were presented by Tamm et al. cited in Niemi (2016, p. 31) as listed below

- Organizational responsiveness as well as the guidance to change are increased
- Decision making is improved
- Communication and collaboration are improved
- Reduction of IT costs
- Alignment of Business and IT domains
- Improvements in business processes
- Improvements in IT systems
- Organizational resource reuse
- Improvements in integration
- Reduction of risk
- Improved compliance with regulations
- Improved stability

It is evident from the benefits presented by the various authors that the application of EA contributes to the improvement of the entire organisation, not only the IT domain

2.7 EA adoption and acceptance

The previous sections examined what EA is, motivations for its adoption and its expected benefits. In this section, the discussion will be on its adoption and acceptance with the aim of determining what EA adoption and acceptance entail.

While the extant literature provides a wealth of advice on the different aspects of EA practice, the success rate of EA initiatives is still low (Löhe & Legner, 2014; Bakar, et al., 2014). Given that this research study is aimed at improving the rate of success of EA initiatives, developing a better understanding of the notion of EA adoption is important. First, a clear definition of the concepts of EA adoption and acceptance is desirable. Syynimaa (2015) defines EA adoption as "...the process where an organisation starts using EA methods and tools for the very first time".

Adoption and acceptance are terms that are regularly used interchangeably in both literature and industry to articulate the decision to use or to introduce and use new technologies or organisational strategies (Gilliland, et al., 2015). However, Gilliland, et al. (2015) pointed out that there is an important difference between adopting and accepting new technology or strategy (e.g. EA) by the organisation. They contend that 'adoption' implies that members of the organisation have decided to use the organisation's new technologies or strategy. This decision is then followed up with the necessary planning, acquisition and implementation of such strategy or technology within the organisation. Meanwhile, 'acceptance' is specifically about the acceptability of the organisation's strategy or technology to the organisation's people (Gilliland, et al., 2015). As pointed out earlier, members of an organisation are crucial stakeholders in EA. The success of EA is therefore dependent on human acceptance.

Without successful EA adoption, it is not possible to realise the benefits of EA. According to Syynimaa (2015), the general process of conducting EA adoption is as follows.

1. Selection of EA framework. Although various EA frameworks may have already been evaluated previously, it is still important to select a framework before describing the current and future states.
2. Describe current state is the second task.
3. The third task is the description of the enterprise's future state. The order of in which the current and future states are described is dependent on the selected framework. For instance in the Kartturi framework (Syynimaa, 2015), it is recommended that the enterprise's future state is described before describing its current state.

4. The final task is the execution of the change.

The challenge with EA adoption is that changes to the organisational culture are inevitable (McNabb & Barnowe, 2009). Also, as previously noted, Miller (2003) argued that "EA is even more about people than technology". Importantly, organisation-wide communication has also been found to be crucial during EA adoption (Syynimaa, 2015).

Lemmetti and Pekkola (2012) pointed out that in the beginning of EA adoption, the knowledge and understanding of EA is low. This implies that effective communication has an important role to play during EA adoption. Similarly Syynimaa (2015) advised that for EA adoption to be successful, it is important that members of the organisation consider EA adoption to be necessary, achievable, valuable to the organisation, beneficial to the individual, and supported by top-management.

The human factors that impact EA acceptance discussed in Section 2.10 are integral in this study's quest to assist organisations successfully adopt EA through the use of KM. These factors formed the basis on which the research instrument (questionnaire) developed in this study is founded.

2.8 EA adoption challenges

Notwithstanding the great benefits of EA as discussed in the previous section, its adoption is fraught with challenges. This section examines the barriers that must be overcome for EA adoption to succeed. These barriers will be further be investigated and analysed in the collected data.

The challenges faced by EA are the hurdles that have to be overcome by an organisation in the pursuit of attaining long-term success during the implementation of enterprise initiatives (Wißotzki, et al., 2013). According to Bente, et al. (2012) these challenges can be attributed to low maturity level of the EA discipline. Some of the difficulties encountered during EA implementation found by Löhe and Legner (2014) and other authors are discussed below.

According to Löhe and Legner (2014), the challenges encountered during EA implementation include the following:

- The initial gathering of information requires a great effort
- Outdated EA artefacts as well as low quality of EA artefacts.
- Existing EA artefacts are not regularly used in day-to-day work as well as in decision-making.
- Lack of EA acceptance in the IT organization and difficulties in enforcing EA policies and standards.
- Lack of coordination between the EA life cycle processes and the existing established IT processes.

Additionally (Wißotzki, et al., 2013) found the following to be some of the major challenges associated with EA:

Insufficient EA awareness

As having emerged from Information Systems Engineering which is a technical domain, EA is yet to fully recognize the significance of the organisation's social factors such as human, organizational behaviour as well as communication. Further, new methodology use always encounters behavioural resistance, as the goals of the organisation might not be shared/ embraced by some members of the organisation.

Delivery of EA value proposition

Delivering tangible EA value proposition remains one of the major challenges for organisations. Therefore, the EAM value proposition needs "...to be communicated to the right stakeholders in the right way and its implementation has to be perceived to be beneficial" (Wißotzki, et al., 2013).

Lack of ability to express information demands

It is difficult for organisations to meet their customers' needs and increase their market share without the ability to manage their overall context. Organizations often lack the ability to articulate their information needs, thereby hindering efforts aimed at designing fit-for-purpose solutions.

For every enterprise a specific EA has to be developed

As stated previously, introducing EA is a complex and cost-intensive process. It has also been found that producing the first documentation is problematic for various reasons such as selection of information, maintenance of information and the quality of information. As noted earlier, EA "is such a complex topic that easy and general solutions are unlikely to appear". Yet Wißotzki, et al. (2013) found that 9 out of 10 people entrusted with rolling out EA counter the questions while gathering customers' information needs with "what is the best practice for this?" In the majority of cases though, the best practices are only partially helpful but the organisation's specific information is essential in order to correctly customize the best practices to the context of the organisation.

Complex tasks require complex approaches

Wißotzki, et al. (2013) caution that "even if you have the smartest approach, you need to get people to execute it in an organization and every time you work with people you have to deal with emotions, which can be quite unpredictable sometimes". Therefore, it is important to motivate members of the organization to learn and adopt new ways of working and /or thinking. Dealing with such complex tasks often entails complex approaches which are typically difficult to teach and sometimes even harder to depict graphically.

Common language/ glossary inside IT and between Business and IT

There is a need to achieve consensus on a common terminology to be used within the organisation. For example, when an architect designs a house, he or she would discuss how rooms, balconies or windows should be constructed using a common vocabulary. There is therefore a need of a framework to be used within an organisation in order to achieve a shared understanding.

Data quality & Consolidation

Wißotzki, et al. (2013) observed that issues pertaining to the quality of data are some of the biggest obstacles due to continuous changes to the business requirements that are not well integrated to the organisation's existing infrastructures. This leads to a heterogeneous and complex application structure. Data quality can be assessed on different dimensions such as completeness, integrity,

reliability and consistency. Low data quality means that it is often not possible to supply managers and other EA stakeholders with the right information timely.

Compliance requirements

The increase in compliance requirements as well as the promulgation of new regulations are challenging particularly for organisations operating in the banking, telecommunication, insurance, and utilities sectors. An efficient compliance management depends on the transparency in the organization. To efficiently implement compliance requirements in an agile manner, it is important to reveal architectural dependencies.

Meanwhile, Bente et al. (2012) found the following as challenges facing EA implementation.

- Compared to other engineering disciplines, the design, development and operational processes of EA are not as mature.
- Unlike in other industries like automotive, IT systems are regularly enhanced and altered while in use. This makes EA an open-ended initiative whose end product has to keep changing. As a result, the effectiveness and tangible benefits of EA are not readily identified.
- EA was originally derived from the IT discipline, and in most organisations, EA initiatives are spearheaded by IT personnel who may not have the necessary comprehension of the business that IT is meant to support. This creates a cost-benefit misrepresentation that is turned down by business leaders.

From the challenges discussed, it is clear that the enterprise architect or the EA team must be able to sell the need for EA to management, users and stakeholders in a way that clearly defines the benefits it brings to the enterprise. At the same time, the EA advocate must not oversell the benefits such that the level of expectation is pitched to an unrealistic level because in most cases, the benefits of EA are long term and may be realised after some years. The principles of change management must also be carefully intertwined with EA implementation so that as many requirements of all stakeholders as possible are addressed. While it may not be possible to cater for all requirements, where compromise is made, communication must be clear so that compromise does not lead to dissatisfaction on the side of the stakeholder affected.

2.9 EA frameworks

The previous sections examined what EA adoption and acceptance entails. The challenged that are often encountered during EA adoption were also discussed. In this section, the focus will be on EA frameworks as vehicles through which EA is adopted.

Organizations typically adopt EA by following a particular framework. An EA framework can be defined as "a method for designing information systems in terms of a set of building blocks and how these blocks fit together" (Shah & El Kourdi, 2007). Schekkerman as cited in Roets (2014) emphasised that "a rigorously defined framework is necessary to be able to capture the vision of the '*entire organisation'* in all its dimensions and complexity". This makes it possible for the organisation's nuts and bolts to be accurately depicted in its EA.

Frameworks promote the specification of architectures by providing a means to design and describe the relevant architectures. Additionally, an architecture framework provides and facilitates the adoption of a common terminology; provides a set of architecture views that focus on certain facets or elements of the architecture; provides a set of architecture types with differing levels of detail, and a methodology to develop and maintain architectures and their views (Ota & Gerz, 2011). A framework therefore defines various types of architectures with different levels of detail and varying timeframes (Ota & Gerz, 2011).

These frameworks help organizations identify technologies and business areas that should be considered when developing an EA (Jonkers, et al., 2006). Therefore, EA must be used together with other stakeholder-specific instruments to ensure that the needs (e.g. relevance of information, level of detail, format of information) of the different stakeholders are satisfied (Jonkers, et al., 2006).

Just as organisations differ, their EAs are also different. As a result, there are many different frameworks that are used to develop EAs (Sajid & Ahsan, 2016). However, according to Scholtz, et al. (2013) EA frameworks serve three primary purposes:

- They provide abstractions of IT and the enterprise on different layers or perspectives that provide a foundation;
- They provide illustrative views of a company at various levels, such as on value chains, business processes, or IT landscapes; and
- They build upon meta models which include organisational and technical context such as process or organisational modelling on the one hand and for modelling the IT organisation on the other hand.

Some of the most EA frameworks are discussed in the following sub-sections. According to (Urbaczewski & Mrdalj, 2006), the most common EA frameworks include the Zachman framework, DoDAF (United States Department of Defence Architecture Framework), FEAF (Federal Enterprise Architecture Framework) and TEAF (Treasury Enterprise Architecture Framework), as well as TOGAF (The Open Group Architecture Framework). Sessions (2007) lists Zachman, TOGAF, FEAF and Gartner Methodology as the top four EA methodologies used by at least 90% of the EA field. (Schekkerman, 2004b) observed that of all industries and governments, 32% use their own EA framework, 18% use Zachman and 9% use TOGAF. In the finance and insurance industry, 83% use their own EA framework while 17% use Zachman. In all other industries, 22% use their own EA framework, 19% use Zachman and 7% use TOGAF.

On the basis of this information, the Zachman framework and TOGAF have been selected for a more detailed discussion in the following sub-sections with the aim of understanding their key principles as well as how they are used to achieve alignment between business and IT.

Zachman Framework

The Zachman Framework dates back to 1987 when Zachman published the widely acclaimed *Framework for Information Systems Architecture* (Haki, et al., 2012). The Zachman framework was in response to two problems experienced in the USA public administration at the time, namely:

1. Increasing complexity of systems – which resulted in the failure of many projects of large system construction
2. Insufficient adaptation to business requirements – despite built system, often already in the production phase and despite massive capital expenditure, the created system did not meet the business expectations.

That concept is regarded as having provided the inspiration today's EA. The Zachman framework focuses on constructing the views of an enterprise instead of providing a process or methodology for creating an architecture or architectural description. It uses a six-by-six matrix representation to provide an illustration of an enterprise. There are six attributes in column elements: what, how, when, who, where, and why. There are six transformational views in the rows of the matrix. The granularity of these views increases and they become more concrete the further down one goes from the views of the planner, owner, designer, builder, integrator, until the user's view. Identification, definition, representation, specification, configuration, and instantiation are actions described by these views. The intersection between interrogatives and transformation form the basis for a comprehensive description of the entire enterprise.

The TOGAF Standard

According to Cameron and McMillan (2013), the TOGAF standard is the most widely adopted EA framework in the industry today. The beginnings of the TOGAF standard dates back to 1995 (Minoli, 2008), and it was based on the American Department of Defense (DoD)'s TAFIM (Technical Architecture Framework for Information Management) (Bente, et al., 2012; Schekkerman, 2004). It models EA as comprising four major domains: business, applications, data, and technology (Schekkerman, 2004).

According to The Open Group (2011) TOGAF "provides the methods and tools for assisting in the acceptance, production and maintenance of an enterprise architecture". TOGAF is designed to be technology agnostic, therefore it is applicable in any sector and industry, and it has abundant documentation as well as a large network of experts supporting it (Bente, et al., 2012). TOGAF comprises six parts (The Open Group, 2011; Bente, et al., 2012):

- Architecture Development Method (ADM)
- ADM Guidelines and Technoques
- Architecture Content Framework
- Architecture Capability Framework
- Enterprise Continuum and Tools
- Reference Models

While frameworks differ, Minoli (2008) pointed out that each framework encompasses four basic components: business architecture, information architecture, application system architecture and infrastructure technology architecture. However, Pham, et al. (2013) added security architecture as a fifth component. Initially, the IT infrastructure architecture encapsulated the security architecture. These components are explained further below.

Business architecture

The *business architecture* is considered to be the official definition of business objectives, organisational structure, elements of the business strategic plan and business processes (Handley, 2008). This layer defines the relationships between the organisation and its clients, suppliers, as well as other providers. This architecture also defines how the organisation interacts with other organism that may impact business operations. Also covered in this layer are business processes that show how activities are done to produce strategic outputs (Pham, et al., 2013). These must be

defined in a way that enables validation and measurement (Schekkerman, 2004). The business architecture makes it possible to describe and visualise the various components of the business and its organisation (Besker & Olsson, 2015). It also captures the functionality provided by the organisation's systems. This layer is considered as the most important, and also the most difficult to implement (Minoli, 2008). Therefore, the business architecture forms the foundation of EA and influences all other architectural components.

Information architecture

The *information architecture* helps identify the important data components within the organization. Data prioritization is one of the key aspects of this architecture. Identification of information that is vital to the organization is an important aspect of this architecture as this will make it possible to build mechanisms to safeguard it. This architecture depicts where critical enterprise data resides and how it is accessed. It entails corporate databases, how these databases are structured and how they communicate (Pham, et al., 2013; Minoli, 2008). Also important in this layer is the way that information flows within an enterprise (Schekkerman, 2004). Knowing which data must be kept, makes it possible determine the required infrastructure. However, Luisi (2014) argues that this layer is perhaps the most valuable as organisations rely on data for their operations.

Application systems architecture

This layer maps all software and line-of business application systems and how they relate with each other to help business units achieve the overall business goals (Minoli, 2008; Handley, 2008).

Infrastructure technology architecture

This layer is an architecture of the IT hardware – including servers, network topology – including routers, switches, nodes and their configurations and storage systems (Pham, et al., 2013; Schekkerman, 2004; Minoli, 2008).

Security architecture

This layer was initially part of the infrastructure technology architecture, but has been split as a result of the integral role of the internet and the threads that it poses (Pham, et al., 2013).

Bakar, et al. (2014) observed that most organizations that have successfully adopted EA do not strictly follow a particular EA methodology or framework instead they adapt such methodologies and frameworks to meet their own organisational needs or use those methodologies and frameworks only as idea contributors.

The following section discusses the EA implementation process as first introduced by Spewak in 1992. Studying this process will help reveal some of the important architecture activities and interactions between the EA team and the organisation as a whole.

2.10 Enterprise architecture planning

EA frameworks were introduced and studied in the previous section. In this section, the process of architecting an enterprise will be examined. This section provides important background knowledge on the subject matter under investigation.

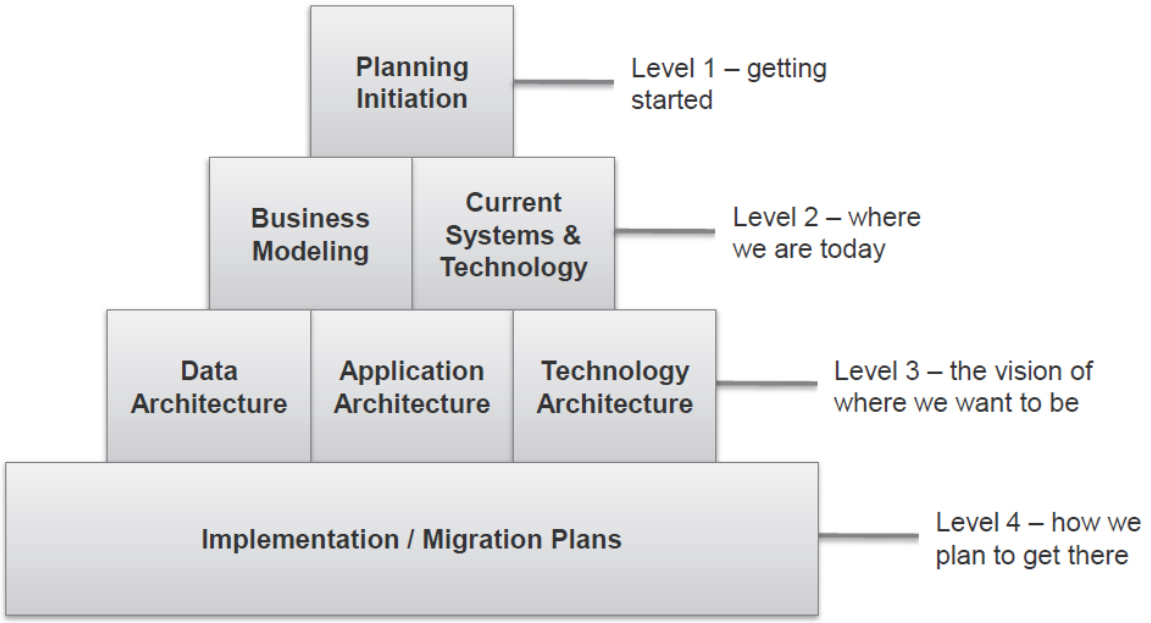
The purpose of enterprise architectural planning (EAP) is the design and implementation of manageable and scalable solutions that are optimised to meet an organisation's needs. The EAP establishes a decision-making process (Gwynne, 2015). According to (Lin & Dyck, 2010), the EAP encompasses:

- Setting the strategic direction of the enterprise.
- Establishment of the IT strategy to effectively use information technology to achieve business objectives and support business strategy.
- Establishment of the business architecture with appropriate organizational structure and processes to achieve effective collaboration of various information systems.
- Building an effective IT architecture, including data and application architectures and information technology infrastructure to support the organization's mission, goals, strategies and objectives.

According to Rouhani, et al. (2013), the first methodology for implementing EA known as the EAP (enterprise architecture planning) was introduced by Steve Spewak in 1992 (Rouhani, et al., 2013). This EAP method is also referred to as the wedding cake model. In 2006, Spewak's model was updated placing greater emphasis on the importance of business knowledge as well as the importance of organizational issues throughout the planning process (Ramos, 2014). An overview of the Wedding Cake model is shown in Figure 2.3. The EAP method encompasses the following phases

- **Phase 1 -** Initiation Planning
- **Phase 2 –** The Preliminary business model phase
- **Phase 3 –** The Enterprise survey phase
- **Phase 4 –** The Current systems and technology architecture phase
- **Phase 5 –** The Data architecture phase
- **Phase 6 –** The Application architecture phase
- **Phase 7 –** The Technology architecture phase
- **Phase 8 –** The Implementation plan phase
- **Phase 9 –** The Planning conclusion phase
- **Phase 10 -** Transitioning to implementation

Figure 2.3 : The EAP wedding cake



Sources: (Jahani, et al., 2010; Spewak & Hill, 1993)

Spewak and Hill offer guidelines on the steps to be performed, procedures to be followed as well as deliverables to be created. Each of the EAP phases as well as the steps performed in each phase is discussed in the following sections. A brief overview of each phase is provided.

Planning initiation

In this first phase, the scope, objectives and expectations of the EAP initiative are defined (Spewak & Hill, 1993, pp. 38-39). Additionally, the favourable and unfavourable corporate culture and other organizational characteristics are investigated in this phase.

Business modelling

This phase marks the beginning of defining the organisation's 'AS-IS' state. In this phase, the description of "where we are and what we have today" is documented. Further, a high level understanding of the business and organisational structure is also derived in this phase.

Current systems & technology

This phase further describes the organisation, detailing its structure and gathering information on the EA constituents, e.g. business functions, processes, applications and technology components. This phase also marks the end of defining the organisation's "AS-IS" state. In this phase, the applications and technology that support the organisation and its processes are analysed.

Data architecture

Defining the organisation's "TO-BE" state begins in this phase. A listing of the needed data entities alongside their related business functions is provided. This listing enables achievement of a data architecture which marks the start of defining "what and where we want to be in the future".

Application architecture

Based on the data architecture, this phase analyses the data entities together with the organisational processes manipulating these entities. This analysis makes it possible to list candidate applications as well as to analyse the impact to the current application portfolio.

Technology architecture

This phase marks the end of defining the organisation's "TO-BE" state. Knowledge of the applications that are necessary to support the organisation's processes enables the description and architecting of the technology platforms that are able to support them.

Implementation/migration plans

Following the definition of the architectures in the above phases, these architectures must be implemented orderly as well as in an integrated manner. This phase prepares the plan for the organisation to achieve its "TO-BE" state. The plan developed in this phase must give clear guidelines and provide clear understanding of what is required to attain the goals of the architectures.

These EA implementation steps further emphasise the pervasive nature of EA as all the spheres of an organisation are impacted during this process. They also reveal the holistic nature of EA as these steps take into consideration the entire organisation.

2.11 Key success factors for adoption of EA

As highlighted in the previous section on architecting an enterprise, EA is highly pervasive. Owing to this pervasive nature, there are certain factors that prevent organisations from achieving the expected benefits of a successful EA. In order to overcome these inhibitors, it is important to determine the critical success factors that are required for EA adoption to be successful. This section is dedicated to discussing these key success factors.

Nikpay, et al. (2013) conducted a literature review of the critical factors for successfully implementing EA initiatives. Table 2.1 lists their findings. Nikpay, et al.'s (2013) review was based on comparing Critical Success Factors (CSFs) Models from five articles: (Van Der Raadt, et al., 2010; Aier & Schelp, 2010; Ylimäki, 2008; Kamogawa & Okada, 2008; Schmidt & Buxmann, 2011). Nikpay, et al. (2013) identified the following as the common factors from the five articles:

- **IT governance** has been found to be a significant factor. Weill and Woodham (2002) define IT governance as "specifying the decision rights and accountability framework to encourage desirable behaviour in the use of IT" (Weill & Woodham, 2002). In addition, Kamogawa and Okada (2008) assert that IT governance specifies a responsibility and decision making structure for promoting the desired behavior for using IT for internal control as well as for risk management.
- **EA cognition** considered as EA's impact on the organisation's process view as well as its data architecture.
- **Management involvement** is reported by all the five articles underlining its importance and it is regarded as the most important factor. Management involvement and support is actually one of the widely mentioned factors necessary for successful implementation of any IT project or initiative (Schiesser, 2010)
- **Documentation** is another crucial factor for successful EA. Every EA activity must be captured in architecture models, standards, principles and guidelines.
- **Planning** is one of the factors mentioned in all five articles reviewed. It is considered to be pivotal to successful EA implementation. The task of mapping the roadmap to a target state must be planned in order for organisations to successfully implement EA and achieve their desired outcomes.
- **Communication and support** is defined by (Nikpay, et al., 2013) as informing and keeping all EA stakeholders informed regarding EA-related issues and activities. It also includes ongoing support offered to EA stakeholders during EA planning and implementation. Effective

communication also enables sharing of knowledge and helps establish a common understanding of the agreed goals, scope, vision, objectives, models and artefacts.

- **Stakeholder participation**. Niemi (2007) emphasised the importance of securing the commitment and support of key stakeholders to the success of EA. Similarly Hafsi and Assar (2016) advise that it is essential to identify the individual members and groups required to contribute during EA development, in particular those individuals and groups "who will gain and those who will lose from its introduction" (Hafsi & Assar, 2016, p. 88), and to formulate strategies to deal with them.
- **Skill of the architect and the EA team** has been mentioned by various authors as integral to the successful implementation of EA initiatives (Van Der Raadt, et al., 2010; Hausman, 2011; Aier & Schelp, 2010). Hausman (2011) suggests that the role of the architect is to, among others identify data and its movement across the enterprise, define guidelines for technical architecture, be able to put together and integrate resources needed to accomplish EA goals and to effectively communicate the vision and goals of the EA initiative. Hausman (2011) further highlights that the enterprise architect must conduct business in a manner that his or her efforts will improve the quality and value of the information technology operations in the enterprise. The architect must also possess strong project management skills to ensure that all activities in the life cycle of the enterprise are carried out using best strategies and practices.

  Minoli (2008) emphasised that the Enterprise Architect is to capture the concerns and requirement of EA stakeholders by developing views of the architecture that demonstrate to the stakeholders how their concerns and requirement will be addressed, and what kind of compromises will be made to address any conflicts between concerns of different stakeholders. In other words, the Enterprise Architect is expected to harmonise all the requirement and concerns of various stakeholders and implement architectures that address as many of those concerns and requirements as possible.

Table 2.1 : Comparison of Critical Success Factors Model (Nikpay, et al., 2013)

Authors * / Factors	KO	SB	AS	VR	T
Governance	✓	✓	✓	✓	✓
cognition	✓				
management	✓	✓	✓	✓	✓
planning	✓	✓	✓	✓	✓
documentation	✓	✓	✓	✓	
programing		✓			
Communication &support	✓	✓	✓	✓	✓
Stakeholder participation		✓		✓	✓
process			✓	✓	✓
scope			✓	✓	✓
Economic pressure			✓		
culture			✓		✓
Skill of architect			✓	✓	✓
Tools/methodology			✓		✓
coverage			✓		
Rules and EA process			✓		
EA model/artifact					✓
Business driven approach					✓
Assessment/evaluation					✓
Training/education					✓

* Legend for

Table 2.1 : Comparison of Critical Success Factors Model (Nikpay, et al.,

From these success factors, it can be seen that it not only requires specialist skills of the Enterprise Architect and the EA team to achieve continued successful implementation of EA, but stakeholder buy-in and management involvement are essential success factors.

2.12 EA stakeholder management

In the previous section, key success factors for EA were presented. In this section, the discussion will be on the role of stakeholders during EA adoption.

In any EA initiative, it is essential to identify the individual members and groups required to contribute during EA development. It is important to identify those individuals and groups "who will gain and those who will lose from its introduction" (Hafsi & Assar, 2016), and to formulate strategies to deal with them.

Owing to its extensively networked nature, EA has a great number of organisational stakeholders. A stakeholder is "any group or individual who can affect or is affected by the achievement of the organization's objectives" (Niemi, 2016). In the context of EA, EA stakeholders are defined as representatives (groups or individuals) of the enterprise who are impacted or affected by the organisation's EA products (Van Der Raadt, et al., 2008). These representatives either provide input into EA decision making or they are expected to conform to the organisation's EA products. While the variety of EA stakeholders is generally organisation-specific (Niemi, 2007), EA stakeholders typically include top management, enterprise architects, software and solutions architects, program and project managers, developers, IT operations, testers and other specialists (Bakar, et al., 2014). These stakeholders have specific perspectives, needs and objectives which they actively pursue. It is therefore essential that EA addresses and balances the needs of these important stakeholders.

Similarly, Niemi (2007) points out that securing the commitment and support of key stakeholders, such as senior management, is crucial to the success of EA. This view is also echoed by van Der Raadt, et al. (2008). Various domains such as management, software architecture, requirements engineering and information systems have highlighted the importance of identifying, involving and managing key stakeholders (Niemi, 2007). Stakeholders' needs and perspectives vary and sometimes conflict. These needs and perspectives must be considered and managed (Niemi, 2007).

Hafsi and Assar (2016) noted the following benefits of successful stakeholder management:

- **Early identification of distinguished and powerful stakeholders.** The inputs of such stakeholders are important in shaping the architecture. This also helps gain their support and leads to improved quality of the models produced. Such support would help the EA team win more resource, thereby improving the likelihood of success of the architecture engagement.
- **Early and frequent communication with EA stakeholders.** This would enable the architecture team to ensure that the architecture process as well as the benefits of EA is fully understood by

EA stakeholders. This would allow the EA stakeholders to more actively support the architecture team when necessary.

- **Anticipation of likely reactions.** It would be beneficial to the architecture team to be able to efficiently anticipating likely stakeholder reactions to the EA artefacts such as architecture models and reports. This ability to anticipate like reactions would enable the architecture team to plan the actions that that are necessary to benefit from positive feedback while addressing or preventing adverse reactions.
- **Early identification of competing or conflicting objectives**. This would allow the architecture team to more effectively identify objectives that either competing or conflicting with each early in the process. The team would then be able to develop a strategy to address any issue related to these misaligned objectives. It is essential to use stakeholder analysis early to identify the key players in the EA engagement. It is also important to update key stakeholders throughout each phase

Bricknall, et al. (2006) similarly, emphasised that not everyone has an interest in all the information captured in the organisation's EA. They advise that content must be based on the needs or interests of the individuals and groups that have been identified as EA's future users. Identification of the intended users of EA should also guide the development of suitable EA artefacts.

Various researchers have found that failure to consider and address the interests and information held stakeholders has led to the failure of numerous initiatives (Nutt, 2002; Bryson, 2004). It is therefore important that information and knowledge held by the various stakeholders is captured and distributed in an effective and efficient manner. EA frameworks play a vital role in addressing stakeholder interests and expectations.

2.13 Conclusion

The fundamental characteristics of EA can be described as follows:

EA is an overarching and holistic approach to the documentation and management of an enterprise's current and future states including the transition plans/ roadmaps in terms of an enterprise's strategy, business processes and technology.

EA enables organisations to make informed decisions and to optimise the implementation of those decisions.

It has also been alluded to in this chapter that it is important for an EA programme to address an organisation's dynamic and political nature.

Chapter 3 will study KM with the aim of developing a deeper understanding of how it can support EA efforts.

CHAPTER 3: Literature Review – Part B: Knowledge Management (KM)

3.1 Introduction

This part of the literature review is devoted to the study of KM. Given that the focus of this research is to study the role of KM in supporting EA, it is therefore important to study KM and its core constructs. This chapter is dedicated to reviewing the extant literature on KM which will help develop a deeper understanding of KM thus enabling the researcher determine KM's role in supporting EA efforts which is the main objective of this study.

The literature reviewed in this chapter and the data collected in chapter 7 will be used to test the following hypothesis.

H_0: KM impedes or has no impact on the success of EA initiatives

H_1: KM supports the success of EA initiatives

In any organisation, KM is intrinsically concerned with the effective use of knowledge for the benefit of the organisation. KM has a potential to make organisations, including financial institutions more innovative and to enhance their competitiveness. As alluded to in Chapter 1, research shows that KM can have positive effect on organisational culture. It is therefore against the backdrop provided in this chapter that the role of KM in supporting EA will be studied.

3.2 Scope

The EA literature review conducted in this chapter pertains to KM and its core constructs. The seminal and contemporary literature reviewed in this chapter will provide that basis for answering the research questions as well as addressing this study's research objectives. Firstly, the literature review will provide an overview of KM followed by the defining what is meant by KM. Some of the essential constructs of KM are also discussed including knowledge and its forms and conversion theories. Knowledge identification, storage and capture, acquisition and creation, sharing and use are some of the knowledge activities discussed in this chapter. KM and technology are then investigated followed by KM and organisational culture.

3.3 Overview of KM

Knowledge is ‘‘power’’ (Li, et al., 2009; Karkoulian, et al., 2013) and it is an integral part of an organisation’s asset base. It fuels growth, productivity and survival of organisations (Matsuo, 2015). Knowledge encompasses the know-how (functional knowledge), know-what (tactical knowledge) and know-why (hypothetical knowledge) (Karkoulian, et al., 2013). Consequently, just as organisations manage their resources, knowledge is an asset that must be managed. Knowledge management has emerged as a discipline that offers the capability to manage this critical resource.

Some authors have argued that the knowledge management discipline gained prominence in the 1990s due to a convergence of increased computing availability, promulgation by consulting firms, and promotion at conferences (Lambe, 2011; Jasimuddin, 2006).

However, there are still contradictory views regarding the true origins of KM. For example, some researchers argue that KM research dates as far back as the mid seventies (see Gu as cited in (Jasimuddin, 2006)) while others claim that it was in the 1990s when the KM field became known. However, it is clear from the review of KM scholarly works, that from the 1990s there was increased attention on KM (Oztekin, et al., 2015). During the 1990s, there were important management scholars and theorists who influenced and contributed greatly to the advancement of KM (Jasimuddin, 2006). They recognised and emphasised the emergent significance of knowledge as an organizational strategic resource.

There is also consensus that KM did not originate from single discipline rather it draws on multiple disciplines such as philosophy, organizational theory, psychology, and sociology. Nowadays KM is regarded as critical in enabling sustained viability and survival of organisations as it enables organisations and individuals to find, and utilize knowledge by employing means that would otherwise not be feasible, geographically, physically and financially (Karkoulian, et al., 2013; Ahani, et al., 2013).

In summary, the common theme among the multitude of KM notions is that knowledge management promises to offer great benefits to organizations.

In the following section, recent and foundational literature will be discussed to define KM.

3.4 Defining knowledge management

The definitions of KM are vast and varied, however they all contain common characteristics only differing on the emphasis of the different aspects of KM (Zwain, et al., 2012). Moreover, there is currently no single definition that explains the whole KM picture, as different authors view KM from various different perspectives, which influences the way they define it. Although it is not the intention of this study to review all the definitions and aspects of KM, it will be useful, however, to selectively refer to some of the widely cited definitions of KM as this would reveal the different aspects of KM thus enriching the discussion of KM in the context of enterprise architecture.

According to Ahani, et al. (2013), KM is a process which helps organizations with identification, selection, organisation, and publishing (transmission) of information. Additionally, KM is defined as an awareness of the organisation's existing knowledge coupled with the creation, sharing of knowledge, utilisation of the existing knowledge, acquisition and storage of knowledge (Ahani, et al., 2013). Malhotra posits that KM encompasses organisational processes "that seek a synergistic combination of data and information processing capacity of information technologies, and the creative and innovative capacity of human beings" (Lech, 2014).

Similarly, Loshin (2001) defines KM as "...the art or science of collecting organizational data and, by recognizing and understanding relationships and patterns, turning it into usable, accessible information and valuable knowledge" (Loshin, 2001; Tang & Hon, 2006).

In summary, the management of knowledge resources is about the identification of the organisation's competitive position with regards to what the organisation knows (strategy), the protection of this position (retention), the growth of this position (creativity) as well as benchmarking (measurement).

Despite a lack of consensus regarding what exactly KM is and is not, there is general agreement regarding its overarching purpose i.e. to leverage knowledge for organisational performance. Understanding KM in a project context is beneficial to this study as this research investigates KM in the context of EA; and EA is adopted as a series of long-term projects. While KM is most commonly studied in the context of the overall organisation, research on KM context of a project exists (Lech, 2014).

3.5 Defining knowledge

Before knowledge can be managed, it is important to define the concept knowledge.

As van den Berg (2013) pointed out, "Epistemologists have been struggling with defining the concept [of knowledge] for thousands of years, yet a universally accepted definition of knowledge has not surfaced". This view is also expressed in Perez-Soltero, et al. (2013, p. 9), where it is noted that even though knowledge has existed for eons, defining and understanding the term knowledge is still fraught with difficulties. It is therefore not the intention of this research to resolve the concept in this study. However, for the purpose of conducting this research, some operational notion of knowledge would be beneficial.

van den Berg (2013) describes knowledge as a meta-resource that surpasses basic resources and considers it to be the inimitable source of commercial success. Knowledge is therefore the essential condition that gives strategic importance to the organisation's resources. However, Nonaka and Takeuchi caution that knowledge cannot be managed in conventional terms, they instead argue that "it is possible to work in organizational dynamics that allows interaction and conversion of individual knowledge to achieve innovations" (Perez-Soltero, et al., 2013, p. 9).

The extant literature establishes that knowledge exists in multiple forms and an important distinction between explicit and tacit knowledge has been established and emphasised (Ranucci & Souder, 2015, p. 257; Massingham, 2014). The next section discusses this distinction in more details.

Explicit, tacit and implicit knowledge

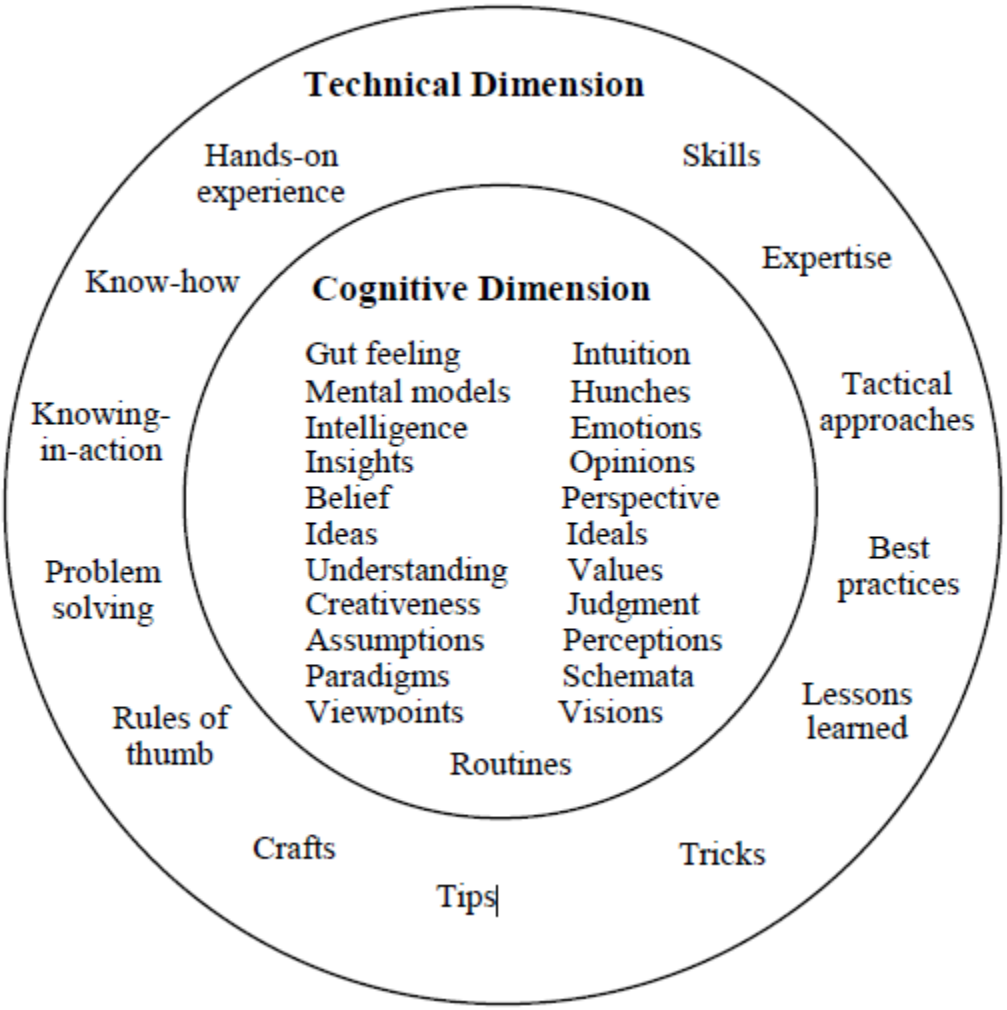
Explicit knowledge is defined as the type of knowledge that can be separated from the knowledge holder and stored in organisational repositories (tangible forms) (Jasimuddin, et al., 2005). Explicit knowledge is therefore easily communicable and codifiable, making it relatively easy to store in organisational repositories. Some scholars argue that explicit knowledge is nothing more than *information* (van den Berg, 2013), which remains lifeless until a knowledgeable individual acts upon it. The knower's cognitive context gives it meaning (Davison, et al., 2013). This type of knowledge does not encompass the less tangible dimension of an individual's knowledge, therefore it can be spread cost effectively and without losing its integrity because "the pattern of formation or rules governing the formation of statements, or language and grammar, is commonly known or standardised between sender and recipient" (van den Berg, 2013). Explicit knowledge can therefore be easily accessed and exploited by all members of the organisation. The ease of replication offers efficiency gains to the organisation. It is however, not always possible to contain such ease of replication within the organisation. This means it is possible for competitors to gain access to the

organisation's valuable explicit knowledge. It can therefore be concluded that, although explicit knowledge is essential to the organisation, it is however, not sufficient for sustained organisational success.

Tacit knowledge on the other hand, is personal and contributes to the knowledge holder's self-worth (Nonaka & Takeuchi, 1995; Nonaka & Kanno, 1998; Dixon, 2000; Roberts, 2000; Bergeron, 2003). Nonaka and Takeuchi posit that tacit knowledge comprises two dimensions: "a technical dimension of knowing how to do something that cannot easily be expressed, and a cognitive dimension of ingrained perceptions that influence an individual's daily interactions" (Ranucci & Souder, 2015). Tacit knowledge cannot be easily codified hence it is regarded as an "imitation guard", moreover, its nested heterogeneity and causal ambiguity (van den Berg, 2013), makes duplicating tacit knowledge difficult (Ranucci & Souder, 2015). Tacit knowledge is therefore regarded as "externally safe" and has been emphasised as most secure and strategically significant for gaining competitive advantage (Jasimuddin, et al., 2005).

According to Nonaka and Takeuchi (1995) tacit knowledge is comprised of the cognitive and technical dimensions. With the cognitive dimension comprised of beliefs, mental models, ideas, values, intuition and paradigms. On the other hand, the technical dimension relates to "know-how", "informal skills" and crafts which are widely accepted definitions of tacit knowledge (Panahi, et al., 2013). Figure 3.1 depicts Nonaka and Takeuchi's tacit knowledge dimensions with examples.

Figure 3.1: Nonaka's Two Dimensions of Tacit knowledge from (Panahi, et al., 2013)



Similar to tacit knowledge, implicit knowledge is dependent on experts. However, in contrast to tacit knowledge, it is possible to extract implicit knowledge from the knowledgeable individual (Bergeron, 2003). As McGinnis and Huang (2007) put it, implicit knowledge is the "unexpressed but expressible knowledge and can be shared by others through common experience or culture. Tacit knowledge cannot be converted to explicit knowledge but implicit knowledge can".

Organisational knowledge conversion theory

Nonaka and Takeuchi's (1995) theory of organisational knowledge conversion is essential in this study as this theory provides the foundational knowledge regarding the flow of information during EA projects. This theory views the interactions between tacit and explicit knowledge as crucial to KM. This theory posits that there are four modes of knowledge interactions i.e. Socialisation, Externalisation, Combination and Internalisation (SECI) that facilitate KM in organisations. When

knowledge is converted from one form to another, it is retained in the organisations regardless of the expert or knowledge source's tenure.

The SECI and ba models

The importance of individuals in knowledge creation has been emphasised by various scholars. Nonaka noted that when individuals interact in groups (e.g. teams), their existing explicit and tacit knowledge results in new knowledge being created and this process occurs through four mechanisms (Richtnér, et al., 2013):

- **Socialization** (tacit-to-tacit conversion) – during this process tacit knowledge is transferred by observing others, sharing experiences and practice which helps develop shared mental models between the knowledge holder and seeker. An example of socialisation is on-the-job training.
- **Externalization** (tacit – to explicit conversion) – tacit knowledge is articulated through this process. This process is usually triggered by discussions between members of the organisation.
- **Combination** (explicit – to – explicit conversion) –this occurs when there is a juxtaposition of various pieces of explicit knowledge leads to the creation of new knowledge.
- **Internalization** (explicit – to – tacit conversion) – this occurs when members of the organisation share their mental models as well as technical know-how. This mechanism is also known as the process of learning-by-doing.

The SECI model is used in this study to investigate knowledge interactions during EA adoption. When planning and developing EA, it is crucial that knowledge held by transitory resources such as external experts or consultants, is assimilated prior to such resources leaving the project. It is equally important that organisational knowledge held by members of the organisation is shared with the project team as this will assist the project team to deliver EA products that are relevant and well-suited to the organisation.

Another commonly cited knowledge conversion philosophy is the *ba* philosophy (Nonaka & Kanno, 1998). Nonaka and Kanno (1998) mentioned the existence of a contextualised space called *ba* in which knowledge sharing can occur. The ba is a Japanese word loosely translating to a place, which may be a physical or virtual place (Chigada & Ngulube, 2015). It provides a platform to advance individual or collective knowledge. According to Chigada and Ngulube, (2015), there are parallels between the *ba* the and SECI model philosophy as shown in Table 3.1 below.

Table 3.1: Nonaka's SECI and ba models

SECI Model	*ba* Philosophy
Socialisation: tacit knowledge is shared through shared experiences (for instance, face to face conversations).	**Originating**: tacit knowledge is shared through shared experiences. As in socialisation, people share this knowledge through face-to-face conversations.
Externalisation: tacit knowledge is converted to explicit knowledge with the help of metaphors and analogies (for example, rock paintings).	**Dialoguing** ba: it is characterised by collective and face-to-face interactions (individuals share their skills and mental models, which are converted into common terms and articulated as concepts).
Combination: tacit knowledge is systemised and refined (for example, the use of telecommunication technologies).	**Systemising** ba: defined by collective and virtual interactions (virtual space facilitates the recombination of existing explicit knowledge to form new explicit knowledge).
Internalisation: explicit knowledge is transferred to tacit knowledge (that is translating theory into practice).	**Exercising**: characterised by individual and virtual interactions. Explicit knowledge is converted into tacit knowledge. This is the same as the internalisation process under the SECI model.

Source: (Chigada & Ngulube, 2015)

3.6 Knowledge Activities

There are numerous definitions of the knowledge life cycle, also referred to as KM phases or activities. According to Wiig, the objectives of KM initiatives are: "[...] to enable an enterprise to act as intelligently as possible in securing its viability and overall success; and [...] to otherwise realise the best value from its knowledge assets" (Ajmal, et al., 2010).

Sedera as referred to in Lech (2014) summarised the various definitions of KM phases and concluded that the KM life cycle comprises four common phases: "*acquisition/creation/generation, retention/storage/capture, share/transfer/disseminate and application/utilization/use*" (Lech, 2014, p. 554). There are other phases mentioned in the literature, phases such as *knowledge need identification* and *knowledge identification* (which occur in the initial phases of a project), as well as *unlearning* (which is a terminal phase). In the same paper, Chan and Rosemann are cited as having asserted that there is no clear demarcation between the phases i.e. where each phase starts and ends. They further state that the phases are not sequential in nature. Heavin and Adam (2012, p. 50) offer a succinct definition of knowledge activities proposed where they define these activities as "transactions or manipulations of knowledge where the knowledge is the object not the result". During EA adoption a significant amount of knowledge is created and shared and must be effectively managed for the benefit of the organisation.

Having considered the knowledge life-cycle phases mentioned above, this study focuses on the following phases as these can be loosely superimposed to cover the entire KM life cycle:

- Knowledge identification
- Knowledge storage and capture
- Knowledge acquisition and creation
- Knowledge sharing
- Knowledge use

Unlearning is excluded in this study as it is a terminal phase that occurs after project completion whereas this study concentrates on EA adoption which has not yet reached completion. The ensuing sections discuss each of these phases in greater details.

3.7 Knowledge identification

According to (Tow, et al., 2015), organisations "often do not know what they (already) know (i.e. their internal organisational knowledge)". Knowledge Identification (KI) is a KM activity that enables organisations to discover their internal organisational knowledge. After an organisation has identified the knowledge, strategies that allow organisations to 'anchor' and utilise such knowledge, can then be developed (Perez-Soltero, et al., 2013).

Knowledge Identification is the process of proactively identifying internal organisational knowledge. An organisation that is uninformed of the knowledge that it already has, due to a lack of awareness regarding who or where its sources of valuable and needed knowledge are or what knowledge is held by these sources, faces a significant problem (Tow, et al., 2015). It is a problem that leads to many subsequent problems faced by such organisations in their quest to leverage their internal organisational knowledge for organisational performance because the organisation cannot leverage knowledge it does not know it has. An inability to identify knowledge means that valuable knowledge cannot be utilised or shared with those who need this knowledge.

Hylton as quoted by Tow, et al. (2015) states that KI is the "indisputable first step in a knowledge management initiative" and to not have KI is "a travesty of justice to knowledge management". Perez-Soltero, et al. (2013, p. 7) also support the view that KI is the first KM step that helps organisations identify the abilities, skills or talents that already exist within the organisation or those that are missing. Given that KI impacts other KM processes, it can be argued then that KI impacts the overall effectiveness of KM.

Knowledge Identification thefore, enables an organisation not only to determine its internal knowledge, it also relates this internal knowledge to the knowledge that exists in its environment (i.e. outside the organisation) e.g. at its competitors (Buckl, et al., 2010). Additionally, Perez-Soltero et al. (2013, p. 10) emphasise that knowledge identification is importat to organisations because it enables them identify knowledge required to realise their visions, missions, and strategic objectives. Knowledge identification also enables organizations to develop with a view to the future as well as to improve their performance and outline strategic and achievable goals. In a similar manner, the mission, vision and strategic objectives of an organisation are important inputs to the development and deployment of an organisation's EA. Locating and accessing this knowledge is therefore critical to the success of EA adoption.

Perez-Soltero, et al. (2013, p. 10) mention two widely recognised methods used to identify knowledge. The first method is the Johnson and Ludvall's model of six knowledge. The model

categorises the knowledge types broadly as: *what, who, how, where, why* and *when*. Another commonly used KI method is termed the 'knowledge audit', which is a diagnosis of the organisation to "know the existing knowledge, who owns it, how it is created, where it is stored, how it flows between members and how to use it". Having identified the internal organisational knowledge (i.e. what the organisation already knows) enables an organisation to establish the knowledge gap, which is the difference between what the organisation knows and what the organisation should know (Buckl, et al., 2010; Perez-Soltero, et al., 2013).

During EA adoption, the project preparation phase would typically the phase in which knowledge identification is first performed. Those entrusted with managing the EA projects must determine the skills and knowledge resources necessary to accomplish the project activities. After identifying the appropriate knowledge sources, it is important to secure access to those sources as they would be important during the project. Knowledge identification would be beneficial throughout the various EA deployment phases or activities.

3.8 Knowledge acquisition and creation

The request for knowledge may result in the creation of new knowledge assets, if the required knowledge is not found during the *knowledge identification* stage (Evans, et al., 2014, p. 92). There might also be a need to create new knowledge assets if the existing knowledge does not completely satisfy the required knowledge needs.

Jensen and Webster (2009) suggest that knowledge creation processes are deliberate actions by organisations to search for new opportunities to innovate. Knowledge creation encompasses all efforts organisations undertake to build up their knowledge base "know-how" (Probst, 1998; Jensen & Webster, 2009). This expansion of the organisation's knowledge base makes it possible for organisations to create new products and services, therefore contributing to the organisation's innovation and success (Rusly, et al., 2015). Acquiring new knowledge also enhances the organisation's existing knowledge and skills (Rusly, et al., 2015).

Oztekin, et al. (2015, p. 3) note that while knowledge can be generated in many ways, there are primarily three main modes through which knowledge is generated: knowledge acquisition, knowledge generation from within the organisation and collaborative knowledge generation. Due to the inherent size and scope of deploying EA, various sources of knowledge provide valuable knowledge and insights throughout the process. Some of the knowledge sources could be EA experts from consulting firms outside the organisation. It is therefore important to acquire and retain knowledge from the various sources during each EA deployment phase. The importance of acquiring knowledge to provide an organisation with the capability of generating novel and innovative ideas has been emphasised in literature (Oztekin, et al., 2015, p. 3).

Although knowledge acquisition (from external sources) is important, it is often argued that the organisation's competitive advantage is derived from generation of knowledge within the organisation (Oztekin, et al., 2015, p. 3). The knowledge creation process is a constantly evolving and emergent process which is highly impacted by organisational culture and social processes. Accordingly, in Nonaka and Takeuchi's (1995) knowledge creation model, three of the four phases incorporate extensive social interactions among the members of the organisation.

According to Jensen and Webster (2009) the learning regimes (i.e. how organisations learn) are defined according to whether knowledge is created through internal or external KM strategies. Under internal KM strategies, ideas, products and processes are produced internally to the organisation and are then marketed, distributed and sold by the same organisation (Jensen & Webster, 2009). This strategy therefore ensures that knowledge creation and capture are managed

internally. Since this strategy uses the organisation's unique skills and resources (which are kept in-house) to create knowledge, the strategy helps safe-guard the organisation against leaking of valuable knowledge to competitors. However, when using the external KM strategies, organisations "use external ideas as well as internal ideas, and internal and external paths to market" (Chesbrough, 2003; Jensen & Webster, 2009) to generate knowledge creating technologies. Under this strategy, organisations do not only rely on their own internal research and development efforts, instead they licence technologies from partners or competitors and form joint ventures to stimulate innovation (Jensen & Webster, 2009). These are important considerations when deploying EA as the EA project team can be comprised of both internal and external resources.

Additionally, the knowledge acquisition process is also impacted by the knowledge recipient's willingness as well as their ability to acquire and utilise knowledge (Chigada, 2014). This has prompted researchers to study the various motivation drivers. There are three sets of motivation drivers described on the source (knowledge holder) side. The first one encompasses individual factors, such as the perceived cost and benefits of knowledge sharing as well as the attitude towards sharing of knowledge. Knowledge acquisition can be inhibited by the individuals' negative attitudes towards learning and sharing. The second one pertains to the contextual factors such as the organisational climate and subjective norms. The final set encompasses the perceived value of knowledge (Chigada, 2014).

On the knowledge recipient's side, the content and source of knowledge must be perceived as valuable by the recipient (Chigada, 2014). The knowledge content's value is derived from its potential benefit to the recipient.

In the context of EA adoption, acquiring knowledge (e.g. from hiring or consulting external EA experts) and integrating this acquired knowledge with knowledge created from within the organisation has a potential to result in EA artefacts that are tailored to meet the organisation's specific requirements. The KM activity of knowledge creation/ acquisition can therefore fulfil an essential role during EA adoption.

3.9 Knowledge capture and codification

Once the knowledge has been analysed and assessed in the knowledge identification and knowledge creation phases and the knowledge is deemed valuable to the organization, it is captured and stored to form an integral component of the organizational memory (Evans, et al., 2014).

Knowledge capture entails processes and activities that are aimed at preventing valuable knowledge leaking (or spilling over) to the competitors (Jensen & Webster, 2009). Knowledge workers like all intelligent beings are in constant need and pursuit of knowledge (Ahsan & Shah, 2006). Ahsan and Shah (2006) further claim that for knowledge to be shared with contemporaries and passed on to future generations it must be recorded and represented in usable formats. Mechanisms to capture knowledge vary from informal to legally codified methods (Jensen & Webster, 2009). The challenge with codifying knowledge is that traditional or conventional methods of protecting creators, entrepreneurs and innovators against immitators have proved inadequate. Intellectual property rights (e.g. trade marks and patents) are often complemented and augmented by other mechanisms of capturing knowledge such as organisational know-how and secrecy (Jensen & Webster, 2009). This is why codified knowledge is not regarded as imitation-safe, however codifying knowledge is highly effective in ensuring that the knowledge seeker has access to knowledge whenever and wherever they might be, without first seeking out the knowledge holder. Further, it creates organisational memory as it allows the organisation to learn from history and not continuously re-invent the wheel. Moreover, it enables knowledge re-use.

It is however important to note that technology influences the way individuals access and manipulate knowledge. Organisations should therefore make appropriate investments in technologies that facilitate the capture, storage and dissemination of knowledge. To enhance efficiency, it is critical that employees have consistent and predictable access to this ever-increasing organisational knowledge base. Water (2003) found that employees want to “find” information instead of “searching for information”. However, as each new piece of content is added, the people’s ability or likelihood to find the piece of information they need, diminishes. It is therefore crucial that knowledge storage is designed such that the previously stored knowledge can be easily found when it is required.

During each EA project/ phase, project knowledge from multiple sources is created, combined and codified. Typically, project management knowledge, organisational knowledge and product knowledge (e.g. EA framework knowledge) are combined with project knowledge that is available before each phase. The KM activities of knowledge capture and codification therefore plays an important role during EA adoption.

3.10 Knowledge sharing

As noted earlier, organizational effectiveness is derived from its employees' knowledge. Employee involvement in knowledge sharing (e.g. face to face or social media and virtual communities of practice) is therefore one of the most important strategies implemented by organizations attempting to effectively manage their knowledge assets (Israilidis, et al., 2015). For the purpose of this research, knowledge sharing is regarded as the transfer of knowledge among individuals (members of an organisation), groups (e.g. teams), departments and organisations (Zhang & Jiang, 2015). The following section discusses knowledge sharing in greater detail.

Knowledge sharing is the process by which an individual imparts his or her expertise, insight, or understanding to another individual so that the recipient of the knowledge may potentially use it to improve his or her performance of his or her tasks (Yu, et al., 2010; Wasko & Faraj, 2005) thus leading to an improvement in the performance of the organisation as a whole (Zhang & Jiang, 2015). In a similar manner, Oztekin, et al. (2015) point out that one of the major objectives of KM is to pull together intellectual resources and avail them to the whole organisation.

The extant literature recognises a set of factors that enable or inhibit knowledge sharing in organisations. Some of the commonly cited variables are: trust, anticipated reciprocal relationships, identification, image, organisational rewards, knowledge self-efficacy, and loss of knowledge power (Israilidis, et al., 2015). Other factors found in literature include: the nature of knowledge being shared i.e. tacit or explicit, codified or personal.

Though Erickson is quoted in Dixon (2000) stating that humans are a "teaching species", research however, has also found that sharing one's knowledge is *unnatural* for many people (Fink & Disterer, 2006). Similarly, Constant, Kiesler, and Sproull point out that *how* a person acquired his or her knowledge influences his or her willingness to share it (Dixon, 2000). Knowledge gained from one's own personal experiences is deeply personal and cannot be easily separated from the holder. Israilidis, et al. (2015) thus suggest that to ensure that sharing of knowledge is effective, it is critical that an organisation creates an environment in which the sharing of one's knowledge results in personal benefit. The knowledge seeker shares what he or she already knows and the knowledge holder feels appreciated, respected and honoured to have been asked for assistance. This therefore implies that when members of the organisation are consulted by the EA project team, the members of the organisation would feel appreciated, respected and honoured.

Additionally, Ackerman and Halverson (2004) observe that in the context of an organisation, knowledge is not value-free. Instead, people regard information obtained through their own experience (less tangible means) as part of "their identity and self-worth" (Dixon, 2000), therefore sharing tacit knowledge is not exactly "free" as it comes at a psychological cost and the potential rewards are not always clear (Ackerman & Halverson, 2004; Zhang & Jiang, 2015). Israilidis, et al. (2015) therefore assert that people share less tangible information if they stand to benefit in some way from sharing such information or knowledge. Additionally, according to Joe, et al. (2013), it is more efficient to "strengthen weak ties to provide access to tacit knowledge, than to try to convert tacit knowledge to explicit knowledge".

On the other hand, knowledge acquired from more tangible sources is viewed as belonging to the organisation and therefore people are much more willing to freely share such tangible information (Dixon, 2000).

In order to facilitate knowledge sharing, Oztekin, et al. (2015) suggest that there are three main approaches to knowledge sharing/ transfer in terms of both the culture of the organisation and technology. The first one places greater emphasis on the importance of technology in the dissemination of knowledge. Technological advances make knowledge sharing between individuals, teams, departments and organisations effective and geographically feasible.

The second approach emphasises the importance of social interactions and cultural aspects within the organisation. Various scholars have emphasised that formal or informal social processes and cultural issues are as important as the technology systems in knowledge sharing and transfer. Scholars caution that technological systems are not a guarantee that people will share knowledge in the organisation. It is the quality and frequency of social interactions and the structure of organisational culture that encourage people to share knowledge. The third approach combines the technology and socio-cultural aspects of KM.

South African banks have adopted a project-based approach to problem solving (Chigada, 2014). Project teams are put together to conduct work on temporal assignments which facilitates social interactions. These social interaction platforms facilitate sharing of tacit knowledge through socialisation activities thereby enabling individual members of project team to acquire new tacit knowledge as espoused by Nonaka and Takeuchi (1995).

Organisations should therefore seek to adopt an approach to knowledge sharing that codifies explicit knowledge in tangible forms, while tacit knowledge is shared through (1) strengthening weak ties as proposed by Joe, et al. (2013), and (2) creation of an environment where sharing tacit knowledge results in personal benefit. This combination of approaches will ensure that the project team deploying EA can access both explicit and tacit knowledge that is necessary to ensure the resulting EA products are appropriate and sufficiently cater for the different stakeholders' needs.

In the context of this study, some of the significant knowledge transfers that have been observed during EA projects are:

- Transferring of organisational knowledge from members of the organisation such as key users to the entire project team which includes external consultants.
- Transfer of project knowledge between the project manager, the project team and key users. Typically, the project team provides feedback on their progress, as well as any potential risks and changes in the scope of the project. Project managers share with the team the plans to manage the proposed changes as well as plans to mitigate the project risks. The project managers also provide the team (and other stakeholders) with updates regarding the status of the overall project.
- Transfer of solution knowledge from EA experts to all the team members

These are consistent with Lech's (2014) observations with regards to knowledge transfers during ERP implementations.

3.11 Knowledge use

The ultimate aim of knowledge identification, creation/ acquisition, storage and sharing is to ensure that knowledge is utilised to solve the organisation's problems (Alrubaiee, et al., 2015). Knowledge use or application is "the phase in which existing knowledge is brought to bear on the problem at hand" (Seeber, et al., 2013). It is the actual utilisation of knowledge for organisational benefit (Muhammed, et al., 2013). In this phase, regardless of whether the source of knowledge is internal or external to the organisation, knowledge is applied regardless. The application of knowledge to new situations increases the organisation's return on investment as it is a process by which individuals apply existing knowledge to get further knowledge regarding specific tasks and context. It is therefore the primary activity through which knowledge is used by the organisation for value creation. As pointed out by Muhammed, et al. (2013), knowledge use is a behavioural manifestation of KM. Knowledge application is therefore aimed at attaining the organisation's goals. Evans, et al. (2014) point out that once the knowledge has been shared, it can be put to use by extracting its value and applying it throughout the organisation to make decisions, solve problems, promote innovation and improve efficiency.

Dalkir (2011) however, puts forward that due to the loss of contextual information during codification, it is possible that codified knowledge may not lead to understanding. This therefore makes it difficult at times to extract value from codified forms of knowledge without the involving of the knowledgeable or expert. Additionally, it is much more difficult to extract value from larger or more complex knowledge assets (Evans, et al., 2014). In such instances, expert intervention may be required for correct and efficient application of the knowledge. As an example, an expert would contextualise a generic document and make it specific to solve the problem at hand. Dalkir, (2011) refers to this as "recontextualization of knowledge".

Additionally, the *knowledge use* stage is regarded as key to the internalisation of tacit knowledge (Evans, et al., 2014). Dalkir (2011) emphasises that failure to execute or poor execution of the knowledge use phase, "all of the KM efforts have been in vain, for KM can only succeed if the knowledge is used". During EA deployment, knowledge application helps ensure that all the relevant knowledge is applied such that the EA products adequately serve the organisation's specific requirements.

Technology plays an important role in KM and the following section discusses this role further.

3.12 KM and Technology

Mavodza and Ngulube (2011) report that it is a commonly held view among researchers and practitioners that IT has a potential to facilitate the rapid searching, accessing, as well as retrieval of previously captured and retained information. This enables members of the organization to effectively communicate (share knowledge) and collaborate. This includes knowledge shared during EA adoption.

Technology plays an important role within KM as it widens the reach and accelerates the transfer of knowledge. Technology also promotes the digital capture, storage, retrieval and dissemination of knowledge. Technology-driven KM systems are therefore aimed at facilitating the transfer of knowledge from the knowledge holders who originally experienced and created it to other members of the organisation who might benefit from the same knowledge (Davison, et al., 2013). It is however important to note that implementing one or more of those tools is not a silver bullet to overcome the shortcomings of the organisation's knowledge sharing processes (Garcia-Perez & Ayres, 2010).

In the extant literature on KM, technology usually appears as a key component (Botha, et al., 2008), as a success factor (Yaghoubi & Maleki, 2012), and as a potential failure factor (Singh & Kant, 2008). Tiwana (2000) however, summarizes the key roles played by technology with KM as follows:

- Technology facilitates communication.
- Technology provides infrastructure for storing codified and explicated knowledge.
- Technology assists with the mapping of dispersed bits and pieces of tacit and explicit knowledge to establish and maintain intricate interdependencies among them.

Additionally, IT systems enable organizations to source new information, however Dreyfus and Iyer (2006) caution that the same IT systems can also limit the information the organization sees. For example, if there is new information which the system is not expecting, the system can filter out or ignore this new information. Evans, et al. (2014) emphasize that one of the most important reasons for processing knowledge is "for individuals, groups and the organization itself to learn, to remember what it has learned and to leverage the collective expertise in order to perform more efficiently and more effectively". In this regard, technology plays an essential part in capturing and codifying knowledge as well as in disseminating knowledge to the organisation's members.

Sample Technologies

Building on the works of Evans and Ali (2013), Evans, et al. (2014) derived a list of sample technologies and techniques that can be adopted in support of each KM activity. The list includes: expertise Location Systems, Workflow Technologies, Idea Management Software, Documents / Content Management Systems, Authoring Tools, Blogs and Wikis, Social Media and Web 2.0, Search Engines and Technologies, Websites, Incident / Helpdesk Systems, Expert Systems / Decision Support Systems, Learning Management Systems

These technologies and initiatives can span more than one KM phase as depicted graphically in Figure 3.2. These technologies have an important role to fulfil in managing knowledge created, stored and shared during EA adoption.

Figure 3.2: Sample KM initiatives adapted from: (Evans, et al., 2014)

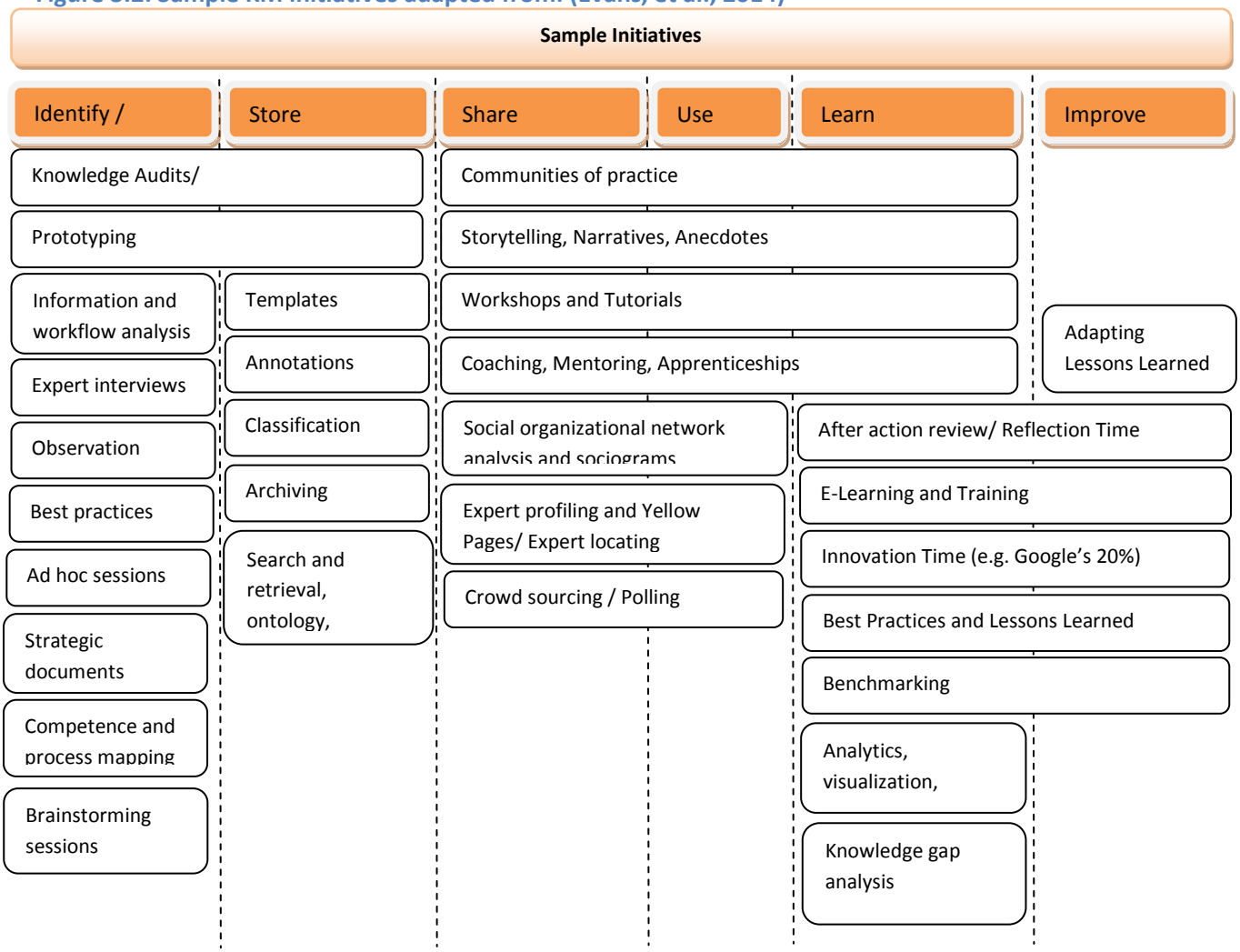
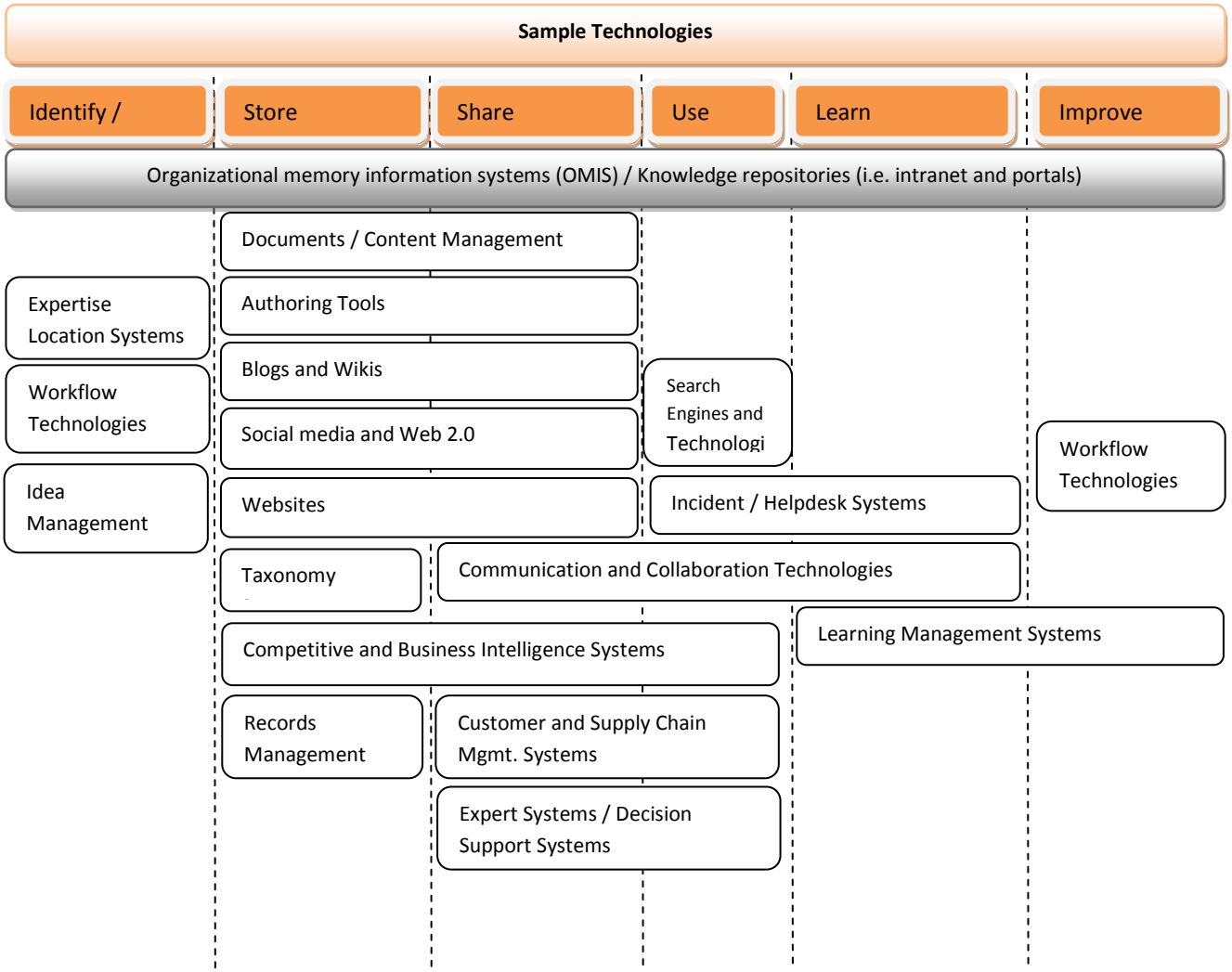


Figure 3.3: Sample KM technologies adapted from (Evans, et al., 2014)



Similarly (Panahi, et al., 2013) summarised the links between the IT tools and tacit knowledge conversions by using the SECI model as shown in Table 3.2.

Table 3.2: Mechanisms and technologies for knowledge creation and sharing (Panahi, et al., 2013)

Face to Face		**IT Assisted**	
Socialisation (*tacit to tacit*)	Externalisation (*tacit to explicit*)	Socialisation (*tacit to tacit*)	Externalisation (*tacit to explicit*)
- Team meetings *- Discussions* *- Interpersonal interactions* *- Apprenticeship* *- Participation* *- Observation*	*- Dialog with team* *- Answering questions* *- Story-telling* *- Metaphors/analogies*	*- Online real-time meetings* *- Synchronous communication (Chat)* *- Online community of practice* *- Groupware systems* *- Social media*	*- Answering questions* *- Annotations* *- Blogs/Wikis* *- Discussion forums* *- Collaborative systems* *- Groupware systems* *- Phone/video conferencing*
Combination (*explicit to explicit*)	Internalization (*explicit to tacit*)	Combination (*explicit to explicit*)	Internalization (*explicit to tacit*)
- Books *- Papers* *- Reports* *- Presentations* *- Indexes, etc.*	*- Learning by doing* *- Learning from books, reports, presentations, lectures, etc.*	*- All forms of technologies* *- Text search* *- Document categorization* *- Podcast/Vodcast* *- Blogs/Wikis* *- RSS* *- Mashups*	*- Visualization* *- Video/Audio presentations* *- Online learning* *- E-mail* *- Webpage*

3.13 KM and organisational culture

Corfield and Paton (2016) pointed out that it is at the core of the knowledge management theory that KM and organisational culture are firmly entwined. Furthermore, the extant literature reveals that the success of KM, its approaches and activities depends on how well these fit with the organisation's specific context and environment. Organisational culture is a significant part of that context. Organisational culture is a term that involves complex ideas, which makes it difficult to comprehensively definite it. One definition, in the words of Hofstede, is: "the collective programming of the mind that distinguishes the members of one group or category of people from another" (Corfield & Paton, 2016). Similarly, Anderson (1984) in Stamper (2014) defines organisational culture as "the pattern of shared beliefs and expectations that govern the way organisation members behave". Both these definitions suggest that organisational culture relates to the existence of common assumptions, values and norms within an organisation.

In this study, Schein's definition of culture is adopted because it incorporates many of the various elements and concepts of culture found in literature. According to Schein, a group's culture can be defined as "[a] pattern of shared basic assumptions that the group learned as it solved its problems of external adaptation and internal integration, that has worked well enough to be considered valid, and therefore, to be taught to new members as the correct way to perceive, think, and feel in relation to those problems" (Aier, 2014).

Organisational culture has been highlighted as a crucial factor in determining the success of knowledge sharing strategies (Stamper, 2014). Moreover, Downes (2014) suggests that an organisational culture that is supportive of KM, "values knowledge highly and encourages its creation, sharing and application through the empowerment of individuals to explore new possibilities and approaches".

Similarly, Corfield and Paton (2016) investigated the relationship between KM and organisational culture and found that although the relationship between the two is complex, there is evidence that KM interventions can lead to an organisational culture change. KM can therefore be used to create an organisational culture that promotes EA adoption.

3.14 Conclusion

The use of KM to gain a competitive advantage is no longer new to organisations. As the old saying goes *knowledge is power* and it fuels growth, productivity and survival of organisations. While its true origin is still shrouded in controversy, KM promises great benefits to organisations.

At the heart of KM is the concept of knowledge. Even though knowledge has existed for eons, defining and understanding the term *knowledge* is still fraught with difficulties. However, given the importance of knowledge in this study, it is important to study it as a concept and to write about it in this study.

The following knowledge activities are discussed in this chapter

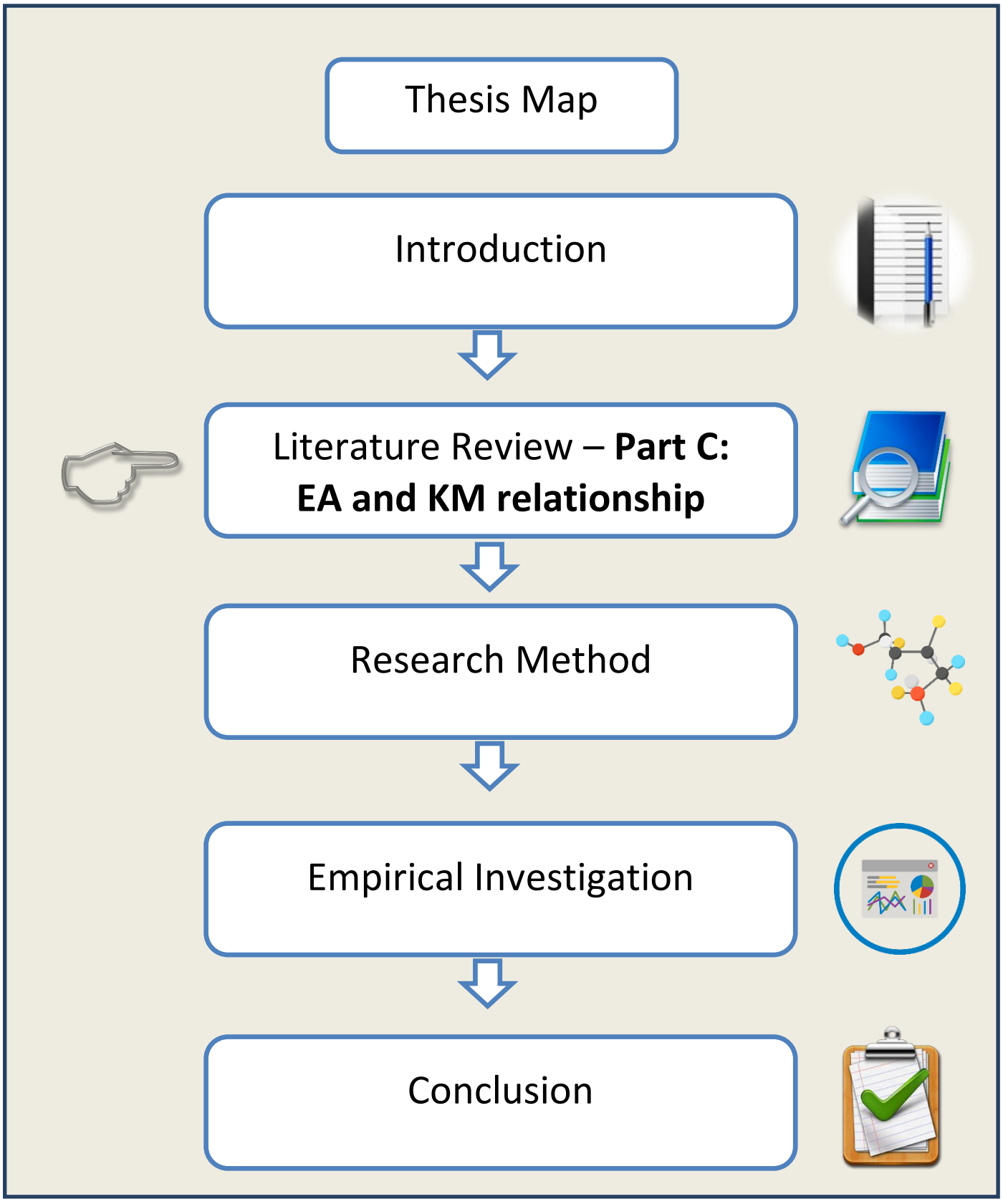
- Knowledge identification
- Knowledge storage and capture
- Knowledge acquisition and creation
- Knowledge sharing
- Knowledge use

The vital role played by technology in KM is studied with the aim of providing practical advice and guidance on applying KM technologies and initiatives during EA initiatives.

Corfield and Paton (2016) investigated the relationship between KM and organisational culture and found that although the relationship between the two is complex, there is evidence that KM interventions can lead to an organisational culture change.

Chapter 4 pays attention to the relationship between EA and KM

CHAPTER 4: Literature Review - Part C: Relation between EA and KM



4.1 Introduction

In this chapter the nature of the relationship that exists between EA and KM is studied. A deeper understanding of this relationship will help determine the role of KM in supporting EA efforts which is the main objective of this study.

According to (Gøtze, 2013), "much of what enterprise architects do is transmit, translate and transform knowledge across boundaries, whether the boundary is between customer and vendor, between "business silos", or between the classic 'business ' and 'IT'''. In a similar manner, the importance of the knowledge created and shared during EA planning and development has been highlighted in Chapters 2 and 3. (McGinnis & Huang, 2007) stated that such knowledge is an important organisational resource which must be properly managed.

It is therefore desirable for the relation between knowledge management and enterprise architecture to be studied and made explicit. With such a relation, whenever there are KM-induced organisational capabilities such as changes to organisational processes or changes to the IT landscape as a result of KM, the EA would accordingly require updating to continue supporting the provision of the organisation's products and services. *Therefore, KM influences EA*.

Similarly, the introduction of change to the organisation requires an analysis of possible impacts triggered by this change and EA can support this analysis because EA provides a comprehensive view of the entire organisation (Azevedo, et al., 2015).

Furthermore, Gilliland, et al. (2015) point out that "if EA is accepted, the organisation has the advantage to gather knowledge about how humans involved in EA operate. Capturing and retaining useful human knowledge may result in reusable information." It is therefore evident that *EA facilitates effective flow of information thus promoting KM within an organisation*.

4.2 Scope

Given that this study focuses on KM's role in supporting EA, it is essential that the existing literature on incorporating KM into the EA adoption process is studied. In addition, it is also the objective of this research to determine the knowledge inputs into EA. In this regards it is important to study the integration of knowledge management with project management particularly given that EA is deployed as a series of projects.

4.3 Incorporating KM into the EA adoption process

This section relies on the works of McGinnis and Huang (2007) in which they studied the applicability of the SECI model during the implementation of an ERP system. It is argued in this study that their findings can be applied to EA projects on the basis that ERP and EA share some important common characteristics:

- Similar to EA, "ERP systems [...] integrate all the information related to a company's business [...] and facilitate decision-making. [...] An ERP system [...] can in some settings have a strategic impact by integrating all the business functions of a company" (Trinskjær, 2009). Trinskjaer (2009) also argued that ERP systems can support all the different areas of an organisation.
- EA and ERP operate on a large scale, over the long term
- They routinely challenge the status quo by introducing change to the enterprise
- They deal with 'wicked' problems. According to (Camillus, 2008) writing for the Harvard Business Review, a 'wicked' problem is a "problem has innumerable causes, is tough to describe, and doesn't have a right answer".

Given these similarities between ERP and EA McGinnis and Huang's findings are considered to be (potentially) applicable to EA implementations as well. They contend that the SECI model is applicable in any IT project because they suggest that knowledge cycles through each of the four quadrants in each phase of any IT project. They further state that identifying the knowledge management steps in each phase of the project can lead to improvements in the organization's capability of managing its knowledge resources.

4.4 SECI application in projects

Owing to the transient nature of projects, knowledge must be created and shared efficiently to contribute to the success of the projects. The applicability of the SECI model in EA adoption projects is discussed in the following section. According to McGinnis and Huang (2007), the process is as follows

- **Socialization** (tacit-to-tacit conversion)

The first step of any phase of a project lies in the socialization quadrant. The boundaries of the overall project phase are defined in this quadrant. The expected deliverables are also identified in this quadrant. Experienced members of the organisation and consultants leverage prior project experience while novice employees acquire tacit knowledge by using their newly acquired knowledge about the applicable techniques and tools. McGinnis and Huang (2007) note that "tacit knowledge is passed between veterans and novices; this exchange is informal and continues throughout the phase".

- **Externalization** (tacit – to explicit conversion)

This is the process of articulating tacit knowledge. This process is usually triggered by discussions between members of the organisation. The acquisition of knowledge about the project as well as its associated deliverables enables the members of the project team begin to interact with the rest of the organisation, thus formalising their tacit knowledge. This process starts generating explicit knowledge.

- **Combination** (explicit – to – explicit conversion)

This occurs when there is a juxtaposition of various pieces of explicit knowledge leads to the creation of new knowledge. According to McGinnis and Huang (2007), in this quadrant project teams are required or expected to specialise in the various functional areas. As a result, the explicit knowledge accumulated by the different sub-teams of the project is coordinated to provide a comprehensive view. Any compromise and /or clarification made are for ensuring that the knowledge captures is understood by the entire group thus benefitting the entire organisation instead of functional silos.

- **Internalization** (explicit – to – tacit conversion)

This occurs when members of the organisation share their mental models as well as technical know-how. This mechanism is also known as the process of learning-by-doing. In this quadrant, the material collected in prior phases of the project is interpreted. McGinnis and Huang (2007) posit that in this quadrant, members of the team review the explicit knowledge gathered as well as the

techniques applied to collect or acquire such knowledge. The organisation's knowledge is thus created or augmented through this creation and addition of new knowledge to the already gathered knowledge. This process helps with the identification of opportunities for "system implementation and refines its outputs (new deliverables, improved documentation, improved training, and process refinements). The continuous improvement nature of this step is critical to the incorporation of knowledge into the implementation lifecycle" (McGinnis & Huang, 2007). The team as well as the organisation are provided with the resulting improvements by the time the next project or cycle starts.

4.5 Integrating KM with project management

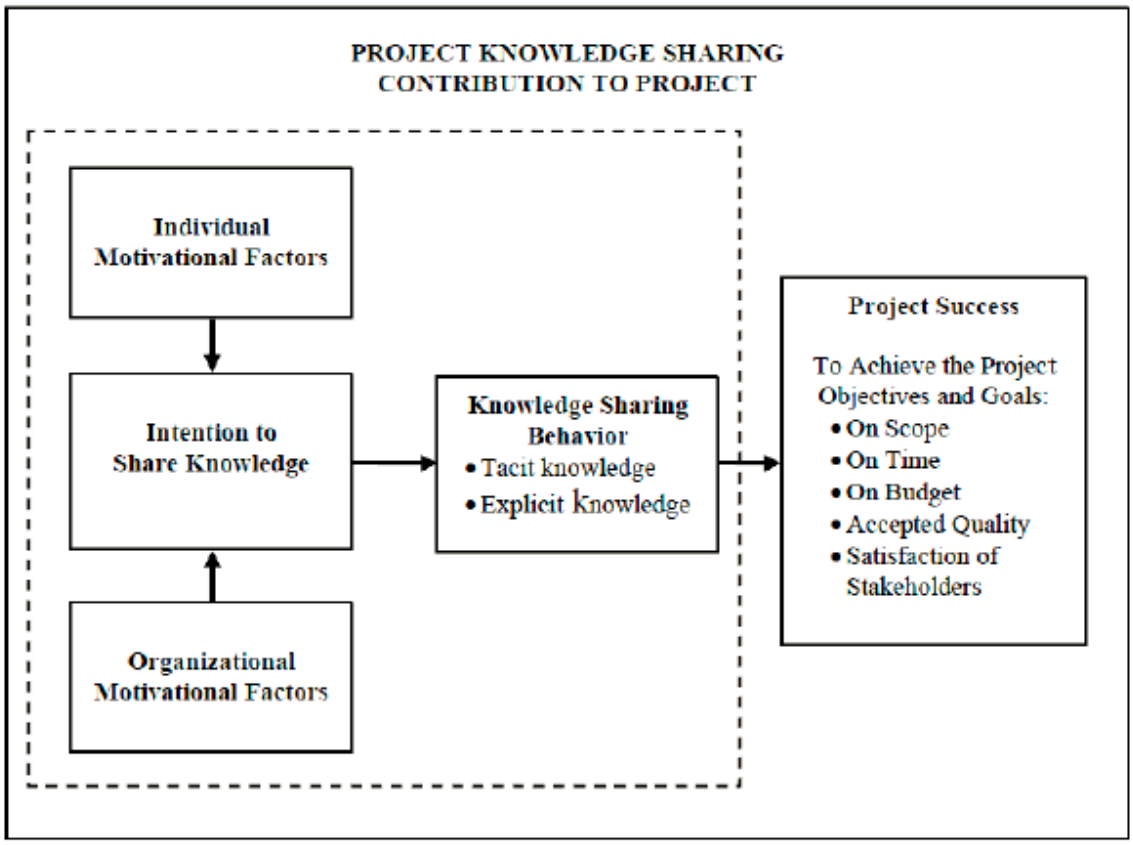
Despite an abundance of literature on knowledge sharing, "little is known about how individuals share knowledge, especially in a project environment" (Ismail, et al., 2009).This section pays attention to the existing literature on integrating KM and project management to improve project success in organisations. This is studied with the aim of developing a deeper understanding of how knowledge sharing between individuals in a project environment takes place. This is important in the context of this study because project management is a vessel through which EA is implemented in organisations.

The ultimate aim of knowledge management is to enable utilisation of knowledge to attain the goals of the organisation. As stated previously, knowledge management enables organisations to be creative and produce attractive products and services that allow organisations to have sustained commercial success. Such products and services are delivered through various projects of the organisation (Yeong & Lim, 2010). As noted previously, the evolution from an enterprise's current state to the envisioned future state is guided through various projects (Ross, et al., 2006).

While there is a plethora of definitions of the terms *project* and *project management*, one of the commonly cited definitions is provided by the Project Management Institute (PMI). According to the PMI's Project Management Body of Knowledge guide (PMBOK), a project is defined as "a temporary endeavour undertaken to create a unique product, service, or result" (Yeong & Lim, 2010). They define project management as "the application of knowledge, skills, tools, and techniques to project activities to meet the project requirement". These definitions have similarities and complement each other (Yeong & Lim, 2010). Project management aims to ensure projects deliver products and services with the required scope, within budget, on time and required quality.

Various authors have pointed out that knowledge management is key to project management success (Yeong & Lim, 2010; Cope III, et al., 2006; Ajmal & Koskinen, 2008). Ismail, et al. (2009) proposed a theoretical framework shown in Fig.4.1 suggesting that the provision of suitable motivators and eliminating inhibitors to knowledge sharing would lead to an efficient and effective knowledge sharing in projects thus leading to a greater probability of project success. According to Ismail et al.'s (2009) model, there is an important relationship between the effectiveness of knowledge sharing during the project and the success of the project. They also found that project success is enhanced by *when* and *how* the sharing of tacit and explicit knowledge takes place.

Figure 4.1: Proposed theoretical framework for project knowledge sharing contribution to project. Source (Ismail, et al., 2009)



Similarly, Cope III, et al. (2006) state that organisations would benefit greatly by capturing and sharing both tacit and explicit knowledge within the project management community. Project managers most frequently adopt (1) shared repository of project artefacts, (2) document and content management systems, (3) lessons learned and best practices repositories as knowledge management practices to help them.

As Serrat (2012) pointed out though, knowledge management where learning is project-based faces significant challenges due to various reasons with one of the chief extenuating circumstances being the transient nature of projects. Serrat (2012) points out that in a project environment "...novel but temporal associations must be forged then fortified. Yet, pressing matters compete for what time, discipline, and skills ought to be made available for that; all the while, the certainty that team members will go their separate ways to take up other work when the project closes militates against earnest intentions to engage in deep knowledge sharing, never mind debriefings". In addition, Ajmal, et al. (2010) caution that identifying critical knowledge, as well as the ability to exploit it, are challenges for project organisations. Owing to the transient nature of project teams, these teams do

not have a defined knowledge system as well as a supporting culture to capture and retain knowledge as ‘‘corporate memory’’. This therefore means, organisations can easily lose critical knowledge assets after project completion and the team is disbanded (Ajmal, et al., 2010).

The creation, capture, and transfer of knowledge in projects should be facilitated by planned management efforts and incentives. For example, Ajmal and Koskinen (2008) propose a deliberate socialisation of lessons learned from a project among members of the project before the project team is disbanded. Without such planned KM initiatives, the experience gained from one project cannot enhance organisational processes by improving execution of subsequent projects (Ajmal & Koskinen, 2008).

Additionally, Levin,(2010) maintains that effective implementation of knowledge management is the key to project management success, which would in turn transform the organization to excellence. Levin (2010) also emphasises the importance of embedding knowledge management throughout the project management lifecycle because the organisation’s knowledge asset base is continuously developed, each project must build on these knowledge assets and share the knowledge.

It can therefore be concluded that knowledge management is key to the success of the various IT projects that guide the transformation of the organisation’s enterprise architecture. By extension, it can be argued that knowledge management is key to enterprise architecture success.

4.6 Conclusion

Given that the focus of this study is on both KM and EA, an explicit relation between the two domains is considered desirable. It has been found that EA supports KM by enabling effective flow of information within an enterprise. It has also been argued that by applying the SECI model in EA projects, the knowledge exchange and sharing of knowledge can be optimised thus improving the likelihood of EA success.

Moreover, it has been argued in the chapter that KM can play key role towards the success of EA through the effective application of KM methods, tools and technologies to the project management discipline.

CHAPTER 5: Literature Review - Part D: The South African motor vehicle and asset finance (VAF) industry

5.1 Introduction

This chapter pays attention to the banking environment in South Africa. Factors that differentiate this sector of the economy are investigated in this chapter highlighting the importance of conducting this research in this industry.

The banking industry is a particularly interesting setting for studying EA adoption. Banks typically struggle with diverse legacy systems that are not easy to integrate and modify. Shrinking profit margins and deregulation are some of the major factors that impact financial institutions and requiring greater organisational agility (Baskerville, et al., 2009).

The traditional banking laws were restrictive and resulted in IT infrastructures that are fragmented, which now require adapting to meet the new demands of the more sophisticated customer base. Banks that have outdated ICT architectures are now faced with increasing demands for Information Systems (IS) architectures that are flexible and cost-effective. According to Baskerville, et al. (2009), the ability "to acquire a new ICT architecture is becoming a key competitive factor to support the new financial business drivers in banking". However, antiquated architectures make it difficult to integrate enterprise applications due to the fact that underlying elements of these architectures have in effect created 'closed' architectures (Baskerville, et al., 2009).

In a similar manner, (Mueller, et al., 2007) note that most information systems in the banking industry consists of legacy systems. Mazursky (1989) cautions that closed architectures impose restrictions that limit access to the important configurations (both software and hardware) thereby forcing organisations to depend on single-vendor solutions for certain components of their ICT (Mazursky, 1989). Moreover, banks also typically struggle with a variety of applications that run on diverse platforms such as Java/ .Net/ COBOL or PL/1 (Mueller, et al., 2007). Baskerville, et al. (2009) also warn that the closed architectures inhibit the banks' capacity to offer new and integrated products as well as the banks' ability to merge with companies or to consolidate redundant operations. Similarly, (Mueller, et al., 2007) found that integrating the banks' products is a particular challenge for bancassurance organisations.

5.2 Scope

Contemporary literature on the banking industry in general, the South African banking industry in particular as well as the South African motor vehicle and asset finance (VAF) industry is discussed in this chapter.

5.3 The banking industry

Market consolidation is one of the major challenges facing organizations in the banking industry (Mueller, et al., 2007). As a result many organizations that traditionally served distinct markets or market segments in the financial services sector are now integrating their offerings. Consequently, the concept of bancassurance as emerged which is "a type of company that offers comprehensive financial services and realises the concept of the one-stop shopping solution in the financial services market" (Amato-McCoy, 2005). These 'bancassurance' organization have significant advantage because they are able to push (promote and offer) their products to the market using effectively the same distribution channels (Mueller, et al., 2007). EA can play a vital role in facilitating this bancassurance business model and strategy.

Moreover, Van Greuning and Bratanovic (2009) noted that since the 1980s the face of banking has been significantly changed by the internationalization of financial flows as well as the rapid innovations in financial markets (Van Greuning & Brajovic-Bratanovic, 2009). Van Greuning and Bratanovic (2009) further observed that a combination of increased competition among banks and non-banks and deregulation as well as the technological progress has provided new opportunities to organizations in this industry. In addition, Van Greuning and Bratanovic (2009) noted that from the late 1980s, traditional banking began to offer decreased margins while there was an increase in capital adequacy requirements. In response to these challenges, the banks became highly imaginative and entered new business areas with increased focus on superior information and knowledge management capabilities.

According to Li (2012), banking is not just a business of money; instead it is a business of information. Li (2012) further noted the importance of managing knowledge in the banking industry just as it is the case in other industries. Capgemni (2008) summarised timelines of how banking systems have evolved since the 1970s as follows:

- **1970 – 1980**: Core banking systems provided basic functionality for core banking transactions
- **1980 – 1990**: Legacy core banking systems were primarily product centric and developed in silos. Bank of Scotland offered customers first internet banking services
- **1990 – 2000**: New core banking systems developed which were flexible and customer centric. Multi-channel processing/integration and adoption of SOA

- **2000 – 2010**: Online banking goes mainstream and banks start to focus on customer centricity. Big data, analytics and cloud based platforms evolved, which led to look towards agile core banking solutions.
- **2010 – 2012**: Banks invest in core architecture due to tighter regulations. There was rapid growth in mobile banking. Banks focused on risk management.
- **2012 – Current**: Convergence of online banking, social networking, payments and mobile has increased banks' focus to overhaul legacy systems for supporting fast-growing digital services and better integration of channels. New IT architecture adopted for core banking solutions which will be scalable, adaptable, agile and economical.

Combining KM and EA for the success of EA is under-researched in the context of this sector. This study will therefore contribute to the body of knowledge for both the EA and KM disciplines.

5.4 The South African banking industry

ATKearney (2012) noted five major trends that are reshaping the way banks operate: the technology tools, new competitors, branch networks, and today's more empowered bank customers. In addition, according to Matoti (2012), the South African banking industry has attracted significant interest from abroad citing an increase in the number of foreign banks that have established a presence in South Africa while other foreign banks have acquired stakes in major banks, such as the merger of ABSA Bank and Barclays and the deal between Industrial and Commercial Bank of China's and Standard Bank.

According to Matoti (2012), changes in the banks' regulatory environment, product offerings, and growth in the number of participants have resulted in increased competition with smaller banks such as African Bank and Capitec Bank entering this industry targeting the low-income and the previously unbanked market (Matoti, 2012). Matoti (2012) further notes that the South African banking sector is regarded to be world class and it has sufficient capital resources, technology and infrastructure and a strong regulatory and supervisory environment. In addition, South Africa's corporate sector is regarded as internationally competitive moreover it relies on sophisticated and advanced ICT and infrastructure (Marais, 2009).

According to PriceWaterhouseCoopers (2013), the South African banking sector continues to grow in an uncertain world. The PricewaterhouseCoopers's (2013) survey findings reveal that South Africa's banking sector is dynamic and evolving fast. Moreover, the findings revealed that changes in regulations and global economic pressures are some of the major forces challenging the banks to continually assess their capacity to enhance their competitiveness through successful use of their knowledge resources.

Additionally, South Africa's open economy as well as its growing local economy have made it necessary for the corporate sector to be innovative and dynamic in adopting information and communication technologies. Many of the larger companies have been aggressive in their pursuit of formal and large-scale EA initiatives. Significantly, (Van Zijl & Van-Belle, 2014) found a strong empirical basis for many claimed EA benefits.

5.5 Motor vehicle and asset finance industry in South Africa

The South African motor vehicle and asset finance industry falls under the South African banking industry which is highly competitive and is dominated by four leading finance houses, namely:

- WesBank, a division of First Rand Bank which has a 32% market share,
- Motor Finance Corporation (MFC), which is a subsidiary of Nedbank which has 24% market share,
- Absa Vehicle and Asset Finance Division, a division of Absa Bank which has an 18% market share
- and Stannic, a division of Standard Bank which also has an 18% (Competition Tribunal of South Africa, 2013).

According to the South Afrcan Automotive Export Manual 2015, South Africa's broader automotive industry contributed 7.2% to the country's GDP (R3 796,5 billion) in 2014 (AIEC, 2015). The vehicle finance industry is therefore a significant contributor to the country's economy (Pieterse, 2009).

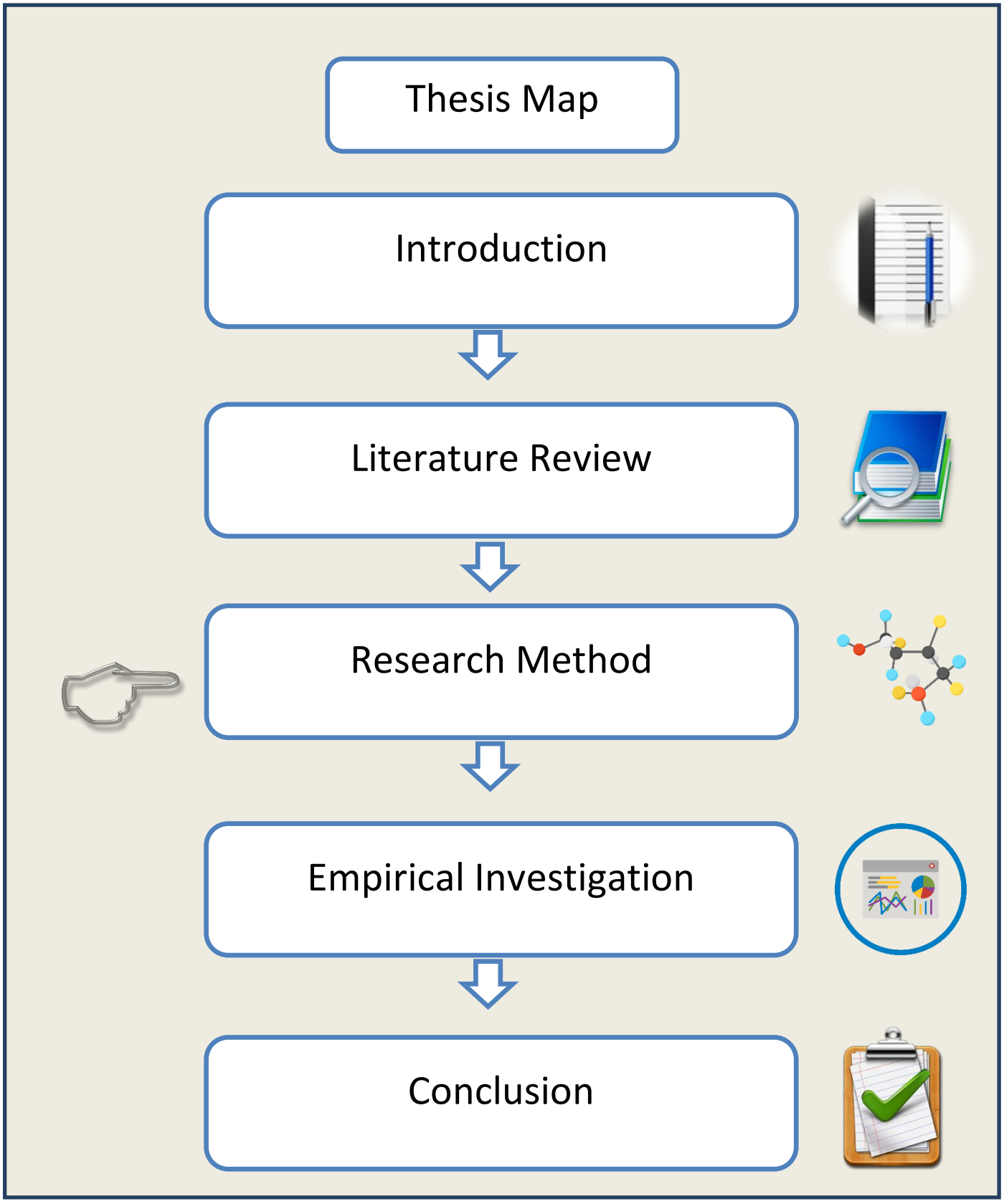
The banking customers' expectations, preferences and tastes are constantly changing. This dictates that the banks must be imaginative and create attractive products and services that best meet customers' needs. In response to these changes in the banks' operating environment, banking systems continue to evolve.

5.6 Conclusion

The important motivations for EA in the banking industry in general, have been highlighted in this chapter. It has been noted that banks typically have heterogeneous IT systems as well as fragmented IT infrastructures which now have to be adapted to meet the new demands of the more sophisticated customer base. Banks are now faced with increasing demands for cost-effective and flexible architectures.

The emergence of the concept of bancassurance has been discussed. An increase in the number of participants in the South African banking sector is one of the factors that have resulted in increased competition. The South African motor vehicle and asset finance industry has been found to be highly competitive and a significant contributor to the country's GDP.

CHAPTER 6: Research Method



6.1 Introduction

This research investigates the integration of KM and EA for the success of EA in the context of a bank operating in the South African motor vehicle and asset finance industry. The importance of EA and KM to the organisations that participate in this industry is also studied. This research further explored the challenges encountered during EA adoption. In Chapter 1, the research objectives and questions guiding this research study were outlined. The literature review in Chapters 2, 3, 4 and 5 provided the theoretical context; it also identified the challenges as well as the benefits of EA. Chapter 6 communicates the manner in which this research has been conducted including how empirical data was gathered.

It is commonly accepted that any research investigation must be founded on a rigorous scientific methodology (Biscaya, 2012). The research methodology is regarded as the "...systematic, formal, rigorous and precise process employed to gain solutions to problems and/or to discover and interpret new facts and relationships" (Biscaya, 2012); with its design described as "the architectural blueprint of a research project, linking data collection and analysis activities to the research questions and ensuring that the complete research agenda will be addressed."

The main purpose of conducting research is to develop knowledge in a particular field (Saunders, et al., 2009), by identifying, investigating and solving an unsolved problem (Biscaya, 2012). Following a particular methodology necessitates an understanding of the methodology's constituent elements together with their interactions to provide appropriate alignment between the research method and field of study.

In this chapter, the researcher articulates the specific choices (and rationale) pertaining to how this research has been conducted in investigating the research problem defined in Chapter 1. This chapter is divided into the following main sections: the research philosophy, research approach, research design and data collection.

6.2 Research Philosophy

Biscaya (2012) emphasized the importance of the research philosophy by stating that, "Research philosophy is the core of any research guiding and unifying the research strategy and techniques" (Biscaya, 2012). This philosophical stance influences both the data requirements for the research as well as the analysis of the collected data. Moreover, the research philosophy includes assumptions regarding the researcher's view of the world; it also relates to "the development of knowledge and the nature of that knowledge" (Saunders, et al., 2009). Saunders, et al. (2009) in table 6.1 offers key features of the four main philosophy paradigms.

Table 6.1 : Research Philosophies

	Positivism	**Realism**	**Interpretivism**	**Pragmatism**
Ontology: *the researcher's view of the nature of reality or being*	External, objective and independent of social actors	Is objective. Exists independently of human thoughts and beliefs or knowledge of their existence (realist), but is interpreted through social conditioning (critical realist)	Socially constructed, subjective, may change, multiple	External, multiple, view chosen to best enable answering of research question
Epistemology: *the researcher's view regarding what constitutes acceptable knowledge*	Only observable phenomena can provide credible data, facts. Focus on causality and law like generalisations, reducing phenomena to simplest elements	Observable phenomena provide credible data, facts. Insufficient data means inaccuracies in sensations (direct realism). Alternatively, phenomena create sensations which are open to misinterpretation (critical realism). Focus on explaining within a context or contexts	Subjective meanings and social phenomena. Focus upon the details of situation, a reality behind these details, subjective meanings motivating actions	Either or both observable phenomena and subjective meanings can provide acceptable knowledge dependent upon the research question. Focus on practical applied research, integrating different perspectives to help interpret the data
Axiology: *the researcher's view of the role of values in research*	Research is undertaken in a value-free way, the researcher is independent of the data and maintains an objective stance	Research is value laden; the researcher is biased by world views, cultural experiences and upbringing. These will impact on the research	Research is value bound, the researcher is part of what is being researched, cannot be separated and so will be subjective	Values play a large role in interpreting results, the researcher adopting both objective and subjective points of view
Data collection techniques most often used	Highly structured, large samples, measurement, quantitative, but can use qualitative	Methods chosen must fit the subject matter, quantitative or qualitative	Small samples, in-depth investigations, qualitative	Mixed or multiple method designs, quantitative and qualitative

Source: (Saunders, et al., 2009)

In this research, the intention was to gather data from a sample of 83 individuals with the aim of measuring the extent to which EA is valued in the participating organisation. Furthermore, the intention was also to measure the prevalence of the barriers to EA adoption as presented in chapter 2 of the literature review. Additionally, the researcher is independent of the data gathering process.

It is for these reasons that the required data were collected using a *positivism* philosophy paradigm.

6.3 Research Approach

This section discusses the selected approach and the rationale for choosing it for answering the research question. In particular, the two broad categories of social science research: quantitative and qualitative research will be covered in this section. Although in recent years, a third approach known as mixed methodology has emerged. This third approach combines the quantitative and qualitative approaches.

The distinction between the two main categories of social science research is often framed in terms of the use of words for qualitative while quantitative research methods use numbers (Creswell, 2014). Another distinction is that quantitative research methods tend to use closed-ended questions, while qualitative methods typically use open-ended questions.

Qualitative research allows researchers to reveal the inner experiences of people, to understand the manner in which meanings were formed, as well as to discover what the variables are instead of testing certain variables (Corbin & Strauss, 2008). Moreover according to Leedy and Ormrod (2005), a qualitative research approach tends to describe and understand the phenomenon from the participants' viewpoint. Through the use of qualitative analysis processes, empirical knowledge is developed by extracting meaning and understanding (Corbin & Strauss, 2008).

On the other hand, quantitative research enables the researcher to quantify or measure the extent of an occurrence or event (Stamper, 2014). Similarly, Clark-Carter (2004) posits that "quantitative research methods involve some form of numerical measurement while qualitative methods involve verbal description". In addition, Creswell (2014) states that quantitative research methods have the following characteristics: "pre-defined, instrument based questions, performance data, attitude data, observational data, census data, statistical data, and statistical interpretation".

According to Creswell (2014), the choice between quantitative and qualitative methods is often dependent on whether the data emerged directly from the study subjects (qualitative) or whether the researcher uses a predefined instrument in measuring known variables found in collected (quantitative) data (Creswell, 2014).

This study fit into the realm of *quantitative* analysis because it would enable the users of this study to quantify the extent to which EA stakeholders within the motor vehicle and asset finance industry recognise and appreciate the role of EA. It was also used to provide insight into the barriers encountered during EA adoption. Additionally, quantitative research methodology was chosen to provide insight into the extent to which EA stakeholders believe that EA efforts might benefit from

introduction or promotion of KM activities such as promoting a culture of knowledge sharing or providing the necessary tools which allow employees and the EA team to collaborate.

6.4 Research Design

Research design provides a framework used to conduct research studies. The research design is important because it enables the researcher to structure and deliver the evidence necessary to answer the research problem. Within the quantitative research methods, Creswell (2014) defined two primary research designs: experimental designs and non-experimental designs. The primary aim of *experimental research* is to determine if a specific treatment has an effect on an outcome. Creswell (2014) further highlights that under the experimental research, the researcher evaluates the treatment's effects on an outcome by dividing the participants or subjects of the study into two groups and providing a specific treatment to only one of group and then determining the scores of both groups on an outcome.

However, non-experimental research design focuses on providing quantitative or numeric descriptions of opinions, attitudes or trends of a population by drawing a sample from the population and studying that sample. This research design comprises both cross-sectional and longitudinal studies through the use of questionnaires or structured interviews to collect research data. The intention is to generalize from a sample to a population (Saunders, et al., 2009; Creswell, 2014).

In conducting the research, the attitudes and opinions of the various EA stakeholders had to be collected from a relatively large population. This research also measured the prevalence of the barriers to EA adoption (discussed in chapter 2), in the participating organisation.

This research therefore lent itself to a *survey study* and a survey study was adopted to guide the collection and analysis of data.

Surveys are either descriptive or relational in nature. The intention of conducting descriptive surveys is to describe the prevailing situation. On the other hand, the intention of conducting relational surveys is to empirically examine relationships among two or more variables. This study seeks to explore the interdependence of enterprise architecture and knowledge management practices. A *relational survey* design, rather than the descriptive method was therefore followed in this study.

6.5 Data Collection

Data collection for this research was through a questionnaire posted on SurveyMonkey (http://www.surveymonkey.com) which is a website designed for public use of web-based surveys. Babbie as cited in De Vos et al. (2013) defines a questionnaire as "a document which contains questions and other types of items designed to solicit information appropriate for analysis". The reason for selecting this tool was that it is able to distribute questionnaires to a wide audience by providing a direct link to the survey. It is also able to track respondents and it is able to consolidate the responses into multiple report formats. It is also password protected thus ensuring privacy.

The design of the questionnaire included a list of fixed alternative questions to enable analysis. By following guidelines provided by Zikmund (2007) on phrasing questions, ambiguous, leading, double-barrelled questions were avoided.

The questionnaire was based on the literature review and linked to the research questions. It contained the benefits of EA to determine the importance of EA to the participating organisation. It also contained the barriers that impede EA efforts as discussed in chapter 2. Additionally, the participants were requested to rank each possible solution to the identified barrier regarding the solution's perceived effectiveness in solving the associated barrier, on a five point Linkert scale.

6.5.1 The questionnaire

The questionnaire was constructed taking the following considerations into cognisance as identified by (Zikmund, 2007):

- The use of technical jargon and abbreviations was avoided. This was important because abbreviated terms can hold different meanings for some respondents.
- The use of leading and loading questions was avoided.
- To avoid ambiguity and vagueness, indefinite words that could be interpreted in many ways were avoided.
- The researcher avoided double barrelled questions.
- The researcher avoided making assumptions about issues.

A pre-test was conducted to determine the validity and design of the questionnaire. The chosen sub-sample comprised members of the target population. The size of the sub-sample was ten participants. Of interest to the researcher was to determine the ease of understanding, flow of the questionnaire. The researcher also needed to establish where any of the questions were ambiguous or confusing. All respondents reported that the questions were easily understandable. The questionnaire was subdivided into three main sections.

- The first section was designed to collect data in regards to research question 1.
- The second section was designed to collect data in regards to research question 2.
- The last section was designed to collect data in regards to research question 3.

6.5.2 Population of relevance

According to Zikmund in Stamper (2014), a population is "any complete group of people, companies, or the like that share some sets of characteristics". The population of relevance for this study consists of all members of the organisation because the entire organisation is either impacted or influences EA.

6.5.3 Unit of analysis

Unit of analysis is an individual working as enterprise architect, solutions architect, project manager, business analysts, IT manager, team leader, system analyst, process analysts, software developers, software testers as well as experts in IT infrastructure.

The rationale for selecting these individuals is because they are either directly influencing, or being affected by enterprise architecture in the organisation. Moreover, Gilliland, et al. (2015) pointed out that in many instances, EA is "conceptualized and misunderstood as relevant only to an enterprise's information systems and its IT. Consequently the need for EA is often expressed by information managers and technologists, and EA adoption is often driven by IT or engineering work levels in an organisation". Successful adoption of EA is therefore highly dependent on its acceptability to these members of the organisation.

6.5.4 Sampling method

Sampling, as defined by Zikmund in Stamper (2014), is "a process of using a small number of items or parts of a larger population to make conclusions about the whole population". Sampling falls into two major categories: probability and non-probability sampling (Welman, et al., 2005).

Under probability sampling, the sample is chosen in a statistically random manner such that each member of the target population has an equal chance of being included in the sample (Welman, et al., 2005; Saunders, et al., 2009). Meanwhile under non-probability sampling, the sample is selected based on the researcher's subjective judgement. Non-probability sampling offers a range of techniques such as convenient sampling, snowball sampling and purposive sampling that can be used when it is not appropriate to follow a random sampling approach for the research question.

Non-probability sampling is also appropriate when the researcher does not have a sampling frame (Saunders, et al., 2009).

The researcher chose to employ a non-probability purposive sampling method for this study. This method allows the researcher to select sample based on his/her knowledge of the population as well as the objectives of the research (Saunders, et al., 2009; Welman, et al., 2005).

This sampling choice might limit the number of participants thus influencing the validity and transferability of the findings. However, a large percentage of the chosen sample participated in this study thus increasing the validity and transferability of the research findings.

Statistically, it is accepted that a sample should preferably be greater than 25. Given that the size of the population surveyed in this study is 115, a sample size of 84 was deemed appropriate for the purposes of this investigation.

6.5.5 Data analysis

Data was extracted from the SurveyMonkey website, in a Microsoft Excel spreadsheet. Reponses were then forwarded to the Department of Statistics at the University of Pretoria: Statomet for statistical analysis.

6.5.6 Reliability

Reliability measures the degree to which measures are error free and will yield consistency in results (Zikmund, 2007). Cronbach's alpha will be used in this research study to determine the inter-item reliability.

6.5.7 Descriptive Statistics

The aim of descriptive statistics is to "provide summary measures of data contained in all elements of a sample" (Zikmund, 2007). Frequency distribution was adopted for this study.

6.5.8 Presentation of data

Data in a research project is presented in four basic ways, namely

- Text paragraph – in this type of presentation, the researcher draws the reader's attention to certain numbers or comparisons to highlight a particular point.
- Semi-tabular form – in this type of presentation, figures are removed from the text and listed in a table.
- Tables and graphs – these are pictorial representations of data and they may simplify the presentation of research data (Zikmund, 2003). According to Zikmund (2003), tables and

graphs are mainly used to “facilitate the summarisation and communication of the meaning of data”.

In this study the data is presented using both textual and graphical representations. Pie charts were used for frequency analysis and tables were used for mean values.

6.5.9 Ethical considerations

The following are some of the ethical considerations that were considered important in the context of this study:

- All reasonable measures were taken to protect the data of individuals involved in the research. No information that can be used to identify each respondent was requested or captured.
- No prizes or incentives were offered for data collection.
- Clearance from the University of Pretoria’s ethics was sought before any data collection commenced.
- Written permission from the Chief Information Officer of the organisation whose employees participated in this research was obtained before administering the questionnaires.
- All participants in this research were informed of and guaranteed their right:
    - **Not to participate** in the research
    - **To give informed consent** of their responses and input forming part of the research report
    - **To anonymity**. All that can potentially be used to identify each participant will not be captured or stored anywhere.
    - **To confidentiality**. All responses will be kept confidential.

6.5.10 Steps to generate data

Step #	Step Description	Anticipated difficulties
1	Design questionnaires	Verifying the validity and reliability of the questions
2	Obtain clearance from the UP Ethics committee	Delays in obtaining clearance due to the committee meeting schedule
3	Identify the target sample	Staff turnover, people leaving and joining the organisation
4	Select a pilot group of eight individuals from our target sample	Availability of these individuals Pilot group might not be a true representation of the entire sample population
5	Administer the questionnaire on the pilot group using email	Logistical glitches. Unclear instructions. Unclear questions. Lack of appropriate options on the questionnaires
6	Re-work the questionnaires using feedback from the pilot phase	Might still overlook important errors and omissions
7	Administer questionnaires to entire sample population using Survey Monkey (https://www.surveymonkey.com)	Lack of interest from sample group Time constraints Inaccurate responses Misinterpreting the questions
8	Receive completed questionnaires	Technical glitches with the website
9	Analyse received responses	

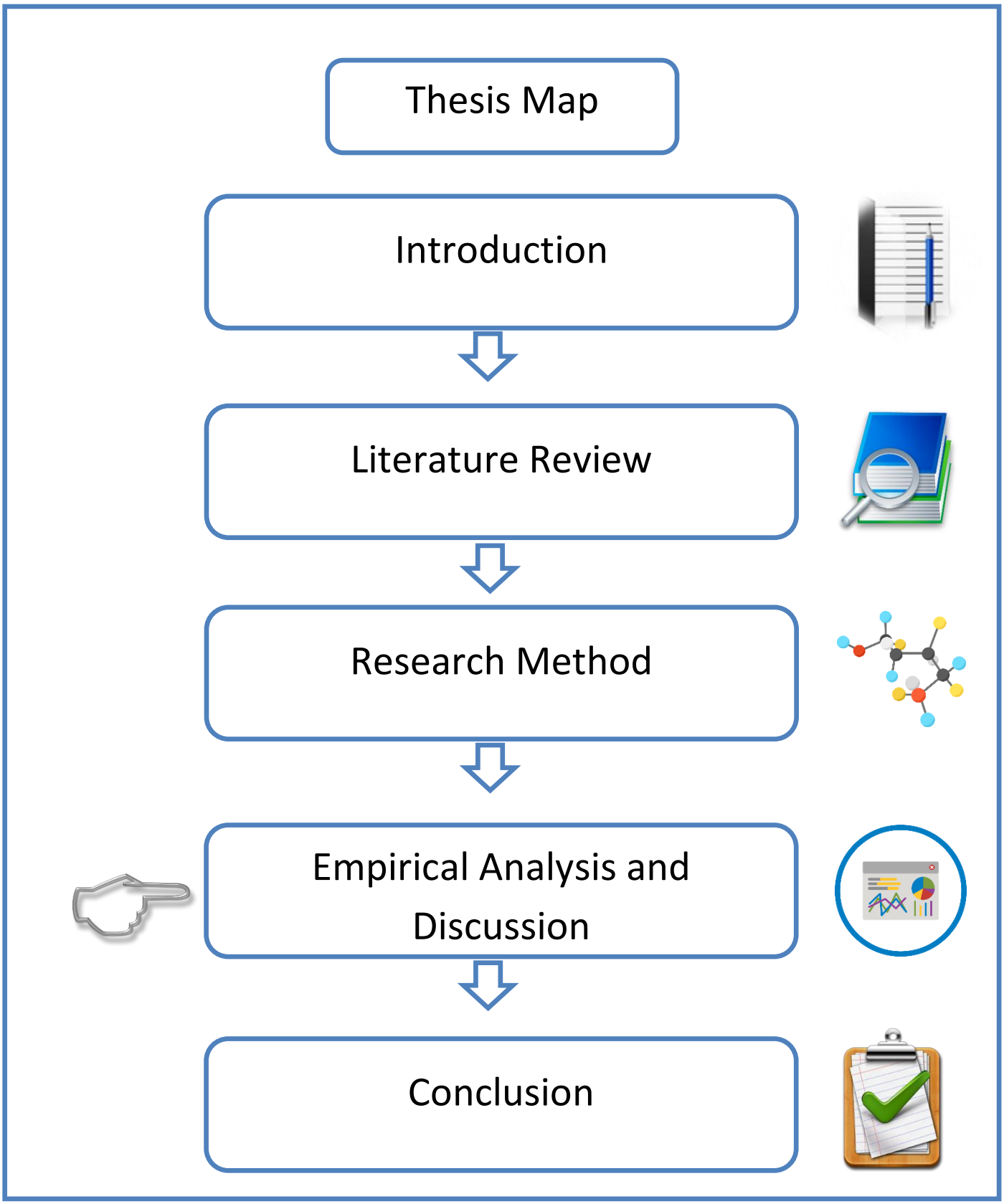
6.6 Conclusion

In this chapter the researcher made specific choices, pertaining to how this research has been conducted, in investigating the research problem defined in Chapter 1. These are tabulated below.

Research Approach Summary	
Research Philosophy	Positivism
Research Approach	Quantitative
Research Design	Survey
Unit of Analysis	Experts in the fields of enterprise architecture, project management, business analysis, systems analysis, IT management, software development, software testing and IT infrastructure
Population	All the members of the organization
Sampling	Non-probability purposive sample
Data Gathering	Online questionnaire
Data Analysis	Frequency tables

The following chapter (chapter 7) will report the data that was collected by conducting this research in the manner described in this chapter.

CHAPTER 7: Empirical analysis and discussion



7.1 Introduction

As noted in Chapter 2, organisations are in a constant state of flux and as a result they are increasingly looking to EA to facilitate foresighted and non-chaotic transformations. It has however, been found that introducing and adopting EA is fraught with difficulties with a reported 66% failure rate. This research focuses on finding out how knowledge management (KM) can be used to successfully adopt EA. It is further hoped that this study will raise the level of understanding of EA so that future EA initiatives become more aligned with the expectations of the important stakeholders.

In this chapter, the aim is to present and analyse the data collected from the selected sample. The research study was conducted using quantitative methods as discussed in the previous chapter. The results are presented using tables and graphs. Descriptive statistics analysis is also performed in relation to research question 2.

The three research questions explored in this study, as posed in Chapter 1 are:

1. What is the significance of EA to the motor vehicle and asset finance industry?
2. What are the barriers to successful EA adoption in the motor vehicle and asset finance industry?
3. How can KM practices be used to increase the possibility of success for EA initiatives?

Instrument Reliability Analysis

This subsection demonstrates reliability of the data collected from the research instrument. As explained in the previous chapter, reliability was measured using Cronbach's alpha. An alpha of 0.7 and higher indicates good internal reliability. Cronbach's alphas were calculated for questions 3 to 5 of the questionnaire to gauge the internal reliability of the questionnaire. The Cronbach alphas achieved were 0.840, 0.833 and 0.723 respectively which indicates good internal reliability.

7.2 Responses to research questions

These questions were explored through the completion of an online questionnaire which collected data on perceptions of the important stakeholders of EA. The sample was drawn from enterprise architects, solutions architects, project managers, software developers, software testers, business analysts, systems analysts, IT team leaders and managers. The sample size was:

N = 84

The size of the population is approximately 110. The sample size of 84 then resulted in a response rate of 76%.

The demographic characteristics of the respondents were not considered a meaningful metric in terms of the research question and this information was therefore not collected. This is a limitation that might impact on the generalizability of the findings. The research findings in relation to each research question are presented below.

7.2.1 Results for research question 1

The survey results pertaining to research question 1 were based on the responses to questions 1, 2 and 3 of the questionnaire. Question 1 of the questionnaire related to the recognition and perceived value of EA in the organisation as was phrased as follows:

Question 1 - Which of the following phrases best describes your recognition of enterprise architecture in the organization?

This question was completed by 84 employees and had a forced ranking setting, whereby each participant in the research could only choose a single option. As shown in Table 7.1, more than 71% of the respondents reported that they know what EA does and they believe it is important. On the other hand, 23% of the respondents reported that they know what EA does, but they do not believe it is imports. Only 6% reported that they did not know EA exists in the organization.

Table 7.1: Survey results for question 1

	Response Count	Response Percent
I did not know Enterprise Architecture exists	5	6.0
I know what EA does, but do not believe it is important	19	22.6
I know what EA does and I believe it is important	60	71.4
Valid responses	**84**	**100.0**
Missing values	**0**	

Question 2 – In which of the following areas do you expect to identify benefits from using EA?

This question was aimed at determining the expected benefits of Enterprise Architecture (EA) to the organisation. This question was open for more than one answer, since it is possible to expect more than one benefit of EA to the organisation. It was completed by 84 respondents resulting in 581 responses. All the respondents indicated that their expect EA benefit to provide the capability to integrate, standardize and/ or eliminate duplication of related processes and systems. The results collected pertaining to this question are tabulated in Table 7.2 below.

Table 7.2: Survey results for question 2

	Response Count	Response Percent
To accomplish enterprise-wide goals, instead of (possibly conflicting) local optimizations.	44	52.4%
To control the complexity of the organization and its systems.	69	82.1%
To integrate, standardize and/or eliminate duplication of related processes and systems.	84	100.0%
To control costs.	17	20.2%
To enable the organization to respond to changes in the outside world in an agile fashion.	73	86.9%
To co-operate with other organizations effectively and efficiently.	25	29.8%
To achieve an optimal fit between IT and the business processes it supports.	56	66.7%
To provide insight into the complexity of the organization.	45	53.6%
To depict a clear image of the desired future situation.	77	91.7%
To provide a vehicle for different stakeholders to communicate with each other effectively.	42	50.0%
To improve management decision making.	49	58.3%

Question 3 – Please indicate (IN YOUR OPINION) how the following have changed or are changing as a result of EA in your organization

This question was aimed at determining the perceived impact of EA to the organisation. The benefits listed under this question were based on the literature review conducted in Chapter 2. Tables 7.3 through 7.13 tabulate the survey results. The respondents were presented with 5 response options: *highly improved*, *improved*, *no change*, *worse*, *don't know*. For statistical analysis, the "Don't Know" responses were treated as "missing values".

Of the 84 responses to this question, 10 were "Don't Know" responses which were treated as missing values. A total of 41 (48.8%) of the respondents reported that Business Efficiency has highly improved with a further 19 (22.2%) reporting that business efficiency has improved as shown in Table 7.3 below.

The mean was calculated across all the responses to this question in order to determine the centre of gravity of the scale and this can be used to rank the eleven sub-questions under question 3. A high mean (Between 3 and 4) implies that the scale leans towards the "Highly improved" scale, while a low mean (between 1 and 2) implies that the means leans towards "No change". These means are also reported.

Table 7.3: Perceived impact of EA on Business Efficiency

	Response Options	Response Count	Response Percent
Business Efficiency	No Change	14	16.7
	Improved	41	48.8
	Highly Improved	19	22.6
Valid responses		**84**	
Missing values		**10**	**11.9**
Average mean		**3.07**	

Respondents have overwhelmingly (94%) reported that EA has resulted in improvement on IT and/ or Business governance while 5 (6%) report that EA has not had an impact on IT and/ or business governance in the organisation. These figures are shown in Table 7.4 below.

Table 7.4: Perceived impact of EA on IT and/ or Business governance

	Response Options	Response Count	Response Percent
IT and/ or Business governance	No Change	5	6.0
	Improved	79	94.0
Valid responses		**84**	
Missing values		**0**	
Average mean		**2.94**	

As shown in Table 7.5, the majority of respondents reported that IT and/ or operating costs optimisation has either improved 37 (44%) or highly improved 22 (26.2%) as a result of EA.

Table 7.5: Perceived impact of EA on IT and/ or operating costs optimization

	Response Options	Response Count	Response Percent
IT and/or operating costs optimization	Worse	5	6.0
	No Change	11	13.1
	Improved	37	44.0
	Highly Improved	22	26.2
Valid responses		**75**	
Missing values		**9**	10.7
Average mean		**3.01**	

Table 7.6 reveals that the majority of the participants reported that decision making has improved 58 (59%) with a further 12 (14.3%) regarding it as highly improved as a result of EA.

Table 7.6: Perceived impact of EA on Decision making

	Response Options	Response Count	Response Percent
Decision making	Worse	5	6.0
	No Change	9	10.7
	Improved	58	69.0
	Highly Improved	12	14.3
Valid responses		**84**	
Missing values		**0**	
Average mean		**2.92**	

The majority of participants reported that the reduction of technical complexity has highly improved 29 (34.5%) with another 24 (28.6%) viewing it as having improved as a result of EA (see Table 7.7). These findings are supported by the existing literature.

Table 7.7: Perceived impact of EA on Reduction of technical complexity

	Response Options	Response Count	Response Percent
Reduction of technical complexity	No Change	26	31.0
	Improved	24	28.6
	Highly Improved	29	34.5
Valid responses		**79**	
Missing values		**5**	**6.0**
Average mean		**3.04**	

A large number of participants 38 (45.2%) reported that EA has not had an impact on the technical integrity; another 5 (6%) reported that the technical integrity has worsened as a result of EA. These findings are contrary to the claims documented in Chapter 2 where it was reported that improved technical integrity is one of the benefits of EA. The possible reason for this discrepancy could be contained in section 7.4.3 where the barriers to successful EA adoption are examined.

Table 7.8: Perceived impact of EA on Technical integrity

	Response Options	Response Count	Response Percent
Technical integrity	Worse	5	6.0
	No Change	38	45.2
	Improved	41	48.8
Valid responses		**84**	
Missing values		**0**	
Average mean		**2.43**	

As can be seen in Table 7.9, according to 43 (51.2%) of the respondents, EA has not made an impact to the organisation's data integrity. This finding also contradicts the literature review conducted in Chapter 2. This contradiction could be a result of the barriers encountered during EA adoption. Section 7.4.3 documents the prevalence of such barriers in the organisation under study.

Table 7.9: Perceived impact of EA on Data integrity

	Response Options	Response Count	Response Percent
Data integrity	No Change	43	51.2
	Improved	29	34.5
	Highly Improved	12	14.3
Valid responses		**84**	
Missing values		**0**	
Average mean		**2.63**	

The majority of respondents 61 (72.6%) reported that the continuity of organizational knowledge has improved as a result of EA (see Table 7.10). This finding is supported by the literature reviewed in Chapter 2.

Table 7.10: Perceived impact of EA on Continuity of organizational knowledge

	Response Options	Response Count	Response Percent
Continuity of organizational knowledge	Worse	5	6.0
	No Change	18	21.4
	Improved	61	72.6
Valid responses		**84**	
Missing values		**0**	
Average mean		**2.67**	

The vast majority 47 (56%) of participants reported that systems integration has highly improved and a further 23 (27.4%) perceive it as improved (see Table 7.11) as a result of EA. Improvements in systems integration is also reported in existing literature as a benefit of EA.

Table 7.11: Perceived impact of EA on Systems integration

	Response Options	Response Count	Response Percent
Systems integration	No Change	14	16.7
	Improved	23	27.4
	Highly Improved	47	56.0
Valid responses		**84**	
Missing values		**0**	
Average mean		**3.39**	

Some 63 (75%) of the respondents reported that risk management has improved as a result of EA (see Table 7.12). Improvement of risk management is also reported as a benefit in the literature reviewed in Chapter 2.

Table 7.12: Perceived impact of EA on Risk management

	Response Options	Response Count	Response Percent
Risk management	Don't Know	10	11.9
	No Change	11	13.1
	Improved	63	75.0
Valid responses		**84**	
Missing values		**0**	
Average mean		**2.85**	

More than half 47 (56%) of the participants reported that audit compliance has improved as a result of EA (see Table 7.13). Existing literature has also mentioned audit compliance to be one of the benefits of EA.

Table 7.13: Perceived impact of EA on Audit compliance

	Response Options	Response Count	Response Percent
Audit compliance	Don't Know	14	16.7
	No Change	23	27.4
	Improved	47	56.0
Valid responses		**84**	
Missing values		**0**	
Average mean		**2.67**	

7.2.2 Results for research question 2

Questions posed under question 4 in the questionnaire were designed to reveal the facilitators and barriers to successful EA adoption. Based on the literature (see Section 2.8), a list of 10 barriers to EA adoption was presented in the questionnaire. The respondents were asked to rate the prevalence of each factor in their organization. The prevalence of each factor was rated on a four-point Linkert scale. The options presented were "Strongly Agree", "Agree", "Disagree" and "Strongly Disagree".

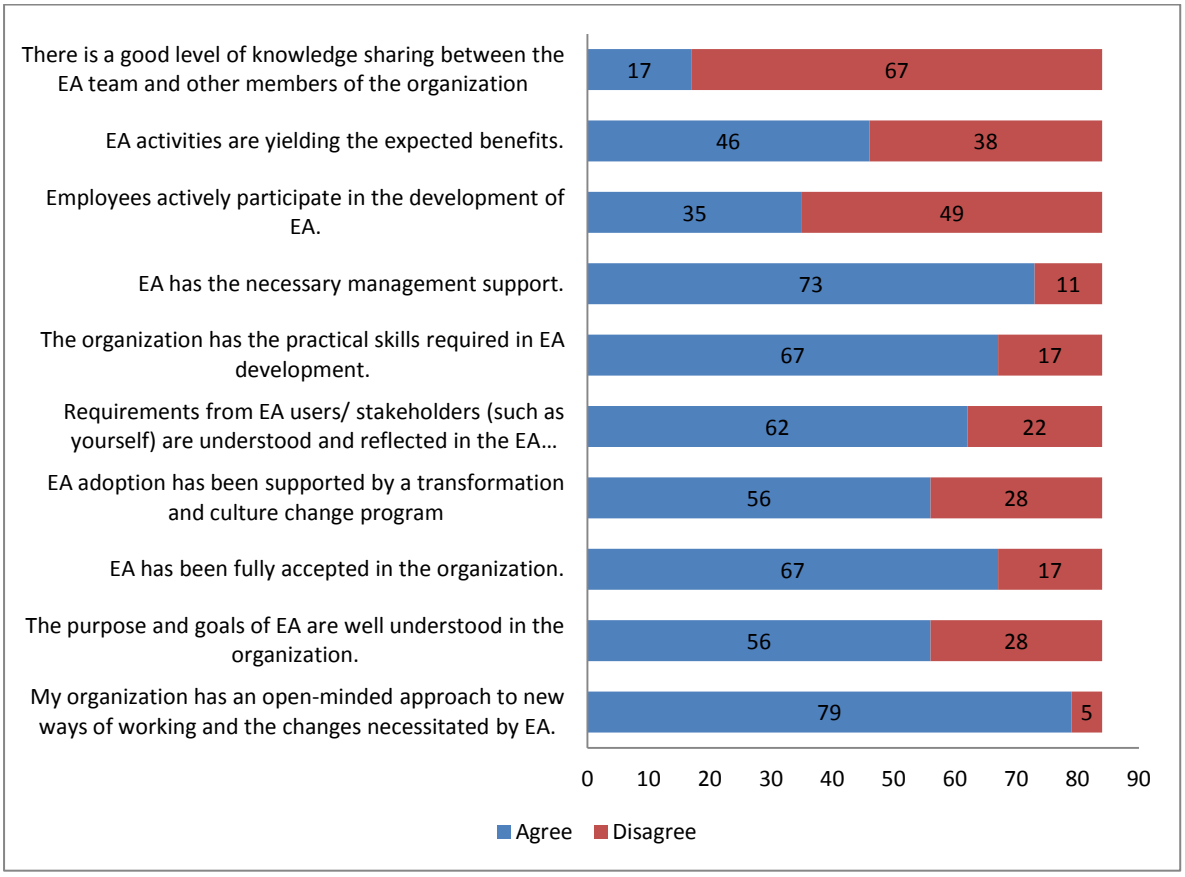
The data collected for each statement is presented in Table 7.14.

Table 7.14: Raw data for research question 2.

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	Freq	%	Freq	%	Freq	%	Freq	%
My organization has an open-minded approach to new ways of working and the changes necessitated by EA	5	6%			69	82.1%	10	11.9%
The purpose and goals of EA are well understood in the organization.			28	33.3%	39	46.4%	17	20.2%
EA has been fully accepted in the organization.			17	20.2%	48	57.1%	19	22.6%
EA adoption has been supported by a transformation and culture change program			28	33.3%	56	66.7%		
Requirements from EA users/ stakeholders (such as yourself) are understood and reflected in the EA artefacts.	5	6%	17	20.2%	62	73.8%		
The organization has the practical skills required in EA development.	5	6%	12	14.3%	55	65.5%	12	14.3%
EA has the necessary management support			11	13.1%	63	75.0%	10	11.9%
Employees actively participate in the development of EA.	5	6%	44	52.4%	13	15.5%	22	26.2%
EA activities are yielding the expected benefits.			38	45.2%	46	54.8%		
There is a good level of knowledge sharing between the EA team and other members of the organization	5	6%	62	73.8%	17	20.2%		

To streamline the analysis, the number of options was collapsed from four to two. This was achieved by combining “Agree” and “Strongly Agree” to one group called “Agree”. “Disagree” and “Strongly Disagree” were also combined into another group called “Disagree”. The frequencies in terms of the two categories are presented in Figure 7.1. This reduction of the number of options will allow comparisons across the two groups.

Figure 7.1 : Factors affecting EA adoption.



7.2.3 Descriptive statistical analysis

Inferential statistical analysis was performed to determine whether a relationship exists between the respondents that perceive EA to be yielding the expected benefits and the other nine factors presented in question 4 of the questionnaire. Pearson Chi-quare tests were used to test the associations/ relationships between the responses to the statement "EA is yielding the expected benefits" and responses to the other statements posed in question 4. The "null hypothesis", H_0 would indicate that there is no association between the variables. On the other hand, H_a "the alternative hypothesis" would indicate that some association between the variables exists.

In order to reject the null hypothesis and conclude that there is sufficient evidence that the alternative hypothesis is supported by the collected data, the researcher used the probability (p-value). The p-value is the measurement of the statistical significance of a hypothesis test. It is also an indicator of the probability that an association exists. The null hypothesis can be rejected for p-values less than 0.05 (the level of significance), which means the results are statistically significant.

7.4.3.1 Cross tabulation results

Cross tabulation calculations were performed to determine if there exist associations between the perceptions as listed below.

- The perception that the organization has an open-minded approach to new ways of working and the changes necessitated by EA and the perception that EA activities are yielding the expected benefits.
- The perception that the purpose and goals of EA are well understood in the organization and the perception that EA activities are yielding the expected benefits.
- The perception that EA has been fully accepted in the organization and the perception that EA activities are yielding the expected benefits.
- The perception that EA adoption has been supported by a transformation and culture change program and the perception that EA activities are yielding the expected benefits.
- The perception that the requirements from EA stakeholders are understood and reflected in the EA artefacts and the perception that EA activities are yielding the expected benefits.
- The perception that the organization has the practical skills required in EA development and the perception that EA activities are yielding the expected benefits.
- The perception that EA has the necessary management support and the perception that EA activities are yielding the expected benefits
- The perception that employees actively participate in the development of EA and the perception that EA activities are yielding the expected benefits.

- The perception that there is a good level of knowledge sharing between the EA team and other members of the organisation and the perception that EA activities are yielding the expected benefits.

7.4.3.2 Cross tabulation results – the organization has an open-minded approach to new ways of working and the changes necessitated by EA

This section presents cross tabulation results for the perception that the organization has an open-minded approach to new ways of working and the changes necessitated by EA and the perception that EA activities are yielding the expected benefits. The analysis presented in this section is based on Table 7.24.

Of the 79 respondents that perceive the organization to have an open-minded approach to new ways of working, the majority (46) perceive EA to be yielding the expected benefits. Pearson's chi square test was performed to determine if there exists an association between the perception that EA activities are yielding the expected benefits and the perception that the organization has an open-minded approach to new ways of working and the changes necessitated by EA. Since the chi square value is equal to 6.436 with 1 degree of freedom and a p-value = 0.011, there is a significant association between the stated perceptions at the 5% level of significance. In this case, there is strong evidence of a significant relationship between those who perceive EA to be yielding the expected benefits and those who perceive the organization to have an open-minded approach to new ways of working and the changes necessitated by EA.

The standardized residuals can be used to determine which cells in the cross tabulation contributed most to the significant overall association. A standardized residual value smaller than -2 or greater than 2 is an indication that the particular cell in the cross tabulation made a large contribution to the overall association. In this case the standardized residuals are slightly smaller than ±2 i.e. 1.8 and -1.7.

None of the respondents reported that EA activities are yielding expected results while reporting that the organization does not have an open-minded approach to new ways of working and the changes necessitated by EA. However, under the null hypothesis of no association between the two perceptions, it was expected that this category will have a number of 2.7. Hence, fewer persons than was expected felt that that EA activities are yielding expected results but that the organization does not have an open-minded approach to new ways of working and the changes necessitated by EA.

Furthermore, five persons reported that EA activities are not yielding expected results and that the organization does not have an open-minded approach to new ways of working and the changes

necessitated by EA. The expected count under the null hypothesis was 2.3, implying that more persons than was expected perceived that EA activities are not yielding expected results and that the organization does not have an open-minded approach to new ways of working and the changes necessitated by EA.

Conclusion

Since all respondents that perceive EA activities to be yielding expected results also perceive that the organization has an open-minded approach to new ways of working and the changes necessitated by EA, the organization should therefore direct their efforts to promoting an open-minded approach to new ways of working.

Table 7.15: Cross tabulation results – the organization has an open-minded approach to new ways of working and the changes necessitated by EA

My organization has an open-minded approach to new ways of working and the changes necessitated by EA * EA activities are yielding the expected benefits.					
			EA activities are yielding the expected benefits.		Total
			Strongly disagree/ Disagree	Agree/Strongly Agree	
My organization has an open-minded approach to new ways of working and the changes necessitated by EA.	Strongly disagree/Disagree	Count	5	0	5
		Expected Count	2.3	2.7	5.0
		Column %	13.2%	0.0%	6.0%
		Standardized Residual	1.8	-1.7	
	Agree/Strongly Agree	Count	33	46	79
		Expected Count	35.7	43.3	79.0
		Column %	86.8%	100.0%	94.0 %
		Standardized Residual	-.5	.4	
Total		Count	38	46	84
		Expected Count	38.0	46.0	84.0
		Column %	100.0%	100.0%	100.0 %

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	6.436[a]	1	.011		
Continuity Correction[b]	4.300	1	.038		
Likelihood Ratio	8.317	1	.004		
Fisher's Exact Test				.016	.016
Linear-by-Linear Association	6.359	1	.012		
N of Valid Cases	84				

a. 2 cells (50.0%) have expected count less than 5. The minimum expected count is 2.26.

b. Computed only for a 2x2 table

7.4.3.3 Cross tabulation results – the purpose and goals of EA are well understood in the organization

This section presents cross tabulation results for the perception that the purpose and goals of EA are well understood in the organization and the perception that EA activities are yielding the expected benefits. The analysis presented in this section is based on Table 7.25.

Of the 56 respondents that perceive that the purpose and goals of EA are well understood in the organization, 29 perceive EA to be yielding the expected benefits while almost the same number (27) do not agree that EA initiatives are yielding the expected benefits.

Pearson's chi square test was performed to determine if there exists an association between the perception that EA activities are yielding the expected benefits and the perception that the purpose and goals of EA are well understood in the organization. Since the chi square value is equal to 0.601 with 1 degree of freedom and a p-value = 0.438, there is therefore not sufficient evidence to reject the null hypothesis.

A total of 17 respondents reported that EA activities are yielding the expected benefits while reporting that the purpose and goals of EA are not well understood in the organization. Under the null hypothesis of no association between the two perceptions, it was expected that this category will have a number of 15.3. Therefore there is an alignment between the expected and recorded number of respondents that perceived that EA activities are yielding expected results while perceiving that the purpose and goals of EA are not well understood in the organization.

Moreover, 11 persons reported that EA activities are not yielding expected results and that the purpose and goals of EA are not well understood in the organization. The expected count under the null hypothesis was 12.7. This further highlights the minimal difference between the expected and reported persons with regards to the two perceptions.

Conclusion

While there is no statistically significant association between the perceptions analysed, it is a meaningful metric to note that 63% of the respondents perceived that EA is yielding the expected benefits while also perceiving that the purpose and goals of EA are well understood in the organization. The remaining 37% perceived EA to be yielding the expected benefits while perceiving that the purpose and goals of EA are not well understood in the organisation. This suggests that the possibility of success for EA initiatives (i.e. EA is perceived as yielding the expected benefits) is increased when the purpose and goals of EA are well understood in the organisation.

Table 7.16: Cross tabulation results – the purpose and goals of EA are well understood in the organization

The purpose and goals of EA are well understood in the organization * EA activities are yielding the expected benefits.					
			EA activities are yielding the expected benefits.		Total
			Strongly disagree/ Disagree	Agree/ Strongly Agree	
The purpose and goals of EA are well understood in the organization.	Strongly disagree/Disagree	Count	11	17	28
		Expected Count	12.7	15.3	28.0
		Column %	28.9%	37.0%	33.3%
		Standardized Residual	-.5	.4	
	Agree/Strongly Agree	Count	27	29	56
		Expected Count	25.3	30.7	56.0
		Column %	71.1%	63.0%	66.7%
		Standardized Residual	.3	-.3	
Total		Count	38	46	84
		Expected Count	38.0	46.0	84.0
		Column %	100.0%	100.0%	100.0 %

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.601[a]	1	.438		
Continuity Correction[b]	.294	1	.587		
Likelihood Ratio	.604	1	.437		
Fisher's Exact Test				.491	.295
Linear-by-Linear Association	.594	1	.441		
N of Valid Cases	84				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.67.

b. Computed only for a 2x2 table

7.4.3.4 Cross tabulation results – EA has been fully accepted in the organization

This section presents cross tabulation results for the perception that EA has been fully accepted in the organization and the perception that EA activities are yielding the expected benefits

Of the 67 respondents that perceive EA to have been fully accepted in the organization, the majority (46) perceive EA to be yielding the expected benefits.

Pearson's chi square test was performed to determine if there exists an association between the perception that EA activities are yielding the expected benefits and the perception that EA has been fully accepted in the organization. The chi square value is equal to 25.800 with 1 degree of freedom and a p-value < 0.001. We can therefore infer that there is a significant association between the stated perceptions at the 5% level of significance. In this case, since the p-value <0.001, there is convincing evidence of a significant relationship between those who perceive EA to be yielding the expected benefits and those who perceive EA to have been fully accepted in the organization.

The standardized residuals were used to determine which cells in the cross tabulation contributed most to the significant overall association. A standardized residual value smaller than -2 or greater than 2 is an indication that the particular cell in the cross tabulation made a large contribution to the overall association. In this case the standardized residuals are 3.4 and -3.1.

None of the respondents reported that EA activities are yielding the expected benefits while reporting that EA has not been fully accepted in the organisation. However, under the null hypothesis of no association between the two perceptions, it was expected that this category will have a number of 9.3. Hence, fewer persons than was expected felt that that EA activities are yielding expected results but that EA has not been fully accepted in the organization.

Furthermore, 17 persons reported that EA activities are not yielding expected results and that EA has not been accepted in the organization. The expected count under the null hypothesis was 7.7, implying that more persons than was expected perceived that EA activities are not yielding expected results and that EA has not been fully accepted in the organization.

Recommendation

Since all respondents that perceive EA activities to be yielding expected results also perceive that EA has been fully accepted in the organization, the organization should therefore direct their efforts to ensuring that EA is accepted in the organization as discussed in Section 2.7.

Table 7.17: Cross tabulation results – EA has been fully accepted in the organization

EA has been fully accepted in the organization * EA activities are yielding the expected benefits.					
			EA activities are yielding the expected benefits.		Total
			Strongly disagree/ Disagree	Agree/Strongly Agree	
EA has been fully accepted in the organization	Strongly disagree/Disagree	Count	17	0	17
		Expected Count	7.7	9.3	17.0
		Column %	44.7%	0.0%	20.2%
		Standardized Residual	3.4	-3.1	
	Agree/Strongly Agree	Count	21	46	67
		Expected Count	30.3	36.7	67.0
		Column %	55.3%	100.0%	79.8%
		Standardized Residual	-1.7	1.5	
Total		Count	38	46	84
		Expected Count	38.0	46.0	84.0
		Column %	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	25.800[a]	1	<0.001		
Continuity Correction[b]	23.103	1	.000		
Likelihood Ratio	32.362	1	.000		
Fisher's Exact Test				<0.001	.000
Linear-by-Linear Association	25.493	1	.000		
N of Valid Cases	84				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.69.

b. Computed only for a 2x2 table

7.4.3.5 Cross tabulation results – EA adoption has been supported by a transformation and culture change program

This section presents cross tabulation results for the perception that EA adoption has been supported by a transformation and culture change program and the perception that EA activities are yielding the expected benefits.

Of the 56 respondents that perceive EA adoption to have been supported by a transformation and culture change program, 29 perceive EA to be yielding the expected benefits while 27 do not perceive EA to be yielding the expected benefits.

Pearson's chi square test was performed to determine if there exists an association between the perception that EA activities are yielding the expected benefits and the perception that EA adoption was supported by a transformation and culture change program. The chi square value is equal to 0.601 with 1 degree of freedom and a p-value = 0.438. There is therefore insufficient evidence to reject the null hypothesis.

Some 17 respondents reported that EA activities are yielding the expected benefits while reporting that EA has not been supported by a transformation and culture change program. Under the null hypothesis of no association between the two perceptions, it was expected that this category will have a number of 15.3. There is therefore minimal difference between the expected (15.3) and recorded (17) number of persons that perceived that EA activities are yielding expected results but that EA has not been supported by a transformation and culture change program. This further indicates a lack of evidence to reject the null hypothesis. Moreover, 11 persons reported that EA activities are not yielding expected results and that EA has not been supported by a transformation and culture change program. The expected count under the null hypothesis was 12.7, further highlighting the minimal difference between the expected and reported persons that perceived that EA activities are not yielding expected results and that EA adoption has not been supported by a transformation and culture change program.

Conclusion

While there is no statistically significant association between the perceptions analysed, it is worth noting that 63% of the respondents perceived that EA is yielding the expected benefits and EA adoption has been supported by a transformation and culture change program. Compared to 37% that perceive EA to be yielding the expected benefits and that EA adoption has not been supported by a transformation and culture change program suggests that it is beneficial to support EA adoption by a transformation and culture change program.

Table 7.18: Cross tabulation results – EA adoption has been supported by a transformation and culture change program

EA adoption has been supported by a transformation and culture change program * EA activities are yielding the expected benefits.					
			EA activities are yielding the expected benefits.		Total
			Strongly disagree/ Disagree	Agree/Strongly Agree	
EA adoption has been supported by a transformation and culture change program	Strongly disagree/Disagree	Count	11	17	28
		Expected Count	12.7	15.3	28.0
		Column %	28.9%	37.0%	33.3%
		Standardized Residual	-.5	.4	
	Agree/Strongly Agree	Count	27	29	56
		Expected Count	25.3	30.7	56.0
		Column %	71.1%	63.0%	66.7%
		Standardized Residual	.3	-.3	
Total		Count	38	46	84
		Expected Count	38.0	46.0	84.0
		Column %	100.0%	100.0%	100.0 %

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.601[a]	1	.438		
Continuity Correction[b]	.294	1	.587		
Likelihood Ratio	.604	1	.437		
Fisher's Exact Test				.491	.295
Linear-by-Linear Association	.594	1	.441		
N of Valid Cases	84				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 12.67.

b. Computed only for a 2x2 table

7.4.3.6 Cross tabulation results – requirements from EA users/ stakeholders are understood and reflected in the EA artefacts

This section presents cross tabulation results for the perception that the requirements from EA users/ stakeholders are understood and reflected in the EA artefacts and the perception that EA activities are yielding the expected benefits.

Of the 62 respondents that perceive that the requirements from EA users/ stakeholders are understood and reflected in the EA artefacts, 35 perceive EA to be yielding the expected benefits while 27 do not perceive EA to be yielding the expected benefits.

Pearson's chi square test was performed to determine if there exists an association between the perception that EA activities are yielding the expected benefits and the perception that requirements from EA users/ stakeholders are understood and reflected in the EA artefacts. The chi square value is equal to 0.273 with 1 degree of freedom and a p-value = 0.601. We can therefore not conclude that there is an association between the stated perceptions.

Some 11 persons reported that EA activities are yielding the expected benefits while reporting that requirements from EA users/ stakeholders are not understood or reflected in the EA artefacts. Under the null hypothesis of no association between the two perceptions, it was expected that this category will have a number of 12.0. There is therefore minimal difference between the expected (12.0) and recorded (11) number of persons that perceived that EA activities are yielding expected results but that requirements from EA users/ stakeholders are not understood or reflected in the EA artefacts. This further indicates that the null hypothesis cannot be rejected. Moreover, 11 persons reported that EA activities are not yielding expected results and that the requirements from EA users/ stakeholders are not understood or reflected in the EA artefacts. The expected count under the null hypothesis was 10.0. This further highlights the minimal difference between the expected and reported persons with regards to the two perceptions.

Conclusion

While there is no statistically significant association between the perceptions analysed, 76.1% perceived that EA is yielding the expected benefits and that requirements from EA users/ stakeholders are understood and reflected in the EA artefacts. Only 23.9% perceive EA to be yielding the expected benefits and that requirements from EA users/ stakeholders are not understood or reflected in the EA artefacts. This suggests that it is beneficial to ensure that requirements from EA users/ stakeholders are understood and reflected in the EA artefacts. Identifying and capturing knowledge, such as stakeholder requirements is discussed in Chapter 3.

Table 7.19: Cross tabulation results – requirements from EA stakeholders are understood and reflected in the EA artefacts

Requirements from EA users/ stakeholders (such as yourself) are understood and reflected in the EA artefacts * EA activities are yielding the expected benefits.					
			EA activities are yielding the expected benefits.		Total
			Strongly disagree/ Disagree	Agree/ Strongly Agree	
Requirements from EA users/ stakeholders (such as yourself) are understood and reflected in the EA artefacts	Strongly disagree/Disagree	Count	11	11	22
		Expected Count	10.0	12.0	22.0
		Column %	28.9%	23.9%	26.2%
		Standardized Residual	.3	-.3	
	Agree/Strongly Agree	Count	27	35	62
		Expected Count	28.0	34.0	62.0
		Column %	71.1%	76.1%	73.8%
		Standardized Residual	-.2	.2	
Total		Count	38	46	84
		Expected Count	38.0	46.0	84.0
		Column %	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	.273[a]	1	.601		
Continuity Correction[b]	.075	1	.785		
Likelihood Ratio	.272	1	.602		
Fisher's Exact Test				.627	.391
Linear-by-Linear Association	.270	1	.604		
N of Valid Cases	84				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 9.95.

b. Computed only for a 2x2 table

7.4.3.7 Cross tabulation results – the organization has the practical skills required in EA development

This section presents cross tabulation results for the perception that the organization has the practical skills required in EA development and the perception that EA activities are yielding the expected benefits.

Of the 67 respondents that perceive that the organization has the practical skills required in EA development, 34 perceive EA to be yielding the expected benefits while 33 do not perceive EA to be yielding the expected benefits.

Pearson's chi square test was performed to determine if there exists an association between the perception that EA activities are yielding the expected benefits and the perception that the organization has the practical skills required in EA development. The chi square value is equal to 2.155 with 1 degree of freedom and a p-value = 0.142. We cannot then conclude that there is an association between the stated perceptions.

Twelve respondents reported that EA activities are yielding the expected benefits while reporting that the organization does not have the practical skills required in EA development. Under the null hypothesis of no association between the two perceptions, it was expected that this category will have a number of 9.3. Therefore more respondents than expected perceived that EA activities are yielding expected results but that the organisation does not have the practical skills required in EA development. Moreover, 5 persons reported that EA activities are not yielding expected results and that the organisation does not have the practical skills required in EA development. The expected count under the null hypothesis was 7.7. This further highlights the minimal difference between the expected and reported persons with regards to the two perceptions.

Conclusion

While there is no statistically significant association between the perceptions analysed, it is noteworthy that 73.9% of the respondents perceived that EA is yielding the expected benefits and that the organisation has the practical skills required in EA development. This figure is almost 3 times higher than the 26.1% that perceive EA to be yielding the expected benefits and that the organisation does not have the practical skills required in EA development. This suggests that ensuring the organisation has the practical skills required in EA development increases the possibility of successful EA initiatives by a factor of almost three.

Table 7.20: Cross tabulation results – The organisation has the practical skills required in EA development

The organization has the practical skills required in EA development. * EA activities are yielding the expected benefits.					
			EA activities are yielding the expected benefits.		Total
			Strongly disagree/ Disagree	Agree/Strongly Agree	
The organization has the practical skills required in EA development.	Strongly disagree/Disagree	Count	5	12	17
		Expected Count	7.7	9.3	17.0
		Column %	13.2%	26.1%	20.2%
		Standardized Residual	-1.0	.9	
	Agree/Strongly Agree	Count	33	34	67
		Expected Count	30.3	36.7	67.0
		Column %	86.8%	73.9%	79.8%
		Standardized Residual	.5	-.4	
Total		Count	38	46	84
		Expected Count	38.0	46.0	84.0
		Column %	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	2.155[a]	1	.142		
Continuity Correction[b]	1.428	1	.232		
Likelihood Ratio	2.222	1	.136		
Fisher's Exact Test				.178	.115
Linear-by-Linear Association	2.129	1	.145		
N of Valid Cases	84				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.69.

b. Computed only for a 2x2 table

7.4.3.8 Cross tabulation results – EA has the necessary management support

This section presents cross tabulation results for the perception that EA has the necessary management support and the perception that EA activities are yielding the expected benefits.

Out of a total of 73 respondents that perceive EA to have the necessary management support, the majority (46) perceive EA to be yielding the expected benefits.

Pearson's chi square test was performed to determine if there exists an association between the perception that EA activities are yielding the expected benefits and the perception that EA has the necessary management support. The chi square value is equal to 15.322 with 1 degree of freedom and a p-value < 0.001. We can therefore infer that there is a significant association between the stated perceptions at the 5% level of significance. In this case, since the p-value <0.001, there is convincing evidence of a significant relationship between those who perceive EA to be yielding the expected benefits and those who perceive EA to have the necessary management support.

The standardized residuals were used to determine which cells in the cross tabulation contributed most to the significant overall association. A standardized residual value smaller than -2 or greater than 2 is an indication that the particular cell in the cross tabulation made a large contribution to the overall association. In this case the standardized residuals are 2.7 and -2.5.

None of the respondents reported that EA activities are yielding the expected benefits while reporting that EA does not have the necessary management support. However, under the null hypothesis of no association between the two perceptions, it was expected that this category will have a number of 6.0. Hence, fewer persons than was expected felt that that EA activities are yielding expected results but that EA does not have the necessary management support.

In addition, 11 persons reported that EA activities are not yielding expected results and that EA does not have the necessary management support. The expected count under the null hypothesis was 5.0, implying that more persons than was expected perceived that EA activities are not yielding expected results and that EA does not have the necessary management support.

Recommendation

Since all respondents that perceive EA activities to be yielding expected results also perceive that EA has the necessary management support, securing management support is therefore essential in increasing the possibility of success for EA initiatives.

Table 7.21: Cross tabulation results – EA has the necessary management support

EA has the necessary management support. * EA activities are yielding the expected benefits.					
			EA activities are yielding the expected benefits.		Total
			Strongly disagree/Disagree	Agree/ Strongly Agree	
EA has the necessary management support.	Strongly disagree/Disagree	Count	11	0	11
		Expected Count	5.0	6.0	11.0
		Column %	28.9%	0.0%	13.1%
		Standardized Residual	2.7	-2.5	
	Agree/Strongly Agree	Count	27	46	73
		Expected Count	33.0	40.0	73.0
		Column %	71.1%	100.0%	86.9%
		Standardized Residual	-1.0	1.0	
Total		Count	38	46	84
		Expected Count	38.0	46.0	84.0
		Column %	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	15.322[a]	1	<0.001		
Continuity Correction[b]	12.884	1	.000		
Likelihood Ratio	19.489	1	.000		
Fisher's Exact Test				<0.001	.000
Linear-by-Linear Association	15.140	1	.000		
N of Valid Cases	84				

a. 1 cells (25.0%) have expected count less than 5. The minimum expected count is 4.98.

b. Computed only for a 2x2 table

7.4.3.9 Cross tabulation results – employees actively participate in the development of EA

This section presents cross tabulation results for the perception that employees actively participate in the development of EA and the perception that EA activities are yielding the expected benefits.

Of the 35 respondents that perceive that employees actively participate in the development of EA, all of them perceive EA to be yielding the expected benefits.

Pearson's chi square test was performed to determine if there exists an association between the perception that EA activities are yielding the expected benefits and the perception that employees actively participate in the development of EA. The chi square value is equal to 49.565 with 1 degree of freedom and a p-value < 0.001. We can therefore infer that there is a significant association between the stated perceptions at the 5% level of significance. In this case, since the p-value <0.001, there is convincing evidence of a significant relationship between those who perceive EA to be yielding the expected benefits and those who perceive that employees actively participate in the development of EA.

The standardized residuals were used to determine which cells in the cross tabulation contributed most to the significant overall association. A standardized residual value smaller than -2 or greater than 2 is an indication that the particular cell in the cross tabulation made a large contribution to the overall association. In this case the standardized residuals are 3.4 and -3.1.

A total of 11 respondents reported that EA activities are yielding the expected benefits while reporting that employees do not actively participate in the development of EA. However, under the null hypothesis of no association between the two perceptions, it was expected that this category will have a number of 26.8. Hence, fewer persons than was expected felt that that EA activities are yielding expected results while perceiving that employees do not actively participate in the development of EA.

Additionally, 38 persons reported that EA activities are not yielding expected results and that employees do not actively participate in the development of EA. The expected count under the null hypothesis was 22.2, implying that more persons than was expected perceived that EA activities are not yielding expected results and that employees do not actively participate in the development of EA.

Recommendation

Since all respondents that perceive employees to be actively participating in EA development also perceive that EA activities to be yielding expected results, the organisation should therefore direct its efforts to promote employee participation in the development of EA.

Table 7.22: Cross tabulation results – Employees actively participate in the development of EA

Employees actively participate in the development of EA. * EA activities are yielding the expected benefits.					
			EA activities are yielding the expected benefits.		Total
			Strongly disagree/ Disagree	Agree/ Strongly Agree	
Employees actively participate in the development of EA.	Strongly disagree/Disagree	Count	38	11	49
		Expected Count	22.2	26.8	49.0
		Column %	100.0%	23.9%	58.3%
		Standardized Residual	3.4	-3.1	
	Agree/Strongly Agree	Count	0	35	35
		Expected Count	15.8	19.2	35.0
		Column %	0.0%	76.1%	41.7%
		Standardized Residual	-4.0	3.6	
Total		Count	38	46	84
		Expected Count	38.0	46.0	84.0
		Column %	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	49.565[a]	1	<0.001		
Continuity Correction[b]	46.484	1	.000		
Likelihood Ratio	63.498	1	.000		
Fisher's Exact Test				<0.001	.000
Linear-by-Linear Association	48.975	1	.000		
N of Valid Cases	84				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 15.83.

b. Computed only for a 2x2 table

7.4.3.10 Cross tabulation results – there is a good level of knowledge sharing between the EA team and other members of the organisation

This section presents cross tabulation results for the perception that there is a good level of knowledge sharing between the EA team and other members of the organisation and the perception that EA activities are yielding the expected benefits.

Of the 17 respondents that perceive that there is a good level of knowledge sharing between the EA team and other members of the organisation, all of them perceive EA to be yielding the expected benefits.

Pearson's chi square test was performed to determine if there exists an association between the perception that EA activities are yielding the expected benefits and the perception that employees actively participate in the development of EA. The chi square value is equal to 17.607 with 1 degree of freedom and a p-value < 0.001. We can therefore infer that there is a significant association between the stated perceptions at the 5% level of significance. In this case, since the p-value <0.001, there is convincing evidence of a significant relationship between those who perceive EA to be yielding the expected benefits and those who perceive that there is a good level of knowledge sharing between the EA team and other members of the organisation.

The standardized residuals were used to determine which cells in the cross tabulation contributed most to the significant overall association. A standardized residual value smaller than -2 or greater than 2 is an indication that the particular cell in the cross tabulation made a large contribution to the overall association. In this case the standardized residuals are 2.5 and -2.8.

A total of 29 respondents reported that EA activities are yielding the expected benefits while reporting that there is a lack of a good level of knowledge sharing between the EA team and other members of the organisation. However, under the null hypothesis of no association between the two perceptions, it was expected that this category will have a number of 36.7. Hence, fewer persons than was expected felt that that EA activities are yielding expected results while perceiving that there is a lack of a good level of knowledge sharing between the EA team and other members of the organisation.

Additionally, 38 persons reported that EA activities are not yielding expected results and that there is a lack of a good level of knowledge sharing between the EA team and other members of the organisation. The expected count under the null hypothesis was 30.3, implying that more persons than was expected perceived that EA activities are not yielding expected results and that there is a

lack of a good level of knowledge sharing between the EA team and other members of the organisation.

Recommendation

Since all respondents that perceive that there is a good level of knowledge sharing between the EA team and other members of the organisation also perceive that EA activities to be yielding expected results, the organisation should therefore direct its efforts to promote knowledge sharing.

There is a good level of knowledge sharing between employees and the EA team * EA activities are yielding the expected benefits

			EA activities are yielding the expected benefits.		Total
			Strongly disagree/ Disagree	Agree/ Strongly Agree	
There is a good level of knowledge sharing between employees and the EA team	Strongly disagree/ Disagree	Count	38	29	67
		Expected Count	30.3	36.7	67.0
		Column %	100.0%	63.0%	79.8%
		Standardized Residual	1.4	-1.3	
	Agree/Strongly Agree	Count	0	17	17
		Expected Count	7.7	9.3	17.0
		Column %	0.0%	37.0%	20.2%
		Standardized Residual	-2.8	2.5	
Total		Count	38	46	84
		Expected Count	38.0	46.0	84.0
		Column %	100.0%	100.0%	100.0%

Chi-Square Tests

	Value	df	Asymptotic Significance (2-sided)	Exact Sig. (2-sided)	Exact Sig. (1-sided)
Pearson Chi-Square	17.607[a]	1	<0.001		
Continuity Correction[b]	15.392	1	.000		
Likelihood Ratio	24.017	1	.000		
Fisher's Exact Test				<0.001	.000
Linear-by-Linear Association	17.397	1	.000		
N of Valid Cases	84				

a. 0 cells (0.0%) have expected count less than 5. The minimum expected count is 7.69.

b. Computed only for a 2x2 table

7.2.4 Results for research question 3

Questions posed under question 5 in the questionnaire were designed to determine the perceived effectiveness of KM in overcoming the barriers to or enhancing facilitators of EA adoption. Based on the literature, a list of 5 KM interventions was presented in the questionnaire. The respondents were asked to rate the effectiveness of each intervention based on the respondent's perception. The perceived effectiveness of each KM intervention was rated on a five-point Linkert scale as perceived by the respondent. The options presented were "Would make things a lot worse", "Would make things slightly worse", "No difference", "Slight improvement" and "Significant improvement". The findings from this section of the questionnaire would contribute in answering research question 3 posed in Chapter 1.

To evaluate this question the means were calculated across all the responses per question in order to determine the centre of gravity of the scale. These means were then used to rank the five sub-questions under question 5. A high mean (Between 4 and 5) implies that the scale leans towards the "significant improvement" scale, while a low mean (between 1 and 2) implies that the means leans towards "Would make things slightly worse".

The intervention perceived to have the most significant impact is the increased involvement of EA users/stakeholders in EA development. This intervention has the highest mean score of 4.73 as shown in Table 7.23.

Table 7.23: KM interventions to increase the possibility of success for EA initiatives

Intervention	N		Mean
	Valid	Missing	
Increase management involvement in EA.	84	0	4.39
Continuous communication pertaining to the purpose and goals of enterprise architecture.	84	0	4.62
Regularly communicating EA-related issues and success stories.	84	0	4.26
Increase involvement of EA users/ stakeholders in EA development	84	0	4.73
Promoting knowledge sharing between employees and the EA team	84	0	4.62

Figures 7.2 to 7.6 depict a graphical representation of perceived effectiveness of each intervention in overcoming EA adoption barriers, thus increasing the possibility of success for EA initiatives.

Figure 7.2 : Perceived effectiveness of increasing management involvement in EA.

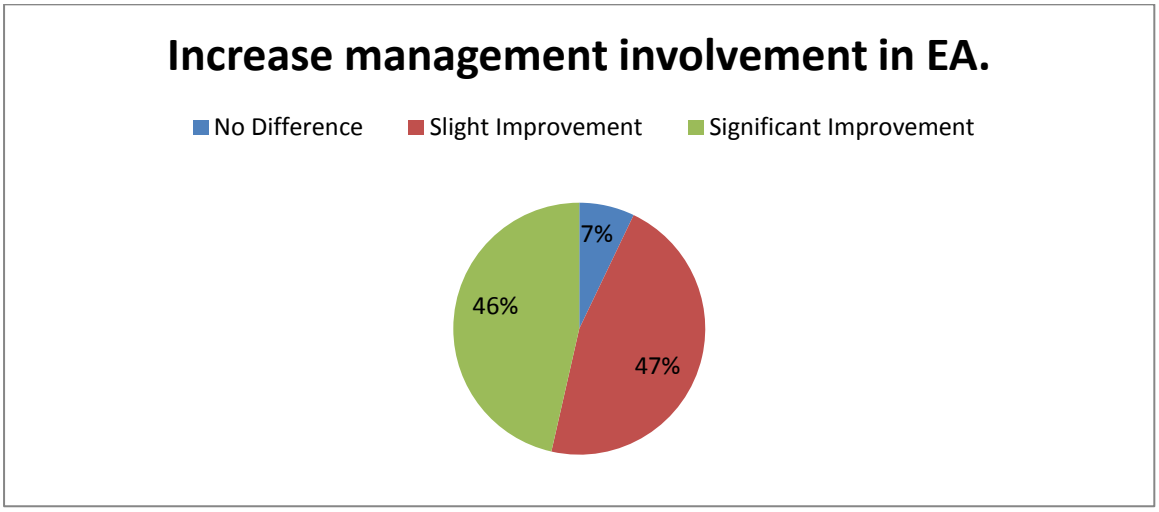


Figure 7.3 : Perceived effectiveness of continuous communication pertaining to the purpose and goals of EA.

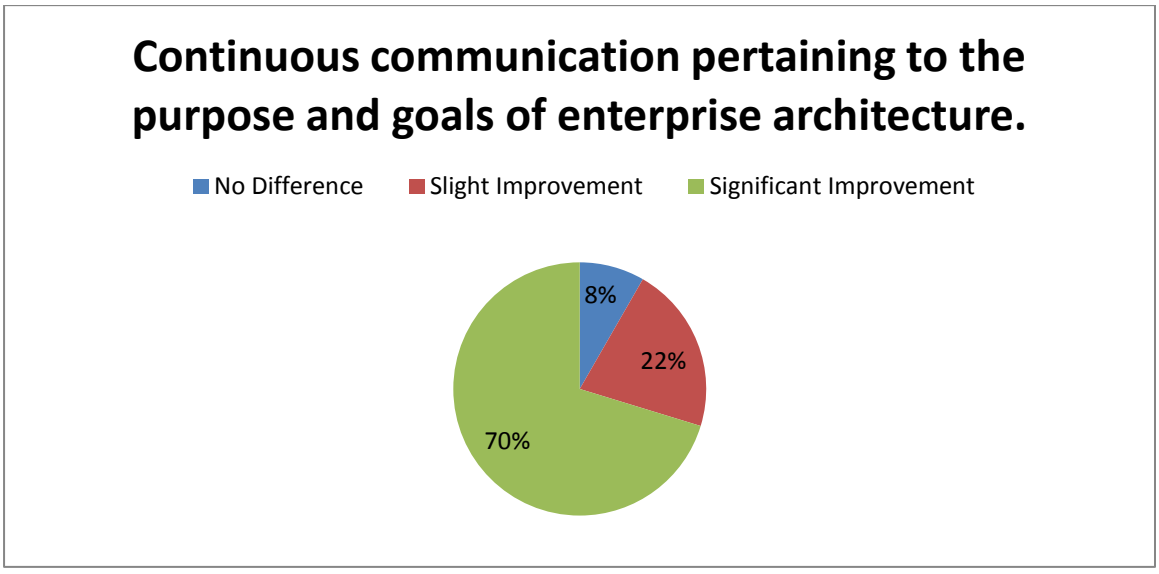


Figure 7.4 : Perceived effectiveness of regularly communicating EA-related issues and success stories

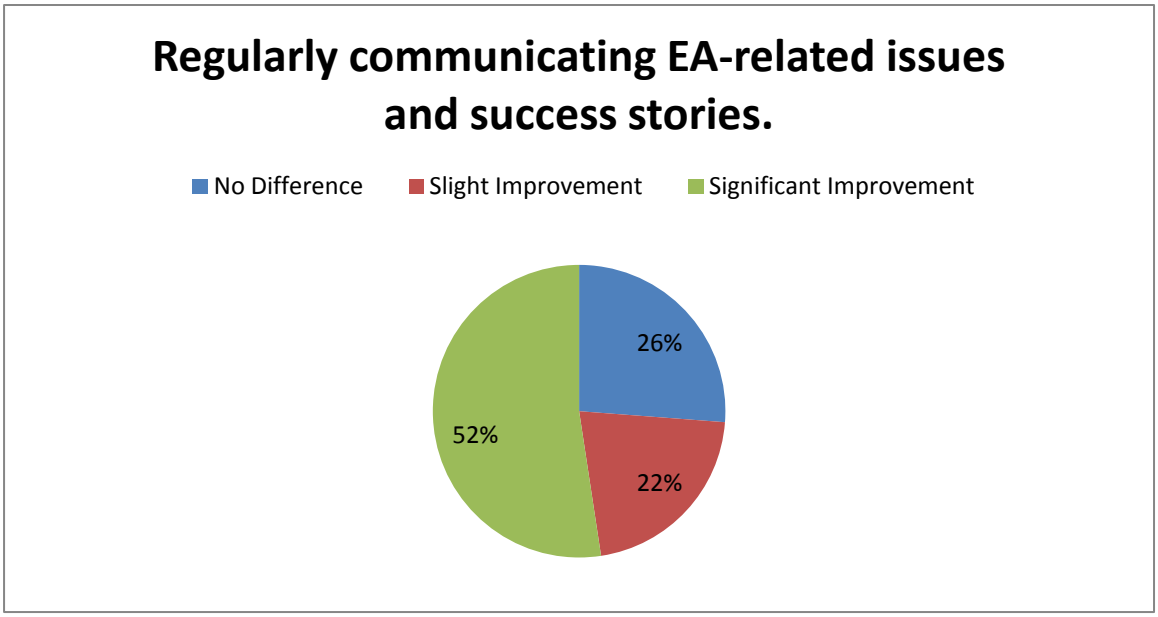


Figure 7.5 : Perceived effectiveness of increased involvdmdng of EA users/ stakeholders in EA development.

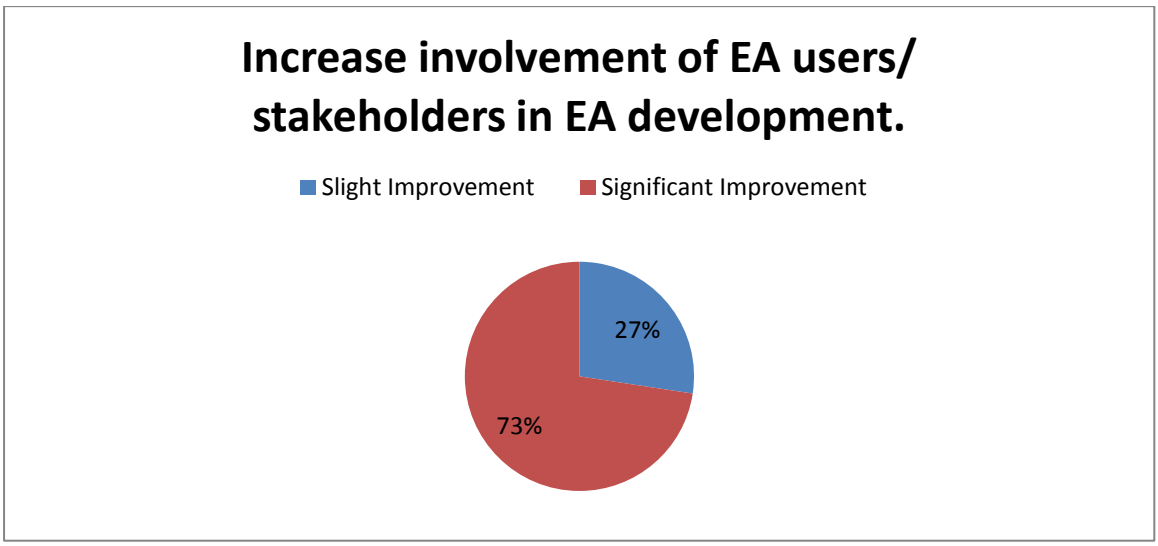
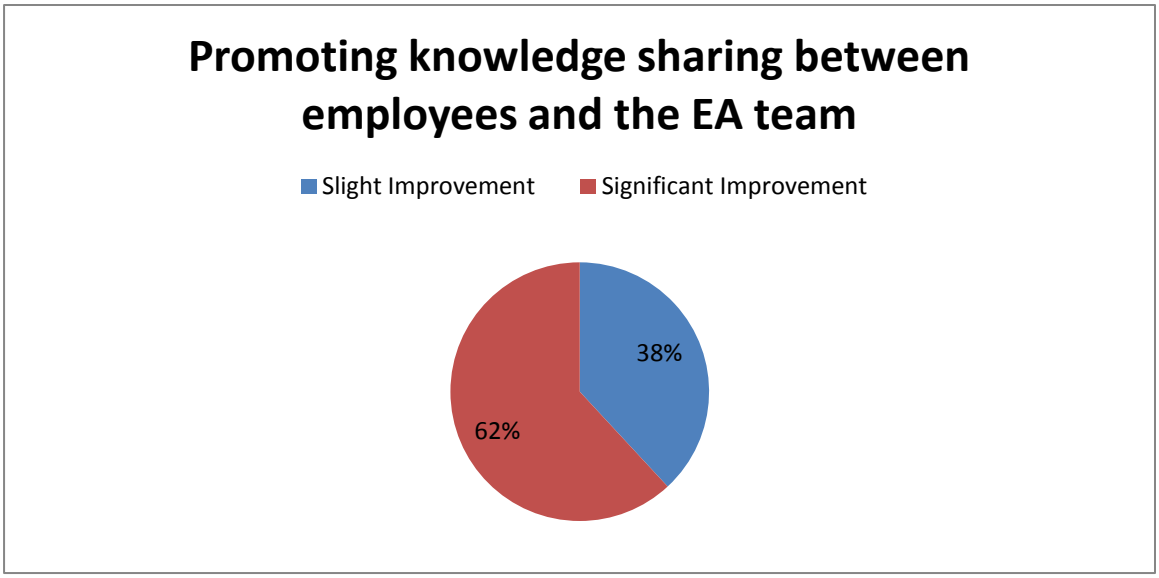


Figure 7.6 : Perceived effectiveness of promoting knowledge sharing between employees and the EA team.



7.2.5 Results for research question 3 conclusion

The results show that all the suggested KM interventions would result in either "Slight improvements" or "Significant improvements" in terms of increasing the possibility of success for EA initiatives. KM processes such as knowledge identification – to ensure important knowledge sources are identified (Section 3.7), knowledge acquisition and creation (Section 3.8), knowledge capture and codification (Section 3.9), knowledge sharing (Section 3.10) and knowledge use (Section 3.11) would therefore increase the possibility of success for EA initiatives.

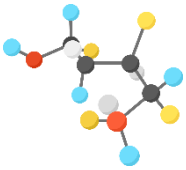
CHAPTER 8: Research Conclusion

Thesis Map

Introduction

Literature Review

Research Method



Empirical Investigation

Conclusion

8.1 Introduction

The previous chapter was focused on analyzing and presenting the results of the empirical investigation of this research. This chapter links the findings of the empirical investigation in chapter 7 to findings in academic literature discussed in Chapters 2, 3, 4 and 5. Answers to the secondary research questions are also presented in this chapter. This would allow the researcher to answer the main research question and draw conclusions of the research topic under study. In this chapter, the contributions of this study to the existing body of knowledge are also presented. Lastly, the suggestions of possible future research are also presented.

The main objective pursued in this research was to determine how knowledge management can be used to successfully adopt enterprise architecture in a South African vehicle and asset finance bank. The researcher had not found academic research on how knowledge management can be used to solve challenges encountered during EA adoption. It was further hoped that the findings of this research would increase the possibility of success for EA initiatives through the use of KM.

The following section presents answers to the three secondary research questions, thereby answering the main research question.

8.2 Answering the Research Questions

The main research question as presented in chapter 1 is:

How can knowledge management be used to successfully adopt enterprise architecture in a South African motor vehicle and asset finance bank?

The following secondary research questions were formulated with the aim of answering this main question. The secondary research questions explored are:

1. What is the significance of EA to the motor vehicle and asset finance industry?
2. What are the barriers to successful EA adoption in the motor vehicle and asset finance industry?
3. How can KM practices be used to increase the possibility of success for EA initiatives?

These secondary questions were chosen such that answering each secondary question would lead to answering the main research question. The following sections are dedicated to answering each of these secondary research questions based on the empirical investigation and the literature review presented in chapters 2, 3, 4 and 5.

8.2.1 Secondary Research Question 1: What is the significance of EA to the motor vehicle and asset finance industry?

Legacy IT environments that exist in large organisations are often complex, inflexible and typically incapable of enabling organisational agility (Ross, et al., 2006). When the strategy of an organisation is acted upon, the implementation process is often gradual, resulting in each strategic initiative implementing its own IT solution, which further adds to the complexity of the IT environment (Ross, et al., 2006). Moreover, this increases IT operating costs. In an effort to solve these challenges, the literature reveals that organizations are adopting EA.

Literature found that EA reduces IT complexity and provides an overarching approach to facilitate organizational transformation. In addition, Wißotzki, et al. (2013) suggest that it is beneficial for organisations to maintain up to date documentation of the complex interplay between business process and information system at all levels of the organisation. Without an overall view of the various complex interactions, decision makers might erroneously take incorrect decisions. EA has been found to be helpful in providing this overall view thus improving decision making.

Existent literature also reveals the numerous challenges encountered during EA adoption. However, limited research was found by the researcher on how the challenges encountered during EA adoption can be solved through KM. This secondary research question determined the importance and expected benefits of adopting EA in a South African motor vehicle and asset finance bank.

The empirical evidence presented in chapter 7 showed that the overwhelming majority of respondents perceive EA to important to the organisation. Empirical evidence also reveals that enabling the organization to respond to changes in the outside world in an agile fashion is regarded as one of the expected benefits of EA adoption.

The significance of EA documented in the literature review together with the results from the empirical evidence adequately answers secondary question 1.

8.2.2 Secondary Research Question 2: What are the barriers to successful EA adoption in the motor vehicle and asset finance industry?

Notwithstanding the many expected benefits of EA as discussed in the literature review and empirical evidence, its adoption is fraught with challenges. This secondary question examines the barriers that must be overcome for EA adoption to succeed. These are the hurdles that have to be overcome by an organisation in the pursuit of attaining long-term success during the implementation of enterprise initiatives (Wißotzki, et al., 2013).

This research sought to determine which barriers to EA adoption are prevalent in the organisation. The empirical evidence reveals that an inadequate level of knowledge sharing between the EA team and other members of the organization. It has also been found in this research that employees are not actively participating in the development of EA.

According to the literature review conducted in chapter 2, delivering tangible EA value proposition remains one of the major challenges for organisations. Therefore, the EAM value proposition needs "...to be communicated to the right stakeholders in the right way and its implementation has to be perceived to be beneficial" (Wißotzki, et al., 2013). The importance of stakeholder involvement is also highlighted by both literature and empirical evidence.

Both empirical evidence and literature review reveal the barriers that have to be overcome for EA adoption to succeed, thus answering secondary research question 2.

8.2.3 Secondary Research Question 3: How can KM practices be used to overcome barriers to EA adoption?

The challenge with EA adoption is that changes to the organisational culture are inevitable (McNabb & Barnowe, 2009). Organisation-wide communication has also been found to be crucial during EA adoption (Syynimaa, 2015). In addition, Syynimaa (2015) advised that for EA adoption to be successful, it is important that members of the organisation consider EA adoption to be necessary, achievable, valuable to the organisation, beneficial to the individual, and supported by top-management.

This secondary research question sought to determine the perceived effectiveness of KM interventions in overcoming the barriers identified in secondary question 2. The empirical evidence reveals that promoting knowledge sharing between employees and the EA team would make a significant contribution in supporting EA initiatives. Empirical evidence also shows that increasing involvement of EA users/ stakeholders in EA development would also greatly benefit EA initiatives. Empirical evidence also shows that regularly communicating EA-related issues and success stories, continuously communicating the purpose and goals of enterprise architecture as well as increasing the level of management involvement in EA would be highly effective in overcoming the reported barriers. Empirical evidence presented in chapter 7 reveals that KM activities such as knowledge sharing are perceived to hold great potential to support EA adoption.

By satisfactorily answering these three secondary research questions, the main research question "How can knowledge management be used to successfully adopt enterprise architecture in a South African motor vehicle and asset finance bank" has been adequately answered. As a result, the research topic can contribute to academic literature. In the following section, a summary of the contributions made by this research is presented.

8.3 Summary of contribution

This research has made significant discoveries on the importance of EA to the motor vehicle and asset finance organization operating in South Africa. This research also discovered the challenges or barriers encountered during EA adoption. The perceived effectiveness of KM interventions was also measured.

Some of the significant discoveries made in this research are that EA is well recognized and perceived to be important. Some of the expected benefits of EA are: (i) To integrate, standardize and/or eliminate duplication of related processes and systems. (ii) To enable the organization to respond to changes in the outside world in an agile fashion. (iii) To achieve an optimal fit between IT and the business processes it supports. Business efficiency and Decision making are perceived as having improved as a result of EA. Some of the barriers to successful EA adoption are that (i) the purpose and goals of EA are not well understood in the organization. (ii) Employees are not actively participating in the development of EA. Some of the KM interventions that are believed to be effective in overcoming the barriers are: (i) Promoting knowledge sharing between employees and the EA team. (ii) Increase involvement of EA users/ stakeholders in EA development. (iii) Increased management involvement in EA.

Conducting this study has contributed in two ways. This study has added to the existing EA and KM body of knowledge, thus contributing to the academic literature on both EA and KM as well as the relation between the two. This study has also offered practical steps of incorporating KM activities during EA adoption thus contributing to the domain of EA practitioners.

8.4 Possible future research

Due to time constraints and access to participants, this research considered only one motor vehicle and asset finance organization in South Africa. It might be desirable for future research to expand to more than one organization which will allow for more generic conclusion to be drawn.

Moreover, this research only focused on the motor vehicle and asset finance bank. It might be more insightful to determine whether similar conclusions can be drawn from the wider banking industry in South Africa.

One of the findings of this research is that the level of knowledge sharing between the EA team and other members of the organization is not optimal. It would therefore be beneficial to investigate the reasons for this lack of knowledge sharing.

8.5 Concluding remarks

As discussed in section 8.2 above, this research has answered the research question posed in chapter 1 by answering the three secondary questions. It was found that the findings of this research are supported by the existing literature.

In this chapter, answers to the three secondary research questions were presented and discussed. This chapter also discussed how this research has contributed to the body of knowledge. Possible future research ideas based on the current research were presented.

In conclusion, KM seems to have the capability of assisting organisations overcome barriers to EA adoption. KM activities therefore, need to be incorporated in the EA adoption programme. It can therefore be concluded that this research succeeded in determining how knowledge management can be used to successfully adopt enterprise architecture in a motor vehicle and asset finance bank in South Africa.

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Appendix A – Questionnaire

How can knowledge management be used to successfully adopt enterprise architecture in a South African motor vehicle and asset finance bank?

The expected benefits of Enterprise Architecture (EA) to the organisation

Please answer the following questions in the context of your current work context. There are no right or wrong answers - just opinions that you have formulated during your work experiences within your organization.

1. Which of the following phrases best describes your recognition of enterprise architecture in the organization?

I did not know Enterprise Architecture exists ○

I have heard of it, but I don't know what it does ○

I know what EA does, but do not believe it is important ○

I know what EA does and I believe it is important ○

2. In which of the following areas do you expect to identify benefits from using EA? (select all that are applicable)

To accomplish enterprise-wide goals, instead of (possibly conflicting) local optimizations. ☐

To control the complexity of the organization and its systems. ☐

To integrate, standardize and/or eliminate duplication of related processes and systems. ☐

To control costs.	☐
To enable the organization to respond to changes in the outside world in an agile fashion.	☐
To co-operate with other organizations effectively and efficiently.	☐
To achieve an optimal fit between IT and the business processes it supports.	☐
To provide insight into the complexity of the organization.	☐
To depict a clear image of the desired future situation.	☐
To provide a vehicle for different stakeholders to communicate with each other effectively.	☐
To improve management decision making.	☐

3. Please indicate (IN YOUR OPINION) how the following have changed or are changing as a result of EA in your organization.

	Highly Improved	Improved	No Change	Worse	Don't Know
Business efficiency	○	○	○	○	○
IT and/or Business governance	○	○	○	○	○
IT and/or operating costs optimization	○	○	○	○	○
Decision making	○	○	○	○	○

Reduction of technical complexity					
Technical integrity					
Data integrity					
Continuity of organizational knowledge					
Systems integration					
Risk management					
Audit compliance					

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Barriers and Facilitators to EA adoption

The following section addresses some of the factors that might promote or impede EA efforts.

4. Please rate (IN YOUR OPINION) the prevalence of the following factors in your organization.

	Strongly Agree	Agree	Disagree	Strongly Disagree
My organization has an open-minded approach to new ways of working and the changes necessitated by EA.	○	○	○	○
The purpose and goals of EA are well understood in the organization.	○	○	○	○
EA has been fully accepted in the organization	○	○	○	○
EA adoption has been supported by a transformation and culture change program	○	○	○	○

Requirements from EA users/ stakeholders (such as yourself) are understood and reflected in the EA artifacts				
The organization has the practical skills required in EA development.				
EA has the necessary management support.				
Employees actively participate in the development of EA.				
EA activities are yielding the expected benefits.				
There is a good level of knowledge sharing between the EA team and other members of the organization				

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Using Knowledge Management practices to overcome barriers to EA adoption

This section evaluates potential solutions to overcome some of the barriers to Enterprise Architecture success.

5. Please rank each solution according to YOUR OPINION on how effective it would be in supporting EA efforts.

	Would make things a lot worse	Would make things slightly worse	No Difference	Slight Improvement	Significant Improvement
Increase management involvement in EA.	○	○	○	○	○
Continuous communication pertaining to the purpose and goals of enterprise architecture.	○	○	○	○	○
Regularly communicating EA-related issues and success stories.	○	○	○	○	○
Increase involvement of EA users/ stakeholders in EA development	○	○	○	○	○
Promoting knowledge sharing between employees and the EA team	○	○	○	○	○

Thank you for taking time to complete this survey. Your input is greatly appreciated. Your responses will be kept confidential.