The Influence of Enterprise Architecture Maturity on Business Value:

A Perspective from the South African Financial Services Environment

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Abstract

Enterprise Architecture (EA) is viewed as a source of business value and competitiveness due to beneficial outcomes such as reduced system complexity, business-information technology (IT) alignment, and improved system integration. However, challenges exist in understanding the relationship between EA and business value at different maturity levels. This research focused on the connection between the EA maturity of an organisation and the business value associated with it in the South African (SA) financial services environment.

This study analysed dominant EA frameworks, maturity models, as well as various explanations of the term *business value* from literature. The resource-based view of the firm (RBV) was used as the underlying theoretical framework to structure this research, by examining EA as an intangible resource, and maturity as a source of heterogeneity. This study further contributed to the RBV operationalisation debate, by using the Architecture Capability Maturity Model (ACMM) as a supporting theory to operationalise EA from a qualitative perspective. The critical realism philosophy, which states that mechanisms generate events, shaped this research by creating focus on the underlying EA mechanisms that led to business value, as well as insights into the opportunities and challenges organisations experience as they progress to higher levels of maturity. This study built a middle range theory using a qualitative approach. Moreover, characteristics of descriptive, exploratory, and explanatory research were used within this investigation. A case study strategy, comprising of semi structured interviews and artefacts was employed to collect data for this study. The results were subsequently examined using thematic analysis techniques.

This study established that within level 1 maturity, minimal EA practices driven by a few staff members were in place. Forms of value such as *hardware cost savings, software cost savings,* and *visualisation* were experienced. Most of the business units fell within level 2 maturity, indicating that EA practices were still under development. Forms of value such as *increased revenue, improved development time* and *reduced complexity* were attained. Business units within level 3 had simple EA practices in place with clear target states. *Process improvements, improved risk management* and *improved customer service* were experienced. Within level 4 maturity, EA was fully integrated into the culture, with EA metrics defined. In addition, forms of value such as *improved decision-making, innovation and enhanced customer insights* were also experienced. None of the business units were rated within level 5 maturity.

This study found that EA was generally implemented at a coarse granularity of refinement across levels 1 and 2 maturities, at a medium granularity within level 3, and a fine granularity within level 4 maturity. Further, this study demonstrated that EA is a source of both tangible and intangible forms of value.

Key words: Enterprise architecture, Maturity, Business Value, Resource Based View, RBV, Critical realism, Qualitative, Tangible, Intangible, Granularity

Declaration

I, Avsharn Bachoo declare that this thesis is my own, unaided work. It is being submitted for the Degree of Doctor of Philosophy Information Systems at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at any other University.

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Signature

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I would like to express my deep gratitude to Professor Judy Backhouse for her guidance, critiques, constructive advice and encouragement during this research. Her positive outlook and confidence in this study inspired me to explore innovative ideas with confidence.

I wish to thank my wife Bahia for her unconditional love, encouragement, support, countless sacrifices and unwavering belief in me. Thank you for being my muse, editor and sounding board. Without you, this journey wound not have been possible.

My children Hannah and Mikaeel, anything is possible if you believe… if your dad can live out his dreams then nothing is impossible for you.

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List of acronyms

ACMM	Architecture Capability Maturity Model
ADM	Architecture Development Method
API	Application Programming Interface
BIAN	Banking Industry Architecture Network
BU	Business Unit
CEO	Chief Executive Officer
CIO	Chief Information Officer
CMM	Capability Maturity Model
COO	Chief Operating Officer
CRC	Complementarity Resource Combination
CRM	Customer Relationship System
DoC	Department of Commerce
DoD	Department of Defence
DoDAF	Department of Defence Architecture Framework
EA	Enterprise Architecture
EAAF	Enterprise Architecture Assessment Framework
EAMM	Enterprise Architecture Maturity Model
EAMMF	EA Management Maturity Framework
EBA	Enterprise Business Architecture
EIA	Enterprise Information Architecture
ESA	Enterprise Solutions Architecture
ETA	Enterprise Technical Architecture
EXCO	Executive Committee
FEA	Federal Enterprise Architecture
FEAF	Federal Enterprise Architecture Framework
GAO	Government Accountability Office
GEAF	Gartner Enterprise Architecture Framework
IAA	Insurance Application Architecture Framework
IS	Information System
IT	Information Technology
MANCO	Management Committee
MBO	Management by Objectives
NASCIO	National Association of State Chief Information Officers
NPV	Net Present Value
OMB	Office of Management and Budget
QMMG	Quality Management Maturity Grid
RBV	Resource-Based View

ROI	Return on Investment
SEI	Software Engineering Institute
SHERQ	Safety Health Environment Risk and Quality
SLR	Systematic Literature Review
SWOT	Strengths, Weaknesses, Opportunities and Threats
TAFIM	Technical Architecture Framework for Information Management
TAFIM	Technical Architecture Framework for Information Management
TEAF	Treasury Enterprise Architecture Framework
TOGAF	The Open Group Framework
US	United States
VRIO	Valuable, Rare, difficult to Imitate, Organisation readiness

Chapter 1: Research Introduction

This chapter introduces the topic of this study. Important concepts such as enterprise architecture, maturity, and business value are presented. The background, theoretical framework, a statement of the problem, research methodology, and contributions of this study are further presented.

1.1 Introduction

In what way does Enterprise Architecture (EA) Maturity influence Business Value? This is a question, which in short describes the focus of this research. Challenges exist in understanding the relationship between EA maturity and business value, as there is limited research that examines EA as an intangible resource and basis for business value (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015). Furthermore, studies have not specifically focused on the way that EA affects business value outcomes at the different maturity levels (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015, 2011; Vallerand et al., 2017). This problem is further compounded by inconsistencies in the definition of the term business value (Cronk and Fitzgerald, 1999), as organisations using different definitions have multiple interpretations of value (Keyes-Pearce, 2005). Investigating this problem is important as organisations can understand the forms of business value that could be attained as they progress towards higher levels of EA maturity. Specifically, the aim of this research is to understand the connection between the EA maturity of an organisation and the business value associated with it in the South African financial services environment.

Over the last decade, the landscape of business and information technology (IT) has evolved extensively (Dutta et al., 2015; Santana et al., 2016). Organisations operate in a complex, highly dynamic environment, driven by technological advances, disruptive innovations, regulatory changes, and globalisation (Medini and Bourey, 2012; Panetto et al., 2016; Walker et al., 2016). Research shows that EA is an instrument that can be used to reduce system complexity (Bucher et al., 2006; Gerber et al., 2010; Lankhorst, 2013a; Lumor et al., 2016; Rouhani et al., 2015, 2013; Sessions, 2007), achieve business-IT alignment (Bricknall et al., 2006; Henderson and Venkatraman, 1993; Pereira and Sousa, 2005), improve system integration (Boh and Yellin, 2007; Richardson et al., 1990; Venkatesh et al., 2007), enhance IT management and strategic competitiveness (Bernard and Grasso, 2009; Cardwell, 2008; Kappelman et al., 2016; Kappelman, 2010; Ross et al., 2006), and assist stakeholders visualise design (Cardwell, 2008; Kruchten et al., 2002). These benefits illustrate the value and growing relevance of EA to organisations (Foorthuis et al., 2016). A more comprehensive list of EA benefits can be found in Appendix 1.

The following section presents a background to the study followed by the theoretical framing.

1.2 Background

Literature demonstrates rapid acceptance of EA within the major sectors of the economy (Ernst et al., 2006; Franke et al., 2016; Government Information Technology Officer's Council of South Africa, 2009; Janssen and Hjort-Madsen, 2007; Lapalme et al., 2016; Niemi and Pekkola, 2016; Vallerand et al., 2017). It has progressed from reactive once-off initiatives into a growing structured field (Bernard, 2012; Van Steenbergen and Brinkkemper, 2009). EA is viewed as a source of business value and competitiveness by researchers and organisations (Kaisler et al., 2005; Ross et al., 2006), due to the various beneficial outcomes discussed below (Boucharas et al., 2010; Foorthuis et al., 2010; Kappelman et al., 2016; Radeke, 2010).

Reduced system complexity

As organisations rapidly grow and become global, their complexities increase (Cardwell, 2008). EA can help simplify complexities for these organisations (Bucher et al., 2006; Gerber et al., 2010; Lankhorst, 2013a; Lumor et al., 2016; Rouhani et al., 2015; Sessions, 2007). EA has been used to reduce organisational complexity, which results in savings and efficiencies (Cardwell, 2008), as well as improve the communication of business functions (Schekkerman, 2011). It can be used as a tool to communicate IT objectives to business users (Kappelman et al., 2008). Furthermore, EA can similarly assist stakeholders by providing them with the ability to visualise, verify, and communicate design decisions before a system is implemented. This represents a cost-saving and risk-mitigation benefit (Bass et al., 2012; Kruchten et al., 2002; Perry and Wolf, 1992).

Business-IT alignment

Business-IT alignment is achieved when an organisation efficiently uses IT to achieve its business goals (Henderson and Venkatraman, 1993; Pereira and Sousa, 2005). Alignment constitutes "business strategy", "IT strategy", "organisational structures and processes", and "IT structures and processes" (Chan, 2002, p. 98; Henderson and Venkatraman, 1993, p. 4; Luftman, 2007, p. 171).

EA encompasses both business and IT domain components that can support organisations to achieve alignment (Bricknall et al., 2006; Gregor et al., 2007; Ross, 2003; Ross et al., 2006; Rouhani et al., 2015; Schwarz et al., 2010; Sessions, 2007). EA enables alignment because it connects business and technology components through common threads (Harrison, 2013; Henderson and Venkatraman, 1993; Kurniawan and Suhardi, 2013; Lapalme, 2012). Business-IT alignment is important because business value is improved when this occurs (Barua et al., 1995; Pereira and Sousa, 2004; Radeke, 2010; Tamm et al., 2015). Furthermore, business forms of value such as financial savings, improved return on investment, industry competitiveness, and enhanced business processes can be achieved with alignment (Henderson and Venkatraman, 1993; Pereira and Sousa, 2005). EA can be used as an instrument to manage complexities in order to achieve business-IT alignment (Aziz and Obitz, 2007; Chan, 2002; Obitz and Babu, 2009).

Improved system integration and standardisation

EA improves system interoperability by resolving system incompatibility issues (Adenuga et al., 2015; Richardson et al., 1990). Moreover, EA develops standardisation and improves integration between business functions (Boh and Yellin, 2007; Venkatesh et al., 2007).

Efficient IT management

Scholars and practitioners have acknowledged that EA improves IT management. EA also reduces solution delivery time, reduces development costs, increases overall organisational agility, improves IT responsiveness, and improves stakeholder satisfaction (Bernard, 2012; Cardwell, 2008; Kappelman et al., 2016; Medini and Bourey, 2012; Miller and Ross, 2003; Ross et al., 2006). Furthermore, EA can create strategic competencies that generate business value for organisations (Miller and Ross, 2003; Ross et al., 2006).

Due to the above outcomes, researchers are exhibiting an increased interest in EA (Alzoubi et al., 2018; Franke et al., 2018; Kasemsap, 2018; Niemi and Pekkola, 2017).

A theoretical framework provides a particular perspective or lens through which to examine a topic. It is introduced during the early stages of research in order to provide structure and a scientific base to support a research study (Creswell, 2017a; Maxwell, 1992). The following section explains the theoretical framework.

1.3 Theoretical Framing

The resource-based view (RBV) is a strategic management and predictive theory (Barney, 1991; Patas et al., 2012) that explains the way that organisations transform their inputs into outputs (Amit and Schoemaker, 1993; Dutta et al., 2005). This theory states that organisations should look inside their environment (as opposed to the outside) for tangible and intangible resources (inputs) that lead to value (outputs) (Barney, 1991; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). **Resources** are inputs that enable an organisation to carry out their activities (Barney, 1991; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). **Tangible resources** are physical assets (commodities) that can be easily purchased in the open market (Barney, 1991; Bergvall-Kåreborn et al., 2009; Schöenherr, 2009). They are primarily a source of short-term value and provide a limited long-term advantage as competitors can easily obtain the same resources. **Intangible resources** have no physical presence, cannot be purchased, and are the primary source of a long-term business value (Wade and Hulland, 2004). **Heterogeneity** assumes that intangible resources of organisations differ from each other and provide business value (Barney, 1991; Patas et al., 2012). Finally, **immobility** assumes that intangible resources are fixed and do not move from organisation to organisation. Due to heterogeneity and immobility, competitors cannot easily imitate an organisation's assets and deploy the same strategies (Albliwi et al., 2014; Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997).

RBV was selected as the underlying theoretical framework for this research, as it helped explain the way resources influence value (Amit and Schoemaker, 1993; Burton and Rycroft-Malone, 2014; Dawson and Watson, 2005; Seddon, 2014; Tamm et al., 2015). The RBV theoretical constructs of *intangible resources, heterogeneity,* and *value* were examined in this research (Amit and Schoemaker, 1993; Tamm et al., 2011). This study examined *EA as an intangible resource* (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015). Intangible resources are a source of outputs such as long-term business value and competitive advantage (Barney, 1991; Bricknall et al., 2006; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). Furthermore, the *maturity of an intangible resource is a source of heterogeneity* (Anderson and Eshima, 2013; Helfat and Peteraf, 2003; López, 2005). Hence RBV was extended by examining the maturity of EA as a source of heterogeneity. This understanding is important because competitors cannot easily imitate organisational assets or deploy the same strategies due to heterogeneity because they are difficult for competing organisations to copy (Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997). Heterogeneity further influences business value and competitive advantage (Anderson and Eshima, 2013; Grant, 1991; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992). RBV assumes that intangible resources such as EA practices and capabilities are not perfectly mobile, and do not move from organisation to organisation (Alwadain et al., 2014; Amit and Schoemaker, 1993; Bui, 2012; Tamm et al., 2015; Vallerand et al., 2017). Finally, this study contributed to the RBV understanding of *business value* (Barney, 1991; Li, 2009; Woodruff, 1997). Literature reveals numerous inconsistent definitions (Keyes-Pearce, 2005) and diverse views on this term (Chesbrough, 2012; Johnson et al., 2008; Kappelman et al., 2016; Sorescu et al., 2011). A deeper and consistent understanding (Keyes-Pearce, 2005) of business value from an EA perspective is important because valuable resources assist organisations by increasing differentiation, decreasing the cost of production, or improving efficiency and effectiveness strategies that place an organisation in a favourable business position (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997).

Figure 1.1 below was developed as an organising framework that illustrates the RBV theoretical constructs of *intangible resources*, *heterogeneity,* and *value* examined in this research (Amit and Schoemaker, 1993; Tamm et al., 2011). This study examined *EA as an intangible resource* (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015) and *maturity as a source of heterogeneity* (Anderson and Eshima, 2013; Grant, 1991; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992). The study further examined EA and maturity as sources of *business value*.

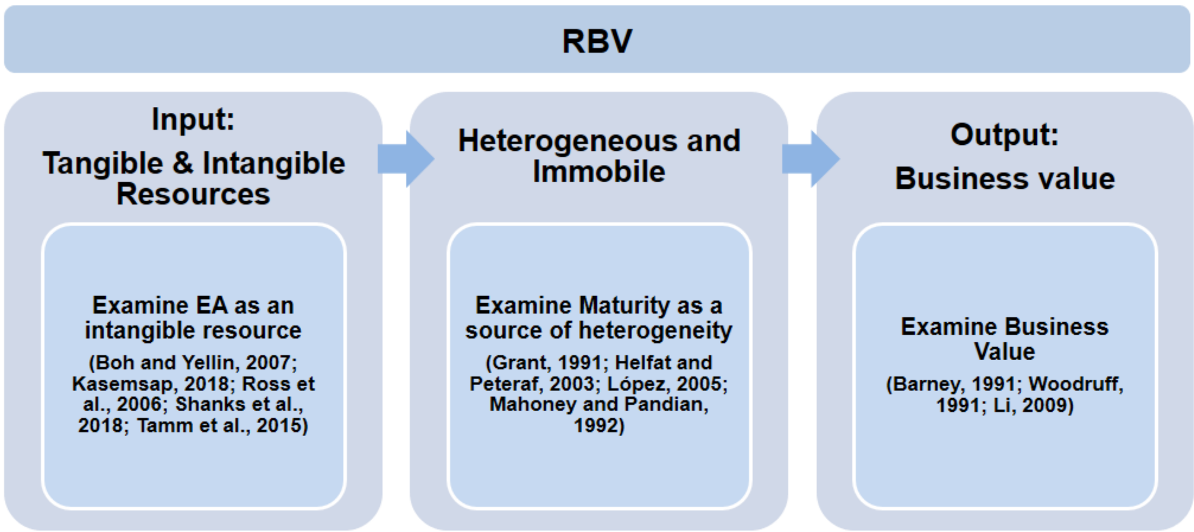

Figure 1.1: Organising Framework for study

Source: Adapted from (Amit and Schoemaker, 1993; Tamm et al., 2015, 2011)

Dominant EA frameworks assessed for this study included Zachman Framework (Bui, 2012; Odongo et al., 2010; Vallerand et al., 2017; Zachman, 1987, 2012), Federal Enterprise Architecture (Kwon, 2004; Sessions, 2007; Urbaczewski and Mrdalj, 2006), Gartner Enterprise Architecture Framework (Bui, 2012; Lapkin et al., 2008; Medini and Bourey, 2012), Department of Defence Architecture Framework (Browning, 2014; Department of Defense Deputy Chief Information Officer, 2011) and Treasury Enterprise Architecture Framework (Cameron and Mcmillan, 2013). The Open Group Framework (TOGAF) (Harrison, 2013) was selected as the EA reference framework for this study because it contained balanced business and IT domains that were comprehensive and flexible (Rouhani et al., 2015, 2013; Sessions, 2007; Van't Wout et al., 2010). EA was described as the practice of designing, planning, implementing, and governing business, application, information and technology domains (Harrison, 2013). Notably, these EA frameworks further defined granularities, layers and views (El Kourdi et al., 2007; Schekkerman, 2011, 2006), and should be distinguished from the underlying RBV theoretical framework.

Dominant maturity models included Quality Management Maturity Grid (Albliwi et al., 2014; Crosby, 1979) and Stages of Growth Model (Aiken et al., 2007; Peter Gottschalk, 2002; King and Kraemer, 1984; Nolan, 1979). The Capability Maturity Model (CMM) (Paulk et al., 1993) was selected as a reference for this study as it identified clear levels of maturity (Paulk et al., 1993). CMM defined *maturity* as the degree of formality and optimisation of practices. This ranged from ad hoc, formally defined, managed, and finally optimised practices (Paulk et al., 1993).

An examination of literature on business value revealed a wide plateau of views on this term (Amit and Zott, 2001; Chesbrough, 2012; Hwang and Christensen, 2008; Johnson et al., 2008; Sorescu et al., 2011). Dominant views on the definition of maturity included econometric, process and perception categories (Cronk and Fitzgerald, 1999; Keyes-Pearce, 2005), management by objectives (Drucker, 1954), value chain (Porter, 1990, 1985a) and balanced scorecard (Kaplan and Norton, 2007). This study used the RBV definition, whereby the term business value referred to tangible and intangible forms of value (Barney, 1991; Bergvall-Kåreborn et al., 2009; Schöenherr, 2009).

The next section introduces the research problem.

1.4 Statement of the Problem

Literature illustrates the fast adoption of EA within academia and industry (Dahlberg et al., 2016; Niemi and Pekkola, 2016; Rouhani et al., 2015; Santana et al., 2016; Vallerand et al., 2017). RBV was adopted as the underlying theoretical framework to help structure this research, examine EA as an intangible resource (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015) and maturity as a source of heterogeneity (Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992). Section 1.2 established the business value of EA (Miller and Ross, 2003; Ross et al., 2006) because it is linked to outcomes such as reduced system complexity (Gerber et al., 2010; Lapalme et al., 2016; Rouhani et al., 2013; Schekkerman, 2011), business-IT alignment (Gregor et al., 2007; Rouhani et al., 2015; Sessions, 2007), improved system integration and standardisation (Boh and Yellin, 2007; Richardson et al., 1990; Venkatesh et al., 2007), as well as efficient IT management and strategic competitiveness (Bernard, 2012; Cardwell, 2008; Kappelman et al., 2016; Ross et al., 2006).

However, challenges exist in fully understanding the business value that organisations experience at the different EA maturity levels. Tamm (2011, p. 156) elaborates “the most important shortcoming in existing research on EA benefits is the lack of rigorous empirical validation of the benefit claims”. Challenges include understanding “the link between EA maturity and value” (Burns et al., 2009, p. 6), “in-depth relationships between enablers and benefits” (Tamm et al., 2011, p. 156), “relationships between specific performance indicators (mechanisms) and implicit or explicit goals” (Vallerand et al., 2017, p. 18), as well as improving theoretical explanations (Tamm et al., 2011).

Examining EA as an intangible resource

RBV describes a *capability* is a subset of an intangible resource that incorporates practices, skills, and competencies, as well as tacit and explicit knowledge (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997). They are used to engage and improve the productivity of other (tangible and intangible) resources within an organisation (Amit and Schoemaker, 1993). Researchers suggest that these resources are challenging to quantify as they reside in relationships between people and organisational routines (Bianchi, 2017; Fernández-Esquinas et al., 2017; Nonaka, 1994). EA is defined as the practice of designing, planning, implementing, and governing business, application, and information and technology domains (Harrison, 2013), and is regarded as such a capability by researchers (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997).

Although there is extensive RBV research that examines intangible resources such as innovation (Wu and Chiu, 2015), alignment (Wiengarten et al., 2013), IT strategy (Larsson, 2005), brand and marketing (Srivastava et al., 2001), operations management (Hitt et al., 2016) and cultural diversity (Richard, 2010) as a basis of business value and competitive advantage, there is limited research that examines EA as an intangible resource and basis for value (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015). These studies do not focus on heterogeneity in the form of EA maturity levels, but implies identifying EA as an intangible resource that leads to value. Notably, these studies propose EA maturity as an area for future research.

TOGAF (Harrison, 2013), the EA reference model selected for this study, decomposes EA into business, application, technology, and data domains. Although the literature clearly articulates these EA domains, it does not show the granularities of refinement of these domains utilised at the different levels of maturity (Bui, 2012; Tamm et al., 2015, 2011; Vallerand et al., 2017; Wang and Zhao, 2009). Literature (Schekkerman, 2011) argues that if organisations understand EA granularity of refinement, then value can be achieved. Different EA granularities of refinement could influence business value differently at the various levels, and organisations would benefit from information on where to appropriately focus effort.

RBV also states that tangible resources are a source of short-term value, and intangible resources a source of long-term value (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). Some researchers (Bricknall et al., 2006) suggest that EA is a long-term investment, and is difficult to demonstrate any short-term value. This view is supported by arguing EA is challenging as it’s too theoretical and focuses on long-term goals that do not solve short-term practical and technical problems faced by organisations (Van Der Raadt and Van Vliet, 2008). However, there is a lack of research investigating the long-term and potential short-term value that can be obtained at the different levels of EA maturity (Tamm et al., 2015, 2011; Vallerand et al., 2017; Wang and Zhao, 2009).

Examining maturity as a source of heterogeneity

Heterogeneity, refers to the fact that intangible resources of organisations differ from each other and these differences influence business value (Barney, 1991; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). The term *maturity* is defined as “a measure to evaluate the capabilities of an organisation with regards to a certain discipline” (Rosemann and de Bruin, 2005, p. 1). A *level* is a stage where the goals of a previous stage have to be achieved in order to progress to the next stage (Maslow, 1955). A maturity model is described as a framework for defining the progression towards an improved state using successive levels (Kazanjian and Drazin, 1989; Paulk et al., 1993; Solli-Sæther and Gottschalk, 2010). A maturity model allows an organisation to assess its practices against a set of criteria to create a benchmark (Butkovic and Caralli, 2013).

Although RBV research has been conducted on the maturity of teams and leadership (Helfat et al., 2007; Helfat and Peteraf, 2003), strategy formulation (López, 2005), general competencies (Mahoney and Pandian, 1992), as well as resources and skills (Grant, 1991) as sources of heterogeneity and business value, these studies have not specifically focused on EA maturity as a source of heterogeneity and business value.

There is limited research that specifically focuses on the way that EA maturity affects business value outcomes at the different levels. Similar EA maturity studies (notably using different theoretical frameworks and methodologies) have produced disparate results. A study (Roest, 2013) showed that EA maturity has to be high in order for organisations to experience high performance. This study illustrated that high performance is achieved within organisations when their business complexity is low, and their EA maturity is high. Another study (Bradley et al., 2012) found that EA maturity levels directly influence the effectiveness of an organisation's IT resources in achieving strategic goals, and indirectly influences the effectiveness of IT resources when IT alignment is incorporated as a mediating variable. Other studies (Khaiata and Zualkernan, 2009) have found that EA maturity levels influence business and IT alignment. These studies, however, still found gaps with strategic business planning, organisational learning, and business processes. Another research article (Venkatesh et al., 2007) found that higher EA maturity produced benefits such as improved integration, standardisation, business processes and operations. These contrasting results show that there is a need to better understand forms of business value that are attained as organisations progress towards higher levels of EA maturity (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015, 2011; Vallerand et al., 2017).

Examining the operational validity of RBV

Operationalisation involves applying a theoretical framework in a real life context to provide practical validity (Bohnenkamp, 2013; Carlile and Jordan, 2005; Colquitt and Zapata-Phelan, 2007). RBV operationalisation is a topic of debate amongst scholars (Barney, 1991; Connor, 2002; Priem and Butler, 2001a, 2001b). Researchers argue that RBV cannot be operationalised due to its tautological (circular reasoning and self-verifying) nature, as it does not contain mechanisms for operationalisation (Bromiley and Fleming, 2002; Caves, 2014; Foss et al., 1995; Hoopes et al., 2003; Lockett et al., 2009; Priem and Butler, 2001a; Rubin, 1973). However, another group of researchers contradict these arguments by arguing that the possession of strategic resources leads to enhanced performance, and that any theory could be rephrased to appear tautological (Barney, 1991, 1986; Crook et al., 2008; Ludwig and Pemberton, 2011; Peteraf and Barney, 2003).

As RBV does not contain any operational mechanisms (Connor, 2002; Priem and Butler, 2001a), "supporting" theory is used to help operationalise RBV (Lockett and Thompson, 2001, p. 741). Theories such as *The Theory of the Growth of the Firm* (Penrose, 1959), the *Strategic Alignment Model* (Henderson and Venkatraman, 1993), *complementary resource combination (CRC)* (April, 2004; Zhuang and Lederer, 2006) as well as various *data frameworks* (Bedeley and Nemati, 2014; Lee et al., 2002; Tamm et al., 2015, 2011; Wang and Strong, 1996) have been used to operationalise RBV. Although these supporting theories have been utilised to operationalise RBV, they do not address important aspects of heterogeneity and maturity required for this study.

This section revealed an important research problem, because despite the importance of EA, and the availability of EA maturity models, there is a lack of research in understanding the way that EA effects business value outcomes at the different levels of maturity (Boh and Yellin, 2007; Lankhorst, 2013a; Niemi, 2006a; Ross and Westerman, 2004). Literature clearly demonstrates that EA generates value for organisations, however, it has not extensively investigated the way that EA affects business value outcomes at the different maturity levels (Bui, 2012; Vallerand et al., 2017). This is important as organisations need to understand the forms of business value attained as they progress towards higher levels of EA maturity (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015, 2011; Vallerand et al., 2017). Researchers (Tamm et al., 2011, p. 141) state the way EA achieves value is unclear, "incomplete, fragmented, and not grounded in theory". This problem is further compounded by the inconsistencies in the definitions of business value (Cronk and Fitzgerald, 1999), as the implication is that those organisations using different definitions have multiple interpretations of value (Keyes-Pearce, 2005).

This research examined EA as an intangible resource (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015) and maturity as a source of heterogeneity (Anderson and Eshima, 2013; Grant, 1991; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992) from an RBV perspective. This study contributed to the RBV theory by examining EA maturity as a basis for business value and competitive advantage (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Ross and Westerman, 2004; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997). It further examined the operational validity of RBV theory (Connor, 2002; Priem and Butler, 2001a).

The research questions for this study are introduced in the subsequent subsection.

1.5. Research Questions

The previous section articulated the challenge with EA and motivated the relevance of this study. The aim of this research was to understand the connection between the EA maturity of an organisation and the business value associated at the various maturity levels. To satisfy this aim, the research question set out below was formulated.

In what way does EA maturity influence business value?

In order to support this main research question, the following sub-questions were formulated. These sub-questions are explored in the different chapters of this study.

EA maturity

1. What are the levels of EA maturity within the South African financial services environment?
2. What are the granularities of EA in use within the South African financial services environment?

Theoretical contribution to RBV

3. What are the tangible and intangible forms of business value influenced by EA heterogeneity?

The previous section further discussed the operational validity of RBV, and conversed theory, such as *The Theory of the Growth of the Firm* (Penrose, 1959), *The Strategic Alignment Model* (Henderson and Venkatraman, 1993), *CRC* (April, 2004; Zhuang and Lederer, 2006), as well as various *data frameworks* (Bedeley and Nemati, 2014; Lee et al., 2002; Tamm et al., 2015, 2011; Wang and Strong, 1996) that can be used to support its operationalisation. However, these supporting theories did not address the aspects of heterogeneity and maturity required for this study.

Similar RBV studies have used CMM to assess the maturity of intangible inputs such *IT quality* (Kishore et al., 2012), *information system maturity* (Dawson and Watson, 2005) or *business analytics* (Cosic et al., 2012) to determine their influence on value and competitive advantage. However, various searches within Scopus and EBSCO Host did not reveal any RBV studies that are operationalised with CMM, specifically using EA as an input. Hence, **Architecture Capability Maturity Model (ACMM)** (Appendix 2), derived from CMM (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010), was selected as a supporting theory to operationalise RBV (Lockett and Thompson, 2001). It was selected for this study as it contained applicable mechanisms comprising of *processes, communication, business-IT alignment, senior management involvement,* and *finance* that were used to evaluate EA practices (De Carvalho et al., 2016b, 2015; Op ’t Land et al., 2009; van Der Raadt et al., 2005).

An organising framework for this study, Figure 1.2 below, was developed to illustrate supporting theory that helps operationalise RBV, the mechanisms that help translate EA into value, as well as the value attained.

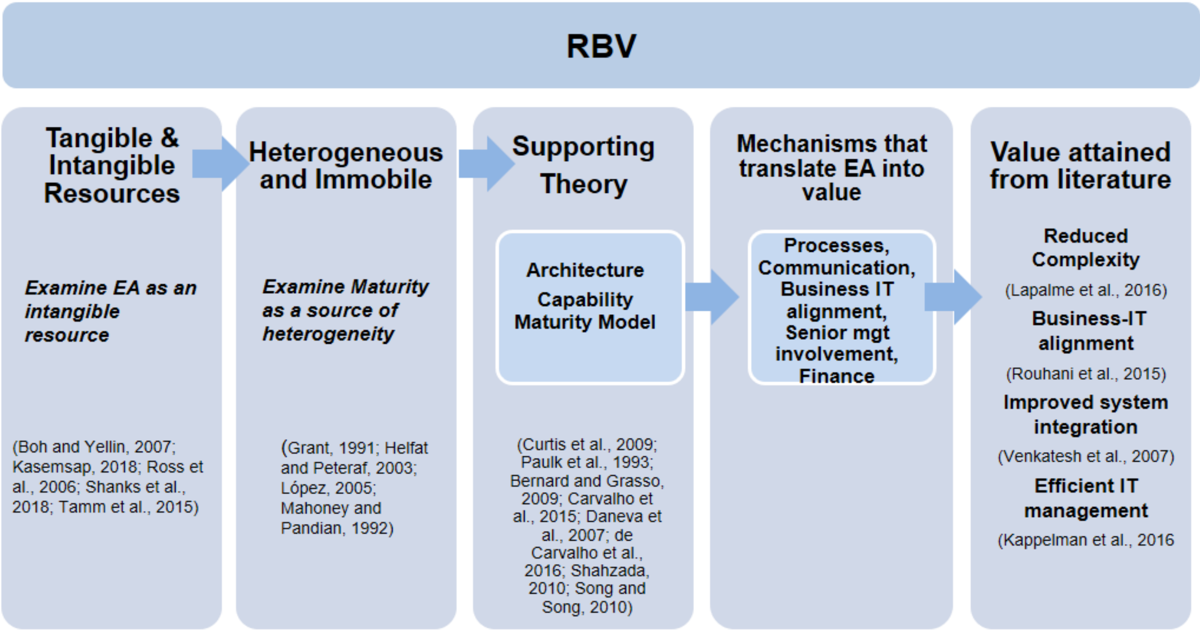

Figure 1.2: Organising Framework incorporating Supporting Theory and Mechanisms

Source: Adapted from (Bradley et al., 2011; Burns et al., 2009; Paulk et al., 1993)

This figure further frames this study within the RBV theory (Creswell, 2017a; Maxwell, 1992). This research examined EA as an intangible resource (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015), and maturity as a source of heterogeneity (Anderson and Eshima, 2013; Grant, 1991; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992).

Appendix 3 illustrates supporting theory such as *The Theory of the Growth of the Firm* (Penrose, 1959), *The Strategic Alignment Model* (Henderson and Venkatraman, 1993), *CRC* (April, 2004; Zhuang and Lederer, 2006), the *data frameworks* (Bedeley and Nemati, 2014; Lee et al., 2002; Tamm et al., 2015, 2011; Wang and Strong, 1996), as well as *ACMM* within a single theoretical framework.

ACMM was used as a conceptual framework to initiate this research, by structuring the interview protocol (Appendix 4) according to the ACMM's mechanisms of *processes, communication, business-IT alignment, senior management involvement,* and *finance* to assess EA practices (Jonker and Pennink, 2009; Neuman, 2014; Sarantakos, 1993). Using thematic analysis (Terry et al., 2017), this study analysed the data collected to identify business value outcomes utilising aspects of grounded theory (Neuman, 2014). Moreover, the mechanisms from the data were evaluated against the ACMM mechanisms from literature. The level of maturity was determined by judging the EA practices, represented by processes, communication, business-IT alignment, senior management involvement, and finance mechanisms, as described by the participants from the study against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

This study further analysed and described the ways the data contributed to ACMM (Belfrage and Hauf, 2017; Galal, 2001; Jonker and Pennink, 2010; Oliver, 2011). The gap in EA literature further related to whether all organisations experience similar value from EA, or whether benefits vary based on their level EA maturity. Moreover, a deeper understanding of the mechanisms that lead to value at the different maturity levels was examined, as well as why these mechanisms result in similar or different forms of value.

The research methodology adopted for this study follows in the subsequent section.

1.6 Research Methodology

This study adopted the idea of the 'research onion', to describe the philosophy, approaches, strategies, time horizons, and the data collection methods in the form of an onion, depicting the stages of a research process (Saunders et al., 2016).

Critical realism was selected as the underlying philosophy for this study. This philosophy enabled a scientific approach to the development of knowledge that entailed the collection of data as well as the understanding of that data (Fletcher, 2016; O'Mahoney and Vincent, 2014), by focusing on the underlying mechanisms that lead to business value (Healy and Perry, 2000). This philosophy helped to understand the EA mechanisms that influenced business value, and uncover insights to explain the forms of benefits, opportunities, and challenges organisations experienced as they moved through higher levels of maturity (Burton et al., 2014; Burton and Rycroft-Malone, 2014).

This research generated meanings from the data collected and recognised patterns and relationships to build a *middle range theory*. *Qualitative* data gathering methods consisting of individual interviews and artefacts were selected for this study (Mingers et al., 2013; Sayer, 2000a, 2000b; Wynn and Williams, 2012). The interviews helped gain a deeper understanding of the ways that EA maturity influenced business value. It further allowed in-depth discussions related to the core concepts of this study. The artefacts provided additional insights into the responses from the interviews (Denzin and Lincoln, 2011).

A *case study* strategy allowed the collection of rich data for in-depth analysis from a specific situation with real life participants (Yin, 2013). Importantly, the case study strategy was aligned to the critical realism and qualitative approaches, and supported the research questions that were *descriptive, exploratory,* and *explanatory* in nature (Easton, 2010; Miles et al., 2014; Miles and Huberman, 1994;

Wynn and Williams, 2012; Yin, 2013). Notably, some principles of grounded theory were adopted for this research as opposed to conducting a grounded theory study.

This *cross-sectional* study allowed comparisons of data at a single point in time (Saunders et al., 2016). This provided the stability required to gather rich data for this research to deeply understand the constructs of EA, and maturity and business value within a time bounded scope, without long-term disruptions (Rindfleisch et al., 2008; Robson, 2016; Saint-Germain, 2016).

The South African financial services sector was selected as a setting for this study due its strong regulatory, compliance, risk, and legal frameworks (Falkena et al., 2004; Fosu, 2013; Luiz and Charalambous, 2009; Singh, 2004). It examined 9 business units in 3 banks of different sizes, complexities, and maturity levels, in order to add to the richness of the study. A total of 52 participants representing different types of business and IT professionals were identified for this research using a purposive sampling approach across these banks. The semi-structured interviews allowed for the collection and recording of complex responses (Collis and Hussey, 2013). Artefacts such as requirement documents, architectural diagrams, design diagrams, and technical specifications were analysed.

Thematic analysis was used to analyse the data, search for patterns, and reveal themes (Braun and Clarke, 2008; Terry et al., 2017). Importantly, this technique assisted categories and themes to emerge from the data (Saldaña, 2016), that enabled the discovery and development of maturity levels in order to answer the research questions.

Synchronic and inter-judge reliability criteria, as well as instrument, internal, and construct validity criteria were adopted for this study (Easton, 2010; Layder, 2011; Miles and Huberman, 1994; Porter, 2007; Yin, 2013). Similar patterns found in the data collected from different sources enhanced the reliability and validity of the interpretations (Miles et al., 2014; Yin, 2013). This research satisfied these criteria by comparing the data from the interviews to search for patterns (Creswell and Miller, 2000; Merriam, 1998a, 1998b; Silverman, 2013). Triangulation of the data from different participants contributed to the internal validity of this research (Bhaskar, 1989; Bisman, 2010; Denzin and Lincoln, 2011; Guba, 1990). All inconsistencies, contradictions, and discrepancies were acknowledged in this study (Bhaskar, 1989; Guba, 1990; Miles and Huberman, 1994). Notably , this study focused on the understanding and explanation of a specific environment (Dobson et al., 2007; Dobson, 1999), as opposed to producing transferable and universal generalisations (Archer et al., 2013; Bhaskar, 2015; O'Mahoney and Vincent, 2014; Ryan et al., 2002).

To reduce bias, the semi-structured interviews were conducted with standard interview protocols (Leedy and Ormrod, 2015; Neuman, 2014). Ethical considerations such as *researcher integrity, permission to interview*, *anonymity and confidentiality, and informed consent* (Bernard, 2015; Mouton, 2011)were adhered to, to the best of the researcher's ability (Neuman, 2014). A *thick description*, *prolonged* *engagement*, *persistent observation*, *peer debriefing,* and *referential adequacy* contributed to the trustworthiness of this study (Lincoln and Guba, 2013).

The contributions of this study will be discussed in the subsequent section.

1.7 Contributions of this research

EA is an emerging practice and an even younger area of research compared to other information system disciplines (Bui, 2012; Kruchten et al., 2006; Tamm et al., 2015, 2011). It has attracted increased interest in academic literature (Nord et al., 2014). This study contributed to both researchers and practitioners understanding of the topic. It used and theoretically contributed to RBV by examining the influence and connection of EA practices on business value (Bridoux, 2004; Kaisler et al., 2005; Ross et al., 2006)at different maturity levels (Alwadain et al., 2014; Bui, 2012; Tamm et al., 2015, 2011; Vallerand et al., 2017). It contributed to understanding the concepts of tangibility and intangibility. This research firstly applied EA as an intangible resource, and further identified tangible and intangible forms of value influenced by EA (Amit and Schoemaker, 1993; Makadok, 2001; Rothaermel, 2015; Seddon, 2014; Wernerfelt, 1984). Importantly, it contributed to the influence of characteristics such as heterogeneity from an EA perspective as a basis for business value (Barney, 1991).

Establishing a relationship between EA maturity and business value is of particular importance to practitioners as organisations need to understand the different forms of business value that can be obtained in order to focus their efforts on the appropriate granularity of refinement. This research further provided insight into the practices that successful organisations performed in order to capture value from EA, as well as the challenges in obtaining it.

1.8 Conclusion

This chapter demonstrated that the acceptance of EA has resulted in an abundance of EA research, with certain inconsistent findings. Other important concepts of this research included the notions of maturity and business value. The most cited EA benefits included reduced system complexity (Gerber et al., 2010; Kappelman et al., 2008; Lapalme et al., 2016; Rouhani et al., 2013; Schekkerman, 2011), business-IT alignment (Bricknall et al., 2006; Gregor et al., 2007; Henderson and Venkatraman, 1993; Miller and Ross, 2003; Rouhani et al., 2015; Sessions, 2007), improved system integration and standardisation (Boh and Yellin, 2007; Richardson et al., 1990; Venkatesh et al., 2007), as well as efficient IT management and strategic competitiveness (Bernard, 2012; Cardwell, 2008; Kappelman et al., 2016; Ross et al., 2006). RBV was introduced as the underlying theoretical framework to structure this research, by examining EA as an intangible resource, and maturity as a source of heterogeneity. An important research problem was demonstrated that despite the importance of EA, there was a lack of research in understanding the different forms of business value that could be achieved at the different levels of maturity. Subsequently, this study used the ACMM framework to understand the levels of EA maturity within organisations and its impact on business value. It demonstrated that an explicit link between these two concepts has not been extensively investigated. A statement of the EA problem, the research questions, and sub-questions for this study, were introduced. The chosen research methodology and a motivation demonstrating that the study would be beneficial to both researchers and practitioners was discussed.

1.9 Structure of this research

The next chapter expands on the underlying RBV theory, and presents previous studies related to the key concepts of this research, i.e. *EA, maturity* and *business value*. The review was conducted in a semi-structured manner using search engines such as Scopus and EBSCO Host for scientific papers using specific search criteria (Cochrane Collaboration, 2018; Higgins and Green, 2014). More importantly, Chapter 2 presents the contributions, shortcomings, and concerns of these concepts. After introducing the underlying literature pertaining to this study, the research methodology used to carry out this study follows.

Chapter 3 expands on the research methodology used for this study and further justifies the critical realism philosophy and the qualitative approaches selected for this study. The sample selection, characteristics of participants, and settings for each of the data gathering methods used for this study is further demonstrated. The data analysis strategy, including the data management and thematic analysis strategy is also presented. The assessment of trustworthiness, criteria for reliability and validity, as well as ethical considerations of the researcher are also covered.

Chapters 4-6 present the findings from the individual interviews from each of the case study settings. The consolidation and overview of these findings is presented in *Chapter 7*, followed by an interpretation in *Chapter 8*. *Chapter 8* further links the findings to the literature review and presents a discussion of the results. In particular, this chapter considers the implications of the research findings for the RBV of the firm, in the specific context of the value of EA as an intangible resource.

Finally, *Chapter 9* concludes this research by summarising the main findings of the study. The implications and contributions of this study are assessed, followed by a discussion of the limitations, as well as recommendations for further research.

Chapter 2: Literature Review

The previous chapter presented key concepts of EA, maturity and business value within the RBV theoretical framework. This chapter analyses relevant research related to these concepts.

2.1 Introduction

Scholars have expressed concerns that more research is required in the areas of EA, maturity, and value (Alwadain et al., 2014; Boh and Yellin, 2007; Bui, 2012; Lankhorst, 2013a; Niemi, 2006a; Ross and Westerman, 2004; Tamm et al., 2015, 2011; Vallerand et al., 2017).

> "Organisations adopting EA need to be aware of its impact… EA must continuously evolve and we need to somehow measure the progress. For this purpose, the concept of maturity was employed for EA which assigns different levels of achievement by means of a maturity assessment... these levels indicate how advanced such entities are in their current stage of evolvement… a higher maturity is sought…in order to increase the value creation from business and IT assets…. Employing a maturity model assumes that an organisation operates more efficiently if higher maturity levels are attained. But there is more to the value argument. What kinds of value does it bring" (Meyer et al., 2011, p. 167).

Similar comments reverberate across EA literature (Kaisler and Armour, 2017; Niemi and Pekkola, 2017).

This chapter analyses literature (Cochrane Collaboration, 2018; Higgins and Green, 2014) pertaining to RBV, EA, maturity, and business value. The following topics are covered within this chapter:

- Literature review strategy;
- RBV theoretical framework;
- Research on EA frameworks and terminology;
- Research on maturity models and terminology;
- Assessment of the term business value;
- Conclusion of the literature review.

The subsequent section introduces the literature review strategy adopted for this study.

2.2 Literature Review Strategy

Literature demonstrates a growing popularity of EA within academia and industry (Anderson, 2017; Kaisler and Armour, 2017; Niemi and Pekkola, 2017; Nowakowski et al., 2017). Various benefits such as reduced system complexity (Gerber et al., 2010; Kappelman et al., 2008; Lapalme et al., 2016; Rouhani et al., 2013; Schekkerman, 2011), business-IT alignment (Bricknall et al., 2006; Henderson and Venkatraman, 1993; Rouhani et al., 2015; Sessions, 2007), improved system integration and standardisation (Boh and Yellin, 2007; Venkatesh et al., 2007), as well as efficient IT management and strategic competitiveness (Bernard, 2012; Cardwell, 2008; Kappelman et al., 2016; Ross et al., 2006). This popularity of EA has subsequently resulted in a large quantity of research, sometimes showing contradictory findings so that the most reliable results are not always clear.

A systematic literature review (SLR) is a process used by researchers to identify, select, and analyse literature related to specific research areas (Armitage and Keeble-Allen, 2008; Cochrane Collaboration, 2018; Higgins and Green, 2014; Tranfield et al., 2003). SLR's assist scholars to understand the degree to which existing literature has evolved towards solving a specific research problem by exploring a broad range of studies (as opposed to single empirical studies) in order to find connections between various empirical results (Baumeister and Leary, 1997; Bem, 1995; Cooper and Hedges, 2009).

This study commenced with a **scoping** step (Cochrane Collaboration, 2018; Higgins and Green, 2014; Siddaway, 2014) that framed the main question *In what way does EA maturity influence business value?* for the study. Before finalisation of this question, a process of pondering took place for several weeks whereby several variations of this question were deliberated. This was done to ensure this question was clear, specific, unambiguous, and answerable before commencing with the review (Higgins and Green, 2014; Khan et al., 2003; Siddaway, 2014). Thereafter, rapid searches were conducted to ascertain if the planned research had been previously conducted (Armitage and Keeble-Allen, 2008).

Planning (Cochrane Collaboration, 2018; Higgins and Green, 2014; Siddaway, 2014) decomposed the research question into the keywords *enterprise architecture, maturity,* and *business value* in order to create search terms. These search terms helped operationalise the research question to locate a broad range of potentially relevant articles that needed to be included in this study (Cochrane Collaboration, 2018; Higgins and Green, 2014). In order to ensure full coverage of the literature, the search included synonyms (e.g. organisation vs. enterprise), different spellings (e.g. organisation vs. organization), broader and narrower terms (e.g. enterprise architecture vs. software architecture) as well as singular, plural, and verb forms of the keywords (Cochrane Collaboration, 2018; Higgins and Green, 2014). Preliminary inclusion and exclusion criteria included variations of the research question in terms of the scope (e.g. South African financial services vs. the whole industry vs. global), influences of the selected articles (e.g. the publication, author, theoretical or empirical perspectives), measurement criteria of the selected articles (e.g. CMM vs. QMMG to measure maturity), research design (e.g., observational vs. experimental and quantitative vs. qualitative), participants of the selected articles (e.g. executives vs. students) and the time horizon of the selected studies (e.g. 6 months vs. 5 years) (Cochrane Collaboration, 2018; Higgins and Green, 2014). Moreover, reasons for inclusion and exclusion of the articles were recorded in a spreadsheet.

Searching and identifying (Cochrane Collaboration, 2018; Higgins and Green, 2014; Siddaway, 2014) relevant articles on the central concepts[1] took place within the Scopus and EBSCO Host search engines to ensure a broad coverage of the topic. The title, abstract, and conclusions of articles were firstly scanned and then the full texts of selected high quality articles were downloaded. Boolean searches (e.g. AND, OR) were conducted to broaden and narrow the searches. Searches by publication year were conducted (e.g. only 2017 vs. 2006-current). Finally, author searches on known contributors to specific subjects were further conducted (e.g. John Zachman on EA and Michael Porter on Value) (Cochrane Collaboration, 2018; Higgins and Green, 2014).

Screening and eligibility (Cochrane Collaboration, 2018; Higgins and Green, 2014; Siddaway, 2014) assessed the quality of studies. The title and abstracts of the results were reviewed to ensure they aligned to this research. The articles that met the requirements of this study were fully downloaded. The full texts of the selected articles were reviewed in detail to ensure they were relevant and appropriate for inclusion into the study. Excluded results were recorded in a spreadsheet, and saved in a separate folder (Cochrane Collaboration, 2018; Higgins and Green, 2014). In order to save time and organise the search results, the references were also exported into a citation manager tool. Meta-analysis synthesis was used to numerically combine article results, whereas narrative synthesis was used on diverse search results (Baumeister and Leary, 1997; Cochrane Collaboration, 2018).

This chapter **interprets and presents** the literature results thematically (i.e. similar concepts grouped together) according to RBV, EA, maturity, and business value (Cooper and Hedges, 2009). The subsections of this chapter are structured with a background, selected theory, strengths and weaknesses, as well as a discussion for each of these concepts (Cochrane Collaboration, 2018; Cooper and Hedges, 2009).

This section articulated the SLR steps that were followed for in research. A background to RBV underlying framework follows in the subsequent section.

2.3 Resourced-Based View

2.3.1 Overview

Background

A theoretical framework provides a scientific base and structure to support a research study (Creswell, 2017b; Maxwell, 1992). It introduces and describes theory that helps explain a research problem (Breakwell et al., 2006; Leedy and Ormrod, 2015; Swanson and Chermack, 2013). Moreover, it provides the rationale and direction to build on theoretical choices at different stages of a study (Creswell, 2017b).

[1] enterprise architecture, maturity, business value, resource based view, critical realism, qualitative, tangible, intangible, granularity

Introduced in section 1.3, RBV was selected as the underlying theoretical framework for this research, as it helped explain the way that resources influence value (Amit and Schoemaker, 1993; Burton and Rycroft-Malone, 2014; Dawson and Watson, 2005; Seddon, 2014; Tamm et al., 2011).

RBV has a rich history with roots dating to key theorists Edith Penrose (1959), Prahalad and Hamel (1990), Rumelt (1991), Barney (1991), Grant (1991), Amit and Schoemaker (1993) and Peteraf (1993) that have contributed to the body of literature. Their various perspectives are argued throughout this study. RBV is one of the most influential and cited management theories, however, it is still regarded as an evolving perspective, with new frameworks, taxonomies, extensions, and arguments published monthly (Chatzoglou et al., 2017; Kraaijenbrink et al., 2010; Portugal Ferreira et al., 2016). This popularity has resulted in RBV concepts being interpreted differently by contrasting authors. This phenomenon is sought by researchers as it encourages theoretical debate, challenges researcher views, advances academia, evolves RBV perspectives, and incites research on contemporary topics (Barney, 1991, 1986; Crook et al., 2008; Ludwig and Pemberton, 2011; Peteraf and Barney, 2003). Major differences have been highlighted within the relevant sections of this research.

RBV explains the way that organisation's transform their inputs into outputs (Amit and Schoemaker, 1993; Dutta et al., 2005). It adopts an *inside out* approach to strategy, and focuses on an organisation's internal resources to achieve value and a competitive advantage. Organisations competing within the same industry achieve different levels of performance due to their tangible and intangible resources (Barney, 1991; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). Contending theories (discussed in section 2.3.2) such as *five forces* (Porter, 1985a) and *dynamic capabilities* (Douma and Schreuder, 2013; Ludwig and Pemberton, 2011) adopt *outside in* approaches to the creation of value and competitive advantages.

Tangible and Intangible Resources

Resources are inputs that enable organisations to carry out their activities. In solitary, they do not provide a significant advantage; however, value is created in the way that they are used. Resources are classified into tangible and intangible forms of value (Barney, 1991; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984).

Tangible resources are physical commodities that can be easily purchased in the open market. They appear within an organisation's financial statements and depreciate over time (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). Furthermore, they are primarily a source of short-term value as competitors can easily obtain the same resources (Barney, 1991; Bergvall-Kåreborn et al., 2009; Schöenherr, 2009).

Intangible resources have no physical presence, cannot be purchased, and have a primary source of long-term business value (Wade and Hulland, 2004). They do not always appear within an organisation's financial statements, and should they be displayed, they are amortised over time (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003).

A *capability* is a subset of an intangible resource that incorporates practices, skills, competencies, as well as tacit and explicit knowledge (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997). They are "difficult to trade and imitate, scarce, appropriable, specialised and bestow a firm with competitive advantage" (Amit and Schoemaker, 1993, p. 36). Capabilities are "sticky" (Priem and Butler, 2001b, p. 25), and can only be transferred indirectly through an intense socialisation process (Kaplan et al., 2001; Nonaka and Toyama, 2015; Pee and Kankanhalli, 2016). They can be understood by observing and practicing, however, cannot be completely replicated or codified (Amburgey and Rotman, 2001; Nonaka and Toyama, 2015; Pee and Kankanhalli, 2016). They have a low transparency to observers and create ambiguity (Kaplan et al., 2001; Nonaka and Toyama, 2015; Pee and Kankanhalli, 2016).

Although capabilities are inherent to individuals, they are also organisational specific and reside within relationships, unique patterns, and organisational routines (Bianchi, 2017; Fernández-Esquinas et al., 2017; Hitt et al., 2016; Nonaka, 1994). They are socially complex procedures that help transform resource inputs into outputs (Collis, 1994; Collis and Montgomery, 2008). Capabilities are further used to engage and improve the productivity of other resources within an organisation (Makadok et al., 2018). Importantly, EA is recognised as a capability by the research community (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997). As discussed previously in this study, it was defined as the practice of designing, planning, implementing, and governing business, application, information, and technology domains (Harrison, 2013).

It is helpful for organisations to classify and understand resources in terms of tangible and intangible concepts. Tangible and intangible resources contribute to different aspects of organisational strategy (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). RBV states that tangible resources are a source of short-term value outputs, whereas intangible resources are a source of long-term value outputs (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). For instance, during recessions, tangible resources such as buildings can be easily converted into cash, whereas intangible resources such as an organisation's branding help maintain relationships with loyal customers (Foon, 2011; Kamasak, 2017; Kumlu, 2014). Distinguishing between tangible and intangible resources assists organisations to develop frameworks to assess their strengths and weaknesses, as well as decompose business problems to improve performance (Falkenreck and Wagner, 2007; Kraaijenbrink et al., 2010). This distinction assists organisations to better understand their internal resources (Connor, 2002). Hence, organisations can develop strategies and improve decisions based on this insight regarding tangible and intangible resources (Medini and Bourey, 2012; Panetto et al., 2016; Walker et al., 2016).

Although both tangible and intangible resources are important contributors to organisational strategies, intangible resources are favoured over tangible forms of value. RBV's empirical research reveals that intangible resources contribute more to organisational success and performance than tangible resources, as they have the potential to improve the earning power of organisations (Foon, 2011; Kamasak, 2017; Kumlu, 2014). For instance, capabilities are difficult to imitate, and hence more valuable than tangible resources such as building and machinery that can be easily obtained by competitors (Foon, 2011; Kamasak, 2017; Kumlu, 2014).

However, researchers argue that organisations have not identified the various types of intangible resources within their establishments, and hence not recognised their value (Lohrey et al., 2017). Furthermore, there are no consistent or standardised techniques to appraise intangible forms of value. This has resulted in subjective and incorrect valuations of intangible resources within organisations (Foon, 2011; Kamasak, 2017; Kumlu, 2014).

Heterogeneity and immobility are the other key constructs of RBV (Barney, 1991).

Heterogeneous and Immobile Resources

Heterogeneity assumes that intangible resources of organisations differ from each other, and that these differences influence the business value (Makadok et al., 2018). Past studies did not focus on heterogeneity such as EA maturity levels, but simply identified EA as an intangible resource that leads to value (Bui, 2012; Grant, 1991; Helfat et al., 2007; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992; Vallerand et al., 2017). The few studies published (Bradley et al., 2012; Khaiata and Zualkernan, 2009; Venkatesh et al., 2007) produced disparate results, demonstrating the need to better understand the forms of business value attained at different levels of EA maturity (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015, 2011; Vallerand et al., 2017). This was important to organisations as they could understand the forms of business value attainable as they progressed towards higher levels of EA maturity (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015, 2011; Vallerand et al., 2017).

Immobility assumes that intangible resources are difficult to move, in limited or fixed supply. These resources are not tradable as commodities and do not leave an organisation when people leave (Makadok et al., 2018). Immobile resources as *non-transferable*, as they can decrease in value when moved (Grant, 1991) and *embedded* into the routines and processes of organisations (Grant, 1991). Intangible resources such as EA capabilities are immobile and do not easily move from organisation to organisation (Alwadain et al., 2014; Amit and Schoemaker, 1993; Bui, 2012; Tamm et al., 2015; Vallerand et al., 2017).

Due to heterogeneity and immobility, competitors cannot easily imitate an organisation's strategy (Albliwi et al., 2014; Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997).

Competitive Advantage and Business Value

A resource is *valuable if it increases product differentiation, decreases the cost of production or improves efficiency and effectiveness strategies that place an organisation in a favourable business position* (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997). *Competitive advantage* is an output condition created by valuable resources (Barney, 1991). Within RBV literature, the concepts of competitive advantage and business value are used interchangeably (Melville et al., 2004; Patas et al., 2012). Once competitive advantage is achieved, *sustainable competitive advantage* can be attained. It should be noted that within an RBV context, the term *sustainable* does not refer to time perpetuity but rather that competitors cannot replicate the benefits of an organisations strategy (Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997). In order for a resource to provide sustainable competitive advantage, it must be (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997):

- *Valuable*: as introduced above, the resource must increase product differentiation, decrease the cost of production, or improve efficiency and effectiveness strategies that place an organisation in a favourable business position (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997).
- *Difficult to imitate*: the resource must represent a *unique location* (unique historical or geographical conditions), have *path dependency* (be created due to an organisation's unique experience or business tenure), embody *causal ambiguity* (when the link between a resource and its benefit is not properly understood by competitors), and be *socially complex* (difficult to imitate due to complex social interactions).
- *Rare*: the resources must only be acquired by one or a few organisations. If many competitors can acquire a resource, then there is no advantage, as each competitor would have the capability to exploit that resource in the same way.
- *Non-substitutability*: there is no equivalent valuable. It is rare or non-imitated resources.

The previous chapter further presented Figure 1.1 that was developed as an organising framework to illustrate the RBV theoretical constructs of *intangible resources*, *heterogeneity,* and *business value* that was examined in this research (Amit and Schoemaker, 1993; Tamm et al., 2011). Figure 1.1 helped "frame" this study, by structuring the key concepts of *EA*, *maturity,* and *business value* according to these RBV constructs (Webster and Watson, 2002, p. 13). Hence this study examined EA as an intangible resource (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015), and the maturity of an intangible resource as a source of heterogeneity (Helfat and Peteraf, 2003; López, 2005). Moreover, this study contributed to the RBV understanding of business value (Barney, 1991; Li, 2009; Woodruff, 1997), as there are numerous inconsistent definitions (Keyes-Pearce, 2005) and diverse views (Amit and Zott, 2001; Chesbrough, 2012; Hwang and Christensen, 2008; Johnson et al., 2008; Kappelman et al., 2016; Sorescu et al., 2011) on the term business value.

2.3.2 Contending Theories

The dominant contending theory to RBV is **dynamic capabilities** theory (Douma and Schreuder, 2013; Ludwig and Pemberton, 2011). While RBV takes an “inside out” perspective (Madhani, 2009, p. 4) and focuses on an organisation’s creation, growth, development, and choice of appropriate internal resources to create business value for an organisation (Ludwig and Pemberton, 2011), dynamic capabilities theory takes an “outside in” (Teece et al., 1997, p. 526) perspective, and focuses on an organisation’s ability to “reconfigure resources” (Bowman and Ambrosini, 2010, p. 30) and address rapidly changing environments and industry forces (Teece et al., 1997). It focuses on an organisation’s competitive survival with regard to outside business conditions (Ludwig and Pemberton, 2011).

However, the dynamic capabilities theory has been criticised as not having a clear, broadly accepted, definition (Easterby-Smith et al., 2009; Kitenga and Kuria, 2014; Williamson, 2016). It has been further criticised for a lack of theoretical foundations and poor empirical support (Arend and Bromiley, 2009; Easterby-Smith et al., 2009; Newbert, 2007; Williamson, 2016) and containing a complex and disconnected body of research (Barreto, 2010). Some researchers have found a weak link between dynamic capabilities and long-term value (Eisenhardt and Martin, 2000; Enders, 2004; Ferdinand et al., 2004; Kato and Kazuki, 2015), due to resources devaluing over time (Wojcik, 2015). This theory has been argued as having unclear value-added relative to existing concepts (Arend and Bromiley, 2009; Danneels, 2008; Kraatz and Zajac, 2001; Winter, 2003). It has been further contended that scholars (Eisenhardt and Martin, 2000; Eisenhardt and Sull, 2001; Nelson and Winter, 1982; Zollo and Winter, 2002) have subjectively interpreted dynamic capabilities from their bespoke research perspectives (Easterby-Smith et al., 2009; Kitenga and Kuria, 2014; Williamson, 2016). Critics have elaborated that the absence of a universally accepted definition has made the measurement of this theory problematic (Williamson, 2016). Attempts to measure dynamic capabilities theory have used distant proxies and the results have not been widely accepted by scholars (Henderson and Cockburn, 1994a, 1994b). The lack of a measurable model has made the understanding of this theory difficult when applied to managerial decision-making (Pavlou and El Sawy, 2011). Some researchers argue that RBV is a precondition to dynamic capabilities as it builds and extends on RBV outcomes (Madhani, 2009; Teece et al., 1997). Finally, similar to RBV, it has been argued that dynamic capabilities has tautological (self-verifying) definitions and problems with operationalisation (Williamson, 1999).

Another contending theory, **knowledge based theory** regards knowledge as the most important resource of an organisation (Grant, 2014). It states that knowledge can be found in people, culture, and identities (Grant, 2014, 1996). Researchers argue that this knowledge is socially complex and thus difficult to imitate. However, several researchers argue that knowledge based theory does not constitute a theory (Foss, 1996; Phelan and Lewin, 2000). **Market Based View** (MBV), another competing theory to RBV, provides an “outside perspective” (Bea and Haas, 2013, p. 26) that interprets an organisations performance through the external industry and the strategic conduct of its competitors (McGahan and Porter, 1997). However, MBV has been criticised as it assumes resources are homogenous by not considering them in the marketplace (Faulkner and De Rond, 2000; Madhani, 2009; Roquebert et al., 1996; Rumelt, 1991).

2.3.3 RBV Strengths

Although some researchers (Priem and Butler, 2001a) have criticised RBV for its tautological nature, another group of researchers have argued that tautologies are useful as they encourage theoretical debate, challenge researcher views, advance and evolve theory perspectives, as well as focus on contemporary topics (Barney, 1991, 1986; Crook et al., 2008; Ludwig and Pemberton, 2011; Peteraf and Barney, 2003).

RBV is regarded as one of the most influential and cited management theory frameworks (Chatzoglou et al., 2017; Kraaijenbrink et al., 2010; Portugal Ferreira et al., 2016). Literature shows that RBV assists organisations to develop frameworks to assess their strengths and weaknesses, as well as decompose business problems to improve performance (Falkenreck and Wagner, 2007; Kraaijenbrink et al., 2010). This theoretical framework recognises characteristics such as value, rareness, and competitive superiority that create competitive advantage (Collis and Montgomery, 2008). Finally, it supports organisations to better understand their internal resources (Connor, 2002), which gives them the ability to innovate and envisage products that "customers need but have not yet even imagined" (Prahalad and Hamel, 1990, p. 6). RBV literature popularly refers to the technology company *Apple*, as a successful case study where innovative products were created by focusing on internal practices, with minimal consideration of industry forces (Kaipa, 2012). Other case studies demonstrated the way *Air Malaysia* initially used an "outside in" approach, however, were still outperformed by *Air Asia*. Air Malaysia subsequently adopted an "inside out" approach by focusing internal core competencies which helped them improve their market share (Cheing, 2012; Delbari et al., 2016; Pearson et al., 2015; Yashodha, 2012).

2.3.4 RBV Criticisms

Despite these benefits, this framework has also been extensively criticised as it is based on a static environment and not aligned with business reality (Ludwig and Pemberton, 2011). RBV has been further criticised for its application of *infinite regress*, where organisations that have expert capabilities can be surpassed by competitors that can develop and improve those capabilities (Collis, 1994; Priem and Butler, 2001a, 2001b). This study, however, focuses on RBV operational validity issues (Connor, 2002; Priem and Butler, 2001a, 2001b).

It should be noted that there is confusion and variation concerning *tangible* and *intangible* terminology within RBV literature, as there is no common understanding of these concepts. The lack of common definitions is problematic and hampers theory evolution (Barney, 1991; Collis, 1994; Hamel and Prahalad, 2013; Helfat et al., 2007; Henderson and Cockburn, 1994a; Teece et al., 1997).

Discussed in section 1.4, RBV operationalisation is an area of debate amongst scholars (Barney, 1991; Connor, 2002; Priem and Butler, 2001a, 2001b). Researchers argue that RBV does not provide mechanisms for operationalisation (Bromiley and Fleming, 2002; Foss et al., 1995; Hoopes et al., 2003). They debate that RBV cannot be operationalised due to its "tautological" (circular reasoning and self-verifying) nature (Priem and Butler, 2001b, p. 28). Others argue that RBV operationalisation "is challenging and nearly impossible" (Caves, 2014; Rubin, 1973). Researchers (Lockett et al., 2009, p. 18) debate that testing the relationship between resources and performance "comes with difficulties in specifying hypotheses and measuring variables". However, another group of researchers (Crook et al., 2008), contradict these arguments and state that RBV can be operationalised, as the possession of strategic resources leads to enhanced performance.

2.3.5 Operationalising RBV

Operationalisation involves applying a theoretical framework in a real life context to provide practical validity (Bohnenkamp, 2013; Carlile and Jordan, 2005; Colquitt and Zapata-Phelan, 2007). Researchers state that operationalising a theoretical framework entails assessing abstract, intangible, or unobservable phenomenon in terms of empirical observations (Godfrey and Hill, 1995; Jonker and Pennink, 2010; Sarantakos, 1993; Shields and Rangarajan, 2013; Yin, 2013). These phenomena are assessed indirectly through mechanisms (e.g., indicators and enablers) of that phenomenon in the form of their observable effects (Godfrey and Hill, 1995; Jonker and Pennink, 2010; Patas et al., 2012).

Quantitative and qualitative studies are operationalised differently (Shields et al., 2012; Shields and Rangarajan, 2013). For quantitative research, mechanisms are identified from literature, or developed prior to commencing a research study (Neuman, 2014, 2016). These mechanisms are then tested and measured numerically using statistical methods after the data is collected (Jonker and Pennink, 2009; Neuman, 2014; Sarantakos, 1993). Qualitative studies are tested through data collection and assessment of the evidence (Shields and Rangarajan, 2013). The data is generally collected within the context of a case study, whereby a researcher commences with a conceptual (or abstract) framework derived from literature or working ideas (Jonker and Pennink, 2009; Neuman, 2014; Sarantakos, 1993). Thereafter, the study is operationalised by describing how specific observations and thoughts about the data contribute to the conceptual framework or working ideas using aspects of grounded theory (Galal, 2001; Neuman, 2014; Shields et al., 2012; Shields and Rangarajan, 2013; Yin, 2013).

Literature suggests the use of "supporting" theory to overcome the challenges of operationalising RBV (Lockett and Thompson, 2001, p. 741). For example, researchers such as Lockett and Thompson (2001, p. 19) have used economic theory and "diversification" as a mechanism to show the influence of a resource on value and organisation performance. Hence, researchers can supplement RBV with other theoretical frameworks and mechanisms to operationalise and understand the way resources influence value and outcomes (Peteraf and Barney, 2003).

2.3.6 Supporting Theory to Operationalise RBV

The organising framework for this study presented in the previous chapter was further adapted in Figure 2.1 to incorporate selected supporting theory and mechanisms from literature to show the way that EA influences value. This figure illustrates supporting theory that helps operationalise RBV, the mechanisms that help translate EA into value, as well as the value attained.

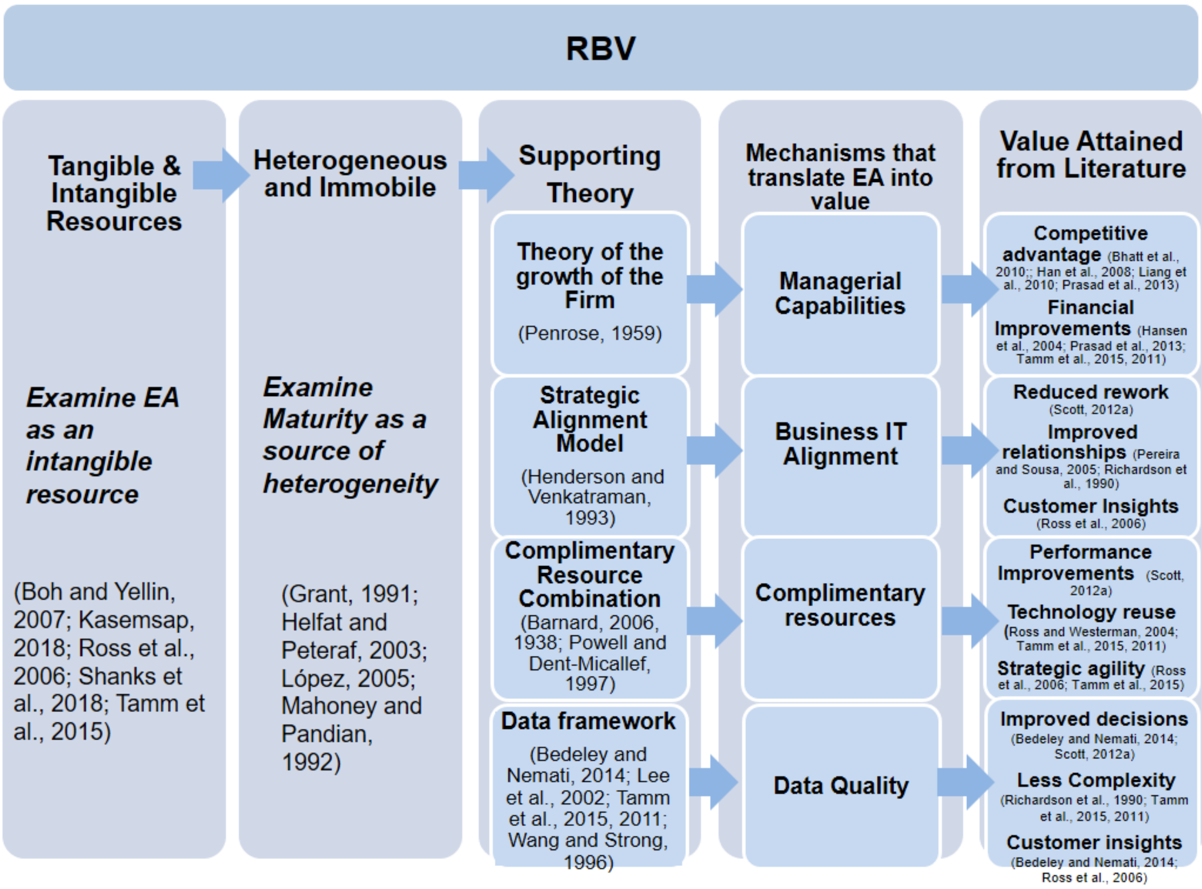

Figure 2.1: Organising Framework incorporating Supporting Theory and Mechanisms
Source: Adapted from (Amit and Schoemaker, 1993; Tamm et al., 2015, 2011)

The Theory of the Growth of the Firm (Penrose, 1959) has been widely adopted to help operationalise RBV (Achtenhagen and Naldi, 2004; Bohnenkamp, 2013; Hansen et al., 2004; Kraatz and Zajac, 2001). Mechanisms from this theory are *productive resources* (the actual tangible or intangible resources) and *administrative resources* (managerial capabilities, experience, and decisions that govern that ways that productive resources are used) (Hansen et al., 2004; Makadok, 2001; Penrose, 1959). This theory states that by focusing on administrative resources, an understanding of an organisation's ability to transform productive resources into services can be gained, even if the productive resources are not measured. It states that what an organisation does with its resources is as important as the resources that it possesses (Barney, 1991; Castanias and Helfat, 1991; Miller, 2003; Robinson, 2008). Hence, theory of the growth of the firm can help operationalise RBV by focusing on the administrative resources when utilising and transforming productive resources to services (Barney, 1991; Jonker and Pennink, 2010; Patas et al., 2012; Penrose, 1959; Wade and Hulland, 2004). RBV studies (Bhatt et al., 2010; Bhatt and Grover, 2005; Han et al., 2008; Liang et al., 2010; Patas et al., 2012; Prasad et al., 2013, 2010; Ravichandran and Lertwongsatien, 2005; Zhang et al., 2008) have identified *managerial and people capabilities* as a mechanism that leads to forms of value such as *competitive advantage* (Hansen et al., 2004) and *improved economic performance* (Hansen et al., 2004).

The **Strategic Alignment Model** (Henderson and Venkatraman, 1993) further supports the operationalisation of RVB (Bernard, 2012; Bricknall et al., 2006; Gregor et al., 2007; Patas et al., 2012; Pereira and Sousa, 2005; Ross et al., 2006; Schwarz et al., 2010; Segars and Grover, 1996; Tamm et al., 2015, 2011). It states that the reason organisations do not obtain value from IT investments is due to the lack of alignment between the business and IT strategy. The model prescribes four perspectives that impact the effective alignment of business and IT strategy. *Strategy execution perspective,* views the business strategy as the primary driver of both organisation design decisions as well as the logic of the IT infrastructure. *Technology potential perspective* similarly views the business strategy as the primary driver. However, it involves the formulation of an IT strategy to support the selected business strategy and the required IT infrastructure and processes. *Competitive potential perspective* is concerned with the exploitation of emerging IT capabilities, the impact of new products and services, the influence of the key attributes of strategy, as well as the development of new relationships. *Service level perspective* focuses on building a leading IT department within an organisation with business strategy playing an indirect role. Researchers (Bernard, 2012; Bricknall et al., 2006; Gregor et al., 2007; Pereira and Sousa, 2005; Ross et al., 2006; Segars and Grover, 1996; Tamm et al., 2015, 2011) have identified *business-IT alignment* as a mechanism that leads to forms of value such as *reduced rework* (Bernard, 2012), *improved relationships* (Pereira and Sousa, 2005; Richardson et al., 1990) and *enhanced customer insights* (Ross et al., 2006).

Complementary resource combination (CRC) has also been used to support the operationalisation of RVB (April, 2004; Zhuang and Lederer, 2006). This theory states that a resource's value is enhanced when combined with other complimentary resources (Barnard, 1938; King, 2014; Powell and Dent-Micallef, 1997). It states that an organisation's configuration of resources (tangible, intangible, people or processes) leads to value as this configuration cannot be easily recreated by another organisation (April, 2004; Harrison et al., 2001; King et al., 2003). Researchers (Newbert, 2007, p. 139) found that when resources are applied individually, value and competitive advantage is not affected. However, combining individual resources with other resources, results in value. Notably, attributes such as "rareness" determine value and competitive advantage, as opposed to the specific resource itself (Newbert, 2007, p. 761). Researchers have found that when EA is combined with other resources, forms of value such as performance improvements (Bernard, 2012), technology reuse (Ross and Westerman, 2004; Tamm et al., 2015, 2011), and strategic agility (Ross et al., 2006; Tamm et al., 2015, 2011) is experienced.

Various **data frameworks** support the operationalisation of RBV (Bedeley and Nemati, 2014; Lee et al., 2002; Tamm et al., 2015, 2011; Wang and Strong, 1996). These data frameworks are built on principles of accuracy, completeness, timeliness, interpretability, and accessibility (Bedeley and Nemati, 2014; Lee et al., 2002; Wang and Strong, 1996). Researchers found that EA improves information about an organisation's processes, as well as data about its customers and business transactions (Tamm et al., 2011). Researchers have identified data quality as a mechanism that leads to forms of value such as *improved decision-making* (Bedeley and Nemati, 2014; Bernard, 2012; Spewak and Hill, 1993), *improved data flow*, and (Richardson et al., 1990; Tamm et al., 2015, 2011) *customer insights* (Bedeley and Nemati, 2014; Ross et al., 2006).

This section introduced the RBV theoretical constructs of *intangible resources*, *heterogeneity,* and *value* that was examined in this research (Amit and Schoemaker, 1993; Tamm et al., 2011). Key concepts of *EA*, *maturity* and *business value* were aligned according to these RBV constructs (Webster and Watson, 2002, p. 13). This section further presented contending theories to RBV. Moreover, the strengths and criticisms of RBV were discussed. Notably, RBV operationalisation concerns were discussed in detail, and the use of supporting theory was presented as an opportunity to operationalise RBV. The subsequent section provides background and terminology on the first construct, EA, to ensure that a common understanding is established.

2.4 EA Models

The previous section discussed that RBV was extended by examining EA as an intangible resource and a basis for business value (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015). This section provides a background and terminology to the concept of EA.

The term EA can be decomposed into two constituent components, *enterprise,* and *architecture*.

- The enterprise component refers to an organisation that structures its mission, goals, and objectives to offer a product or service (Chen et al., 2008).
- The architecture component is referred to as a blueprint, design, or an abstraction such as creating the structure of a city or information system (IS), its components, and the ways that they interrelate (Medini and Bourey, 2012).

However, once these components are combined, researchers argue that literature does not provide a universally accepted definition of the term EA (Bui, 2012; Chen et al., 2008; Doucet et al., 2008; Lapalme, 2012; Vallerand et al., 2017). They debate that there are various descriptions dependent on a researcher's perspective or framework (Bui, 2012; Lapalme, 2012; Lapalme et al., 2016). Furthermore, they discuss that due to EA being an emerging discipline, several definitions exist in literature (Kaisler and Armour, 2017; Lapalme et al., 2016; Nowakowski et al., 2017; Wagter et al., 2005). Appendix 5 provides additional examples of the definitions from literature.

As a formal discipline, EA is less than 30 years old (Franke et al., 2016; Greefhorst and Proper, 2011; Lapalme et al., 2016; Silva et al., 2017). As with any emerging profession or practice, there are many perspectives and schools of thought surrounding the topic. As an analogy to construction architecture, the term EA was adopted to describe the principles that govern the structures of an organisation (Zachman, 1987). John Zachman introduced the concept in the 1980's when he observed similarities in the construction process of buildings and aeroplanes (Bernard, 2012; Bradley et al., 2011; Bui, 2012; Finkelstein, 2006; Kappelman et al., 2008; Rico, 2006). He noted that these industries managed their processes from the viewpoints of different stakeholders such as owners, engineers, or builders (Finkelstein, 2006). In 1987, using this analogy, Zachman published *A Framework for Information Systems Architecture* in the IBM Systems Journal (Langenberg and Wegmann, 2004; Zachman, 1987). This article signified the establishment of EA as a subject and the formation of the first EA framework (Cardwell, 2008; Langenberg and Wegmann, 2004; Zachman, 1987).

After Zachman's contribution, various EA frameworks were introduced in academia and industry such as the Technical Architecture Framework for Information Management (TAFIM) developed in the late 1980's (Minoli, 2008; Rouhani et al., 2015, 2013; Sessions, 2007), Federal Enterprise Architecture Framework (FEAF) introduced in the 1990's, and The Open Group Framework (TOGAF) presented in the early 2000's (Harrison, 2013; Rouhani et al., 2015, 2013; Sessions, 2007). A notable historical highlight occurred in 1996 when the US government passed the Clinger-Cohen Act that prescribed all US government agencies implement EA frameworks, in order to improve the way the government acquired IT (Bui, 2012; Congress, 1996; Dahlberg et al., 2016). This catapulted research interest in this topic (Bui, 2012; Dahlberg et al., 2016).

It must be noted that an EA framework should be distinguished from the underlying RBV theoretical framework discussed in the previous section. EA is the practice of designing, planning, implementing, and governing business, application, information and technology domains (Harrison, 2013). It provides a model for EA concepts and knowledge to be represented within an organised structure (Chen et al., 2008) using granularities, layers, or views (El Kourdi et al., 2007; Schekkerman, 2011, 2006).

EA practices have grown substantially over the past two decades with continued progress forecast for the next cycle (Buregio et al., 2015; Ross et al., 2006; Rouhani et al., 2015, 2013; Silva et al., 2017; Winter and Fischer, 2006). It is important to understand the dominant EA frameworks (Bui, 2012; Odongo et al., 2010; Rouhani et al., 2015, 2013; Sessions, 2007; Urbaczewski and Mrdalj, 2006; Vallerand et al., 2017) in literature, as they each define EA differently (Bernard, 2012; Bradley et al., 2011; Kappelman et al., 2016). These dominant EA frameworks are introduced below.

2.4.1 Zachman Framework

According to Zachman (1987, p. 276), "the increased scope of design and levels of complexity of information systems implementations are forcing the use of some logical construct (or architecture)". The previous subsection introduced John Zachman as one of the pioneers of EA (Bernard, 2012; Bradley et al., 2011; Bui, 2012; Finkelstein, 2006; Goethals, 2005; Goethals et al., 2006; Kappelman et al., 2008; Rico, 2006). His framework (Zachman, 1987) is referred to as a classification scheme, visually represented as a table with columns and rows (Bui, 2012; Odongo et al., 2010; Vallerand et al., 2017). Zachman's Framework (1987) describes the same item, using different types of explanations such as textual or graphical. This allows different stakeholders to understand the same concepts from different outlooks, which ultimately creates a holistic view of the environment. This concept is referred to as *perspectives* whereby the views of stakeholders are considered when developing EA (Cardwell, 2008; Ota and Gerz, 2011). This framework is commonly referred to as a taxonomy for describing an organisation at enterprise level based on its information and technical characteristics (Bui, 2012).

Illustrated in Appendix 6, Zachman's framework (1987) composed of a two-dimensional schema. Each row represents a total view of the solution from a specific perspective. The rows define the view of stakeholders that make use of the models with explanations within the cells. The top row characterises a generic perspective of an organisation, while lower rows are sequentially more detailed. The bottom row defines the actual data, code, and people that are part of the organisation. The framework is comprised of two parts, the first comprising of the *scope planner's perspective* providing a contextual view, the *business model owner's perspective* providing a conceptual view, the *system model designer's perspective* that develops a logical view as well as the *technology model builder's perspective* that produces a physical view of an organisation (Cardwell, 2008; Frankel et al., 2003; O'Rourke et al., 2003; Zachman, 1987). The second part of Zachman's Framework deals with the six basic questions of *what, how, where, who, when* and *why* types of questions (Goethals et al., 2006; Urbaczewski and Mrdalj, 2006).

The major strength of Zachman's Framework (1987) is that it is *open source* (Aksulu and Wade, 2010; Bahill et al., 2006; Cameron and Mcmillan, 2013; Feller and Fitzgerald, 2000; Jonkers et al., 2006; Lankhorst, 2013a; Leist and Zellner, 2006; Oda et al., 2009). This results in a *technology agnostic, vendor* and *product neutral* EA framework (Aksulu and Wade, 2010; Bahill et al., 2006; Cameron and Mcmillan, 2013; Feller and Fitzgerald, 2000; Jonkers et al., 2006; Lankhorst, 2013a; Leist and Zellner, 2006; Oda et al., 2009). The other strength of this framework is its *simplicity* with rows and columns (Bahill et al., 2006; Leist and Zellner, 2006). This results in the framework providing *immediate value* such as improving business *agility*, reducing system *complexity,* and reducing solution delivery time (Bahill et al., 2006; Leist and Zellner, 2006; Zachman, 1987).

However, Zachman's framework has been severely criticised by researchers for its *lack of adequate guidelines*. Researchers have argued that the framework provides inadequate guideline details for its processes and implementation procedures, and over emphases the concept of views (Sowa and Zachman, 1992). The argument extends to the notion that this framework provides insufficient business direction as it does not provide specifics to establish a business component of EA formulation. Researchers elaborate that it is merely a basic classification structure for descriptive representations of complex entities (Griffin, 2005). Other researchers have supported this view by arguing it is a simple ontology, as it does not provide instructions or procedures for its application (Kang et al., 2010; Kingston, 2008). This school of researchers has debated that this framework is over simplistic, because each cell contains just a single instance of an entity, which prevents further problem decomposition required for complex problems (Griffin, 2005). It has been further argued that the Zachman Framework (1987) lacks the tools to support its meta models due to its lack of standard artefact descriptions for its framework's cells (Varga, 2003). The debate on lack of guidelines extends to Zachman framework not being affiliated to any professional organisation (Sowa and Zachman, 1992). Moreover, its lack of guidelines for problem solving has resulted in an inadequate cognitive direction (Kang et al., 2010; Kingston, 2008).

The other major weakness of this framework relates to its *approach*. It has been criticised as it leads to a document heavy approach (Magalhaes et al., 2007; Mary and Rodrigues, 2011; Matthee et al., 2007). Moreover, it is biased towards traditional, data-centric approaches (Magalhaes et al., 2007; Mary and Rodrigues, 2011; Matthee et al., 2007).

Finally, Zachman (1987) has been criticised for its *practical* application. Researchers argue that the metaphor of building a house is not suited to IS development (Simsion, 2005; Simsion et al., 2012). Furthermore, is not well known in business and few practitioners are aware of it (Magalhaes et al., 2007; Mary and Rodrigues, 2011; Matthee et al., 2007).

An EA framework for federal agencies of the US government follows in the next section.

2.4.2 Federal Enterprise Architecture

Following the Clinger-Cohen Act (discussed earlier), Federal Enterprise Architecture (FEA) was initiated within the US government, by the CIO Council in April 1998. Its primary objective was to develop an EA for federal agencies (Federal government of the United States, 2013; Kwon, 2004; Rouhani et al., 2013; Sessions, 2007; Urbaczewski and Mrdalj, 2006; US Office of Management and Budget, 2012). It was intended to assist these federal agencies to identify opportunities for improvement through standardisation, interoperability, and consolidation. It is one of the most widely used frameworks among US federal agencies (Masuda et al., 2016; Vargas et al., 2016). The Office of Management and Budget (OMB) is responsible for FEA within the US government. OMB states “the FEA is a tool that enables the Federal Government to identify opportunities to leverage technology and alleviate redundancy, or to highlight where agency overlap limits the value of IT investments” (US Office of Management and Budget, 2012).

Illustrated in Appendix 7, FEA is comprised of reference models with structured guidelines (Bui and Levy, 2017; Kappelman et al., 2008; Mondorf and Wimmer, 2017; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006). The *performance reference model* is used for measuring the performance and outputs across the various federal agencies. This model creates performance information, builds end to end processes from inputs to outputs and detects opportunities for performance enhancement, across the federal agencies. It links individual federal agency strategies, internal business components, and investments to overall strategic results. It measures the success of their technology investments and their impact on strategic outcomes. The *data reference model* provides a standardised taxonomy of data classifications that is used to identify opportunities for data sharing, exchange, and reuse. It enables this by standardizing data descriptions through the taxonomy. Furthermore, it standardizes a method of describing data, and facilitates inter-agency communication about data. It facilitates the detection sharing of data across the various federal agencies. *Application reference model* defines the types of services required to maintain the various business processes. It further categorizes service components according to how they support the performance and business goals of the agencies. It provides a technological view of systems that support business functionality, i.e. it provides the linkage between the business and technical views of the agencies. The *infrastructure reference model* identifies the technology components and interfaces used to support the business reference model. It is a standardised taxonomy for services, specifications, and technologies. Furthermore, it specifies the technologies and standards required for developing technology systems. The *security reference model* provides a common methodology for implementing security initiatives within the federal agencies, while considering business and performance goals. Finally, the *business reference model* promotes collaboration across the various federal agencies.

Moreover, the aim of this model is to identify mission-critical lines of business, business processes, and functions. It provides a standardised taxonomy of business services, such as business areas, lines of business, and business sub-functions. This model promotes collaboration by describing the government in the form of common business areas, instead of by each agency.

Notably, FEA uses an incremental method to develop EA. It uses the concept of levels to decompose EA into segment architecture and solution architecture. FEA is further comprised of *profiles* called *geospatial*, *records management* and *security* that promotes consistent, common EA practices (Bui, 2012).

FEA's strength lies in its *comprehensive* resources. It contains detailed reference models, incorporates a methodology, an assessment framework, a standardised taxonomy as well as a governance structure (Bui, 2012; Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006). The other advantage of FEA is that it is freely available on the federal government website. Moreover, it does not support any specific vendor and is technology neutral (Harmon, 2005; Schekkerman, 2011, 2006).

FEA is *beneficial* as it assists federal agencies to identify opportunities for improvement through common EA practices, standardisation, and consistency (Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006). Other researchers have found this framework provides a common approach for IT procurement, and facilitates sharing of information across federal agencies that subsequently results in cost reductions (Cameron and Mcmillan, 2013; Donaldson et al., 2015; Mahdavifar et al., 2012). Finally, it has the ability to deliver instant value (Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006).

However, FEA is difficult to implement outside of the US federal environment, as it does not address significant aspects of business and IT alignment due to its federal government inclination (Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006). Furthermore, it does not define the specific components in order to implement it (Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006). Researchers debate that it is not a complete EA framework as it does not address significant aspects of strategy, stakeholders, business activities, infrastructure, and workforce. Literature states that it does not contain a complete process to develop EA, as it does not define baseline and target architectures, it does not specify how to develop a transition plan and, it does not define best practices for EA (Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006).

Gartner, is an international consulting, advisory, and research company (Broadbent and Kitzis, 2004; Luftman and Ben-Zvi, 2011). Their EA framework is introduced in the subsequent section.

2.4.3 Gartner Enterprise Architecture Framework

Gartner Enterprise Architecture Framework (GEAF) is described as “the process of translating the business vision and strategy by creating and improving the key principles and models that describe the enterprise's future state and enable its evolution” (Lapkin et al., 2008, p. 2). It is comprised of a set of EA principles customised according to customer business needs (Medini and Bourey, 2012). GEAF’s principles include developing a current EA state, target EA state, gap analysis, roadmap, business and IT components, the use of a top down approach, as well as identification of capabilities. GEAF states that EA effort encompasses strategizing, communicating, leading, and governing (Bui, 2012; Lapkin et al., 2008; Medini and Bourey, 2012).

Illustrated in Appendix 8, GEAF is comprised of various sub architectures (Chew and Gottschalk, 2012; De Vries, 2010). The *enterprise technical architecture* (ETA) is the technical standards model that supports the various sub architectures. The ETA contains technical domains for applications, database, networks, and security. The *enterprise information architecture* (EIA) helps an organisation investigate, retrieve, interpret, and develop information required to make decisions and maintain business functions. EIA framework has ‘data sharing’, ‘data description’, and ‘data context’ components that are used by an organisation. The *enterprise solutions architecture* (ESA) is comprised of the applications supporting the business functions specified in the business architecture. The ESA facilitates the transition from a silo-based application centric IT to an enterprise approach. This allows individual departments to leverage shared and reusable components. The ESA includes a catalogue of current (as is) applications as well as proposed target (to be) applications. The *enterprise business architecture* (EBA) defines the business strategy, governance, and business functions of an organisation. Furthermore, it establishes a baseline that describes which departments perform these functions. The EBA provides a common reference model as well as a holistic view of the current and target state of an organisation. The EBA defines the key drivers for building the various EA sub-architectures.

GEAF's major strength is its strong emphasis on a *future state* architecture, that results in quick time to value for organisations (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012; Glissmann and Sanz, 2010; Pereira and Sousa, 2005, 2004; Vires, 2010). Furthermore, it contains detailed IT standards (Schekkerman, 2011, 2006). Researchers have also commended GEAF's EBA, but stating it extensively clearly defines the business strategy and business functions of an organisation (Glissmann and Sanz, 2010).

However, GEAF's major weakness is related to its propriety nature and lack of open information available to the general public (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012; Pereira and Sousa, 2005, 2004; Schekkerman, 2011; Vires, 2010). Furthermore, GEAF does not contain comprehensive guidelines, only high-level principles (Bui, 2012; Robertson et al., 2008; Rouhani et al., 2015, 2013; Sessions, 2007).

The framework developed by the US Department of Defence (DoD) for EA follows in the next section.

2.4.4 The Department of Defence Architecture Framework

The Department of Defence Architecture Framework (DoDAF) was established by the US DoD to promote shared EA principles, common assumptions, and standard terminology. It is also a mandatory framework required by the Clinger-Cohen Act described earlier. DoDAF's components are *defining the use of EA*, *EA objectives*, *EA scope*, *data requirements,* and *EA documentation* (Browning, 2014; Department of Defense Deputy Chief Information Officer, 2011; Richards et al., 2007). It is structured according to viewpoints such as capability, data, operations, and services, illustrated in Appendix 9 (Browning, 2014; Department of Defense, 2010; Department of Defense Deputy Chief Information Officer, 2011; Richards et al., 2007).

DoDAF's major strength is its data interchange functionality that allows data to be transferred in a mutual format. This helps data and information to be easily shared within the DoD in a common format (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). Literature further describes DoDAF's guidelines as structured and standardised (Bhasin et al., 2007; Dryer et al., 2007; Mccarthy, 2006)

However, DoDAF is complex to implement outside of the DoD domain due to its rigid structures (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). Furthermore, DoDAF is not a holistic enterprise-wide framework and does not specify business and technical components (Bhasin et al., 2007; Dryer et al., 2007). It does not contain best practices or implementation guidelines (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). Researchers have argued that DoDAF has mediocre business focus and lacks business and financial artefacts (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). Researchers have further argued that DoDAF is large and complex and hence only suitable for big systems. Therefore, this framework requires a team to implement it, due to its size. Moreover, researchers state that the DoDAF diagrams are too complex to understand and require amendment (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). Time to value is subsequently reduced due to this complexity.

The framework established by the US Treasury for EA follows in the next section.

2.4.5 The Treasury Enterprise Architecture Framework

The Treasury Enterprise Architecture Framework (TEAF) was developed by the US Treasury to introduce EA within its bureaus (Cameron and Mcmillan, 2013). The objective of this framework is to facilitate the integration and information sharing of shared requirements amongst its bureaus. It is intended to provide a guide for building and designing business processes for legislative requirements in order to enable quick changes in a business process (Schekkerman, 2011; Vargas et al., 2016). Moreover, this framework incorporates EA benefits into normal business operations, and develops a structure for creating and managing an EA (Cameron and Mcmillan, 2013).

Illustrated in Appendix 10, the framework is comprised of views, perspectives, and work products (Cameron and Mcmillan, 2013). Its objective is to facilitate integration, information sharing, and utilising common requirements across the bureaus (Schekkerman, 2011, 2006). TEAF's activities include defining an EA strategy, an EA management process, an EA repository, as well as EA roles and responsibilities (Cameron and Mcmillan, 2013).

TEAF's strength lies in its strong business focus (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). However, TEAF's guidelines contain insufficient details or specifications (Odongo et al., 2010; Urbaczewski and Mrdalj, 2006). Moreover, researchers state that the TEAF diagrams are complex to understand (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). TEAF's major weakness is its applicability outside the US Treasury domain (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006).

The Open Group is an independent, vendor and technology-neutral association that provides industry services such as research, standards, and certification (Anderson, 2017; Jonkers et al., 2006; Langenberg and Wegmann, 2004). Their framework follows in the next section.

2.4.6 The Open Group Framework (TOGAF)

The Open Group Framework (TOGAF) originates from an obsolete standard called Technical Architecture Framework for Information Management (TAFIM) originally developed by the US DoD. TAFIM was discontinued by the DoD in 1995 due to similarities with DoDAF (presented earlier) and handed to the Open Group in order to promote the Clinger-Cohen Act (Congress, 1996; Harrison, 2013; Jonkers et al., 2006; Langenberg and Wegmann, 2004).

Illustrated in Appendix 11, TOGAF comprises of EA **business, application, technology** and **data** domains. These domains are further viewed in terms of **coarse, medium** and **fine** granularities of refinement (Harrison, 2013).

The **business** domain manages elements related to the *strategy, people,* and *processes* of an organisation. The *coarse grain refinement* is a conceptual perspective that defines the organisational business needs. It defines *what* the organisation does in terms of its objectives, goals, relationships and capabilities. This granularity does not include any detailed business rules, but high-level business concepts. The *medium grain refinement* is a logical perspective that defines *how* the conceptual layer will be achieved. This granularity is often diagrammatic in nature. Finally, the *fine grain refinement* is a perspective that defines physical implementation details in terms of *where* the logical processes take place, and who will perform them (Emery and Hilliard, 2009; Stuht and Speck, 2016).

The **application** domain manages the functionality, behaviour, and design of software. The *coarse grain refinement* is a conceptual perspective that defines *what* software applications are required by the organisation. The *medium grain refinement* is a logical perspective that defines *how* the conceptual layer will be achieved, e.g. if software services are needed. The *fine grain refinement* is a perspective that defines the actual physical deployments and environments of the software.

The **technology** domain manages the hardware infrastructure technology such as end user devices, networks, servers, storage, databases, and data centres. The *coarse grain refinement* is a conceptual perspective that defines *what* technology is required to support the organisation. The *medium grain refinement* is a logical perspective that defines *how* the conceptual layer will be achieved, e.g., by specifying particular operating systems or types of servers. The *fine grain refinement* is a perspective that defines *where* the technology will be physically deployed, e.g., in a data centre, desktop, or the cloud.

Finally, the **data** domain manages elements related to the way data is managed. The *coarse grain refinement* is a conceptual perspective that defines *what* data types are required to support the organisation. The *medium grain refinement* is a logical perspective that defines *how* the data will be used, e.g., the sales and analytics departments may use different views of the same data. Moreover, this level defines the specific technologies that will be used to manage the data. Finally, *fine grain refinement* is a perspective that defines *where* a particular view of data will be physically managed.

TOGAF further organises *current*, *transition,* and *future* state architectures (Harrison, 2013). Another part of TOGAF (Harrison, 2013) is the architecture development method (ADM) which is a generic process to develop an EA (Harrison, 2013; Minoli, 2008). The *continuum* classifies solutions and architectures on a scale ranging from generic through to organisation specific (Harrison, 2013).

TOGAF's domains, ADM, and continuum are comprehensive and flexible (Rouhani et al., 2015, 2013; Sessions, 2007; Van't Wout et al., 2010). Furthermore, it has balanced business and IT components (Urbaczewski and Mrdalj, 2006). TOGAF is open source, vendor and technology neutral (Johnson and Ekstedt, 2007; Minoli, 2008) and enables organisations to simplify complex IS's (Wegmann et al., 2007, 2005).

However, TOGAF's governance and maturity model have been criticised as being primitive and not well developed (Bui, 2012). It also requires customisation to implement and provides limited guidelines (Rouhani et al., 2015; Sessions, 2007; Urbaczewski and Mrdalj, 2006). Furthermore, TOGAF assumes a seamless integration with an organisation's existing internal processes (Odongo et al., 2010), which may be unrealistic.

This section presented a background and overview of dominant EA frameworks from literature. The subsequent section commences with a discussion of these frameworks.

2.4.7 Discussion and Selection of an EA Framework

The previous subsection presented a background of the Zachman Framework, FEA, GEAF, DoDAF, TEAF, and TOGAF EA frameworks. This section is structured using criteria adapted from literature (Leist and Zellner, 2006; Sessions, 2007; Urbaczewski and Mrdalj, 2006) to guide the discussion of these EA frameworks. This section concludes with the selection of an appropriate framework for this study.

Guidelines refer to support procedures for an EA framework's taxonomy, processes, catalogues or reference-models (Sessions, 2007). Importantly, some EA frameworks contained simple guidelines, while others incorporate detailed methodologies (Urbaczewski and Mrdalj, 2006). The EA frameworks further differed in the abstraction that they address (Urbaczewski and Mrdalj, 2006). For example, *Zachman's Framework* did not contain comprehensive guidelines, procedures, or instructions for implementation (Griffin, 2005; Kang et al., 2010; Kingston, 2008; Mary and Rodrigues, 2011; Sowa and Zachman, 1992; Varga, 2003). It has been argued that this framework is very basic as it only accommodates a single instance of a situation, and hence not suitable for complex problems (Griffin, 2005). Similarly, *TEAF* includes coarse grain descriptions of processes and work products for documenting and modelling EA. However, they are basic guidelines without sufficient detail (Odongo et al., 2010; Urbaczewski and Mrdalj, 2006). Techniques are also missing for creating EA specification documents (Mary and Rodrigues, 2011). *FEA* however, contains structured guidelines and detailed reference models such as a performance reference model, data reference model, application reference model, and security reference model (Bui and Levy, 2017; Kappelman et al., 2008; Mondorf and Wimmer, 2017; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006). Similarly, *GEAF* contains comprehensive guidelines such as ETA, EIA, and ESA. Moreover, technical standard documents, as well as a catalogue of current and target applications, are included in GEAF (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012; Glissmann and Sanz, 2010; Pereira and Sousa, 2005, 2004; Vires, 2010). *DoDAF* also includes comprehensive guidelines that are structured and standardised (Mccarthy, 2006). *TOGAF* is comprised of detailed architectural domains for applications, data, and technical infrastructure. It further includes an ADM process and an 'enterprise continuum' that classifies solutions and architectures on a scale ranging from generic foundation through to organisation-specific architectures (Harrison, 2013; Rouhani et al., 2015, 2013; Sessions, 2007; Van't Wout et al., 2010).

Business focus discusses the framework's emphasis on technology to drive business value (Sessions, 2007). Researchers have debated that *Zachman's Framework* does not provide details to establish a business component for EA formulation (Kang et al., 2010; Kingston, 2008; Odongo et al., 2010; Sowa and Zachman, 1992), as it is a basic classification structure of descriptive representations (Griffin, 2005). Similarly, researchers have argued that *DoDAF* does have a strong business focus and lacks business and financial artefacts (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). Likewise, *TEAF* does not emphasize the business value (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). However, *FEA* contains a focused 'Business Reference Model' that provides a standardised taxonomy of business services, such as business areas, lines of business and business sub-functions (Kappelman et al., 2008; Kappelman and Zachman, 2013; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006). *GEAF* contains an 'Enterprise Business Architecture' model that clearly defines the business strategy, governance, and business functions of an organisation (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012; Glissmann and Sanz, 2010; Pereira and Sousa, 2005, 2004; Vires, 2010). Finally, *TOGAF* has a specific 'business domain' that strongly focuses on the processes a business uses to meet its goals (Harrison, 2013; Rouhani et al., 2015, 2013; Sessions, 2007; Van't Wout et al., 2010).

Vendor neutrality and Information availability entails a framework's independence and focuses on the accessibility of free quality information about the framework (Sessions, 2007). Researchers have noted that *GEAF's* weakness is related its propriety nature and information availability to the general public (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012; De Vries, 2010; Pereira and Sousa, 2005; Schekkerman, 2011). Both Zachman Framework and TOGAF are open source, technology agnostic, vendor, and product neutral frameworks (Aksulu and Wade, 2010; Cameron and Mcmillan, 2013; Harmon, 2005; Johnson and Ekstedt, 2007; Lankhorst, 2013b; Lankhorst and Drunen, 2007; Minoli, 2008). *FEA, DoDAF,* and *TEAF* are also vendor neutral. However, these frameworks were developed for specific use in particular areas, in these instances, for use within US governmental environments. Although these frameworks are freely available to the public on their respective websites, they are difficult to implement outside of the US governmental environment, as they do not address significant aspects of business and IT alignment due to their federal government inclination (Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006). Hence, Zachman and TOGAF have broader application in the industry (Odongo et al., 2010; Rouhani et al., 2013; Sessions, 2007; Urbaczewski and Mrdalj, 2006).

Time to value refers to the length of time required for a framework to start delivering business value (Sessions, 2007). Researchers have debated that *DoDAF* is large, complex, and requires a team to implement due to its size. Time to value is subsequently reduced as due to this complexity (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). Similarly, TEAF diagrams are complex to understand, and it lacks a process component. Time to value is subsequently reduced as due to this complexity (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006). *Zachman's* simplicity with basic rows and columns, however, has the ability to add immediate value to organisations (Bahill et al., 2006; Leist and Zellner, 2006). Similarly, *FEA* reference frameworks have the ability to deliver immediate value (Kappelman and Zachman, 2013; Urbaczewski and Mrdalj, 2006; Winter and Fischer, 2006). *GEAF* rates strongly on time to value due to its delivery focus on business outcomes and its strong focus on defining a future state (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012; De Vries, 2010; Pereira and Sousa, 2005; Schekkerman, 2011). TOGAF enables organisations to rapidly respond to dynamic environments (Langenberg and Wegmann, 2004).

This discussion revealed that the EA frameworks address different components of the architecting process (Odongo et al., 2010; Rouhani et al., 2015; Sessions, 2007; Urbaczewski and Mrdalj, 2006). For example, TOGAF emphases the architectural domains (without specifying architecture constructs) and Zachman concentrates on architectural perspectives (without specifying the process) (Boucharas et al., 2010; Odongo et al., 2010). Furthermore, many of the EA frameworks differ in terms of their approach. Hence, they cannot be all classified in the same way. The selection of an EA framework has to, therefore, be based on organisational specific requirements or areas of concern (Odongo et al., 2010; Rouhani et al., 2013; Sessions, 2007; Urbaczewski and Mrdalj, 2006). It is also important to clearly comprehend the components of the EA frameworks in order to understand if the organisational needs are met.

Although all the frameworks have strengths and weakness, TOGAF was selected as a reference for this research because it contains balanced business, application, technology, and data domains (Urbaczewski and Mrdalj, 2006) that support the objectives of this study. Moreover, TOGAF meets the requirements of this study as it contains processes such as the ADM that are comprehensive and flexible (Rouhani et al., 2015, 2013; Sessions, 2007; Van't Wout et al., 2010).

Moreover, TOGAF is considered one of the most commonly utilised and widely accepted EA frameworks by both researchers and practitioners (Cabrera et al., 2016; Esmaeil Zadeh et al., 2012). It is managed by an open group that is a vendor and technology neutral organisation (Johnson and Ekstedt, 2007; Minoli, 2008).

TOGAF supports managing complexity arising from both business and IT environments. This simplification of complexity enables organisations to rapidly respond to dynamic market and IT environments (Langenberg and Wegmann, 2004; Wegmann et al., 2007). This ability to reduce complexity has been the most cited benefit from all the frameworks (Gerber et al., 2010; Hanschke, 2009; Jonkers et al., 2006; Lankhorst, 2013a; Lapalme et al., 2016).

TOGAF was used to extend RBV by viewing EA as an intangible resource (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015). This is important because intangible resources are a source of long-term business value (Barney, 1991; Bricknall et al., 2006; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984).

Note, this research adopts the TOGAF EA definition as follows. ***EA is the practice of designing, planning, implementing, and governing business, application, and information and technology domains*** (Harrison, 2013). This definition provides a model for EA concepts and knowledge to be represented within an organised structure (Chen et al., 2008) using granularities, layers, or views (El Kourdi et al., 2007; Schekkerman, 2011, 2006). The *coarse granularity* conceptually defines *what* the specific domain does in terms of its objectives. The *medium granularity* is a logical layer that defines *how* the coarse layer will be achieved. Finally, the *fine granularity* physically defines actual implementation details (Harrison, 2013).

Despite the various EA frameworks, EA has evolved into a well-accepted discipline with its value rapidly gaining momentum (Anderson, 2017; Bernard, 2012; Bucher et al., 2006; Kaisler and Armour, 2017; Nowakowski et al., 2017; Silva et al., 2017; Van Steenbergen and Brinkkemper, 2009). The following subsection introduces 'maturity', another important aspect of this research.

2.5 Maturity Models

The previous section discussed that RBV was extended by examining maturity as a source of heterogeneity (Anderson and Eshima, 2013; Grant, 1991; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992). Furthermore, maturity was defined as "a measure to evaluate the capabilities of an organisation in regards to a certain discipline" (Rosemann and de Bruin, 2005, p. 1). Isaac Newton described maturity as "to stand on the shoulders of giants", where new discoveries were built on previous discoveries (Gleick, 2004). This concept of maturity was derived from the development of humans and organisms. The Oxford dictionary (Oxford English Dictionary, 2017) describes it as "the state, fact, or period of being fully grown or physically developed". Analogies such as "humans evolving through different stages of infancy, childhood, adolescence" (Veger, 2008, p. 35) or "crawl, walk, and run" (Nottonson and DeLong, 2008, p. 116) are sometimes used to describe this concept. This idea of humans and other organisms developing their capabilities has been applied to organisations to understand the ways that they evolve through different levels of growth.

Moreover, it is important to understand the history and evolution of maturity models to appreciate and comprehend this research. The history of maturity models can be traced to 1943 when Abraham Maslow defined the 'Hierarchy of Needs' (Maslow, 1955). Maslow defined five levels with the precondition that the goals of the previous level had to be achieved to progress to the next stage. This concept of levels and consecutiveness led to the concept of maturity models (Becker et al., 2010; Röglinger et al., 2012).

Maturity models have received growing interest within IS research in recent years (Becker et al., 2010, 2009; De Bruin et al., 2005; Fendt, 2013; Ho et al., 2016; Mettler, 2009; Vallerand et al., 2017; Van Steenbergen et al., 2010). A maturity model is a framework defining the progression towards an improved state using successive levels (Paulk et al., 2006, 1993). They assume that organisations follow certain predictable patterns when they evolve up the levels (Becker et al., 2010; Gottschalk, 2009). It provides a structure for an organisation to approach problems and challenges in a structured way, provides a benchmark to assess practices, and a roadmap for improving them, with each leading level superior to the previous level (Becker et al., 2010; Chew and Gottschalk, 2012; Ho et al., 2016; Kazanjian and Drazin, 1989). Moreover, they assist organisations to assess and compare their own practices against best practices (or competitors), with a plan for continuous improvement (Butkovic and Caralli, 2013; Grant and Pennypacker, 2006; Ho et al., 2016; Paulk et al., 2006; Pennypacker and Grant, 2003).

Notably, maturity models have been criticised as being too broad, not addressing critical competencies, not defining any limits of their applicability and suggesting that any model could be applied to any organisation (Cooke-Davies, 2007; Cooke-Davies and Arzymanow, 2003; Grobler and Steyn, 2006; Ibbs, 2005). Moreover, they have been criticised as being inflexible when managing change, not adhering to quality management principles, and disregarding people components (Jugdev and Thomas, 2002). It has also been argued that the theoretical foundations of maturity models do not have sufficient empirical support (Crawford, 2005; Grobler and Steyn, 2006; Jugdev and Thomas, 2002).

Prominent maturity models (Curtis et al., 2009; Paulk et al., 1993) are introduced in the subsequent subsections.

2.5.1 Quality Management Maturity Grid

Quality Management Maturity Grid (QMMG) is used by organisations to assess service and product quality (Crosby, 1979; Paulk et al., 2006).

Illustrated in Appendix 12, Crosby (1979) referred to the first level as *uncertainty*. At this level, quality as a management tool is not understood by the organisation. Issues are reviewed as they occur and inadequate effort is made to develop quality. Furthermore, there is limited acceptance of prevention strategies. The second level is referred to as *awakening,* where organisations become aware of the problems caused by poor quality. At this level, they begin to realise that quality management has value, but are not prepared to invest resources. Teams are formed to review key problems, but no long-term solutions are considered by these organisations. Organisations operating at the *enlightenment* level recognise that quality issues stem from poor processes and performance measures. These organisations address problems transparently, resolve them in a methodical way, and enforce corrective action. An organisation attains *wisdom* when it incorporates quality management into its processes and exposes its business functions to quality associated improvements. These organisations quickly recognise problems, deploy preventive action plans. Finally, organisations operating at a *certain* level of maturity regard quality management as a crucial component of its processes. These organisations implement continuous quality improvement solutions (Crosby, 1979; Paulk et al., 2006).

QMMG assists organisations to visualise progress over time, assess quality management, and focus on human factors such as leadership and attitude (Albliwi et al., 2014). However, critics argue that QMMG is highly subjective and its implementation is dependent on a researcher's experience (Albliwi et al., 2014). It further lacks a strong theoretical base (Albliwi et al., 2014; Garvin and March, 1986). QMMG emphases motivation and planning, however, it does not specify any implementation details (Garvin and March, 1986). Finally, QMMG discusses an organisations cost of quality, but does not show how to implement and measure its improvement (Albliwi et al., 2014; Garvin and March, 1986).

Richard Nolan, a prominent researcher from Harvard Business School (Nolan, 1982), developed the stages of a growth model that follows in the subsequent section.

2.5.2 Stages of Growth Model

The Stages of Growth Model also assess capabilities or components of IS maturity (Aiken et al., 2007; Peter Gottschalk, 2002; Petter Gottschalk, 2002; King and Kraemer, 1984; Nolan, 1979). Illustrated in Appendix 13, *initiation* is the first stage of this model, and assess capabilities when IT is procured for the first time within an organisation. IT departments obtain minimal support from management and operate in a "carefree" manner. *Contagion* is a critical stage of IT growth characterised by the proliferation of systems within an organisation. At this level, users are casually excited about using IT, and organisational control is relaxed. This stage signifies an increase in budgets, as well as improvement of IT use within the organisational business units. The *control* stage is when organisations react to unnecessary resource costs on IT. This stage moves focus from the control of IT to the control of data resources. Characteristics of this stage are that there is an increase in computer use, and a greater reliance on IT to an organisation. Organisations at the *integration* stage focus on resolving silos of IT by creating integrated systems. Features of this phase include an increase of by users, improved budgets for data processing, and more demand for real time database capabilities. Organisations operating at the *data administration* stage focus on managing data as opposed to IT. This level establishes data administration and the identification of data patterns. Finally, the *maturity* level includes systems accurately displaying the information requirements of an organisation. There is a focus on data resources to trigger business value. These organisations regard data processing as a data resource function, and focus on data resource strategic planning.

Stages of Growth (Nolan, 1979) is one of the most widely recognised and cited models within IS (De Carvalho et al., 2016b; Lee and Lee, 1991; Röglinger et al., 2012). It is widely used by organisations that need to understand and analyse complex IS problems, and assists with the planning and managing of IS resources (De Carvalho et al., 2015; Lee and Lee, 1991). However, critics argue that the model is too general (King and Kraemer, 1984). Furthermore, its empirical validity has been disproven by several researchers (Benbasat et al., 1984; Drury, 1983; Peter Gottschalk, 2002; King and Kraemer, 1984; Lee and Lee, 1991), who found that the benchmark variables (e.g. the chargeback methods) used by Nolan (1979) were not confirmed in empirical studies.

The capability maturity model is introduced in the next section.

2.5.3 Capability Maturity Model (CMM)

The CMM was introduced by Watts Humphrey in the late 1980’s to develop and refine an organisation's IS development process (Curtis et al., 2009; Paulk et al., 1993). It was advanced by Carnegie Mellon University’s Software Engineering Institute (SEI), sponsored by the US Department of Defence (DoD) to assess if government contractors could implement software projects (Curtis et al., 2009; Paulk et al., 1993).

Discussed earlier in the section, maturity refers to the notion of organisations developing their practices and evolving through different levels of growth (Nottonson and DeLong, 2008; Rosemann and de Bruin, 2005; Veger, 2008). The CMM provides a framework for organising these evolutionary steps into five maturity levels that provide successive foundations for continuous improvement (Curtis et al., 2009; Paulk et al., 1993). These five maturity levels provide a gauge for assessing the maturity of an organisation's practices. Each level comprises a set of characteristics, and provides a layer in a path of continuous improvement. It is important to note that the attainment of capability outcomes at each level is a prerequisite to proceeding to the next level of maturity. Furthermore, CMM is non-prescriptive in its application (Curtis et al., 2009; Paulk et al., 1993). The general structure of the CMM is presented in Figure 2.2.

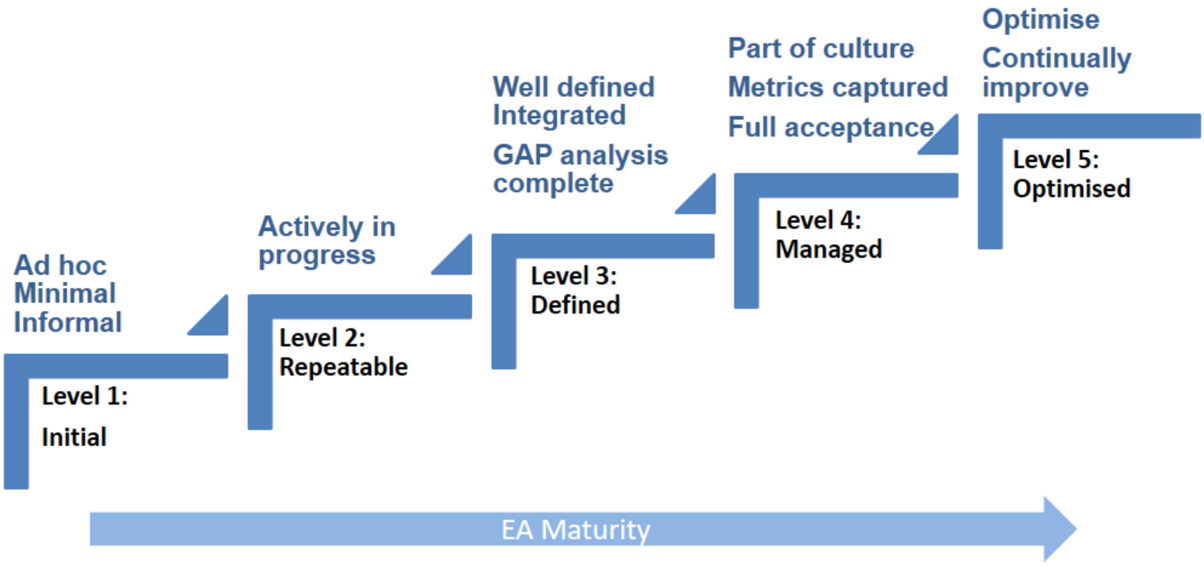

Figure 2.2: CMM Maturity Levels

Source: Adapted from (Paulk et al., 1993)

The model describes five levels of the process of maturity (Paulk et al., 1993). During level 1 maturity, practices are ad-hoc, inconsistent, chaotic, and not repeatable. At level 2 maturity, practices are simple efforts that are emerging. Basic project management techniques are established, and successes could be repeated. Level 3 contains standard business practices, internal standard software processes, documentation, and integration. During level 4 maturity, the practices are quantitatively managed with metrics. At this level, organisations monitor and control their practices through data collection and analysis. Level 5 maturity pro-active practices and capability improvement, is implemented through qualitative feedback (Paulk et al., 1993).

CMM is regarded as one of the most widely accepted and established models to assess the capability maturity of an organisation by both academia and industry (Burnstein et al., 1996; Fendt, 2013; Rosemann and de Bruin, 2005). Moreover, empirical evidence shows that organisations adopting CMM obtain higher returns on their original investment (Doss et al., 2017; Herbsleb et al., 1997). However, researchers argue that CMM (and its derived models) may not be appropriate for every organisation as it requires significant time and effort for implementation and involves organisational cultural change. Furthermore, they argue that it is not mandatory for successful software development (Rosemann and de Bruin, 2005).

Although CMM was originally developed as a tool to evaluate DoD contractors, researchers now accept it as a general reference model to assess maturity levels of generic practices or capabilities within an organisation (Burnstein et al., 1996; Paulk et al., 1993; Vallerand et al., 2017). Studies show that CMM levels and terminology can be adapted and translated to assess EA maturity (Vallerand et al., 2017; Van Steenbergen et al., 2010). Dominant models that have been derived from CMM and adapted to assess EA maturity are introduced below (Burnstein et al., 1996; Paulk et al., 1993; Vallerand et al., 2017).

The **EA management maturity framework (EAMMF)** was adapted from CMM (Matthes, 2011; Perko, 2009) and customised for the US Government Accountability Office (GAO), in order to assess EA maturity (GAO, 2010). It includes an *EA awareness* stage where there are no established foundations for effective EA development and use. This is followed by an *EA management foundation* stage where an organisation has commenced developing initial EA content and has basic structures, roles, and responsibilities for EA governance. During the third stage *developing EA products,* EA maturity is incomplete, however, a transition plan has commenced with emphasis on current and future states. At the *completing EA* stage, an organisation has the ability to define their current and target states in terms of business, information, service, and technology. Finally, during the *EA leveraging* stage, an organisation uses EA to select projects that are strategically linked to the business objectives to allow system interoperability. The major criticism of EMMF is its limited use outside of the GAO environment (Kaisler et al., 2005; Kaisler and Armour, 2017).

Stage maturity model (Holland and Light, 2001) also adapted from CMM (Vallerand et al., 2017), is comprised of three stages, *organisation is about to commence with an enterprise wide solution, implementation is complete and being fully utilised within the organisation,* and finally, *organisations have institutionalised the solution and are engaged in the process of obtaining strategic value.* This model further identifies maturity features such as the *strategic use of IT* that focuses on the significance of IT function within the business, *organisational sophistication* that describes the organisational evolution resulting from an application, *penetration of the application* that describes how extensively a system is used within an organisation, *vision* that recognises strategic potential for the use of the application and, finally, *drivers and lessons* that focuses on the leanings during the implementation of the application. However, critics have argued that the stage maturity model lack s evidence of validity testing (Carcary, 2009).

Another derived model is the **enterprise architecture maturity model (EAMM)** (NASCIO, 2010) that represents the National Association of State Chief Information Officers (NASCIO) from the USA. NASCIO uses EAMM to review its EA program to, assess maturity levels, increase predictability, and process control and effectiveness (Vallerand et al., 2017). The model commences with an organisation that has no recognised standards or base practices in place. Thereafter, the initial *informal* level has defined standards, but informal processes with an organisation. The *repeatable* level has defined standards and processes as well as repeatable metrics in place. The *well-defined* level has distinct standards and processes defined within an organisation. This is followed by a *managed program* whereby metrics are analysed and acted upon by an organisation. Finally, a *continuously improving* organisation has targets in place that are set based on business and technical goals.

However, EAMM does not include all components of the entire EA function, provides minimal EA details, and do not provide any guidelines for use (Van Der Raadt and Van Vliet, 2009). Other concerns have been highlighted on the models business technology practically, as well as ability to facilitate knowledge sharing across an organisation (Vallerand et al., 2017).

The **enterprise architecture assessment framework (EAAF)** (Meyer et al., 2011) was derived from CMM by the US Federal government Office of Management and Budget (OMB) to allow federal agencies to assess and report on their EA activity and maturity (Matthes, 2011; Perko, 2009; US Office of Management and Budget, 2012). An organisation at an *undefined* level has no processes in place. An *initial* level has informal and ad-hoc EA practices adopted by an organisation. Practices and artefacts exist but may be incomplete. *Managed* organisations have EA practices that are planned and managed, and artefacts that are complete with a high-level of definition. *Utilised* organisations have EA processes and products that are documented, understood, and are used in decision-making activities. EA practices that are measured for effectiveness against a set of established performance criteria are referred to as an *oriented* organisation*.* Finally, an *optimised* organisation has EA practices that continuously drive business improvement, with demonstrable improvements in efficiency, cost savings, and service quality. Furthermore, EAAF contains guidelines for each level of maturity. These guidelines were compiled from EA best practice (Matthes, 2011; Perko, 2009; US Office of Management and Budget, 2012). Moreover, EAAF consists of the following capability areas such as *completion* that evaluates the development of an organisation's EA and EA products, *use* that concentrates on how EA is governed and managed, and *results* that assess EA outcomes.

However, the model had limited applicability outside of the Federal environment (Van Steenbergen et al., 2010).

The **SOA maturity model**, also derived from CMM, measures the maturity of SOA adoption. Researchers have developed several variations of this model to assist organisations to assess the extent that they have progressed on their SOA journey (Inaganti and Aravamudan, 2007; Mougayar, 2005; Pulparambil et al., 2017; Sprott, 2007). The first level is referred to as the *early learning* stage where pilots of SOA projects are considered. Thereafter, the *applied* stage applies SOA on selected important projects. The *integrated* stage utilises SOA for integration between projects. *Enterprise* stage establishes SOA at an enterprise level. Finally, at the *ecosystem* stage of SOA supports all virtual business functions.

SOA maturity models can be used to create and communicate a common definition of SOA within an organisation by helping to clarify vague definitions. Improved requirements gathering is experienced with this model. The cited benefit of SOA maturity models is that they can help to guide SOA adoption (Bani-Ismail and Baghdadi, 2016; Meier, 2006; Pulparambil et al., 2017; Whybrow, 2005).

However, the model has been criticised due to lack of theoretical foundations, having a technical bias, no governance principles, and limited applicability outside of a SOA environment (Bani-Ismail and Baghdadi, 2016; Meier, 2006; Pulparambil and Baghdadi, 2016; Whybrow, 2005).

Finally, **architecture capability maturity model (ACMM)** was developed by the US Department of Commerce (DoC) to assist with internal EA assessments (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op ’t Land et al., 2009). Organisations operating within *level 1* maturity follow informal EA practices. Moreover, these EA efforts are ad hoc and dependent on individual people. *Level 2* includes organisations where basic emerging EA practices are documented, and roles and responsibilities are established. These organisations have an EA vision, principles, and business linkages. At this point in the maturity program, processes are repeatable and reusable templates are starting to be developed. Organisations operating within *level 3*, follow EA procedures that are communicated to IT and business staff. The EA framework is well defined using approved standard and templates. Processes are further documented across the organisation. Basic performance metrics are implemented. Furthermore, current and target architecture states are defined. *Level 4* organisations follow managed and measured EA practices. At this stage, EA capabilities are part of the culture. Quality metrics associated with the EA practices are further captured. Finally, organisations at level 5 ensure continuous improvement of EA practices.

Importantly, ACMM specifies EA mechanisms such as *processes* that assess whether there are guidelines, steps, and decisions involved in the way that EA development work is completed, as well as their effectiveness. *Communication* mechanisms assess if EA is documented and disseminated and stored. *IT business alignment* characterises whether the activities of the IT teams are aligned with the organisation’s business goals and objectives, i.e. whether IT initiatives support business goals. *Senior management involvement* assesses management involvement in EA practices. Finally, *and finance* mechanism assesses an organisation’s consideration of EA when acquiring new investments (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010). An expanded list of the EA mechanisms and their characteristics can be found in Appendix 2.

Researchers state that a maturity level is determined by “making informed, reasonable, and professional judgments about each key practice and its associated goals” (Paulk, 1999, p. 21). Other researchers support this technique of using judgement to determine maturity levels by stating that “a researcher may choose to apply expert judgement, without employing a formal mathematical approach” (Mirzianov and Mitasiunas, 2015, pp. 1–2), and “professional judgement must be applied when interpreting CMM activities of a particular organisation” (Cooper and Fisher, 2002, p. 7). Hence the level of maturity for this study was determined by judging the EA practices, represented by processes, communication, business-IT alignment, senior management involvement, and finance mechanisms from the data against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

This subsection introduced the CMM maturity model, as well as its derived models. The selection of the maturity model used as a reference for this study follows in the next section.

2.5.4 Discussion and Selection of a Maturity Model

The previous subsection described a maturity model as a framework defining the progression towards an improved state using successive levels (Paulk et al., 2006, 1993). These models provided structures for organisations to approach problems and challenges in a logical way, provide a benchmark to assess capabilities, and a roadmap for improving them (Chew and Gottschalk, 2012; Ho et al., 2016; Kazanjian and Drazin, 1989).

Maturity models such as QMMG assisted organisations to visualise progress over time, assess quality management and evaluate human factors (Albliwi et al., 2014). However, its implementation is highly subjective and dependent on a researcher’s experience (Albliwi et al., 2014). QMMG did not have a robust theoretical base and did not demonstrate how to implement the quality and human measures stated above (Albliwi et al., 2014; Garvin and March, 1986).

Stages of Growth (Nolan, 1979) was used by organisations to understand and analyse complex IS problems, and assist with the planning and managing of IS resources (De Carvalho et al., 2015; Lee and Lee, 1991). However, its empirical validity was been disproven by several researchers (Benbasat et al., 1984; Drury, 1983; Peter Gottschalk, 2002; King and Kraemer, 1984; Lee and Lee, 1991), who found that the benchmark variables (e.g. the chargeback methods) used by Nolan (1979) were not confirmed in empirical studies.

There is vast research that demonstrates CMM produces cost saving benefits (Doss et al., 2017; Herbsleb et al., 1997; Jasmine, 2010; Müller, 2011; Paulk et al., 2006; Rosemann and de Bruin, 2005). However, scholars argue that CMM (and its derived models) may not be appropriate for every organisation as it requires considerable time and effort for implementation and involves organisational cultural change. Furthermore, they argue that it is not mandatory for successful software development (Rosemann and de Bruin, 2005).

Although QMMG, Stages of Growth, and CMM have strengths and weakness, CMM was selected as a reference for this study because it is one of the most widely accepted and established models to assess the capability maturity of an organisation by both academia and industry (Burnstein et al., 1996; Fendt, 2013; Rosemann and de Bruin, 2005). Furthermore, it meets the needs of this study by clearly identifying levels of maturity (Paulk et al., 1993). Moreover, empirical evidence shows that organisations adopting CMM obtain higher returns on their original investment (Doss et al., 2017; Herbsleb et al., 1997). CMM enables organisations to improve project predictability (Müller, 2011; Paulk et al., 1993). The model assists with improved error detection, lower remediation costs, and improved cost probability

(Müller, 2011; Paulk et al., 1993). Early defect detection enabled by CMM also provides savings of cost of rework (Doss et al., 2017; Herbsleb et al., 1997). Finally, it helps organisations improve product quality, productivity, cycle time reduction, and customer satisfaction (Herbsleb et al., 1997; Jasmine, 2010). Notably, it improves productivity in the long run as higher-quality products are produced that requires less maintenance. Moreover, repeatable practices at higher CMM level reduces redundancy and excessive workload (Paulk et al., 2006).

Importantly, it was shown that CMM was used as a blueprint to derive other maturity models (Burnstein et al., 1996; Paulk et al., 2006; Van Steenbergen et al., 2010), including several for EA maturity. One of these derived models, ACMM, was selected as a reference model for this study as it contained appropriate mechanisms such as *processes, communication, business-IT alignment, senior management involvement,* and *finance* that are relevant to this study to evaluate EA practices (De Carvalho et al., 2016b, 2016a, 2015; Op ’t Land et al., 2009; van Der Raadt et al., 2005).

Previously in this study, section 1.3 argued that RBV is extended by examining maturity as a source of heterogeneity (Anderson and Eshima, 2013; Grant, 1991; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992). Extending heterogeneity is important because the maturity of resources and practices influences business value and competitive advantage (Anderson and Eshima, 2013; Grant, 1991; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992). It must be noted that researchers (Dawson and Watson, 2005; Kishore et al., 2012) have similarly used the maturity and CMM to extend RBV, however, to address different research problems.

Organisations aim to obtain business value from their investments in EA (Chesbrough, 2012). The following section introduces this topic.

2.6 Business Value Models

Recall section 1.3 stated that this study contributes to the RBV understanding of business value (Barney, 1991; Li, 2009; Woodruff, 1997) from an EA perspective. An examination of literature on this concept revealed a wide plateau of views on this term (Amit and Zott, 2001; Chatain and Mindruta, 2017; Chesbrough, 2012; Hwang and Christensen, 2008; Johnson et al., 2008; Kashyap et al., 2017; Sorescu et al., 2011). Business value has been argued as “obscure, controversial, and provoked an enormous volume of literature…this concept has different meanings for different authors and, not infrequently, in the works of one author” (Encyclopedia.com, 2017). Researchers have elaborated that business value definitions are “unclear, frequently inadequate, often partisan and sometimes completely absent” (Bannister and Remenyi, 2000, p. 43). It has been argued that there a “lack of construct validity, and definitional inconsistency” in the definitions of business value (Cronk and Fitzgerald, 1999, p. 406). Researchers have gone as far as to compare business value to beauty, arguing that it is a nebulous opaque concept, as it changes at different points in time, for instance, literature shows that being overweight was historically considered beautiful, however modern society considers the contradictory true (King and McClure, 2014).

Historically, literature broadly organised the concept of business value into **objective** and **subjective** categories (Fine, 2013; King and McClure, 2014; Sinha, 2010). The **objective** category of business value traced its roots to goods and services being derived from labour (Dobb, 1973; Dobson, 2002; Fine, 2013; Groenewegen and Dobb, 1974; King and McClure, 2014; Kurz, 2003; Sinha, 2010). The **subjective category** of value focused on the preferences of consumers. It states that in order for an object to have value, the object must satisfy human needs and be in scarce supply (Feenstra, 2015; Fine, 2013; Hindriks and Myles, 2006; Kauder, 2015; King and McClure, 2014; Mirowski, 1984; Moseley, 2015; Nicholas, 2012; Sen, 1993; Sinha, 2010). Historical milestones on the object and subjective categories of business value can be found in Appendix 14.

However, recent literature focuses on the following dominant views regarding the concept of business value.

2.6.1 Econometric, Process, and Perception Models of business value

Some researchers have broadly classified the term business value into econometric, process, and perception categories (Cronk and Fitzgerald, 1999; Keyes-Pearce, 2005).

The **econometric model** is described as “the economic contribution of IT investments that shape the nature of the business through its influence on corporate strategies and future investments in technology” (Barua et al., 1995, p. 21). Within this category, adapted forms of accounting and finance, concepts are used to explain the concept (Chesbrough, 2012; Dehning and Richardson, 2002; Hitt and Brynjolfsson, 1996). Business value is described as the relationship between potential value, conversion contingencies, realised value and locus value (Davern and Kauffman, 2000; Schwarz et al., 2010). Researchers term this category as IT’s effect on an organisational value that contributes to future cash flows by reducing costs or increasing revenue (Peffers and Saarinen, 2002). Literature suggests the use of profitability, consumer surplus, and productivity to measure business value (Hitt and Brynjolfsson, 1996). It can be further measured using financial instruments, such as discounted cash flow, cost reduction, economic value (Chesbrough, 2010, 2012). Notably, researchers within this category have acknowledged that these financial methods do not completely encapsulate the concept of business value due to the tangible nature of these measures (Sircar et al., 2000).

The process model describes business value in terms of organisational processes. Within this category, business value is described as the contribution to organisational performance in the way IT affects critical business activities (Tallon et al., 1999). Business value includes the organisational performance impacts of IT at both the intermediate and organisation level, and comprises of both efficiency and competitive impacts (Melville et al., 2004). It is further determined by an organisation’s management responsible for obtaining value from IT (Soh and Markus, 1995). Moreover, the process category is measured using qualitative metrics, such as relative benefit and customer satisfaction surveys (Osterwalder et al., 2011).

Perception model defines business value in terms of the managerial perception derived from organisational objectives as well as IT and business unit operations. Business value is defined by its perceived impact on each of these levels (Weill and Broadbent, 2009). It is also viewed as a subjective assessment beyond financial measures (Smith and McKeen, 2003). These researchers state that a prerequisite of any IT (or business) value proposition is that the stakeholders of that initiative agree on what value is delivered and how it is recognised.

This subsection demonstrated views of business value grouped into econometric, process, and perception categories. However, the econometric literature does not consistently and clearly specify measures to define business value (Keyes-Pearce, 2005; Sircar et al., 2000). This implies that organisations using different measures, would have inconsistent or multiple definitions of value (Keyes-Pearce, 2005). Moreover, researchers state that there is an overemphasis on financial measures (Kaplan and Norton, 2007). The process category of business value is subjective as managers of an organisation determine business value with no guidance or frameworks (Keyes-Pearce, 2005). Perceptions of business value by people within the same organisation create problems due to subjectivity (Smith and McKeen, 2003). Therefore, these categories may not be a good indication of business value.

Peter Drucker, an influential scholar, is considered the "founder of modern management" (Bowman and Wittmer, 2000, p. 13; Flaherty, 1999, p. 1; Romar, 2004, p. 51). Notably, he was a strong opponent to econometric categories of business value as he believed these techniques did not consider the entire organisational process (Drucker, 1954; Soh and Markus, 1995; Watson, 2002). Drucker's interpretation of business value is discussed in the subsequent subsection.

2.6.2 Management by Objectives Model

Drucker's (1954) views on business value have been widely accepted since the 1950's, and modern literature (Chong, 2013; Kurzynski, 2012; LaFollette and Fleming, 1977; Magretta, 2002; Turriago-Hoyos et al., 2016) recognises him as a major contributor to the term business value.

Drucker (1954) argued that the objective of an organisation is to create a customer (Watson, 2002). He subsequently popularised the question "Who is the customer? And what does the customer value?" (Ovans, 2015, p. 1). He argued that organisations must add value in order to create wealth (Drucker, 1954; Drucker et al., 2015; Watson, 2002). Furthermore, he debated that organisations place too much focus on their internal understanding of value, as opposed to a customer's perspective of it. He said a "customer never buys a product…the customer buys value," and value is the customer's view of value as opposed to an organisation's view (Drucker et al., 2015, p. 56). Drucker argued that an organisation should create value for customers, employees, and partners, and wealth for owners (Drucker, 1954; Soh and Markus, 1995). Notably, a service was described as a means to deliver value to customers (Drucker, 1954).

Management by Objectives (MBO) is a management theory that aims to develop and improve the performance of an organisation by clearly defining objectives that are agreed upon by both management and employees (Drucker, 1954). According to this theory, the involvement of both management and employees in organisational planning and goal setting results in improved organisational performance (Drucker, 1954). MBO focuses organisational results by aligning the work of its staff to a common set of objectives. It recommends employee participation in goal setting and action plans creates business value by facilitating commitment and alignment of objectives across an organisation (Drucker et al., 2015; Soh and Markus, 1995; Watson, 2002)

MBO states that when specific goals are set and attained, the outcomes that support organisational, operational, tactical, and strategic objectives must be brought forward. It states that participative decision-making facilitates goal setting with staff participation. Explicit performance period involves the time required for staff employees to carry out actions in a planned routine to meet their targets. Finally, MBO suggests performance feedback that assists staff to assess if they are on track in order for them to retain or adjust their behaviour (Drucker et al., 2015).

However, critics (Deming, 2013) argue that Drucker over emphases the setting of goals and targets as opposed to actual outcomes and does not consider the environment in which the goals are set, such as available resources or stakeholders.

Therefore, Drucker's interpretation may be counterproductive and not a good indication of business value. Michael Porter is a prominent economist, researcher, and author from Harvard Business School (Kiechel, 2011). His interpretation of business value follows in the subsequent section.

2.6.3 Value Chain Model

Value chain is an organisational theory (Moxham and Kauppi, 2014) comprised of a network of activities that an organisation performs in order to create value for its customers (Porter, 1990, 1985a; Porter and Heppelmann, 2015). The goal of these activities is to create a profit that exceeds the cost of providing a product and thus to generate value (Porter, 1990, 1985a). Porter (1985, p. 38) states that business value is related to "the amount buyers are willing to pay for what a firm provides them" and is measured by total revenue. It further assesses the value that each individual activity contributes to its product or service. It states that when these items are organised into systematic activates it allows an organisation to produce something of value that customers that are willing to buy. It suggests that an organisation is more than an unplanned collation of people and commodities. Value chain outlines the activities of an organisation, and links them to its competitive strengths. Moreover, Porter (1985) states that the skills required to execute manage the connections between these activities are the basis of business value. This definition was expanded to an organisation being a network of internal and external relationships, where business value is viewed as a collaborative and common goal for the whole network (Florén and Agostini, 2015; Thornton et al., 2013).

Value chain is further decomposed into two categories of activities (Porter, 1985a; Porter and Heppelmann, 2015). *Primary activities* entail *inbound logistics* that involve the relationship with suppliers and include all the activities required to process inputs. *Operations* are the activities required to transform inputs into outputs. It incorporates the raw materials and goods that are manufactured into the final product. Notably, 'value' is added to the product at this stage as it moves through the production line. *Outbound Logistics* include the activities required to collect, store, and distribute the output. *Marketing and sales* activities inform buyers about products and services. Finally, *service* includes all the activities required to maintain the product or service after sales. The secondary category of activities, are *support activities* (Porter, 1985a; Porter and Heppelmann, 2015) and include *procurement* that entails the purchase of inputs, or resources, for an organisation, *human resource management* that involves of the activities in employing, training, developing, and remunerating staff, and *technological development* that entails the activities related to managing, processing and advancing technology, and finally *infrastructure* that entails accounting legal, and finance functions.

However, weaknesses exist with Porter's (1990, 1985, 2015) interpretation of business value. Long-term strategic costs such as future costs, market prices, and future capital investments are difficult to predict (Hoque, 2005; Institute of Management Accountants, 1996). Furthermore, the scale and scope of value chain analysis are large in size and time-consuming to implement (Merchant, 2012). Finally, value chains are aligned towards manufacturing type organisations and difficult to adapt to other types of industries (Merchant, 2012).

Therefore, Porter's interpretation may be counterproductive and not a good indication of business value. The balanced scorecard approach to business value is introduced in the next section.

2.6.4 Balanced Scorecard Model

The balanced scorecard is a model that is used to align business activities to the vision and strategy of an organisation. It was developed as a performance assessment framework to provide organisations with a balanced view of their performance (Kaplan and Norton, 2007; Lawrie and Cobbold, 2004; Muralidharan, 2004). This balanced view includes both traditional and financial perspectives, as well as non-financial perspectives (Kaplan and Norton, 2007). Balanced scorecard assesses *value* by comparing an organisation against a reference value composed of these financial and non-financial perspectives. The model recommends that an organisation implement corrective actions for any variations during this comparative assessment against the perspectives (Muralidharan, 2004).

The balanced scorecard specifies that an organisation is viewed from the following perspectives (Kaplan and Norton, 2007). **The financial perspective** recommends that organisations select a small number of pertinent high-level financial measures to answer the question "How do we look to shareholders?” Notably, Kaplan and Norton (2007) state that organisations typically over emphasise the financial perspective of value, which results in an unbalanced state. Hence the next view is the **customer perspective**, which proposes organisations ask, "How do customers see us?" This component highlights the importance of customer satisfaction to an organisation. Literature states that weak performance from this perspective is an indicator of future organisational decline, even if the financial perspective is positive (Kaplan and Norton, 2007). The third view, the **business process perspective** proposes that organisations ask, "What must we excel at?" It refers to an organisation’s internal business processes, allows it to understand its health, and whether their products and services meet customer requirements. Finally, the **learning and growth perspective** asks, "How can we continue to improve, create value, and innovate?" This perspective includes cultural attitudes related to self-improvement.

Notably, the balanced scorecard model further proposes the use of strategy maps to demonstrate how value is created for an organisation. These strategy maps demonstrate a logical, step by step flow between strategic objectives in the form of a cause-and-effect chain (Kaplan and Norton, 2007).

Balanced scorecard was referred to as one of the most influential management instruments of the 20th century by the editors of Harvard Business Review (De Geuser et al., 2009; Sibbet, 1997). Another global study found that 66% of a 1221 sample of international executives use balanced scorecard (Rigby, 2015). However, academics have criticised the balanced scorecard for lack of citations and theoretical evidence (Lingle and Schiemann, 1996; Malina and Selto, 2001; Nørreklit, 2000; Schneiderman, 1999). Importantly, the academic community has argued that the balanced scored is financially biased and does not appropriately consider intangible, social, and political aspects (Andersen and Lawrie, 2002; Kong, 2010; Neely, 2007).

The subsequent section presents a discussion of these models and concludes with a definition of business value that is used in this study.

2.6.5 Discussion and Selection of a common Business Value definition

The previous subsections revealed an on-going debate on the concept and definition of business value in literature (Amit and Zott, 2001; Brandenburger and Stuart, 1996; Chatain and Mindruta, 2017; Chesbrough, 2012; Hwang and Christensen, 2008; Kashyap et al., 2017; Mooney et al., 1996; Sorescu et al., 2011). The arguments described business value as obscure, controversial, unclear, inadequate, inconsistent and nebulous (Bannister and Remenyi, 2000; Cronk and Fitzgerald, 1999; Encyclopedia.com, 2017; King and McClure, 2014)

Furthermore, the previous subsections categorised the definitions into econometric, process, and perception. However, the econometric literature does not consistently and clearly specify measures to define business value (Keyes-Pearce, 2005; Sircar et al., 2000). This implied that organisations using different measures have inconsistent or multiple definitions of value (Keyes-Pearce, 2005). Moreover, literate demonstrates an overemphasis on financial measures (Kaplan and Norton, 2007). The process category of business value was subjective as managers with an organisation determine business value with no guidance or frameworks (Keyes-Pearce, 2005). Perceptions of business value by people within the same organisation create problems due to subjectivity (Smith and McKeen, 2003). Therefore, these categories may not be a good indication of business value.

However, critics argue that Drucker overemphasised the setting of goals and targets as opposed to actual outcomes. It has been argued that's these goals are difficult to identify and are unrealistic. Furthermore, MBO does not consider the environment in which the goals are set such as availability of resources and stakeholders. MBO is both document and time consuming, as this model requires numerous meetings that are artefact intensive. Moreover, it develops conflicting objectives when there are multiple departments involved. MBO has been faulted as it rewards a punishment based approach on employees. Notably, MBO has to be systematically conducted and there is no stimulation of innovation with this model (Deming, 2013; Hoffmann-Burdzińska and Flak, 2016). Therefore, Drucker's interpretation may be counterproductive and not a good indication of business value.

Value chain was introduced as a network of activities that an organisation performs in order to create value for its customers (Porter, 1990, 1985a; Porter and Heppelmann, 2015). The goal of these activities was to create a profit that exceeded the cost of providing a product and thus generated value (Porter, 1990, 1985a). However, the data required to implement a value chain is contained within an organisations financial cycle. This is problematic for long-term strategic decision-making as future costs, market prices, and future capital investments are difficult to predict (Hoque, 2005; Institute of Management Accountants, 1996). Furthermore, identifying cost and revenue for each link of the value chain is difficult, as there are no prescribed methods to identify them (Hoque, 2005; Institute of Management Accountants, 1996). Moreover, the scale and scope of value chain analysis are large in size and time-consuming to implement (Merchant, 2012). The format of the value chain is oriented towards manufacturing types of organisations and is difficult to adapt to other types of industries (Merchant, 2012). Case studies show that value chain analysis resulted in resistance from staff (Hoque, 2005; Institute of Management Accountants, 1996). Finally, although value chain is popular within academia, industry usage has been shown to be low (Merchant, 2012). Therefore, these problems indicate that value chain is not a good indication of value.

The balanced scorecard was developed as a performance assessment framework to provide organisations with a balanced view of their performance (Kaplan and Norton, 2007; Lawrie and Cobbold, 2004; Muralidharan, 2004). However, academics have criticised the balanced scorecard for lack of citations and theoretical evidence (Lingle and Schiemann, 1996; Malina and Selto, 2001;

Nørreklit, 2000; Schneiderman, 1999). Importantly, the academic community has argued that the balanced scored is financially biased and does not appropriately consider intangible, social, and political aspects (Andersen and Lawrie, 2002; Kong, 2010; Neely, 2007). These problems indicate that the balanced scorecard may not provide a good indication of value.

As demonstrated above, all the business value models have strengths and weaknesses (Simmons, 1998). However, this research adopts and extends the RBV description (introduced in section 1.3), which states that *business value is an output condition created by valuable resources. A resource is valuable if it increases product differentiation, decreases the cost of production or improves efficiency and effectiveness strategies that place an organisation in a favourable position* (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997). This definition aligns with both the theoretical framework and the aim of this study. Introduced earlier, *tangible* resources which are physical assets (commodities) that can be easily purchased in the open market (Barney, 1991; Bergvall-Kåreborn et al., 2009; Schöenherr, 2009). Some researchers classify tangible resources into *financial resources*, i.e. items that appear on financial statements and depreciate over time, *physical resources* such as buildings or machinery, and *organisational resources* such as productivity gains, increased revenue, resource cost savings, or hardware cost savings (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). *Intangible* resources have no physical presence and cannot be purchased (Wade and Hulland, 2004). For instance, capabilities, practices, enhanced user experience, increased customer satisfaction, brand power, as well as items that are amortized are intangible forms of value. Notably, intangible resources may be derived from tangible resources. For instance, innovative patents, may be derived from an organisations technology systems (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). Intangible resources are embedded in unique patterns of routines, and hence problematic for competitors to imitate (Hitt et al., 2016).

It is helpful for organisations to classify and understand resources in terms of tangible and intangible concepts. Researchers state that both the tangible and intangible resources contribute to different aspects of organisational strategy (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). RBV states that tangible resources are a source of short-term value, whereas intangible resources is a source of long-term value (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). For instance, during periods of crisis, tangible acquisitions such as the procurement of modern technologies could provide organisations with improved profitability due to faster processing times, however, intangible changes such as process re-engineering may be required for long-term sustainability. Furthermore, during these crisis periods, tangible resources are considered more flexible, and can be easily converted into cash, whereas intangible resources such as the organisational brand help maintain its relationship with loyal customers. Distinguishing between tangible and intangible resources, assists organisations to develop frameworks to assess their strengths and weaknesses, as well as decompose business problems to improve performance (Falkenreck and Wagner, 2007; Kraaijenbrink et al., 2010). This distinction assists organisations to better understand their internal resources (Connor, 2002). Moreover, intangible resources assist organisations by increasing product differentiation, decreasing the cost of production, or improving efficiency and effectiveness strategies that place an organisation in a favourable business position (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997).

Finally, this theoretical framework recognises characteristics such as rareness, and competitive superiority that create competitive advantage (Collis and Montgomery, 2008). Hence, organisations can develop strategies and make decisions based on this insight regarding the tangible and intangible value that could be attained (Medini and Bourey, 2012; Panetto et al., 2016; Walker et al., 2016).

Although both tangible and intangible resources play important roles in contributing to organisational strategies, literature reveals that intangible resources are favoured over intangible resources. RBV empirical research reveals that intangible resources contribute more to organisational success and performance than tangible resources (Foon, 2011; Kamasak, 2017; Kumlu, 2014). Intangible resources have the potential to improve the earning power of organisations in conjunction with its tangible assets (Foon, 2011; Kamasak, 2017; Kumlu, 2014). Intangible resources such as intellectual property, patents, and copyrights are difficult to imitate, and hence more valuable than tangible resources such as building and machinery that can be obtained by competitors (Foon, 2011; Kamasak, 2017; Kumlu, 2014).

However, researchers have raised concerns relating to intangible resources. These include the acknowledgement of intangible resources within organisational financial statements (Lohrey et al., 2017). Researchers have argued that organisations have not identified the various types of intangible resources with their establishments, and have hence not recognised the value generated from them (Lohrey et al., 2017). Furthermore, organisations have not standardised techniques to appraise intangible resources. This has resulted in subjective and incorrect valuations of intangible resources (Foon, 2011; Kamasak, 2017; Kumlu, 2014).

Furthermore, the overall RBV framework has also been extensively criticised as it is based on a static environment and not aligned with business reality (Connor, 2002; Kraaijenbrink et al., 2010; Ludwig and Pemberton, 2011; Miller and Ross, 2003). RBV focuses on the internal components of an organisation and does not consider external market conditions (Kraaijenbrink et al., 2010). RBV has been further criticised for its application of *infinite regress*, where organisations that have expert capabilities can be surpassed by competitors that can develop and improve those capabilities (Collis, 1994; Priem and Butler, 2001a, 2001b).

The subsequent section discusses concerns from literature.

2.7 Concerns emerging from the EA literature

Figure 2.1, introduced earlier in this chapter, illustrated the mechanisms and the benefits obtained from EA. A comparison of the different benefits shows a high agreement among researchers that EA produces a wide range of intangible benefits. Apart from cost reduction (Bernard, 2012; Kappelman et al., 2016; Niemi and Pekkola, 2016; Wan et al., 2013), few tangible outcomes were found in the studies. Specifically, the type of cost reduction was a *lower ROI on technology investments* (Kappelman et al., 2016; Ross et al., 2006). These articles show that as an intangible resource, EA is primarily a source of long-term value; however, some short-term benefits are achievable.

This first concern with the shortlisted articles was vague problem statements. The papers had to be examined in detail to understand the actual problem being addressed. Furthermore, the aims and objectives were not clearly articulated up front. For example, the article *Big Data Analytics: A key capability for competitive advantage* (Bedeley and Nemati, 2014) commenced with the phrase, *the impact of Big Data Analytics (BDA) on a firm's competitive advantage* without clarity of the problem statement. With the article *Designing Company-wide Information Systems: Risk Factors and Coping Strategies* (Segars and Grover, 1996), the problem statements and objectives emerged through the paper. Moreover, none of the papers provided background information on the participants or research settings.

The next concern relates to the rationale of the research choices for articles. No reasons were provided as to why particular methods or instruments were appropriate for the specific types of studies. Moreover, the concern extended to the lack of detail with the design and procedures used for the papers. As the design procedures were described as a high-level, replicating the study by another researcher would be difficult. Another concern was the lack of discussion on reliability and validity measures. Specifically, the validity of measures was not discussed at all in any of the papers. The cited references for each of the selected papers were also reviewed. The majority of the references were relevant to the EA problem under investigation, and were sourced from reputable academic journals. Notably, the article *How does enterprise architecture add value to organisations?* (Tamm et al., 2011) contains several non-academic references such as *Infosys EA Surveys* that were included in the research.

Further confusion relates to the use of different terminology to describe the same concept. For example the term, *business-IT alignment* (Ross et al., 2006) was also referred to as *organisational alignment* (Tamm et al., 2015, 2011), *bridge between the business and technical domains* (Pereira and Sousa, 2004) or *the link between organisational and IS strategies* (Segars and Grover, 1996) by different authors to describe the same (or similar) concept.

In analysing the articles, it was found that some papers such as *An Introduction to Enterprise Architecture* (Bernard, 2012) focused directly on EA as a resource and blueprint, whereas other papers such as *Enterprise Architecture as Strategy - Creating a Foundation for Business Execution* (Ross et al., 2006) focused on EA as a capability and practice. It is important to understand this distinction as the former focuses on the actual resource and the latter highlights the managerial and people impact of EA. This distinction is made in, *The Theory of the Growth of the Firm* (Penrose, 1959) and discussed earlier.

Interestingly, the review shows that different supporting theory and mechanisms can result in the same forms of value. Illustrated in Figure 2.1, *improved customer insight* can be the result of *data quality* (Bedeley and Nemati, 2014; Ross et al., 2006) or *business-IT alignment* (Ross et al., 2006). Another observation from the review was that the EA mechanisms were vastly different, with no rationale or reasoning as to why particular mechanisms were used or why they bridge theoretical gaps. Notably, the article *The effect of the resource based view on decisions in supply management* (Bohnenkamp, 2013) argued that proposing mechanisms are problematic due to the vast range of mechanisms available to operationalise a resource.

The following section summarises this chapter.

2.8 Summary of Literature Review

This chapter analysed literature pertaining to the concepts of *RBV, EA*, *maturit*y, and *business value* in order to support the research question of the way that EA maturity influences business value. It introduced the SLR approach to identify and analyse influential literature concerning these concepts (Armitage and Keeble-Allen, 2008; Cochrane Collaboration, 2018; Higgins and Green, 2014; Tranfield et al., 2003).

RBV was discussed as the theoretical framework underpinning this research, as it helped explain the way intangible resources influence value (Amit and Schoemaker, 1993; Burton and Rycroft-Malone, 2014; Dawson and Watson, 2005; Seddon, 2014; Tamm et al., 2011). Contending theories to RBV (Bea and Haas, 2013; Douma and Schreuder, 2013; Ludwig and Pemberton, 2011; Teece et al., 1997), as well as its strengths and weaknesses, were also discussed (Collis, 1994; Connor, 2002; Falkenreck and Wagner, 2007; Kraaijenbrink et al., 2010; Ludwig and Pemberton, 2011; Priem and Butler, 2001b, 2001a).

A background and historical overview of EA as well as dominant EA frameworks were introduced. An analysis of Zachman Framework, FEA, GEAF, DoDAF, TEAF and TOGAF was presented (Browning, 2014; Cameron and Mcmillan, 2013; Department of Defense, 2010; Federal government of the United States, 2013; Harrison, 2013; Lapkin et al., 2008; Rouhani et al., 2013; Sessions, 2007; Urbaczewski and Mrdalj, 2006; US Office of Management and Budget, 2012; Zachman, 2012). TOGAF was selected as the reference EA framework for this research, as it contained balanced business, application, technology and data domains that were comprehensive and flexible (Cabrera et al., 2016; Esmaeil Zadeh et al., 2012; Rouhani et al., 2015, 2013; Sessions, 2007; Van't Wout et al., 2010).

A maturity model was introduced as a framework defining progression towards an improved state, using successive levels, by means of a structured approach (Becker et al., 2010; Maslow, 1955; Paulk et al., 2006; Röglinger et al., 2012). Dominant models such as QMMG, Stages of Growth and CMM (Aiken et al., 2007; Crosby, 1979; Curtis et al., 2009; Peter Gottschalk, 2002; Petter Gottschalk, 2002; King and Kraemer, 1984; Nolan, 1979; Paulk et al., 2006)were introduced. It was shown that CMM was used as a blueprint to derive other maturity models (Burnstein et al., 1996; Paulk et al., 2006; Van Steenbergen et al., 2010), including several for EA maturity. One of these derived models, ACMM, was selected as a reference for this research, as it contained appropriate mechanisms that were relevant to evaluate the EA practices to determine maturity levels (De Carvalho et al., 2016b, 2016a, 2015; Op ’t Land et al., 2009; van Der Raadt et al., 2005).

A debate on the concept and definition of business value from literature was introduced (Amit and Zott, 2001; Brandenburger and Stuart, 1996; Chatain and Mindruta, 2017; Chesbrough, 2012; Hwang and Christensen, 2008; Kashyap et al., 2017; Mooney et al., 1996; Sorescu et al., 2011). The arguments described the concept of business value as obscure, controversial, unclear, inadequate, inconsistent and nebulous (Bannister and Remenyi, 2000; Cronk and Fitzgerald, 1999; Encyclopedia.com, 2017; King and McClure, 2014).

Business value definitions from econometric, process, and perception models, as well as MBO, value chain, balanced scorecard, and RBV were examined (Barney, 1991; Cronk and Fitzgerald, 1999; Drucker, 1954; Drucker et al., 2015; Kaplan and Norton, 2007; Keyes-Pearce, 2005; Porter, 1990, 1985b). Although all these business value models had strengths and weaknesses, the RBV description that *business value is an output condition created by valuable resources. A resource is valuable if it increases product differentiation, decreases the cost of production, or improves efficiency and effectiveness strategies that place an organisation in a favourable position* (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997) was selected as it aligned with both the theoretical framework and the aims of this study. The next section introduces the research approach selected for this study.

Chapter 3: Research Methodology

This chapter introduces the underlying philosophy, approach, purpose, and strategy adopted for this study. Research choices, times frames, as well as the techniques and procedures are outlined in this chapter.

3.1 Introduction

Chapter 1 introduced this study by providing a background to the key concepts of EA, maturity and business value. It further introduced the RBV theoretical framework as well as the statement of the problem and research questions. Chapter 2 analysed important studies from literature pertaining to these key concepts.

This chapter presents the research methodology, a “framework associated with a particular set of paradigmatic assumptions made when conducting research” (O’Leary, 2004, p. 85). The research methodology has to align to the objectives of the study, and have the ability to be replicated by other researchers (Glatthorn et al., 2005). Importantly, the research methodology adopted is an important aspect to increase the rationality of a study (Creswell, 2017b). Illustrated in Figure 3.1 below, this study adopted the idea of the ‘research onion’, to describe the philosophy, approaches, strategies, time horizons and the data collection methods in the form of an onion, depicting the stages of a research process (Saunders et al., 2016).

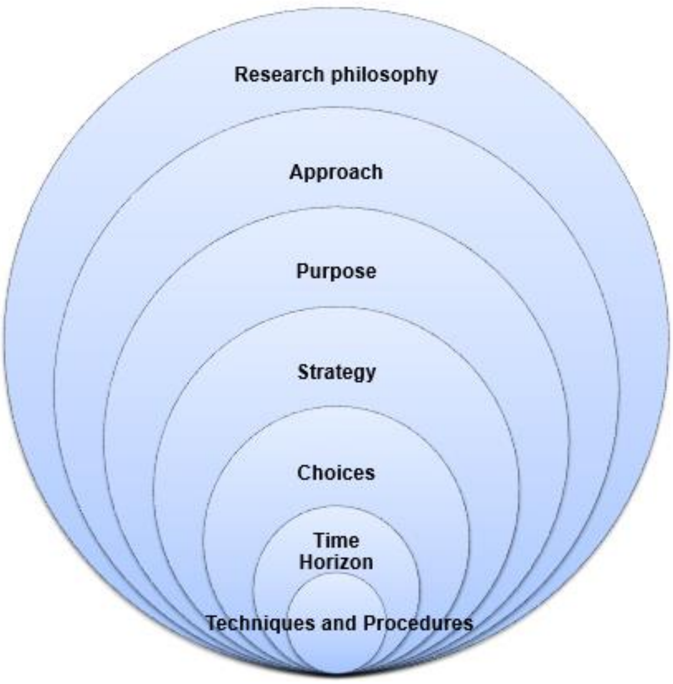

Figure 3.1: Research Onion

Source: Adapted from (Saunders et al., 2016)

Research *philosophy* forms the outermost layer of the research onion, and is related to the development and understanding of knowledge (Saunders et al., 2016). Critical realism, an emerging middle ground philosophy, was selected for this research as it is suitable for studies that explore mechanisms behind events, and involve data collection, as well as understanding and interpretation of data (Archer et al., 2013, 1998; Bhaskar, 2015; Fletcher, 2016; O'Mahoney and Vincent, 2014; Sayer, 2000b, 2000a). The next layer of the research onion, the research *approach,* ,is based on the appropriateness to answer the research questions (Bryman and Bell, 2015). This research built a middle range theory using a qualitative approach. The research *purpose* entails the outcomes obtained by the research questions as well as the way that the results are used (Yin, 2013). Furthermore, the research *strategy* involves the overall plan to answer the research questions (Saunders et al., 2016). Aspects of descriptive, exploratory, and explanatory research *choices* were adopted for this research within a case study strategy. Multiple qualitative research *techniques* in the form of semi-structured individual interviews and artefacts were used to collect data for this study. A cross-sectional *time horizon* allowed the comparison of different population groups at a single point in time for this study (Saunders et al., 2016). The innermost layer of the research onion includes the *techniques and procedures*. The data collection was conducted across three settings, and included business and IT participants. The data analysis strategy comprised of thematic analysis to identify themes in the data (Braun and Clarke, 2008). Reliability and validity are standards that were adhered to ensure data quality in this research (Saunders et al., 2016).

Details of the research philosophy follow in the next section.

3.2 Philosophy

A **philosophy** is an over-arching understanding of the development of knowledge and the nature of that knowledge (Saunders et al., 2016). It involves "how a researcher views the world, their assumptions about human knowledge and about the nature of the realities encountered, shape how a research question is understood and the associated research design" (Saunders and Tosey, 2012, p. 58). It includes the set of beliefs concerning the nature of the reality being investigated (Bryman and Bell, 2015). It further examines knowledge creation and corroboration (Saunders et al., 2016). Philosophies are shaped by *ontological, epistemological* and *axiological* questions (Lincoln and Guba, 2007).

Ontology concerns itself with the fundamental nature of existence, where there is no right or wrong answer as different people view topics differently depending on their background, role, or values (Dilts and Delozier, 2009). It is the study of being or existence (Saunders et al., 2016) and addresses deep questions such as *what is existence?* and, *what is the nature of existence?* (Bryman, 2008; Bryman and Bell, 2015).

Epistemology studies the nature of knowledge, the rationality of belief, and justification (Bateson, 1987; Moser, 2009; Schnegg, 2015). It involves the different *methods* of discovering the truth (based on the ontology) as well as the relationship between the researcher and the reality being studied. It is concerned with questions such as *what do you know?* and *how do you know it?* (Saunders et al., 2016). **Axiology**, enclosed by epistemology, refers to the role of values and ethics within the research process (Saunders et al., 2016). It describes how researchers deal with both their own values as well as those of the research participants (Carter and Little, 2007; Denzin and Lincoln, 2011; Lincoln and Guba, 2007). These concepts were applied to the subsequent sections of this research. Dominant philosophies are *positivism, interpretivism,* and *critical realism* (Fletcher, 2016; Gorski, 2013).

Positivism views reality as an objective topic where knowledge is observable and measurable (Hammersley, 2014; Lather, 2006). It is an empirical, quantitative perspective, based on natural phenomena, their properties, and relations. Furthermore, it views information derived from sensory experience and interpreted through reason and logic, as the primary source of all authoritative knowledge (Macionis and Gerber, 2013). Although not essential, this perspective commonly relies on hypothesis testing (deducted from theory) to determine if relationships are generalisable to a population (Balnaves, Mark And Caputi, 2001; Remenyi and Williams, 1995). The strength of this philosophy is that generalisations can be easily made across different settings and population groups (Onwuegbuzie et al., 2014). Moreover, due to the quantitative approach, future predictions can be made (Onwuegbuzie et al., 2014). Furthermore, positivist studies typically adhere to a defined structure during the research process. This structure provides a smaller variance for error which subsequently results in a more accurate study (Hammersley, 2014; Lather, 2006; Trochim and Donnelly, 2006; Trochim, 2015). This philosophy further saves time as data can be quickly gathered from large volumes of people (Cohen et al., 2007).

Although positivist approaches are valuable within IS research, it has been criticised as it does not accurately represent behaviour and human social action (Bullock, 1999; Lancaster, 2005; Ramanathan, 2008). Scholars argue that objective inferences and conclusions can only be made if the researcher is objective and disregards their emotions. These scholars debate that human behaviour naturally comes with emotional responses, and there is no guarantee this does not influence a study (Bullock, 1999; Cohen et al., 2007; Lancaster, 2005; Ramanathan, 2008). Scholars debate that positivism studies are inflexible, due to the focus on measurement and calculations (Bullock, 1999; Cohen et al., 2007; Lancaster, 2005; Ramanathan, 2008). Moreover, "positivists see things as they are and tend to disregard unexplained phenomenon" (Denzin and Lincoln, 2011, p. 59). These scholars argue that positivism studies reduce lateral thinking, and decrease solving problems creatively (Bullock, 1999; Denzin and Lincoln, 2011; Lancaster, 2005; Ramanathan, 2008). Finally, scholars argued that although generalisation is a benefit of positivism, a general understanding of a situation is not helpful within a particular context, as it is too abstract and broad for a direct application to a specific local situation (Onwuegbuzie et al., 2014).

Interpretivism views reality as a subjective topic where knowledge is generated from observing, interpreting, and understanding the details of a situation (Ormston et al., 2013; Remenyi and Williams, 1995). Interpretivist research is generally qualitative, and uses methods such as unstructured interviews or participant observations. Researchers have a high degree of involvement and interaction with participants (or situation), and practice *verstehen* (meaningful acting) whereby they interpret a situation “by putting themselves in the shoes” of the participants (Macionis and Gerber, 2013; Monette, 2014, p. 40).

This perspective is suitable for complex social or business situations where the intentions, motivations, and influences of people or organisations need to be understood (Ormston et al., 2013; Remenyi and Williams, 1995). Furthermore, it is comprehensive and provides depth and insights to a situation in order to understand what is really occurring. The predicament of this benefit is that these studies cannot be easily generalised or transferred due to the in-depth nature and narrow focus of interpretivism research (Ormston et al., 2013; Remenyi and Williams, 1995). These studies have been further criticised for their high subjectivity. This subjectivity creates a situation for researcher bias, which could undermine the reliability of a study (Ormston et al., 2013; Remenyi and Williams, 1995). The low structure and lack of statistical methods have been further criticised (Bullock, 1999; Lancaster, 2005; Ramanathan, 2008).

Critical realism is regarded as an emerging middle ground philosophy between positivism and interpretivism (Archer et al., 2013, 1998; Sayer, 2000a, 2000b) that acknowledges both objective and subjective reality (Bhaskar, 2015; Fletcher, 2016; O’Mahoney and Vincent, 2014), and does not adhere to any specific theoretical framework (Easton, 2010). The term critical realism can be decomposed into two constituent components, *critical* and *realism* (Archer et al., 1998; Bhaskar, 2015; Fletcher, 2016; O’Mahoney and Vincent, 2014). The *critical* component refers to an *epistemic fallacy*, the concept of analysing ontological statements (what exists) in terms of epistemological statements (what can be known or understood). The epistemic fallacy is due to the separation of knowledge (epistemology) from existence (ontology). The *realism* component refers to the existence of real mechanisms (underlying structures or causes) which shape events (Archer et al., 1998; Bhaskar, 2015; Fletcher, 2016; O’Mahoney and Vincent, 2014). Critical realism states that society and culture are produced by human activities (agency). Therefore, society is continuously changing due to the dynamic nature of human actions (Archer et al., 2013, 1998; Bhaskar, 2015; Fletcher, 2016; O’Mahoney and Vincent, 2014). Hence, there is a mutually influential relationship where humans shape society, which again affects human activities (Bhaskar, 2015).

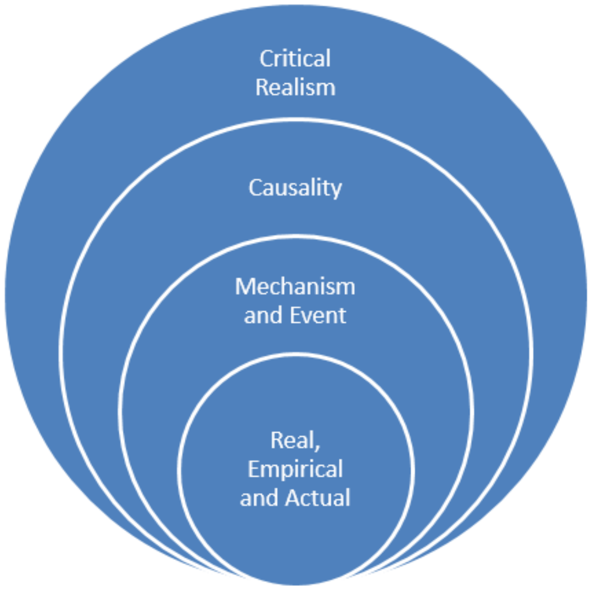

Figure 3.2: Overlapping Layers of Critical Realism

Source: adapted from (Bhaskar, 2015; Mingers and Willcocks, 2004)

As critical realism does not have any predictive power, it is used for explanatory reasons. Illustrated in Figure 3.2, *causality* assists with explanations by connecting concepts in order to understand cause and effect as well as deeply assess the relationships between input and output variables (Yin, 2013). This helped distinguish causal events from coincidental events and correlations (Hammersley, 2014; Mingers et al., 2013; Mohr, 1999). Mechanisms allow a researcher to understand unobservable underlying factors that may indirectly influence a result. They are an important feature of critical realism, as it explores the underlying cause of observed events to explain their emergence (Sayer, 2000b). Society, according to this perspective, can be understood if people realise the mechanisms that generate events. It requires a deep understanding of a social situation, beyond the observable, as well an understanding of the mechanisms behind an event. It states that reality (unobservable structures) is independent of human thought and influences observable events (Archer et al., 2013; Fletcher, 2016; Healy and Perry, 2000; O'Mahoney and Vincent, 2014). This is important to this study as it allows the researcher to distinguish between an event and the mechanisms (structures) that cause it (Bhaskar, 2015; Deming, 2013; Fletcher, 2016).

This philosophy is further viewed within another three layers. The *actual* layer includes the actual events generated by the mechanisms, the *empirical* layer includes observable experiences, and the *real* layer includes the underlying mechanisms that have produced the actual events (Linder and Cantrell, 2000; Mingers, 2004; Mingers et al., 2013; Mingers and Willcocks, 2004). The actual, empirical, and real layers address causality within critical realism (Mingers et al., 2013; Raduescu and Vessey, 2009). Importantly, this ontology of three layers enables scholars to research beyond empirically observed events, and analyse causal mechanisms within the real layer that influence those events. This is a significant differentiator of critical realism, as positivism and interpretivism are comprised of linear ontologies that only operate within the empirical layer (Mingers et al., 2013; Raduescu and Vessey, 2009).

The critical realism perspective states that people experience sensations and images of things in the real world, as opposed to things directly. It views primary qualities of objects such as numbers, facts, figures (independent of any observer) as accurately represented by our senses, and the secondary qualities of objects such as taste and sensations (dependent on the observer) as not accurately represented by our senses (Bhaskar, 2015; Fletcher, 2016; O'Mahoney and Vincent, 2014). This perspective states that reality exists, however, it cannot be fully apprehended (Guba, 1990). Furthermore, it states that perceptions have a degree of flexibility and that there are differences between reality and people's perceptions of reality (Churchland, 2015). Within critical realism, reality extends beyond the self and consciousness, and is not fully discoverable (Bisman, 2010).

As previously discussed in Chapter 1 (section 1.3), this study intended to understand the mechanisms that helped translate EA into value, as well as the forms of value attained. Hence the critical realism philosophy was selected for this study to help understand the EA mechanisms that lead to business value. It allowed the uncovering of insights to help explain the forms of benefits, opportunities, and challenges that organisations experience as they move through higher levels of maturity (Burton et al., 2014; Burton and Rycroft-Malone, 2014). Moreover, this study required a scientific approach to the development of EA knowledge that entailed the collection of data as well as the understanding of that data (Fletcher, 2016; O'Mahoney and Vincent, 2014). Critical realism provided the structure to collect rich data and convert it into developed theoretical descriptions and explanations and deep understanding (Burton and Rycroft-Malone, 2014; Kontos and Poland, 2009; Pawson et al., 2005; Pawson and Tilley, 1997). Finally, it applied "the theoretical foundations of RBV to develop insights into why organisations engage in improvement work, the impact and extent of outcomes, opportunities and challenges" that organisations experience through stages of improvement (Burton and Rycroft-Malone, 2014, p. 1). Hence, the critical realism philosophy underpinned this research, as it helped to comprehend the mechanisms underlying EA value, and provided insights into the way that EA maturity influences business value within the South African financial services environment. The RBV operationalisation approach (sections 1.3 and 2.3.5) is supported within a critical realism philosophy (Belfrage and Hauf, 2017; Dobson, 2012; Oliver, 2011; Pather and Remenyi, 2004).

Although literature states that the strength of critical realism in qualitative research is its ability to, "render complexity intelligible, its descriptive and explanatory focus, its reconciliation of organisational and structural factors, and its ability to recognise the existence of wider knowledge while respecting the importance of social meaning to humans" (Given, 2008, p. 168), it must be noted that research underpinned by critical realism has been criticised as "provisional, fallible, incomplete, and extendable" (Carlsson, 2005, p. 281). This is due to it representing a version of reality (i.e. it is not a complete representation of reality) as well as imperfect human behaviour (Fletcher, 2016; Given, 2008; O'Mahoney and Vincent, 2014).

The next layer of the ‘research onion’ is the research approach, and follows in the subsequent subsection.

3.3 Approach

There are two typologies that can be applied to research (Bryman and Bell, 2015; Saunders et al., 2016). The first relates to the *qualitative* and *quantitative* approaches, and the second typology to *deductive* and *inductive* approaches. The selection of these approaches is based on their appropriateness to answer the research questions (Bryman and Bell, 2015).

Quantitative research commonly focuses on the measurement and analysis of relationships between variables (Mack et al., 2011). This approach typically uses structured methods such as closed questionnaires and surveys to elicit and categorise responses, quantify variations, predict relationships, or describe characteristics of a population. It uses numerical data obtained by assigning number values to responses (Mack et al., 2011). Finally, this approach is subject to statistical assumptions and conditions (Mack et al., 2011). Qualitative research commonly seeks to confirm hypotheses about phenomena (Balnaves, Mark And Caputi, 2001) and is generally associated with a **deductive** research approach, however, these are not absolute (Lodico et al., 2013; Neuman, 2014). With such an approach, a researcher tests a theory (or hypotheses) and designs a strategy in order to examine its formulation (Saunders et al., 2016). This research approach is predominately applied to research areas where there are pre-defined theories available (Saunders et al., 2016).

Conversely, **qualitative** research is a free-form research approach that is used to gain insight into the underlying issues surrounding a research problem by gathering non-statistical feedback and opinions rooted in people's feelings, attitudes, and perceptions (Creswell, 2017b; Ormston et al., 2013). This form of research provides a deeper understanding of an environment, based on a sample of participants, using interactive data collection methods that allow concerns and perceptions to be explored (Denzin and Lincoln, 2011). Qualitative research is generally associated with an **inductive** approach, however, this is not absolute (Lodico et al., 2013; Neuman, 2014). Inductive approaches are used in building a theory*,* whereby a researcher collects data in order to develop a theory (Saunders et al., 2016). This research approach is often applied to research areas where there are inadequate theories available, or a discipline seeks theories and structures (Saunders et al., 2016).

A **middle range** theory incorporates both inductive and deductive thinking (Pollitt, 2013; Tilley and Pawson, 2000). It is defined as “logically interconnected sets of propositions that lie between concrete hypotheses and all-inclusive systematic efforts to explain all observed phenomena” (Hassan and Lowry, 2015, p. 2). This theory explains a specific set of phenomena and is limited in scope, as opposed to a grand theory (Gregory et al., 2009) that seeks to explain phenomena at a societal level (Boudon, 1991; Merton, 2007, 1968). Middle range theories integrate propositions, concepts and strategies, and theoretical empirical research (Merton, 2007, 1968; Pollitt, 2013; Tilley and Pawson, 2000). It is beneficial as it “focuses attention on the scope of research and gives legitimacy to the study of partial aspects of the complex organisation phenomenon” (Beres and Price, 1980, p. 258).

Notably, **abduction** (retroduction) is a form of logical inference that pursues the simplest and most likely explanation. It entails determining a precondition to explain a conclusion (Dobson, 2012; Eastwood et al., 2014; Thagard and Shelley, 1997).

In a conference *Trends in Enterprise Architecture Research*, it was debated that quantitative research approaches are not suitable for examining and reporting rich, contextual data, concerning the organisational benefits of EA (Lankhorst, 2013b). Qualitative research, however, provides a deep understanding of the influence of EA maturity on business value (Beres and Price, 1980; Boudon, 1991; Danermark et al., 2002; Gregory et al., 2009; Merton, 1968; Smith, 2010).

Hence, this research built **a middle range theory** using a **qualitative** approach. Aspects of abduction were applied to this study. These approaches supported the **critical realism** philosophy (Dobson, 1999; Downward et al., 2002; Downward and Mearman, 2007; Maxwell and Mittapalli, 2010; Pollitt, 2013; Thomas, 2006; Tilley and Pawson, 2000) selected for this study by generating qualitative insights on EA maturity (Burton et al., 2014; Burton and Rycroft-Malone, 2014) and focusing on the underlying mechanisms that lead to business value (Healy and Perry, 2000). Critical realism aligns to a middle range theory by providing explanations of “demi-regularities” of resources, inputs, and the influence on outputs (Burton and Rycroft-Malone, 2014, p. 1). The *middle range* approach was suitable for this research as it generated meanings from the data collected in order to recognise patterns and relationships to build a theory. Moreover, ACMM mechanisms were used to initiate components of this study. This approach supported the critical realism philosophy, whereby patterns, resemblances, and regularities in experience, were observed in order to reach conclusions, and to generate theory (Miles et al., 2014; Saunders et al., 2016). The theory was built by studying the data in order to provide a deep understanding of the influence of EA maturity on business value (Beres and Price, 1980; Boudon, 1991; Danermark et al., 2002; Gregory et al., 2009; Merton, 1968; Smith, 2010). *Qualitative* research is associated with a middle range research approach whereby a theory is built in order to understand and explain a bounded problem from different perspectives (Easterby-Smith et al., 2009; Gray, 2014; Pollitt, 2013; Tilley and Pawson, 2000). The qualitative approach provided “richness, depth, density and the contextual embedding of data with critical realism” (Bisman, 2010, p. 10). This approach was suitable for this study as it strived to understand the underlying mechanisms that influence business value within critical realism (Healy and Perry, 2000). Hence, qualitative data gathering methods consisting of individual interviews and the collection of artefacts were selected for this study (Mingers et al., 2013; Sayer, 2000a, 2000b; Wynn and Williams, 2012).

The research purpose is the third layer of the ‘research onion’ and is introduced in the next subsection.

3.4 Purpose

The research purpose clearly articulates the study intent and the outcomes expected by a researcher (Saunders et al., 2016). The research purpose entails the outcomes that can be obtained by research questions as well as the way that the results intend to be used (Yin, 2013). This intent can be achieved with **descriptive research** that accurately describes the profile of participants, events or situations, and is used in cases where the research problem is structured and recognised (Saunders et al., 2016). Descriptive research is designed to provide systematic information, data or characteristics about a population or social phenomenon being studied (Shields and Rangarajan, 2013). **Exploratory research** aims to gather as much information as possible on a research discipline situation and can also meet this intent (Yin, 2013). It involves investigating what is occurring in order to understand, ask questions, and evaluate new occurrences (Robson, 2016). Moreover, exploratory research can be easily modified by expanding or concentrating a viewpoint to adapt to a situation (Adams and Schvaneveldt, 1991). This type of research is generally conducted when a problem has not been clearly defined (Shields and Rangarajan, 2013). Finally, **explanatory research** analyses 'cause and effect' relationships (Yin, 2013). It studies a problem or situation in order to generate relationships between variables (Saunders et al., 2016). Descriptive, exploratory, and explanatory research are supported within critical realism studies (Burton et al., 2014; Easton, 2010).

The primary research question, *In what way does EA maturity influence business value?,* as well as the sub-questions, *What are the levels of EA maturity within the South African financial services environment?; What are the granularities of EA in use within the South African financial services environment?;* and *What are the tangible and intangible forms of business value influenced by EA heterogeneity?* All contain characteristics of descriptive, exploratory, and explanatory research in order to understand the mechanisms of EA maturity that influence business value, and as well as the ways that the results can be used to extend RBV. Utilising all three types of research in a study can help create better quality data and greater insights (Burton et al., 2014; Shields and Rangarajan, 2013).

The research strategy is the fourth layer of the 'research onion' and follows in the subsequent section.

3.5 Strategy

The research strategy is the overall plan to answer the research questions (Saunders et al., 2016). It specifies the data collection methods based on the research questions, research objectives, and the literature review (Saunders et al., 2016).

An **experiment** is a strategy that involves a scientific test to determine if changing an independent variable affects another dependent variable (Hakim, 2000; Saunders et al., 2016). **Surveys** aim to collect large volumes of data from specific population groups and align them to quantitative data collection methods (Saunders et al., 2016). **Action research** involves an interactive inquiry where a researcher actively participates in a change situation while conducting research (Brannick and Coghlan, 2007; Saunders et al., 2016). **Grounded theory** is defined as “the discovery of theory from data systematically obtained from social research” with the aim “to generate or discover a theory” (Glaser and Strauss, 1967, p. 2). Theory is developed during the data collection process, whereby the theory is built from data or is grounded in the data (Neuman, 2014). It includes the construction of theory through the analysis of data (Martin and Turner, 1986; Yancey et al., 2016) and procedures to develop conceptual categories (Strauss and Corbin, 2015). This strategy is appropriate for studies exploring contextual factors that affect social relationships and behaviour of individuals (Crooks, 2011). It is appropriate for studies that aim to understand the underlying causes to help resolve the participant's concerns (Strauss and Corbin, 2015). Conceptualization and operationalisation occur simultaneously with data collection and preliminary data analysis and a researcher must be open to the unexpected.

A **case study** is an empirical investigation of a specific situation with real-life participants. It is regarded as a form of qualitative descriptive research that deeply studies and draws conclusions about that situation and those participants, as opposed to a wide statistical survey that focuses on generalisations and cause-effect relationships. It focuses on explorations and descriptions of a situation (Becker et al., 2005; Robson, 2016; Yin, 2013). The term case study can refer to single or multiple case studies as sources of evidence (Yin, 2013) and involves studying single or multiple cases concurrently or consecutively in order to assess an issue (Crowe et al., 2011). Notably, case study results have been criticised for their *low external validity*, as their generalisation to a wider population is limited and replication of results are difficult (Miles et al., 2014; Miles and Huberman, 1994; Yin, 2013). Furthermore, determining cause-effect relationships are problematic (Miles et al., 2014; Miles and Huberman, 1994; Yin, 2013). Proponents of case studies have, however, argued that researchers should select situations and sites that have a broad representativeness and applicability (Yin, 2013). Case studies are typically based on the observation, analysis, and interpretation of qualitative data, generally conducted by an individual researcher. Hence, there is wide scope for researcher *bias* and subjective feelings that could influence results (Miles et al., 2014; Miles and Huberman, 1994; Yin, 2013). This research used artefact data to minimise distortion by the interaction of the researcher and participant (Corbetta, 2003). Another suggestion is that case study should be defined as a research strategy, an empirical inquiry that investigates a phenomenon within its real-life context. However, a case study was suitable for this research as it aligned with the qualitative research questions that were descriptive, exploratory, and explanatory in nature (Yin, 2013). They are an acceptable research method within the critical realism research philosophy (Easton, 2010; Miles et al., 2014; Miles and Huberman, 1994; Wynn and Williams, 2012). A case study provided the context for this study to understand the way organisations move through levels of maturity (Burton et al., 2014). Furthermore, a case study provided rich data for in-depth analysis (Yin, 2013), to help answer the primary research question, *In what way does EA maturity influence business value?,* to obtain an in-depth understanding of the types of tangible and intangible forms of value that organisations experience, as they progress towards higher levels of EA maturity. Similarly, the case study facilitated the answering of the remaining sub-research questions. Moreover, the case study provided high internal validity to this research as it delivered a more complete understanding of the organisation and permitted multiple sources of data. The case study furthermore provided a holistic and realistic account of the context (Miles et al., 2014; Wynn and Williams, 2012). A case study was suitable for this research as it built a mid-range theory to understand the bounded problem of identifying the underlying mechanisms of EA's influence on business value at the various maturity levels.

The choice of research follows in the subsequent section. This is the fifth layer of the research process selected for this study.

3.6 Research Choices

Research techniques include **mono** or **multiple** methodological choices. A mono selection is a mutually exclusive research choice, comprising of either a qualitative or quantitative technique. A multiple selection choice comprises of (Saunders et al., 2016):

- a combination of qualitative and quantitative techniques;
- multiple qualitative techniques; or
- multiple quantitative techniques.

This research adopted multiple qualitative techniques to collect data in the form of semi-structured individual interviews and artefacts. This choice was appropriate for this study, as the interviews helped gain a deeper understanding of the ways that EA maturity influenced business value. Artefacts were collected to provide further insights into the responses from the interviews (Denzin and Lincoln, 2011). The time horizon for this study, the sixth layer, follows in the subsequent section.

3.7 Time horizon

Time horizon can be categorised based on the period dimension of research (Saunders et al., 2016). It should be based on the appropriateness to answer the research questions (Saunders et al., 2016).
Longitudinal research studies a phenomenon or makes comparisons over a period of time. With this approach, researchers conduct several observations of the same environment over a long period of time (Saunders et al., 2016). **Cross-sectional** research studies a phenomenon at a specific point in time, typically studying different individuals with similar characteristics (Saunders et al., 2016). A cross-sectional study was conducted for this research as it allowed the comparison of different population groups at a single point in time (Saunders et al., 2016). This was appropriate for this study as the business and IT landscape is in a state of rapid change and constant evolution (Dutta et al., 2015; Santana et al., 2016). Comparisons at a single point in time provided the stability required to gather rich data for this study to deeply understand the constructs of EA, maturity, and business value within a time-bound scope, without long-term disruptions (Rindfleisch et al., 2008; Robson, 2016; Saint-Germain, 2016). It further allowed the in-depth understanding of the underlying mechanisms of the constructs within a point in time, from dispersed organisations, business units, and participants (Levin,

2006; Rindfleisch et al., 2008; Robson, 2016; Saint-Germain, 2016). Data on attitudes and behaviours were also rapidly gathered to support the critical realism philosophy and qualitative approach (Sayer, 2000a). The data gathered could be used by other researchers for longer-term studies (Leech and Haug, 2015). Importantly, the researcher also had time limitations with regard to accessing the participants (Robson, 2016).

Hence the different business unit maturities and their impact on business value were studied at the present point in time (Saunders et al., 2016).

The techniques and procedures adopted for this study follow in the next section.

3.8 Techniques and procedures

The previous sections of this chapter peeled the layers of Saunder's research onion (Saunders et al., 2016). The selections made in each of these layers influenced the data collection and analysis methods selected for this research.

As critical realism is an emerging middle ground philosophy between positivism and interpretivism, (Archer et al., 2013; Bhaskar, 2015; Fletcher, 2016; O'Mahoney and Vincent, 2014; Sayer, 2000b), it does not have its own body of techniques and procedures, but rather draws these from other paradigms (Dobson, 2012; Eastwood et al., 2014; Mingers et al., 2013; Sayer, 2000a; Thagard and Shelley, 1997; Wynn and Williams, 2012).

The following subsections describe these data collection and analysis techniques and procedures.

3.8.1 Data Collection and Sources of Data

Data collection is the process of gathering information from a variety of sources to obtain a comprehensive and accurate picture of an area of research. It captures relevant evidence that is translated into rich data which is used for analysis (Miles et al., 2014). The research setting is the environment in which a study is conducted (Yin, 2013). This study was conducted within the South African financial services sector. Sources of data include individual interviews and artefacts. This study primarily obtained data from these two sources to allow in-depth discussions of the data related to the core concepts of this study. The following section introduces the research setting for this study.

3.8.1.1 Research setting

Introduced above, a research setting is an environment in which a study is conducted (Yin, 2013). The South African financial services sector was selected for this study as it is highly regarded both nationally and internationally for its strong regulatory, compliance, risk and legal frameworks (Beck et al., 2016;

Blankson et al., 2017; Fosu, 2013; Luiz and Charalambous, 2009). Research suggests that although South Africa is classified as an emerging market, the banking system compares favourably to mature first world industrialised countries (Beck et al., 2016; Blankson et al., 2017; Fosu, 2013). Literature further reveals that:

- the 2015/2016 World Economic Forum Global Competitiveness Survey ranked South Africa 8th in Financial Sector Development from a sample of 140 countries (Dutta et al., 2015; Schwab et al., 2015).
- Lafferty, the largest independent international banking advisory group ranked two major South African Banks as part of the top 10 banks in the world consecutively in 2015 and 2016 respectively. The remaining major South African Banks featured within the top 100 banks in the world (Lafferty, 2016).

Hence, this sector is useful to both researchers and practitioners seeking to obtain deeper insight as to some of the reasons it is successful. It must, however, be noted that this research focused on business units of different sizes, complexities, and maturity levels within these banks to add to the richness of the study.

The following section details the individual interviews used for this research.

3.8.1.2 Individual interviews

Individual interviews are guided conversations that allow the researcher to ask a participant questions regarding the research topic in a fluid rather than rigid way (Yin, 2013). They offer researchers the chance to explore topics in-depth and to gain an appreciation of a subject area (Saunders et al., 2016; Sutcliffe and Sawyer, 2013). Individual semi-structured interviews were conducted for this study because they allowed for the collection and recording of complex responses (Collis and Hussey, 2013). Individual interviews further allowed full discussion and explanations of the questions and answers in order to understand the relationship between EA maturity and business value (Yin, 2013) while aligning to the critical realism philosophy selected for this study (Easton, 2010; Smith and Elgers, 2014). Notably, interviews are costly, time-consuming (setting up, interviewing, transcribing, analysing) and different researchers may understand, interpret, and transcribe interviews in different ways (Denzin and Lincoln, 2011; Merriam, 1998a).

An individual interview protocol, presented in Appendix 4, was designed to probe key questions around the central theme of this research. This interview protocol is based on ACMM mechanisms (Appendix 2) that were selected as a reference model for this study (Bernard and Grasso, 2009; Shahzada, 2010; Song and Song, 2010; Vahid and Moghaddam, 2006). As previously discussed, ACMM was selected as a reference for this study as it contains applicable mechanisms such as *processes, communication, business-IT alignment, senior management involvement, and finance* that is used to evaluate EA practices (De Carvalho et al., 2016b, 2015; Op 't Land et al., 2009; van Der Raadt et al., 2005). Part A of the protocol was structured to firstly assess the EA practices of a department based on the ACMM mechanisms. Subsequently, part B of the protocol was designed to then elicit the business value of each of these mechanisms.

A pre-test (small-scale trial of particular research components) of the interviews was conducted for this study to improve the reliability and validity of the results by testing the clarity of the research questions and the types of responses elicited (Mathison, 2011; Maxwell, 1992; Patton, 2015).

Participants representing different types of business and IT professionals were targeted for this research using a purposive sampling approach. A purposive sample is a non-probability sample that is selected based on the characteristics of a population and the objectives of a study (Bernard, 2015). The researcher identified participants such as chief information officers (CIO) that were senior technology executives, enterprise architects that were responsible for EA, junior IT specialists that were responsible for applications and technology infrastructure, chief executive officer's (CEO) responsible for overall managerial decisions, chief operating officer's (COO) responsible for day to day operations, business unit managers responsible for business unit functions and junior business specialists responsible for specialist operations, from major South African banks. Illustrated in Table 3.1 below, these participants represent a strategic mix of business and IT practitioners that were relevant to this study to ensure that EA opinions were covered from both a business and IT perspectives, as well as junior and senior roles. In total, 56 people were identified to participate in the individual interviews. This table further illustrates that the participants were selected from 9 business units within the 3 banks.

Table 3.1: Table for individual interviews

	Bank A				Bank B				Bank C				
Role	**BU1**	**BU2**	**BU3**	**Total**	**BU1**	**BU2**	**BU3**	**Total**	**BU1**	**BU2**	**BU3**	**Total**	
CIO	2	1	2	**5**	1	1	1	**3**	1	1	1	**3**	11
Enterprise Architect	2	1	2	**5**	0	1	2	**3**	0	1	1	**2**	10
Junior IT specialist	3	2	1	**6**	1	1	1	**3**	0	0	0	**0**	9
CEO/COO	2	1	1	**4**	0	0	1	**1**	1	1	1	**3**	8
Business manager	2	1	2	**5**	1	1	1	**3**	1	1	1	**3**	11
Junior business specialist	2	2	2	**6**	1	0	0	**1**	0	0	0	**0**	7
	13	8	10	**31**	4	4	6	**14**	3	4	4	**11**	56

In order to increase the reliability of the findings from the interviews, artefacts were collected from participants (Baskerville and Myers, 2015; Yeasmin and Rahman, 2012).

3.8.1.3 Collection of Artefacts

An artefact is a tangible, physical specimen, created within the normal course of activities in the workplace environment (Bernard, 2015; Campbell, 1999). It is developed for purposes other than a study, but can be used by a researcher for cognitive purposes (Corbetta, 2003). Examples of artefacts include *texts* such as emails, policy and procedure manuals, performance appraisals, sales reports, brochures, annual reports, design specifications, employment application forms, *visuals* such as organisational charts, logos, photographs, screen captures, drawings and *audio or video* tapes such as training films, voice messages, and helpline conversations (Bernard, 2015; Campbell, 1999).

For this study, artefacts such as requirement documents, architectural diagrams, design diagrams, and technical specifications were collected and critically analysed. These artefacts were used to provide further insights and depth, in the form of any contradictions or inconsistencies from the interviews. Artefacts are beneficial because they can be used to corroborate and augment evidence from various sources during qualitative research (Yin, 2013). Furthermore, the artefact data is not subject to distortion due to the interaction between the researcher and the participant (Corbetta, 2003). However, researchers also argue that artefacts could have weaknesses in terms of accuracy and completeness of the data (Patton, 2015).

Importantly, there are sensitive issues related to intellectual property, competitiveness, legalities and privacy, when using artefacts from the workplace for research. A researcher has to consider these issues but still obtain quality information from artefacts (Campbell, 1999). Literature (Cassell and Symon, 1994) states that researchers must request special permission to view these artefacts. Permission must also be requested to take copies of the artefacts. If permission is not granted to take copies, a researcher may request on-site only access to the artefacts, using a form for documenting information on the artefacts rather than simply taking notes, and record contextual information about the artefact on the form such as the artefact's creator, date of creation, the number of review cycles resulting in this version of the artefact, and the technology used to create the artefact (Campbell, 1999).

Due to sensitivities, the artefacts were studied on-site, using an artefact form, presented in Appendix 15 for some business units. The form was completed on site by the researcher and was executed in conjunction with the interviews (Campbell, 1999). This form also aligned to the ACMM mechanisms (Appendix 2) and the TOGAF (Harrison, 2013) reference frameworks selected for this study, as well as artefact types identified from literature (Bernard, 2012; Noran and Bernus, 2008). Moreover, the artefacts were studied for quality, usability, accuracy, completeness, and conciseness (Lee et al., 2002).

The following section presents the data analysis strategy that was used in this study.

3.8.2 Data analysis strategy

Literature (Miles et al., 2014; Miles and Huberman, 1994) describes data analysis as a process of data reduction, data display and conclusions. The following strategy was applied to the analysis of individual interviews and artefacts.

3.8.2.1 Data management

Data management was designed to maintain, as much as possible, the participants' ideas from the individual interviews, as well as to permit on-going analysis (Patton, 2015). As previously stated, interviews were recorded using a tape recorder, with permission from the participants (Mathison, 2011; Maxwell, 1992). Furthermore, the researcher maintained abbreviated notes in a section of the interview protocol (Maxwell, 1992) called "interview comments" (see Appendix 4). These are referred to as "raw" field notes gathered from interviews (Patton, 2015). After each interview, the recordings and "raw" field notes were transcribed by the researcher into a notebook, referred to as "expanded" field notes (Miles et al., 2014; Miles and Huberman, 1994; Morse and Richards, 2012).

Artefacts were collected after each interview. In the instances where permission was denied, the artefact form was completed in conjunction with each individual interview. A log was maintained of all artefacts collected. Moreover, the physical artefacts collected were stored in a physical cabinet (Mathison, 2011; Maxwell, 1992). The technique used to analyse this data follows in the next section.

3.8.2.2 Thematic analysis

Thematic analysis is a method for "identifying, analysing, and reporting patterns (themes) within data" (Terry et al., 2017, p. 79). It is used within critical realism and qualitative research to reveal themes within the data (Daly et al., 1997; Miles et al., 2014; Miles and Huberman, 1994).

Themes are defined as patterns across datasets that are significant to a research problem (Daly et al., 1997; Terry et al., 2017). A *data set* is the transcribed data per participant from the interviews (Saldaña, 2016). Importantly, a theme is not determined by high frequency, but rather by occurrences and spaces across datasets (Terry et al., 2017). *A priori themes* are themes identified in advance, based on characteristics and definitions of the research topic from literature or a researcher's theoretical orientation (Bulmer, 1979; Maxwell, 2013; Ryan and Bernard, 2003; Strauss and Corbin, 2015). It must be noted that a researcher's judgement contributes to identifying themes and a priori themes (Braun and Clarke, 2006). Themes can occur at both a *semantic* and *latent* level (Boyatzis, 1998). Semantic themes identify explicit surface meanings and provide rich descriptions, however, do not identify the depth or complexity of the dataset. Latent themes identify underlying ideas, patterns, and assumptions, however, require an in-depth interpretation of the data (Boyatzis, 1998).

A *code* is the label assigned to particular pieces of datasets that contribute to a theme (Saldaña, 2016). A prominent researcher on this method stated that a "good code" captures the qualitative richness of a phenomenon (Boyatzis, 1998, p. 1). Codes help determine matches, frequencies, locations, occurrences, and relationships between themes (Guest, 2012). Coding is the process for developing themes within the data by searching for significant moments in the data and encoding it prior to interpretation (Boyatzis, 1998; Miles et al., 2014; Miles and Huberman, 1994). Hence a theme is the outcome of coding (Saldaña, 2016).

Thematic analysis supports the middle range theoretical approach selected for this study (Terry et al., 2017). Notably, thematic analysis supports an inductive data driven approach, where themes identified are linked to the data. With this approach, coding of data takes place without adhering to a preconceived (or predetermined) framework (Boyatzis, 1998). Thematic analysis also supports the deductive theory driven approach, which is less descriptive as it has to adhere to a preconceived framework (Crabtree et al., 1999).

Thematic analysis can entail *reflective* or *phenomenological* investigations. Reflective thematic analysis proceeds by reading transcribed data, identifying possible themes, comparing and contrasting themes as well as building theoretical models (Guest, 2012). Phenomenological thematic analysis subjectively focuses on the human experience with participant perceptions, feelings, and experiences as paramount to a study (Guest, 2012).

Qualitative and critical realism research acknowledges that researchers are inherently biased by their cultural experiences and worldviews. Hence, any bias within critical research needs to be acknowledged by the researcher (Bisman, 2010; Creswell, 2017b; Denzin and Lincoln, 2011; Sayer, 2000a, 2000b). Thematic analysis acknowledges a researcher as the tool of analysis, and requires a *reflexivity* journal be maintained. The reflexivity journal is a document containing memos and close reflections of potential findings and implications of a study (Creswell, 2017b).

It must be noted that thematic analysis differs from content analysis, which utilises predefined mutually exclusive categories to count the frequency of words, phrases, or themes (Terry et al., 2017).

Thematic analysis for this study commenced with the identification of **a priori themes** (Bulmer, 1979; Maxwell, 2013; Ryan and Bernard, 2003; Strauss and Corbin, 2015). A priori themes comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* (De Carvalho et al., 2016a, 2015; Op 't Land et al., 2009; van Der Raadt et al., 2005), were adopted from the ACMM mechanisms (Bulmer, 1979; Maxwell, 2013; Ryan and Bernard, 2003; Strauss and Corbin, 2015) to analyse EA practices. Thereafter, a **familiarisation of the data** (Braun and Clarke, 2008; Terry et al., 2017) by the researcher took place. During this step, data from the interview transcripts and artefacts were studied to become acquainted with their content.

Subsequently, **data coding** (Terry et al., 2017) took place. The coding step involved the production of initial codes from the data (Braun and Clarke, 2008; Terry et al., 2017). The codes had to be clear and concise in order to identify key features of the data that could be relevant to answering the research questions. Initially, manual coding was conducted on the datasets by highlighting text data in order to identify initial codes (Braun and Clarke, 2008; Terry et al., 2017). Thereafter, a software program, *Nvivo* was used to assist with automation, to help gain efficiencies in the coding (Bazeley, 2014; Bazeley and Jackson, 2013; Fereday and Muir-Cochrane, 2006; Gibbs, 2004; Guest et al., 2012; Paulus et al., 2017; Woods et al., 2016).

The subsequent step entailed **searching for themes** (Terry et al., 2017), that involved inspecting the codes and collated data in order to identify significant broader patterns of meaning, i.e. potential themes. It further involved organising, analysing, and examining data important to each potential theme, in order to determine the viability of each potential theme. These potential themes were developed into mind maps to help visualise and sort these codes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Once the codes were arranged into potential themes and visualisations developed, the next step, **reviewing themes**, involved a refinement by collapsing and decomposing the potential themes identified in the previous step. Thereafter, these refined themes were further fine-tuned through a process of thinking and deliberation. The initial codes were reviewed by re-reading all the data extracts that fitted into each theme to ensure they formed a coherent pattern. Reviewing themes (Terry et al., 2017) included inspecting the potential themes against the dataset to determine if it answers the research questions.

The final step captured the essence of each theme by **defining and naming** each theme (Braun and Clarke, 2008; Terry et al., 2017). This step involved a detailed analysis, scope and focus, naming, and 'story' of each theme. This step involved the final analysis and scribing. It entailed merging the analytic narrative and data extracts as well as contextualising the analysis in relation to existing literature. Furthermore, decisions were made on which themes made contributions to the understanding of the data (Braun and Clarke, 2008; Terry et al., 2017). Member checking took place by reverting to the original sample to check if the interpretation was an accurate representation (Braun and Clarke, 2008; Terry et al., 2017).

Using the above steps, a ***latent*, *middle range* and *reflective*** thematic analysis approach "captured the intricacies of meaning within the data" (Guest, 2012, p. 33), in order to assess the levels of EA maturity, and the granularity that EA domains used, to understand the tangible and intangible forms of value achieved as well as the challenges confronted by organisations as they progressed towards higher levels of maturity. The level of maturity was determined by evaluating and judging the EA practices, represented by processes, communication, business-IT alignment, senior management involvement, and finance mechanisms, as described by the participants from each business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The EA granularity was similarly determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from each business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

As discussed previously, a middle range approach was selected for this study as this research aimed to generate meanings from data collected in order to identify patterns and relationships to build a theory. Moreover, this approach supported critical realism whereby patterns, resemblances, and regularities in experience were observed in order to generate theory reach and conclusions (Miles et al., 2014; Saunders et al., 2016).

Thematic analysis was selected for this study as it is a flexible technique that supports the qualitative critical realism philosophy (Terry et al., 2017) and RBV theory (Lane et al., 2002). Importantly, as discussed above, thematic analysis enabled categories and themes to emerge from the data (Saldaña, 2016) that enabled the development of levels in order to answer the research questions. However, this high flexibility also made it challenging to focus on specific aspects of the data (Terry et al., 2017). Furthermore, reliability is a concern with thematic analysis as an extensive variety of interpretations could develop from the data (Guest, 2012). Reliability concerns are addressed in the subsequent section. The data quality considerations for this research follow.

3.8.3 Data Quality

Reliability and validity are standards in order to ensure data quality in research (Saunders et al., 2016). However, there are multiple views of reliability and validity both from a qualitative literature and critical realism perspective. Researchers may view reliability and validity from a quantitative perspective to find equivalents (Andrews, 1984; LeCompte and Goetz, 1982). The employment of descriptive language can be used by scholars to provide legitimacy for reliability and validity (Eisner, 1991; Lincoln and Guba, 2007; Marshall and Rossman, 2016). Finally, researchers may re-conceptualise reliability and validity using a set of evaluation criteria (Lather, 2003; Miles et al., 2014; Yin, 2013).

As critical realism is an emerging middle ground philosophy (Archer et al., 2013; Bhaskar, 2015; Fletcher, 2016; O'Mahoney and Vincent, 2014; Sayer, 2000b), there are no specific criteria to establish reliability and validity of findings (Mingers et al., 2013; Sayer, 2000b; Wynn and Williams, 2012). These criteria are a subject of debate in literature, with researchers arguing, "discussions are nevertheless challenging…the challenge stems from certain inherent contradictions and inconsistencies" (Smith and Johnston, 2014, p. 2). Hence different researchers adopt criteria from other paradigms (Easton, 2010; Johnston and Smith, 2008; Layder, 2011; Miles et al., 2014; Miles and Huberman, 1994; Porter, 2007). Furthermore, within a qualitative research framework, there are no statistical techniques to establish the reliability and validity of research findings (Andrews, 1984; Durrheim et al., 2010).

Synchronic and *inter-judge* reliability criteria, as well as *internal, triangulation, instrument, construct* and *transferability* validity criteria were adopted for this study (Easton, 2010; Layder, 2011; Miles and Huberman, 1994; Porter, 2007; Yin, 2013). Researchers further state that if similar patterns are established in data collection from different sources, the reliability and validity of the interpretations are enhanced (Miles et al., 2014; Yin, 2013). This research satisfied these criteria by comparing the thematic analysis data from the interviews and artefacts to search for patterns (Creswell and Miller, 2000; Merriam, 1998a, 1998b; Silverman, 2013). These criteria for reliability and validity are supported within critical realism research (Easton, 2010; Layder, 2011; Miles et al., 2014; Porter, 2007).

3.8.3.1 Reliability

Reliability is described as a study being "consistent and reasonably stable over time and across researchers and methods" (Miles and Huberman, 1994, p. 278). It refers to the extent to which a measure yields the same results after repeated trials (Carmines and Zeller, 1979; Yin, 2013). With regard to reliability from a critical realist perspective, literature states it "… is to collect observational data and report on observational conditions in as reliable a way as technology will permit… and to ensure that the observational conditions are accurately reported so that other scientists can replicate the results… the position we have outlined is a form of realism" (Ryan et al., 2002, pp. 16–18).

Moreover, reliability ensures that similar conclusions would be made by other researchers performing a similar study (Saunders et al., 2016). This study ensured **synchronic reliability**, the similarity of outcomes observed from multiple sources within a similar period by using a standardised interview protocol and artefact form (Baskerville and Myers, 2015; Kirk and Miller, 1986; Yin, 2013). These forms were used for multiple participants, after which similar patterns were investigated. Where discrepancies occurred, this research examined the reasons for these inconsistencies. Furthermore, this study ensured **inter-judge reliability**, the degree of agreement between coders, through discussions with the supervisor, presentation of early results at conferences, and participant discussions (DeVellis, 2003). The validity of this research was achieved as follows.

3.8.3.2 Validity

Literature states that validity "determines whether the research truly measures that which it was intended to measure and how truthful the research results are" (Lincoln and Guba, 2013, p. 300). It must be noted that within the critical realism paradigm, both quantitative and qualitative criteria are accepted as appropriate ways of determining validity (Bisman, 2010; Denzin and Lincoln, 2011). Hence, various authors (Creswell, 2017b; Hammersley, 2014; Lincoln and Guba, 2013; Patton, 2015; Yardley, 2000; Yin, 2013) have proposed competing validity measures (Burton-Jones, 2009; Healy and Perry, 2000; Miles and Huberman, 1994) for qualitative and critical realism research.

This study ensured **internal validity**, the credibility and authenticity of research (Miles and Huberman, 1994) by “applying pattern-seeking and matching methods across cases” (Yin, 2013, pp. 13–14). *Pattern matching* was achieved via themes generated from the thematic analysis, where patterns from the different participants and artefacts were checked (Yin, 2013). Analysis within and between interviews was conducted to increase the internal validity of the results (Merriam and Tisdell, 2015).

Triangulation, the “convergence of multiple sources of evidence” (Patton, 2015, p. 83) from different participants contributed to the internal validity of this research (Bhaskar, 1989; Bisman, 2010; Denzin and Lincoln, 2011; Guba, 1990). For critical realist qualitative research, triangulation from different data sources is used as a technique to demonstrate trustworthiness in the analysis (Bhaskar, 1989; Guba, 1990; Miles et al., 2014). It enhances a study to be rich, robust, comprehensive, and well-developed (Hammersley, 2014; Miles et al., 2014). Although consistently is valued, within critical realism, inconsistencies are not viewed as weakening evidence, but opportunity to uncover a deeper meaning in the data (Bisman, 2010; Patton, 2015). Hence, all inconsistencies, contradictions, and discrepancies were examined and acknowledged in this study.

Instrumental validity addresses whether generated observations from one instrument match those from an alternative measure (Kirk and Miller, 1986; Marshall and Rossman, 2016; Nunnally, 1978; Nunnally and Bernstein, 1994). Data from semi-structured individual interviews and artefacts were triangulated for this research. Similar patterns in the results from each method demonstrated the validity of these instruments (Denzin and Lincoln, 2011; Ragin, 2014; Trochim, 1989).

Construct validity was accomplished by the establishment of correctly defined and consistently applied operational measures for the concepts being studied (Kirk and Miller, 1986; Marshall and Rossman, 2016). This was achieved through the use of standardised protocols for the individual interviews and forms for the artefacts. Literature suggests that multiple sources of evidence encourage convergent lines of inquiry (Kirk and Miller, 1986; Marshall and Rossman, 2016). This was accomplished by a diverse sample of participants consisting of IT and business executives. Furthermore, discussions took place with selected participants to ensure accurate interpretations are made by the researcher in relation to their contribution (Bisman, 2010; Denzin and Lincoln, 2011).

Transferability seeks to understand if the conclusions of a study are transferable to other contexts (Kirk and Miller, 1986; Marshall and Rossman, 2016; Miles and Huberman, 1994; Patton, 2015). However, critical realist researchers state “the target for realist research is not the determination of an objective or generalisable truth but the achievement of the best we can do at the time i.e., practically adequate explanations” (Sayer, 2000b). Transferability with critical realism refers to a “probabilistic truth, rather than an absolute truth” (Bisman, 2010, p. 9). As critical realism does not have any predictive power, and is used for descriptive and explanatory benefits (Dobson et al., 2007; Dobson, 1999). It helps explain a specific environment, as opposed to producing universal generalisations (Archer et al., 2013; Bhaskar, 2015; O’Mahoney and Vincent, 2014; Ryan et al., 2002). Researchers elaborate that a rich, contextualised understanding of an environment is valuable as it could reveal higher-level concepts and theories that are not unique to an environment (Archer et al., 2013; Bhaskar, 2015; Glaser, 2008; Kerlinger, 1986, 1973; Misco, 2007). The use of multiple participants with different characteristics and observing for similarities within the outcomes, across business units with different degrees of complexity, led to some degree of empirical transferability across the financial services sector in South Africa, and theoretical transferability in the extension to the RBV of an organisation (Kirk and Miller, 1986; Marshall and Rossman, 2016; Patton, 2015; Yin, 2013).

3.8.3.3 Researcher bias

Literature states "qualitative research, which is an approach that acknowledges the researcher's subjectivity, requires that the "biases, motivations, interests or perspectives of the inquirer" are identified and made explicit throughout the study" (Lincoln and Guba, 2007, p. 290). Bias is when the results of a study were not obtained under the conditions of pure chance (Leedy and Ormrod, 2015). Bias occurs when a researcher performing a study influences the results, in order to portray a certain outcome (Leedy and Ormrod, 2015; Neuman, 2014). Individual interviews rely heavily on the skill of the interviewer and the quality of the results is heavily dependent on that factor (Leedy and Ormrod, 2015; Neuman, 2014). Furthermore, in essence, the interviewer becomes the measuring instrument and the accuracy is therefore questionable (Neuman, 2014). Biases exist with individual interviews due to its high-level of subjectivity and low level of control (Leedy and Ormrod, 2015; Neuman, 2014). Critical realism believes that researchers are inherently biased by their cultural experiences and worldviews. Hence, any bias within critical research needs to be acknowledged by the researcher declared in the researcher's ethical stance (Bisman, 2010; Denzin and Lincoln, 2011; Sayer, 2000b).

To reduce bias, a semi-structured interview with a standard interview protocol was used for this study (Leedy and Ormrod, 2015; Neuman, 2014). A *reflexivity* journal to document reflections of potential findings and implications of this research study was maintained (Creswell, 2017b). The researcher's ethical stance contributed to the quality of this research (Bernard, 2015; Mouton, 2011). This follows in the subsequent section.

3.8.3.4 Ethical considerations

Literature (Bernard, 2015) states ethics begins and ends with the researcher, and that the researcher's personal moral code is the strongest defence against unethical behaviour. **Researcher integrity** was maintained in this study by adhering to the highest technical standards for research and practice. The limits of the finding, as well as the methodological constraints that determine the validity of the findings, were disclosed. Finally, this study disclosed details of the methods and research designs that are relevant to interpretations of research findings (Bernard, 2015; Mouton, 2011). **Permission** to interview the participants was firstly obtained from the organisations where the research took place, as well as the university's ethics committee. Permission was also obtained from the participants prior to individual interviews. **Anonymity and confidentiality** ensured that the identity of an individual was kept secret (Bernard, 2015; Mouton, 2011). This study ensured that the organisations where the research takes place were anonymous, and were referred to as “Bank A”, Bank B” and “Bank C”.

The participant details were not recorded on the interview protocol, and remained anonymous. Data from this study was presented in the form of codes, which prevented the linking of participants or organisations to specific responses. **Informed consent** was obtained from all the participants. Moreover, the researcher communicated the aims of the study to the participants. The participants were further informed about the steps taken to maintain the anonymity of responses, the researcher’s contact details, and the process for receiving a copy of the results. These ethical considerations were adhered to, to the best of the researcher’s ability.

3.8.3.5 Assessment of trustworthiness

Literature suggests that trustworthy qualitative research needs to be based on “systematic collection of data, using acceptable research procedures, and allowing the procedures and findings to be open to systematic critical analysis from others” (Lincoln and Guba, 2013, p. 53).

A **thick description** entails having a detailed description of the research process showing how the researcher reached the conclusions. This assists other researchers to replicate the study and arrive at a similar general scheme (Lincoln and Guba, 2013). This study conducted an extensive literature review, provided a description of the research methodology, the qualitative research design, as well as a description of the data analysis strategy in the chapters of this research. The semi-structured individual interview protocols were also presented (Mathison, 2011; Maxwell, 1992; Patton, 2015). **Prolonged engagement** involves the researcher investing sufficient time to learn about the culture to be studied, detecting and minimising distortions that may slowly shape the data, and building trust with the participants (Lincoln and Guba, 2013). The researcher of this study has over 17 years of experience in the IT and business environment, with five of these years in an architecture role. Also, time was spent with the participants exchanging introductions prior to the individual interviews to build up trust with them (Lincoln and Guba, 2013). The time span for this study ranged over approximately 3 years. **Persistent observation** means identifying characteristics and elements relevant to the research (Lincoln and Guba, 2013). Persistent observation was demonstrated in this study through the diligent note taking in the form of “raw” field notes and recording of the individual interviews (Lincoln and Guba, 2013, p. 297). **Peer debriefing** involves exposing oneself to peers in a manner similar to that of an analytic session, to explore aspects that may be implicit in the researcher's mind (Creswell, 2017b; Lincoln and Guba, 2013). This was achieved with the assistance of the researcher’s colleague, of a similar status, who reviewed the research process, as well as the results of this study (Creswell, 2017a). Furthermore, presentations of early results took place at seminars and conferences. **Referential adequacy** is the use of mechanically recorded data such as tape recorders, videotapes, photographs (Lincoln and Guba, 2013). This study recorded all the interviews using a tape recorder in order to retain the original feedback from the individual interviews. Furthermore, a referencing system was set up in order to trace interview and artefact data back to the original source (Creswell, 2017a; Lincoln and Guba, 2013). The subsequent section concludes this chapter.

3.9 Conclusion

This chapter introduced the research methodology used for this research. This study adopted the idea of the 'research onion', to describe the philosophy, approaches, strategies, time horizons, and the data collection methods in the form of an onion, depicting the stages of a research process (Saunders et al., 2016). The *philosophy* formed the outermost layer of the research onion, and is related to the development and understanding of knowledge (Saunders et al., 2016). Critical realism, was selected for this research as it is suitable for studies that involved data collection, as well as understanding and interpretation of that data (Archer et al., 2013, 1998; Bhaskar, 2015; Fletcher, 2016; O'Mahoney and Vincent, 2014; Sayer, 2000b, 2000a). The next layer of the research onion was the research *approach*, which was based on the appropriateness to answer the research questions (Bryman and Bell, 2015). This research built a middle range theory using a qualitative approach. The research *purpose* entailed the outcomes obtained by the research questions as well as the way that the results were used (Yin, 2013). Furthermore, the research *strategy* involved the overall plan to answer the research questions (Saunders et al., 2016). Aspects of descriptive, exploratory, and explanatory research *choices* were adopted for this research within a case study strategy. Multiple qualitative research *techniques* in the form of semi-structured individual interviews and artefacts were used to collect data for this study. A cross-sectional *time horizon* allowed the comparison of different population groups at a single point in time for this study (Saunders et al., 2016). The innermost layer of the research onion included the *techniques and procedures*. The data collection was conducted across three settings and included senior business and IT leaders. The data analysis strategy comprised of thematic analysis to identify themes in the data (Braun and Clarke, 2008). Finally, reliability and validity, which are the standards that were adhered to ensure data quality, was discussed in this research (Saunders et al., 2016). The presentation of findings from the first case study follows.

Chapter 4: Presentation of Findings: Case Study 1

Examples of data evidence to support the findings from the first case study are introduced in this chapter.

4.1 Introduction

The previous chapter explained the interview sample selection as well as the characteristics of participants and settings. This chapter introduces data evidence from case study 1, referred to as Bank A in this research. Data from 3 business units of Bank A are introduced, within the following structure:

- presentation of findings from business unit 1;
- presentation of findings from business unit 2;
- presentation of findings from business unit 3.

For each of these business units, the data is organised in line with the research questions, i.e., *the levels of EA maturity, the EA granularity,* and *the tangible and intangible forms of value achieved from EA*. The data is presented in tabular form, comprising of *direct quotations*, to draw illustrative examples from the participants (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). The thematic analysis technique, introduced in the previous chapter, comprising of *familiarisation with the data, coding*, *searching for themes*, *reviewing themes*, as well as *defining and naming* steps, was applied to this section of the research (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). A software program, *Nvivo* was used to assist in the automation of coding and visualisation of themes (Bazeley, 2014; Bazeley and Jackson, 2013; Fereday and Muir-Cochrane, 2006; Gibbs, 2004; Guest et al., 2012). A contextualisation of Bank A follows.

4.1.1 Background to Case Study 1

Bank A is one of the oldest financial institutions in South Africa, and was established locally in the early 19th century. It is ranked as one of the largest banking groups in Southern Africa. Its head office is in Johannesburg, South Africa, and is listed on 8 stock exchanges across Africa. The bank has a further unlisted footprint across Europe and Asia. It provides banking and insurance to retail, commercial, corporate, and public-sector customers. The bank has assets close to R1 trillion, with headline earnings close to R11 billion. It employs approximately 32 000 permanent staff, with approximately 13 000 of these staff deployed within its technology areas (BankA, 2018; Fanta and Makina, 2017; Lafferty, 2016; SARB, 2018).

Bank A is comprised of independent business units that operate autonomously, referred to as a federated business model. These business units are structured in line with the services offered by the bank, such as home loans, credit cards, personal loans or investment business units. Although these business units are independent, their internal designs are similar, with each business unit having their own management structure including of a CEO, CIO, COO and CFO to support their internal functions of finance, human resources, operations, IT or other specialisations based on services offered. The sizes of these business units vary from approximately 50 to 800 staff (BankA, 2018; SARB, 2018).

Illustrated in Table 4.1 below, a total of 31 individuals were invited to participate in the interviews from 3 business units across Bank A. Fifteen people accepted and participated in the individual interviews, representing an acceptance rate of 48%.

Table 4.1: Participant selection

Bank A									
	Business Unit 1		**Business Unit 2**		**Business Unit 3**		**Total**		**Acceptance**
Role	Identified	Participated	Identified	Participated	Identified	Participated	Identified	Participated	
CIO/CTO/IT Head (A.BU.P1)	2	**1**	1	**1**	2	**1**	**5**	**3**	**60%**
Enterprise Architect (A.BU.P2)	2	**1**	1	**1**	2	**1**	**5**	**3**	**60%**
IT specialist (A.BU.P3)	3	**1**	2	**1**	1	**0**	**6**	**2**	**33%**
CEO/COO (A.BU.P4)	2	**1**	1	**1**	1	**0**	**4**	**2**	**50%**
Business manager (A.BU.P5)	2	**1**	1	**1**	2	**1**	**5**	**3**	**60%**
Business specialist (A.BU.P6)	2	**0**	2	**1**	2	**1**	**6**	**2**	**33%**
Total	**13**	**5**	**8**	**6**	**10**	**4**	**31**	**15**	**48%**

Due to the federated structure, the inception of EA at Bank A varied across the business units. Without being specifically asked, a participant commented on the relevance of this research *"EA empowers business and IT strategy, both today and tomorrow"* (A.BU1.P4.1). General comments from other participants can be found in Appendix 25. Their comments gave a clear indication of the importance and timely nature of this project. The next section presents the findings from the first business unit.

4.2 Presentation of Findings from Bank A, business unit 1

This section presents the data used to determine the EA maturity level, the EA granularity of refinement, as well as the tangible and intangible forms of value obtained from EA for Bank A, business unit 1 (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). Additional evidence from this business unit can be found in Appendix 16.

Business unit 1 was a specialist business unit that provided *data analytics, actuarial, quantitative, and statistical services* to other internal business units within Bank A. It was composed of approximately 100 staff, including of a CEO, CIO, CFO and HR head. The IT staff is responsible for decision systems, an analytics engine, a big data platform, credit bureau systems, and a data warehouse platform.

Business staff is responsible for developing credit scorecards, propensity models, quantitative models and statistical datasets. Illustrated in Table 4.1, a total of 13 people were invited to participate in the interviews from this business unit. Five people accepted and participated in the interviews, representing an acceptance rate of 38%. The participants were a mix of business and IT professionals from different levels of seniority.

The data used to determine the EA maturity level follows.

4.2.1 The level of EA maturity at Bank A, business unit 1

This subsection presents data related to the EA practices from the first business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part A of the interview protocol (Appendix 4) was used to gather this data. The level of maturity was determined by evaluating and judging the EA practices, represented by processes, communication, business-IT alignment, senior management involvement, and finance mechanisms, as described by the participants from this business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

Table 4.2: Mechanisms of EA

<table>
<tr><th>Mechanism</th><th>Evidence</th><th>Codes</th><th>Theme</th><th>Level</th></tr>
<tr><td rowspan="3">Processes</td><td>"our architectural processes are <u>connected</u> to all our key business and IT processes. We also have <u>architectural metrics</u>… personally <u>monitor</u> and produce <u>monthly reports</u> on our architecture progress to our risk committee and to our group CIO… its <u>entrenched</u> into this team. I'm a firm <u>supporter</u> in its benefits" (A.BU1.P1.1)</td><td>• Connected
• Architectural Metrics
• Monitor
• Monthly reports
• Entrenched
• Management support</td><td rowspan="3">Entrenched EA business practices used for simple and complex initiatives, that is monitored and continuously improved by management</td><td rowspan="3">The theme extends across levels 4 and 5 maturities</td></tr>
<tr><td>"for us, architecture is a combination of <u>practices</u> centred on driving <u>business value</u>. It varies from <u>simple</u> initiatives like using architecture to define unclear processes and looking for areas of improvement, or as <u>complex</u> as re-engineering the entire business strategy" (A.BU1.P4.1)</td><td>• Practices
• Business value
• Simple initiatives
• Complex initiatives</td></tr>
<tr><td>"are <u>well defined</u>, <u>consistently executed</u> and regularly evaluated… we strive to <u>continuously improve</u> our EA… its benefit to us cannot be overstated… <u>updated</u> as new changes go live" (A.BU1.P5.1)</td><td>• Well defined
• Consistently executed
• Continuous improvement
• Updated</td></tr>
<tr><td>Communication</td><td>"our architectural solutions reflect the <u>latest systems</u> that are in production, it's now <u>embedded</u> into our processes… <u>business requirement documents</u> and <u>business cases</u> are developed for every project… it's in <u>Archimate</u>" (A.BU1.P1.1)</td><td>• Latest systems
• Embedded
• Business requirements documents
• Business case
• Archimate</td><td>Comprehensive and updated target state documentation developed with an EA tool and</td><td>Theme extends across levels 4 and 5 maturities</td></tr>
</table>

Mechanism	Evidence	Codes	Theme	Level
	"target state documents for all applications and infrastructure… architecture documents developed with Archimate… measurements in place for monitoring" (A.BU1.P2.1)	• Target state documents • Archimate • Measurements • Monitoring	stored in the repository	
	"changed our habits… both functional requirements and non-functional requirements in place… data flow diagrams and data dictionary uses a standardised architectural pattern" (A.BU1.P3.1)	• Habits • Function requirements • Non-functional requirements • Standardised architectural pattern		
	"the entire department uses and has access to the architecture documents… architecture documents are stored on Archimate tool repository" (A.BU1.P4.1)	• Tool repository • Entire department • Access		
	"Architecture was discussed as a priority at the last strategy session…it was said that all projects have to be driven by architecture, no exception… now indoctrinated into the process… documents in the repository are up to date…all users get an alert when changes are made to the repository" (A.BU1.P5.1)	• Priority • All projects • Indoctrinated • Up to date • Repository		
Business-IT alignment	*"technical initiatives are selected from the project prioritisation forum…chaired by the business team using architectural documents as a reference" (A.BU1.P1.1)*	• Prioritisation • Business chair • Reference documents	Business driven technology solutions prioritised by business	Theme extends across levels 3 and 4 maturities
	"business drivers determine our technical roadmap" (A.BU1.P2.1)	• Business drivers		

Mechanism	Evidence	Codes	Theme	Level
	"monthly review of technical program by the CEO" (A.BU1.P3.1)	• Monthly review • CEO	stakeholders regularly	
	"business solution focused architecture that has modernised our environment… both technical and people environment" (A.BU1.P4.1)	• Business solution • Technical • People		
	"to get our architecture to this level was not a once off event… it required care… it bigger than a single event… we had to invest in it to make it sustainable… incorporate it into our day to day operations" (A.BU1.P5.1)	• Incorporate into daily operations		
Senior-Management Involvement	*"Manco are part of the architecture review board" (A.BU1.P1.1)*	• Management Committee • Architecture board	Architecture integrated into the business by involving management with the architecture board that approves all projects	Theme extends across levels 3 and 4 maturities
	"review board approves all projects and changes in scope" (A.BU1.P2.1)	• Review board approval		
	*"in the mid 2000s, this department was struggling with a number of things… on the surface we were profitable, but we had very high staff turnover issues, that was destabilizing the department. We were losing up to 5 staff a month thanks to management politics… and cumbersome processes. We had a number of interventions from ** (external consultancy company), one of those interventions was EA a few years back… I'm not saying the EA was the sole reason, but we have had stability since then… the architecture integrated into our processes, into our KPA's… that has changed our behaviour" (A.BU1.P3.1)*	• Stability • Integration • Behaviour		

Mechanism	Evidence	Codes	Theme	Level
	"architecture blueprints included in risk committee board pack" (A.BU1.P4.1)	• Risk committee board		
	"minutes of architecture board meeting sent to EXCO" (A.BU1.P5.1)	• Executive committee		
Finance	*"my view is that it is better to be consistently good than occasionally great… we have better measures in place for financial forecasting of both CAPEX and OPEX expenditure… we have standards and models for predictive budgeting… there is definitely better aligned with the business needs… our architectural processes helped us achieve this" (A.BU1.P1.1)*	• Measures • Financial forecasting • Predictive budgeting • Standards • Models • Aligned	Predictive and proactive financial models in place aligned and integrated into the business strategy	Theme extends across levels 4 and 5 maturities
	"gives us a competitive advantage by ensuring this department's IT expenditure is focused on the correct strategic core financial competencies… we have become much more proactive with our involvement in IT spend… we have architectural blueprints that now aid us" (A.BU1.P3.1)	• Focused • Proactive • Strategic • Involvement		
	"EA integrated into our strategy and core business activities… all capex procurement needs architectural signoff… we use Delphi techniques for project selection and ranking… more for the high-value procurement decisions… we also review the budget against the architecture forecast before any big IT procurement purchases… the CEO has to sign off any variances…. for about the last 2 years we	• Integrated • Strategy • Business • Delphi technique • High value procurement • Budget against architecture forecast • CEO sign off variances		

Mechanism	Evidence	Codes	Theme	Level
	evaluate our EA practices… focused on unlocking the value" *(A.BU1.P4.1)*	• Evaluate EA practices • Focused		

Illustrated in Table 4.2, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were adopted from the ACMM mechanisms to understand the EA practices (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result.

The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). This business unit had comprehensive and updated EA business practices that were continuously improved by management. Furthermore, senior management of this business unit were directly involved with the EA processes. They were proactively involved with the architecture board. This business unit distributed regular communications to their staff on the latest EA architecture development and standards. Furthermore, this business unit's finance department reviewed EA before any major purchases. Procurement of all IT systems took EA into account, with variances also requiring formal sign offs. For instance, technology upgrades were reviewed and budgeted based on the EA target state. The participants revealed that this business unit had predictive financial models as well as EA metrics that adjusted its annual budgeting and financial year end processes based on feedback from EA practices. Furthermore, this business unit had specific metrics evaluating its EA practices. This business unit used a specialised EA tool, "*Archimate*" to document and map its EA practices.

Artefacts from this business unit were analysed to confirm claims from the participants, as well as assess for quality and completeness using the artefacts collection procedure outlined in Chapter 3 (Bernard, 2015; Campbell, 1999). The artefacts were analysed on site due to data sensitivity concerns from the business unit, using the form in Appendix 15. Artefacts included business requirement documents, technical specifications, "as is" documents, target state documents, gap analysis, financial models, and data architecture models. An attempt was made to link these types of artefacts to the specific mechanisms; however, no reliable pattern could be established. This was due to the large variety of artefacts developed and structured according to the business unit specific services and functional requirements. However, this study eventually assessed the quality of artefacts and organised them into *current*, *transition,* and *future* state architectures (Harrison, 2013). The EA documentation and artefacts reviewed were of a high quality, up to date reflecting the latest production environments, and focused on the EA transition state.

Codes including *connected, practices, well defined, entrenched, consistently executed, continuous improvement* and *management support* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 16, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *entrenched EA business practices used for simple and complex initiatives, that is monitored and continuously improved by management; comprehensive and updated target state* *documentation developed with an EA tool and stored in the repository; business driven technology solutions prioritised by business stakeholders regularly; architecture integrated into the business by involving management with the architecture board that approves all projects* and *predictive and proactive financial models in place aligned and integrated into the business strategy* were developed.

Thereafter **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The themes of the *processes, communication, business-IT alignment, senior management involvement, and finance* mechanisms from this business unit were evaluated against the characteristics of the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). This business unit contained EA *processes* that were entrenched into the business practices and were continuously improved by management. It was found that the traits of this mechanism aligned to characteristics of practices extending across levels 4 and 5 maturities. Regarding the *communication* mechanism, this business unit incorporated comprehensive and updated documentation in the repository, which aligned to characteristics of practices extending across levels 4 and 5 maturities. *Business-IT alignment* was evident as business driven technology solutions were prioritised by business stakeholders, which aligned to characteristics of practices extending across levels 3 and 4 maturities. Furthermore, *senior management* was actively involved with EA practices as well as their architecture board, which aligned to the characteristics of practices extending across levels 3 and 4 maturities. Finally, predictive *financial* models were implemented, which aligned to characteristics of practices extending across levels 4 and 5 maturities. Overall, the EA practices within this business unit were characterised as being embedded into the department, as well as including metrics (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op ’t Land et al., 2009; Paulk et al., 2006).

The **defining and naming step** concluded the analysis with *entrenched, comprehensive and updated EA business practices that are well established and part of the business unit culture* used to describe this theme. Based on these evaluations, it was judged that **bank A, business unit 1** operated within **maturity level 4**.

Once the level had been established, the next step was to identify the EA granularity for this business unit, and follows in the next subsection.

4.2.2 EA granularity within Bank A, business unit 1

This subsection presents data related to the EA granularity in use. The granularity was determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from this business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The interview protocol (Appendix 4, Section A, questions 6-10) was structured to elicit these responses.

Table 4.3: EA granularity

Domains	Evidence	Codes	Theme	Granularity
Business	*"integrates the structure of this department in terms of its governance and processes. It includes our business objectives, goals, benefits, costs, and risks. It defines exactly what our department will deliver to support the bank's objectives… we are always incrementally planning for change" (A.BU1.P1.1)*	• Governance • Processes • Business objectives • Goals • Benefits • Costs • Risks • Incrementally planning for change	Focus on business needs and solutions as well as how they are obtained. Includes processes, objectives, goals, and the locations	Business architecture defined at a fine granularity of refinement
	"business domain centric design… we design around the business services, not the data… so for example, we design around the credit scoring process, or the customer setup process… and show the locations like the branch, service centre and head office where they are executed… management uses VUCA where we assess volatility, uncertainty, complexity and ambiguity of the market to understand disruptions" (A.BU1.P2.1)	• Business domain centric • Business services • Credit scoring process • Customer set up process • Locations • Volatility • Uncertainty • Complexity • Ambiguity		
	"we have the basic vision, mission and goals in place… but we are independent business units where our services represent business functions… each business unit has a specific focus. We have a mini value chain within each business unit… strong focus on innovation" (A.BU1.P3.1)	• Vision, mission, goals • Value chain • Innovation		

Domains	Evidence	Codes	Theme	Granularity
	"is more than a collection of blueprints… it is a practice…it provides solutions, not just models and blueprints" (A.BU1.P4.1)	• Practice • Solutions		
	"it broadly shows the business needs, and then how they are obtained and measured… it is made up of services that signify business functions" (A.BU1.P5.1)	• Business needs • How • Services		
Application	*"has evolved over the years… it has shifted from a series of quick win diagrams made up of cost savings in IT to a focus on decision-making, strategy execution and transformation" (A.BU1.P1.1)*	• Decision-making • Strategy execution • Transformation	A layered micro-services application architecture with the principles of high cohesion, low coupling, autonomy and single focus	Application architecture defined at a fine granularity of refinement
	"we are using a micro-services architecture… we have decomposed systems into the finest level of detail… it's all based on services… even processing a loan application form is a service function that is called… and the generating a reference number is another service that is called" (A.BU1.P2.1)	• Micro-services • Finest level of detail • Process loan application form • Generate reference number		
	"Principles of high cohesion are enforced… systems have to have a single focus and singe responsibility" (A.BU1.P3.1)	• High cohesion • Single focus • Single responsibility		
	"modularity… low coupling and autonomous systems that are independently changeable and independently deployable are mandatory for deployment" (A.BU1.P4.1)	• Modularity • Low coupling • Autonomous • Independently changeable • Independently deployable		
	"have a layered architecture, with services within each level… we start at the top player with requirements gathering to define	• Layered architecture • Services		

Domains	Evidence	Codes	Theme	Granularity
	that the business wants. Once the requirements are bedded down, we move to the next layer to source the technology… so the BRS would specify a cross sales need or a customer relationship improvement requirement. We would then source Microsoft CRM to match that requirement" (A.BU1.P5.1)	• Top layer requirements gathering • Source technology • Microsoft CRM		
Technology	*"stateless architecture, that caters for synchronous and asynchronous messaging is compulsory… everything has to be events based" (A.BU1.P1.1)*	• Stateless • Synchronous • Asynchronous • Events based	A hybrid cloud layered micro-services architecture that is stateless and resides in a container environment	Technology architecture defined at a fine granularity aligning of refinement
	"all our systems are virtualised… from our databases, storage, desktops, and networks" (A.BU1.P2.1)	• Virtualized		
	"we are using container technology for our services" (A.BU1.P3.1)	• Container technology		
	"Our objective is to fast track the cloud computing platform… we want a software-defined data centre, using IT as a service. This needs to be done for the whole bank. The rules engine to filter scoring rules has to be centralised for the group… we running on a Linux operating system at minimal cost… a service registry database is in place… applications mostly written in java… abundance of java developers" (A.BU1.P4.1)	• Fast track cloud computing • Software-defined data centre • IT as a service • Rules engine centralised • Linux • Registry • Java		
	"big migration to cloud technology… we have adopted SaaS, IaaS and PaaS… a hybrid cloud architecture with servers on premises that scale into the cloud… because its hybrid, our IBM servers will be scaled down" (A.BU1.P5.1)	• Hybrid cloud architecture • IBM servers		

Domains	Evidence	Codes	Theme	Granularity
Data	*"a few years ago, the sheer volume and variety of data that flowed through the different departments of the bank made it difficult to extract information and gain business insight… since we have implemented our new data architecture, we have common data formats, single view of the customer and just to name a few" (A.BU1.P1.1)*	• Volume • Variety • Common data format	A methodical data architecture focusing on principles of volume, velocity and variety, including logical and physical details. A big data strategy further in place.	Data architecture defined at a fine granularity of refinement
	"the structure of our department's logical and physical data assets… composed of models that determine which data is collected, and how it is used in the bank. We literately have hundreds of sources of data… even from social media… the data has it has to comply with various legislative requirements… we use Qlikview to consolidate" (A.BU1.P2.1)	• Logical • Physical • Models • How • Qlikview		
	"we introduced a new data architecture built around 3 principles. Volume, velocity and variety of data. Volume is the size of data, velocity to the speed of change and variety refers to the sources of data… forward thinking and progressive architecture" (A.BU1.P3.1)	• Volume • Velocity • Variety		
	"big data strategy in place… the department's approach is to get big by starting small… customers are leaving a detailed digital footprint… we want to separate the signal from the noise… have built our big data stack using Hadoop, Cassandra, HiveQL and Scoop, with open source technologies. We have to cross-sell and upsell with is the bank's strategy. Need access to the marketing consent and FICA status of the same customer to be	• Big data strategy • Hadoop • Cassandra • HiveQL • Cross-sell • Upsell • Marketing consent		

Domains	Evidence	Codes	Theme	Granularity
	compliant. Link to the FICA database and customer consent database. All links to the customer master file" (A.BU1.P5.1)	• FICA database		

Illustrated in Table 4.3, **a priori themes** (Strauss and Corbin, 2015) comprising of these domains were adopted from TOGAF (Harrison, 2013). This table lists the evidence collected that supported the codes within each domain, as well as the theme and granularity identified. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017).

Business architecture

This business unit contained the vision and mission statements that were embedded into the business unit culture, and was prevalent in the form of business unit slogans within the artefacts examined. Furthermore, the business unit had clearly defined its business goals and objectives. Principles such as *"incremental planning"* were also revealed. Moreover, business processes such as the *credit scoring process*, and the *customer set up process* were defined. Physical locations related to where the business processes were executed, such as, the *branch*, *service centre,* and *head office* was also specified. This business unit also defined internal focus themes such as *"innovations"*, that were further specified within the staff contract artefacts. The artefacts revealed staff role grids with generic job descriptions representing the staff design as well as how the various roles were defined. Detailed job roles such as *analyst programmer*, *project manager*, *actuarial team*, *credit team* were defined within the artefacts.

Application architecture

The application architecture had comprised of a layered micro-services hybrid cloud architecture designed with the principles of high cohesion, low coupling, autonomy, and a single focus. The results showed that various software architectural objectives, such as *"modularity",* principles such as *"decomposing programs into cohesive and loosely coupled modules to reduce complexity"* and functionality such as *"processing loan application forms"*, required to support the business were defined. Detailed functions such as *"generating a reference number"* were further specified.

Artefacts from this business unit had identified details specifying the way that the application functionality was built. The business unit categorised its applications into services and functional behavioural groups. This categorisation allowed this business unit to plan the design of target state applications before selecting and procuring the actual applications to fulfil those services, for instance, this business unit specified *"customer relationship system (CRM)"* as a function before procuring the actual vendor commercial product. Furthermore, the business unit had categorised and grouped vendors, such as *"IBM"*, *"Microsoft",* and *"Cisco"* by the functions that they performed. Additionally, implementation details such as cross dependencies between different vendor-applications were specified in the artefacts, for instance, cloud platform required a *"Cisco"* router to ensure the quality of service. Details such as the name and series of the components were defined. This helped the business unit to understand the way that the physical deployment was affected, and the functionality was defined in the artefacts.

Furthermore, this business unit specified the physical environment such as production environment and testing environment depicting where the software was deployed in its artefacts. It further detailed the version and instances of applications that resided within these environments.

Technology architecture

This business unit contained layered micro-service architecture. It followed a goal of a stateless design that resided within a hybrid cloud container environment. It had clearly defined technology objectives such as *"fast track cloud computing"*, and *"software-defined data centre"*, principles such as *"IT as a service"*, and functions such as *"rules engine to filter scoring rules"*. This business unit contained details that described the way that the technology was implemented. Technology components such as *"Linux"* describing the operating system classes and functions were also specified. The technology was further grouped into areas of focus such as platforms, databases, and warehouses. Vendor technology partners such as *"IBM"* were further articulated. Technology relationships and roles linking the technology to applications were detailed. Programming languages such as *"Java"* were specified in their architecture. Technology nodes such as backup server were further detailed.

Data architecture

The data architecture included goals such as the use of "*open source"* data technologies, and principles of *"volume"*, *"velocity"* and *"variety"*. The business unit had a clear big data strategy, with data technologies such as *"Hadoop", "Cassandra", "HiveQL" and "Scoop"* specified. Strategic data objectives such as the ability to as "*cross-sell and upsell"* products to customers were in place. This business unit had clearly defined its data functionality such as customer and product groups. For instance, artefacts showed a detailed architecture for the customer master file. This business unit additionally had views and attributes of its data. Data views such as the *"marketing consent"* and *"FICA status"* of the same customer was available from different departments. Data from specific applications such as *"Qlikview"* were available. The physical architecture of data stores such as "*FICA database"* and *"customer consent database"* was clearly designed.

Codes including *business domain centric, micro-services, layered architecture, hybrid cloud architecture, and volume* and *velocity* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 16, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes were namely; *focus on business needs and solutions as well as how they are obtained. Includes processes, objectives, goals, and the locations; a layered micro-services application architecture with the principles of high cohesion, low coupling, autonomy and single focus; a hybrid cloud layered micro-services architecture that is stateless and resides in a container environment* and *a methodical data architecture focusing on* *principles of volume, velocity and variety, including logical and physical details. A big data strategy further in place* identified.

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Bank A, business unit 1 specified its business architecture at a fine granularity of refinement as it articulated physical implementation details illustrating where its business processes were implemented, as well as the stakeholders that performed those processes. This business unit placed a strong focus on its business needs and solutions and further illustrated details showing the way that they were obtained. This business unit expressed its processes, objectives, goals, and the locations of its business value chain. The application architecture was also specified at a fine granularity of refinement, as it described the actual physical deployments and environments of its software. It was designed as a layered micro-services application architecture incorporating principles of high cohesion, low coupling, and autonomy. This business unit's technology architecture was specified at a fine granularity of refinement. It described where its technology was physically deployed. The technology architecture was designed as a hybrid cloud layered micro-services architecture that was stateless and that further resided in a container environment. The data architecture of this business unit was specified at a fine granularity of refinement. It defined where particular views of data were physically managed. It comprised of a methodical data architecture that focused on principles of volume, velocity, and variety. The data architecture included logical and physical details. A big data strategy was further in place. Based* on these evaluations, it was judged that **bank A, business unit 1** defined its overall EA at a **fine granularity of refinement**.

Once the granularity of refinement had been identified, the next step was to identify the business value of EA for this business unit, which commences below.

4.2.3 Business Value of EA from Bank A, business unit 1

This subsection presents data related to the business value of EA from the first business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part B of the interview protocol (Appendix 4), was used to collect this data. It was used to understand the value related to each EA mechanism that was perceived by the participants.

Table 4.4: Value of EA

Mechanism	Evidence	Codes	Theme	Value
Processes	*"our EA processes helped with <u>visualisation</u> of business and IT touch points across of the silos. It accelerated our <u>innovation</u> implementations… we are making more <u>agile decisions</u> more often… our architecture helps make that possible" (A.BU1.P1.1)*	• Visualisation • Innovation • Agile decisions	Improved decision-making processes experienced by the business unit as a result of EA	Benefits such as improved decision-making, innovation and insights were experienced within business unit A.1 as a result of EA
	"Value contribution is the most difficult to quantify. Financial models are available for our EA processes. An improvement in <u>business decision-making</u> has been the biggest benefit for me" (A.BU1.P2.1)	• Business decision-making		
	"My answer will not come close to telling the full story… bottom line is that there is value, but we don't necessarily have all the tools to quantify...we have some measurements, but have not conceived how to fully measure… I have seen an improvement in <u>proactive sales</u> like <u>cross-sell</u> and <u>upsell</u> opportunities, this gives us an <u>advantage</u> over Bank (C)" (A.BU1.P3.1)	• Proactive sales • Cross-sell • Upsell • Competitive advantage		
	"facilitates the <u>automation</u> of many repetitive tasks within the process workflows. The architecture enables process improvements like the removal of <u>blockages</u> and removal of <u>redundancy</u>. This translates into <u>improved decisions</u>, improved <u>customer insights</u> which give us value" (A.BU1.P4.1)	• Automation • Blockages • Redundancy • Improved decisions • Customer insights		
Communication	*"is not just about beautiful diagrams and artefacts… yes it contains a <u>current state, future state,</u> and <u>a transition plan</u>…but it's also about enabling <u>solutions</u>… it's an <u>approach</u>" (A.BU1.P1.1)*	• Current state • Future state • Transition plan • Solutions approach	EA helps the business unit create an approach to	

Mechanism	Evidence	Codes	Theme	Value
	"gives us the ability to integrate our data across the various business units in the bank, which improves our insights into customer behaviour… we hence do targeted communication based on customer behaviour" (A.BU1.P2.1)	• Integrate data • Insights • Customer behaviour • Targeted communication	enable innovative solutions, and better understand customer behaviour that reveals customer insights	
	"you know they say that you cannot sell unicorns!... architecture has to deliver value that can be measured… it took a few years to fine tune and quantify its value…. a platform to understand customer behaviour is the biggest benefit… personalised communication can then take place" (A.BU1.P3.1)	• Customer behaviour • Personalised communication		
	"My view is that architectural communication value is an articulation of the strategy solution. It the place action meets the business objectives" (A.BU1.P4.1)	• Strategy solution • Action • Business objectives		
Business-IT alignment	*"everything with architecture in our business can be traced back to the business objectives…. This prevents architecture becoming a sequence of separated technology experiments… the focus is on providing business solutions" (A.BU1.P1.1)*	• Business objectives • Business solutions	Innovative business solutions that are deployed faster, are experienced by the business unit due to EA	
	"proactive sales and service has been a focus of this department… we have actuarial models that allow us to offer alternative products from other business units to customers, our architecture helps us integrate with other business units that have completely different systems to achieve this" (A.BU1.P2.1)	• Proactive sales and service • Integration		
	"improving organisational agility, operating capabilities, innovation, and customer insights" (A.BU1.P3.1)	• Agility • Capabilities • Innovation		

Mechanism	Evidence	Codes	Theme	Value
		• Insights		
	"gives business the ability to adapt faster, deploy new products earlier and grab market share profits before Bank (B)" (A.BU1.P4.1)	• Adapt faster • Deploy earlier • Profits • Competitive advantage		
Senior-Management Involvement	*"the architecture enables cooperation and agreement amongst the managers on planning the tasks and activities to implement and execute the strategy… help improve the decisions with minimal conflict" (A.BU1.P1.1)*	• Cooperation • Agreement • Improve decisions • Minimal conflict	EA enables improved decision-making amongst senior management of the business unit	
	"EXCO doesn't understand technical details… and they don't need to… unfortunately, they are required to sponsor complex technical projects… the architecture diagrams are most valuable in improving their understanding and decision-making" (A.BU1.P2.1)	• Improved understanding • Improved decision-making		
	"triggered innovation amongst the MANCO team" (A.BU1.P3.1)	• Innovation		
	"enables management to identify the technical gaps that impact decision-making… innovation is another value add to management" (A.BU1.P4.1)	• Identify gaps • Innovation		
	"assists managers identify what is important to customers and how that customer experience can be improved" (A.BU1.P5.1)	• Customer needs • Customer experience		
Finance	*"our budgets are being squeezed with the current economic downturn…there is pressure for the IT department to rationalise its spend based on our ROI… the architecture helps demonstrate IT's ability to deliver a business competitive advantage… its ROI and link to the strategy" (A.BU1.P1.1)*	• ROI • Competitive advantage	EA helps the business unit improve ROI and clarify	

Mechanism	Evidence	Codes	Theme	Value
	"cleaner separation of capex and opex… it creates an unambiguous prioritisation process for the banks spending. EXCO is always concerned with IT spend" (A.BU1.P2.1)	• Clear capital expenditure • Clear operational expenditure • Prioritisation	prioritisation decisions	
	"enables target state budget planning and forecasts… clarify which gaps are most critical to prioritise" (A.BU1.P3.1)	• Target state budget planning • Target state forecasts • Clarify • Prioritisation		
	"architecture helps the finance team identify provide innovative solutions to technical problems, manage the risk and apportion the correct budget allocations to specific technologic solutions" (A.BU1.P4.1)	• Innovation • Risk • Budget allocations		
	"the roadmap and strategy helps synchronize the business and IT efforts in a single view" (A.BU1.P5.1)	• Synchronise business and IT • Single view		

Illustrated in Table 4.4, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were used to understand the EA practices, with the questions structured to obtain insights into the forms of value experienced for each of these mechanisms (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). **Codes** comprising of *business decision-making, visualisation, innovation, agile decisions, proactive sales* and *competitive advantage* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 16, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *improved decision-making processes experienced by the business unit as a result of EA; EA helps the business unit create an approach to enable innovative solutions, and better understand customer behaviour that reveals customer insights; innovative business solutions that are deployed faster are experienced by the business unit due to EA; EA enables improved decision-making amongst senior management of the business unit* and *EA helps the business unit improve ROI and clarify prioritisation decisions* were developed.

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Benefits such as improved decision-making, innovation and insights were experienced within business unit A.1 as a result of EA. EA assisted the business unit to improve their decision-making processes. Furthermore, it helped create an approach to foster innovative solutions, as well as the faster deployment of these solutions. A better understanding of their customer behaviour revealed insights for the business unit. Finally, EA helped the business unit improve their ROI, as well as clarify project prioritisation decisions.*

The next section presents findings from the second business unit within Bank A.

4.3 Presentation of Findings from Bank A, business unit 2

This section presents the data used to determine the EA maturity level, the EA granularity, as well as the tangible and intangible forms of value obtained from EA for Bank A, business unit 2 (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). Further evidence from this business unit can be found in Appendix 17.

The second business unit provided *home loan mortgage products* to customers of Bank A, requiring funds to purchase real estate property. The home loan products were structured to be repaid within specified periods and interest rates by customers to the bank A home loan product was regarded as a secured loan, as the property served as collateral to the bank (BankA, 2018). This business unit employed over 1000 permanent staff, including a CEO, CIO, CFO and HR head. Property brokers, agents, and consultants are also employed by this business unit through a commission payment model. The IT staff was responsible for the various home loan systems such as the origination system, commission system, and underwriting system. Business staff were responsible for risk profiling of customers, developing credit models, property valuations, and liaising with the reserve bank (BankA, 2018; SARB, 2018). Illustrated in Table 4.1, a total of 8 people were invited to participate in the interviews from this business unit. Six people accepted and participated in the interviews, representing an acceptance rate of 75%. The participants were a mix of business and IT professionals from different levels of seniority.

The data used to determine the EA maturity level follows.

4.3.1 The level of EA maturity at Bank A, business unit 2

This subsection presents data related to the EA practices from the second business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part A of the interview protocol (Appendix 4) was used to gather this data. The level of maturity was determined by judging the EA practices as described by the participants from this business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

Table 4.5: Mechanisms of EA

Mechanism	Evidence	Codes	Theme	Level
Processes	*"we have light blueprints of our systems... no future state yet, but we getting there" (A.BU2.P1.1)*	• Light blueprints • No future state	Simple EA blueprints being developed encompassing the current state environment, with an architect recently appointed	Theme concentrated within level 2 maturity
	"we have just nominated a staff member to own the architecture with clear responsibilities… trying to offset our reliance on one the developers with succession planning" (A.BU2.P2.1)	• Just nominated • Clear responsibilities • Reliance on developer		
	"the business is in a constant state of flux due to new product deployments and business demands… our architecture is in development, but one of the key features is that it facilitates the design of processes that are flexible with negligible costs. Processes can easily be customised to adapt to the flux" (A.BU2.P3.1)	• In development • Facilitates process design • Flexible processes • Negligible costs • Customised processes		
Communication	*"the basic use of architecture is a department imperative for all projects, across all teams… our architecture is relatively up to date with the latest system changes and our primary drive is improved communications between business and IT teams to improve our decision-making… we sometimes rely on one or two experts for help but are steadily fine tuning the architecture" (A.BU2.P1.1)*	• Imperative for all projects • Relatively updated • Improved communications • Reliance on a few experts	Essential communication takes place for all projects, with reliance on a few experts to execute. Basic EA artefacts comprising of current state	Theme concentrated within level 2 maturity
	"our architecture standards document was put in place a few months ago… still gaining acceptance" (A.BU2.P3.1)	• Architectural standards • A few months ago • Gaining acceptance		

Mechanism	Evidence	Codes	Theme	Level
	"we still need to establish the future state architecture" (A.BU2.P4.1)	• No future state architecture	environment documents developed	
	"business cases, GAP analysis and' as is' documents are developed for every project" (A.BU2.P5.1)	• Business case • GAP analysis • As is documents		
	"our department has the basics in place such as the vision, mission goals" (A.BU2.P6.1)	• Basics • Vision • Mission • Goals		
Business-IT alignment	*"with the complexity and fast changing nature of IT, our architecture is important for defining our technical direction… it is still fairly new with a few holes missing, but still captures this departments structure in a formal design that supports our evolution and change… it also ensures that our technical designs align to the bank's business strategic objectives" (A.BU2.P1.1)*	• Fairly new • Holes missing • Structure • Formal design • Evolution • Change • Align to strategic objectives	Formal design that aligns IT to business, however, with gaps in the architecture	Theme extends across levels 1 and 2 maturities
Senior-Management Involvement	*"at our last EXCO session, the management team argued that our biggest risk was not aligning our systems to meet customer needs, and a failure to deliver value to the bank. The management team since agreed to get more involved with the architectural process… we will see how this evolves as it was only recently agreed and there is still internal squabbling amongst them, however they all realise that architecture plays a key role in aligning our systems to meet*	• Risk of not aligning systems • Management team to get more involved • Recently agreed • Squabbling	Selective management involvement with more effort required	Theme extends across levels 1 and 2 maturities

Mechanism	Evidence	Codes	Theme	Level
	customer needs… since IT can have such an intense effect on the bank's performance, inability to manage IT can have a very serious impact on the bank as a whole" (A.BU2.P3.1)			
	"senior management is absolutely aware of the architectural program… their involvement is still selective and haphazard" (A.BU2.P5.1)	• Management aware • Selective involvement • Involvement haphazard		
Finance	*"this bank is a huge organisation… our architecture highlights the problem of technology projects created within silos… we now have a single view of all projects across the group… that helps us lower our costs due to less duplication… there is some benefit to the CFO and her team…but still new" (A.BU2.P4.1)*	• Projects within silos • Single view of projects • Lower cost • Less duplication • Benefit to CFO • New	Projects silos evident with financial alignment related to lower cost and reduced duplication experienced	Theme extends across levels 1 and 2 maturities

Illustrated in Table 4.5, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were adopted from the ACMM mechanisms to understand the EA practices (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result.

The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). It was found that essential communication took place for all projects, with financial alignment experienced. There was a formal design process, however, with a few gaps prevalent. Furthermore, there was no future state architecture in place. There was a reliance on a few experts to execute initiatives within this business unit. It was revealed that more management involvement was required to prevent projects silos. Moreover, this business unit was characterised by selective degrees of commitment from the senior managers.

Artefacts from this business unit were analysed to confirm claims from the participants, as well as assess for quality and completeness using the artefacts collection procedure outlined in Chapter 3 (Bernard, 2015; Campbell, 1999) and the form in Appendix 15. Artefacts included business cases, functional requirements; rules based documents, and target state documents. An attempt was made to link these types of artefacts to the specific mechanisms, however, no reliable pattern could be established. This was due to the large variety of artefacts developed and structured according to the business unit specific services and functional requirements. However, this study eventually assessed the quality of artefacts and organised them into *current*, *transition*, and *future* state architectures (Harrison, 2013). The documents were checked for formal sign offs, as well as 'final' versions to ensure the quality and completeness of the artefacts reviewed (Bernard, 2015; Campbell, 1999). As these artefacts were based on standardised templates, the layout and navigation were clear. However, there was room for improvement in terms of the document quality, as many of the artefacts were incomplete or contained basic spelling and grammatical errors. Moreover, formal signoff's for many of these artefacts were also missing. Version control standards were also not consistently followed. Finally, not all the artefacts were stored in the central repository. The focus of the artefacts was on the current state of the business unit.

Codes including *light blueprints, no future state, just nominated, in development, recent* and *gaining acceptance*, were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 17, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *simple EA blueprints being developed encompassing the current state environment, with an architect recently appointed; essential communication takes place for all projects, with reliance on a few experts to execute. Basic EA artefacts comprising of current state environment documents developed; a formal design that aligns IT to business, however, with gaps in the architecture; selective management* *involvement with more effort required* and *projects silos evident with financial alignment related to lower cost and reduced duplication experienced* were developed.

Thereafter **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The themes of the *processes, communication, business-IT alignment, senior management involvement, and finance* mechanisms from this business unit were evaluated against the characteristics of ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). This business unit contained simple EA *processes* that were being developed, with no future state architecture. It was found that the traits of this mechanism aligned to the characteristics of practices within level 2 ACMM. With regard to the *communication* mechanism, this business unit distributed essential communication for all projects, with a reliance on a few experts to execute, which aligned to the characteristics of practices within level 2 ACMM. *Business-IT alignment* was evident with aspects of formal design; however, it has gaps in the architecture, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Furthermore, more *senior management* involvement was required with the EA practices, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Finally, projects silos evident with financial alignment experienced, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Overall, the EA practices within this business unit were characterised basic and in progress (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op 't Land et al., 2009; Paulk et al., 2006).

The defining and naming step concluded with *simple EA capabilities evident with basic EA practices being developed within Bank A, business unit 2*. Based on these evaluations, it was judged that **bank A, business unit 2** operated within **maturity level 2**.

Once the level had been established, the next step was to identify the EA granularity for this business unit, this follows in the next subsection.

4.3.2 EA granularity within Bank A, business unit 2

This subsection presents data related to the EA granularity in use. The granularity was determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from this business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The interview protocol (Appendix 4, Section A, questions 6-10) was structured to elicit these responses.

Table 4.6: EA granularity

Domains	**Evidence**	**Codes**	**Theme**	**Granularity**
Business	*"it's an abstraction of our departments primary business activities, capabilities and services… it even distinguishes between customer facing functions, vendor related functions, execution, and management functions… just to name a few" (A.BU2.P2.1)*	• Abstraction • Primary • Activities • Capabilities • Services • Functions	Incorporates the vision, mission and goals of the business unit. Abstraction of primary activities, capabilities, services and functions, as well as the end to end value chain	Business architecture defined at a coarse granularity of refinement
	"contains the end to end value chain across the business… functions like operations, finance and analytics are documented" (A.BU2.P3.1)	• End to end • Value chain • Functions documented		
	"view of the business strategy, vision, mission and goals of the department… our goal is to improve home loan sales by 15% … we have a risk principle to make sure there is clear segregation of duties amongst staff" (A.BU2.P4.1)	• Strategy • Vision • Mission • Goals • Improve home sales by 15% • Segregation of duties		
	"shows how everything is put together in the department" (A.BU2.P5.1)	• How • Put together		
Application	*"we have a conceptual view of the event and messaging architecture that we are designing … this will be used for our proactive sales and cross-selling value proposition… we have specified the 'what' like customer set up functionality…but have not defined the implementation logistics as yet" (A.BU2.P1.1)*	• Conceptual view • Proactive sales • What • Customer set up functionality	Conceptual view of application capabilities and	Application architecture defined at a coarse

Domains	Evidence	Codes	Theme	Granularity
	"the team has specified what application capabilities are required for each business domain… our goal is to build software for building for reusability using principles of high coupling and low cohesion… for example, in the underwriting team, 'risk assessment' is an application capability required that can be reused" (A.BU2.P3.1)	• Application capabilities • Goal of reusability • Principles of low coupling and high cohesion	customer set up. Includes blueprints and patterns incorporating principles of low coupling and high cohesion	granularity of refinement
	"they say every business is a software business… we ensure the relevant patterns are applied to the designs" (A.BU2.P4.1)	• Relevant patterns		
	"The focus on the application is specifying what is needed and eliminating duplicate applications in a blueprint view" (A.BU2.P5.1)	• What is needed • Blueprint		
	"systems built for interoperability and flexibility are principles of our software architecture" (A.BU2.P6.1)	• Interoperability • Flexibility • Principles		
Technology	*"our objective is to build a cloud platform over the next few years… we aim to use infrastructure as a service with cloud storage… right now, our technology architecture shows the mainframe, databases, and network layers" (A.BU2.P2.1)*	• Objective of cloud platform • Aim infrastructure as a service • Mainframe • Databases • Network • Layers	Layered snapshot view of data centres, mainframe, databases and networks. Objective to migrate to a	Technology architecture defined at a medium granularity of refinement
	"a now a view of all the data centres across the country. The actual physical IP addresses of the servers are not available as yet. There are tools that can ping the servers and create a list of the devices. This is our next project" (A.BU2.P3.1)	• Now view • Data centres		

Domains	Evidence	Codes	Theme	Granularity
	"we have an accurate overview of our LAN and WAN network infrastructure. Its shows the routers, switches and wireless access points" (A.BU2.P4.1)	• Accurate overview • Network • Accesses points	cloud platform	
	"the firewalls, perimeter and VPN are detailed in a single snapshot view" (A.BU2.P5.1)	• Single snapshot view		
	"we are migrating all data from the NAS to SAN. The migration plan is in the architecture… big optimisation expected" (A.BU2.P6.1)	• Are migrating • Migration plan		
Data	*"we are busy building a big data architecture… we are developing a data lake and evaluating a number of technologies such as Hardoop and Spark" (A.BU2.P2.1)*	• Busy building • Big data architecture • Are developing	High-level architecture in place, with concerns about the number of moving parts. Big data architecture is being built, with the objective of a single source of customer master data and minimal duplication	Data architecture defined at a coarse granularity of refinement
	"we are looking at moving from tradition SQL database to NOSQL and HiveQL… more emphasis on unstructured data analytics" (A.BU2.P6.1)	• Looking at moving • More emphasis		
	"customer and transactional data has a big focus… looking for patterns, but we still novices" (A.BU2.P4.1)	• Looking for patterns • Novices		
	"still concerns with our data architecture and a single view of customer... too many moving parts" (A.BU2.P5.1)	• Concerns • Too many moving parts		
	"high-level data architecture in place…our objective is to have minimal duplication within our databases, we also aim to a single source of customer master data with accurate customer details, address and telephone number" (A.BU2.P1.1)	• High-level • Objective • Minimal duplication • Single source • Customer master data • Accurate customer details		

Illustrated in Table 4.6, **a priori themes** (Strauss and Corbin, 2015) comprising of these domains were adopted from TOGAF (Harrison, 2013). This table lists the evidence collected that supported the codes within each domain, as well as the theme and granularity identified. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017).

Business architecture

It was established that Bank A, business unit 2 contained a business architecture depicting its primary activities. Business goals such as *"improve personal loan sales by 15%"* were clearly articulated. There was a strong emphasis on internal business principles such as *"segregation of duties"* within this business unit. Moreover, business unit functions such as *"operations*, *finance* and *analytics"* were defined. Furthermore, the business unit did not specify the roles of the stakeholders. The outcomes from both the interviews and artefacts did not contain details showing how these goals could be realised.

Application architecture

This business unit had a conceptual view of its application capabilities. The results showed that various software architectural objectives, such as *"building for reusability"* were clearly articulated. Furthermore, principles such as high coupling and low cohesion, and functionality for their customer set up required to support their business processes, were defined. However, there was minimal detail showing implementation and execution specifics.

Technology architecture

This business unit had built a layered snapshot view of its technology stack. This business unit had clearly defined its technology objectives such as building a cloud platform, principles such as *"infrastructure as a service"*, and domains such as cloud storage. However, these were only specified at a coarse granularity of refinement.

Data architecture

It was found that the data architecture was being built within bank A, business unit 2. This architecture included clear objectives such as minimal duplication within its databases, principles such as the ability to view a single source of customer master data, and finally itemised data concepts such as a customer address and telephone number. Strategic data and information goals such as preventing duplicate customers were further enforced. Documentation to manage these models was in place, such as architecture for the customer master file. However, the artefacts revealed that finer details demonstrating the data fields and the types of databases used were inconsistently defined.

Codes including *abstraction, conceptual view, relevant patterns, what is needed, blueprint, layers, now view,* are *migrating, and busy building* were derived from the data (Braun and Clarke, 2008; Silver and

Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 17, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of: *incorporates the vision, and mission and goals of the business unit. Abstraction of primary activities, capabilities, services and functions, as well as the end to end value chain; conceptual view of application capabilities and customer set up, includes blueprints and patterns incorporating principles of low coupling and high cohesion; layered snapshot view of data centres, mainframe, databases, and networks, objective to migrate to a cloud platform* and *high-level architecture in place, with concerns about the number of moving parts. Big data architecture is being built, with the objective of a single source of customer master data and minimal duplication* identified.

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Bank A, business unit 2 specified its business architecture at a coarse granularity of refinement. This business unit described its business objectives, vision, mission, and goals. An abstraction of its primary activities, capabilities, services and functions, as well as the end to end value chain was articulated. The application architecture was specified at a coarse granularity of refinement and described the software applications that were required by the business unit. It contained a conceptual view of its application capabilities and customer set up functions. The architecture included blueprints and patterns incorporating principles of low coupling and high cohesion. Furthermore, this business unit's technology architecture was defined at a medium granularity of refinement. It described the way that the technology was implemented, by providing a layered snapshot view of the data centres, mainframe, databases and networks. This business unit had an objective to migrate its technologies to a cloud platform. The data architecture was specified at a coarse granularity of refinement. It defined the types of data at a high-level that was required to support the business unit. It articulated the risks and concerns about the number of moving parts within its environment. Big data architecture was being built, with the objective of creating a single source of customer master data and with minimal data duplication.* Based on these evaluations, it was judged that **bank A; business unit2** defined its overall EA at a **coarse granularity of refinement**.

Once the granularity of refinement had been identified, the next step was to identify the business value of EA for this business unit, which commences below.

4.3.3 Business Value of EA from Bank A, business unit 2

This subsection presents data related to the business value of EA from the second business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part B of the interview protocol (Appendix 4), was used to collect this data. It was used to understand the value related to each EA mechanism that was perceived by the participants.

Table 4.7: Value of EA

Mechanism	Evidence	Codes	Theme	Value
Processes	"*we live in a fast changing world, it is important for us to stay ahead of the competition... we have to react faster to market changes, and are always looking at new and unusual ways of doing things… at first I thought architecture was simply old wine in new bottles… I've had experience with so many overinflated, hyped fads over the years… these trends come and go… however our architectural processes have definitely simplified our technical complexity and improved our profitability" (A.BU2.P1.1).*	• Simplified complexity • Improved profitability	EA helps the business unit simplify technical complexity and enables the business strategy which improves their profitability	Forms of value such as reduced complexity, increased revenue and an improvement in the portability of applications were experienced within business unit A.2 as a result of EA
	"for us, process value means that EA creates and enables the business strategy objectives. That means executing a new product… a new service… it's about business results, ultimately more revenue generation, standardisation of processes and agnostic systems" (A.BU2.P2.1).	• Enables business strategy • Revenue generation • Standardisation of processes • Agnostic systems		
Communication	*"helps convey a strategic view of the department… our systems are our centre stage… EA cuts complications for business stakeholders and increases profitability" (A.BU2.P3.1).*	• Strategic view • Cuts complications • Increases profitability	EA helps create a strategic view of the business unit by enabling a clear structured approach to problem solving. It further improves the	
	"gives a clear structured approach for articulating our business strategy to the IT teams… improves problem ambiguity" (A.BU2.P5.1).	• Clear structured approach • Improves problem ambiguity		
	"connects all the moving parts across the SDLC… both the product and systems teams, i.e. the business and technical	• Connects SDLC • Work together		

Mechanism	Evidence	Codes	Theme	Value
	teams, can easily <u>work together</u> to <u>understand</u> the <u>value chain</u>… <u>portability</u> benefits and <u>standardisation</u>" (A.BU2.P6.1).	• Understand value chain • Portability • Standardisation	portability of applications	
Business-IT alignment	*"our CEO wants our credit decision process to be made to be more accurate, faster, more sophisticated… and cheaper… credit systems are expensive and we need a return on those investments… our architecture helps us get a <u>quicker return</u> on the system costs while <u>improving</u> the <u>quality</u> of the credit decisions, which results in on-boarding customers with the right profile, and the <u>correctly selected product</u>… all done within a <u>simpler</u> and more <u>user-friendly</u> framework" (A.BU2.P3.1).*	• Quicker return • Improving quality • Correctly product selection • Simpler • User-friendly	EA supports the business unit experience a quicker return revenue on their investments	
	"EA provides an <u>action plan</u> that takes <u>months</u> as <u>opposed</u> to <u>years</u>. We don't have the luxury of waiting for a year or more for projects to go live. Many of our systems are already outdated…it creates a <u>transition plan</u> to spearhead our journey… and a <u>clear forecast</u>" (A.BU2.P5.1).	• Quick action plan • Transition plan • Clear forecast		
	"it's <u>complementary</u> to other functions like business analysis, process engineering and project management, but more <u>simple</u> and <u>visible</u>" (A.BU2.P2.1).	• Complementary • Simple • Visible		
Senior-Management Involvement	*"<u>clarifies</u> how our funds are spent by the techies by translating the complex technical details of projects into a "<u>simple business language</u> that is <u>easily understood</u> by management" (A.BU2.P2.1).*	• Clarification • Simple business language • Easy to understand	EA converts complex technical details into simple	

Mechanism	Evidence	Codes	Theme	Value
	"the EA shows how the business and IT components fit together… help management clearly visualise and pinpoint the problematic areas that require change. The EA diagrams play a key role in this" (A.BU2.P3.1).	• Components fit together • Visualise • Pin point • Identify problematic areas	business language that's easy for management to understand and agree. Helps them visualise problem areas	
	"facilitates general agreement amongst senior management on the plan for strategy execution… platform for the senior management to decide on a specific project route and option" (A.BU2.P4.1).	• Management agreement • Project selection • Project route option		
Finance	*"a massive transformation is underway in our business to improve customer service and to push our sales targets… our architecture reduces the complication and creates a holistic view of our customers by considering information from the finance department, to marketing, as well as all the subsidiaries that improve our returns" (A.BU2.P1.1).*	• Reduces complication • Holistic view of customer • Improve returns	EA enables the business unit to simplify and visualise the impact of financial decisions. Creates a holistic view of a customer	
	"Facilitates financial decisions... EXCO approval does not guarantee that the project will be successful still depends on the availability of skilled resources, deciphering technical complexity, project prioritisation to name a few… the architecture helps EXCO by simplifying and facilitating the financial decisions. The architecture brings clarity to the financial decision process" (A.BU2.P2.1).	• Simplify financial decisions • Facilitate financial decisions • Clarity		
	"the diagrams are helpful when the traditional costing formulas fail… stakeholders visualise the actual impact in	• Visualise financial impact		

Mechanism	Evidence	Codes	Theme	Value
	the environment and can then apply business acumen on the <u>financial impact</u>" (A.BU2.P5.1).			

Illustrated in Table 4.7, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were used to understand the EA practices, with the questions structured to obtain insights into the forms of value obtained for each of these mechanisms (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). **Codes** including *simplified complexity, improved profitability, enables business strategy, revenue generation, standardisation of processes, interoperability, quicker return* and *improving quality* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 17, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *EA helps the business unit simplify technical complexity and enable the business strategy which improves their profitability; EA helps create a strategic view of the business unit by enabling a clear structured approach to problem solving. It further improves the portability of applications; EA supports the business unit experience and quicker return revenue on their investments; EA converts complex technical details into simple business language that's easy for management to understand and agree. It helps them visualise problem areas* and *EA enables the business unit to simplify and visualise the impact of financial decisions. In addition, it creates a holistic view of a customer* were developed.

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Forms of value such as reduced complexity, increased revenue, and an improvement in the portability of applications were experienced within business unit A.2 as a result of EA. EA enabled the business unit to create a strategic view of its business unit by creating a holistic view of its customer, and a clear structured approach to problem solving. It helped them convert complex technical details into a simple business language that was easy for management to understand and agree. Furthermore, EA enabled the business unit to visualise the impact of financial decisions, which helped them experience a quicker return on their investments and in turn improved their profitability. Finally, the business unit experienced an improvement in the portability of their applications due to the influence of EA.*

The next section presents findings from the last business unit within Bank A.

4.4 Presentation of Findings from Bank A, business unit 3

This section presents the data used to determine the EA maturity level, the EA granularity, as well as the tangible and intangible forms of value obtained from the third business unit of Bank A (Braun and

Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). Further evidence from this business unit can be found in Appendix 18.

This business unit provided *savings and investment products* to customers of Bank A. It offered approximately 35 types of products such as savings products, fixed deposit products, unit trusts and long-term investments. These products had various periods ranging from once off to monthly investment terms. This business unit further provided options for local or offshore investments for some of these products. It composed of approximately 500 staff, including of a CEO, CIO, CFO, HR head. The IT staffs were responsible for unit trust systems, trading systems, and forex systems. Business staff were responsible for developing and modifying products, providing customers with advice, and analysing international trends (BankA, 2018; SARB, 2018). Illustrated in Table 4.1, a total of 10 people were invited to participate in the individual interviews from this business unit. Four people accepted and participated in the individual interviews, representing an acceptance rate of 40%. The participants were a mix of business and IT professionals from different levels of seniority.

The data used to determine the EA maturity level follows.

4.4.1 The level of EA maturity at Bank A, business unit 3

This subsection presents data related to the EA practices from the third business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part A of the interview protocol (Appendix 4) was used to gather this data. The level of maturity was determined by judging the EA practices as described by the participants from this business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

Table 4.8: Mechanisms of EA

Mechanism	Evidence	Codes	Theme	Level
Processes	*"my department has developed an 'as-is' architecture that represents our current state, and a planned architecture to show the direction of the business unit over the next three years…has become popular with the staff… we have improved the turnaround time of our system builds... this will help the team even if I'm not around" (A.BU3.P1.1)*	• As is • Current state • Planned state • Faster system builds • Succession plan	Comprehensive EA processes with current and future states established. Business unit has experienced good adoption with an architectural review board established	The theme extends across levels 3 and 4 maturities
	"clear blueprint of our applications and infrastructure…I found the transition documents between current and future states particularly helpful" (A.BU3.P2.1)	• Clear blueprint • Transition documents • Current state • Future state		
	"minutes of the architecture review board is sent to the department after each meeting and stored on Share point" (A.BU3.P5.1)	• Architecture review board • Minutes distributed		
	"good adoption of architecture since its introduction, no resistance that I'm, aware of… has become quite rooted into the team… architectural processes and components and touch points are built into our SDLC. Any variance or changes needs a formal signoff from the architect" (A.BU3.P6.1)	• Good adoption • No resistance • Rooted • Architectural processes built into SDLC • Variance needs sign off		
Communication	*"I mentioned this earlier, the transition documents between current and future state particularly is valuable… our architecture documents are integrated into the SDLC… a phase cannot start without approval" (A.BU3.P1.1)*	• Transition documents • Current state • Future state • Integrated into SDLC	Updated comprehensive documentation integrated into	The theme extends across levels 3 and 4 maturities

Mechanism	Evidence	Codes	Theme	Level
	"latest version of systems architecture available in the repository. Change control in place, so we can see variances between the original version and updates made to the documents… the latest documents are comprehensive with explicit detail of all inputs and outputs. It displays all the subsystems integrated into the ecosystem… connected to the bank's vision" (A.BU3.P2.1)	• Latest versions • Change control • Variances visible • Comprehensive • Explicit • Displays integrated ecosystem	SDLC that encompasses current and future states. Strong staff accountably of EA with regular communication in place.	
	"the EA team ultimately own the architecture capability in the department… senior management and staff are also accountable… the introduction of reference models was a game changer… no need to reinvent the wheel" (A.BU3.P5.1)	• EA team own architecture • Senior management accountable • Reference models helpful		
	"the architecture tool is advanced… many of the diagrams are reverse engineered from the code, so the diagrams are always completely up to date with the latest version… the architecture team does regular presentations in the staffed back sessions" (A.BU3.P6.1)	• Architecture tool • Advanced • Reverse engineered • Up to date • Latest version • Regular presentations to staff		
Business-IT alignment	*"this bank has a number of independent business units that sometimes work in isolation… our architecture helps us work through the issues, opportunities, and challenges of aligning our business unit's technology with the bank's technology… it has become a vital function for our team and is fundamental*	• Work through issues and opportunities • Align business unit to the bank • Vital function • Innovation • Growth	Strong business-IT alignment allowing innovation and growth	The theme extends across levels 3 and 4 maturities

Mechanism	Evidence	Codes	Theme	Level
	to support and sustain our innovation and growth" (A.BU3.P1.1)			
	"for us architecture is a business-driven strategy that supports planning and decisions… it provides a coordinated view of this business unit… ultimately we want to understand customer behaviour so they can service them better" (A.BU3.P2.1)	• Business driven strategy • Planning • Decisions • Coordinated view		
	"architecture develops opportunities for us… it has improved IT responsiveness to business needs" (A.BU3.P5.1)	• Improved IT responsiveness to business		
Senior-Management Involvement	*"everyone talks about resistance and change management… we haven't experienced any of that… full support from exco to junior staff… part of the way that we operate… even the CEO mentions architecture in his newsletters" (A.BU3.P1.1)*	• Full support • Part of the way that staff operate	Strong management support of EA. Used in reporting, governance, compliance and cost-benefit analysis	Theme concentrated within level 3 maturity
	"the senior managers use many of the architectural diagrams in their monthly reporting" (A.BU3.P2.1)	• Senior management use architectural diagrams • Reporting		
	"the managers use the architectural documents to enforce governance and compliance" (A.BU3.P5.1)	• Enforce governance • Enforce compliance		
	"the financial managers request architectural documents regularly. They use it for cost-benefit analysis and projections" (A.BU3.P6.1)	• Cost-benefit analysis • Projections		
Finance	*"the finance team is very involved… they review our diagrams during the budget cycles, and use some of the diagrams in their budget presentations" (A.BU3.P1.1)*	• Involvement • Budget cycles • Budget presentations	EA used to understand technical	Theme extends across levels 2 and 3 maturities

Mechanism	Evidence	Codes	Theme	Level
	"business cases use the diagrams to illustrate the cost-benefit calculations, and show where the changes are taking place" (A.BU3.P2.1)	• Business cases • Cost-benefit • Show changes	impacts of changes, financial cycles, presentations and business cases	
	"we are going to RFI for a large project… the architecture documents are being used in the RFI packs" (A.BU3.P5.1)	• Request for Information (RFI)		
	"the risk department also reviews our documents to help understand technical impacts, and the governance and compliance requirements to mitigate any risks" (A.BU3.P6.1)	• Understand technical impacts • Governance • Compliance		

Illustrated in Table 4.8, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were adopted from the ACMM mechanisms to understand the EA practices (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result.

The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). EA processes with current and future states were integrated into the business unit's system development lifecycle. This business unit had comprehensively documented its system development lifecycle as well as its EA components. Any variance from the system development lifecycle processes required a formal process to be followed with a signoff from the business unit architect. It was found that strong business-IT alignment that allowed for innovation and growth with management support was prevalent in the department. Furthermore, EA was incorporated into the business unit financial processes and cycles. It was found that EA had been integrated into the business unit annual year end budgeting cycle. This business unit included EA when making any financial decisions. Moreover, this business unit complied with EA standards when procuring any IT equipment. Senior management, such as the CEO of this business unit actively supported and embraced EA practices. For instance, the CEO of this business unit provided regular communication to staff on EA achievements during their staff feedback sessions as well as in their monthly newsletters. Furthermore, staff from this business unit understood the benefit of EA and actively contributed to architectural initiatives. Notably, this business unit used specialised EA tool.

Artefacts from this business unit were analysed to confirm claims from the participants, as well as assess for quality and completeness using the artefacts collection procedure outlined in Chapter 3 (Bernard, 2015; Campbell, 1999), and using the form in Appendix 15. Artefacts used in this business unit include SWOT analysis, "as is" documents, target state documents and data dictionaries. An attempt was made to link these types of artefacts to the specific mechanisms; however, no reliable pattern could be established. This was due to the large variety of artefacts developed and structured, according to the business unit specific services and functional requirements. However, this study eventually assessed the quality of artefacts and organised them into *current*, *transition* and *future* state architectures (Harrison, 2013). The documents were checked for formal sign offs, as well as 'final' versions to ensure the quality and completeness of the artefacts reviewed. This business unit also regularly updated their EA documentation and maintained them within their internal 'SharePoint' repository. A gap analysis with a transition plan between their current and future states was documented. Furthermore, the EA plans were connected to both their internal business unit as well as the banks strategic and tactical plans. Overall, EA practices were well adhered to within this business unit.

Codes including *current state, planned state, faster system builds, succession plan, transition documents, good adoption, no resistance, rooted, and comprehensive* and *explicit* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 18, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *comprehensive EA processes with current and future states established. Business unit has experienced good adoption with an architectural review board established; updated comprehensive documentation integrated into SDLC that encompasses current and future states. Strong staff accountably of EA with regular communication in place; strong business-IT alignment allowing innovation and growth; strong management support of EA. This is used in reporting, governance, compliance and cost-benefit analysis* and *EA used to understand technical impacts of changes, financial cycles, presentations and business cases* were developed.

Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The themes of the *processes, communication, business-IT alignment, senior management involvement, and finance* mechanisms from this business unit were evaluated against the characteristics of ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). This business unit contained EA comprehensive *processes* that included current and future states. It was found that the traits of this mechanism aligned to the characteristics of practices extending across levels 3 and 4 maturities. Regarding the *communication* mechanism, this business unit incorporated updated comprehensive documentation integrated into its SDLC, which aligned to the characteristics of practices extending across levels 3 and 4 maturities. Strong *business-IT alignment* was evident that allowed innovation and growth, which aligned to the characteristics of practices extending across levels 3 and 4 maturities. Furthermore, there was strong *senior management* support which aligned to the characteristics of level 3 ACMM. Finally, EA was used for *financial* cycles and contributed to presentations and business cases, which aligned to the characteristics of practices extending across levels 2 and 3 maturities. Overall, the EA practices within this business unit were characterised as being formal, fully updated, and well accepted with the business unit (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op ’t Land et al., 2009; Paulk et al., 2006).

Finally, **defining and naming** concluded this step with *formal EA capabilities* as well as *comprehensive EA processes supported by management, with current and future states integrated into SDLC,* were used to describe this theme of this business unit. Based on these evaluations, it was judged that **bank A, business unit 3** operated within **maturity level 3**.

Once the level had been established, the next step was to identify the EA granularity for this business unit, and follows in the next subsection.

4.4.2 EA granularity within Bank A, business unit 3

This subsection presents data related to the EA granularity in use. The granularity was determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from this business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The interview protocol (Appendix 4, Section A, questions 6-10) was structured to elicit these responses.

Table 4.9: EA granularity

Domains	Evidence	Codes	Theme	Granularity
Business	*"This bank has grown so complex over the years that it is difficult to understand how all of the departments fit together … at the same time, our executives want to reshape and transform it to be more competitive and customer centric… our business architecture contains our specific business models that support this strategy…our software architecture contains our principles and guidelines that we use during the analysis, design and development of our systems" (A.BU3.P1.1)*	• Specific business models • Strategy • Principles • Guidelines • Analysis • Design	Specific business models encompassing strategy and principles that are aligned to tactical demands. Includes detailed functions, capabilities, inputs and outputs	Business architecture defined at a fine granularity of refinement
	"aligns our strategic objectives to tactical demands" (A.BU3.P2.1)	• Alignment • Strategic • Tactical demands		
	"at a business level, it includes the business functions, the inputs, processes and outputs… it's in our strategy documents" (A.BU3.P5.1)	• Functions • Inputs • Processes • Outputs • Strategy documents		
	"Details the capability building blocks for the department" (A.BU3.P6.1)	• Capability building blocks		
Application	*"we have a services based architecture in place. Our current focus is on APIs end encapsulation" (A.BU3.P1.1)*	• Services architecture • API • Encapsulation	Services architecture with API's incorporating principles of	Application architecture defined at a medium
	"the department's application principles are cloud based, scale elastic, channel agnostic. We adopted these principles as a	• Principles • Cloud		

Domains	Evidence	Codes	Theme	Granularity
	reference a few years ago. We have moved from quarterly release cycles to <u>continuous deployment</u>" (A.BU3.P2.1)	• Elastic • Agnostic • Continuous deployment	cloud, elastic scaling and continuous demand	granularity of refinement
	"scalability and performance are important to system performance… we have designed to scale up and down <u>on demand</u>… our goal is <u>elastics scaling</u>" (A.BU3.P5.1)	• On demand • Elastic scaling		
Technology	*"we are using <u>Microsoft Azure</u>, <u>software</u> and <u>infrastructure</u> as a <u>service</u>… at a <u>high-level</u>, our technical architecture <u>diagrammatically</u> illustrates our <u>hardware</u> like servers and workstations and <u>how</u> they are <u>connected</u> to our <u>network</u> technology… and then link to the <u>cloud</u>" (A.BU3.P1.1)*	• Microsoft Azure • Software as a service • Infrastructure as a service • High-level • Diagram • Hardware • How • Connected • Network • Cloud	Cloud technology stack incorporating software and infrastructure as a service. Includes hardware, servers and network layout	Technology architecture defined at a fine granularity of refinement
	"the <u>server architecture</u> includes the <u>CPU layout</u>, the <u>buses</u> and interfaces, through to the <u>network connectivity</u> and power supply" (A.BU3.P2.1)	• Server architecture • CPU layout • Buses • Network connectivity		
	"we have a <u>mix</u> of rack and blade <u>servers</u>. The <u>layout</u> and <u>integration</u> is <u>clearly documented</u>" (A.BU3.P5.1)	• Mix servers • Layout and integration • Clearly documented		

Domains	Evidence	Codes	Theme	Granularity
	"we predominately run VM's. The complete design from hosts to hypervisors is in the architecture blueprint" (A.BU3.P6.1)	• Virtual machines • Complete design • Architecture blueprint		
Data	"*data at rest, data in motion and data in use… essentially that's what our data architecture shows us" (A.BU3.P1.1)*	• Data at rest • Data in motion • Data in use	Focus on customer engagement, to enhance offers. Shared data concepts incorporating rest, use and motion principles.	Data architecture defined at a coarse granularity of refinement
	"with the splurge of social media, we realised that data was growing at an enormous rate… and there was valuable insights that could be found in this data when harnessed effectively… our architecture helped transform our traditional database technologies that were designed over a decade ago to modern technologies… we have now drastically improved our revenue by aggregating all data that we gather about a customer in order to optimise our engagement and revenue with them, e.g. determining exactly what offers to send them and through the appropriate channel and at what point in time… all possible with our architecture" (A.BU3.P2.1)	• Data aggregation • Customer • Optimise • Engagement • Offers • Appropriate channel • Timing		
	"focus on data… we view data is an asset that is shared, and accessible… encryption all transactions if key…. The structured data is mature and detailed. Meta and unstructured data is still immature" (A.BU3.P6.1)	• Data Asset • Shared • Accessible • Encryption • Structured data is mature • Unstructured data is immature		

Illustrated in Table 4.9, **a priori themes** (Strauss and Corbin, 2015) comprising of these domains were adopted from TOGAF (Harrison, 2013). This table lists the evidence collected that supported the codes within each domain, as well as the theme and granularity identified. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017).

Business architecture

The business architecture focused on the business unit strategy, as well as the tactical implementation. Artefacts such as strategy documents were in place within this business unit. Analysis of these strategy documents showed clear business strategies, vision, mission, and business goals with objectives. Moreover, this business unit developed role grids, organisational structures, and RACI charts that displayed details such as the actual roles of individuals who executed the tasks.

Application architecture

Bank A, business unit 3 had developed service application architecture with goals of cloud hosting, elastic scaling, and continuous demand. The results showed that various software architectural objectives, such as *"encapsulation"* and principles such as *"on demand elastic scaling"* were defined. This business unit had created categories for target state applications before selecting and procuring the actual applications to fulfil those services. This business unit had identified fine grain details specifying how the application functionality was implemented within its artefacts. It had specified the actual physical location of the applications.

Technology architecture

The technology architecture included hardware component details. It had clearly defined technology objectives such as *"cloud migration",* goals such as *"continuous deployment"* and principles such as *"elasticity"*. These details included the cloud platforms such as *"Microsoft Azure"*, technology types such as the "*software as a service",* and *"infrastructure as a service"*. This business unit also contained details on how the cloud technologies were implemented. Technology relationships and roles linking the technology to applications and the staff members were further detailed.

Data architecture

The data architecture incorporated rest, used, and motion data principles. This business unit contained other data concepts such as *"data is an asset, data is shared,* and *data is accessible"*. Strategic data and information goals such as *"encryption"* standards were further enforced as well as documentation to manage these models were in place, such as the data architecture for the data aggregation. Artefacts showed that this business unit had data views, as well as attributes of its data within its documentation.

Codes comprising of *specific business models, strategy, principles, guidelines, tactical functions* and *scalability* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 18, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *specific business models encompassing strategy and principles that are aligned to tactical demands includes detailed functions, capabilities, inputs and outputs; services architecture with API's incorporating principles of cloud, elastic scaling and continuous demand; cloud technology stack incorporating software and infrastructure as a service. This includes hardware, servers and network layout* and *focus on customer engagement to enhance offers, shared data concepts incorporating rest, use, and motion principles were* identified.

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Bank A, business unit 3 specified its business architecture at a fine granularity of refinement. It articulated physical implementation details illustrating where the business processes were implemented and the stakeholders that performed those tasks. This business unit built specific business models that encompassed their strategy, principles, and tactical demands. The architecture included detailed functions, capabilities, inputs, and outputs. The application architecture was designed at a medium granularity of refinement and illustrated the way that the software was implemented. It comprised of service architecture with its API's incorporating principles of cloud, elastic scaling and continuous demand. The technology architecture was specified at a fine granularity of refinement, and illustrated where the technology was physically deployed. It comprised of a cloud technology stack built as a service model. The design included hardware, servers, and the network layout. The data architecture was specified at a coarse granularity of refinement, and described the data types required to support the business unit. The design focused on enhancing offers to promote customer engagement. It incorporated shared data concepts such as rest, use, and motion principles.* Based on these evaluations, it was judged that **bank A, business unit 3,** defined its overall EA at a **medium granularity of refinement**.

Once the granularity of refinement had been identified, the next step was to identify the business value of EA for this business unit, which commences below.

4.4.3 Business Value of EA from Bank A, business unit 3

This subsection presents data related to the business value of EA from the third business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part B of the interview protocol (Appendix 4), was used to collect this data. It was used to understand the value related to each EA mechanism that was perceived by the participants.

Table 4.10: Value of EA

Mechanism	Evidence	Codes	Theme	Value
Processes	*"helps us understand the <u>'why'</u> behind <u>customer behaviour</u>… very different from traditional thinking, and this added dimension greatly aids in <u>customer service</u>" (A.BU3.P1.1)*	• Why • Customer behaviour • Customer service	EA enables people, process and technology alignment improvements that lead to customer service improvements for the business unit	Business-IT alignment, improved agility and customer service benefits were experienced within business unit A. 3 as a result of EA
	"With the <u>agility</u> and <u>process improvements</u> brought from the architecture, staff are able to concentrate on the <u>customer</u>. They have more <u>capacity</u> to respond <u>quickly</u> to customer queries, focus on customer <u>solutions</u> that improve the overall customer <u>experience</u>" (A.BU3.P2.1)	• Agility • Process improvements • Customer • Capacity • Quickly • Solutions • Experience		
	"<u>Visualise</u> and <u>analyse</u> the <u>interrelationships</u> of <u>key process activities</u>… provides a clear view of the processes… improves <u>business-IT alignment</u> and mitigates <u>risk</u>" (A.BU3.P5.1)	• Visualise • Analyse • Interrelationships • Key process activities • Business-IT alignment • Risk mitigation		
	"when processes between business and IT do not align, projects fail. Architecture is the <u>catalyst</u> for <u>process improvement</u>… aligns <u>people</u>, <u>process</u>, and <u>technology</u> to improve <u>customer service</u>" (A.BU3.P6.1)	• Catalyst • Process improvement • People, process, technology • Customer service		
Communication	*"one of the most important benefits that we have experienced is <u>collaboration</u> across business and IT staff… lots of emotion and politics between the business and IT teams… EA creates*	• Collaboration • Common business platform • Transparent language	Clear transparent communication	

Mechanism	Evidence	Codes	Theme	Value
	a common platform… a means of connecting these teams using a transparent language… create a safe environment for debate" (A.BU3.P2.1)	• Debate	that leads to customer service improvements and agility experienced by the business unit	
	"transparent communications and access to vital information for business and IT staff" (A.BU3.P5.1)	• Transparent communications		
	"there are no common definitions in the bank for many business and technology terminologies… terms we use every day like systems, technology, strategy or data all mean different things to different stakeholders… architecture facilitates clear common transparent communication" (A.BU3.P6.1)	• Clear common communication		
Business-IT alignment	*"a few years back there were 4 major banks, now there are 5… to survive in today's competitive banking industry, we need to build our capabilities around delivering the best service within shortest specified timeframes and costs. Our architecture gives us this agility… reducing our IT development time means we first to market, which then gives us an edge over (Bank B)" (A.BU3.P1.1)*	• Service • Shortest time frame • Cost • Competitive advantage	EA enables operational and strategic alignment that results in competitive advantage and service improvements	
	"without an architecture, business and IT stakeholders drift further apart… different business managers create their own siloed strategies to meet their KRA and KPA's… often a narrow view of the world… IT stakeholders attempt to interpret these siloed strategies… mostly honest attempts to help business… but magnifies the problem… alignment and agility	• Alignment • Agility		

Mechanism	Evidence	Codes	Theme	Value
	is only achieved with an architectural framework" (A.BU3.P2.1)			
	"the architecture gives the department the ability to act through its <u>people</u>, <u>processes</u>, and <u>technologies</u>… every business unit in this bank, no matter how large or small benefits from the <u>blueprint</u>… it helps the business unit improved <u>agility</u>, <u>productivity</u> and <u>risk</u> management from both <u>strategic</u> and <u>operational</u> levels" (A.BU3.P6.1)	• People, processes, technology • Blueprint • Agility • Productivity • Risk • Strategic • Operational		
Senior-Management Involvement	*"architecture is our <u>common platform</u>… when the IT managers and business managers talk about where the business is going, we have a more harmonious <u>working relationship</u> with less tension between us and a more streamlined <u>common business plan</u>" (A.BU3.P1.1)*	• Common platform • Working relationship • Common business plan	EA creates a common platform for management to align strategies, identify areas for improvement and be more responsive to change	
	"Management often build strategies in a sterile environment, without understanding all the dependencies. The strategies are built on things such as sales targets, without considering all the moving parts, from <u>people</u>, <u>processes</u> to <u>systems</u>… architecture prevents <u>misaligned strategies</u>" (A.BU3.P5.1)	• People, processes, technology • Systems • Alignment		
	"the architecture helps managers identify <u>areas for improvement</u>. It helps be more <u>responsive to change</u>, more <u>transparent</u> and build <u>scalability</u> into solutions. It prevents them from diving straight into technology solutions without an <u>environmental understanding</u>" (A.BU3.P6.1)	• Areas for improvement • Responsive to change • Transparent • Scalable • Environmental understanding		

Mechanism	Evidence	Codes	Theme	Value
Finance	*"perpetuates our financial investments to ensure maximum ROI. Our projects require participation from multiple business unit's. Without a defined process, we run the risk of poor planning and prioritisation… process improvements brought about from the architecture ensures we are planning our projects for maximum financial benefit" (A.BU3.P1.1)*	• Maximum ROI • Planning • Prioritisation • Process improvements • Maximum financial benefit	The business unit experiences maximum financial benefit in the shortest time enabled by EA	
	"helps select high value projects for funding…then helps with execution of projects with the shortest delivery time" (A.BU3.P2.1)	• High value projects • Shortest delivery time		
	"providing a clear value proposition has been a leap for EA… we have been able to streamline our processes, that has resulted in cost savings" (A.BU3.P6.1)	• Clear value proposition • Streamline processes • Cost savings		

Illustrated in Table 4.10, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were used to understand the EA practices, with the questions structured to obtain insights into the forms of value obtained for each of these mechanisms (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). **Codes** comprising of *customer behaviour, business-IT alignment*, *capacity, quickly, solutions, customer experience, visualise, interrelationships, customer service*, and *improved agility* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 18, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *EA enables people, process and technology alignment improvements that lead to customer service improvements for the business unit; clear transparent communication that leads to customer service improvements and agility experienced by the business unit; EA enables operational and strategic alignment that results in competitive advantage and service improvements; EA creates a common platform for management to align strategies, identify areas for improvement and be more responsive to change,* and *the business unit experiences maximum financial benefit in the shortest time enabled by EA* were developed.

Thereafter, **the defining and naming** step finalised the description of this business unit's theme as follows. *Business-IT alignment, improved agility and customer service benefits were experienced within business unit A.3, as a result of EA. EA created a common platform for management to align strategies, as well as become more agile and responsive to change. It enabled people, process and technology alignment, as well as operational and strategic business alignment. These alignments subsequently improved customer service for the business unit. Furthermore, they experienced an improvement in financial benefits within a shorter period of time.*

The following section concludes the presentation and findings of evidence from Bank A.

4.5 Conclusion

This chapter organised and presented the data from case study 1, referred to as Bank A in this research. It presented examples of this data from business unit A.1, business unit A.2, and business unit A.3. The evidence was presented in the form of *direct quotations* from the interviews, further using thematic analysis to develop the themes (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015).

This research found that business unit A.1 contained *proactive EA capabilities and practices* that were *well established and part of the culture*. This business unit utilised EA at a fine granularity of refinement. This business unit experienced forms of value such as improved decision-making, innovation, and customer insights as a result of EA.

Furthermore, this study found that business unit A.2 contained *simple EA capabilities and practices* that were *under development*. This business unit implemented EA at a coarse granularity of refinement. Business unit A.2 experienced forms of value such as reduced complexity, increased revenue, and an improvement in the portability of applications.

Finally, this study found that business unit A.3 had *formal EA capabilities and practices* that were *well supported* with *clear target architectures*. Business unit A.3 implemented EA at a medium granularity of refinement. It experienced forms of value such as business-IT alignment, improved agility, and improved customer service.

The next chapter presents the findings from Bank B.

Chapter 5: Presentation of Findings: Case Study 2

This chapter presents evidence in the form of data excerpts to support the findings from the second case study.

5.1 Introduction

This chapter introduces data evidence from case study 2, referred to as Bank B in this research. Data from 3 business units of Bank B are introduced, within the following structure:

- presentation of findings from business unit 1;
- presentation of findings from business unit 2;
- presentation of findings from business unit 3.

For each of these business units, the data is organised in line with the research questions, i.e., *the levels of EA maturity, the granularity of EA* and *the tangible and intangible forms of business value obtained from EA*. The data is presented in a tabular form, comprising of direct quotations, to draw illustrative examples from the participants (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). The thematic analysis technique from Chapter 3 was applied to this section of the research (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). A software program, *Nvivo,* was used to assist in the automation of coding and visualisation of themes (Bazeley, 2014; Bazeley and Jackson, 2013; Guest et al., 2012; Maher et al., 2018). A contextualisation of Bank B follows.

5.1.1 Background to Case Study 2

Bank B was established in the late 19^{th} century, and is ranked as one of the largest banking groups in Africa. It operates across 20 countries in Africa, as well as another 6 countries across Europe and Asia. Its head office is in Johannesburg, South Africa, and it is listed on multiple African stock exchanges. It provides banking and insurance to retail, commercial, corporate, and public-sector customers. The bank has assets close to R2 trillion, with headline earnings close to R12 billion. The bank employs approximately 54 000 staff, with approximately 25 000 of these staff within its technology areas (BankB, 2018; Fanta and Makina, 2017; Lafferty, 2016; SARB, 2018).

Bank B has a hybrid structure, whereby the individual business units manage operational aspects of IT, HR, and finance, and the group centrally manages governance, and standards and policies related to these functions. Business units are designed according to the services offered by the bank, such as personal loans, home loans, investments or savings. They have similar management structures, with an Executive responsible for each business unit, and specialised staff employed based on the services offered. The sizes of the business units vary from approximately 50 to 500 staff (BankB, 2018; SARB, 2018).

Illustrated in Table 5.1 below, 14 people were invited to participate in the individual interviews from Bank B. Seven people accepted and participated in the individual interviews, representing an acceptance rate of 50%.

Table 5.1: Participant selection

Bank B									
	Business Unit 1		Business Unit 2		Business Unit 3		Total		Acceptance
Role	Identified	Participated	Identified	Participated	Identified	Participated	Identified	Participated	
CIO/CTO/IT Head (B.BU.P1)	1	1	1	0	1	0	3	1	33%
Enterprise Architect (B.BU.P2)	0	0	1	1	2	0	3	1	33%
IT specialist (B.BU.P3)	1	1	1	0	1	1	3	2	67%
CEO/COO (B.BU.P4)	0	0	0	0	1	0	1	0	0%
Business manager (B.BU.P5)	1	0	1	1	1	1	3	2	67%
Business specialist (B.BU.P6)	1	1	0	0	0	0	1	1	100%
Total	4	3	4	2	6	2	14	7	50%

The inception of EA at Bank B commenced approximately 7 years ago. A participant, without being specifically asked, commented that *"our enterprise architecture gives us an integrated view of our fragmented legacy systems".* Her comments gave a clear indication of the importance and timely nature of this project. The next section presents the findings from the first business unit.

5.2 Presentation of Findings from Bank B, business unit 1

This section presents the data used to determine the EA maturity level, the EA granularity, as well as the tangible and intangible forms of value obtained from EA for Bank B, business unit 1 (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). Further evidence from this business unit can be found in Appendix 19.

This business unit provided *personal loan products* to customers of Bank B, requiring unencumbered funds for a variety of needs ranging from vacations, medical needs, or educational requirements. The transaction type offered by this business unit was regarded as an unsecured loan, as it was granted based on a customer's credit history. The repayment period for the loans were structured through fixed instalment amounts repayable over fixed terms (BankB, 2018). The business unit was composed of approximately 500 permanent staff, including a business unit Executive, CIO, CFO, HR, and support heads. The hybrid management structure included governance components of finance, HR, and IT functions sourced from the group. The IT staff was responsible for systems such as the credit lookup system, risk rating systems, customer lookup systems, and the national credit act database. Business staff were responsible for risk profiling of customers, developing credit models, and processing applications (BankB, 2018; SARB, 2018). Illustrated in Table 5.1, a total of 4 people were invited to participate in the interviews from this business unit. Three people accepted and participated in the interviews, representing an acceptance rate of 75%. The participants were a mix of business and IT professionals from different levels of seniority.

The data used to determine the EA maturity level follows.

5.2.1 The level of EA maturity at Bank B, business unit 1

This subsection presents data related to the EA practices from the first business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part A of the interview protocol (Appendix 4) was used to gather this data. The level of maturity was determined by judging the EA practices (represented by EA processes, communication, business-IT alignment, senior management involvement, and finance mechanisms) as described by the participants from this business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

Table 5.2: Mechanisms of EA

Mechanism	Evidence	Codes	Theme	Level
Processes	*"it's only been <u>recently formalised</u>. The diagrams are still <u>high-level</u>… we <u>only</u> have architectural diagrams in place <u>for</u> the <u>tier1systems</u>" (B.BU1.P1.1)*	• Recently formalised • High-level • Only tier 1 systems	Basic current state environment EA processes recently formalised for core systems, however no future state diagrams and architect has been appointed	Theme concentrated within level 2 maturity
	"it will take <u>at least another</u> year to have the architectural capability fully up and running. The <u>basics</u> are <u>in place</u>, but <u>not</u> at an <u>advanced</u> level. <u>No</u> architectural <u>governance</u>, <u>future state</u> documents or formal <u>architectural standards</u> in place as yet" (B.BU1.P3.1)	• At least another year • Basics in place • Not advanced • No architectural governance • No standards • No future state		
	"the architectural work is being done by the system analyst in the department. There are <u>clear responsibilities</u> defined between her and the other analysts, as we have <u>not formally appointed</u> an <u>architect</u>… <u>simple blueprints</u> have been developed for the core systems… we <u>still documenting</u> the <u>peripheral systems</u>" (B.BU1.P6.1)	• Clear responsibilities • No formally appointed architect • Simple blueprints • Still documenting		
Communication	*"we have <u>explicit</u> architectural documentation for our <u>tier1systems</u>… tier <u>2</u> and <u>3</u> systems are <u>still being documented</u>… the team is reviewing industry reference architectures… this still <u>needs more investigation</u>" (B.BU1.P1.1)*	• Tier 1 explicit • Tier 2 and 3 being documented • Needs more investigation	Documentation available for tier 1 core 'as is' systems. Secondary and 'to be' still has to be documented.	Theme extends across levels 1 and 2 maturities
	"only issue with our architecture is that we have the '<u>as is' in place</u>, but <u>not</u> the <u>'to be'</u>… the <u>architecture repository</u> was <u>recently published</u> to the department…some staff are <u>still</u>	• 'As is' in place • No 'to be'		

Mechanism	Evidence	Codes	Theme	Level
	struggling with access or don't have licences… the documents are generally up to date" (B.BU1.P3.1)	• Architecture repository recently published • Still struggling with access • Licence issues • General updated	Repository navigation still problematic	
	"it's a basic file structure with architecture documents in their respective folders… still trying to navigate and find my way through the repository" (B.BU1.P6.1)	• Basic file structure • Still trying • Navigation confusion		
Business-IT alignment	*"progressing… we are experiencing improved development time, simplification, scalable systems and better governance… those are just some of the improvements at the top of my head that architecture is bringing this business unit" (B.BU1.P1.1)*	• Progressing • Improved development time • Simplification • Scalable • Governance	Simple business-IT alignment at an executive level, but more convincing required. Benefits of improved development time, scalability and governance experienced	Theme extends across levels 1 and 2 maturities
	"Alignment is more at an executive level… still some convincing needed mixed understanding of EA value" (B.BU1.P3.1)	• Executive level • More Convincing needed • Mixed understanding		
	"there is a clear indication of IT supporting the business strategy" (B.BU1.P6.1)	• Clear IT alignment		
	"the attainment of business goals, for this department, as well as the planning and execution of business scenarios including	• Driven by management	EA use is erratic and not	Theme extends across levels 1

Mechanism	Evidence	Codes	Theme	Level
Senior-Management Involvement	*the delivery of business value is driven by the management team" (B.BU1.P1.1)*		fully leveraged by involvement, however, slow buy-in established	and 2 maturities
	"erratic EA not fully leveraged by management" (B.BU1.P3.1)	• Erratic • Not fully leveraged		
	"it's been a rocky journey, but management is slowing buying into EA… we have started sketching the way this business unit is structured as well as how its capabilities, processes, and information fit together" (B.BU1.P6.1)	• Rocky journey • Slowly buying into EA • Started sketching		
Finance	*"despite being new, it has already started helping us ensure delivery against our promises to business… our architecture simplifies and ensures financial governance… that the IT investment is justified, … that we are doing the right thing with our investment in IT, by ensuring it is in line with our business vision and strategy… it's simple, practical and creates visibility of its contributions to the business" (B.BU1.P1.1)*	• Being new • Simplifies • Governance • Simple • Practical • Visible	Basic finance involvement with governance benefits such as improved business cases, and simplified financial governance being recognised	Theme extends across levels 1 and 2 maturities
	"Intermittent at times…the potential opportunities are beginning to be recognised by the CFO" (B.BU1.P3.1)	• Intermittent • Beginning to be recognised		
	"used in the business cases" (B.BU1.P6.1)	• Business case usage		

Illustrated in Table 5.2, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance,* were adopted from the ACMM mechanisms to understand the EA practices (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result.

The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). Senior management involvement with EA practices was erratic, with a mixed understanding of EA value. The use of EA resulted in simple business-IT alignment experienced at a management level. However, more convincing was required on the use of EA to gain momentum as it was not fully leveraged by management. Furthermore, there was intermittent EA input into the finance strategy within this business unit; however, benefits were being recognised with this input.

This business unit did have a few clear EA communication and governance standards that were documented within their repository, however, the communications occurred infrequently. It was found that navigation within the repository was a problem for the staff. This business unit had documentation available for its core and 'as is' systems, however, secondary and 'to be' systems had to still be concluded. Artefacts from this business unit were analysed to confirm claims from the participants, as well as assess for quality and completeness using the artefacts collection procedure outlined in Chapter 3 (Bernard, 2015; Campbell, 1999), as well as the form in Appendix 15. Examples of the artefacts used in this business unit included feasibility studies, technical specifications, "as is" documents, data warehouse specifications, data dictionaries, and logical data models. An attempt was made to link these types of artefacts to the specific mechanisms; however, no reliable pattern could be established. This was due to the large variety of artefacts developed and structured according to the business unit specific services and functional requirements. However, this study eventually assessed the quality of artefacts and organised them into *current*, *transition,* and *future* state architectures (Harrison, 2013). The documents were checked for formal sign offs, as well as 'final' versions to ensure the quality and completeness of the artefacts reviewed. This business unit had a comprehensive repository of templates, whereby staff simply downloaded the relevant template for a project, and completed the details. However, although standard templates were used by staff, a review of the completed artefacts showed that they were not necessarily user-friendly, as they were technically oriented without a balanced business component. Many of the figures and diagrams within these artefacts contained inconsistent terminology used to describe the same components. Furthermore, many sections of the artefacts were incomplete or left blank. The focus of the artefacts was on the business unit's current state.

Codes including *recently formalised, high-level, only tier 1 systems, at least another year, basics in place, not advanced, no architectural governance, simple blueprints* and *still documenting* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for**

themes step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 19, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of *basic current state environment EA processes recently formalised for core systems, however no future state diagrams and architect has been appointed; documentation available for tier 1 core 'as is' systems. Secondary and 'to be' still has to be documented. Repository navigation still problematic; simple business-IT alignment at an executive level, but more convincing required. Benefits of improved development time, scalability and governance experienced; EA use is erratic and not fully leveraged by involvement, however, slow buy-in established* and *basic finance involvement with governance benefits such as improved business cases, and simplified financial governance being recognised* were developed.

Thereafter **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The themes of the *processes, communication, business-IT alignment, senior management involvement, and finance* mechanisms from this business unit were evaluated against the characteristics of ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). This business unit contained EA *processes* that were basic and recently formalised for its core systems. It was found that the traits of this mechanism aligned to the characteristics of the level 2 maturity. Regarding the *communication* mechanism, this business unit developed documentation for its core 'as is' systems. Secondary and 'to be' artefacts had to still be documented. Repository navigation was still problematic, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. *Business-IT alignment* was simple at an executive level; however more convincing was required to gain momentum, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Furthermore, EA was not fully leveraged by *senior management*, which also aligned to the characteristics of practices extending across levels 1 and 2 maturities. Finally, basic *financial* involvement was experienced with governance benefits being recognised, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Overall, the EA practices within this business unit were characterised as basic, simple, and in progress (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op 't Land et al., 2009; Paulk et al., 2006).

Finally, **the defining and naming step** concluded with *EA in progress, with basic EA processes recently introduced and being formalised* used to describe this theme. Based on these evaluations, it was judged that **bank B, business unit 1** operated within **maturity level 2**.

Once the level had been established, the next step was to identify the EA granularity for this business unit, and follows in the next subsection.

5.2.2 EA granularity within Bank B, business unit 1

This subsection presents data related to the EA granularity in use. The granularity was determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from this business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The interview protocol (Appendix 4, Section A, questions 6-10) was structured to elicit these responses.

Table 5.3: EA granularity

Domains	Evidence	Codes	Theme	Granularity
Business	*"is a simple framework, showing our business capabilities… our bank is made up of many business units… our business architecture helps smooth this structure and demonstrates this to our stakeholders" (B.BU1.P1.1)*	• Simple framework • Business capabilities • Smooth • Structure • Demonstrates	Simple blueprint of business architecture illustrating the value chain and capabilities, and outside touch points with a focus on customer satisfaction	Business architecture defined at a medium granularity of refinement
	"it's a blueprint of the departments of the bank" (B.BU1.P3.1)	• Blueprint		
	"internally, the business architecture shows the business value chain of the bank. It shows how value is created between the customer and the product houses. It illustrates the business steams and networks in the form of a value chain. It also shows the outside touchpoints from the reserve bank, the regulators, competitors and market disruptions… our goal is to improve customer satisfaction" (B.BU1.P6.1)	• Business value chain • How value created • Business streams • Networks • Outside touch points • Improve customer satisfaction		
Application	*"we have to remain competitive with innovative product and service offerings… big dependency on IT… software runs all the bank's core business processes… shows the configuration of the applications, their interfaces, and connectors, whereas our data architecture models our strategy for data collection and data use, improvements as well as our database design" (B.BU1.P1.1)*	• Application configurations • Interfaces • Connectors • Data collection • Data improvement	Strategic view of critical applications with an events focus including applications, interfaces and connectors, that does not	Application architecture defined at a coarse granularity of refinement
	"gives a strategic view of the banks critical applications. It does not concentrate on specific applications" (B.BU1.P3.1)	• Strategic view • Critical applications • Not specific applications		

Domains	Evidence	Codes	Theme	Granularity
	"our systems are event based, running a distributed asynchronous messaging hub" (B.BU1.P6.1)	• Event based • Distributed asynchronous	concentrate on specific applications	
Technology	*"we have 3 high-level views set up of our technical architecture, 'compute', 'network' and 'storage'. It covers the client server design like the directory, print, web, database, email servers and the operating systems. On the network side, we include the TCP/IP setup, MAC addresses and ports" (B.BU1.P1.1)*	• 3 high-level views • Compute • Network • Storage	Comprehensive distributed 3 level network architecture incorporating compute, network and storage concepts.	Technology architecture defined at a coarse granularity of refinement
	"our technology architecture is very comprehensive… it contains our entire distributed network computing environment from the mainframe to the applications… to the firewalls and servers" (B.BU1.P3.1)	• Comprehensive • Distributed • Network • Mainframe • Firewall • Servers		
	"the network architecture is getting a refresh due to the cloud migration. So, it will be completed within the next few months. The firewalls, DMZ and VPN have been documented in detail. We are busy with the DHCP and DNS. The other parts have not been updated" (B.BU1.P6.1)	• Network • Completed in next few months • Busy		
Data	*"the bank's data architecture manages the flow of data throughout every stage… from the time it is created… and initial storage to the time it becomes obsolete and is deleted. The architecture organises data into separate tiers according to business policies. For example, frequently accessed data is*	• Flow of data • Every stage • Organise data • Separate tiers	Data architecture manages the flow of data through all	Data architecture defined at a coarse

Domains	Evidence	Codes	Theme	Granularity
	stored is stored on the SAN, and less critical data is stored on the NAS which is cheaper" (B.BU1.P1.1)		stages, with the customer information file being the master source of data, and is not fully updated.	granularity of refinement
	"everything revolves around the 'customer information file' system. It is the master data source. It stores core data like the customer ID number. This system contains is the most accurate and the single source of truth… Transaction data is being requested more frequently from the business stakeholders. They look for cross-sell and upsell opportunities" (B.BU1.P3.1)	• Customer information file • Master data source • Transaction data • Cross-sell • Upsell		
	"we used to have the data domains mapped with most of the details, but it has not been updated. We have lost key individuals in that space. But are filling those gaps" (B.BU1.P6.1)	• Not updated • Lost key individuals		

Illustrated in Table 5.3, **a priori themes** (Strauss and Corbin, 2015) comprising of these domains adopted from TOGAF (Harrison, 2013). This table lists the evidence collected that supported the codes within each domain, as well as the theme and granularity identified. The analysis commenced with the **familiarisation of the data** step, whereby the participant's comments were examined (Braun and Clarke, 2008; Terry et al., 2017).

Business architecture

This business unit had developed simple blueprints of its business architecture showing its value chain. Business goals such as *"improve customer satisfaction"* were clearly articulated. There was a strong emphasis on internal business principles such as clear *"business streams"* within this business unit. Moreover, business unit functions clearly specifying department purposes were defined. The results from both the interviews and artefacts did not contain details showing how aspects of the value chain could be realised or the roles of stakeholders.

Application architecture

The strategic and critical applications of Bank B, business unit 1 were clearly documented. It defined what specific applications were required by the department. The results showed that various software architectural objectives, such as *"event based systems"* and principles such as *"distributed asynchronous design"* were specified. The business unit provides further refinement by defining how the objectives were achieved by specifying functions such as "*configuration of the applications", "their interfaces",* and *"connectors"* that the software applications needed to provide. However, the business unit did not specify any actual implementation details such as the deployment environments of these applications.

Technology architecture

Bank B, business unit 1, contained a technology architecture view showing the different system tiers. This business unit had only defined technology goals such as *"compute, network, and storage"* principles. Other designs such as implementation and execution details were not specified.

Data architecture

Diverse data architectures were developed within Bank B, business unit 1. However, these are not fully updated due to staff turnover. This business unit's core focus was on the management of their customer information file system that contained the banks master data. It had objectives such as searching for *"cross-sell and upsell"* opportunities from the data. However, there was an inconsistency on how some of the objectives and principles would be executed.

Codes including *simple framework, business capabilities, blueprint, business value chain, strategic view, critical applications* and *not specific applications* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 19, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *simple blueprint of business architecture illustrating the value chain and capabilities, and outside touch points with a focus on customer satisfaction; strategic view of critical applications with an events focus including applications, interfaces and connectors, and does not concentrate on specific applications; comprehensive distributed 3 level network architecture incorporating compute, network, and storage concepts* and *data architecture manages the flow of data through all stages, with the customer information file being the master source of data, and is not fully updated.*

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Bank B, business unit 1, specified its business architecture at a medium granularity of refinement. It defined the ways that the business objectives were achieved by designing a simple blueprint illustrating its value chain, capabilities, outside touch points and a focus on customer satisfaction. The application architecture was defined at a coarse granularity of refinement. Without concentrating on specific applications, it defined the software required, by designing a strategic view of its critical applications, comprised of an events platform, interfaces, and connectors. The technology architecture was specified at a coarse granularity of refinement, and defined the technologies that were required to support the business unit. This domain comprised of a comprehensive distributed 3 level network architecture incorporating compute, network, and storage concepts. The data architecture was defined at a coarse granularity of refinement and described the types of data that was required to support the business unit. The data architecture illustrated the flow of data through all stages within the business unit and specified its customer information file as the master source of data.* Based on these evaluations, it was judged that **bank B, business unit1,** defined its overall EA at a **coarse granularity of refinement**.

Once the granularity of refinement had been identified, the next step was to identify the business value of EA for this business unit, which commences below.

5.2.3 Business Value of EA from Bank B, business unit 1

This subsection presents data related to the business value of EA from the first business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part B of the interview protocol (Appendix 4), was used to collect this data. It was used to understand the value related to each EA mechanism that was perceived by the participants.

Table 5.4: Value of EA

Mechanism	Evidence	Codes	Theme	Value
Processes	*"the bank is experiencing faster development time and more sophistication with its architectural capabilities. It helps attain the right mix of people and IT to leverage data, service customers, and lean processes… our architectural model simplifies our processes… this in turn improves the development of the next generation of products and services" (B.BU1.P1.1)*	• Faster development time • Right mix of people and IT • Simplify processes • Improves development	EA practices facilitate faster development time for the business unit	Improved development time, simplification of complexity and standardisation of technologies were benefits experienced within business unit B.1 as a result of EA
	"Quantifying architectural processes is problematic at best… makes information transparent and more usable. In the banking arena, we experience quicker systems delivery time, and less complexity… this leads to a better customer experience across channels" (B.BU1.P3.1)	• Transparent • More usable • Quicker delivery time • Less complexity • Better customer experience		
	"we use a 'run, grow and transform' model in the department. All 3 parts need to be delivered simultaneously… that's not a joke… this is where architecture comes in… faster deployment time and simpler processes… the repository is the key. Each new development step now takes less time than the previous because of the reusable components… we reuse the same stored procedures and objects whenever possible… repository" (B.BU1.P6.1)	• Faster development • Simpler processes • Less time than previous • Reusable components • Stored procedures		

Mechanism	Evidence	Codes	Theme	Value
Communication	*"Staff are adverse to change, no matter how good the intent… even when the strategy is clearly communicated and intended for their own benefit… often, management assumes that staff will embrace the strategy if it is clear and comes from a place of authority… the reality is that staff are often fearful of change…there are trust issues… suspicious of managements understanding of the changes to their work… and if management will change direction in the strategy cycle… this is where architecture <u>enhances communication</u> with the <u>visibility</u> of <u>forecasting</u> where the changes will take place… <u>simplifies</u> the <u>changes</u> and in a <u>consistent</u> way… key, shows where money will be made" (B.BU1.P1.1)*	• Enhanced communication • Visibility • Consistency • Simplify changes	EA enhances communication, simplifies complexity and standardises integration for the business unit	
	"Strategies are hazy in most of the departments that I have worked in… the architecture provides a <u>simple view</u> of the operating model in a <u>uniform format</u>… the <u>entire value chain</u>… from project inception to implementation… <u>simplification increases</u> our <u>understanding</u>…. which eventually <u>improves profitability</u>" (B.BU1.P3.1)	• Simple view • Uniform format • Entire value chain • Simplification • Increased understanding • Improved profitability		
	"previously, I have found a <u>gap</u> between the <u>strategy formation</u> and its <u>implementation</u>… the architecture fills this gap…gives us a <u>standardised</u> approach to project <u>integration</u>… <u>quicker implementation</u> and <u>quicker revenue</u> generation and profits… <u>fills</u> the <u>gaps</u> between <u>operations</u> and <u>strategy</u>" (B.BU1.P6.1)	• Fills gap between strategy formation and implementation • Standardised approach • Integration • Quicker implementation		

Mechanism	Evidence	Codes	Theme	Value
		• Fills gap between operations and strategy		
Business-IT alignment	*"I think that the frustrations experienced by business and IT teams is largely due to a mismatch of expectations… although we are one bank, there is also a silo culture… unfortunately, the banks operating model encourages this behaviour… because of outdated structures, individual KPA's, as opposed to joint 'business-IT' KPA's… the current model is designed to measure individual business and IT staff as opposed to delivering joint solutions… architecture has been the only <u>common platform</u> to fill this void… facilitates <u>inter-operability</u> between <u>business</u> and <u>IT</u>, <u>better planning</u>, which <u>improves projects sdlc time</u>" (B.BU1.P1.1)*	• Common platform • Interoperability • Better planning • Improved project SDLC time	The business unit experiences an improvement in project time, better planning and communication due to the EA practices	
	"technology is the heart of transformation for this bank… we are competing against disruptive, technology start-ups that are providing innovative financial solutions… kids operating in their basements from anywhere in the world… that's who the bank is competing with…. and we have a case with business and IT departments squabbling with each other… architecture is the <u>common communication language</u> that we all understand… <u>prevents misunderstandings</u>, <u>better planning</u>" (B.BU1.P1.1)	• Common communication language • Prevents misunderstandings • Better planning		
	"substantial gaps exist between managements ambitions and what they realistically can achieve. Management wants	• Common dialogue platform	EA creates a common	

Mechanism	**Evidence**	**Codes**	**Theme**	**Value**
Senior-Management Involvement	*speed and innovative, and simple integrated technologies that are user friendly… but a culture of frustration between senior management and IT… frustrations caused by complex legacy systems…the architecture gives senior management a platform and an environment for common dialogue" (B.BU1.P1.1)*		dialogue platform for business and IT stakeholders. It simplifies management understanding of technology due to a standardised platform	
	"the architecture has allowed business management to work more closely with IT management… better synergy… better understanding of the systems" (B.BU1.P3.1)	• Better synergy between business and IT • Better systems understandings		
	"these days, the bank requires a more nimble working relationship between business management and IT… the architecture model facilitates this relationship… benefits of visibility and simplicity (B.BU1.P6.1)	• Nimble working relationship • Visibility • Facilitates relationship • Simplicity		
Finance	*"architecture is a tool… a valuable tool that helps with simplification of complexity and improve our technical decisions… it has helped us uncover many relevant details during integration… systems built faster" (B.BU1.P1.1)*	• Simplification of complexity • Improve technical decisions • Details integration • Built faster	EA helps align priorities, improve forecasting and enables faster system builds for the business unit	
	"Management is now also thinking outside the box… which means they want a 3 dimensional view of the technologies in the bank… the architecture allows creates this view with an alignment of priorities aligned to the project costs… benefits include a single procurement model and accurate forecasting" (B.BU1.P3.1)	• 3 dimensional view of technologies • Alignment of priorities • Single procurement model • Accurate forecasting		

Illustrated in Table 5.4, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were used to understand the EA practices, with the questions structured to obtain insights into the forms of value obtained for each of these mechanisms (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). **Codes** comprising of *faster development time*, *simplify processes, common platform, common language, fills gap between strategy formation and implementation, standardised approach* and *less complexity*, were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 19, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *EA practices facilitate faster development time for the business unit; EA enhances communication, simplifies complexity and standardises integration for the business unit; the business unit experiences an improvement in project time, better planning and communication due to the EA practices; EA creates a common dialogue platform for business and IT stakeholders. It simplifies management understanding of technology due to a standardised platform* and *EA helps align priorities, improve forecasting and enables faster system builds for the business unit* were developed.

Thereafter, **the defining and naming** step finalised the description of this business unit's theme as follows. *Improved development time, simplification of complexity and standardisation of technologies were benefits experienced within business unit B.1 as a result of EA. EA created a common dialogue platform for business and IT stakeholders. This simplified complexity and enhanced management's understanding of technology, due to a standardised platform. Furthermore, it enabled faster development time for building systems within the business unit.*

The next section presents findings from the second business unit within Bank B.

5.3 Presentation of Findings from Bank B, business unit 2

This section presents the data used to determine the EA maturity level, the EA granularity, as well as the tangible and intangible forms of value obtained from EA for Bank B, business unit 2 (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). Further evidence from this business unit can be found in Appendix 20.

This business unit provides *credit card products* to customers of Bank B. The product was comprised of a plastic card issued by Bank B, that allowed its customers to transact at a retailer point of sale or online. Borrowing limits were pre-set according to a customer's credit rating, and interest charges commences about a month after a purchase (BankB, 2018). The business unit was composed of approximately 1000 permanent staff, including of a business unit Executive, CIO, CFO, HR and support heads. Strategic components of finance, HR, and IT functions are sourced from the group. The IT staff was responsible for systems such as the card lookup system, Visa/MasterCard system, risk rating systems, customer lookup systems, and the national credit act database. Business staff were responsible for risk profiling of customers, developing credit models and processing applications (BankB, 2018; SARB, 2018). Illustrated in Table 5.1, a total of 4 people were invited to participate in the individual interviews from this business unit. Two people accepted and participated in the individual interviews, representing an acceptance rate of 50%. The participants were a mix of business and IT professionals from different levels of seniority.

The data used to determine the EA maturity level follows.

5.3.1The level of EA maturity at Bank B, business unit 2

This subsection presents data related to the EA practices from the second business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part A of the interview protocol (Appendix 4) was used to gather this data. The level of maturity was determined by judging the EA practices as described by the participants from this business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

Table 5.5: Mechanisms of EA

Mechanism	Evidence	Codes	Theme	Level
Processes	*"still green… relying on a couple of people involved… it provides us with an overview and transparency of our systems… the benefits are clear savings… not only does our architecture reduce the cost and damage caused by our IT bombs, it fosters trust, teamwork and confidence from the business stakeholders… difficulty retaining talented staff" (B.BU2.P2.1)*	• Still green • Relying on a couple of staff • Transparency • Trust • Teamwork • Confidence • Difficulty retaining staff	EA processes new and gives the ability for quick decision-making, however key person dependency a problem, as well as staff retention and turnover issues	Theme concentrated within level 1 maturity
	"we aim to build our systems flexibly… the visibility of our architecture helps us make quick business decisions as it gives us the ability to slice and dice through the systems… continuous savings…the only problem is the staff turnover… not a bank problem, but an industry problem… when those staff are not around, much of the effort and momentum is lost…sometimes everything comes to a halt" (B.BU2.P5.1)	• Visibility • Quick decisions • Continuous savings • Staff turnover problem • Industry problem		
Communication	*"the team is still getting familiar with the new architectural notations that the guys are using… we roughly there… … still too many gaps in the process, some fine tuning to the processes and we should be there… our problem is not with architecture, but finding the right people to fill the roles… massive skill shortage in the industry… that's where the problem is… big key man dependency… should be driven by the process, but its driven by specific staff… other*	• Still getting familiar • Roughly there • Too many gaps • Fine tuning required • Problem finding right people • Key man dependency • Driven by specific staff • Vendor dependency	EA communication is still gaining momentum, and requires fine tuning. However, there is no common	Theme concentrated within level 1 maturity

Mechanism	Evidence	Codes	Theme	Level
	problem…the vendors are pushing their agendas" (B.BU2.P2.1)		vision, and it's being driven by specific staff	
	"some way to go… we don't necessarily share a common vision about the strategy of this business… not applied to all the projects… dependent on who is running the project… we have some professionally written documents… absolute key man dependency…with implicit knowledge… also too many contractors" (B.BU2.P5.1)	• No common vision • Not applied to all projects • Person dependency • Contractor problem • Some professional documents • Key man dependency • Implicit knowledge		
Business-IT alignment	*"The problem we have in these big banks is the silos. Business units usually build solutions to suit just their needs… with relatively little regard of the impact to the overall banks IT architecture" (B.BU2.P2.1)*	• Silos • Business unit focus • Minimal regard for bank impact	Business unit silos are prevalent, with a misalignment with the bank's overall architecture	Theme concentrated within level 1 maturity
	"The architectural processes are not very stable, but we still get a lot of useful work out of it" (B.BU2.P5.1)	• Unstable • Useful work		
Senior-Management Involvement	*"internal politics is the issue… internal fighting… managers inconsistent in managing staff…not holding staff accountable" (B.BU2.P2.1)*	• Internal politics • Internal fighting • Inconsistent staff management • Staff not accountable	Internal politics, in-fighting and staff not held accountable. Architecture not defined as a competency	Theme concentrated within level 1 maturity
	"they haven't defined architecture as a competency… I feel there is still a lack of strong leadership… the managers don't connect and build relationships with staff… there is still the 'them and us' problem" (B.BU2.P5.1)	• haven't defined architecture as a competency • No strong leadership • No connections		

Mechanism	Evidence	Codes	Theme	Level
		• No relationships • Them and us problem		
Finance	*"it depends on who is running the project. We apply it to some projects to help link our department's IT scorecard to the bank's strategic projects… these projects have provided system and application cost savings" (B.BU2.P2.1)*	• Person dependency • Apply to some projects • Cost savings	Key man dependency and staff churn a problem	Theme extends across levels 1 and 2 maturities
	"Constant churn of the staff diminishes architectures capability… the value gets lost" (B.BU2.P5.1)	• Staff churn problems		

Illustrated in Table 5.5, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance,* were adopted from the ACMM mechanisms to understand the EA practices (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result.

The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). It was established that EA gave the business unit the ability to make quick decisions. However, more fine tuning was required as business unit silos were prevalent, with a misalignment of these business unit silos with the bank's overall architecture. It was further found that there was no common vision across the business unit. EA practices within this business unit were inconsistent as they were dependent on specific staff members that advocated its value for particular projects. Besides the dependency on specific individuals, this business unit was characterised as having an excessively high staff turnover rate, which resulted in intermittent EA momentum applied. Additionally, this business unit had a high degree of internal conflict related to the roles of staff due to an overlap of responsibilities. An inconsistent degree of management support featured within this business unit, with some managers advocating EA practices, whereas others had no interest in its presence.

Artefacts from this business unit were analysed to confirm claims from the participants, as well as assess for quality and completeness using the artefacts collection procedure outlined in Chapter 3 (Bernard, 2015; Campbell, 1999), as well as the form in Appendix 15. Examples of the artefacts developed in this business unit included capability documents, as is documents, target state documents, and data flow diagrams. An attempt was made to link these types of artefacts to the specific mechanisms; however, no reliable pattern could be established. This was due to the large variety of artefacts developed and structured according to the business unit specific services and functional requirements. However, this study eventually assessed the quality of artefacts and organised them into *current*, *transition,* and *future* state architectures (Harrison, 2013). The documents were checked for formal sign offs, as well as 'final' versions to ensure the quality and completeness of the artefacts reviewed (Bernard, 2015; Campbell, 1999). The artefacts used in this business unit were stored in a central location that was easily accessible by the staff. This business unit made use of standardised templates for developing artefacts, which made user navigation easy due to this consistency. However, although these artefacts targeted a business audience, they were difficult to understand and comprehend, as they were written in a technical style. Furthermore, figures and graphics within these documents contained screenshots of raw code, with no textual explanations, which made the interpretation of these artefacts more difficult. Many of the documents contained inaccuracies such as the incorrect or outdated versions of the screenshots. Several of the artefacts reviewed were incomplete with key sections missing. Some of these documents did not clearly state the names of the stakeholders, whereas other artefacts contained stakeholders that were not involved in the project. The focus of the artefacts was on the business unit's current state. None of the documents reviewed were explicitly linked to the business unit future state architecture.

Codes including *still green, relying on a couple of staff, difficulty retaining staff, quick decisions, continuous savings, staff turnover problem, still getting familiar, too many gaps, problem finding right people* and *key man dependency,* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 20, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of *EA processes new and gives ability for quick decision-making, however key person dependency a problem, as well as staff retention and turnover issues; EA communication is still gaining momentum, and requires fine tuning. However, there is no common vision, and it's being driven by specific staff; business unit silos are prevalent, with a misalignment with the bank's overall architecture; internal politics, in-fighting and staff not held accountable. Architecture was not defined as a competency* and *key man dependency and staff churn a problem* were developed.

Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The themes of the *processes, communication, business-IT alignment, senior management involvement, and finance* mechanisms from this business unit were evaluated against the characteristics of ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). This business unit contained EA *processes* that were new and provided it with the ability for quick decision-making. However, problems with staff retention and turnover were evident. It was found that the traits of this mechanism aligned to the characteristics of level 1 maturity. EA *communication* was still gaining momentum within this business unit, and required fine tuning. However, there was no common vision, and EA was being driven by specific staff, which aligned to the characteristics of level 1 maturity. *Business-IT alignment* was characterised as having business unit silos prevalent, with a misalignment with the bank's overall architecture, which aligned to the characteristics of level 1 maturity. Furthermore, *senior management* involvement was characterised as encompassing internal politics, fighting, and staff not being held accountable, which aligned to the characteristics of level 1 maturity. Finally, the finance mechanism *had a key man dependency and staff churn a problem with regard to the EA contribution,* which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Overall, this business unit was characterised as containing EA practices that were ad-hoc, inconsistent, and person dependent (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op 't Land et al., 2009; Paulk et al., 2006).

Finally, **the defining and naming step** concluded with *informal EA capabilities and practices that are new, still gaining momentum within Bank B, business unit 2.* Based on these evaluations, it was judged that **bank B, business unit 2,** operated within **maturity level 1**.

Once the level had been established, the next step was to identify the EA granularity for this business unit, and follows in the next subsection.

5.3.2 EA granularity within Bank B, business unit 2

This subsection presents data related to the EA granularity in use. The granularity was determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from this business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The interview protocol (Appendix 4, Section A, questions 6-10) was structured to elicit these responses.

Table 5.6: EA granularity

Domains	Evidence	Codes	Theme	Granularity
Business	*"outlines this department's structure... we are a fairly complex business… and our architecture shows interactions between people, processes, and technology… we speak of our business architecture in this department, but it is not formalised… it's a few business models like SWOT and a scorecard that we use… more formalisation is needed" (B.BU2.P2.1)*	• Departments structure • Interactions • People, process, technology • Not formalised • Few business models • SWOT • Scorecard	Informal business architecture showing the interaction of people, processes and technology. Comprises of goals, SWOT and scorecards. However, problems with execution	Business architecture defined at a coarse granularity of refinement
	"our business goals are defined, it's to reduce customer complaints by 15%… people accountability is a concern… our scorecard objective is to establish performance criteria for all staff… the execution of the business plan is where we fall short… EXCO strat sessions take place quarterly where the strategy is developed, but the team struggles with the practical application… long-term strategic plans and short-term tactical plans are in place, but the department struggles to execute" (B.BU2.P5.1)	• Business goals defined • Reduce customer complaints by 15% • Establish performance criteria • People accountability concern • Objectives • Execution problem • Practical application a problem		
Application	*"we have a software goal to get a single source of the truth, but honestly, no real application architecture in the true sense… just lots of software being maintained… some loose structure… functionality like settle debt is clear… depicts the various software packages and how they behave… too much redundancy… we need to standardise the department's platforms… maintenance is a nightmare… we are forming architectural standards and guidelines so on the right track" (B.BU2.P2.1)*	• Goal of single source of truth • No real application architecture • Software being maintained • Loose structure • Functionality of settle debt • How software behaves • Redundancy problem	Monolithic application architecture comprised of many loose applications. Problems with maintenance,	Application architecture defined at a coarse granularity of refinement

Domains	Evidence	Codes	Theme	Granularity
		• Maintenance problem • Forming standards and guidelines	duplication of systems and large code bases. Moving towards services architecture	
	"Monolithic architecture in place… moving towards a more services oriented set up. Still have large code bases that we are breaking up… will take time, as these are legacy systems built over many years… duplicate systems in our department is a problem… too many systems doing the same thing. This happens because of peoples egos where managers tried to justify their existence. We need rationalisation, so we have to retire the old systems... on the plus side, the IDE environment is well organised" (B.BU2.P5.1)	• Monolithic • Services oriented being set up • Large code base • Duplicate systems • Rationalisation required • IDE organised		
Technology	*"I think the technology stack is setup well… we have a goal of building a single end to end platform with a SOA architecture. The standards are in place for end user devices, networks, storage, servers. It shows the applications that we deployed in the various infrastructure layers of the bank's mainframe… this depicts both the development and production environments… the benefit comes in when we deploy new systems" (B.BU2.P2.1)*	• Set up well • Goal of a single platform with SOA • Standards • Shows applications • Layers • Depicts environments • Deployment benefits	Well set up technology architecture showing the layers and environments. Follows OSI reference model	Technology architecture defined at a fine granularity of refinement
	"the network architecture is robust… we follow the OSI reference architecture with 3 layers… TCP/IP standards in place, a full repository of IP addresses, and ports, and a register of all routers and switches…domains and functions from the storage platforms to	• Network architecture • Robust • OSI reference • Storage domain platform • Message service function		

Domains	Evidence	Codes	Theme	Granularity
	messaging services are there… we fall short with the basics like patching of machines… too many VM's" (B.BU2.P5.1)	• Basic processes not working		
Data	*"on the data side, we are a traditional SQL shop with data residing on an SQL database. Our data and database architecture is fairly well organised. We have been a SQL shop since the 1990's. The data is organised and structured. It's unlikely that we will move away from this, as we have found SQL is the only language capable of handling our workloads without falling over due to its dynamic scalability. It's very robust and stable… we have differential backups that have not failed in years… we can retrieve large volumes of records from the database in microseconds… the fastest processing time in the industry… data is stored in various formats and standards in the department… depends on the data type… we do have a diagram with this overview" (B.BU2.P2.1)*	• SQL environment • Well organised • Structured • Dynamic scalability • Differential backups not failed • Formats • Standards • Diagrams • Overview	Well organised data architecture focusing on structured data in an SQL environment. A goal of minimal total cost of ownership. Challenges with big data migration use to unstructured data.	Data architecture defined at a coarse granularity of refinement
	"our goal is to have minimal total cost of ownership… we have a challenge with data integration and interfaces across the departments… we only have control within this department… new challenges as we move towards big data and unstructured data… our systems designed around structured data" (B.BU2.P5.1)	• Goal of minimal total cost of ownership • Data integration and interface challenge • Department control • Big data challenges • Unstructured data challenges		

Illustrated in Table 5.6, **a priori themes** (Strauss and Corbin, 2015) comprising of these domains were adopted from TOGAF (Harrison, 2013). This table lists the evidence collected that supported the codes within each domain, as well as the theme and granularity identified. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017).

Business architecture

Business unit B.2 built an informal architecture comprising of goals, such as "*reduce customer complaints by 15%"* that were further expanded within the various artefacts. Scorecards with objectives such as *"establishing performance criteria"* for staff were further established within this business unit. Moreover, SWOT (strengths, weaknesses, opportunities, and threats) exercises for internal functions such as such as HR, finance, and marketing, were conducted. However, the artefacts revealed that this business unit goals and objectives were not linked to the overall bank's strategy.

Application architecture

The application architecture within bank B, business unit 2, was designed as a loosely structured monolithic model that was moving towards a service based architecture. The results showed that clear software architectural goals such as a *"single source of the truth"* were applied. Moreover, architectural objectives for functionality such as *"settle debt*" were defined. However, this business unit did not demonstrate any evidence to support the implementation and deployment of these goals and objectives.

Technology architecture

Within bank B, business unit 2, the technology architecture was structured within layers and environments. This business unit had clearly defined its technology goals such as the delivery of a *"single end to end platform"* and objectives such as *"service oriented architecture"*. Domains such as *"storage platforms"* and functions such as *"messaging services"* were articulated. However, technology components, vendors, nodes, and execution details were not specified.

Data architecture

This business unit contained a data architecture focusing on structured data within an SQL environment. This business unit clear data objectives such as a "*minimal total cost of ownership"* and goals such as *"differential backups to be performed daily"*. Artefacts revealed that documentation to manage these goals, such as architecture for the backups were in place. However, details demonstrating the data fields and the types of databases used, were inconsistently defined.

Codes comprising of *departments structure, interactions, not formalised, few business models, SWOT, scorecard, business goals, execution problem, practical application a problem, no real application architecture* and *loose structure*, were derived from the data (Braun and Clarke, 2008; Silver and

Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 20, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of *informal business architecture showing the interaction of people, processes and technology; comprises of goals, SWOT, and scorecards. However, problems with execution, monolithic application architecture, comprised of many loose applications*; *problems with maintenance, duplication of systems and large code bases. Moving towards services architecture; well set up technology architecture showing the layers, and environments. It follows OSI reference model* and *well organised data architecture focusing on structured data in an SQL environment, goal of minimal total cost of ownership, and challenges with big data migration use to unstructured data.*

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Bank B, business unit 2, defined its business architecture at a coarse granularity of refinement. This domain comprised of its objectives, goals, relationships, capabilities, SWOT and scorecards. Furthermore, this domain was informally developed and showed the interaction of people, processes, and technology within the business unit. The application architecture was defined at a coarse granularity of refinement. This domain specified the software applications that were required by the business unit, and was designed as a monolithic-application architecture comprised of various loosely coupled applications. A transition plan describing a strategy to move towards service based architecture was in place. The architecture highlighted problems related to the maintenance of large code bases within the existing systems as well as duplicate systems procured for certain functions. The technology architecture was defined at a fine granularity of refinement. This domain illustrated where the technology was physically deployed, by depicting the layers and environments, structured within an OSI reference model. The data architecture was specified at a coarse granularity of refinement. It defined the types of data required to support the business unit, and was designed within a structured data in an SQL environment. Moreover, a data goal focusing on the minimal total cost of ownership was in place.* Based on these evaluations, it was judged that **bank B, business unit 2,** defined its overall EA at a **coarse granularity of refinement**.

Once the granularity of refinement had been identified, the next step was to identify the business value of EA for this business unit, which commences below.

5.3.3 Business Value of EA from Bank B, business unit 2

This subsection presents data related to the business value of EA from the second business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part B of the interview protocol (Appendix 4), was used to collect this data. It was used to understand the value related to each EA mechanism that was perceived by the participants.

Table 5.7: Value of EA

Mechanism	Evidence	Codes	Theme	Value
Processes	*"we work with vast amounts of sophisticated technology… small room for error… we need to know how to process the information to meet business needs… our architecture helps improve the quality of our technical documentation… architecture makes our systems transparent and processes visible… this leads to hardware and software savings, and better management of uncertainty" (B.BU2.P2.1)*	• Quality technical documentation • Transparent processes • Visible • Hardware savings • Software savings • Management of uncertainty	EA improves the quality of technical documentation that leads to hardware and software savings	Forms of value such as hardware cost savings, software cost savings and improved documentation were experienced within business unit B.2 as a result of EA
	"day to day operational processes and strategic process often conflict with each other… the architecture bridges the gap thanks to the visualisation… less document intense, people cost savings and hardware cost savings" (B.BU2.P5.1)	• Bridges gap • Visualisation • Less document intense • People cost savings • Hardware cost savings		
Communication	*"being part of senior management, I have challenges in keeping the stakeholders focused on the projects and working in synergy with each other. I have found that pictures facilitate better communication between people. It manages a common expectation and is a reference point for any disagreements… I have found benefits savings on infrastructure costs, application costs" (B.BU2.P2.1)*	• Pictures • Common expectation • Reference point • Savings • Infrastructure costs • Application costs	EA helps manage stakeholder expectations and enables them to reach consensus on disagreements. Hardware and software	
	"the architecture helps the stakeholders be transparent and honest with each other. They struggle with traditional project	• Transparent • Honest		

Mechanism	Evidence	Codes	Theme	Value
	management techniques… doesn't give a holistic view… the blueprints facilitate consensus amongst them… better technical decisions that results in software and hardware efficiencies and savings… communication helps turn ideas into reality. Architectural diagrams give us the capability to translate ideas into value propositions that can be used to convince exco to invest in… results in innovation" (B.BU2.P5.1)	• Consensus • Better technical decisions • Software efficiencies • Hardware efficiencies • Savings • Innovation	savings further experienced	
Business-IT alignment	*"In the last decade, technology has made it a lot easier for us to make informed decisions and deliver systems… but as a famous superhero said, with great power comes great responsibility… our architectural design models allows us to make these risky decisions with more confidence than in the past. Mitigating risk means savings to the bottom line" (B.BU2.P2.1)*	• Mitigating risk • Savings	Cost savings, risk mitigation and improved documentation experienced by the business unit resulting from EA	
	"drives our innovation and momentum… although new, it's now hard to imagine how we would now function without our architectural processes… has transformed the way that business and IT departments work, by involving business stakeholders in technical design sessions. The architecture creates alignment for both sides and improves cost savings… clear documentation…ensures no misunderstanding during development" (B.BU2.P5.1)	• Innovation • Momentum • Transformation • Stakeholder involvement • Alignment • Cost savings • Documentation • Misunderstanding		
	"traditionally, the bank had an autocratic hierarchical structure… gradually over time this has waned… the banks	• Common platform • Resource efficiencies	Architecture creates a	

Mechanism	Evidence	Codes	Theme	Value
Senior-Management Involvement	*culture has become more democratic and interactive… we have social media platforms in the department like yammer where staff share their ideas… more collaboration and teamwork across staff and senior management…the visibility of the architecture provides a <u>common platform</u> for management and staff to unite… we have experienced <u>resource</u> and <u>software efficiencies</u>" (B.BU2.P2.1)*	• Software efficiencies	common platform and single view of initiatives for senior management. It further provides resource efficiencies	
	"the bank's strategy is a spaghetti mix of quick wins and long-term platform changes across the departments… these initiatives can only be represented within a <u>single view</u> with the architectural platform... this <u>visualisation</u> of the initiatives provides us with benefits like <u>less duplication</u> of effort and <u>technology cost savings</u>" (B.BU2.P5.1)	• Single view • Visualisation • Less duplication • Technology cost savings		
Finance	*"Investments in suitable projects that generate the highest business value… <u>hardware</u> and <u>software</u> savings and <u>improved ROI</u>" (B.BU2.P2.1)*	• Hardware savings • Software savings • Improved ROI	Hardware and software cost savings experienced, improved ROI as well as a common framework created by EA	
	"while the architecture provides a <u>common framework</u> to view the different domains, the value for me is <u>highlighting</u> the <u>duplicate applications</u> and outdated infrastructure… and the <u>hardware</u> and <u>software savings</u> that follow…the architecture creates the framework for <u>prioritising projects based on ROI</u>" (B.BU2.P5.1)	• Common framework • Highlight duplicate applications • hardware savings • software savings • Project prioritising based on ROI		

Illustrated in Table 5.7, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance,* were used to understand the EA practices, with the questions structured to obtain insights into the forms of value obtained for each of these mechanisms (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result. The analysis commenced with the **familiarisation of the data** step, whereby the participant's comments were examined (Braun and Clarke, 2008; Terry et al., 2017). **Codes** comprising of *quality technical documentation, transparent processes, visibility, hardware savings, software savings* and *management of uncertainty*, were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 20, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *EA improves the quality of technical documentation that leads to hardware and software savings; EA helps manage stakeholder expectations and enables them to reach consensus on disagreements. Hardware and software savings further experienced; cost savings, risk mitigation and improved documentation experienced by the business unit resulting from EA; architecture creates a common platform and single view of initiatives for senior management. It further provides resource efficiencies* and *hardware and software cost savings experienced, improved ROI, as well as a common framework created by EA* were developed.

Thereafter, **the defining and naming** step finalised the description of this business unit's theme as follows. *Forms of value such as hardware cost savings, software cost savings and improved documentation were experienced within business unit B.2 as a result of EA. EA created a common platform and single view of initiatives for senior management. This helped manage stakeholder expectations and enabled them to reach consensus on disagreements. Furthermore, it improved the quality of technical documentation that led to hardware and software savings. EA finally influenced resource efficiencies which improved ROI for the business unit.*

The next section presents findings from the last business unit within Bank B.

5.4 Presentation of Findings from Bank B, business unit 3

This section presents the data used to determine the EA maturity level, the EA granularity, as well as the tangible and intangible forms of value obtained from EA for Bank B, business unit 3 (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). Further evidence from this business unit can be found in Appendix 21.

This business unit provided *commercial and business banking products* to customers of Bank B. Customers were in the form of small to medium companies, as opposed individuals. Business unit 3 provided a variety of products such as loans, investments, and transactional services to these companies. This business unit provided both secured and unsecured types of products (BankB, 2018). It was composed of approximately 1500 permanent staff, including of a business unit Executive, CIO, CFO, HR, and support heads. Components of finance, HR, and IT functions are centralised sourced from the group. The IT staff were responsible for systems such as the cheque clearance system, cash management system, private equity financing system and tax clearance and lookup systems. Business staff were responsible for issuing letters of credit, guarantees, risk profiling, advisory services and drawing up business plans (BankB, 2018; SARB, 2018). Illustrated in Table 5.1, a total of 6 people were invited to participate in the individual interviews from this business unit. Two people accepted and participated in the individual interviews, representing an acceptance rate of 33%. The participants were a mix of business and IT professionals from different levels of seniority.

The data used to determine the EA maturity level follows.

5.4.1 The level of EA maturity at Bank B, business unit 3

This subsection presents data related to the EA practices from the third business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part A of the interview protocol (Appendix 4) was used to gather this data. The level of maturity was determined by judging the EA practices as described by the participants from this business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

Table 5.8: Mechanisms of EA

Mechanism	Evidence	Codes	Theme	Level
Processes	*"the original architecture framework was set up by an external consultancy… so the <u>basic framework</u> is in place… architectural <u>roles</u> and <u>responsibilities</u> are <u>evolving</u>, but we have a <u>work overload problem</u> in this department… and sometimes the architectural team is <u>lethargic</u> but gets the job done" (B.BU3.P3.1)*	• Basic framework • Roles and responsibilities evolving • Work overload problem • Lethargic	Basic EA processes in place for core systems, but staff problems with regard to focusing on EA due to work overload	Theme extends across levels 1 and 2 maturities
	"<u>basic</u> architectural <u>processes</u> are <u>in place</u> for the <u>core systems</u>, the processes for the <u>non</u>-<u>core</u> systems are still <u>being developed</u>… too many <u>distractions</u>… <u>difficult to focus</u> on EA to get it properly off the ground" (B.BU3.P5.1)	• Basic processes in place core systems • Non-core being developed • Distractions • Difficult to focus		
Communication	*"we have <u>basic</u> architecture <u>documents for</u> most of our <u>critical applications</u>… we have an <u>architectural standards</u> document… the <u>repository</u> is generally <u>up to date</u> with the <u>latest production systems</u>… the <u>infrastructure</u> architecture documents are fairly <u>up to date</u>… only concern is that some of the <u>business plans</u> have <u>not</u> been <u>considered</u> in the design" (B.BU3.P3.1)*	• Basic documents for critical applications • Architectural standards • Repository updated • Latest production systems • Infrastructure updated • Business plans not considered	Basic updated EA documents in the repository for the critical systems. Staff awareness activities take place regularly	Theme concentrated within level 2 maturity
	"we are making good progress with <u>raising architecture awareness</u>… the architecture team provides <u>feedback to staff</u> in all the <u>monthly</u> staff feedback sessions" (B.BU3.P5.1)	• Raising architecture awareness • Monthly feedback to staff		

Mechanism	Evidence	Codes	Theme	Level
Business-IT alignment	*"still in its infancy, our architecture is an essential component in ensuring the efficient and secure operation of this bank… it helps us understand regulations like POPI, FAIS and FICA, and how to transform these regulations through various technology channels" (B.BU3.P3.1)*	• Still infancy • Essential component • Understand regulations • Transform	Intermittent alignment that is progressing. EA useful for understanding regulations	Theme extends across levels 1 and 2 maturities
	"I've worked at this bank for over 15 years and the issues of IT and alignment has been here since day 1. Architecture certainly can help, will not solve everything, but can help… we are still early days with the architecture blueprints" (B.BU3.P5.1)	• Issues with IT alignment • Blueprints		
Senior-Management Involvement	*"we have intermittent hands-on involvement… the odd opposition from management… some rebellious… architecture does feature in the MANCO agenda… various degrees of commitment" (B.BU3.P3.1)*	• Intermittent management involvement • Odd opposition • Rebellious • Management committee • Various degrees of commitment	Gradual involvement by senior managers, but key man dependency issues are prevalent	Themes spreads across level 1 and 2 maturities
	"there is a gradual buy-in from most of the senior managers… they are all definitely aware of its capability… key man dependency is a major problem with architecture… when the champion leaves, all the knowledge leaves with that person" (B.BU3.P5.1)	• Gradual buy-in from managers • Aware • Key man dependency		
Finance	*"we realised that IT architecture has become an integral part of banking today… it is fundamental to the support, sustain and growth this business… architecture spans across all business*	• Integral • Fundamental strategic asset • Competitive advantage	Fundamental to business operations.	Theme extends across levels 1 and 2 maturities

Mechanism	Evidence	Codes	Theme	Level
	units of this bank… it is not just an operational enabler for us but a <u>strategic asset</u> that gives us a <u>competitive advantage</u>… we <u>now give it</u> our full <u>support</u> and <u>always try</u> and ensure we have funding for its presence" (B.BU3.P3.1)	• Recent • Always try	Financial benefits experienced such as risk reduction	
	"our architecture also <u>reduces</u> significant internal and external <u>risks</u> for us… still <u>being developed</u>, it provides a framework to govern our IT systems to try and mitigate some of these risks" (B.BU3.P5.1)	• Reduces risks • Being developed		

Illustrated in Table 5.8, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were adopted from the ACMM mechanisms to understand the EA practices (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result.

The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). EA was becoming fundamental to business operations, and useful for understanding regulations. There was gradual involvement by senior managers in EA practices, with business-IT alignment steadily progressing. However, senior management displayed various degrees of commitment, with some managers advocating EA, with other managers resisting or opposing any new practices. Various efforts relating to improving EA practices were being established such as the introduction of regular staff awareness activities. However, there were staff problems in the department regarding focusing on EA due to a work overload problem. Furthermore, a dependency on specific individuals was an issue. Financial benefits such as risk reduction were experienced.

Artefacts from this business unit were analysed to confirm claims from the participants, as well as assess for quality and completeness using the artefacts collection procedure outlined in Chapter 3 (Bernard, 2015; Campbell, 1999) as well as the form in Appendix 15. It was found that basic EA processes and updated documentation were in place for critical core systems, and were stored within the repository. Examples of the artefacts used in this business unit include business requirement documents, functional requirements, GAP analysis, and data warehouse specifications. An attempt was made to link these types of artefacts to the specific mechanisms; however, no reliable pattern could be established. This was due to the large variety of artefacts developed and structured according to the business unit specific services and functional requirements. However, this study eventually assessed the quality of artefacts and organised them into *current*, *transition,* and *future* state architectures (Harrison, 2013). The documents were checked for formal sign offs, as well as 'final' versions to ensure the quality and completeness of the artefacts reviewed. As all the artefacts were developed from standard templates, they were found to be well organised and clearly structured. However, many of them were incomplete, as all the solution features were not documented. Furthermore, most of the artefacts contained the minimum details. Although the standard templates were used, the writing style differed notably across different individuals involved in the projects. Moreover, text and graphics within the artefacts did not always follow the corporate identity (CI) of the respective business units. The artefacts focused on the current state and were linked to the business unit's strategy or target state.

Codes including *basic framework, roles and responsibilities evolving, work overload problem, lethargic, basic processes in place for core systems, non-core being developed, distractions* and *difficult to focus,* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 21, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of *basic EA processes in place for core systems, but staff problems with regard to focusing on EA due to work overload; basic updated EA documents in the repository for the critical systems. Staff awareness takes place regularly; intermittent alignment that is progressing. EA useful for understanding regulations; gradual involvement by senior managers, but key man dependency issues are prevalent* and *fundamental to business operations. Financial benefits experienced such as risk reduction* were developed.

Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The themes of the *processes, communication, business-IT alignment, senior management involvement, and finance* mechanisms from this business unit were evaluated against the characteristics of ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). This business unit contained EA *processes* that were basic and in place for its core systems, however staff problems were evident regarding focusing on EA due to work overload issues. It was found that the traits of this mechanism aligned to the characteristics of practices extending across levels 1 and 2 maturities. Regarding the *communication* mechanism, this business unit incorporated basic updated EA documents in its repository for its critical systems. Furthermore, staff awareness activities took place regularly, which aligned to the characteristics of level 2 maturity. *Business-IT alignment* was intermittent and was still progressing. EA was found to be useful for understanding regulations, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Furthermore, there was gradual involvement by *senior managers*, with EA becoming fundamental to business operations, however, a dependency on specific individuals was an issue prevalent, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Finally, *financial* benefits were experienced with the advantages of risk reduction experienced, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Overall, the EA practices within this business unit were characterised as basic, simple, and in progress (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op ’t Land et al., 2009; Paulk et al., 2006).

Finally, the **defining and naming step** concluded with *EA being established as well as EA processes being developed and communicated within business unit B.3* used to describe this theme. Based on these evaluations, it was judged that **bank B, business unit 3,** operated within **maturity level 2**.

Once the level had been established, the next step was to identify the EA granularity for this business unit, and follows in the next subsection.

5.4.2 EA granularity within Bank B, business unit 3

This subsection presents data related to the EA granularity in use. The granularity was determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from this business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The interview protocol (Appendix 4, Section A, questions 6-10) was structured to elicit these responses

Table 5.9: EA granularity

Domains	Evidence	Codes	Theme	Granularity
Business	*"we have a business strategy document where the architecture is defined… it has the departments strategic objectives, shows our roadmap… it's that simple, but extremely powerful… every project, every system and every financial decision has to align to that" (B.BU3.P3.1)*	• Business strategy • Architecture defined • Strategic objectives • Roadmap • Simple • Align	Informal architecture in place that includes strategic objectives, roadmap, structures and functions	Business architecture defined at a coarse granularity of refinement
	"the departments business architecture is informal, but we have it in place. It shows how the department is structured, functions and processes, and how we fit into the bank" (B.BU3.P5.1)	• Informal • Structured • Functions • Processes		
Application	*"there is no doubt that we are fully dependent on software architecture. Many of the bank's innovations that we now take for granted like cell phone banking simply wouldn't exist without the clever software architecture. For example, cell phone banking uses the same backend architecture as internet banking… a clever services oriented piece of architecture… although we have innovative products built on the software architecture, key man dependency is a serious concern" (B.BU3.P3.1)*	• Innovations • Same backend architecture • Services oriented • Key man dependency	Services oriented application architecture that uses the same backend for several applications. Focus on the communication mechanism. Notable key	Application architecture defined at a coarse granularity of refinement
	"uses SOA… so our architecture shows our services and how they communicate with each other… every project follows a number of phases: concept, design, development, testing, and so forth... but there's one crucial step in the process that can make or break the success of the solution… the application architecture. This ensures	• Services oriented architecture • How communicate • Pattern		

Domains	Evidence	Codes	Theme	Granularity
	that the correct technical decisions are made using the correct <u>pattern</u>" (B.BU3.P5.1)		man dependencies	
Technology	*"<u>early stages</u>… a lot of <u>work</u> has <u>to still be done</u> to create technology methods, models and tools for this department… includes the <u>technology vision</u> and <u>strategy</u> and <u>specific</u> technologies… we have a list of the <u>interfaces</u>, <u>parameters</u>, <u>databases</u>, <u>mainframes</u> and networks… specifies the <u>protocols</u> used, everything is <u>not up to date</u>" (B.BU3.P3.1)*	• Early stages • Work to be done • Technology • Vision • Strategy • Specific • Interfaces • Parameters • Databases • Mainframes • Not up to date	A picture that depicts the configurations, servers, networks, as well as the vision, and strategy	Technology architecture defined at a coarse granularity of refinement
	"my honest opinion is that the infrastructure set up and architecture is critical… just like a foundation that supports a building. The business architecture is just fluff. Our infrastructure of <u>servers</u> and <u>networks</u> supports all the applications… its <u>robust</u> and we have a <u>picture depicting</u> all the <u>configurations</u>" (B.BU3.P5.1)	• Servers • Networks • Robust • Picture depicting configurations		
Data	*"is really <u>sophisticated</u>… it contains the <u>datatypes</u> such as transaction data, historical data, and master data, for example… the <u>frequency</u> at which the data will be made available from the various systems as well as whether the processing must take place in <u>real time</u>, near real time, or in <u>batch mode</u>" (B.BU3.P3.1)*	• Sophisticated • Data types • Frequency • Real time • Batch mode	Context that includes data types, frequency, structures,	Data architecture defined at a medium

Domains	Evidence	Codes	Theme	Granularity
	"for me, our data architecture gives <u>context</u>… you see, without context, data is meaningless. The architecture develops the <u>structure</u> for meaningful information to be created by interpreting the context around data… The resulting information then <u>guides</u> our <u>decisions</u>… within the bank, data is consumed in <u>different ways</u> by different departments and systems. It is important to understand these different ways so that the architecture can meet all stakeholder requirements. Data that card division sees as important may be viewed as secondary by the home loans department. Our data architecture is built on <u>abstractions</u> and <u>views</u> to meet a variety department needs" (B.BU3.P5.1)	• Context • Structure • Guides decisions • Different ways • Abstractions • Views	abstractions and views	granularity of refinement

Illustrated in Table 5.9, **a priori themes** (Strauss and Corbin, 2015) comprising of these domains were adopted from TOGAF (Harrison, 2013). This table lists the evidence collected that supported the codes within each domain, as well as the theme and granularity identified. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017).

Business architecture

Furthermore, bank B, business unit 3 had developed a simple application architecture that included *"strategic objectives", "roadmap", "structures"* and *"functions"*. The results from both the interviews and artefacts did not contain details showing how these goals could be realised, and did not specify implementation details or the roles of stakeholders. There was a perception that the business architecture was less important, and was described as *"just fluff"*.

Application architecture

There was a services oriented application architecture implemented within bank B, business unit 3, with notable dependency on specific individuals. The results showed that various software architectural objectives, such as *"services oriented architecture"*, principles such as the use of *"architectural patterns"* were defined. However, there were minimal details describing the inputs and outputs of the objectives.

Technology architecture

Simple technology architecture with components was constructed within Bank B, business unit 3. This business unit had defined a *"technology vision"* and *"strategy"*. However, the artefacts revealed that details were out of date.

Data architecture

A data architecture that included data types and data views was in place within bank B, business unit 3. It clearly specified data velocities such as frequency, real time, and batch mode. Documentation to manage these modes was in place, however, specified at an inconsistent level of detail.

Codes comprising of *strategic objectives, roadmap, simple, align, informal, services oriented, key man dependency, early stages* and *work to be done* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 21, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *informal architecture in place that includes strategic objectives, roadmap, structures and functions; services oriented application architecture that uses the same backend for several applications. Focus* *on the communication mechanism. Notable key man dependencies; a picture that depicts the configurations, servers, networks, as well as the vision, and strategy* and *context that includes data types, frequency, structures, abstractions and views.*

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *The business architecture of Bank B, business unit 3, specified at a coarse granularity of refinement, described its strategic objectives, roadmap, structures, and functions. The application architecture was defined at a coarse granularity of refinement. This domain specified the software applications required by designing service oriented architecture, using a common backend for several of its applications. The technology architecture was defined at a coarse granularity of refinement. It specified the technologies required as a picture that depicted the configurations, servers, and networks of the business unit. The data architecture was defined at a medium granularity of refinement, and specified the data types, frequency, structures, abstractions, and views of data required.* Based on these evaluations, it was judged that **bank B, business unit3,** defined its overall EA at a **coarse granularity of refinement**.

Once the granularity of refinement had been identified, the next step was to identify the business value of EA for this business unit, which commences below.

5.4.3 Business Value of EA from Bank B, business unit 3

This subsection presents data related to the business value of EA from the third business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part B of the interview protocol (Appendix 4), was used to collect this data. It was used to understand the value related to each EA mechanism that was perceived by the participants.

Table 5.10: Value of EA

Mechanism	Evidence	Codes	Theme	Value
Processes	*"We are constantly looking for ways to do more work in a shorter amount of time… we have automated just about all manual reporting processes to take the burden off our staff… our systems run all our reports, tracks projects and monitor financials… this has become possible with our architectural models… for us, innovate products is the only way to gain market share… hence we need quicker time to market. The development time on the projects is gradually improving as the architecture is maturing… since we are burdened with exorbitant costs of doing business… more regulation… and a diminishing customer base, we also need a better ROI on our systems. This means doing something different, cleverer or better that will make a difference in terms of value by using the latest technology… our architecture helps improve this ROI" (B.BU3.P3.1).*	• Automated reports • Tracks projects • Monitor financials • Quicker time to market • Development • Time improvements • ROI	EA processes help the business unit improve their development time and ROI	Faster development time, higher ROI and improved technical integration were experienced within business unit B. 3 because of EA.
	"the problem with traditional process approaches to business and IT is the siloed approach. I have found them to be too process intense and benefits difficult to see… I have seen processes being created for the sake of processes… our architecture flags components requiring improvement… it helps uncover underlying issues related to both business and technical problems… the architecture provides a holistic approach of assessing domains and	• Holistic approach • Visibility • Faster systems development • Simpler integration • Interoperability • More revenue • Requiring improvement		

Mechanism	Evidence	Codes	Theme	Value
	states…. With <u>visibility</u>… this has resulted in <u>faster systems development</u> and <u>simpler integration</u> and <u>interoperability</u> across diverse systems… absolutely <u>more revenue</u>" (B.BU3.P5.1).	• Uncover underlying issues		
Communication	*"the bank is becoming flatter in its structures and staff are required to play a more interactive role in its strategy… our architecture creates a <u>platform</u> as well as a set of <u>tools</u> to facilitate <u>communication</u> around the <u>strategy</u>… some time back, the staff could not clearly understand the banks strategy… also, I spoke about the <u>repository</u> just now… we have sped up <u>delivery time</u> with the repository… its <u>folders</u> are analysis, design, development, testing and implementation, fits with the <u>SDLC</u>. We look for <u>patterns</u> for each phase… just <u>reuse</u> patterns to speed up delivery… architecture filled this gap" (B.BU3.P3.1).*	• Platform • Tools • Communication • Strategy • Sped up development time • Repository • Delivery time • Folders • SDLC • Patterns • Reuse	Architectures create a platform to improve communications. Furthermore, the EA repository facilities reusability that results in improved development time	
	"the department develops <u>basic solutions</u>…also <u>cutting-edge technologies</u>…. architecture helps <u>understand</u> and <u>communicate</u> both extremes… also enhances communications and <u>access</u> to <u>critical information</u>" (B.BU3.P5.1).	• Basic solutions • Cutting-edge technologies • Understand • Communicate • Access to critical information		
Business-IT alignment	*"our competitiveness, to a large degree is based on the effective use of our IT systems… our systems are also complex not necessarily integrated…our architecture improves <u>integration</u> across the various <u>systems</u> in the*	• Integration • Right information to right people	EA helps the business unit improve integration	

Mechanism	Evidence	Codes	Theme	Value
	bank… it provides the right information to the right people… architecture gives us this integration" (B.BU3.P3.1).		across the banks systems. Aligns strategies, people, processes and technologies	
	"enables alignment between the business strategies and the stakeholders required to fulfil those strategies… also aligns people, process, and technologies across the bank" (B.BU3.P5.1).	• Aligns business strategies to stakeholders • Aligns people, process and technologies		
Senior-Management Involvement	*"creates a holistic view of the business objectives and the technologies required to support them... management can see which technologies are linked to the business objectives and which objectives are the highest priority for the bank… project delivery alignment that improves development time…. And better profitability returns" (B.BU3.P3.1).*	• Holistic view • Can see • Technologies linked to business objectives • Highest priority • Alignment • Improves development time • Profitability returns	EA creates a holistic view of the business objectives by linking them to the technologies. It further ensures quicker development time, improved returns and less integration complexity	
	"The problems that the bank faces today is much more complicated than a few years ago… management cannot solve these problems alone… staff collaboration is needed for use to think out of the box, think creatively, but within boundaries… the architectural models trigger our though process to think differently… it is important to think within a framework or we will not have the right balance of ideas that be realistically implemented… Staff think of senior management as an aloof group people that sit at the top of	• Trigger though process • Think differently • Framework • Faster development • Less integration complexity • Quicker returns • Faster deployments integration		

Mechanism	Evidence	Codes	Theme	Value
	the bank… times have changes and senior management is much more hands-on with strategic and operational aspects of running the bank… management is expected to display both soft leadership to motivate staff and IT leadership to introduce technical innovation… architecture is critical to get this mix right… I have seen much faster deployments with teams referencing the architecture… integration is the most complex, and architecture is critical in this space, less integration complexity… our returns and payback periods on IT investments are also quicker" (B.BU3.P5.1).			
Finance	*"While the architecture provides a framework for visualisation and common understanding, for me, the real benefit is in identifying inefficiencies… which lead to savings… the architecture creates the structure for prioritising projects and linking them to the business strategy… the blueprint is most valuable for rationalisation of software, removing duplicate technologies, which improves profits… sdlc benefits as well with faster deployments… identify risk points in the business value chain" (B.BU3.P3.1).*	• Visualisation • Common understanding • Identifying inefficiencies • Savings • Structure • Prioritising projects • Linking to strategy • Rationalisation • Profits • SDLC benefits • Identify risk	Improved development time, inefficiency identification, rationalisation and integration benefits experienced due to EA	
	"all projects are not created equal… and the business case may not reflect the true cost and benefits, due to the linear	• Rounded view • Identifies touch points		

Mechanism	Evidence	Codes	Theme	Value
	financial formulas used to assess them… don't consider regression costs for example… some projects contribute more value to the bank, but not reflected in the business case calculations… the architectural assessment gives a more <u>rounded view</u> of the project and <u>identifies touch points</u> that have <u>integration costs</u> associated… the architecture view gives a more <u>accurate value assessment</u> of a project…helps manages <u>prioritise</u> higher value <u>projects</u> more accurately… we have improved <u>project benefit returns</u> with the architecture" (B.BU3.P5.1).	• Integration • Costs • Accurate • Value • Assessment • Prioritise projects • Project benefit returns		

Illustrated in Table 5.10, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were used to understand the EA practices, with the questions structured to obtain insights into the forms of value obtained for each of these mechanisms (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). **Codes** comprising of *improved development time*, *improved ROI* and *integration*, were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 21, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *EA processes help the business unit improve their development time and ROI; architectures create a platform to improve communications. Furthermore, the EA repository facilities reusability that results in improved development time; EA helps the business unit improve integration across the banks systems. Aligns strategies, people, processes, and technologies; EA creates a holistic view of the business objectives by linking them to the technologies. It further ensures quicker development time, improved returns and less integration complexity* and *improved development time, inefficiency identification, rationalisation and integration benefits experienced due to EA* were developed.

Thereafter, **the defining and naming** step finalised the description of this business unit's theme as follows. *Faster development time, higher ROI and improved technical integration were experienced within business unit B. 3 as a result of EA. EA created a holistic view of the business objectives by linking them to the technologies. It aligned strategies, people, processes and technologies. The EA repository facilitated reusability that resulted in faster system development time and less integration complexity across systems in the bank. Subsequently a higher ROI was achieved due to the faster deployment of systems.*

The following section concludes the presentation and findings of evidence from Bank B.

5.5 Conclusion

This chapter organised and presented evidence of data from business units B.1, B.2, and B.3 from Bank B (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015).

This research established that EA capabilities were *being developed* within business unit B.1. This business unit applied EA at a coarse granularity of refinement. Furthermore, the business unit experienced forms of value such as improved development time, simplification, and standardisation because of EA.

Furthermore, this study found that B.2 had *informal EA capabilities and practices* that were *dependent on individual champions* within the department. This business unit applied EA at a coarse granularity of refinement. B.2 experienced forms of value such as hardware cost savings, resource cost savings, and improved quality of documentation.

Finally, this study found that EA within B.3 was *being established*. This business unit implemented EA at a coarse granularity of refinement. B.3 experienced forms of value such as improved development time, better ROI, and improved system integration.

The next chapter presents the findings from Bank C.

Chapter 6: Presentation of Findings: Case Study 3

This chapter presents examples of data evidence to support the findings from the final case study.

6.1 Introduction

This chapter introduces data evidence from case study 3, referred to as Bank C in this research. Data from 3 business units of Bank C are introduced, within the following structure:

- presentation of findings from business unit 1;
- presentation of findings from business unit 2;
- presentation of findings from business unit 3.

For each of these business units, the data is organised in line with the research questions, i.e., *the levels of EA maturity, the granularity of EA domains in use* and *the business value of EA*. For each of these business units, The data is presented in a tabular form, comprising of direct quotations, to draw illustrative examples from the participants (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015).

The thematic analysis technique from Chapter 3 was applied to this section of the research (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). A software program, *Nvivo* was used to assist in the automation of coding and visualisation of themes (Bazeley, 2014; Bazeley and Jackson, 2013; Fereday and Muir-Cochrane, 2006; Gibbs, 2004; Guest et al., 2012). A contextualisation of Bank C follows.

6.1.1 Background to Case Study 3

Bank C was established in the 1990's through the merger of several small South African financial service providers. In the early 2000's, majority share ownership was acquired by a global international banking group. Subsequently in 2018, majority local share ownership was again established. Bank C is ranked as one of the largest banking groups in Southern Africa. Its head office is in Johannesburg, South Africa, and is listed on multiple international stock exchanges. It provides banking and insurance to retail, commercial, corporate, and public sector customers. The bank has assets close to R1.5 trillion with headline earnings close to R8 billion. It employees a total of approximately 35 000 staff, with approximately 17 000 of these staff employed within technology areas (BankC, 2018; Fanta and Makina, 2017; Lafferty, 2016; SARB, 2018).

Bank C has a hybrid management structure, whereby the individual business units manage operational aspects of IT, HR, and finance functions, and the group centrally manages governance, standards, and policies related to these functions. Business units are designed according to the services offered by the bank, such as personal loans, home loans, investments, or savings. The business units have similar management structures, with an Executive responsible for each business unit, and other specialised staff employed based on the services offered. The sizes of the business units vary from approximately 100 to 500 staff (BankC, 2018; SARB, 2018).

Illustrated in Table 6.1 below, 11 people were invited to participate in the individual interviews from Bank C. Six people accepted and participated in the individual interviews, representing an acceptance rate of 55%.

Table 6.1: Participant selection

Bank C									
	Business Unit 1		Business Unit 2		Business Unit 3		Total		Acceptance
Role	Identified	Participated	Identified	Participated	Identified	Participated	Identified	Participated	
CIO/CTO/IT Head (C.BU.P1)	1	1	1	1	1	0	3	2	67%
Enterprise Architect (C.BU.P2)	0	0	1	0	1	1	2	1	50%
IT specialist (C.BU.P3)	0	0	0	0	0	0	0	0	0%
CEO/COO (C.BU.P4)	1	1	1	0	1	0	3	1	33%
Business manager (C.BU.P5)	1	0	1	1	1	1	3	2	67%
Business specialist (C.BU.P6)	0	0	0	0	0	0	0	0	0%
Total	3	2	4	2	4	2	11	6	55%

The inception of EA at Bank C commenced approximately 9 years ago. Without being specifically asked, a participant commented, *"I think it is impossible to accomplish long-term business success without leveraging the value of architecture in this technology era".* Her comments give a clear indication of the importance and timely nature of this project. The next section presents the findings from the first business unit at Bank C.

6.2 Presentation of Findings from Bank C, business unit 1

This section presents the data used to determine the EA maturity level, the EA granularity, as well as the tangible and intangible forms of value obtained from Bank C, business unit 1 (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). Further evidence from this business unit can be found in Appendix 22.

This business unit provided a variety of *insurance products* to customers of Bank C. Customers paid a monthly premium to the bank to receive insurance coverage. The products were designed to ensure that Bank C covered a customer's loss, if stipulated conditions in their policy were not adhered to (BankC, 2018). Business unit 1 was composed of approximately 800 permanent staff, including of a business unit Executive, CIO, CFO, HR, and support heads. Strategic components of finance, HR, and IT functions were centralised sourced from the group. The IT staff was responsible for systems such as the broker interfaces, short-term insurance system, long-term insurance system and underwriting systems. Business staff were responsible for risk profiling of customers, developing insurance models, legal services, and processing insurance claims (BankC, 2018; SARB, 2018). Illustrated in Table 6.1, a total of 3 people were invited to participate in the individual interviews from this business unit. Two people accepted and participated in the individual interviews, representing an acceptance rate of 67%. The participants were a mix of business and IT professionals from different levels of seniority.

The data used to determine the EA maturity level follows.

6.2.1 The level of EA maturity at Bank C, business unit 1

This subsection presents data related to the EA practices from the first business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part A of the interview protocol (Appendix 4) was used to gather this data. The level of maturity was determined by judging the EA practices (represented by EA processes, communication, business-IT alignment, senior management involvement, and finance mechanisms) as described by the participants from this business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

Table 6.2: Mechanisms of EA

Mechanism	Evidence	Codes	Theme	Level
Processes	*"key man dependency is rife… our architecture is still dependent on people that back this initiative… those projects tend to provide us with better quality documentation of our systems… that itself is a huge accomplishment… very few of our competitors can boast that… it also gives us the ability to integrate our business processes across the bank… lastly we experience cost saving from an IT infrastructure perspective" (C.BU1.P1.1).*	• Key man dependency • Dependent on people • Integrate • Processes • Cost saving	Key man dependency, staff turnover, and success consistency problem, with EA implemented at a business unit level, as opposed to enterprise level	Theme concentrated within level 1 maturity
	"we are moving in the right direction… we have introduced EA, but the focus is not at an enterprise level. We are still focusing on specific technical problems… we call it EA, but are actually designing technical solutions… some of the projects are real gems… case study material… the problem is the consistency of our success. The lack of skills is a fundamental problem. The top guys have become opportunistic and take advantage of this… they move around the banks to the highest bidder or to projects in crisis… the projects quality is determined by the champion responsible" (C.BU1.P4.1).	• Introduced EA • Not at enterprise level • Specific technical problems • Consistency problem • Lack of skills • Determined by champion • Move to crisis projects		
Communication	*"I've said this earlier, we have a key man dependency problem… the systems are very advanced, but the knowledge is a problem… some of the senior team members are already close to retirement… we haven't built any resilience around them" (C.BU1.P1.1).*	• Key man dependency • Knowledge problem • Haven't built resilience	EA not linked to enterprise business strategy, with a key man	Theme concentrated within level 1 maturity

Mechanism	Evidence	Codes	Theme	Level
	"the designs are progressive… we have won a number of international awards for the projects that we have implemented… not linked to the bank's strategy… not our fault… we don't have a unified business strategy" (C.BU1.P4.1).	• Designs progressive • Not linked to strategy • Don't have a unified strategy	dependency and knowledge sharing concern	
Business-IT alignment	*"although still limited in scope, our architecture provides IT transparency to our business stakeholders" (C.BU1.P1.1).*	• Limited in scope • IT transparency	Minimal business-IT alignment that is limited in scope, with a stakeholder dependency	Theme extends across levels 1 and 2 maturities
	"we are responsible for many systems…there is clear alignment for some of the systems… depends on the business stakeholder and their involvement with us" (C.BU1.P4.1).	• Systems alignment • Depends on stakeholder		
Senior-Management Involvement	*"being part of exco, I have supported this… we have allocated budget for an architectural tool… the tool licensing is expensive, demonstrates our commitment to establish this function" (C.BU1.P1.1).*	• Supported • Allocated budget • Architectural tool • Commitment	Good management support and involvement with a committed budget for EA	Theme extends across levels 1 and 2 maturities
	"we support EA in the same way that we support the other competencies like project management, business analysis and processing engineering… it's up to the architecture team to make a success of the situation" (C.BU1.P4.1).	• Support • Up to the architecture team		
Finance	*"Our architecture has grown organically… due to the bank's size, we still have duplicated systems, inconsistent data, and makeshift integration across the business units… despite these challenges, our architecture has still helped reduce our*	• Grown organically • Duplicated systems • Inconsistent data • Makeshift integration	Basic EA practices evolved organically, with	Theme extends across levels 1 and 2 maturities

Mechanism	Evidence	Codes	Theme	Level
	technology costs and accelerate time to market by facilitating common approaches" (C.BU1.P1.1).	• Reduce costs • Accelerate time • Common approaches	finance issues including consistency and integration concerns. Has reduced costs	
	"we have basic architectural process in place. It is much better than before. We will go a long way if the consistency is maintained" (C.BU1.P4.1).	• Basic architectural process		

Illustrated in Table 6.2, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were adopted from the ACMM mechanisms to understand the EA practices (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result.

The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). Basic EA practices had evolved organically, with good management involvement and support. A committed budget for EA was available. However, a dependency on specific individuals was the primary concern within this business unit. EA was implemented at a business unit level, and was not linked to the overall bank's strategy. This business unit's environment was disorganised, with EA reliant on particular champions. However, these champions were often moved to projects that were in crisis, and, because of this movement, EA expertise and knowledge left when these champions were reassigned. Coupled with this, the other EA practices were intermittent within this business unit as it was similarly dependent on the specific individuals driving the EA momentum.

Artefacts from this business unit were analysed to confirm claims from the participants, as well as assess for quality and completeness using the artefacts collection procedure outlined in Chapter 3 as well as the form in Appendix 15 (Bernard, 2015; Campbell, 1999). Examples of artefacts used in this business unit include business requirement documents, functional requirements, "as is" documents and data warehouse specifications. An attempt was made to link these types of artefacts to the specific mechanisms; however, no reliable pattern could be established. This was due to the large variety of artefacts developed and structured according to the business unit specific services and functional requirements. However, this study eventually assessed the quality of artefacts and organised them into *current*, *transition,* and *future* state architectures (Harrison, 2013). The documents were checked for formal sign offs, as well as 'final' versions to ensure the quality and completeness of the artefacts reviewed. Although standard templates for the business unit artefacts were available within the repository, the quality was inconsistent as they were similarly dependent on the individuals that authored them. They varied from high quality, complete and accurate documents, to unfinished, poorly written artefacts that were difficult to comprehend. Many contained verbose language that was difficult to understand when reviewed out of the project context. The artefacts were also inconsistently applied to the various phases of the project lifecycle, with some projects containing comprehensive end to end artefacts, whereas other projects contained partial initiation documents such as business requirements documents. Again, the quality of the artefacts was dependent on the individual staff members assigned to the particular projects. Focus of the artefacts was placed on the business unit's current state.

Codes including *key man dependency, dependent on people, not at enterprise level, specific technical problems, consistency problem, lack of skills* and *not linked to strategy* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 22, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *key man dependency, staff turnover, and success consistency problem, with EA implemented at a business unit level, as opposed to an enterprise level; EA not linked to enterprise business strategy, with a key man dependency and knowledge sharing concern; minimal business-IT alignment that is limited in scope, with a stakeholder dependency; good management support and involvement with a committed budget for EA* and *basic EA practices evolved organically, with finance issues including consistency and integration concerns and, has reduced costs,* were developed.

Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The themes of the *processes, communication, business-IT alignment, senior management involvement, and finance* mechanisms from this business unit were evaluated against the characteristics of ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). This business unit contained EA *processes* that had a dependency on specific individuals and consistency problem. Furthermore, EA was implemented at a business unit level, as opposed to an enterprise level. It was found that the traits of this mechanism aligned to the characteristics of level 1 maturity. Regarding the *communication* mechanism, EA was not linked to bank business strategy, with key person dependencies being a concern. This aligned to the characteristics of level 1 maturity. There was minimal *business-IT alignment* with limited scope, with a stakeholder dependency, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Furthermore, there was good *senior management* support and involvement with a committed budget for EA, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Finally, on the *financial* mechanism, basic EA had evolved organically, with duplicate systems and integration a concern, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Overall, the EA practices within this business unit were characterised as being ad-hoc, inconsistent, and person dependent (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op 't Land et al., 2009; Paulk et al., 2006).

Finally, the **defining and naming step** concluded with *EA practices dependent on individual person efforts within business unit C.1* used to describe this theme. Based on these evaluations, it was judged that **bank C, business unit 1** operated within **maturity level 1**.

Once the level had been established, the next step was to identify the EA granularity for this business unit, and follows in the next subsection.

6.2.2 EA granularity within Bank C, business unit 1

This subsection presents data related to the EA granularity in use. The granularity was determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from this business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The interview protocol (Appendix 4, Section A, questions 6-10) was structured to elicit these responses.

Table 6.3: EA granularity

Domains	Evidence	Codes	Theme	Granularity
Business	*"the department's awareness of business architecture has grown over the last few years. Both the business and IT stakeholders are having workshops to define the architecture. Although there is much talk, there is little agreement on the scope and the way it needs to be implemented… we have started developing architecture blueprints of the department… we are learning as we go… we have a business goal to reduce operational expenditure by 10%... our aim is to improve decision-making and improve alignment between the business and IT… our motto has been to provide the best customer service in the industry... quality to not be sacrificed at any cost… our business architecture is defined by those statements" (C.BU1.P1.1)*	• Awareness grown • Workshops to define architecture • Little agreement on scope • Blueprints • Learning as we go • Business goal to reduce operational expenditure • Improve decision-making • Alignment	Good progress EA with awareness having grown. More blueprints visible. However, it has not made broad inroads at an organisational level, still perceived as an IT thing and a reliance on selected champions	Business architecture defined at a coarse granularity of refinement
	"First the good stuff…we have good progress and architecture has generated a lot of interest in the department. Many blueprints and diagrams, good visibility… many projects successfully implemented with the assistance of the architecture… we have formalised processes for agents' commission and claims administration… now for some not so good feedback… after 6 odd years, architecture still hasn't made broad inroads into the bank. Many of the senior managers do not understand the concept of architecture… others see it as purely an IT thing… we are designing our architecture to be an objective reference point to improve decisions… this can be anything from business expansion to technology selection… we also still reliant on one or two strong champions to keep the momentum" (C.BU1.P4.1)	• Good progress • Generated interest • Blueprints • Diagrams • Visibility • Agents commission and claims administration • Still hasn't made broad inroads • Managers do not understand the concept • An IT thing • Reliant on champions		

Domains	Evidence	Codes	Theme	Granularity
Application	*"is designed to create a broad perspective of the bank's ecosystem. On the IT side, it flags the systems that the bank owns before buying additional technology… improves decisions and lowers costs… the process orders function works very well… the blueprints help departments understand how they could leverage off each other's technologies… some of our architecture is aspirational at this point in time" (C.BU1.P1.1)*	• Broad perspective of ecosystem • Flags systems • Improves decisions • Process order function • Lowers costs • Blueprints • Leverage • Aspirational	Broad perspective of ecosystem structured in a simple layered model with tiers. Focus on integration	Application architecture defined at a coarse granularity of refinement
	"This bank is comprised of various departments with their own systems. These vary in size from 10 to a 1000 person staff department. With these different departmental systems, integration is always a problem. Our architecture is a simple layered model with the different tiers sitting in the different layers… we have a goal to use standardised off the shelf software whenever possible" (C.BU1.P4.1)	• Integration • Simple layered model • Tiers • Goal of standardised software		
Technology	*"this bank has been a local and international market leader for many years… our technology and network architecture is vendor neutral… we select the best technologies from leading technology houses… and incorporate them into an internal stacked ecosystem that gives us the ability to stay at the forefront of banking" (C.BU1.P1.1)*	• Vendor neutral • Stacked	Vendor neutral technology architecture with a solution focus on simplicity that facilities	Technology architecture defined at a coarse granularity of refinement
	"looking for simplicity facilitates complex technology *problem solving. There are always trade-offs with technology decisions… the architecture provides the tools and techniques to reach consensus on appropriate solutions… solution focus" (C.BU1.P4.1)*	• Simplicity • Facilitates complex problem solving • Consensus on solutions		

Domains	Evidence	Codes	Theme	Granularity
		• Solution focus	problem solving	
Data	*"The focus of our data architecture is on gathering and storing the data… as well as selecting appropriate technologies to move and store this data and ensure its availability to the business stakeholders" (C.BU1.P1.1)*	• Focus on gathering and storing data • Selecting appropriate technologies	Relational database architecture that focuses on gathering and storing data, as well as processing and analysis of data	Data architecture defined at a coarse granularity of refinement
	"our data architecture is simply an advanced relational database with detailed tables to access the data… is more of a framework that shows how our data is processed and analysed for the stakeholders… the key factor when looking at data is understanding its relationships" (C.BU1.P4.1)	• Advanced relational database • Framework • How data is processed and analysed • Understanding relationships		

Illustrated in Table 6.3, **a priori themes** (Strauss and Corbin, 2015) comprising of these domains were adopted from TOGAF (Harrison, 2013). This table lists the evidence collected that supported the codes within each domain, as well as the theme and granularity identified. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017).

Business architecture

This business unit employed business goals such as "*reduce operational expenditure by 10%"* that were clearly articulated. Awareness for business architecture within business unit C.1 had grown in recent years with more blueprints visible. However, it had not made broad inroads at an organisational level. The goals of this business unit were specified within the various artefacts; however, they were not linked to the bank's organisational strategy. A reliance on selected champions was a problem prevalent in this department. Processes such as their *"agent's commission"* and *"claims administration"* were inconsistently specified, with some artefacts detailed, and key components missing from other artefacts. Furthermore, this business unit did not specify execution details and roles of the stakeholders.

Application architecture

The application architecture within business unit C.1 was structured as a simple layered model. This department defined its current state environment blueprint model. The results showed that various software architectural goals and objectives, such as the use of standardised off the shelf software was applied. However, finer implementation details demonstrating how these goals and objectives would be executed and implemented were not specified.

Technology architecture

Bank C, business unit 1, had a vendor neutral technology architecture that facilitated problem solving. This business unit had clearly defined objectives such as the implementation of technology *"simplicity"*, principles such as *"layered model"*, and domains such as *"vendor neutral platform*. However, these were only specified at a coarse granularity. Granular level details such as technology components, implementation, and execution details were not specified.

Data architecture

Business unit C.1 implemented a relational database architecture that focused on gathering and storing data. This business unit had clear data objectives such as *"relational database framework principles"*. Goals such as *"enhance data relationships"* were further enforced. Documentation to manage these goals, such as architecture for relationships within the customer master file, was in place.

Codes comprising of *awareness grown, workshops to define architecture, little agreement on scope, blueprints, learning as we go, good progress, still hasn't made broad inroads, an IT thing* and *managers* *do not understand the concept*, were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017).

The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 22, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of *good progress with awareness having grown, more blueprints visible. However, it has not made broad inroads at an organisational level, still perceived as an IT thing and a reliance on selected champions; broad perspective of ecosystem structured in a simple layered model with tiers. Focus on integration; vendor neutral technology architecture with a solution focus on simplicity that facilities problem solving* and *relational database architecture that focuses on gathering and storing data, as well as processing and analysis of data.*

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Bank C, business unit 1 defined its business architecture at a coarse granularity of refinement. Its objectives, goals, relationships and capabilities were illustrated as blueprints at a business unit level. Although EA awareness had progressed, it has not made broad inroads at an organisational level. Notably, EA was still perceived as an IT thing with a reliance on selected champions. The application architecture was defined at a coarse granularity of refinement illustrating a broad perspective of the business unit ecosystem. It was structured within a simple layered model with tiers, and a focus on system integration. The technology architecture was defined at a coarse granularity of refinement. It specified the technologies required to support the business unit. It was comprised of a vendor neutral technology design with a solution focus on simplicity that facilitated problem solving. The data architecture was defined at a coarse granularity of refinement. It comprised of a relational database architecture that defined the types of data required by the business unit. It focused on gathering, storing, processing and analysis of data.* Based on these evaluations, it was judged that **bank C, business unit1** defined its overall EA at a **coarse granularity of refinement**.

Once the granularity of refinement had been identified, the next step was to identify the business value of EA for this business unit, which commences below.

6.2.3 Business Value of EA from Bank C, business unit 1

This subsection presents data related to the business value of EA from the first business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). This data was used to determine the value obtained for each EA mechanism.

Table 6.4: Value of EA

Mechanism	Evidence	Codes	Theme	Value
Processes	*"architecture is the only capability which provides us with the opportunity to <u>understand</u> our <u>current systems</u>, <u>make decisions</u> to <u>analyse</u> specific <u>technology</u> choices and plan our <u>integration</u> accordingly… the blueprints help identify <u>duplicate applications</u> and <u>unnecessary hardware</u>… the <u>rationalisation</u> reduces IT <u>costs</u>" (C.BU1.P1.1)*	• Understand current systems • Decisions • Analyse • Integration • Duplicate applications • Unnecessary hardware • Rationalise costs	EA enables rationalisation of applications that result in technology cost savings	Software cost savings, hardware cost savings and visualisation experienced
	"our architectural methodology results in a <u>faster</u>, more <u>efficient</u> and <u>cost effective</u> way to deliver our products and services and <u>improve customer satisfaction</u>" (C.BU1.P4.1)	• Faster • Efficient • Cost effective • Improve customer satisfaction		
Communication	*"Why does one project within the bank flourish while another with similar requirements stumble…I have found that many times, the root of the problem is a lack of communication across projects… architecture has helped as it <u>identifies components of systems</u> from other departments that can be <u>reused</u>… multiple <u>cost savings</u>" (C.BU1.P1.1)*	• Identifies components of systems • Reuse • Cost savings	EA facilitates communication that lead to cost savings, reuse and visualisation benefits for the business unit	
	"It <u>facilitates communication</u> with business stakeholders at all levels, contributes to <u>solutions</u> that more accurately <u>meets</u> their <u>requirements</u>. The architecture gives us the ability to communicate and debate <u>design decisions</u> before the system is built… <u>prevents rework</u> later on, and thus <u>save costs</u>… the	• Facilitates communication • Solutions • Meets requirements • Design decisions • Prevents rework • Saves costs		

Mechanism	Evidence	Codes	Theme	Value
	visualisation facilities communication about complex systems and problems from multiple points of view" (C.BU1.P4.1)	• Visualisation • Multiple points of view		
Business-IT alignment	*"we pride ourselves on being customer focussed and consumer oriented… however minimal emphasis is given to improving service delivery and efficiency… for us improving customer experience starts with technology… to better enable decision-making that results in improved customer service… our architecture provides a clear current view of our technologies to enable us to make service delivery possible" (C.BU1.P1.1)*	• Decision-making • Improved customer service • Current view • Service delivery	EA enables the business unit to improve decision-making and enhance customer service and aid infrastructure and software cost savings	
	"I see the architecture as a working ecosystem for business and IT to converse… I use it as a reference to understand what is happening… practically, I have flagged areas for improvement and inefficiencies… multiple systems that can be consolidated… cost savings for both infrastructure and software" (C.BU1.P4.1)	• Ecosystem • Converse • Reference • Areas for improvement • Infrastructure cost savings • Software cost savings		
Senior-Management Involvement	*"being part of exco, I have used the architectural diagrams to understand the overall health of IT and to develop a vision of where the department needs to go with it's IT systems…that's the strategic stuff… I've also used the diagrams to identify duplicate systems, visualise complex interfaces… the duplicate systems has led to cost savings… helped me with the big picture thinking" (C.BU1.P1.1)*	• Understand IT health • Vision • Strategy • Identify duplicate systems • Visualise • Cost savings • Big picture thinking	EA enables visualisation of systems by senior management, that leads to cost savings	

Mechanism	Evidence	Codes	Theme	Value
	"A lot of the staff under estimate the significance of the architecture… honestly, many of them just don't know what it is… I have benefited from the visibility and understanding of both the business structure and the systems, identifying areas for savings, licences, duplication of systems is another one" (C.BU1.P4.1)	• Visibility • Understanding • Business structure • Systems • Savings • Licences • Duplication of systems		
Finance	*"The success of our business depends on certain elements… capable people, robust processes and importantly the right technologies… our track record has proven that our investment in the right technologies has improved our market share and overall competitiveness… our architecture has brought us decent savings by guiding us choose the correct technologies" (C.BU1.P1.1)*	• Savings • Choose correct technologies	EA enables cost reductions for the business unit by rationalisation and correct technology choices	
	"helps us analyse the current systems and identify areas where changes could lead to technology cost reductions. I've got some cases that I can share… the architecture has recently flagged a case where my department and the procurement department has their different process engineering software… we rationalised to use one product, reducing IT and support costs… easily identifies technologies that cab be reused. We have recently built a repository of reusable components… has already started reducing overall systems cost" (C.BU1.P4.1)	• Analyse current systems • Cost reductions • Rationalising • Reducing support costs		

Illustrated in Table 6.4, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were used to understand the EA practices, with the questions structured to obtain insights into the forms of value obtained for each of these mechanisms (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). **Codes including** *visualisation, customer satisfaction, hardware cost* and *software cost savings*, were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 22, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of *EA enables rationalisation of applications that results in technology cost savings; EA facilitates communication that lead to cost savings, reuse and visualisation benefits for the business unit; EA enables the business unit to improve decision-making and enhance customer service and aid infrastructure and software cost savings; EA enables visualisation of systems by senior management, that leads to cost savings* and *EA enables cost reductions for the business unit by rationalisation and correct technology choices* were developed.

Thereafter, **the defining and naming** step finalised the description of this business unit's theme as follows. *Software cost savings, hardware cost savings, and visualisation of systems experienced within business unit C.1 as a result of EA. EA enabled rationalisation of applications, the reuse of technologies and the correct selection of technologies that resulted in technology cost savings. Furthermore, it enabled the visualisation of systems by management.*

The next section presents findings from the second business unit within Bank C.

6.3 Presentation of Findings from Bank C, business unit 2

This section presents the data used to determine the EA maturity level, the EA granularity, as well as the tangible and intangible forms of value obtained from EA for Bank C, business unit 2 (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). Further evidence from this business unit can be found in Appendix 23.

This business unit provided a variety of *risk management services* to internal business units within Bank C. It focused on a wide variety of risks including IT risks, market risks, financial and legal uncertainties, as well as natural disasters. The business unit concentrated on the identification, analysis, assessment and controls of unacceptable risks on behalf of Bank C (BankC, 2018). Business unit 2 was composed of approximately 150 permanent staff, including of a business unit Executive, CIO, CFO, HR, risk officers and support heads. Strategic components of finance, HR, and IT functions, were centralised and sourced from the group. The IT staff were predominately responsible for a risk management system, that had modules for risk identification, analysis, assessment and monitoring. Business staff were responsible for assessing regulations, risk assessments, operation risk management and research (BankC, 2018; SARB, 2018). Illustrated in Table 6.1, a total of 4 people were invited to participate in the individual interviews from this business unit. Two people accepted and participated in the individual interviews, representing an acceptance rate of 50%. The participants were a mix of business and IT professionals from various levels of seniority.

The data used to determine the EA maturity level follows.

6.3.1 The level of EA maturity at Bank C, business unit 2

This subsection presents data related to the EA practices from the second business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part A of the interview protocol (Appendix 4) was used to gather this data. The level of maturity was determined by judging the EA practices as described by the participants from this business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

Table 6.5: Mechanisms of EA

Mechanism	**Evidence**	• **Codes**	**Theme**	**Level**
Processes	*"The foundations of this departments architecture was established sometime ago, so it's fairly mature. The team is well respected in the bank, and their inputs are sought after in many forums… the risk committee, procurement… just to name a few… the processes are mature in my opinion… we now frequently refer all projects to the architecture board for review. We have a future state architecture in place" (C.BU2.P1.1)*	• Foundations established some time ago • Respected • Inputs sough • Processes mature • Architecture board • Future state	Mature EA processes incorporating an architecture board, future state, standards and reference model	Theme extends across levels 3 and 4 maturities
	"I think that the team has come a long way… standards are in place, we are seeing reference models that are considered… stored on documentum… the architecture board is up and running" (C.BU2.P5.1)	• Standards in place • Reference models • Documentum • Architecture board		
Communication	*"our architecture helps with clarifying business priorities and identifying core competencies… enables the department to assign key resources to projects, and leverages the department's top talent… entrenched in the prioritisation forum… we have developed a variety of standard reference models that we use… we have full support of our EXCO and MANCO… our CEO is onboard… that sums up our architecture" (C.BU2.P1.1)*	• Priorities • Core competencies • Assign resources • Leverage talent • Entrenched in prioritisation forum • Reference model • Management support	Frequent communication on EA in the form of minutes, with benefits including resource prioritisation and business-IT alignment experienced	Theme concentrated within level 3 maturity
	"it is really the bridge between business strategy and IT execution… frequent architecture updates communication	• Bridge business strategy and IT execution • Communication		

Mechanism	Evidence	• Codes	Theme	Level
	takes place and the minutes of the committee is circulated to the department" (C.BU2.P5.1)	• Minutes		
Business-IT alignment	*"actively connecting what IT is doing with our business strategy is top priority, even above other things like adherence to process governance. For me, it's more about business alignment than technology alignment… IT adherence to the business strategy… the IT team to evaluate business problems and propose innovative solutions… a progressive architecture changes the game for me" (C.BU2.P1.1)*	• Connecting IT to business • Business alignment • IT adherence • Solutions	EA helps operationalise business plan by connecting IT to business and forcing on business solutions. Results in improved relationships with business	Theme extends across levels 3 and 4 maturities
	"architecture helps realistically operationalise the business plan objectives for the IT team… creates that connection with business and IT…helps IT get their priorities right and bond the relationship with business stakeholders" (C.BU2.P5.1)	• Operationalise business plan • Business-IT connection • Priorities • Bond relationship		
Senior-Management Involvement	*"a big capex investment was just made to upgrade the architecture tool. The shows management commitment to architecture… the team is formalising standards like a modelling language and notations…archimate I think… Exco often requests the architectural diagrams for their presentations and reporting… always positive feedback" (C.BU2.P1.1)*	• Management commitment • Formalising standards • Modelling language • Notations • Diagrams • Presentations • reporting • Positive feedback	Mixed senior management commitment, however with no resistance. Use of EA artefacts for management reporting and presentations	Theme extends across levels 3 and 4 maturities
	"different degrees of involvement from management… not experienced any resistance from the management team, or	• Different degrees of involvement • No resistance supportive		

Mechanism	Evidence	• Codes	Theme	Level
	anyone for that matter. As long as the benefits are demonstrated… supportive of all the ideas put forward with regard to the standards and processes" (C.BU2.P5.1)			
Finance	*"our architecture is integrated with budgets, allocations, forecasts and financial control… it has helped shape our IT spending pattern from a big portfolio of short-term projects to long-term initiatives" (C.BU2.P1.1)*	• Integrated with finances • Shape IT spending	EA integrated into financial processes, that resulted in reshaping IT spending pattern	Theme concentrated within level 3 maturity
	"years ago, alignment was an elusive goal… we have leapt forward with our architectural practices… much more financial consistency across the business and systems teams… we've been able to quantify the improvement time with NPV… using the project investment costs over the development time" (C.BU2.P5.1)	• Consistency • NPV		

Illustrated in Table 6.5, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were adopted from the ACMM mechanisms to understand the EA practices (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result.

The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). Management and general staff of this business unit actively supported EA practices. Communication was the most prevalent in this business unit, with the CIO providing frequent EA feedback to staff through emails. This business unit had a comprehensively documented EA governance process. Artefacts from this business unit were analysed to confirm claims from the participants, as well as assess for quality and completeness using the artefacts collection procedure outlined in Chapter 3 as well as the form in Appendix 15 (Bernard, 2015; Campbell, 1999). Artefacts included standardised EA blueprints for its HR, finance, legal, and facilities departments, with any modifications requiring a formal sign off. An attempt was made to link these types of artefacts to the specific mechanisms, however, no reliable pattern could be established. This was due to the large variety of artefacts developed and structured according to the business unit specific services and functional requirements. However, this study eventually assessed the quality of artefacts and organised them into *current*, *transition,* and *future* state architectures (Harrison, 2013). This business unit had a clear 3-year target vision, with a transformation plan in place to move from the current to the target state. Furthermore, their EA plans are linked to both their business unit and the banks strategic and tactical plans. Furthermore, resource prioritisation was experienced, with strong business-IT alignment and a focus on business solutions. This business unit further maintained and updated its documentation on their 'documentum' shared folder system. The analysis showed that this business unit had incorporated EA the business unit's financial processes. For instance, EA was included when making all procurement decisions. Furthermore, this business unit procured an expert EA tool set.

Codes including *respected, inputs sought, processes mature, architecture board, future state, standards in place* and *reference models,* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 23, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of *mature EA processes incorporating an architecture board, future state, standards and reference model; frequent communication on EA in the form of minutes, with benefits including resource prioritisation and business-IT alignment experienced; EA helps operationalise business plan by connecting IT to business and forcing on business solutions. Results in improved relationships with business; mixed senior management commitment, however, with no resistance. Use of EA artefacts for management reporting and presentations* and *EA integrated into financial processes, that resulted in reshaping IT spending pattern,* were developed.

Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The themes of the *processes, communication, business-IT alignment, senior management involvement, and finance* mechanisms from this business unit were evaluated against the characteristics of ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). This business unit contained mature EA *processes* incorporating an architecture board, future state, standards and reference model. It was found that the traits of this mechanism aligned to the characteristics of practices extending across levels 3 and 4 maturities. Regarding the *communication* mechanism, resource prioritisation and business-IT alignment were experienced, which aligned to the characteristics of level 3 maturity. There was strong *business-IT alignment* with a focus on business solutions, which aligned to the characteristics of practices extending across levels 3 and 4 maturities. Furthermore, there was firm *senior management* commitment, which aligned to the characteristics of practices extending across levels 3 and 4 maturities. Finally, EA was integrated into *financial* processes, which aligned to the characteristics of level 3 maturities. Overall, the EA practices within this business unit were characterised as being formal, fully updated, and well accepted with the business unit (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op 't Land et al., 2009; Paulk et al., 2006).

Finally, the **defining and naming step** concluded with *comprehensive EA capabilities and practices that are clear and regularly communicated to all staff within business unit C.2.* Based on these evaluations, it was judged that **bank C, business unit 2** operated within **maturity level 3**.

Once the level had been established, the next step was to identify the EA granularity for this business unit, and this follows in the next subsection.

6.3.2 EA granularity within Bank C, business unit 2

This subsection presents data related to the EA granularity in use. The granularity was determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from this business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The interview protocol (Appendix 4, Section A, questions 6-10) was structured to elicit these responses.

Table 6.6: EA granularity

Domains	Evidence	Codes	Theme	Granularity
Business	*"It creates a framework of operating models for us to analyse the impact of proposed projects… clarifies our strategic intent by looking at both our vision statements and day to day tactical realities... it structures and illuminates our strategy in the form of a value chain… makes it more understandable across the department…helps help translate this strategy into a plan of action" (C.BU2.P1.1)*	• Framework • Operating models • Impact of proposed projects • Clarifies strategic intent • Tactical realities • Structures strategy • Value chain • Strategy into action	Focus on execution by linking strategy to tactical action. Structures the strategy in the form of a value chain	Business architecture defined at a medium granularity of refinement
	"I have found the business architecture valuable with strategy execution... the frilly vision and mission statements need to be executed and measured… the architecture plays an important role in how the bank's strategy gets translated into departmental tactical action" (C.BU2.P5.1)	• Strategy execution • How strategy translated action • Tactical action		
Application	*"we have just built an enterprise service bus… this integrates different applications from the different business units in the bank… now the various applications from across the banks can talk to each other via this bus" (C.BU2.P5.1)*	• Enterprise service bus • Application integration	Enterprise service bus architecture integrates different applications. The architecture helps envision current systems	Application architecture defined at a medium granularity of refinement
	"helps us envision different technology alternatives and opportunities…. includes using existing systems in innovative ways, recognising new systems that can be developed, and foreseeing new products and services for the bank" (C.BU2.P5.1)	• Envision different technology alternatives • Using existing systems in innovative ways • New systems • Foreseeing new products		

Domains	Evidence	Codes	Theme	Granularity
			and new products	
Technology	*"I see our architecture as the plumbing of the business… it details the inputs, tools, and outputs… we use a standard reference architecture as a base, and customise it for particular segments… we use it for scenario planning to determine what outcomes will be experienced with certain changes… almost like a predictor to see the effect of changes… it creates a direct line of sight between systems and the business" (C.BU2.P1.1)*	• Plumbing • Inputs, tools and outputs • Standard reference architecture • Customise particular segments • Predictor • Line of sight between systems and business	Model that depicts the current plumbing and server as a predictor to see the effects of changes. Incorporates inputs, tools and outputs. Use of reference base models as a base that is customised for segments. Embedded into everyday processes	Technology architecture defined at a fine granularity of refinement
	"shows the application servers, middleware and operating systems… actually more than a diagram, a competency in the department… it is becoming ingrained in the fabric of this department… becoming embedded into everyday processes used to manage the business" (C.BU2.P5.1)	• Servers, middleware, operating systems • More than a diagram • Competency • Ingrained into fabric • Embedded into everyday processes		
Data	*"shows how our data flows, the core components such as the hardware, physical databases, the software and storage used, flow of information, security, how the data is aggregated and governed… it provides us with a common vocabulary… without*	• Data flows • Core components • Aggregated	Details data flows and core components, data	Data architecture defined at a fine

Domains	Evidence	Codes	Theme	Granularity
	this, data is always misused… includes all <u>data assets</u> within an <u>integrated view</u> at <u>different levels of abstraction</u>" (C.BU2.P1.1)	• Governed • Common vocabulary • Data assets • Integrated view • Different levels of abstraction	aggregation, common vocabulary and abstractions. Includes customer, sales and product information	granularity of refinement
	"I think that it is most <u>obscured</u> architectural <u>domain</u>… it slots in between the business and application domains… its <u>broad</u>… includes <u>customer</u> information, <u>sales</u> transactions, <u>product</u> profiles… <u>activities</u> such as data structures and database design" (C.BU2.P5.1)	• Obscured domain • Broad • Customer • Sales • Product • Activities		

Illustrated in Table 6.6, **a priori themes** (Strauss and Corbin, 2015) comprising of these domains were adopted from TOGAF (Harrison, 2013). This table lists the evidence collected that supported the codes within each domain, as well as the theme and granularity identified. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017).

Business architecture

Bank C, business unit 2 had constructed a comprehensive business architecture focusing on strategy execution. It developed clear, well-defined, and integrated business operating models. Furthermore, this business unit had documented an end to end value chain spanning from product inception to deployment. Artefacts such as strategy documents were in place for the business unit. Analysis of these strategy documents showed clear business strategies, vision, mission, and business goals with objectives. This business unit had clearly documented processes to support its business functions. Moreover, the artefacts were linked to these process workflows. This business unit, however, did not contain finer physical details of the actual implementation of the business architecture, for instance, the artefacts did not specify the physical branches where the strategies had to be deployed.

Application architecture

Furthermore, an innovative application architecture incorporating an enterprise service bus design was in place at bank C, business unit 2. This business unit had identified finer details specifying how the service bus functionality was built. Detailed functions such as the components of the service bus were further specified. They categorised their applications into application services and functional behavioural groups that were used to plan target state applications before selecting and procuring the actual applications. The artefacts revealed that this business unit further categorised and grouped vendors such as *"IBM, Microsoft* and *Oracle"* by name. Additionally, implementation details such as cross dependencies between different vendor applications were specified, for instance, *"Microsoft service desk"* requires *"IBM server"* to run transactions.

Technology architecture

This business unit had clearly defined technology objectives such as the use of its enterprise service bus for all integration. This business unit also contained fine grain details on how the enterprise service bus technologies were implemented. Its design incorporated a detailed reference model depicting all inputs, outputs, and tools. Inputs included a risk management system, modules such as risk identification, analysis and assessment, and monitoring and technology components such as the application servers, middleware, and operating systems. The use of reference base technology architecture was embedded into the culture of the department as participants continuously made reference to the service bus.

Data architecture

Detailed data architecture was constructed at bank C, business unit 2, with fine granularity of data refinement. It detailed the core components such as the hardware, physical databases, the software and storage used, the flow of information, data vocabulary, security, as well as how the data was aggregated and governed.

Codes including *framework, impact of proposed projects, clarifies strategic intent, structures strategy, ingrained into fabric, standard reference architecture* and *strategy execution,* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017).

The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 23, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of *focus on execution by linking strategy to tactical action. Structures the strategy in the form of a value chain; enterprise service bus architecture integrates different applications. The architecture helps envision current systems and new products; model that depicts the current plumbing and server as a predictor to see the effects of changes, incorporates inputs, tools, and outputs, use of reference base models as a base that is customised for segment, embedded into everyday processes,* and *details data flows and core components, data aggregation, common vocabulary and abstractions. It includes customer, sales and product information.*

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Bank C, business unit 2, defined its business architecture at a medium granularity of refinement. It specified the way that the business objectives were achieved by defining the execution and linking the business unit strategy to tactical actions. It structured the strategy in the form of a value chain for the business unit. The application architecture was specified at a medium granularity of refinement. It defined the way that the software applications were implemented using an enterprise service bus architecture that integrated different applications. Furthermore, the architecture created views of the current systems as well as views of new products in development. The technology architecture was defined at a fine granularity of refinement and specified where the technologies were physically deployed. It comprised of a model depicting the current plumbing inputs, tools, and outputs. The business unit used reference models as a base that was customised for various segments. The architecture practices were embedded into everyday business unit processes and served as a predictor to visualise the effects of changes. The data architecture was specified at a fine granularity of refinement. It contained views illustrating where the data was physically managed. Core data components including data flow aggregations, common vocabularies, and abstractions were articulated. Customer, sales, and product data of the business unit were defined within the architecture.* Based on these evaluations, it was judged that **bank C, business unit2,** defined its overall EA at a **medium granularity of refinement**.

Once the granularity of refinement had been identified, the next step was to identify the business value of EA for this business unit, which commences below.

6.3.3 Business Value of EA from Bank C, business unit 2

This subsection presents data related to the business value of EA from the second business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part B of the interview protocol (Appendix 4), was used to collect this data. It was used to understand the value related to each EA mechanism that was perceived by the participants.

Table 6.7: Value of EA

Mechanism	Evidence	Codes	Theme	Value
Processes	*"this bank is made up of multiple departments… our architecture has not only brought these <u>businesses closer</u>, but has allowed these departments to <u>function as a single</u> interdependent <u>unit</u>... while still allowing the departments to maintain some freedom and <u>autonomy</u>, with less <u>risk</u>… this means we can <u>share information</u> quickly and efficiently and remove obstacles of different platforms… we now have more synergy between the IT departments that improves our <u>agility</u>… helps us adopt a more <u>evolutionary</u> approach to product development" (C.BU2.P1.1)*	• Businesses closer • Function as a single unit • Autonomy • Risk • Share information • Agility • Evolutionary	EA brings synergy across autonomous business units, improves risk and process management	Risk management, business-IT alignment and process improvement experienced within business unit C.2 because of EA
	"to get ahead in today's business world doesn't mean being the biggest bank or adopting the latest and most cutting-edge technology… it does mean getting a <u>simple streamlined</u> view <u>holistic view of</u> the <u>process</u>… the only way we can compete in the marketplace is by being more <u>swift</u> and <u>agile</u>, and <u>responding to change faster</u>. Our systems have <u>improved</u> our <u>efficiency</u> and <u>decreased human error</u>… improved <u>risk management</u>…this was made possible by automating processes… which was possible with our architecture… our biggest benefit… in my view is <u>simplification</u> of <u>processes</u>" (C.BU2.P5.1)	• Simple streamlined processes • Holistic view • Swift • Agile • Respond to change faster • Improved efficiency • Decreased human error • Risk management • Process simplification		

Mechanism	Evidence	Codes	Theme	Value
Communication	*"in this department, we see architecture as a connection between our business vision and technology. We have led within the banking industry for several years thanks to our unmatched level of systems integration, resources, and partnerships… we provide just about every type of financial services product to every segment of the market… our architecture improves productivity, risk and customer understanding by enabling communication, collaboration, and knowledge sharing across the business" (C.BU2.P1.1)*	• Connect business and technology • Productivity • Risk • Customer understanding	EA enables a business and technology connection, improves risk management and process efficiencies	
	"an arena for our business partners to state their requirements... to articulate their goals… the reality is the BRS's and spec's do not clearly capture them… the spec's are vague… the architecture helps them explicitly articulate their goals in simple business terms… makes the IT more responsive to business requirements… more process efficiencies because the requirement are clearly understood upfront… for me, the architectural diagrams have been a saviour during audits… so benefit of risk management" (C.BU2.P5.1)	• Requirements • Articulate goals • Simple business terms • Process efficiencies • Audits • Risk management		
Business-IT alignment	*"aligns IT to business… reduces costs, improves accuracy, shortens processing times, enables swift decision-making and improves customer service… for example, reducing the use of wet signatures, and replacing them with biometrics and PINS ensured a reduction in fraudulent transactions and enabled the branch staff to work faster… we were only able to achieve*	• Business-IT alignment • Reduces costs • Improves accuracy • Shortens processing times • Swift decision-making	EA improves processing times, enables risk management as well as	

Mechanism	Evidence	Codes	Theme	Value
	these benefits with the use of architecture as it gave us an integrated view of all the touch point systems and people involved. Another example…we need to be compliant with many many industry <u>regulations</u>…. the architecture ensures that we can <u>implement</u> requirements from FAIS and FICA rapidly, preventing fines. Our architecture <u>integrates risk</u> and compliance into the banks processes, making it more visible to staff" (C.BU2.P1.1)	• Customer service • Implement regulations • Integrates risk	business-IT alignment for the business unit	
	"architecture gives business and IT teams a round table to debate… an <u>open channel of communication</u> on the requirements, as we all want the same thing… helps iron out any conflicts and make compromises… creates <u>agility</u> and <u>process efficiencies</u> in the project" (C.BU2.P5.1)	• Open channel of communication • Agility • Process efficiencies		
Senior-Management Involvement	*"at any time, we have multiple projects driven by different business managers, all competing for the same IT resources… naturally, internal fighting happens… during the prioritisation meetings, the architectural diagrams <u>facilitate</u> the <u>selection</u> of the <u>projects</u> even if the spec's were not clear… obviously it doesn't please all of the conflicting project priorities, but the <u>transparency</u> helps the stakeholders select projects based on risk, customer benefit, or internal process efficiencies" (C.BU2.P1.1)*	• Project selection • Transparency	EA helps senior management improve their project selection, make informed design choices before systems are built and recognise risk	
	"the bank is always grappling with decisions on platform choices to support its expansions… also short-term and long	• Costs • Integration		

Mechanism	Evidence	Codes	Theme	Value
	value, <u>costs</u>… <u>integration</u> challenges… the architecture improves <u>transparency</u> and recognises <u>risk</u>… helps us make informed <u>design</u> choices <u>before</u> the <u>system</u> is <u>built</u>" (C.BU2.P5.1)	• Transparency • Risk • Design • Before system built		
Finance	*"helps spot components that can be <u>reused</u> in other departments… points to <u>process efficiencies</u> and cross project <u>reuse</u>" (C.BU2.P1.1)*	• Reuse • Process efficiencies	EA improves risk management, increases confidence in projects and creates process efficiencies	
	"The obvious one for me is that it <u>uncovers problems</u> that if left would result in other issues that would be more expensive to fix later…in short, the architecture <u>improves processes</u> and <u>identifies risk upfront</u>… even if no problems are identified, it <u>increases</u> the <u>confidence</u> in the <u>projects</u>" (C.BU2.P5.1)	• Uncovers problems • Improves processes • Identifies risk upfront • Increases confidence		

Illustrated in Table 6.7, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were used to understand the EA practices, with the questions structured to obtain insights into the forms of value obtained for each of these mechanisms (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). **Codes including** *risk management, business-IT alignment, businesses closer, function as a single unit, autonomy, risk* and *simplification*, were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 23, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *EA brings synergy across autonomous business units, improves risk and process management; EA enables a business and technology connection, improves risk management and process efficiencies; EA improves processing times, enables risk management as well as business-IT alignment for the business unit; EA helps senior management improve their project selection, make informed design choices before systems are built and recognise risk* and *EA improves risk management, increases confidence in projects and creates process efficiencies* were developed.

Thereafter, **the defining and naming** step finalised the description of this business unit's theme as follows: *Risk management, business-IT alignment and process improvement experienced within business unit C.2 as a result of EA. EA helped senior management recognise risk, improve their project selection and make informed design choices before systems are built. It further brings synergy and alignment across autonomous business units. Processing efficiencies such as improved processing times were experienced, influenced by EA.*

The next section presents findings from the last business unit within Bank C.

6.4 Presentation of Findings from Bank C, business unit 3

This section presents the data used to determine the EA maturity level, the EA granularity, as well as the tangible and intangible forms of value obtained from Bank C, business unit 3 (Braun and Clarke, 2008; Creswell, 2017b; Denzin and Lincoln, 2011; Mathison, 2011; Maxwell, 2013; Patton, 2015). Further evidence from this business unit can be found in Appendix 24.

This business unit provided a variety of *foreign exchange (forex) products* to customers of Bank C. These included foreign currency, international payments, and travel cards (BankC, 2018). Business unit 3 was composed of approximately 600 permanent staff, including of a business unit Executive, CIO, CFO, HR, and support heads. Strategic components of finance, HR, and IT functions were centrally sourced from the group. The IT staff was responsible for systems such as the forex systems, international payment systems, and currency management systems. Business staff were responsible for treasury, compliance with reserve bank regulations, as well as policies for importers and exporters (BankC, 2018; SARB, 2018). Illustrated in Table 6.1, a total of 4 people were invited to participate in the individual interviews from this business unit. Two people accepted and participated in the individual interviews, representing an acceptance rate of 50%. The participants were a mix of business and IT professionals from different levels of seniority.

The data used to determine the EA maturity level follows.

6.4.1 The level of EA maturity at Bank C, business unit 3

This subsection presents data related to the EA practices from the third business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part A of the interview protocol (Appendix 4) was used to gather this data. The level of maturity was determined by judging the EA practices as described by the participants from this business unit against the ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999).

Table 6.8: Mechanisms of EA

Mechanism	Evidence	Codes	Theme	Level
Processes	*"we have introduced our <u>new</u> architectural <u>models</u> and are <u>busy setting up</u> monthly architectural committee meetings… the new committee will ensure that our IT spending is aligned with business strategy and objectives… also, one of their mandates will be to identify reusable technology assets for cost saving purposes" (C.BU3.P3.1)*	• New models • Busy setting up meetings	EA being set up with current state environment models complete	Theme concentrated within level 2 maturity
	"possibly <u>another year to be fully up and running</u> … the <u>current state</u> is <u>complete</u>… the <u>future states till need</u> to be documented" (C.BU3.P5.1)	• Another year to be fully up and running • Current state complete • Future state in progress		
Communication	*"a <u>shared folder</u> was set up with all the models. Looks <u>positive</u>… the team gets airtime in all the <u>management forums</u> and staff town halls" (C.BU3.P3.1)*	• Shared folder • Positive • Management forums	EA discusses in management forums, with the EA models and sporadic reference models set up in a shared folder	Theme extends across levels 1 and 2 maturities
	"we have introduced <u>some sporadic reference models</u> for the database design. Works well" (C.BU3.P5.1)	• Some reference models • Sporadic		
Business-IT alignment	*"the architecture function is still in its <u>infancy</u>, but it's already <u>making</u> an <u>impact</u>… it <u>breaks down</u> IT and business <u>silos</u> by identifying <u>common solutions</u> that <u>reduce time to market</u> and <u>risk</u>… it provides <u>transparency</u> to IT and business teams and*	• Infancy • Making impact • Breaks silos • Common solutions • Reduce time to market	Strong EA support from staff, and making a gradual impact	Theme concentrated within level 2 maturity

Mechanism	Evidence	Codes	Theme	Level
	helps design solutions that make sense for the bank as a whole" (C.BU3.P3.1)	• Risk • Transparency • Solutions	into business silos, by focusing on common business solutions	
	"our architectural… construction in progress… we are making inroads. Strong support from the staff and the vendor" (C.BU3.P5.1)	• In progress • Inroads • Strong support from staff		
Senior-Management Involvement	*"our management team is new… the CIO is new… they are progressive in their thinking and have given architecture full support. There is still some resistance from the older managers" (C.BU3.P3.1)*	• New management team • Architecture given support from new managers • Resistance from older managers	EA recently implemented by a new and supportive management team, with some resistance from older managers	Theme extends across levels 1 and 2 maturities
	"Implemented recently, the architecture highlights our inefficiencies. It gives the department a fresh opportunity to work more efficiently, also results in efficient processes and eases system interoperability" (C.BU3.P5.1)	• Implemented recently • Highlights inefficiencies • Fresh opportunity • Efficient processes • Interoperability		
Finance	*"our architecture highlights redundant, non-strategic and high risk projects before they get funding during our project prioritisation meetings… it helps us create a practical way to manage our project portfolios, by rationalising existing systems to give us cost reductions, and helps us remove redundancy in project deployments… we are still in the early stages of formalising the details" (C.BU3.P3.1)*	• Highlights redundancy • Projects before funding • Practical • Rationalising • Cost reductions • Early stages	Random, EA involvement with no formal strategy. Financial benefits such as rationalisation and redundancy experienced	Theme extends across levels 1 and 2 maturities
	"random involvement at all levels... no formal EA strategy from the finance team" (C.BU3.P5.1)	• Random involvement • No formal strategy		

Illustrated in Table 6.8, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were adopted from the ACMM mechanisms to understand the EA practices (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result.

The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). EA practices were recently introduced in this business unit. A new management team was recently appointed, that supported EA. However, there was some resistance from the older managers, with some of them displaying various degrees of commitment and support for EA practices, coupled with resistance from some managers. This business unit did have a few EA finance standards that were documented in the repository; however, there was no formal finance strategy regarding EA within this business unit. Efficiency benefits, instances of business-IT alignment value, as well as financial benefits such as rationalisation and redundancy, were experienced.

This business unit built a shared folder for its EA reference models, with EA communications taking place distributed sporadically. Artefacts from this business unit were analysed to confirm claims from the participants, as well as assess for quality and completeness using the artefacts collection procedure outlined in Chapter 3 and the form in Appendix 15 (Bernard, 2015; Campbell, 1999). Artefacts used in this business unit included RACI charts, business requirement documents, technical specifications, use cases and data flow diagram. An attempt was made to link these types of artefacts to the specific mechanisms; however, no reliable pattern could be established. This was due to the large variety of artefacts developed and structured according to the business unit specific services and functional requirements. However, this study eventually assessed the quality of artefacts and organised them into *current*, *transition,* and *future* state architectures (Harrison, 2013). The documents were checked for formal sign offs, as well as 'final' versions to ensure the quality and completeness of the artefacts reviewed. One of the artefacts analysed, the RACI chart, displayed EA responsibilities, the specific staff accountable, as well as consulted and informed individuals such as the CEO and COO for EA within the business unit. The current state environment architectural diagrams had been completed. For instance, a technical reference model was developed, however, was not linked to the future target EA state.

Codes including *new models, busy setting up meetings, another year to be fully up and running, current state complete, future state in progress,* and *shared folder,* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 24, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *EA being set up with current state environment models complete; EA discusses in management forums, with the EA models and sporadic reference* *models set up in a shared folder; strong EA support from staff, and making gradual impact into business silos, by focusing on common business solutions; EA recently implemented by new and supportive management team, with some resistance from older managers* and *random, EA involvement with no formal strategy. Financial benefits such as rationalisation and redundancy experienced* were developed.

Thereafter **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The themes of the processes, communication, business-IT alignment, senior management involvement, and finance mechanisms from this business unit were evaluated against the characteristics of ACMM levels found in Appendix 2 (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). This business unit contained EA *processes* that were being set up with current their state complete. It was found that the traits of this mechanism aligned to the characteristics of the level 2 maturity. With regard to the *communication* mechanism, this business unit developed a shared folder with their EA reference models, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. *Business-IT alignment* was in progress, which aligned to the characteristics of level 2 maturity. Furthermore, there was a new *management* team that supported EA, with efficiency benefits experienced, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Finally, *financial* benefits such as rationalisation and redundancy were experienced, which aligned to the characteristics of practices extending across levels 1 and 2 maturities. Overall, the EA practices within this business unit were characterised as basic, simple, and in progress (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op 't Land et al., 2009; Paulk et al., 2006).

Finally, the **defining and naming step** concluded with *simple EA capabilities and that are new and being set up with the current state environment complete* used to describe this theme. Based on these evaluations, it was judged that **bank C, business unit 3,** operated within **maturity level 2**.

Once the level had been established, the next step was to identify the EA granularity for this business unit, and follows in the next subsection.

6.4.2 EA granularity within Bank C, business unit 3

This subsection presents data related to the EA granularity in use. The granularity was determined by evaluating and judging the *business*, *application*, *technology*, and *data* domains, in terms of *coarse*, *medium* and *fine* granularities of refinement (section 2.4.6 and Appendix 11) as described by the participants from this business unit (Cooper and Fisher, 2002; Fraser et al., 2017; Mirzianov and Mitasiunas, 2015; Paulk, 1999). The interview protocol (Appendix 4, Section A, questions 6-10) was structured to elicit these responses.

Table 6.9: EA granularity

Domains	Evidence	Codes	Theme	Granularity
Business	*"these days, banks are challenged with understanding the impact of disruption… companies like UBER have turned the industry on its head… so banks are looking for new approaches to execute their strategies… our business and technology architecture helps implement and transform our plans so that we can also disrupt the industry… and meet the needs for the customer of the future" (C.BU3.P3.1)*	• Implement plans • Transform plans • Customer of the future needs	Holistic blueprint that bring everything together. Focus on priority items, implementation and transformation to meet future customer needs	Business architecture defined at a coarse granularity of refinement
	"knowing where the business is going is key…. creates a blueprint for action that helps brings everything together…a holistic, common understanding of business the operations… focuses on the priority items" (C.BU3.P5.1)	• Blueprint • Brings everything together • Holistic common understanding • Priority items		
Application	*"the skeleton of the various systems that we have implemented in this department… it shows the outlooks… the data storage… and how the software and modules interact and interface with each other" (C.BU3.P3.1)*	• Skeleton • Outlooks • Data storage • Software • Interact • Interface	Skeleton outlining the application interactions, outlooks, storage, interfaces, and functions	Application architecture defined at a coarse granularity of refinement
	"shows the interaction between our various applications related to their functions… we designed it a few years back with a consultancy house... our mainframe hardware architecture was designed by the vendor using their model… it classifies the technologies and is	• Interaction • Functions • Model • Classifies		

Domains	Evidence	Codes	Theme	Granularity
	structured to align the technologies to the business objectives and initiatives" (C.BU3.P5.1)			
Technology	*"depicts the location of our different deployment environments, including non-production environments, such as development and pre-production" (C.BU3.P3.1)*	• Location • Deployment environments	Collaborative framework that builds a strategic roadmap with business stakeholders and shows the locations of the deployment environments	Technology architecture defined at a medium granularity of refinement
	"The framework helps us to collaborate with business stakeholders, build strategic roadmaps and permit business and IT alignment" (C.BU3.P5.1)	• Framework • Collaborate • Strategic roadmaps • Alignment		
Data	"*our data architecture is evolving… its contains an enterprise data model with sub designs for each product house, entity hierarchies, reference* data *values, and data taxonomies*" *(C.BU3.P3.1)*	• Evolving • Enterprise data model • Hierarchies • Reference values • Taxonomies	Evolving data architecture comprised of enterprise data models, integration models and meta models.	Data architecture defined at a coarse granularity of refinement
	"we have detailed database, data integration, content and meta data architectures in place… it contains all our data models, policies, data rules. Our new strategy is around data without borders" (C.BU3.P5.1)	• Detailed database integration • Meta data architectures • Data without borders		

Illustrated in Table 6.9, **a priori themes** (Strauss and Corbin, 2015) comprising of these domains were adopted from TOGAF (Harrison, 2013). This table lists the evidence collected that supported the codes within each domain, as well as the theme and granularity identified. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017).

Business architecture

Bank C, business unit 3, had a holistic common understanding of their business priorities. They built components of business architecture at a coarse granularity of refinement. Business goals such as a plan for *"customer of the future"* were clearly articulated. There was a strong emphasis on internal business principles such as *"holistic view"* within these business units. The results from both the interviews and artefacts did not contain finer details showing how these goals could be realised in the form of implementation details.

Application architecture

This business unit developed an application outlook that illustrated the interfaces and interactions of their systems. Various software architectural objectives, such as classifying and aligning all technologies to business objectives as well as data storage principles were defined. However, this business unit did not demonstrate any evidence to support the implementation or deployment of its objectives.

Technology architecture

Furthermore, a collaborative framework showing the technology environments was prevalent in Bank C, business unit 3. It had defined technology roadmaps to permit business and IT alignment. However, these were only specified at a coarse granularity of refinement. Finer grain refinements such implementation details were not specified.

Data architecture

Furthermore, an evolving data architecture that comprised of reference frameworks was constructed at bank C, business unit 3. Strategic data and information principles to manage hierarchies, reference data values, and data taxonomies were enforced. However, inconsistencies were picked up as documentation was not kept updated.

Codes comprising of *transform plans, customer needs , blueprint, holistic common understanding, priority items* and *outlooks* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017).

The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 24, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprised of *holistic blueprint that bring everything together. Focus on priority items, implementation, and transformation to meet future customer needs; skeleton outlining the application interactions, outlooks, storage, interfaces, and functions; collaborative framework that builds a strategic roadmap with business stakeholders and shows the locations of the deployment environments* and *evolving data architecture comprised of enterprise data models, integration models and meta models.*

Thereafter, **the defining and naming step** finalised the description of this business unit's theme as follows. *Bank C, business unit 3, specified its business architecture at a coarse granularity of refinement. It defined its objectives, goals, relationships, and capabilities within a holistic blueprint. The architecture prioritised the transformation and implementation initiatives that met future customer needs. The application architecture was specified at a coarse granularity of refinement. It designed a skeleton outlining its application interactions, outlooks, storage, interfaces, and functions of the business unit. The technology architecture was specified at a medium granularity of refinement. It designed a collaborative framework incorporating a strategic roadmap with business stakeholders. It further defined the locations of the deployment environments. The data architecture was specified at a coarse granularity of refinement. It consisted of an evolving data architecture comprising of enterprise data models, integration models, meta models, and data types.* Based on these evaluations, it was judged that **bank C, business unit 3,** defined its overall EA at a **coarse granularity of refinement**.

Once the granularity of refinement had been identified, the next step was to identify the business value of EA for this business unit, which commences below.

6.4.3 Business Value of EA from Bank C, business unit 3

This subsection presents data related to the business value of EA from the second business unit (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). Part B of the interview protocol (Appendix 4) was used to collect this data. It was used to understand the value related to each EA mechanism that was perceived by the participants.

Table 6.10: Value of EA

Mechanism	Evidence	Codes	Theme	Value
Processes	*"our architectural processes have helped us quickly identify areas that require automation… which in turn saves manual processing time… the bank is on a constant optimisation drive… and over and over again, system changes are required to make processes more efficient… the result is that manual tasks are sometimes not needed after the technical changes are implemented" (C.BU3.P3.1)*	• Identify automation • Efficient	EA processes identify areas for automation, improve profitability, assist with simplification and interoperability of applications for the business unit	Increased revenue, reduced complexity and interoperability of applications experienced
	"this bank is in an accelerated expansion mode, every staff member has to be must be operating at optimal productivity. If we are bogged with inefficient processes, then money is lost. The architecture is an enabler for us to increase productivity… we sometimes quickly become entangled with complex IT systems and disparate software and hardware… the value of our architecture is in the simplification it creates for us and interoperability of diverse applications… more profitability for the bank as well" (C.BU3.P5.1)	• Productivity • Simplification • Interoperability • Profitability		

Mechanism	Evidence	Codes	Theme	Value
Communication	*"we have a mix of homegrown applications, and applications from different vendors… the architecture gives us a <u>holistic view</u> of this mix, facilitates <u>migration</u> of these applications across environments and <u>reduces</u> our <u>complexity</u>" (C.BU3.P3.1)*	• Holistic view • Migration • Reduces complexity	EA creates a holistic view of the business unit's applications, reduces complexity, improves profitability and eases interoperability of applications	
	"the bank's systems have evolved over time… speaking from experience, we initially had a poorly planned architecture…if you can call it an architecture… was complex and built for quick win strategic expansion projects. We have grown and matured since then… our architecture now allows <u>seamless portability</u> of our software and easy <u>interoperability</u> across the software… <u>not</u> so many <u>siloed</u> systems" (C.BU3.P5.1)	• Seamless portability • Interoperability • Not siloed		
Business-IT alignment	*"the bank is focusing on increased revenue from customer acquisition across Africa… with fierce competition, we have to provide exceptional service, the systems have to be simple and quick. The bank's architecture has played an important role in a design that allows this expansion this easily. We can seamlessly deploy instances of the system in any country, with minor customisation like currency changes. The architecture facilitates easy <u>integration</u> and <u>operability</u> with host country peripheral systems like local credit bureaus, and allows <u>profits</u> to be generated much <u>faster</u>" (C.BU3.P3.1)*	• Integration • Operability • Faster profits	The business unit experiences improved profitability and a standardisation language for business and IT stakeholders to converse	

Mechanism	Evidence	Codes	Theme	Value
	"always been a challenge on how to bridge the gap between business strategy and IT implementation. The way I see it… this gap is caused by speaking totally different languages. Business stakeholders speak about strategy, objectives and goals, IT staff speak about java scripts, executables and IDE's. Our architecture creates a standardised language for business and IT to converse. Results in a better understanding of requirements, less rework and more revenue" (C.BU3.P5.1)	• Standardised language • Business and IT converse • Understanding requirements • Less rework • More revenue		
Senior-Management Involvement	*"definitely shorter development time… we can pinpoint exactly where the changes need to take place… far less complexity than a few years ago… less time sitting in meetings and workshops" (C.BU3.P3.1)*	• Shorter development time • Less complexity • Fewer meetings	EA helps improve profitability, reduces complexity and improves development time for the business unit	
	"innovation has improved… the clarity brought by architecture allows staff to modify processes that improves performance and improves profitability" (C.BU3.P5.1)	• Innovation • Clarity • Modify process • Improves performance • Improves profitability		
Finance	*"we only introduced our architecture processes a few years ago… I have seen these architecture processes make a direct impact on the revenue of the bank… how… because we are launching new products faster than the previous years… which means we get a quicker return on our investment… we track the benefits realisation and business cases of all new*	• Revenue • Launching faster • Quicker return on investment	The business unit experiences an increase in revenue, improved ROI and quicker	

Mechanism	Evidence	Codes	Theme	Value
	product launches, so we can associate a monetary figure to our architecture" (C.BU3.P3.1)		launch of products from their EA implementation	
	"a few years back, we wasted a lot of time and money on integrating, maintaining, and upgrading different versions of software. Sometimes when systems were upgraded, even more <u>integration</u> was needed for <u>interoperability</u> of the upgraded versions of software to work the other systems. The architecture increased <u>project delivery timelines</u> and improved <u>usability</u> of the applications for the developers" (C.BU3.P5.1)	• Integration • Interoperability • Project delivery timelines • Usability		

Illustrated in Table 6.10, **a priori themes** (Strauss and Corbin, 2015) comprising of *processes, communication, business-IT alignment, senior management involvement, and finance* were used to understand the EA practices, with the questions structured to obtain insights into the forms of value obtained for each of these mechanisms (De Carvalho et al., 2016a). This table lists the evidence collected that supported the codes within each mechanism and the theme which was identified as a result. The analysis commenced with the **familiarisation of the data** step, whereby the participant comments were examined (Braun and Clarke, 2008; Terry et al., 2017). **Codes** including *automation, efficient, productivity, reduces complexity, simplification, interoperability, profitability, holistic view,* and *migration,* were derived from the data (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). The **searching for themes** step then commenced whereby these codes were developed into preliminary mind maps, found in Appendix 24, to assist with the creation of themes (Braun and Clarke, 2008; Henderson and Segal, 2013; Silver and Lewins, 2014; Terry et al., 2017). Thereafter, **reviewing of themes** took place where the themes were fine-tuned and refined (Braun and Clarke, 2008; Silver and Lewins, 2014; Terry et al., 2017). Themes comprising of *EA processes identify areas for automation, improve profitability, assist with simplification and interoperability of applications for the business unit; EA creates a holistic view of the business units applications, reduces complexity, improves profitability and eases interoperability of applications; The business unit experiences improved profitability and a standardisation language for business and IT stakeholders to converse; EA helps improve profitability, reduces complexity, and improves development time for the business unit* and *the business unit experiences an increase in revenue, improved ROI, and quicker launch of products from their EA implementation* were developed.

Thereafter, **the defining and naming** step finalised the description of this business unit's theme as follows. *Increased revenue, reduced complexity and interoperability of applications were experienced within business unit C. 3 because of EA. EA created a holistic view of the business unit's applications and identified areas for automation. It further enabled the business unit to experience an improved ROI and quicker launch of its products.*

The following section concludes the presentation and findings of evidence from Bank C.

6.5 Conclusion

This chapter organised and presented evidence of data from business units C.1, C.2, and C.3 from Bank C (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015).

This research found that business unit C.1 had *informal, people dependent EA practices* within the business unit. This business unit applied EA at a coarse granularity of refinement. This business unit experienced forms of value such as software cost savings, hardware cost savings, and "as is" understanding of the current state environment as a result of EA.

Furthermore, this study found business unit C.2 contained *comprehensive EA capabilities and practices* that *clear and regularly communicated* to staff*.* This business unit applied EA at a medium granularity of refinement. Business unit C.2 experienced forms of value such as risk management, business-IT alignment, and process improvements.

Finally, this study established that business unit C.3 contained *simple EA capabilities and practices* that were *new and being established.* This business unit applied EA at a coarse granularity of refinement. Business unit C.3 experienced forms of value such as increased revenue, reduced complexity, and interoperability of systems. The next chapter consolidates the findings from all the case studies examined in this study.

Chapter 7: Consolidation of Findings

This short chapter combines the thematic results from the three case studies into a consolidated overview. The interpretation and discussion can be found in the subsequent chapter

7.1 Introduction

Chapter 1 introduced the aim of this research, which was to understand the connection between the EA maturity of an organisation and the business value associated with it in the South African financial services environment. Key concepts of EA, maturity, and business value, as well as the RBV theoretical framework, were presented. Chapter 2 subsequently elaborated on these concepts in the literature review. The underlying philosophy, approach, purpose, and strategy, as well as the techniques and procedures adopted for this study, were outlined in Chapter 3. Examples of evidence to support the findings from the 3 case studies, were presented across Chapters 4 to 6.

This chapter consolidates the results from these 3 case studies. The sections are aligned to the research questions, i.e

- What are the levels of EA maturity within the South African financial services environment?
- What are the granularities of EA in use within the South African financial services environment?
- What are the tangible and intangible forms of business value influenced by EA heterogeneity?

A total of 56 people were invited to contribute to the individual interviews from 9 business units across 3 banks. Twenty-eight people accepted and participated in the interviews, representing an acceptance rate of 50%. The subsequent section commences with the first enquiry on the levels of EA maturity levels within the South African Financial Services environment.

7.2 The levels of EA maturity within the South African financial services environment

Figure 7.1 below presents a consolidated view of the EA maturity levels of the business units from Banks' A, B and C, structured within the ACMM framework.

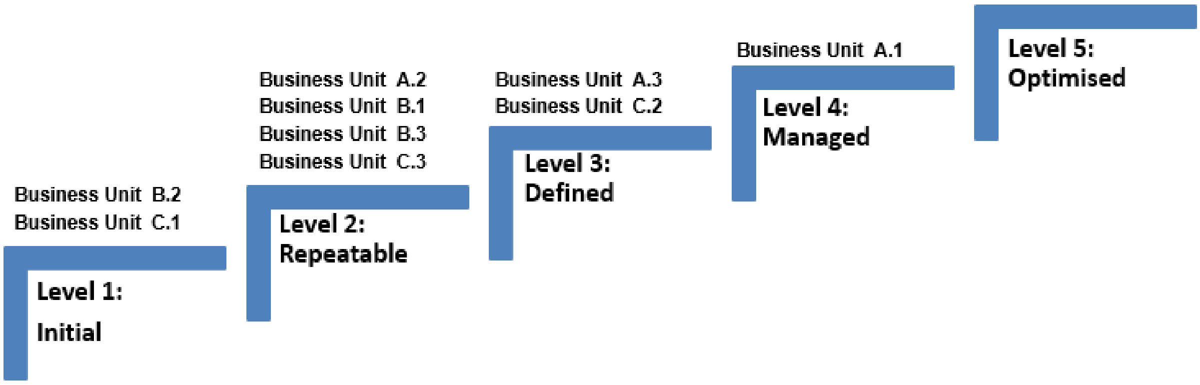

Figure 7.1: EA Maturity Levels of the Business Units assessed

Level 1 maturity

The thematic analysis results from section 5.3.1, concluded with *informal EA capabilities and practices that are new, still gaining momentum within Bank B, business unit 2,* and established that it operated within maturity level 1. It was found that EA provided this business unit with the ability to make quick decisions. However, more fine tuning was required as business unit silos were prevalent, with a misalignment of these business unit siloed architectures with the banks overall architecture. EA practices within this business unit were inconsistent as they were dependent on specific staff members that advocated the value of particular projects. Furthermore, this business unit was characterised as having an excessively high staff turnover rate, which resulted in intermittent EA momentum applied. An inconsistent degree of management support and internal conflict featured within this business unit, with some managers advocating EA practices, whereas others had no interest in its presence.

The thematic analysis results from section 6.2.1 concluded with *EA practices dependent on individual person efforts within Bank C, business unit 1*, and established that it operated within maturity level 1. This research found that this business unit had informal EA practices and capabilities that were dependent on specific staff. EA was implemented at a business unit level, as opposed to an organisational level, and was not linked to the overall bank's strategy. Basic EA practices had evolved organically, with management involvement. A committed budget for EA was available. However, a dependency on specific individuals was the primary concern within this department. This business unit's environment was disorganised, with EA reliant on particular champions. However, these champions were often moved to projects that were in crisis, and, because of this movement, EA expertise and knowledge left when these champions were reassigned.

Level 2 maturity

The thematic analysis results from section 4.3.1 concluded with *simple EA capabilities evident with basic EA practices being developed within Bank A, business unit 2,* and established that it operated within maturity level 2. It was found that essential communication took place for all projects, with financial alignment experienced. There was a formal design process, however, with a few gaps prevalent. Furthermore, there was no future state architecture in place. There was a reliance on a few experts to execute initiatives within this business unit. It was revealed that more management involvement was required to prevent project silos. Furthermore, this business unit was characterised by selective degrees of commitment from the senior managers.

The thematic analysis results from section 5.2.1 concluded with *EA in progress, with basic EA processes recently introduced and being formalised within bank B, business unit 1* and established that it operated within maturity level 2. The use of EA resulted in simple business-IT alignment experienced at a management level. However, more convincing was required on the use of EA to gain momentum as it was not fully leveraged by management. Senior management involvement with EA practices was erratic, with a mixed understanding of EA value. This business unit did have a few clear EA communication and governance standards that were documented within their repository, however, the communications occurred infrequently. Furthermore, there was intermittent EA input into the finance strategy within this business unit. There was basic finance involvement with governance benefits being recognised by the department. This business unit had documentation available for its core and 'as is' systems, however secondary and 'to be' systems had to still be concluded. It was found that an EA repository was developed, however navigation within this repository was a problem for the staff.

Section 5.4.1 concluded with *EA being established as well as EA processes being developed and communicated within business unit B.3*, and established that this business unit operated within maturity level 2. Basic EA processes and updated documentation were in place for critical core systems, and were stored within the repository. It was found that EA was becoming fundamental to business operations, and useful for understanding regulations, with regular staff awareness activities taking place. Business-IT alignment was steadily progressing. Financial benefits such as risk reduction were experienced. There was gradual involvement of senior managers in EA practices. However, the management displayed various degrees of commitment, with some managers advocating EA, and others resisting or opposing any new practices. Additionally, there were staff problems in the department regarding focusing on EA due to a work overload issue. A dependency on specific individuals was a problem.

The thematic analysis results from section 6.4.1 concluded with *simple EA capabilities and that are new and being set up with current state environment complete* within bank C, business unit 3, and established that this business unit operated within maturity level 2. EA practices were being set up with the current state environment blueprints complete. For instance, a technical reference model was being developed for EA; however, this model was not linked to the future target EA state. This business unit built a shared folder to store its EA reference models, with EA communications taking place sporadically. A new management team was recently appointed, that supported EA, however, there was some resistance from the older managers, characterised by elements of internal politics. Efficiency benefits, some business-IT alignment value, as well as financial benefits such as rationalisation and redundancy, were experienced. This business unit did have a few EA finance standards that were documented in the repository; however, there was no formal finance strategy regarding EA within this business unit.

Level 3 maturity

Section 4.4.1 concluded with *formal EA capabilities as well as comprehensive EA processes supported by management, with current and future states integrated into the SDLC, within bank A, business unit 3*, established that it operated within maturity level 3. There was good management support coupled with a strong business-IT alignment that allowed innovation and growth within this business unit. Senior management, such as the CEO of this business unit actively supported and embraced EA practices. Furthermore, staff from this business unit understood the benefit of EA and actively contributed to architectural initiatives. Moreover, this business unit had comprehensively documented governance processes of all its EA components. This business unit further included EA when making any financial decisions. Moreover, this business unit complied with EA standards when procuring any IT equipment. Notably, this business unit used a specialised EA tool.

Section 6.3.1 concluded with *comprehensive EA capabilities and practices that are clear and regularly communicated to all staff within bank C, business unit 2,* and established that it operated within maturity level 3. This business unit had comprehensively documented its EA governance processes, future state architecture, EA standards, and reference models, and formed an architecture board. Furthermore, resource prioritisation was experienced, with a strong business-IT alignment and a focus on business solutions. Moreover, senior management commitment to EA practices was experienced within the business unit. Communication was prevalent in this business unit, with the CIO providing frequent EA feedback to staff through emails. Furthermore, their EA plans were linked to both their business unit and the banks strategic and tactical plans. The artefacts showed that this business unit had incorporated EA in the business unit's financial processes. Furthermore, this business unit procured an expert EA toolset.

Level 4 maturity

Section 4.2.1 concluded with *entrenched, comprehensive and updated EA business practices that are well established and part of the business unit culture* within bank A, business unit 1, and established that it operated within maturity level 4. This business unit further distributed regular communications to their staff on the latest EA architecture development and standards. Its EA practices were continuously advanced by management. A differentiator at this level was that this business unit had specific metrics to evaluate its EA practices. The business unit further had predictive financial models that were available in the repository. Furthermore, senior management was proactively involved with the architecture board. This business unit's finance department reviewed EA before any major purchases.

Level 5 maturity

The EA practices within ACMM at the optimising level were characterised being in a state of continuous improvement (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op 't Land et al., 2009; Paulk et al., 2006). None of the business units assessed in this study featured within level 5 maturity.

The subsequent section presents the outcome of the second research question related to the granularity of EA domains in use.

7.3 Granularities of EA within the South African financial services environment

Figure 7.2 below presents a consolidated view of the EA granularities of refinement in use from all the business units, structured within the ACMM framework.

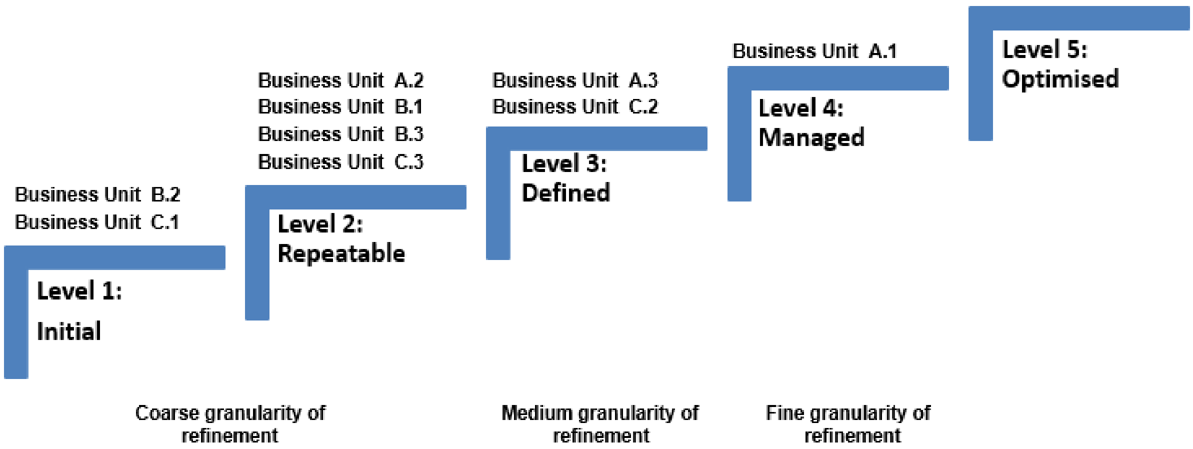

Figure 7.2: Granularities of EA within business units

As previously stated, TOGAF (Harrison, 2013) was selected as the reference EA framework for this study. It is comprised of a **business** domain (comprising of a strategy, vision, mission, goals, objectives, and value chain), **application** domain (comprising of a software blueprint), the **technology** domain (comprising of end-user devices, networks, servers, and storage) and **data** domain (comprising of the data and information pattern used in the business unit). These domains were further viewed in terms of **coarse**, **medium,** and **fine** granularities of refinement. The coarse granularity conceptually defined the specific domain objectives. The medium granularity was a logical layer that defined the way that the coarse granularity was achieved. Finally, the fine granularity physically defined implementation details (Harrison, 2013). The literature did not show the EA granularities utilised at the different levels of maturity (Bui, 2012; Tamm et al., 2015, 2011; Vallerand et al., 2017; Wang and Zhao, 2009). Organisations could benefit from this understanding as it would guide them on where to appropriately focus effort. Table 7.1 presents a detailed summary of the EA granularities of refinement in use from all the business units.

Table 7.1: Detailed Summary of EA Granularities

Maturity Level	Business Unit	Business Domain	Application Domain	Technology Domain	Data Domain	Overall Granularity
4	Business Unit A.1	Fine	Fine	Fine	Fine	Fine
3	Business Unit A.3	Fine	Medium	Fine	Coarse	Medium
3	Business Unit C.2	Medium	Medium	Fine	Fine	Medium
2	Business Unit A.2	Coarse	Coarse	Medium	Coarse	Coarse
2	Business Unit B.1	Medium	Coarse	Coarse	Coarse	Coarse
2	Business Unit B.3	Coarse	Coarse	Coarse	Medium	Coarse
2	Business Unit C.3	Coarse	Coarse	Medium	Coarse	Coarse
1	Business Unit B.2	Coarse	Coarse	Fine	Coarse	Coarse
1	Business Unit C.1	Coarse	Coarse	Coarse	Coarse	Coarse

Coarse Granularity of Refinement

Bank C, business unit 1 defined its *business* domain at a coarse granularity. It specified the business unit objectives, goals, relationships, and capabilities, and made good progress with EA awareness within the business unit. More blueprints were becoming visible within the business unit; however, it has not made broad inroads at an organisational level. EA was still perceived as an *IT thing* with a reliance on selected champions. The *application* domain was also defined at a coarse granularity. This business unit specified its software applications, and defined a broad perspective of its ecosystem by structuring this domain within a simple layered model with tiers, and focusing on integration. The *technology* domain was defined at a coarse granularity. This business unit specified the technology required to support its operations, and was comprised of a vendor neutral architecture with a solution focus on simplicity that facilitated problem solving. The *data* domain was similarly defined at a coarse granularity. This business unit specified the data types required to support its operations, and comprised of a relational database architecture that focused on gathering and storing data, as well as the processing and analysis of that data. This business unit defined its overall EA at a **coarse granularity of refinement**.

The *business* domain of **bank B, business unit 2,** was defined at a coarse granularity. It specified its objectives, goals, relationships, and capabilities. Furthermore, this domain was informal and showed the interaction of people, processes, and technology. The *application* domain was also defined at a coarse granularity. It specified the software applications required by the business unit and contained a monolithic design comprised of many loosely coupled applications. There were problems with maintenance, duplication of systems, and large code bases. A plan to transform this architecture into services architecture was in place. The *technology* domain was defined at a fine granularity. This business unit specified where the technology was physically deployed, depicted the layers and environments developed with an OSI reference model. The *data* domain was defined at a coarse granularity. It specified the data types required to support the business unit, and focused on a structured data in an SQL environment. A goal of a minimal total cost of ownership was in place. Finally, this business unit defined its overall EA at a **coarse granularity of refinement**.

The *business* domain of **bank C, business unit 3,** was defined at a coarse granularity. This business unit specified its business objectives, goals, relationships, and capabilities. It comprised of a holistic blueprint that brought everything together for the business unit. There was a focus on priority items, implementation and transformation to meet future customer needs within the architecture. The *application* domain was also defined at a coarse granularity. The software applications required by the business unit were specified within a skeleton outlining the application interactions, outlooks, storage, interfaces, and functions of the business unit. The *technology* domain was defined at a medium granularity. This business unit specified the ways that the technology objectives were achieved and included a collaborative framework that incorporated a strategic roadmap with business stakeholders. It further defined the locations of the deployment environments. The *data* domain was defined at a coarse granularity. The data types that were required to support the business unit were specified, and consisted of an evolving data architecture comprising of enterprise data models, integration models, and meta models. The overall granularity of bank C, business unit 3, was defined at a **coarse granularity of refinement**.

The *business* domain of **Bank B, business unit 3,** was defined at a coarse granularity. It specified its strategic objectives, roadmap, structures, and functions. The *application* domain, defined at a coarse granularity, specified the software applications that were required by the business unit. It comprised of a service oriented application architecture that used the same backend for several applications. The *technology* domain, defined at a coarse granularity, specified the technology that was required to support the business unit. It comprised of a picture that depicted the configurations, servers, networks, as well as the vision and strategy of the business unit. The *data* domain was defined at a medium granularity. It specified the data types that were required to support the business unit, and included data types, frequency, structures, abstractions, and views of data. Finally, the overall EA of Bank B, business unit 3, was defined at a **coarse granularity of refinement**.

Bank B, business unit 1, defined its *business* domain at a medium granularity. This business unit specified the way that the business objectives were achieved, and was comprised of a simple blueprint illustrating the value chain and capabilities, and outside touch points with a focus on customer satisfaction. The *application* domain, defined at a coarse granularity, specified the software applications that were required by the business unit. It comprised of a strategic view of the critical applications with an events platform focus, including applications, interfaces, and connectors, without concentrating on specific applications. The *technology* domain was defined at a coarse granularity, and specified the technology that was required to support the business unit. It was comprised of a comprehensive distributed 3 level network architecture incorporating ‘compute’, ‘network’ and ‘storage’ concepts. This business unit’s *data* domain was defined at a coarse granularity, and specified the data types that were required to support the business unit. The data domain managed the flow of data through all stages, with the customer information file being the master source of data. This business unit defined its overall EA at a **coarse granularity of refinement**.

Finally, **bank A, business unit 2,** defined its *business* domain at a coarse granularity. It specified the business objectives, the vision, mission, and goals of the business unit, as well as an abstraction of its primary activities, capabilities, services and functions, as well as the end to end value chain. The *application* domain, defined at a coarse granularity, specified the software applications required by the business unit. It was composed of a conceptual view of application capabilities and its customer set up. It included blueprints and patterns incorporating principles of low coupling and high cohesion. Furthermore, this business unit's *technology* domain, defined at a medium granularity, specified how the technology was implemented. It provided a layered snapshot view of the data centres, mainframe, databases, and networks. The business unit had an objective to migrate to a cloud platform. The *data* domain was defined at a coarse granularity, and specified the data types that were required to support the business unit. It was designed as a high-level architecture with concerns about the number of moving parts. Big data architecture was being built, with the objective of a single source of customer master data and minimal duplication. Finally, the overall EA of bank A, business unit 2, was defined at a **coarse granularity of refinement**.

Medium Granularity of Refinement

Bank C, business unit 2, defined its *business* domain at a medium granularity. It described the way that the business objectives were achieved, and focused on business execution by linking the business unit strategy to tactical actions. It structured the strategy in the form of a value chain for the business unit. The *application* domain, defined at a medium granularity, specified the way that the software applications were implemented. It comprised of an enterprise service bus architecture that integrated different applications. The architecture helped envision current systems and new products for the business unit. The *technology* domain was defined at a fine granularity, specified where the technology was physically deployed. It comprised of a model that depicted the current plumbing and served as a predictor to see the effects of changes. It incorporated inputs, tools, and outputs. The business unit made use of reference models as a base that was customised for its various segments. The architecture was embedded into everyday business unit processes. The *data* domain, defined at a fine granularity, described where a particular view of data was physically managed. Details data flows and core components, data aggregation, common vocabulary, and abstractions were articulated. It included customer, sales, and product information of the business unit. Finally, Bank C, business unit 2, defined its overall EA at a **medium granularity of refinement**

Furthermore, **bank A, business unit 3,** defined its *business* domain at a fine granularity. It described its physical implementation details in terms of where the business processes took place, and the stakeholders that performed them. Specific business models encompassing strategy and principles that were aligned to their tactical demands were defined. The architecture included detailed functions, capabilities, inputs, and outputs. The *application* domain, defined at a medium granularity, described the way that the software application was implemented. It comprised of a services architecture with API's incorporating principles of cloud, elastic scaling, and continuous demand. Furthermore, its *technology* domain was defined at a fine granularity. It described where the technology was physically deployed. It detailed a cloud technology stack incorporating software and infrastructure as a service model. The design included hardware, servers and the network layout. The *data* domain, defined at a coarse granularity, described the data types that were required to support the business unit. The design focused on its customer engagement, to enhance offers. It incorporated shared data concepts such as rest, use, and motion principles. Finally, bank A, business unit 3, defined its overall EA at a **medium granularity of refinement**.

Fine Granularity of Refinement

Bank A, business unit 1 described its *business* domain at a fine granularity. It described physical implementation details in terms of where the business processes took place, and which stakeholders performed them. It had a strong focus on its business needs and solutions as well as how they were obtained. This business unit includes processes, objectives, goals, and the locations of its business value chain. The *application* domain was defined at a fine granularity. It specified the actual physical deployments and environments of the software. It was designed as a layered micro-services application of architecture with the principles of high cohesion, low coupling, autonomy, and single focus. Furthermore, this business unit's *technology* domain, defined at a fine granularity, described where the technology was physically deployed. It was designed as a hybrid cloud layered micro-services architecture that is stateless and resides in a container environment. The *data* domain, defined at a fine granularity, described where particular views of data were physically managed. It was a methodical data architecture focusing on principles of volume, velocity, and variety, including logical and physical details. A big data strategy was further in place. Bank A, business unit 1, described its overall EA at a **fine granularity of refinement**.

The business value of EA for each of the levels follows in the subsequent section.

7.4 Tangible and Intangible forms of Business value influenced by EA Heterogeneity

Figure 7.3 consolidates the forms of business value from earlier chapters that business units experience at the escalating levels of maturity.

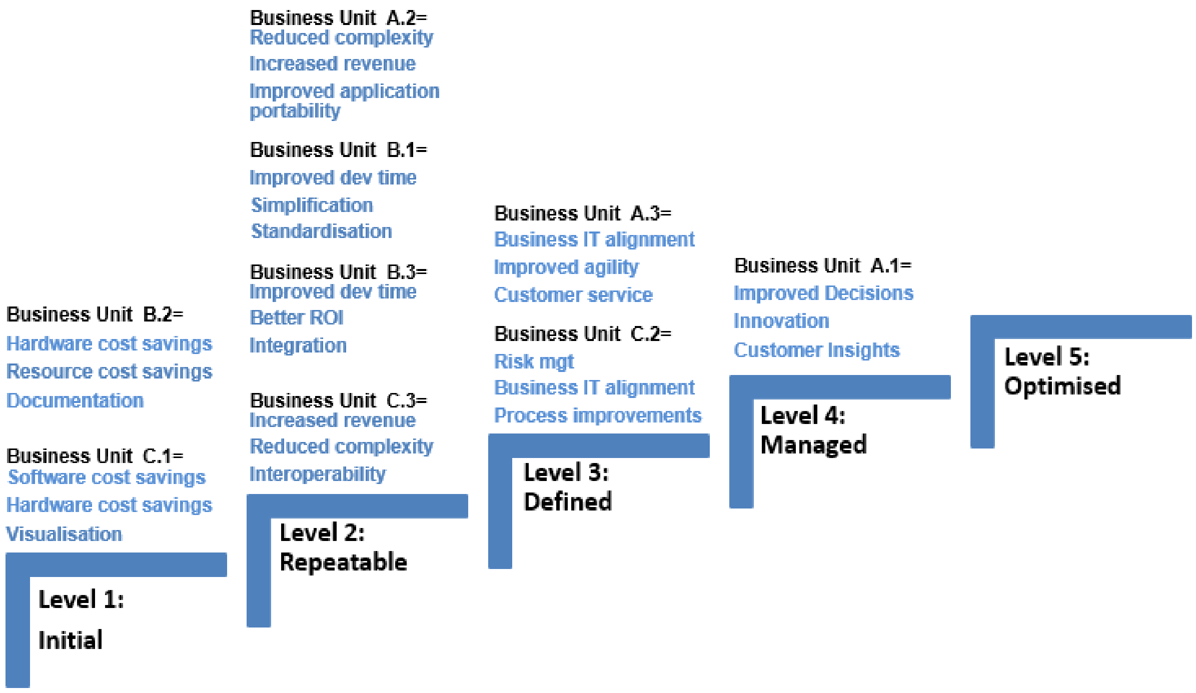

Figure 7.3: EA value attained at different levels of maturity

Within **level 1 maturity**, forms of value such as *hardware cost savings, software cost savings and improved documentation* were experienced within **business unit B.2**. EA created a common platform and single view of initiatives for senior management. This helped manage stakeholder expectations and enabled them to reach consensus on disagreements. Furthermore, it improved the quality of technical documentation that led to hardware and software savings. EA finally influenced resource efficiencies which improved ROI for the business unit. *Software cost savings, hardware cost savings,* and *visualisation* were experienced within **business unit C.1**. EA enabled rationalisation of applications, the reuse of technologies, and the correct selection of technologies that resulted in technology cost savings. Furthermore, it enabled the visualisation of systems by management.

Forms of value such as *reduced complexity, increased revenue, and an improvement in the portability of applications* were experienced within the **level 2 maturity**, **business unit A.2,** as a result of EA. It enabled the business unit to create a strategic and holistic view of its customer base as well as a clear structured approach to problem solving. It helped them convert complex technical details into a simple business language that was easy for management to understand and agree. Furthermore, EA enabled the business unit to visualise the impact of financial decisions, which helped them experience a quicker return on their investments and, in turn, improved their profitability. Finally, the business unit experienced an improvement in the portability of their applications due to the influence of EA. *Improved development time, simplification, and standardisation* were identified as value experienced within **business unit B.1**. EA created a common dialogue platform for business and IT stakeholders. This simplified complexity and enhanced the management's understanding of technology due to a standardised platform. Furthermore, it enabled faster development time for building systems within the business unit. *Improved development time, improved ROI, and integration* as value experienced within **business unit B.3** because of EA. It created a holistic view of the business objectives by linking them to the technologies. It aligned strategies, people, processes, and technologies. The EA repository facilitated reusability that resulted in faster system development time and less integration complexity across systems in the bank. Subsequently, a higher ROI was achieved due to the faster deployment of systems, *increased revenue, reduced complexity, and interoperability* as forms of value experienced within **business unit C.3** because of EA. It created a holistic view of the business unit's applications and identified areas for automation. It further enabled the business unit to experience an improved ROI and quicker launch of its products.

Within **level 3 maturity**, *business-IT alignment, improved agility, and customer service* as value experienced within **business unit A.3**. EA created a common platform for management to align strategies, as well as become more agile and responsive to change. It enabled people, process, and technology alignment, as well as operational and strategic business alignment. These alignments subsequently improved customer service for the business unit. Furthermore, they experienced an improvement in financial benefits within a shorter period of time. Whereas *risk management, business-IT alignment, and process improvement* as value experienced within **business unit C.2** because of EA. It helped senior management recognise risk, improve their project selection and make informed design choices before systems are built. It further brings synergy and alignment across autonomous business units. Processing efficiencies such as improved processing times were experienced influenced by EA.

Finally, **business unit A.1** featured within **level 4 maturity**. *Improved decision-making, innovation and customer insights* were experienced as a result of EA. It assisted the business unit to improve their decision-making processes. Furthermore, it helped create an approach to foster innovative solutions, as well as the faster deployment of these solutions. A better understanding of their customer behaviour revealed insights for the business unit. Finally, EA helped the business unit improve their ROI, as well as clarify project prioritisation decisions.

These results were further analysed using the thematic analysis techniques from Chapter 3 to fine tune the patterns and themes (Daly et al., 1997; Terry et al., 2017). Figure 7.4 finalised the forms of business value attainable at these levels.

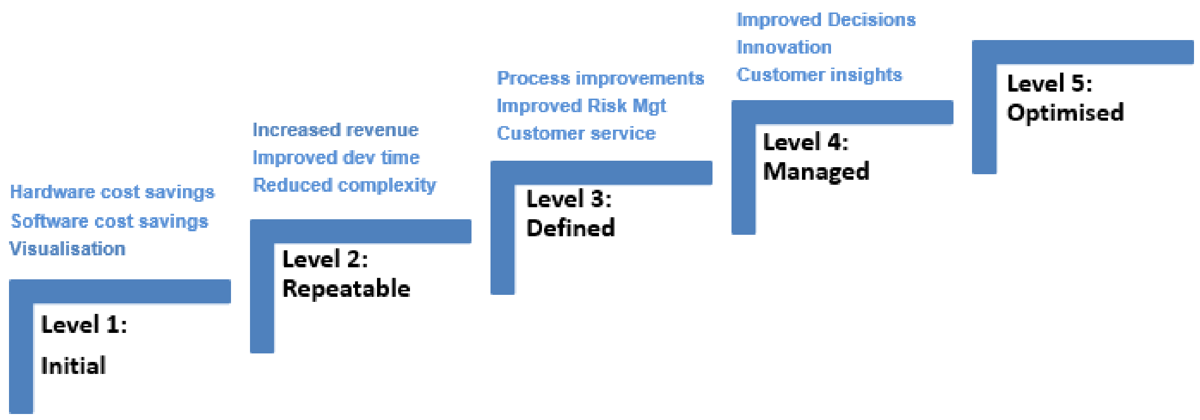

Figure 7.4: Final results: EA value attained at different levels of maturity

Forms of value such as *hardware cost savings, software cost savings,* and *visualisation* were experienced within **level 1** maturity. Within **level 2**, the forms of business value that business units realised were *reduced complexity, increased revenue,* and *improved development time*. Business units within EA maturity **level 3** experienced *process improvements*, *improved risk management* and *enhanced customer service.* Finally, this study revealed that within **level four,** business units benefited from *improved decision-making, innovation, and enhanced customer insights* due to EA. This research found that none of the business units featured within **level 5** maturity.

As introduced in Chapter 2, there were diverse views from literature on the term business value (Amit and Zott, 2001; Chatain and Mindruta, 2017; Chesbrough, 2012; Hwang and Christensen, 2008; Johnson et al., 2008; Kashyap et al., 2017; Sorescu et al., 2011). Business value was described as inconsistent, obscure, controversial, and unclear (Bannister and Remenyi, 2000; Cronk and Fitzgerald, 1999; Encyclopedia.com, 2017; King and McClure, 2014). Definitions from econometric, process, and perception models, as well as MBO, value chain, balanced scorecard, and RBV were examined. Although all these business value models had merit, the RBV description that, *business value is an output condition created by valuable resources. A resource is valuable if it increases product differentiation, decreases the cost of production or improves efficiency and effectiveness strategies that place an organisation in a favourable position (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997)* was selected for this study, as it aligned with both the theoretical framework and the aims of this study.

This study demonstrated that EA is a source of both tangible and intangible forms of value. Forms of value such as *hardware cost savings, software cost savings, increased revenue* and *improved development time* were tangible (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003) benefits. Other forms of value such as *visualisation*, *process improvements, reduced complexity*, *improved risk management*, *enhanced customer service, improved decision-making, innovation, and enhanced customer insights* were intangible forms (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003) of value generated by EA. The next section concludes this chapter.

7.5 Conclusion

This chapter consolidated the evidence that was collected from the 3 case studies and structured the results according to the main concepts of this research, i.e. levels of EA maturity, the granularity of EA domains in use, and value of EA.

The research found business units **B.2** and **C.1** were classified within level **1 maturity**. Forms of value such as *hardware cost savings, software cost savings,* and *visualisation* were experienced at this level. Business units within level 1 used EA at a coarse granularity of refinement. Business units **A.2, B.1, B.3** and **C.3** were characterised within the level **2 maturity**. At this level, the forms of business value that these business units realised were, *increased revenue, improved development time,* and *reduced complexity*. Business units within level 2 used EA at a coarse granularity of refinement. Business units **A.3** and **C.2** were characterised as being within level **3 maturity**, and experienced *process improvements, improved risk management,* and *improved customer service.* Business units within level 3 used EA at a medium granularity of refinement. Finally, this study revealed that **business unit A.1** operated within **level 4** maturities, with forms of value such as *improved decision-making, innovation, and enhanced customer insights* experienced due to EA. Business units within level 4 used EA at a fine granularity of refinement. Notably, none of the business units featured within level 5.

Chapter 8 presents a discussion of these findings.

Chapter 8: Interpretation and Discussions of the Results

This chapter provides insights into the results from the three case studies analysed in this research.

8.1 Introduction

Earlier chapters of this research established that challenges exist in understanding the relationship between EA maturity and business value (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997). Furthermore, studies had not specifically focused on the way that EA affects business value outcomes at the different maturity levels (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015, 2011; Vallerand et al., 2017). The importance of investigating this problem was argued as organisations could understand the forms of business value attainable as they progress towards higher levels of EA maturity. To investigate this aim, the study examined 9 business units in 3 banks, of different sizes and complexities. Fifty-six individuals comprising of business and IT professionals from these business units were invited to participate in the interviews. Twenty-eight individuals accepted and finally participated in the interviews.

This chapter is structured into 3 sections as follows:

- Discussion of results;
- Insights into Theory;
- Insights into EA Transitions and General Observations.

8.2 Discussion of results

The research questions were established previously in this study and are as follows:

1. What are the levels of EA maturity within the South African financial services environment?
2. What are the granularities of EA in use within the South African financial services environment?
3. What are the tangible and intangible forms of business value influenced by EA heterogeneity?

Figure 8.1 below summarises the characteristics of the EA practices, the granularity of the domains as well as the forms of value experienced at each level of maturity found in this study.

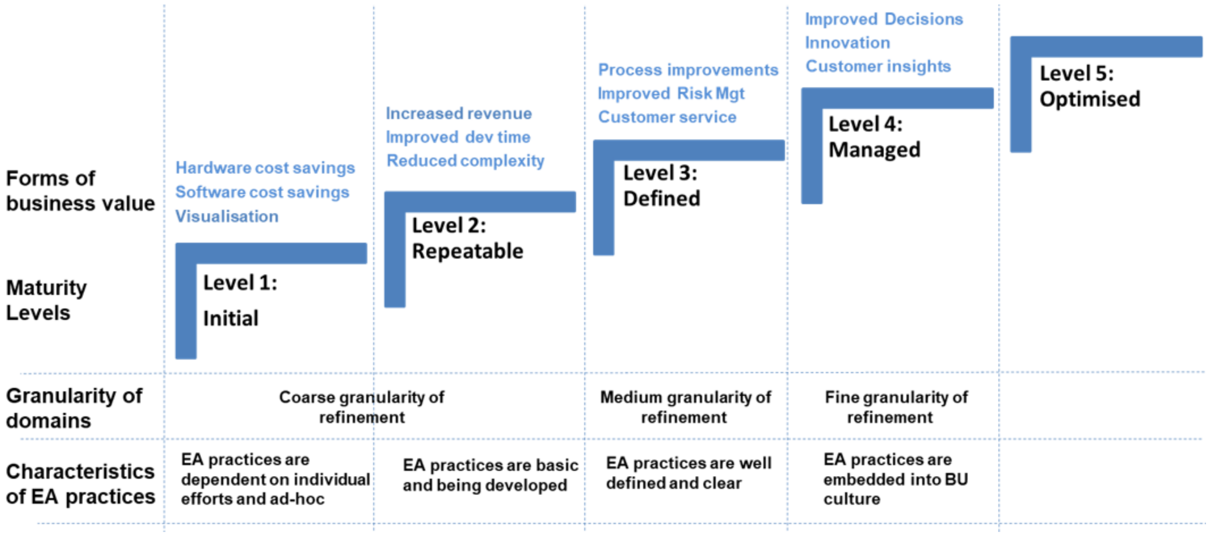

Figure 8.1: Summary of results

The following subsections discuss the research questions and are structured according to the levels of EA maturity.

8.2.1 Level 1 Maturity

EA Practices

The most notable trait of the business units at the first level of maturity was a dependency on specific individuals for architectural effort momentum. Furthermore, these champions were not necessarily formally appointed EA's, but rather senior developers within their respective business units that had an interest in architecture. EA practices at this level were inconsistent as they were dependent on these champions that advocated its value. High staff turnover was another characteristic of business units at this level. Due to this high staff turnover problem, EA champions were often moved to projects that were in crisis. Because of this movement, EA effort was intermittent and disorganised as the expertise and knowledge left when these champions were reassigned. Business units at this level had a strong reliance on IT vendors to drive solutions, due to their staff turnover problem.

Intertwined with a dependency on specific individuals, this study found that not all staff was actively supporting the EA initiative. The EA champions cited poor business engagement as a reason for the low adoption of EA. There was minimal involvement of senior management in the EA practices at this level. The results demonstrated that EA did not prominently feature within these business unit management meeting agendas. The business units at this level perceived EA to be a tool for the IT department to *"draw diagrams"* (B.BU2.P5.1) to illustrate their technical specifications. This resulted in a weak IT link to business strategies. Furthermore, the EA champions from these business units argued that maintaining the EA momentum was challenging, as staff often had a limited understanding of its importance. In order to gain any EA influence on business-IT alignment, the champions had to continually promote its importance.

Again, due to this dependency on specific individuals, EA documentation was a combination of high and low-quality artefacts. EA documentation primarily included technical blueprints of systems, as well as a few finance and communication artefacts. Furthermore, most documents illustrated the current state environment, with ad hoc future state environment artefacts available.

This study found that business units at this level initiated various projects to meet their specific short-term needs without regard to the impact of the bank's overall architecture. Furthermore, the champions focused most of their efforts on these specific projects, and hence EA often had a silo-based view of the bank. There were no unified architectural processes across the various business applications and technology and data domains which resulted in minimal commonality, and limited EAs ability to achieve benefits such as *customer insights* across the bank. This eventually resulted in incompatible technologies and a cumbersome heterogeneous IT landscape that was driven by the specific business unit requirements in response to their immediate short-term targets. Moreover, a complex environment for integration with other business units was created.

Granularity of EA

The business units within level 1 maturity generally implemented EA at a coarse granularity of refinement. At this coarse granularity, the general focus was on the objectives and strategic goals of the architectural domains. Although this granularity defined the actual objectives, it did not define the way that these objectives were executed. Principles such as high-level rules that governed the way that these domains were delivered by the business unit, were specified. Moreover, the functionality that represented the behaviour of the domains to fulfil objectives was defined. For instance, the *business* domain incorporated coarse operating models, value chains, and people capabilities. As indicated by Table 7.1 previously, all the business units at the first level of maturity defined their business domain at a coarse granularity. The *application* domain specified the applications that were required. Furthermore, all the business units at this level similarly specified this domain at a coarse level of granularity. The *technology* domain defined infrastructure required to support these components. Furthermore, as EA was driven by specific individuals, this domain included a mix of granularities, with the one business unit C.1 defining its technology domain at a coarse granularity, and the other business unit B.2, at a fine granularity of refinement. Finally, the *data* domain specified the data types and reporting requirements for each of the domains. However, the business units did not clearly specify the way in which these domain objectives were implemented and executed. All the business units at this level defined their domains at a coarse granularity of refinement.

Tangible and Intangible forms of Value

As previously indicated in Figure 8.1, this study found that business units, even the lowest level of maturity, experienced business value with the adoption of EA.

At this initial level, value in the form of **visualisation** of systems was achieved. Architecture provided these business units with the visibility to gain a horizontal view of their business and IT landscapes that were problematic. These business units developed simple blueprints to visualise these landscapes. The visibility, created by EA, allowed these business units to cancel noncompliant projects that were not aligned with their strategy, and prioritise items that generated the most value. According to a participant from this level,

"*we cancelled a physical call centre upgrade project, as we wanted these agents to work from home… the bank needed a virtual contact centre and soft PABX unified communications solution that could enable agents to work remotely… a physical call centre upgrade would not have met our long-term strategy*" (B.BU2.P2.1).

Besides identifying noncompliant projects, the visibility ensured standardisation and consolidation across business and IT departments by highlighting costly and complex legacy systems, as well as flagging minimally used applications.

Furthermore, forms of value such as **hardware cost savings** and **software cost savings** were experienced. Over 80% of participants from this level cited these forms of cost reduction as one of the most commonly achieved outcomes of EA. This was an important outcome, as organisations taking advantage of EA, even on an ad-hoc basis, have the potential to experience immediate value in the form of this hardware and software cost savings. EA repositories functioned as catalogues for these business units, which helped improve procurement decisions with regards to the rationalisation of hardware and software. A participant revealed that they reviewed the EA catalogues prior to large infrastructure purchases. She cited an example of 3 different MIS reporting applications, 2 sales systems, and 2 bespoke customer relationship systems (CRM) that performed similar functions within the bank. One participant said the following, quote:

"we had a patchwork of independent systems…architecture helped identify and eliminate these duplications…this reduced IT spending across the group" (C.BU1.P4.1).

The EA visibility allowed this business unit to rationalise systems, accurately procure licences and negotiate better discounts with suppliers, which resulted in hardware and software savings.

As noted previously, RBV argued that tangible resources are a source of short-term value, whereas intangible resources a source of long-term value (Barney, 1991; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). Forms of value such as hardware and software cost savings are deemed tangible, as they can be easily measured with metrics such as cost to income ratios and budget versus actual cost savings (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). Forms of value such as visualisation was an intangible form of value (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). Hence, business units at lower levels of maturity experienced both tangible and intangible forms of value.

In summary, EA influenced tangible forms of value such as hardware and software cost savings, as well as intangible forms of value such as visualisation of systems. However, although these forms of value were achievable within level 1 maturity, there was erratic and inconsistency due to the dependency on specific individuals. The EA practices of business units at this level was characterised as being ad hoc, due to this dependency on specific individuals as well as individual business units driving their short-term targets.

The following subsection discusses the finding from business units within level 2 maturity.

8.2.2 Level 2 Maturity

EA Practices

As the EA was still gaining traction within business units at this level, the maturity of EA practices was of a basic nature, with a notably reduced dependency on specific individuals. Simple EA processes were implemented, with minimal EA standards and principles documented. The internal repositories of these business units were fairly up to date with the current state environment blueprint architectures. However, there was still no authority, such as an architecture board or architect enforcing EA governance. Furthermore, there were no future or target state architectures in place. There was an influence of EA on the financial governance of IT procurement with regards to purchases. Additionally, there was an inconsistent use of a formal EA software toolset.

Moreover, EA occasionally featured within these business unit management meeting agendas. There was selective senior management involvement with EA, with various degrees of commitment. Artefacts showed that there was some degree of alignment between the business and IT departments, as many of the systems were mapped to the business objectives. However, business units at this level predominately perceived EA as a tool for the IT department. EA communications and distribution of information took place sporadically.

Granularity of EA

Business units across level 2 maturity generally implemented EA at a coarse granularity of refinement. At this coarse granularity, the focus was on the objectives and strategic goals of the architectural domains. Although this granularity defined the actual objectives, it did not define the way that these objectives were executed. Their *business* domain included their primary business activities, value chain, strategic objectives, business principles, and functions. However, the results from both the interviews and artefacts did not contain finer details showing the way that this architecture was realised. The business unit further did not specify the roles of the stakeholders. As indicated in Table 7.2 previously, all the business units at this level defined their business domain at a coarse granularity, with the exception of one business unit, B.1, that defined this domain at a medium granularity. These business units developed *application* domain capabilities that included their software architectural objectives, principles, functionality as well as the interfaces and interactions of the systems. There was a coarser granularity of detail, demonstrating the way that the application architecture would be executed. All the business units at this level defined their application domain at a coarse granularity of refinement. Two of the business units from this level, B.1 and B.3, defined their *technology* domain goals, objectives, and domains, specifying this domain at a coarse granularity. The remaining 2 business units from this level, A.2 and C.3, went into further detail and defined their technology components, vendors, nodes, and versions, specifying this domain at a medium granularity of refinement. It was found that these business units designed various types of *data* architectures. They specified their data goals, objectives and principles. Strategic data and information principles to manage hierarchies, reference data values, and data taxonomies were enforced. However, finer granularity such as the data fields and the implementation details were not defined. All the business units at this level defined this domain at a coarse granularity, with the exception of B.3, who defined this level at a medium granularity of refinement.

Tangible and Intangible forms of Value

Discussed in Chapter 2, outcomes from the preceding level follow to the next level of ACMM maturity (Curtis et al., 2009; Paulk et al., 1993). This study concurred with this aspect of ACMM, and found that business units within level 2 EA maturity experienced greater hardware and software savings as well as enhanced visualisation benefits, implying a tighter alignment between the EA maturity and the value benefit.

Notably, the transition from cost savings to **revenue generation** took place at this level. It is important to understand this transition point, as revenue is the consequence of activities, such as selling primary goods or services that define the existence of an organisation (Chesbrough, 2012; Dehning and Richardson, 2002; Hitt and Brynjolfsson, 1996). The implication of this finding is that profitability value can be generated from EA, from level 2 onwards.

The increased revenue experienced by these business units was achieved by the quick time to market deployments of new products enabled by EA. For instance, business unit 2, from bank A, which operated within the home loan market, was the early adopter of a beta version database, sourced from an industry-leading vendor. This beta version database could instantly process home loan applications. As a result, this business unit could provide its customers with an immediate home loan decision, whereas competitors took a few days to provide such as decision. This business unit was consequently able to demonstrate revenue generation due to the quick time to market deployment of this database. According to a participant from this business unit:

> "*we have to be constantly adopting the latest technologies to stay ahead of the curve…our architecture is a key enabler for this early adoption*" (A.BU2.P2.1).

However, this increased revenue was a short-term competitive advantage, as these new products were built using cutting-edge technologies. With time, competitors could procure or develop similar products built on comparable technologies. Hence, with time, these benefits could eventually be offset.

Similarly, business unit 3, from bank C, implemented a new orchestrator controller that allowed its business analysts to make credit rate adjustments, without the need of raising a request to their IT department to make lengthy programmatic changes. Using this orchestrator controller, this business unit was able to make credit rate adjustment changes quicker than its competitors, and was able to subsequently gain market revenue due to the faster turnaround time of their changes. Similarly, these benefits were short lived, as competitors were able to procure similar orchestrator controllers from vendors within a few months.

Improved development time was a further type of value experienced at this level. For instance, business unit 1, from bank B, achieved this benefit by building an EA repository of reusable components with standard interfaces and interconnectors. A participant (B.BU1.P6.1) from this business unit revealed that each new development task took less time than the previous using this EA repository of reusable components. This participant cited that items such as *"stored procedures"* and *"objects"* were frequently reused from this EA repository. Notably, time was also reduced during the testing of projects, as previously developed stored procedures and objects from the repository were already verified.

Bank B, business unit 3, similarly built an EA repository, however, achieved development time savings by structuring the layout of the repository in line with their SDLC. This EA repository visually displayed each phase of the SDLC such as analysis, design, development, testing, and implementation. Within the analysis phase, for instance, EA helped reduce time by identifying common patterns within business problems and requirements. These patterns were categorised and logged into their repository, which made the identification of future business problems easier. Architects could use this repository to swiftly make comparisons to previous business problems and speed up the requirements generation for the analysis phase. Similarly, for subsequent phases of the SDLC, the architects categorised and logged design patterns into the repository. By categorising and reusing old patterns, the business unit could reduce the time required for each of these phases.

Moreover, intangible forms of value such as **reduced complexity** emerged at this level of maturity. EA facilitated simplification through EA standards and principles such as modularisation and encapsulation. These EA standards and principles helped these business units group common functionality and simplify interactions through common interfaces that reduced implementation complexity. According to a participant from bank C, business unit 3,

"our complexity has grown over time…we built our systems to do one thing, and they were modified to do things that they were never meant to do…complexities began to emerge as the technologies began to overlap each other…we faced the problem of buying new technologies without decommissioning legacy systems…we eventually ended up with a tangle of overlapping new and old systems that no one really understands, and costs us money. Our architecture endeavours have played a role in reducing and managing the complexity chaos for us" (C.BU3.P3.1).

EA further enabled business units at this level to simplify their business and IT structures, functions, and relationships.

Within level 2 maturity, business units experienced tangible forms of value such as increased revenue and improved development time. These forms of value were deemed tangible, as they could be easily measured with financial income ratios and time sheets (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). Intangible forms of value such as reduced complexity were experienced (Mustak, 2017; Vidrașcu, 2013).

In summary, the maturity of EA practices within these business units was characterised as being basic, with a notably reduced dependency on specific individuals. Simple EA processes, as well as basic EA standards and principles, were prevalent within business units at this level. The blueprints contained current EA states; however, no future or target state architectures were documented. EA influenced tangible quick win forms of value such as increased revenue and improved development time, as well as intangible forms of value, such as reduced complexity.

This study found that business units within level 2 of the maturity curve experienced greater benefits than the outcomes from the previous level, implying tighter alignment between EA maturity and value at higher levels of maturity. For instance, business unit B.2 and C.1 within level 1 of the maturity curve experienced hardware and software cost savings. However, business units within level 2 experienced greater cost savings than those business units within level 1 of the maturity curve.

The following subsection discusses the findings from business units within level 3 maturity.

8.2.3 Level 3 Maturity

EA Practices

The EA practices within business units within level 3 maturity became more structured. These business units typically produced deliverables comprising of their current state environment, transition plan and target state environment. These target environments were generally 3-year end state visions of the business unit's business and IT ecosystem. The target state documents included roadmaps for specific technologies, as well as recommended plans of action to reach the target state. The business units used standardised templates for their EA process efforts. These documents further included architectural policies, standards, and procedures for areas such as security and infrastructure for reaching the target state, artefacts such as gap analysis documents explained shortfalls of the current state environment regarding meeting business objectives. Architecture roadmaps that described the projects required to move from the current state environment to the future state environment were detailed. Furthermore, EA artefacts were used as a benchmark to facilitate discussions between the IT and business departments. EA diagrams were also used to share the outcomes of projects to their staff. These outcomes contributed to project post-implementation reviews.

These business units applied various industry reference models such as *Banking Industry Architecture Network* (BIAN) and *Insurance Application Architecture Framework* (IAA) within their environments. These reference models provided a standardised template solution for specific functional areas. The reference models further defined common vocabulary, and guidelines, with the intent of enhancing integration processes. To cite a participant, from bank C, business unit 2,

"*we are developing a single enterprise architecture framework based on BIAN and services oriented framework (SOA) principles. The common standards from BIAN help integrate the department silos to take us to the next level of growth… this strategy will support the banks structure, and allow future integration of systems… supports our ESB*" (C.BU2.P5.1).

The use of these industry reference models facilitated smoother integration efforts across business units, while still maintaining the autonomy of these different business units.

Business units at this level of maturity level forced formal engagement between business and IT departments, by incorporating EA practices into management meetings, and project prioritisation meeting agendas. A participant said,

"*the architecture practices are entrenched into the project prioritisation forums, can't be treated as a separate function*" (C.BU2.P1.1).

This pointed to EA being embedded into these business unit cultures, with the technical teams aligning their priorities with the business objectives. This is an interesting differentiator for business units at this level, as EA was intentionally structured to target key business projects. By creating this link between EA and key projects, the business units were continually reminded of its importance. Moreover, this linking of EA to key projects ensured it remained relevant to the bank, due to its association with the benefits created by the project.

This study established that business units with level 1maturity had a notable dependency on individual efforts, with a reduced dependency within the level 2 maturity. Within level 3 maturity, specific managers had to still champion its value; however, there was no critical reliance as found within level 1 maturity. This was due to EA being more entrenched into the banks culture as well as being more standardised within level 3.

This study uncovered that the *availability of skilled resources* was a major factor to EA success. Business units at this level of maturity had acknowledged this, and built strong internal skills by sponsoring and encouraging EA training of staff. These business units recognised EA as a professional career with formal roles and responsibilities. They further developed a defined formal path for architects to progress their careers. Business units at this level of maturity had positioned EA at a higher level of seniority with more decision-making authority than business units at lower levels of maturity. Interestingly, the champions within level 3 were predominately members of management, whereas at lower levels, the champions were IT developers. Although all the mechanisms had a role in improving maturity, *staff development and training* was identified as a new practice to improve maturity.

These business units frequently communicated EA efforts through both formal and informal awareness plans that endorsed EA practices throughout the business unit. According to a participant from bank C, business unit 2,

"*I realised that a communication plan, backed by case studies to demonstrate benefits realisation, influenced stakeholder view of architecture*" (C.BU2.P5.1).

Business units at this level measured the benefits of EA by using financial metrics. For instance, bank C, business unit 2, was able to quantify the improvement in development time by using a Net Present Value (NPV) calculation. This business unit calculated the NPV by using the project investment costs over the development time as well as the relative costs of EA. It demonstrated that a project using EA produced an improvement in development time in comparison to a project that did not use EA. According to a participant,

"*initially, the lack of architecture's demonstrable value to our business had been our greatest challenge…once measurements were implemented, EA accelerated*" (C.BU2.P5.1).

Other measures, such as cost-benefit analysis, quality, and customer experience metrics, were evident across business units at this level as well.

Granularity of EA

Aspects of a medium granularity of refinement emerged at level 2; however, as business units moved across level 3 maturities, the medium granularity of refinement became prevalent. At this medium granularity, the focus was on the objectives and strategic goals of the architectural domains and their objectives. It then defined the way that these objectives were executed. The *business* domain defined the business strategies, vision, mission, and business goals. This domain architecture further refined the way this would be achieved, by defining the processes that will perform these capabilities as well as the stakeholder roles that perform the process. Moreover, the business units implemented diagrams such as role grids and organisational structures. As shown in Table 7.1 previously, business unit C.2 was defined at a medium granularity, and the other business unit, A.3, was defined at a fine granularity of refinement. The *application* domain incorporated various software goals, objectives, principles, and patterns. The business units had defined finer details specifying the way that the software was built. They categorised their applications into functional groups that was used to plan target state applications before procuring the actual applications. Both of the business units at this level defined this domain at a medium granularity of refinement. Furthermore, the *technology* domain included comprehensively detailed hardware components incorporating their full technology stack. The business units had clearly defined their technology objectives, goals, principles, as well as detailed reference model depicting all inputs, outputs, and tools. The business units also defined finer details on the way that the technologies were implemented. Both of the business units at this level defined this domain at a fine granularity of refinement. Finally, the *data* domain incorporated data at rest, use and motion data principles, goals and views, and attributes of their data. Business unit, C.2 was defined at a fine granularity, and the other business unit, A.3, was defined at a coarse granularity of refinement.

Tangible and Intangible forms of Value

Discussed in Chapter 2, outcomes from the preceding level follow to the next level of ACMM maturity (Curtis et al., 2009; Paulk et al., 1993). This study found that business units within level 3 EA maturity experienced greater benefits of hardware cost savings, software cost savings, visualisation, increased revenue, improved development time, and reduced complexity than the previous level, again implying tighter alignment between EA maturity and value at higher levels of maturity. This finding reinforced ACMM (Curtis et al., 2009; Paulk et al., 1993).

Referring to Figure 8.1, this study found that EA guided business units to **improve processes** by helping them visualise the steps and interconnections between their end to end tasks. The EA models helped business units understand complex interconnections between processes that were confusing, conflicting, or redundant. This enabled unnecessary steps to be removed from the business unit processes. According to a participant from bank C, business unit 2,

> "*a visual representation of the process flow helps everyone understand exactly how the process operates, who operates it at particular points along the line, and where the process crosses with other processes and services… I look at all the tasks needed, and often spot opportunities to save time and avoid duplication of work… I often also spot areas of improvement, and define exactly what we are trying to improve, and the priorities for improvement"* (C.BU2.P5.1).

Moreover, this EA visualisation assisted bank A, business unit 3, enhance its processes by ensuring they were as lean as possible by reducing unnecessary tasks. It assisted staff to visualise where improvements were needed by looking at system development lifecycle tasks such as completion times and testing processes. It improved these processes by identifying areas for process automation. Participants from this business unit further cited improvements in their *marketing, sales, fulfilment* and *relationship* processes with the use of EA. They found that EA enhanced their marketing processes by streamlining the way that they targeted prospective customers. Improvements in the sales process were experienced, as EA improved the conversion of prospective customers to sales. EA was found to streamline their fulfilment processes by simplifying the tasks of delivering products to customers after a sale. According to a participant,

"*the timing of the fulfilment process can vary based on the quality and completeness of the data we have for a prospective customer…for example the time of the day that we contact a potential customer could affect the customer experience…if the customer is busy, it will mean additional costs or a lost sale*" (A.BU3.P1.1).

Finally, it was established that EA helped improve the relationship processes by highlighting activities to help strengthen the relationship with the customer. Notably, each of the above processes were comprised of various complex sub processes that EA helped to improve. This business unit cited EA blueprints as contributors to understanding and improving these sub processes.

The other form of value experienced at this level was **improved risk management**. Bank C, business unit 2, cited stringent legislative regulatory frameworks within the financial services sector, as well as frequent amendments to these regulatory frameworks. Whenever new legislation was passed or existing legislation amended, disruptive organisational changes were required to comply with these amendments. Participants cited, *Basel II* (that standardised the way banks managed risk and stipulated capital adequacy), *SHERQ* (that regulated environmental health and safety risks), *King II* (that regulated corporate behaviour with generally agreed best practices) and *Sarbanes-Oxley* (that regulated controls for financial reporting and auditing), as important frameworks for the bank. Each of these frameworks was completely independent, and individually required their own committees, structures, activities, and processes in order to be compliant. Participants argued that EA created common structures and synergy by addressing these regulatory frameworks in a holistic manner, while still complying with the individual framework requirements. According to a participant, EA made it

"easier to understand the impact of legislative change before it transpired" (C.BU2.P5.1).

EA supported the implementation and monitoring of these regulatory frameworks by providing a holistic view of people, processes, and systems. As EA, it created an overall view of the bank, any legislative amendments could be isolated, and its impact examined at the different business unit touch points. Participants stated that EA assisted them to implement the regulatory amendments without disrupting the business, as the domain blueprints made isolating the impact of the legislation easier. EA's documentation supported the senior managers with governance analysis, monitoring, control structures, and procedures for regulatory reporting. At a more detailed EA level, technical changes were mapped to the relevant regulatory framework objectives. This facilitated traceability between the framework requirements, business impact, and the affected systems.

Improved **customer service** value become prominent at this level. Bank A, business unit 3, found the use of EA beneficial in visualising, planning, and mapping the customer journey across its functions such as marketing, sales, and the call centre. According to a participant,

> *"it is important for us to see how the bank is structured, and how a customer interacts with us to consume saving and investment products. Visual representations of the customer journey are pertinent, as they show us customer touch points and interactions across the business silos in a single snapshot"* (A.BU3.P6.1).

This business unit used EA to identify customer service problems that emerged at the handoff points between these business function silos. Furthermore, it helped with the collaboration and sharing of customer experiences across these silos. EA aided this business unit to identify problem points within the customer journey that had a significant impact on the overall customer experience. It provided a single integrated view of a customer across different functional silos, due to its visibility across all the points of interactions. Participants said that root-cause diagnosis of customer pain points become easier since the introduction of EA. Subsequently, it exposed the pain points of customers that were obscured from any single functional silo.

Moreover, participants from bank A, business unit 3, cited various other customer service improvements encompassing sales, product delivery, and problem resolution processes enhanced by EA. Participants stated that although traditional process workflows were helpful in understanding the customer journey, they were still superficial as they did not identify customer needs and behaviours. EA helped business units magnify data below the surface to understand customer needs and opportunities for improvement. Based on this deep understanding of customer data, EA assisted business units design new journeys, as well as re-engineer existing journeys.

In summary, the EA practices were more structured as business unit's utilised standardised templates for their EA efforts. EA documentation contained current state, gap analysis, and future target state views of the environment. These business units applied various industry reference models within their environments. They forced formal engagement between IT and business departments, and intentionally structured EA to target key business projects. This linking of EA to key projects ensured it remained relevant to the bank. Specific managers had to still champion EA value, however, not as aggressively as lower levels of maturity, due to EA being more entrenched into the organisational culture. Notably, this study established that the *availability of skilled resources* was a major factor to EA success.

Business units at this level of maturity had recognised this and built strong internal skills by sponsoring and encouraging EA training, and further recognised EA as a professional career for staff. Finally, business units at this level were able to accurately measure the benefits of EA by using financial metrics. Intangible (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003) forms of value such as *process improvements, enhanced risk management,* and *better customer service,* were experienced.

Furthermore, this study found that business units within level 3 EA maturity experienced greater benefits of the previous level outcomes, again implying tighter alignment between EA maturity and value at higher levels of maturity (Curtis et al., 2009; Paulk et al., 1993).

The following subsection discusses the finding from business units within level 4 maturity.

8.2.4 Level 4 Maturity

EA Practices

The one business unit within level 4 maturity had a broader focus on EA. Unlike the lower level business units that perceived EA as predominately a blueprint, bank A, business unit 1, viewed architecture as a practice, that involved applying a set of tools and techniques to solve business problems. Furthermore, this business unit placed more emphasis on the gap analysis by creating a culture of transformation and continuous evolution of driving the business unit towards its specified future state goal. The EA practices were ingrained into the fabric of the department by ensuring all daily tactical operations were aligned to the future state. Furthermore, the business unit had designed their EA practices to be included in both technology and business strategic planning, with a strong formal engagement between the departments. EA was not treated as an independent IT function, but as part of the business strategy.

The EA practices were further incorporated into management and project prioritisation agendas. Furthermore, *Delphi techniques* contributed to EA decision-making for project selection and ranking. For instance, the senior management used Delphi technique to select alternative options such as developing applications in-house versus buying software. They accomplished this by conducting individual assessments of EA choices, and subsequently sharing the results in a follow-up meeting where a final decision was made. This technique was predominately used was for large, high-value, procurement decisions.

This business unit had fostered extensive and unified support from various stakeholders for EA. Senior management was actively involved in EA reviews and enhancements. EA processes were also used to measure and share the outcomes of projects to their staff. These outcomes contributed to project post-implementation reviews and staff performance reviews. Furthermore, EA was used as a tool to foster collaboration between the IT and business departments.

All the business units developed artefacts detailing their internal strategy, vision, mission, goals, strategic themes, objectives, and key performance areas. However, this business unit expanded its strategy by focusing on outside market conditions. This business unit developed a perspective to assess volatility, uncertainty, complexity, and ambiguity of technology and industry disruptions in relation to themselves.

The EA repository was updated to reflect the latest architectures that were in the business unit production environments. Formal EA software tools were used to document and map the EA. Interestingly, the use of common industry reference models was prevalent. By using these common reference models, the business unit could comply with the standardisation required for future integration efforts across different business units, while still maintaining the autonomy and independence of the individual business unit.

The other differentiator within level 4 was the prevalent use of metrics specifically designed to measure EA within the business unit. Artefacts revealed that this business unit utilised statistical metrics to assess the *number of projects that leveraged the EA repository for target state designs, the percentage of projects architecturally aligned to target state, the percentage of reuse of common designs, percentage of reuse of architectural components used,* and *frequency analysis* to determine *patterns for EA improvement.* The use of statistical metrics subsequently made EA more predictable.

Granularity of EA

The business unit within level 4 maturity defined their architecture at an even finer granularity of refinement. At this fine granularity, the focus was on the objectives and strategic goals of the architectural domains and their objectives. It then defined the way that these objectives were executed. This granularity contained details such as where the physical implementation was taking place, as well as the role of stakeholders performing the task.

This business unit had clearly defined its *business* goals and objectives. Vision and mission statements were further embedded into the business unit culture, and was prevalent in the form of slogans within the artefacts examined. Business rules and themes were specified in staff contracts in order to meet strategic objectives. The artefacts revealed staff role grids with generic job descriptions representing the staff design as well as how the various roles were defined. Locations, where the business processes were executed, were also specified. This domain was defined at a fine granularity of refinement.

The *application* domain specified various software architectural objectives, principles, and functionality. This business unit categorised its applications into services and functional behavioural groups. This categorisation allowed this business unit to design target state applications before procuring the actual applications to fulfil those services. This business unit specified the physical environment such as production environment and testing environment depicting where the software was deployed in its artefacts. It further detailed the version and instances of applications that resided within these environments. This domain was defined at a fine granularity of refinement.

This business unit level had defined its *technology* objectives, principles, and functions. Technology components describing the classes and functions were also specified. This business unit contained finer details describing the way that the technology was implemented. Technology relationships and roles linking the technology to applications were detailed, as well as the locations of the technologies. This domain was defined at a fine granularity of refinement.

The *data* domain defined at a fine granularity of refinement, focused on principles of volume, velocity, and variety. It had a clear big data strategy, and focused on principles such as the use of open source data technologies. This business unit had clearly defined its data functionality such as customer and product groups. This business unit additionally had views and attributes of the data. The physical architecture of data stores was clearly designed.

Tangible and Intangible form of Value

This study found that business units within level 4 EA maturities gained the benefits from the previous levels, again implying tighter alignment between EA maturity and value at higher levels of maturity. This finding reinforced ACMM that argued outcomes from the preceding level is carried to the next level of maturity (Curtis et al., 2009; Paulk et al., 1993).

EA was found to influence a wide variety of **decision-making** capabilities at this level. Participants stated that they were overwhelmed with the large volume and variety of data in their environments. To cite a participant,

"*there is an information overload…all this information is making decisions harder…every mouse click and every keyboard stroke adds to this tsunami of data… that old saying about a picture being worth a thousand words…EA helps us to see the big picture…helps identify trends and patterns*" (A.BU1.P1.1).

This participant expressed challenges in comprehending and processing the volume of data. Moreover, the complexity of data required significant effort to understand and analyse. Other participants at this level stated that EA presented a consolidated view of the data in an understandable and easily comprehensible format. The blueprints and diagrams generated from EA assisted the business unit to visualise and identify patterns in the data that subsequently helped them make better decisions. It helped create meaningful contexts of the data by identifying opportunities for change. Moreover, this business unit used EA to make more informed decisions about business and technology solutions to support service delivery.

Coupled with this problem of high volume, complex data, participants expressed difficulty in modelling decisions related to *underwriting, loan approvals,* and *credit limit increases*. Participants stated that data was generated by different applications and platforms, and dispersed across multiple business units throughout the product lifecycle. EA created an integrated view of data across the various applications and platforms involved in this lifecycle. EA was found to help improve the accuracy and consistency of decisions across these areas of the product lifecycle. Participants stated that EA's visual depictions contributed to more effective product related decisions throughout the product lifecycle. Furthermore, product related data represented in a visual form facilitated a common understanding, collaboration, and sharing across staff with different competency levels.

Participants stated that during periods of recessions, EA helped them make better decisions, as architecture provided a holistic view across the landscape of business and IT. This helped them to identify sources of potential capital and areas that could generate cash. This included buy versus lease arrangements, outsource versus insource, and on-premises versus cloud solutions decisions.

EA enabled **innovation** by helping the business unit assess the impact, viability and implementation of new ideas. It helped this business unit to understand the impact of the innovation on the business and technical ecosystem. It provided value by assisting the business units with holistic visibility across the business and IT domains. A participant commented

"*for me, EA is a catalyst for innovation… innovation doesn't just happen, it has to be planned… innovation is about swiftly and efficiently implementing new ideas, products and processes… it requires a full understanding of the bank, its systems, processes and people…and meaningful insights from experienced people as well as a cultural change… without EA, decision-making around the right ideas is a gamble*… *EA synergises technology and people…it provides a horizontal view of the bank*" (A.BU1.P3.1).

Moreover, EA assisted the business unit to understand the potential impact of change brought about by the innovation. It enabled them to assess the viability of the innovation against its vision and strategic direction. EA further assisted this business unit by filtering and differentiating good ideas from poor suggestions. The business unit could monitor metrics such as time to-market for new products with the assistance of EA.

As found previously, business units within level 3 maturity experienced value in the form of *improved customer service* because of EA. While an improvement in customer service was beneficial, the business unit within level 4 had the ability to reshape this customer service into **customer insights**. Notably, customer service refers to an organisations ability to assist and provide advice to customers that buy or use their products and services, whereas customer insights refers to identifying patterns in customer behaviour (Grönroos, 2017; Maklan et al., 2017; Steiner et al., 2016).

Participants perceived customer insights to be more valuable, as they could ascertain what was important to customers. The business unit could subsequently develop tailored product offerings that could directly target specific customer needs. Furthermore, bespoke messaging could target individual customer requirements. According to a participant,

"*a few years ago, a customer walked into a branch and took out personal loan…we did a credit check, and the transaction was simply processed… these days, it goes beyond that transaction...we look at things such as Tweets and Facebook comments to check for any cross-sale opportunities…the key is offering the right product at the right place and at the right time, tailored for that specific customer*" (A.BU1.P3.1).

The structures created by EA allowed this business unit to consolidate the disparate data silos into a single, integrated view, of a customer in the form of a single reference dashboard. EA allowed high volume complex data, spread across the multiple systems to be consolidated into an understandable and comprehensible format. This single reference dashboard created rich visualisations that assisted this business unit to gain insights and identify patterns in the data. Furthermore, it allowed the business unit to analyse customer demographics and transactional history. This gave them the ability to tailor and fine-tune relevant offers for specific customers. Moreover, EA allowed the bank to identify hidden opportunities based on customer behavioural history.

In summary, the EA mechanisms became more structured and embedded into the business unit culture from level 4 onwards. The other differentiator within level 4 was the prevalent use of statistical metrics. *Delphi techniques* contributed to EA decision-making for project selection. Other metrics included the *number of projects that leveraged the EA repository for target state designs*, *the percentage of projects architecturally aligned*, *the percentage of reuse of common designs* and *percentage of reuse of architectural components* and *frequency analysis to determine patterns for EA improvement*. Intangible (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003) forms of value such as improved decisions, innovation, and customer insights were experienced. Furthermore, this study found that business units at this level of EA maturity experienced greater benefits of the previous level outcomes, again implying tighter alignment between EA maturity and value at higher levels of maturity (Curtis et al., 2009; Paulk et al., 1993).

The following subsection discusses the finding from business units within level 5 maturity.

8.2.5 Level 5 Maturity

The EA practices within ACMM at the **optimising** level were characterised as being in a state of continuous improvement (De Carvalho et al., 2016b, 2015; Department of Commerce, 2016; Op 't Land et al., 2009; Paulk et al., 2006). Similar to level 4, fine grain refinement defines implementation details including the location of business processes, application deployments, and environments of software, the location of the technology deployments, as well as where particular views of data are physically managed (Emery and Hilliard, 2009; Stuht and Speck, 2016).

None of the business units operating within **level 5** maturity indicated that, although all the business units had invested in EA to some degree, more momentum was required to reach the top level of maturity. In order to move to level 5, the business units needed to further improve the focus on continuous improvement, as well as continue to maintain the *business*, *application*, *technology* and *data* domains within a fine granularity of refinement. Furthermore, additional statistical control techniques were required to move to the next level.

Literature was assessed to investigate the types of benefits that organisations adopting EA continuous improvement and statistical practices obtain. These organisations improve their *predictability,* as EA enables them to forecast scenarios and determine the optimal course of action when experiencing those scenarios. This predictability gives them the ability to optimise trade-offs between costs, benefits, and customer service within these scenarios (Curley et al., 2016; Grossman, 2018; Mishra et al., 2016).

The next section discusses insights into the dominant theories used in this study.

8.3 Insights into Theory

This section provides theoretical insights from this research. The following section overlays critical realism, the underlying philosophy used in this research and the RBV theoretical framework with this study's findings.

8.3.1 Critical Realism and RBV Overlays

Recall that critical realism does not have any predictive power, and is used for explanatory reasons. *Causality* assisted with explanations by connecting concepts in order to understand cause and effect, as well as deeply assess the relationships between input and output variables (Yin, 2013). This helped distinguish causal events from coincidental events and correlations (Hammersley, 2014; Mingers et al., 2013; Mohr, 1999). Furthermore, mechanisms supported the understanding unobservable underlying factors that influenced events and results (Archer et al., 1998; Bhaskar, 2015; Fletcher, 2016; O'Mahoney and Vincent, 2014; Sayer, 2000b). Critical Realism was viewed within actual, empirical, and real layers to address causality (Linder and Cantrell, 2000; Mingers, 2004; Mingers et al., 2013; Mingers and Willcocks, 2004). This was important for this study, as positivism and interpretivism philosophies are comprised of linear ontology's that operate within the empirical layer (Mingers et al., 2013; Raduescu and Vessey, 2009). This ontology of three layers enabled the researcher to investigate beyond empirically observed events, and research within all three layers.

The critical realism philosophy supported the underlying RBV framework used in this study (Belfrage and Hauf, 2017; Dobson, 2012; Oliver, 2011; Pather and Remenyi, 2004). RBV explains the way that organisations transform their inputs into outputs (Amit and Schoemaker, 1993; Dutta et al., 2005). Inputs comprise of tangible and intangible resources that enable an organisation to carry out their activities. Heterogeneity assumes that intangible resources of organisations differ from each other, whereas immobility assumes that intangible resources are fixed and do not move from organisation to organisation. Outputs were forms of value generated from inputs (Barney, 1991; Patas et al., 2012).

This study examined *EA as an intangible resource* input (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015) and *maturity as a source of heterogeneity* (Anderson and Eshima, 2013; Grant, 1991; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992). The study further examined forms of *business value* as outputs.

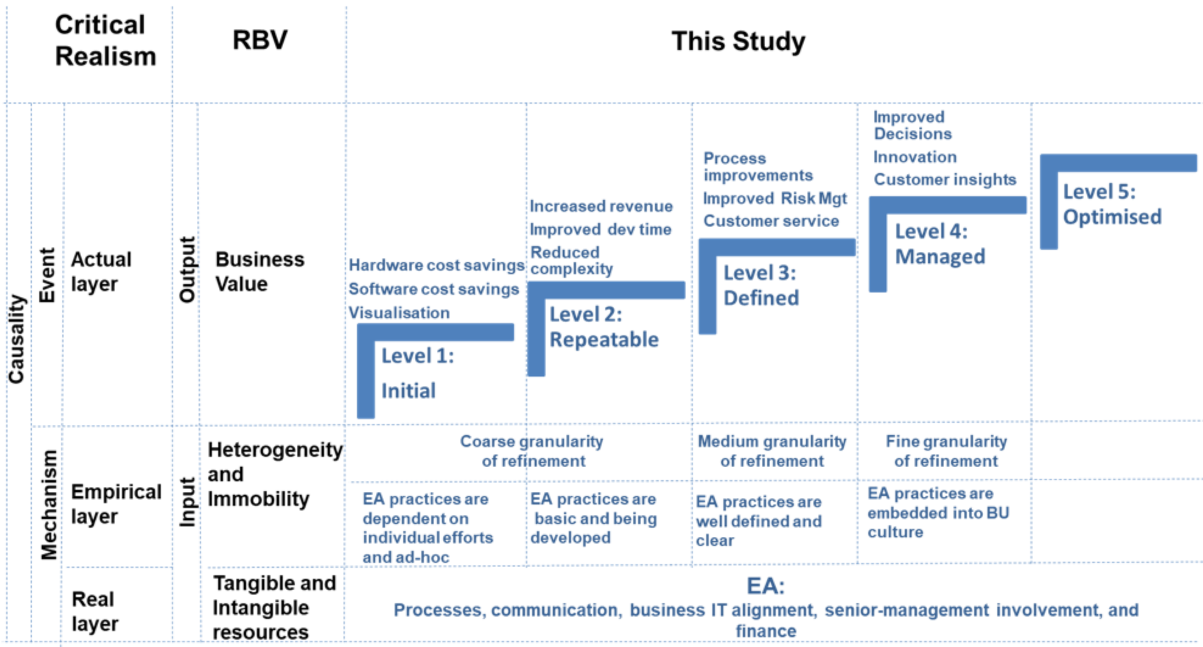

Figure 8.2: Critical Realism and RBV overlay on this study

Illustrated in Figure 8.2, causality connected mechanisms and events in order to understand cause and effect as well as deeply assess the relationships between input and output variables.

The *real layer* included EA as an intangible resource that influenced the actual events (Linder and Cantrell, 2000; Mingers, 2004; Mingers et al., 2013; Mingers and Willcocks, 2004). This layer comprised of EA processes, communication, business-IT alignment, senior management involvement, and finance mechanisms assessed in this study.

The *empirical* layer included observable experiences. It was a subset of the real layer, and influenced the actual layer (Linder and Cantrell, 2000; Mingers, 2004; Mingers et al., 2013; Mingers and Willcocks, 2004). Heterogeneity of EA practices was characterised as being *person dependent* within the first level of maturity, *under development* within the second level, *well defined* and *clear* within the third level, and *embedded into the culture* within the fourth level of maturity.

The *actual* layer included the events generated by the mechanisms (Linder and Cantrell, 2000; Mingers, 2004; Mingers et al., 2013; Mingers and Willcocks, 2004). RBV business value outputs were aligned to this level. *Hardware* and *software* cost savings as well as *visualisation* benefits were experienced within the first level of maturity, *increased revenue, improved development time* and *reduced complexity* were experienced within the second level, *process improvements, enhanced risk management* and *better customer service* experienced within the third level, and *improved decision-making, innovation, and enhanced customer insights* experienced within the fourth level of maturity.

Further insights into resource inputs follow.

8.3.2 Resource Inputs: Tangibility, Intangibility and Capabilities

As indicated previously, RBV explains the way that organisations transform their inputs into outputs (Amit and Schoemaker, 1993; Dutta et al., 2005). Resources are inputs that enable organisations to carry out their activities. Furthermore, it is helpful for organisations to classify and understand resources in terms of tangible and intangible concepts, as they contribute to different aspects of organisational strategy (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984).

Tangible resources are a source of short-term value outputs, whereas intangible resources are a source of long-term value outputs (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). For instance, during recessions, tangible resources such as buildings can be easily converted into cash, whereas intangible resources such as EA capabilities create efficiencies by improving IT management (Kappelman et al., 2016; Venkatesh et al., 2007). Distinguishing between tangible and intangible resources, assists organisations to develop frameworks to assess their strengths and weaknesses, as well as decompose business problems to improve performance (Falkenreck and Wagner, 2007; Kraaijenbrink et al., 2010). This distinction assists organisations to better understand their internal resources (Connor, 2002). Hence, organisations can develop strategies and improve decisions based on this insight regarding tangible and intangible resources (Medini and Bourey, 2012; Panetto et al., 2016; Walker et al., 2016).

Although both tangible and intangible resources are important contributors to organisational strategies, intangible resources are favoured over tangible resources. RBV empirical research reveals that intangible resources contribute more to organisational success and performance than tangible resources, as they have the potential to improve the earning power of organisations (Foon, 2011; Kamasak, 2017; Kumlu, 2014). For instance, EA capabilities are difficult to imitate, and hence more valuable than tangible resources such as building and machinery that can be easily obtained by competitors (Foon, 2011; Kamasak, 2017; Kumlu, 2014).

As discussed previously, a *capability* is a subset of an intangible resource that incorporates practices, skills, competencies, as well as tacit and explicit knowledge (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997). Although capabilities are inherent to individuals, they are also organisational specific and reside within relationships, unique patterns, and organisational routines (Bianchi, 2017; Fernández-Esquinas et al., 2017; Hitt et al., 2016; Nonaka, 1994). Importantly, EA is defined as the practice of designing, planning, implementing, and governing business, application, information. and technology domains (Harrison, 2013), and is recognised as a capability by the research community (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997).

The common theme from literature is that capabilities contain tacit and explicit components that reside within organisational routines. *Tacit* capabilities cannot be codified, contain personal views and internal ideas acquired through practice (Nonaka and Toyama, 2015). This study found that within lower levels of EA maturity, tacit EA capabilities were prevalent, as the business units often had a dependency on specific individuals. These individuals were often senior developers that had a personal interest in architecture. They were influential in championing and advocating EA. Furthermore, these champions were not necessarily formally appointed EA's, but rather senior developers within their respective business units. These individuals collaborated with business stakeholders and positioned EA as a joint business-IT venture. They collaborated with senior management and junior staff on EA efforts and aggressively communicated its value to the organisation. However, EA expertise and knowledge left when these staff members were reassigned. Generally, a coarse granularity of refinement was observed, across the business units within lower levels of EA maturity. *Explicit* components can be easily transferred through training (Nonaka and Toyama, 2015). As business units moved up the maturity curve, the EA practices gradually became more repeatable due to the reduced dependency on individual efforts. Furthermore, business units within levels 3 and 4 had formalised EA training. More explicit capabilities were prevalent within business units at higher levels of maturity, as EA was embedded into independent departmental processes. EA was viewed as a practice that involved applying a set of tools and techniques to solve business problems. EA resided within organisational routines, daily tactical operations, as well as technology and business strategic planning. Generally, a medium to a finer granularity of refinement was observed across the business units across higher levels of maturity.

Capabilities should be applied *to a diverse mix of markets* (Hamel and Prahalad, 2013; Prahalad and Hamel, 1990). This study found that EA was implemented across a mixed range of business units, and hence was able to access diverse markets ranging from home loans, credit card, personal loans, and foreign exchange segments. Furthermore, capabilities should make a contribution to the *perceived* *benefits of the end products* (Hamel and Prahalad, 2013; Prahalad and Hamel, 1990). Participants from this study identified outcomes such as hardware cost savings, software cost savings, improved visualisation, increased revenue, improved development time, reduced complexity, process improvements, improved risk management, improved customer service, improved decision-making, innovation, and enhanced customer insights. Finally, capabilities should be *difficult for competitors to imitate* (Hamel and Prahalad, 2013; Prahalad and Hamel, 1990). This study found that within the same bank, business units at lower maturity levels were unable to replicate the benefits of business units at higher levels, despite having access to similar resources.

Heterogeneity and immobility were the other key constructs of RBV (Barney, 1991).

8.3.3 Heterogeneity and Immobility

As previously explained, heterogeneous and immobile resources assist an organisation to achieve business value and competitive advantage (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984).

Heterogeneity assumes intangible resources of organisation's differ from each other and these differences influence business value (Makadok et al., 2018). Past studies did not focus on heterogeneity such as EA maturity levels, but simply identified EA as an intangible resource that leads to value (Bui, 2012; Grant, 1991; Helfat et al., 2007; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992; Vallerand et al., 2017). The few studies published (Bradley et al., 2012; Khaiata and Zualkernan, 2009; Venkatesh et al., 2007) produced disparate results, demonstrating the need to better understand the forms of business value attained at different levels of EA maturity (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015, 2011; Vallerand et al., 2017). This was important to organisations as they could understand the forms of business value attainable as they progressed towards higher levels of EA maturity (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015, 2011; Vallerand et al., 2017).

Referring to Figure 8.1, this research revealed different EA maturity levels across the business units in the banks. This study established that organisations seeking to improve their EA practices should focus efforts on refining the maturity of EA *processes, communications, business-IT alignment, senior management involvement, and finance*. The characteristics of these EA mechanisms influenced the level of EA maturity. Business units operating at *level 1* maturity adhered to minimal EA practices that were primarily driven by a few individual staff members. However, most of the business units operated within *level 2* maturity, indicating that EA practices were still being developed in those departments. Business units operating at *level 3* had clear and well-defined EA practices in place. One business unit operated within *level 4* maturity, where EA had fully integrated into the business unit culture and used statistical techniques to measure EA. None of the business units operated within *level 5* indicating that although the business units had invested effort in EA, more momentum was required to reach the top level of maturity.

Immobility assumes that intangible resources are difficult to move, in limited supply, or fixed. These resources are not tradable as commodities and do not leave an organisation when people leave (Makadok et al., 2018), as they are *embedded* (Grant, 1991) into the routines and processes of organisations. This study found that within maturity level 1, EA practices were fairly mobile due to the dependency on specific individuals for architectural momentum. Because of staff movement, EA expertise and knowledge left when these staff members were reassigned. However, as business units moved up the maturity curve, the EA practices became less mobile due to the reduced dependency on individual efforts. From level 3 maturity onwards, EA was embedded into independent departmental processes, organisational routines, daily tactical operations as well as technology and business strategic planning.

The following section provides insights into the RBV operationalisation and mechanisms from this study.

8.3.4 RBV Operationalisation and Mechanisms

Notably, from our previous discussion, RBV operationalisation is a topic of debate amongst scholars (Barney, 1991; Connor, 2002; Priem and Butler, 2001a, 2001b). Operationalisation involves applying a theoretical framework in a real life context to provide practical validity (Bohnenkamp, 2013; Carlile and Jordan, 2005; Colquitt and Zapata-Phelan, 2007). It entails assessing abstract or unobservable phenomenon in terms of their empirical observations (Godfrey and Hill, 1995; Jonker and Pennink, 2010; Sarantakos, 1993; Shields and Rangarajan, 2013; Yin, 2013). These phenomena are assessed indirectly through mechanisms of that phenomenon in the form of their observable effects (Godfrey and Hill, 1995; Jonker and Pennink, 2010; Patas et al., 2012).

As RBV did not contain any mechanisms (Connor, 2002; Priem and Butler, 2001a), ACMM (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010) was used as a supplementary theoretical framework, as it contained mechanisms to operationalise RBV (Peteraf and Barney, 2003). ACMM specified EA mechanisms such as *processes* that assessed guidelines, steps, and decisions in the way that EA was practiced. The *communication* mechanism assessed the way that EA was documented, disseminated, and stored. The *IT business alignment* mechanism assessed whether the activities of the IT teams were aligned with the organisation's business goals and objectives, i.e. whether IT initiatives supported business goals. The *senior management involvement* mechanism assessed management involvement in EA practices. Finally, the *finance* mechanism assessed an organisation's consideration of EA when acquiring new investments (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010). Table 8.1 below summarises the characteristics of these mechanisms found in this study.

Table 8.1: Summary of EA practices

Practice	Level 1	Level 2	Level 3	Level 4
Process	EA informal and dependent on individual efforts. EA inconsistent, intermittent and disorganised. High staff turnover. Expertise leaves with staff.	Reduced dependency on specific individuals. EA practices basic and being developed.	EA practices are well defined and clear and more structured. Individuals champion EA, but no reliance. EA embedded into the culture.	Comprehensive EA practices that are well established and part of the culture. A culture of transformation as EA continuously improved. Viewed as a practice
Communication	Inconsistent communication. Combination of high and low-quality artefacts. Current state architecture documented.	Essential communication took place, but sometimes inconsistently. Internal repositories up to date. Minimal standards and principles. Current state architecture documented.	Frequent EA communication. Current state, transition plan and target state EA documented. Use of standardised templates, policies, procedures and industry reference models. Use of specialised EA tool.	Comprehensive regular communication. Up to date current, transition, and target state architecture documented with formal EA tool. Stored in a repository.
Business-IT Alignment	Weak IT link to business strategies Perceived EA to be a tool for the IT department. The staff has a limited understanding of EA. Mixed incompatible technologies.	Some degree of alignment between the business and IT Systems mapped to business objectives Various degrees of staff commitment. Perceived to be a tool for the IT department.	Forced engagement between business and IT EA feature in management meetings, and prioritisation agendas.	Business driven solutions. EA part of the business strategy. EA used to foster collaboration between the IT and business. Support from various stakeholders for EA.
Management Involvement	Minimal management and staff involvement. EA does not feature within management meetings.	Selective management involvement. Occasionally featured in meetings.	Good management support. Management actively supported and embraced EA practices.	Management actively involved in EA reviews and enhancements
Finance	Inconsistent EA input into the finance strategy.	Intermittent EA input into the finance strategy,	Included EA when making any financial decisions.	Predictive and proactive financial models in place

Practice	Level 1	Level 2	Level 3	Level 4
		with a few EA finance standards that documented in the repository.	Use of financial metrics.	aligned and integrated into the business strategy.

Although all the mechanisms were intertwined and played an important part in operationalising EA, participants were most enthusiastic about the *communication* mechanism. This mechanism was prominent as it described the way that EA was documented, disseminated, and stored. Architecture provided these business units with the visibility to gain a horizontal view of their business and IT landscapes, which subsequently helped them, identify problems within these landscapes. Furthermore, EA enabled simplification through the visibility created by the EA diagrams. According to a participant,

"*when I listen to some of the developers describe the system, even I experience confusion… they make too many assumptions about our knowledge and use too much technical jargon. The architectural diagrams convey complex information in a clear, concise way*" (C.BU1.P1.1).

Furthermore, the researcher assessed a variety of EA artefacts on site as part of this study. In most cases, the EA artefacts served as an abstraction or an approximate representation of either the business requirements, or current state or target solution. The researcher found that the visualisation created by these artefacts was an effective way to manage both business and IT complexity. The researcher was able to easily grasp several complex concepts, such as the design of a new product from the artefacts, without having the necessary business unit experience or knowledge.

A perspective into business value outputs follows in the subsequent section.

8.3.5 Outputs: Tangibility and Intangibility

Illustrated in Figure 8.3, this study demonstrated that EA (an intangible input resource) is responsible for tangible and intangible output forms of value.

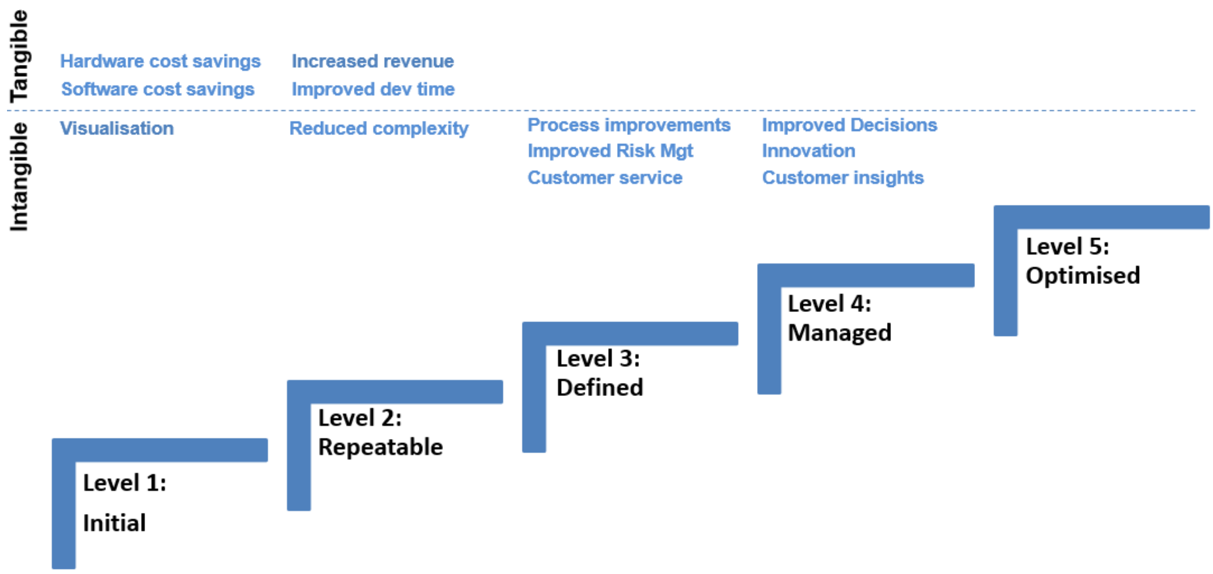

Figure 8.3: Tangible and Intangible forms of value

Within *level 1* maturity, output forms of value such as *hardware* and *software* cost savings were experienced. These were deemed tangible, as they could be easily measured with metrics such as cost to income ratios and budget versus actual cost savings (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). Output forms of value such as *visualisation*, deemed an intangible form of value, (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003) was also experienced. Within *level 2* maturity, business units experienced *increased revenue* and *improved development time*. These forms of value were deemed tangible forms of value, as they could be easily measured with financial income ratios and time sheets (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). Intangible forms of value such as *reduced complexity* were experienced (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). Business units at *level 3* maturity experienced intangible (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003) forms of value such as *process improvements, enhanced risk management,* and *better customer service*. Finally, this study revealed that within *level 4* maturity, intangible forms of value such as *improved decision-making, innovation, and enhanced customer insights* due to EA were experienced (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). This research found that none of the business units featured within level 5 maturity.

An outcome from this study was that business units could gain immediate value from EA, even at the lowest level of maturity. This study found that as EA maturity improved, business units experienced greater value, implying a strong alignment between maturity and the value advantage. For instance, business units across levels 3 and 4 maturities experienced greater cost savings than business units across levels 1 and 2 maturities. Reviewing this specific outcome in more detail, business units at lower levels of maturity experienced this cost saving due to simple EA blueprints that helped them visualise the business-IT landscape. They were able to minimise duplication and save costs through hardware and software rationalisation. Business units at higher levels of maturity further leveraged off this same benefit, due to their strong business-IT alignment and collaboration with business stakeholders. Mature business units were able to accurately procure the correct technologies for business needs, as well as accurately estimate the licence volumes required. Mature business units were subsequently able to negotiate better discounts with suppliers that resulted in cost savings across a wider range of expenses.

Customer insights were the type of value most commonly sought by the business units in this research. All business units aspired to achieve this form of value, as it allowed them to understand customer behaviour and subsequently create personalised sales and service offerings. However, only one business unit within level 4 maturity experienced this. It was found that this business unit had consolidated all its individual databases from the various systems into a single integrated data warehouse. As the data was consolidated within a single source, this business unit had the ability to search for patterns and proactively present offers to customers based on their behaviour. This architecture contrasted with business units at lower levels of maturity that had different databases for each function such as the call centre, marketing, and sales. Business units at lower EA maturity levels hence experienced missed opportunities due to not having a single consolidated view of customer behaviour.

Business units across levels 1 and 2 maturities experienced both tangible and intangible value outputs. However, as business units moved up the maturity curve to level 3, predominately intangible forms of value were experienced. This suggests that EA influences both short-term and long-term forms of value across levels 1 and 2 maturities, and influences long-term value from level 3 onwards.

Furthermore, section 2.6 revealed a wide plateau of views on the term business value (Amit and Zott, 2001; Chatain and Mindruta, 2017; Chesbrough, 2012; Hwang and Christensen, 2008; Johnson et al., 2008; Kashyap et al., 2017; Sorescu et al., 2011). It was argued that business value "has different meanings for different authors and, not infrequently, in the works of one author" (Encyclopedia.com, 2017), and changes at different points in time (King and McClure, 2014). This study found that the forms of value realised from EA was relative to the maturity level of a business unit. This outcome is supported in literature, where researchers state "we propose that the difficulty of evaluating value stems from the abstract nature and nearly infinite range. As a result… it's not evaluated on a single scale, but instead on subscales composed of comparison standards that are selected at the time of judgment" (Buechel and Morewedge, 2014, p. 93). This study found that different forms of tangible and intangible business value are obtained at different levels of maturity.

The subsequent section links the EA mechanisms to the forms of value identified in this study.

8.3.6 EA Mechanisms Linked to the Business Value Outputs

Detailed in Appendix 27, the value themes from this study were analysed to determine patterns between the EA mechanisms and the value outputs using the thematic analysis techniques from Chapter 3 (Daly et al., 1997; Terry et al., 2017). Table 8.2 links the EA mechanisms and the forms of business value identified in this study.

Table 8.2: Mechanisms linked to forms of business value

Practice	**Business Value Theme**
Process	• Reduced complexity • Improved development time • Customer service
Communication	• Customer insights • Visualisation • Reduced complexity
Business-IT Alignment	• Improved risk management • Increased revenue • Innovation
Senior Management Involvement	• Improved decisions • Visualisation • Reduced complexity
Finance	• Process improvements • Hardware cost savings • Software cost savings

As discussed earlier in the study, the *processes* mechanism assessed whether there were guidelines, steps, and decisions involved in the way that EA was practiced (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010). This mechanism was linked to *reduced complexity*. EA enabled simplification through EA standards and principles such as modularisation and encapsulation that helped group common functionality and simplify interactions through common interfaces. *Improved development time* was a further type of value that was achieved by developing an EA repository of reusable components containing standard interfaces and interconnectors. The repository enabled development tasks to take less time due to the availability of reusable components. Similarly, testing time was reduced, as previously developed components were already verified within the repository. Improved *customer service* was also linked to the communication mechanism. EA was beneficial in visualising, planning, and mapping a customer's journey across business unit functions such as marketing, sales, and the call centre. EA helped identify customer service problems at the handoff points between these function silos.

The *communication* mechanism assessed the way that EA was documented, disseminated, and stored (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010). *Customer insights* referred to identifying patterns in customer behaviour. The structures created by EA facilitated the consolidation of disparate data silos into a single, integrated, reference dashboard. This enabled the development of tailored product offerings that could directly target specific customer needs. Furthermore, EA resulted in the creation of simple blueprints that helped *visualise* business and IT landscapes that were problematic. The visibility ensured standardisation and consolidation across business and IT departments by highlighting costly and complex legacy systems as well as flagging minimally used applications. This visibility allowed the cancellation of projects that were not aligned to business unit strategy, and the prioritisation of items that generated the most value. Furthermore, EA *reduced complexity* through the introduction of standards and principles that simplified the understanding of systems.

The *IT business alignment* mechanism assessed whether IT initiatives supported business goals (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010). EA *improved risk management* by supporting the implementation and monitoring of various regulatory frameworks. The EA blueprints created a holistic view of people, processes, and systems. Subsequently, legislative amendments could be isolated and their impact examined at the different touch points without disrupting business operations. Furthermore, an *increase in revenue* was experienced due to the quick time to market deployments of new products enabled by EA. Furthermore, EA helped assess the impact, viability, and implementation of *innovations*. It helped to understand the impact of innovations on the business and technical ecosystems.

Senior management involvement assessed the involvement of management with EA practices (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010). EA improved *decision-making* capabilities as it presented a consolidated view of complex and high volume data in an understandable and easily comprehensible format. It created an integrated view of data across the various applications and platforms underlying their product lifecycles. EA was found to help improve the accuracy and consistency of decisions across areas of product lifecycles. Furthermore, EA provided these business units with the visibility to gain a horizontal view of their business and IT landscapes, which subsequently helped them identify problems within these landscapes. Finally, EA *reduced complexity* through the introduction of standards and principles that simplified the understanding of systems.

Finally, the *finance* mechanism assessed an organisation's consideration of EA when acquiring new investments (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010). EA guided business units to *improve processes* by helping them visualise the steps and interconnections between their end to end tasks. The EA models helped business units understand complex interconnections between processes that were confusing, conflicting, or redundant. This enabled business units to visualise where improvements were needed. The EA visibility allowed business units to rationalise systems, accurately procure licences, and negotiate better discounts with suppliers which resulted in *hardware* and *software savings*.

As indicated previously, RBV is an evolving perspective, with various extensions, frameworks, taxonomies and arguments (Chatzoglou et al., 2017; Kraaijenbrink et al., 2010; Portugal Ferreira et al., 2016). The following section discusses one such extension.

8.3.7 Extending this study with the Valuable, Rare, Difficult to Imitate and Organisation readiness (VRIO) Lens

There is a perspective amongst some RBV researchers that if a resource is *valuable, rare, difficult to imitate,* and if *the organisation is ready* (VRIO) to exploit that resource, then *sustainability* can be achieved (Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997). Importantly, within the RBV context, the term *sustainability* does not refer to time perpetuity such as short-term and long-term, but rather that competitors cannot replicate the benefits of an organisations strategy (Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997). It should be noted that this research was not structured to directly assess VRIO, however, there was sufficient information gathered during this study to briefly evaluate EA against this lens.

RBV states a resource is *valuable* if it increases product differentiation, decreases the cost of production, or improves efficiency and effectiveness strategies that place an organisation in a favourable business position (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997). This study demonstrated that EA is valuable as it influenced outputs such as hardware cost savings, software cost savings, improved visualisation, increased revenue, improved development time, reduced complexity, process improvements, improved risk management, improved customer service, improved decision-making, innovation, and enhanced customer insights. These value outputs placed the business units in favourable positions, making EA a valuable resource.

For a resource to be considered *rare*, it must be acquired by only one or a few organisations (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997). If many competitors can acquire a resource, then there is no advantage as each competitor would have the ability to exploit that resource in the same way. Although the availability of skilled resources was a major challenge to EA success, it was still adopted by all the business units within this study. Furthermore, literature demonstrated rapid acceptance of EA within the major sectors of the economy (Ernst et al., 2006; Franke et al., 2016; Government Information Technology Officer's Council of South Africa, 2009; Janssen and Hjort-Madsen, 2007; Lapalme et al., 2016; Niemi and Pekkola, 2016; Vallerand et al., 2017). EA was thus not considered a rare resource.

In order for resources to be *difficult to imitate*, researchers have defined additional criteria as follows (Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997).

- *Unique location* states that exclusive historical or geographical conditions are required for the resource to be conceived. As stated above, EA was adopted by all the business units within this study, with rapid acceptance within the major sectors of the economy (Vallerand et al., 2017). Hence and no unique location was required for it to be initiated.
- *Path dependency* states that resources are created due to an organisation's unique experience and business tenure. Hence competitors cannot simply copy an organisations value creating strategy. This study found there was a path dependency, and lessons learned for business units at lower

levels of maturity wanting to improve their maturity level. Some of these lessons can be found in section 8.2.

- *Causal ambiguity* is created when the link between a resource and its benefit is not clearly understood by the organisation itself or competitors. Challenges include understanding “the link between EA maturity and value” (Burns et al., 2009, p. 6) and “in-depth relationships between enablers and benefits” (Tamm et al., 2011, p. 156). However, this research reduced casual ambiguity by linking the EA mechanisms to business value outcomes at the different maturity levels, as well as understanding the EA practices at these levels. Causal ambiguity is further explored in the subsequent subsection.
- *Social complexity* exists when resources are developed based on complex social interactions (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997). This study found that business units at lower maturity levels often had a dependency on specific individuals. The EA champions were influential in helping business units move up the maturity curve. These champions collaborated with business stakeholders and positioned EA as a joint business-IT venture. They collaborated with senior management and junior staff on EA efforts and aggressively communicated its value to the organisation. Hence social complexity exists with EA.

Although EA did not require a unique location, it was difficult to imitate the practices of mature business units. However, EA practices within business units at lower maturity levels were people dependent, and organisations could simply recruit suitable architects to initiate an EA capability, hence could be imitated at lower maturity levels.

Organisational readiness assesses if an organisation is structured to exploit its resources (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997). EA was widely adopted at a business unit level. However, this study found that the business unit structure of large financial services organisations was problematic. As a result, staff built or procured systems for their specific business units with little regard to the impact on the overall organisation’s architecture. This led to effort spent on quick win initiatives. Staff was further incentivised at a business unit level, as opposed to an organisational level. Furthermore, due to shareholder pressure to demonstrate profitability, business units sometimes declined projects that were expected to produce long-term benefits, as those projects reduced organisational interim financial results.

Under the VRIO lens, EA was considered a valuable resource; however, it could not be considered a rare resource, as it could be easily acquired. It was found that EA could be easily imitated at lower levels of maturity, however, was difficult to imitate at higher levels primarily due to EA’s path dependency and social complexity. Individual business units easily exploited EA, however, the silo structure of large financial services organisations was problematic for EA. VRIO assumes a linear approach when it assesses resources (Knott, 2015). As EA did not meet criteria such as rarity, it could not be considered a source of *sustainable* competitive advantage, but rather a source of competitive *parity* (Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997).

Causal ambiguity is elaborated in the following section that follows.

8.3.8 The Causal Ambiguity Paradox

It was explained earlier in this study that causality connects concepts in order to comprehend cause and effect and understand relationships between input and output variables (Yin, 2013). Causal ambiguity is defined as "the condition under which neither the firm nor its rivals can determine the causes of firm performance" (Powell et al., 2006, p. 96). It is created when the relationship between an input resource and its output value is not clearly understood by an organisation or its competitors (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997). This unclear relationship makes it is difficult for competitors to replicate the resource through imitation, as they do not know which resources to imitate. Hence, causal ambiguity impairs imitation and supports organisational value creation (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997).

However, there is a paradoxical relationship. Although causal ambiguity makes it difficult for competitors to imitate organisational resources, it also makes it difficult for organisations to understand their own resource relationships (King and Zeithaml, 2001; McIver and Lengnick-Hall, 2017; Powell et al., 2006).

To overcome causal ambiguity, some competitors have forfeited resource imitation, and commenced with the identification of resource substitutes that may achieve similar value outputs. Researchers refer to this scenario as *the competence substitution dilemma* (King, 2007; McEvily et al., 2000). The implications of this phenomenon on this study are that business units could substitute EA with other capabilities such as process engineering, project management, or business analysis to achieve the value outcomes identified in this study. Hence, EA maturity does not exclusively imply the value benefits identified in this study. However, these arguments require substantial further investigation, and are noted as an area for future research. Researchers state, "despite significant attention and progress, there remains considerable ambiguity about causal ambiguity" (King, 2007, p. 156). Researchers argue that "causal ambiguity can be hard to work out, even for the firm that owns a resource" (Dierickx and Cool, 1989, p. 92).

This study reduced causal ambiguity as it improved the understanding of the connection between the EA maturity of an organisation and the business value associated with it within the South African financial services environment. Characteristics of EA practices were identified as mechanisms to improve this understanding. It further included establishing the levels of EA maturity, as well as the granularity of EA that was in use. Moreover, this study linked the forms of tangible and intangible value obtained from EA.

As an evolving perspective, literature contains various RBV extensions and arguments (Chatzoglou et al., 2017; Kraaijenbrink et al., 2010; Portugal Ferreira et al., 2016). Some researchers have suggested extending RBV with *systems perspective* to further reduce causal ambiguity (Morecroft, 2002).

8.3.9 Extending RBV with Systems Perspective

Researchers state "the performance of a firm should not only be interpreted as an output of the firm's activities, but should also be considered as an input of the firm's actions. That is, the performance of a firm can be fed back into the resource system of the firm, and be used as a basis for a new investment for a new resource or further development of the existing resources" (Huh, 2013, p. 4).

This cycle of feeding outputs back into an organisation is referred to as the *systems perspective* (Huh, 2013; Morecroft, 2002). Researchers argue that this is a technique to reduce causal ambiguity. Furthermore, researchers argue that this advances the traditional static RBV into the *dynamic* RBV (not to be confused with dynamic capabilities theory), where an organisation is seen as a dynamic resource system (Morecroft, 2002).

This research partially addressed the systems perspective by categorising the outputs of hardware cost savings, software cost savings, improved visualisation, increased revenue, improved development time, reduced complexity, process improvements, improved risk management, improved customer service, improved decision-making, innovation, and enhanced customer insights into tangible and intangible concepts, that would lead in turn to short-term and long-term value for an organisation (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). However, further studies would be required to assess constructs such as heterogeneity and immobility of these outputs, to fully ascertain their influence once channelled back into the organisation's ecosystem. This is noted as an area for future research.

The following section links EA outputs from literature to the outputs identified in this study.

8.3.10 Value outputs from literature linked to value outputs from this study

In Chapter 1, section 1.2 of this study introduced the EA forms of value obtained from literature. Furthermore, Figure 1.2, the organising framework for this study, illustrated supporting theory that helps operationalise RBV, the mechanisms that help translate EA into value, as well as the value attained. Figure 8.4 below extends this organising framework, by linking the forms of value found in this study to the forms of value found in literature.

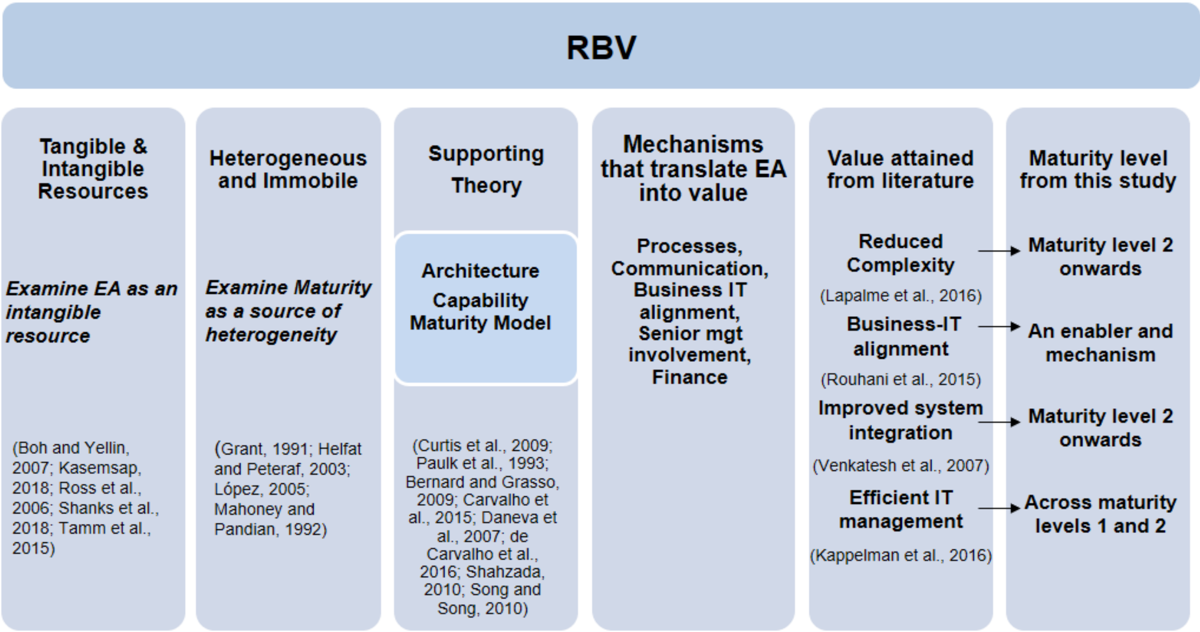

Figure 8.4: Forms of value from literature linked to forms of value from this study

The literature established that business value in the form of *reduced system complexity* was attainable from EA (Gerber et al., 2010; Kappelman et al., 2008; Lapalme et al., 2016; Rouhani et al., 2013; Schekkerman, 2011). However, this study found that *reduced system complexity* (Gerber et al., 2010; Kappelman et al., 2008; Lapalme et al., 2016; Rouhani et al., 2013; Schekkerman, 2011) was achievable for organisations operating from EA maturity level 2 onwards. Reduced system complexity was facilitated through visibility, architectural standards, and principles, that helped these business units group common functionality and simplify interactions through common interfaces.

The literature further established that business value such as *business-IT alignment* was attainable from EA (Bricknall et al., 2006; Gregor et al., 2007; Henderson and Venkatraman, 1993; Miller and Ross, 2003; Rouhani et al., 2015; Sessions, 2007). However, this study viewed *business-IT alignment* as a mechanism and enabler to achieve value, as opposed to a form of value that can be obtained. EA enabled alignment because it connected business and technology components through common threads (Harrison, 2013; Henderson and Venkatraman, 1993; Kurniawan and Suhardi, 2013; Lapalme, 2012). Furthermore, EA encompassed both business and IT components that supported the business units to achieve alignment (Bricknall et al., 2006; Gregor et al., 2007; Ross, 2003; Ross et al., 2006; Rouhani et al., 2015; Schwarz et al., 2010; Sessions, 2007).

Moreover, the literature review found that business value in the form of *improved system integration and standardisation* (Boh and Yellin, 2007; Richardson et al., 1990; Venkatesh et al., 2007) was attainable from EA. This research concurred with the literature, and established that this form of value was attainable for the business units from level 2 maturities onwards. EA enabled architectural standards and principles such as modularisation, encapsulation and micro-services that helped these business units simplify interactions through common interfaces. This resulted in simplification achieved by reuse of components facilitated by implementing EA standards. Furthermore, the establishment of a repository of reusable components with standard interfaces eased system integration.

Furthermore, the literature review established that *efficient IT management* comprised of reduced solution delivery time and development costs as forms of value generated by EA (Bernard, 2012; Cardwell, 2008; Kappelman et al., 2016; Ross et al., 2006). This research concurred with the literature, and found that these forms of value were attainable across levels 1 and 2 maturities.

Finally, the business value outcomes identified at the different levels of maturity from this study were compared to a hierarchy of business value outcomes from literature. An article entitled *Building Value through EA* argued “our study further suggests that there is an order to value delivered via EA. As organisations mature, they capture cost savings and operational risk reduction earliest, whereas reduced complexity and increased agility become more apparent as their EA maturity increases… now cases are being resolved 25 percent faster, resulting in efficiency gains” (Burns et al., 2009, p. 7). Another study entitled *The relationship between enterprise architecture, business complexity and business performance* (Roest, 2013), identified an improvement in customer satisfaction, process improvements and decision making at higher levels of EA maturity. Further research entitled, *IT value management in leading firms* (Keyes-Pearce, 2005), ranked cost savings as the type of value least sought by organisations as they are easy to obtain, followed by improved development time, process improvements, and finally improved decision making. Other comparative studies (Ross et al., 2006; Steghuis et al., 2005; Tamm et al., 2015) have ranked benefits such as innovation, customer service and insights on a higher scale than visualisation and reduced complexity benefits. Although these studies have used different theoretical frameworks, models, scales and criteria to assess business value, the general hierarchy of business value outcomes from literature (Burns et al., 2009; Keyes-Pearce, 2005; Roest, 2013; Ross et al., 2006; Steghuis et al., 2005; Tamm et al., 2015) broadly aligns to the business value outcomes identified in this study representing higher manifestations of value.

The subsequent section provides insights into the EA granularity.

8.3.11 EA Granularity

TOGAF (Harrison, 2013), the EA reference model selected for this study, decomposed EA into business, application, technology, and data domains. However, it did not show the granularities of refinement of these domains utilised at the different levels of maturity (Bui, 2012; Tamm et al., 2015, 2011; Vallerand et al., 2017; Wang and Zhao, 2009). Understanding EA granularities of refinement assist organisations achieve value (Schekkerman, 2011).

EA domains comprising of business, application, technology, and data domains were examined. This study found a refinement in the granularity of EA as business units moved up the maturity curve.

Business units at lower levels of maturity generally applied EA at a coarse granularity, whereas business units at higher levels of maturity applied EA at a finer granularity of refinement.

Detailed in Table 7.1, business units across levels 1 and 2 maturities generally applied EA at a *coarse* granularity of refinement and focused on EA domain objectives. Analysing this in more detail, the *business* domain defined the vision, mission, goals, strategy, governance, and capabilities. Apart from one business unit (B.1) that defined this domain at a medium granularity, the remaining business units (A.2, B.3, C.3, B.2 and C.1) defined this domain at a coarse granularity. The *application* domain defined the software objectives required to support the business unit. All the business units defined this domain at a coarse granularity of refinement. Furthermore, the *technology* domain defined the infrastructure technologies required to support the business units. Three business units (B.1, B.3 and C.1) defined this domain at a coarse granularity, two business units (A.2 and C.3) at a medium granularity and one business unit (B.2) at a fine granularity of refinement. It appears that business units find it easier to achieve a finer granularity of refinement within the technology domain. Moreover, the *data* domain defined the types that were required by the business units. Principles, such as coarsely defined rules that governed the way that these domains were delivered by the business unit, were specified. Apart from one business unit (B.3) that defined this domain at a medium granularity, the remaining business units (A.2, B.1, C.3, B.2 and C.1) defined this domain at a coarse granularity.

As business units moved into level 3 maturity, a medium granularity of refinement generally became prominent. Besides defining the specific domain achieved in terms of its objectives, the medium granularity defined the way that the objectives were achieved. Analysing this level in more detail, the *business* domain defined the business strategies, vision, mission, and business goals, as well as the stakeholders responsible for this domain. One of the business units (C.2) was defined at a medium granularity, whereas the other business unit (A.3) was defined at a fine granularity of refinement. The *application* domain incorporated various software goals, objectives, principles, and patterns as well as finer details specifying the way that the software was built. Both of the business units at this level defined this domain at a medium granularity of refinement. Furthermore, the *technology* domain included their technology objectives, goals, principles, detailed reference models, as well as the way that the technologies were implemented. Both of the business units at this level defined this domain at a fine granularity of refinement. Finally, the *data* domain incorporated data at rest, use, and motion data principles, goals, and views and attributes of their data. One of the business units (C.2) was defined at a fine granularity, whereas the other business unit (A.3) was defined at a coarse granularity of refinement.

The business unit within level 4 maturity defined EA at an even finer granularity of refinement. The business unit defined the specific domain objectives. It then defined the way that the objectives were implemented. This granularity contained details such as where the physical implementation was taking place, as well as the role of stakeholders performing the task. All the domains were defined at a fine granularity of refinement.

In essence, the granularity of the EA mechanism appears to have provided the ability to realise value.

The following subsection discusses the IT productivity paradox.

8.3.12 The IT Productivity Paradox

The *IT productivity paradox* was another topic of debate amongst researchers (Dewan and Kraemer, 1998; Wetherbe, 2008). It refers to a slowdown in US productivity between the 1970s and 1980s, despite there being considerable development in IT over the same period. Researchers argue that although there were substantial investments into IT systems, however, minimal productivity improvement has been demonstrated (Willcocks and Lester, 1999). Research shows that organisations that modernised their practices achieved greater benefits from their technological investments (Dewan and Kraemer, 1998; Wetherbe, 2008). Furthermore, organisations that invested substantially into IT, but did not adopt modern organisational practices did not significantly improve their productivity (Brynjolfsson and Hitt, 1998).

Counter studies argued that data issues, as well as "shortcomings in research, not practice as the root of the productivity paradox" (Brynjolfsson, 1993, p. 30) and that benefits from IT were negated by losses in other areas (Dewan and Kraemer, 1998; Wetherbe, 2008). Furthermore, the paradox demonstrated a delayed IT-related productivity improvement (Dewan and Kraemer, 1998).

This study assessed this lens and concurred with aspects of the IT productivity paradox. Research shows that organisations with modern organisational practices achieved greater benefits from their technological investments (Dewan and Kraemer, 1998; Wetherbe, 2008). This study found that business units with more maturity EA practices achieved greater benefits than business units with less mature practices.

The following subsection unpacks general insights and observations from this study across the EA maturity levels.

8.4 General Insights into EA Transitions

This section provides insights on EA transitions across the maturity levels and general researcher observations. These insights are summarised in Figure 8.5 below. Note that this figure focused on the EA polarities between the lowest and highest levels, as some of the transitions across maturity levels were subtle in nature without clear dividing points. Details can be found in the subsections below.

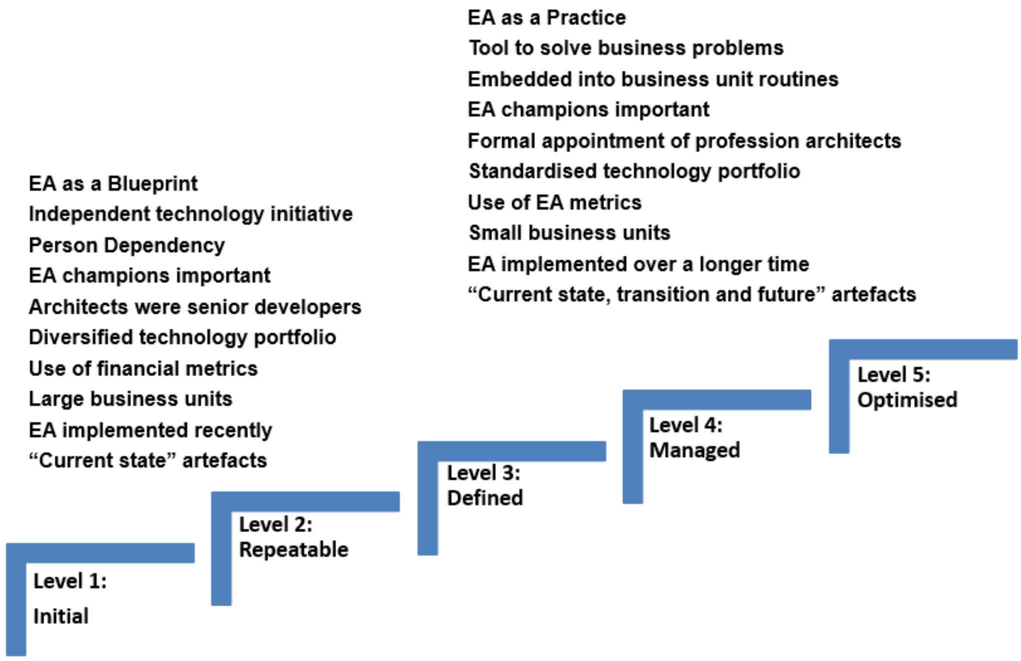

Figure 8.5: EA insights

The first subsection discusses the transition of EA from a blueprint to a practice.

8.4.1 EA Blueprint to EA Practice

Firstly, all the business units assessed in this study made advancements in their EA practices, and viewed it as an ongoing priority. This study found that business units across levels 1 and 2 maturities had a narrow focus on EA and perceived it to be a blueprint, as well as an *independent technology initiative*. As business units moved across level 3 maturity, they began to broaden their view on EA, and perceived it to be more of proficiency, with an improvement in business-IT alignment. This study found that the one business unit within level 4 maturity had a wider perspective of EA, and viewed it as a practice, that involved applying a set of tools and techniques to *solve business problems*. EA was entrenched into the business decision-making process. This study showed strong business-IT alignment practices with the technical teams aligning their priorities to the business objectives at higher levels of maturity.

The following subsection discussed EA dependencies and routines.

8.4.2 Person Dependency to Embedded Routines

This study established that business units with level 1 maturity had a notable dependency on individual efforts. Although forms of value such as cost savings were experienced, they were erratic and inconsistent due to this dependency. Coupled with person dependency, business units at lower levels had a strong reliance on outside vendors. As business units moved up the maturity curve, EA gradually became more embedded into routines and processes, and there was a reduced dependency on individual efforts. Within level 3 maturity, specific managers had to still champion its value, however, there was no critical reliance as found within level 1 maturity. This was due to EA being more entrenched into the business unit routines and hence embedded into their culture within level 3. The business unit within level 4 had intentionally structured EA to target critical business projects. This linking of EA to critical projects ensured that it remained visible and relevant to the business unit due to its association with the benefits created by the project. This is a lesson for lower level business units wanting to gain visibility and momentum in their EA efforts.

The EA champions were influential in helping business units move up the maturity curve. These champions collaborated with business stakeholders and positioned EA as a joint business-IT venture. They collaborated with senior management and junior staff on EA efforts and aggressively communicated its value to the organisation.

The following subsection discusses EA roles and skills availability.

8.4.3 Senior Developers to Senior Architects

This study found that the *availability of skilled resources* was a major challenge to EA success. At lower levels of maturity, individuals were not formally appointed as architects, but were primarily senior developers within their respective business units that assumed the role due to their personal interest in EA. Business units at lower levels of maturity did not recognise and fully acknowledge EA as a formal career.

Conversely, business units across levels 3 and 4 acknowledged this career path, and built strong internal skills by sponsoring and encouraging EA training. These business units recognised EA as a professional career path with formal roles and responsibilities. Business units across levels 3 and 4 maturities had positioned architects at a higher level of seniority within the business unit with more decision-making power.

The following subsection discusses technology portfolio mixes.

8.4.4 Diversified Technologies to Standardised Technologies

This found that business units across levels 1 and 2 maturities had large diversified portfolios of different programming languages, operating systems, and tools.

This contrasts with business units across levels 3 and 4 that had implemented standardised off-the-shelf packaged technologies within minimal or no customisation. They further used standard programming languages and standard operating systems across a variety of applications. The use of standardised technologies reduced future interface complexity. A participant from bank A, business unit 1, operating within level 4, commented,

"*inexperienced CIO's make a terrible mistake of driving customisation as the first rather than the last option… my department predominately uses vanilla out of the box solutions, for the majority of applications… functions such as finance, human resources, or procurement typically don't give us any competitive advantage… we keep those technologies standard*" (A.BU1.P1.1).

Furthermore, this study noted a strong alignment between EA maturity and the value advantage. Although business units within levels 1 and 2 maturity levels experienced cost savings, business units at higher levels of maturity experienced greater cost savings due to the efficiencies gained with the use of standardised technologies. Coupled with standardisation, business units at higher levels of EA maturity had a strong focus on the reuse of existing components to support business requirements. They further maintained a common repository of services and solutions that could be reused. On the contrary, although some business units at lower levels of maturity did have these repositories, they did not maximise their use due to navigation and access issues.

The following section discusses the use of metrics within the business units.

8.4.5 Financial Metrics to EA Metrics

Literature has demonstrated the benefit of using performance metrics within organisations (Fenton and Pfleeger, 2014; Radjenović et al., 2013; Wallace and Sheetz, 2014). Researchers state that "you cannot manage what you cannot measure" (Harrington, 1991, p. 16; Kabra and Ramesh, 2017, p. 5). An unexpected finding from this research was insights into the types of EA metrics that business units utilise at the different levels of maturity.

This study found that business units across levels 1 to 3 maturities utilised *financial metrics* such as ROI, NPV, and cost-benefit analysis, *customer metrics* such as customer satisfaction surveys, call centre holding time and problem resolution time, *process metrics* such as measuring task times, and *compliance metrics* such as compliance frameworks.

However, the differentiator within level 4 was that the business unit used statistical metrics specifically designed to measure EA. This business unit used *Delphi techniques* to enhance EA decision-making, *frequency analysis* to determine patterns for EA improvement, and measured *the number of projects that leveraged the EA repository for the target state designs*, *the percentage of projects architecturally aligned to the target state*, and *the percentage reuse of architectural components*.

The subsequent subsection discusses the structure of the financial services organisations analysed in this research.

8.4.6 Structure of large financial services organisations

This study found that the siloed business unit structure of large financial services organisations was problematic. As a result, staff built or procured systems for their specific business units with little regard to the impact on the overall organisation's architecture. This led to their effort being spent on quick win initiatives. Staff was further incentivised at a business unit level, as opposed to an organisational level. Furthermore, due to shareholder pressure to demonstrate profitability, participants revealed that business units sometimes declined projects that were expected to produce long-term benefits, as those projects reduced organisational interim financial results.

The subsequent section links the business unit size in relation to the EA maturity level.

8.4.7 Business unit size in relation to EA implementation

Although there was no research question directly evaluating the business unit size in relation to the EA maturity level, there was sufficient information gathered during this study to assess the size of the business unit and the EA maturity level to understand any relationships. Figure 8.6 below links the size of the business unit to the EA maturity level.

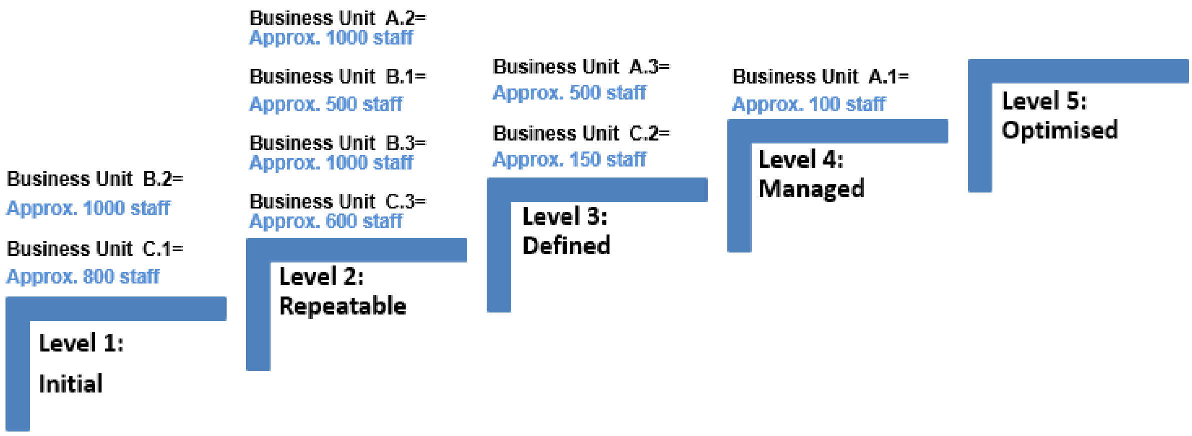

Figure 8.6: Business unit size in relation to EA maturity level

Within **level 1 maturity**, this research found that business unit B.2 employed approximately 1000 staff, whereas C.1 employed approximately 800 staff members. Within **level 2 maturity**, business unit A.2 employed approximately 1000 staff, B.1 employed approximately 500 staff, B.3 employed approximately 1000 staff, and C.3 approximately 600 staff members. Within **level 3 maturity**, business unit A.3 employed approximately 500 staff, whereas business unit C.2 employed approximately 150 staff members. Finally, within **level 4 maturity**, business unit A.1 employed approximately 100 staff.

From this study, it would appear that it may be easier to achieve maturity within smaller business units; however, further investigation is required.

The following section provides insights into the inception of EA in relation to EA maturity.

8.4.8 Inception of EA in relation to EA maturity

Similar to the previous section, there was no interview question directly requesting the EA inception time frame, however, many of the respondents spontaneously mentioned their business units EA commencement during the interviews. Hence the data was analysed to determine if there was any relationship between the EA inception and the maturity of EA, illustrated in Figure 8.7.

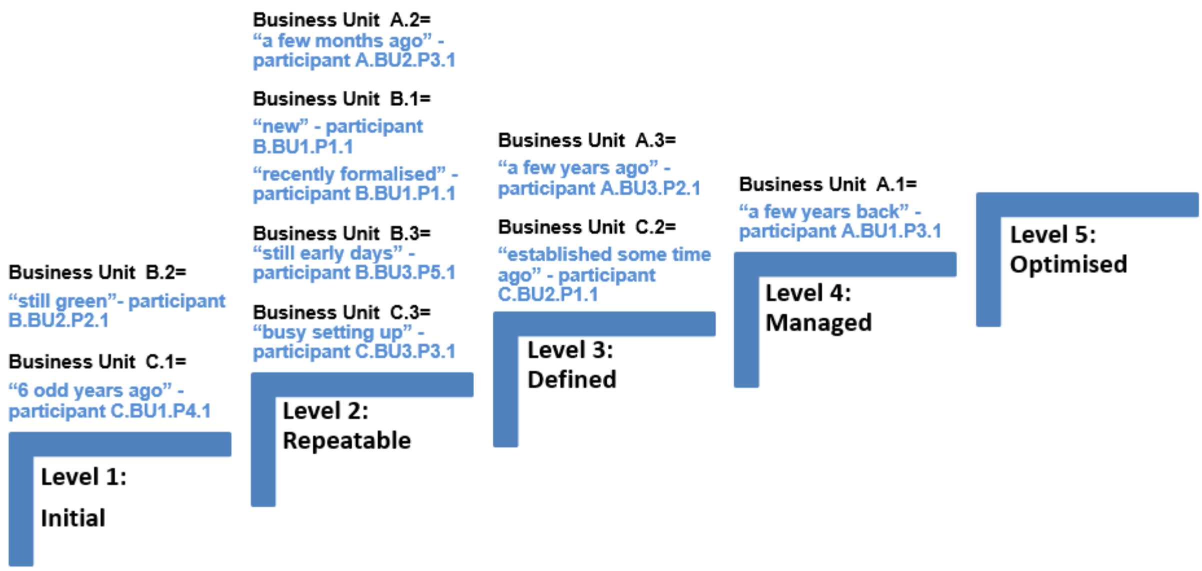

Figure 8.7: Inception of EA in relation to maturity level

Within **level 1 maturity**, this research found that EA was "still green" (see table 5.5, participant B.BU2.P2.1) within business unit B.2, and implemented "6 odd years" ago (see table 6.3, participant C.BU1.P4.1) within business unit C.1. Within **level 2 maturity**, this research found that EA was implemented "a few months ago" (see table 4.5, participant A.BU2.P3.1) within business unit A.2. Within business unit B.1, EA was "new" (see table 5.2, participant B.BU1.P1.1) and only "recently formalised" (see table 5.2, participant B.BU1.P1.1). Within business unit B.3, EA was "still early days" (see table 5.8, participant B.BU3.P5.1) whereas business unit C.3 was "busy setting up" EA (see table 6.8, participant C.BU3.P3.1). Within **level 3 maturity**, the EA journey commenced "a few years ago" (see table 4.7, participant A.BU3.P2.1) for business unit A.3, and "established some time ago" (see table 6.8, participant C.BU2.P1.1) for business unit C.2. Finally, within **level 4 maturity**, EA was implemented "a few years back" (see table 4.2, participant A.BU1.P3.1) for business unit A.1.

With the exception of business unit C.1, where EA was implemented “6 odd years” ago, it appeared that business units across levels 1 and 2 maturities had implemented EA within a more recent time period, whereas business units across levels 3 and 4 had established EA over a longer time period. This could imply that EA maturity improves with time, although the experience of business unit C.1 indicates that this is not necessarily the case.

Insights into the artefacts obtained from the business units follows.

8.4.9 Assessment of EA artefacts

A large assortment of artefacts including business requirement documents, technical specifications, "as is" documents, target state documents, gap analysis, financial models and data architecture models were assessed. An attempt was made to link these types of artefacts to the specific mechanisms, however, no reliable pattern could be established. This was due to the large variety of bespoke artefacts developed and structured according to the business unit specific services and functional requirements.

This study eventually organised the artefacts into *current*, *transition,* and *future* state architectural themes (Harrison, 2013), and linked them to the EA maturity levels. The data was analysed to determine the relationship between the EA artefacts and the maturity of EA, illustrated in Figure 8.8.

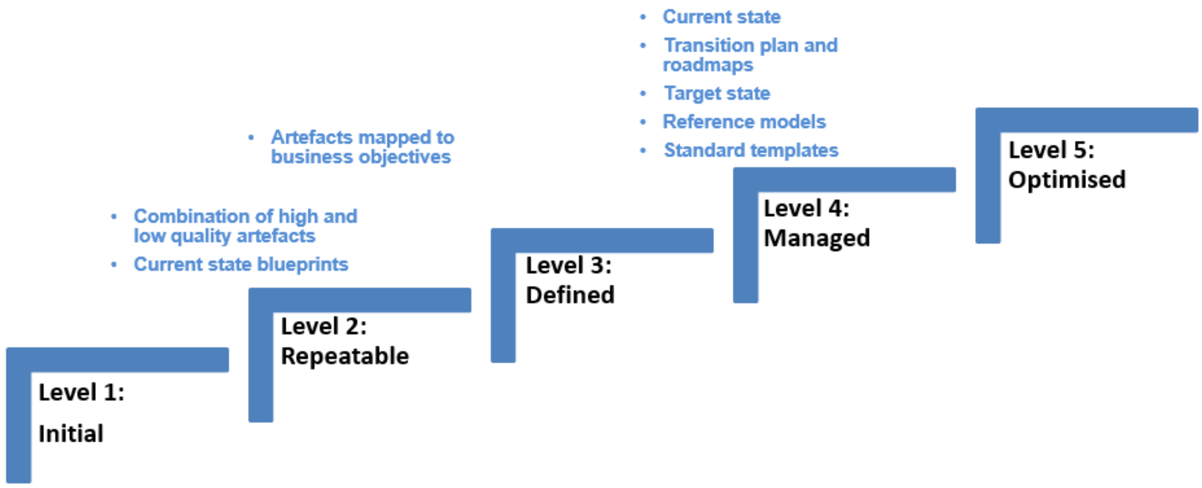

Figure 8.8: Focus on EA artefacts

Business units across levels 1 and 2 maturities displayed EA documentation that was a combination of high and low quality artefacts due to the dependency on specific individuals. EA documentation primarily included current state technical blueprints of systems and sporadic target state artefacts. Notably, business units within level 2 contained artefacts that had a stronger alignment between the business and IT departments, as many of the systems were mapped to the business objectives.

Whereas artefacts business from units within levels 1 and 2 maturities focused on the current state environment, the business units across levels 3 and 4 maturities, typically produced deliverables comprising of their current state, transition plan, and target state environments. These target environments were generally 3-year end state visions of the business and IT ecosystem. The business units used reference models and standardised templates for their EA efforts. Artefacts further included architectural policies, standards, and procedures for areas such as security and infrastructure for reaching the target state. Architecture roadmaps that described the projects required to move from the current state to the future state were detailed. Notably, the business unit within level 4 maturity placed more emphasis on the transition plan artefacts which supported its culture of movement towards its specified future state goal.

The following section concludes this chapter.

8.5 Conclusion

This chapter interpreted and discussed the results. It established that within level 1 maturity, forms of value such as *hardware cost savings, software cost savings,* and *visualisation* were experienced. Minimal EA practices were in place that was primarily driven by a few individual staff members. Within level 2 maturity, forms of value such as *increased revenue, improved development time,* and *reduced complexity* were attained. Most of the business units fell within this level, indicating that EA practices were still under development in those departments. *Process improvements, improved risk management,* and *improved customer service* were attained within level 3. Business units at this level had simple EA practices in place with clear target states that were well accepted and communicated within the teams. Level 4 maturity experienced forms of value such as *improved decision-making, innovation, and enhanced customer insights*. Within this business unit, EA was fully integrated into the culture, with EA metrics defined. None of the business units were rated at level 5 indicating that although all the business units had invested in EA to some degree, more momentum was required to reach the top level of maturity.

An overlay of the critical realism and RBV constructs on this study was conducted in order to illustrate the alignment of the philosophy and underlying theoretical framework on this research. An argument that intangible resources contributed more to organisational performance than tangible resources followed. Another argument of EA as a capability comprising of tacit and explicit components had arisen. This study found that EA practices were less immobile at lower levels of maturity due to the dependency on individual efforts, and immobile at higher levels of maturity, as EA was embedded into organisational processes. A summary of EA practices uncovered in this study took place. Moreover, this study demonstrated that EA (an intangible input resource) is responsible for tangible and intangible output forms of value. An exercise was conducted to link the business value outputs to the EA mechanisms. This was followed by extending this study with the VRIO lens. A discussion of the causal ambiguity paradox trailed. The cycle of feeding outputs back into an organisation was referred to as systems perspective. This allowed the static nature of RBV to be addressed. This study partially addressed this extension by categorising the value outputs into tangible and intangible forms. The forms of value found in this study were thereafter linked to the forms of value found in literature.

This study found a refinement in the granularity of EA as business units moved up the maturity curve. Business units at lower levels of maturity generally applied EA at a coarse level of granularity, whereas business units at higher levels of maturity applied EA at finer levels of granularity. Business units at the upper end of the maturity curve entrenched EA as part of the business decision-making process, with strong business-IT alignment practices. This study found that the *availability of skilled resources* was a major challenge to EA success. Mature business units built strong internal skills by sponsoring and encouraging EA training. This study found that EA champions were influential in helping business units move up the maturity curve. These mature business units implemented standardised off-the-shelf packaged technologies within minimal or no customisation. An outcome from this study was that business units can gain immediate value from EA, even at the lowest level of maturity. Moreover, as EA maturity improved, business units experienced greater value, implying a strong alignment between EA maturity and the value advantage. Customer insights were the type of value most commonly sought by the business units, and could be achieved by consolidating all databases into a single database. The differentiator within level 4 was the use of statistical metrics specifically designed to measure EA. The size of the business units was linked to the maturity level to analyse the relationship. Furthermore, the data was analysed to determine if there was any relationship between the EA inception and the maturity of EA. Finally, this study organised the artefacts into current, transition, and future state architectural themes and linked them to the EA maturity levels.

Chapter 9: Conclusion

An overview of this study, as well as the implications and main contributions of this research, is outlined in this chapter. Furthermore, limitations, followed by recommendations for future research are suggested.

9.1 Introduction

The preceding chapter interpreted the findings from the three case studies analysed in this research. This chapter concludes the research effort by presenting an overview of each chapter followed by the main findings of this study. The implications and contributions of the study are then assessed, followed by a discussion of the biases, the limitations, as well as recommendations for further research. A synopsis of the chapters is presented in the following section.

9.2 Overview of chapters

Chapter 1 showed that organisations operate in a complex dynamic environment, driven by technological advances, disruptive innovations, regulatory changes, and globalisation (Medini and Bourey, 2012; Panetto et al., 2016; Walker et al., 2016). EA was introduced as an instrument to reduce system complexity (Gerber et al., 2010; Lankhorst, 2013a; Lumor et al., 2016; Rouhani et al., 2015; Sessions, 2007), achieve business-IT alignment (Bricknall et al., 2006; Henderson and Venkatraman, 1993; Pereira and Sousa, 2005), improve system integration (Boh and Yellin, 2007; Richardson et al., 1990; Venkatesh et al., 2007), enhance IT management and strategic competitiveness (Bernard and Grasso, 2009; Cardwell, 2008; Kappelman et al., 2016; Ross et al., 2006) and assist stakeholders visualise design (Cardwell, 2008; Kruchten et al., 2002). However, problems existed in understanding the relationship between EA maturity and business value, as there were limited studies that examined EA as an intangible resource and basis for business value (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015). Furthermore, research did not focus on the way that EA affects business value outcomes at the different maturity levels (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015; Vallerand et al., 2017). The significance of investigating this problem is that organisations could understand the forms of business value that could be attained as they progressed towards higher levels of EA maturity. Hence, the aim of this research was to understand the connection between the EA maturity of an organisation and the business value associated with it.

Chapter 2 analysed literature pertaining to the concepts of *RBV, EA*, *maturit*y, and *business value* in order to support the research questions. That chapter introduced the SLR approach, used to identify and analyse influential literature concerning these concepts (Armitage and Keeble-Allen, 2008; Cochrane Collaboration, 2018; Higgins and Green, 2014; Tranfield et al., 2003). RBV was discussed as the underlying theoretical framework for this research, as it helped explain the way resources influence value (Amit and Schoemaker, 1993; Burton and Rycroft-Malone, 2014; Dawson and Watson, 2005; Seddon, 2014; Tamm et al., 2011). Strengths and weaknesses of RBV (Bea and Haas, 2013; Douma and Schreuder, 2013; Ludwig and Pemberton, 2011; Teece et al., 1997), as well as contending theories were discussed (Collis, 1994; Connor, 2002; Falkenreck and Wagner, 2007; Kraaijenbrink et al., 2010; Ludwig and Pemberton, 2011; Priem and Butler, 2001b, 2001a).

A background and historical overview of EA as well as dominant EA frameworks were introduced. An analysis of the Zachman Framework, FEA, GEAF, DoDAF, TEAF and TOGAF was presented (Browning, 2014; Cameron and Mcmillan, 2013; Department of Defense, 2010; Federal government of the United States, 2013; Harrison, 2013; Lapkin et al., 2008; Rouhani et al., 2013; Sessions, 2007; Urbaczewski and Mrdalj, 2006; US Office of Management and Budget, 2012; Zachman, 2012). TOGAF was selected as the reference EA framework for this research, as it contained balanced business and IT architectural domains that were comprehensive and flexible (Cabrera et al., 2016; Esmaeil Zadeh et al., 2012; Rouhani et al., 2015, 2013; Sessions, 2007; Van't Wout et al., 2010).

A maturity model was introduced as a structured framework defining progression towards an improved state, using successive levels (Becker et al., 2010; Maslow, 1955; Paulk et al., 2006; Röglinger et al., 2012). Dominant maturity models such as QMMG, Stages of Growth, and CMM were introduced (Aiken et al., 2007; Crosby, 1979; Curtis et al., 2009; Peter Gottschalk, 2002; Petter Gottschalk, 2002; King and Kraemer, 1984; Nolan, 1979; Paulk et al., 2006). CMM was used as a blueprint to develop other derived maturity models (Burnstein et al., 1996; Paulk et al., 2006; Van Steenbergen et al., 2010), including several for EA maturity. One of these derived models, ACMM, was selected as a reference maturity model for this research, as it contained appropriate mechanisms that were relevant to assess the levels of EA maturity (De Carvalho et al., 2016b, 2016a, 2015; Op 't Land et al., 2009; van Der Raadt et al., 2005).

A debate on the concept and definition of business value from the literature was further introduced in Chapter 2 (Amit and Zott, 2001; Brandenburger and Stuart, 1996; Chatain and Mindruta, 2017; Chesbrough, 2012; Hwang and Christensen, 2008; Kashyap et al., 2017; Mooney et al., 1996; Sorescu et al., 2011). The arguments described the concept of business value as obscure, controversial, unclear, and inconsistent (Bannister and Remenyi, 2000; Cronk and Fitzgerald, 1999; Encyclopedia.com, 2017; King and McClure, 2014).

Business value definitions from econometric, process, and perception models, as well as MBO, value chain, balanced scorecard, and RBV, were examined (Barney, 1991; Cronk and Fitzgerald, 1999; Drucker, 1954; Drucker et al., 2015; Kaplan and Norton, 2007; Keyes-Pearce, 2005; Porter, 1990, 1985b). Although all the business value models had strengths and weaknesses, the RBV description of *business value is an output condition created by valuable resources. A resource is valuable if it increases product differentiation, decreases the cost of production or improves efficiency and* *effectiveness strategies that place an organisation in a favourable position (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997)* was selected as it aligned with both the theoretical framework and the aims of this study.

Chapter 3 introduced the research methodology used for this research. This study adopted the idea of the 'research onion', to describe the philosophy, approaches, strategies, time horizons, and the data collection methods in the form of an onion, depicting the stages of a research process (Saunders et al., 2016). Critical realism, was selected as the research *philosophy* for this research as was suitable for studies that involved data collection, as well as an understanding and interpretation of that data (Archer et al., 2013, 1998; Bhaskar, 2015; Fletcher, 2016; O'Mahoney and Vincent, 2014; Sayer, 2000b, 2000a). This research built a middle range theory using a qualitative *approach*. Aspects of descriptive, exploratory, and explanatory research *choices* were adopted for this study within a case study strategy. Multiple qualitative research *techniques* in the form of semi-structured individual interviews and artefacts were used to collect data. A cross-sectional *time horizon* allowed the comparison of different population groups at a single point in time for this study (Saunders et al., 2016). The data collection was conducted across three settings and included business and IT participants. The data analysis strategy comprised of thematic analysis to identify themes in the data (Braun and Clarke, 2008). Finally, reliability and validity standards that were adhered to, in order to ensure data quality in this research, was discussed (Saunders et al., 2016).

Chapter 4, organised and presented data from case study 1, referred to as Bank A in this research, using thematic analysis techniques to develop themes (Braun and Clarke, 2008; Mathison, 2011; Maxwell, 2013; Patton, 2015). This research found that business unit A.1 operated within level 4 maturities, and experienced forms of value such as improved decision-making, innovation, and customer insights as a result of EA. Furthermore, this study found business unit A.2 operated within level 2, and experienced forms of value such as reduced complexity, increased revenue, and an improvement in the portability of applications. Finally, this study found business unit A.3 operated within level 3 maturity, and experienced forms of value such as business-IT alignment, improved agility, and improve customer service.

Chapter 5, organised and presented the data from case study 2, referred to as Bank B in this research. That chapter found business unit B.1 operated within level 2 maturity, and experienced forms of value such as improved development time, simplification, and standardisation as a result of EA. Furthermore, it found that business unit B.2 operated within level 1 maturity and experienced forms of value such a hardware cost savings, resource cost savings, and improved quality of documentation. Finally, business unit B.3 operated within level 2 maturity, and experienced forms of value such as improved development time, better ROI, and improved system integration.

The data from case study 3, referred to as Bank C was presented in **Chapter 6**. This research found that business unitC.1 operated within level 1 maturity, and experienced forms of value such as software cost savings, hardware cost savings, and visualisation because of EA. Furthermore, this study found business unit B.2 operated within level 3 maturity and experienced forms of value such as risk management, business-IT alignment, and process improvements. Finally, this study found business unit B.3 within level 2 maturity, and experienced forms of value such as increased revenue, reduced complexity, and interoperability of systems.

Chapter 7 consolidated the evidence collected from the 3 case studies and structured the results in line with the research questions. This research found that business units B.2 and C.1 operated within level 1 maturity. Minimal EA practices were in place that was primarily driven by a few individual staff members. Forms of value such as *hardware cost savings, software cost savings,* and *visualisation* were experienced at this level. Business units within level 1 maturity implemented EA at a coarse granularity of refinement. Furthermore, business units A.2, B.1, B.3 and C.3 operated within level 2 maturity. EA practices were still under development in those departments. At this level, the forms of business value that these business units realised were *increased revenue, improved development time* and *reduced complexity*. Business units within level 2 maturity implemented EA at a coarse granularity of refinement. Business units A.3 and C.2 operated within level 3 maturity, had simple EA practices in place with clear target states. They experienced *process improvements, improved risk management,* and *improved customer service.* Business units within level 3 maturity implemented EA at a medium granularity of refinement. Finally, this study revealed that business unit A.1 operated within level 4 maturity. Within this business unit, EA was fully integrated into the culture, with EA metrics defined. Forms of value such as *improved decision-making, innovation, and enhanced customer insights,* were experienced due to EA. Business units operating within level 4 maturity implemented EA at a fine granularity of refinement. Notably, none of the business units operated at level 5.

Chapter 8 provided insights into the results of the three case studies analysed in this research. An important outcome from this study was that business units can gain immediate value from EA, even at the lowest level of maturity. Moreover, as EA maturity improved, business units experienced greater value, implying a strong alignment between EA maturity and the value advantage. Interestingly, customer insights were the type of value most commonly sought by the business units, and could be achieved by consolidating all databases into a single database. Business units at the upper end of the maturity curve entrenched EA into the business decision-making process; with strong business-IT alignment practices. Chapter 8 discussed the finding that the *availability of skilled resources* was a major challenge to EA success. Mature business units built strong internal skills by sponsoring and encouraging EA training. Importantly, mature business units implemented standardised off-the-shelf packaged technologies within minimal or no customisation. This study found that EA champions were influential in helping business units move up the maturity curve. The differentiator within level 4 was the use of statistical metrics specifically designed to measure EA. This study found a relationship between the EA maturity level and the granularity of EA. Business units implemented EA at a coarse granularity of refinement across levels 1 and 2 maturities, implemented EA at a medium granularity within level 3 maturity, and a fine granularity within level 4 maturity.

This study opposed literature, that argues EA is a long-term investment, and that it is difficult to demonstrate any short-term value (Bricknall et al., 2006). This study demonstrated that EA brings both tangible and intangible forms of value, which RBV interprets as sources of short-term and long-term benefits.

The main findings of this study follow in the next section.

9.3 Main findings

The objectives of this research included understanding the connection between the EA maturity of an organisation and the business value associated with it, within the South African financial services environment. It further included establishing the levels of EA maturity, as well as the granularity of EA that was in use. Finally, this study explored the forms of tangible and intangible value obtained from EA. The results from this study addressed those objectives as follows.

This research found that within level **1 maturity**, EA practices were primarily driven by a few individual staff members. The EA practices at this level were characterised as being ad hoc, with no unified practices across the various business, applications, technology, and data domains. Due to the dependency on specific individuals, EA documentation was a combination of high and low-quality artefacts. This documentation primarily included finance and communication artefacts. Interestingly, there was an insignificant technology linkage to business strategies, again dependent on the specific individuals involved in the projects. Moreover, EA did not prominently feature in these business unit strategy agendas. Business units at this level perceived EA as a tool for the technology department to document their systems. There was minimal involvement of senior management in the EA practices at this level. Interesting, business units at lower levels of maturity cited poor business engagement as a reason for the low adoption of EA. Business units operating within level 1 maturity generally implemented EA at a coarse granularity of refinement.

Tangible forms of value such as **hardware and software cost savings** were achievable at this level. This is an important outcome, as organisations taking advantage of EA, even on an ad-hoc basis, have the potential to experience immediate value in the form of this hardware and software cost savings. Intangible forms of value such as **visualisation** of systems were also achievable at this level that resulted in long-term benefits. The visibility of their hardware and software helped improve procurement decisions, assisted with the rationalisation of systems and licences by identifying duplication, helped identify noncompliant projects that were not aligned to the organisational strategy, prioritise items that generated high value, highlight costly and complex legacy systems, and flag minimally used applications. EA provided these business units with the visibility to gain a horizontal view of their business and IT landscapes. These business units developed simple blueprints to visualise their business processes, applications, and technologies.

The majority of business units, totalling 4 departments fell within **maturity level 2**, indicating that EA practices were still developing within the banks. The EA practices were characterised as being basic, with a notably reduced dependency on specific individuals. EA champions from these business units stated that maintaining the EA momentum was still challenging, as staff often had a limited understanding of its importance. These business units had simple blueprints as well as standards and principles of their current EA states. However, there were no future or target state architectures in place. There were also simple EA documents in use, however, with no linkage to the future state. Notably, there was an alignment between the business and technology departments as the technologies are mapped to the business objectives. However, business units at this level still perceived EA as a tool for the technology department. Moreover, EA still did not prominently feature in these business units' strategic agendas. There was selective involvement of EA by senior management, with various degrees of commitment. EA communications in these business units took place sporadically. However, their internal repositories were up to date with the current state environment blueprint architectures. Notably, these business units did not use any formal EA software tools. Furthermore, there was an insignificant influence of EA on the financial governance of technology procurement. Business units operating within level 2 maturity generally implemented EA at a coarse granularity of refinement.

Within level 2 maturity, tangible forms of value such as **increased revenue** were experienced. This short-term gain was achieved by the quick time to market deployment of new technologically advanced solutions, enabled by the visibility of EA. However, it was found that with time, competitors could procure or build similar technologies, which eventually levelled these benefits. Tangible forms of value such as **improved development time** were another benefit experienced. This value was achieved by building an EA repository of reusable components containing standard interfaces. The use of this EA repository enabled each new development task to take less time than the previous period. An intangible form of value such as reduced complexity was further attained. EA facilitated simplification through visibility, architectural standards, and principles that helped these business units group common functionality and streamline interactions through common interfaces that reduced implementation complexity.

The EA practices became more structured within business units from **maturity level 3** onwards. Business units had simple EA practices in place that were well accepted and communicated within the teams. They used EA processes to measure and share the outcomes of projects to their staff. The outcomes of these measurements were further used in project post-implementation reviews and staff performance reviews. EA documentation at this level was comprehensive, and importantly contained future target environments of the business unit. These target environments were 3-year end state visions of the business unit. Interestingly, business units at this level of maturity level incorporated their EA practices into strategic planning, by creating a link between EA and key projects. This essentially forced formal engagement between IT and business departments. By creating this link between EA and key projects, the business units were continually reminded of its importance. These business units also developed formal and informal awareness plans to endorse EA practices and communicate its value throughout the organisation. Interestingly, the procurement department included the EA team for any

IT purchases with cost-benefits considered. Business units operating within level 3 maturity generally implemented EA at a medium granularity of refinement.

Furthermore, as business units moved up the maturity curve to level 3, a more prominent transition from tangible to intangible forms of value took place. This study found that EA aided business units with **process improvements** by helping them visualise and understand complex interconnections between processes that were confusing, conflicting, or redundant. This intangible form of value enabled staff to visualise where process improvements were needed, as well as identify unnecessary steps. Another intangible form of value experienced at this level was **improved risk management**. Business units cited stringent legislative compliance regulations within the financial services sector, as well as frequent amendments to these regulations. EA influenced value by addressing various risk regulations in a holistic manner, creating common structures and synergy, while still meeting the individual regulatory compliance needs. It helped visualise the relationship between business unit risks, internal controls, and operational risk management. Furthermore, by segmenting the bank's environment into a clear application, technology, and data domains, EA helped business units manage risk created by the regulatory the requirements. As EA created an overall view of the business unit, any legislative amendments could be isolated, and its impact examined at different operational levels. Further, intangible forms of value such as improved **customer service** started to become prominent at this level. Business units found EA beneficial in visualising, planning, and mapping the customer journey across the individual departments such as marketing, sales, and call centres and it helped with the collaboration and sharing of customer experiences across these departments. Business units at this level were able to use EA to identify customer service problems that emerged at the handoff points between the business silos. Notably, EA provided the ability to design new customer processes as well as reinvent existing ones. This study found that as business units moved up the maturity curve, they experienced greater benefits than the previous level, implying tighter alignment between EA maturity and value at higher levels of maturity.

The one business unit within **level 4** of the maturity curve had a wider perspective of EA. They viewed EA as a practice that involved applying a set of tools and techniques to solve business problems. EA was entrenched into the business decision-making process. This study showed strong business-IT alignment practices with the technical teams aligning their priorities with the business objectives at higher levels of maturity. This view contrasted with business units at a lower maturity level that perceived EA as a blueprint, as well as an independent technology decision.

A differentiator at this level was the prevalent use of metrics such as *Delphi techniques*, *frequency analysis* and *the percentage of reuse of common designs* that specifically measured aspects of EA. Moreover, the EA processes were closely related to both core IT and business processes. Business units kept their EA documentation updated by reflecting the latest architectures that were in their production environments. Interestingly, these business units developed common reference models for them to comply with. Notably, senior management was actively involved in EA reviews and enhancements. These business units built strong internal skills by sponsoring and encouraging EA training. These business units regularly communicated EA benefits to all staff. Business units operating within level4 maturity implemented EA at a fine granularity of refinement.

Level 4 maturity experienced intangible forms of value such as **improved decision-making**. EA presented a consolidated, integrated view of large and complex business unit data in an understandable and easily comprehensible format. The blueprints and diagrams generated from EA assisted these business units to visualise and identify patterns in this data that subsequently helped them make better decisions. It helped create meaningful contexts in the data by identifying opportunities, improving customer service, and decreasing risk. EA was found to help these business units improve the accuracy and consistency of decisions across these areas of the product lifecycle. EA enabled **innovation** by assisting with the rapid implementation of new ideas. It provided value by providing business units with holistic visibility across the business and IT domains. Moreover, it assisted the business unit to understand the potential impact of change brought about by the innovation. It further helped them assess the viability of the innovation against its vision and strategic direction. Level 4 maturity further experienced intangible forms of value such as **enhanced customer insights**. EA enabled the business unit to create tailored offerings of products that directly targeted customer specific needs. EA structures further helped gain insights by connecting disparate data silos to create a single, integrated view, of a customer. The blueprints and diagrams generated from EA assisted these business units to create rich visualisations and identify patterns in the data within a single reference dashboard, without the need to access various disparate data silos. This gave them the ability to tailor and fine-tune bespoke offers for specific customers.

None of the business units operated within **level 5** maturity, indicating that although all the business units had invested in EA to some degree, more momentum was required to reach the top level of maturity. In order to move to level 5, the business units needed to further improve the focus on continuous improvement, and maintain the EA domains within a fine granularity of refinement. Furthermore, additional statistical control techniques were required to move to the next level. Literature shows that organisations adopting EA continuous improvement and statistical practices improve their *predictability,* as EA enables them to forecast scenarios and determine the optimal course of action when dealing with those scenarios. This predictability gives them the ability to optimise trade-offs between costs, benefits, and customer service within these scenarios (Curley et al., 2016; Grossman, 2018; Mishra et al., 2016).

These findings address the research aims and objectives identified in Chapter 1, and have implications as well as contributions for the academic body of knowledge and practitioners. These are discussed in the next section.

9.4 Contributions and Implications of this study for academics and practitioners studying EA

The results of this study respond to recent calls for research into understanding the relationship between EA maturity and value, as well as improving theoretical explanations (Boh and Yellin, 2007; Bui and Levy, 2017; Li, 2009; Ross et al., 2006; Tamm et al., 2015, 2011). These studies propose EA maturity as an area for future research. The implications of this research, set out below, include those of theoretical and practical consequences for academics and practitioners (Corley and Gioia, 2011; Crane et al., 2016; Denzin, 2017; Denzin and Lincoln, 2011).

9.4.1 Theoretical contributions and implications

For doctoral research, it is recommended that students “extend, clarify, or apply received theories in new and interesting ways, rather than introduce radical new grand theory paradigms” when making theoretical contributions (Makadok et al., 2018, p. 1530). These contributions should equate to “pieces of the puzzle” towards theory construction (Reynolds, 2015, p. 91). This research built a middle range theory using a qualitative approach and made the following contributions and implications.

Critical Realism Contributions and Implications

The methodological implications of this study relate to the critical realism research philosophy used for this project (Denzin, 2017; Denzin and Lincoln, 2011). Information systems research is dominated by the use of positivism and interpretivism philosophies (Archer et al., 2013, 1998; Sayer, 2000a, 2000b).

The application of critical realism in this study was therefore a methodological contribution (Archer et al., 2013, 1998; Sayer, 2000a, 2000b). Causality assisted with explanations by connecting concepts in order to understand cause and effect as well as deeply assess relationships between EA input and business value outputs variables (Yin, 2013). Furthermore, mechanisms supported the understanding unobservable underlying factors that influenced events and results (Archer et al., 1998; Bhaskar, 2015; Fletcher, 2016; O’Mahoney and Vincent, 2014; Sayer, 2000b).

Critical Realism was viewed within actual, empirical and real layers to addressed causality (Linder and Cantrell, 2000; Mingers, 2004; Mingers et al., 2013; Mingers and Willcocks, 2004). This ontology of three layers enabled the researcher to investigate beyond empirically observed events, and research within all three layers. The *real layer* included EA as an intangible resource that influenced the actual events (Linder and Cantrell, 2000; Mingers, 2004; Mingers et al., 2013; Mingers and Willcocks, 2004). This layer comprised of EA processes, communication, business-IT alignment, senior management involvement, and finance mechanisms assessed in this study. The *empirical* layer included observable experiences. It was a subset of the real layer, and influenced the actual layer (Linder and Cantrell, 2000; Mingers, 2004; Mingers et al., 2013; Mingers and Willcocks, 2004). EA practices were characterised as being *person dependent* within the first level of maturity, *under development* within the second level, *well defined* and *clear* within the third level, and *embedded into the culture* within the fourth level of maturity. Finally, the *actual* layer included the events generated by the mechanisms (Linder and Cantrell, 2000; Mingers, 2004; Mingers et al., 2013; Mingers and Willcocks, 2004). *Hardware* and *software* cost savings as well as *visualisation* benefits were experienced within the first level of maturity, *increased revenue, improved development time* and *reduced complexity* were experienced within the second level, *process improvements, enhanced risk management,* and *better customer service* experienced within the third level, and *improved decision-making, innovation, and enhanced customer insights,* experienced within the fourth level of maturity. This was important for this study, as positivism and interpretivism philosophies were comprised of linear ontologies, that operated within the empirical layer (Mingers et al., 2013; Raduescu and Vessey, 2009).

This study contributed to these layers of critical realism by the uncovering of insights to help explain the forms of benefits, opportunities, and challenges that organisations experience as they moved through higher levels of maturity (Burton et al., 2014; Burton and Rycroft-Malone, 2014). It provided insights into the way these mechanisms influenced business value outcomes within the South African financial services environment.

RBV contributions and implications

According to Tamm (2011, p. 156), *"the most important shortcoming in existing research on EA benefits is the lack of rigorous empirical validation of the benefit claims*", as well as *"improving theoretical explanations*". This study theoretically contributed to the RBV research by examining EA as an intangible resource and maturity as a source of heterogeneity. It contributed to the RBV debate that suggested intangible resources are a source of long-term value, by demonstrating short-term and long-term benefits. This was achieved by identifying tangible and intangibles forms of value obtained from EA. This study further used maturity levels as a source of heterogeneity.

As discussed earlier, RBV explains the way that organisations transform their inputs into outputs (Amit and Schoemaker, 1993; Dutta et al., 2005). Although there are extensive RBV studies that examine various intangible resources as a basis of business value and competitive advantage (Larsson, 2005; Richard, 2010; Srivastava et al., 2001; Wiengarten et al., 2013; Wu and Chiu, 2015), there was limited research that examined EA as an intangible resource and a source of business value (Boh and Yellin, 2007; Kasemsap, 2018; Ross et al., 2006; Shanks et al., 2018; Tamm et al., 2015). Intangible resources are favoured over tangible resources, as they contribute more to organisational success, as they have the potential to improve the earning power (Foon, 2011; Kamasak, 2017; Kumlu, 2014). As a subset of intangible resources, EA capabilities incorporated tacit and explicit components that resided within organisational routines (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997). This study contributed to RBV as it linked tacit and explicit capabilities to maturity levels. It found that within lower levels of maturity, tacit EA capabilities were prevalent, as the business units often had a dependency on specific individuals. As business units moved up the maturity curve, more explicit capabilities became prominent, as EA was embedded into independent departmental routines.

Heterogeneity assumes that intangible resources of organisation's differ from each other and these differences influence business value (Makadok et al., 2018). Past studies did not focus on heterogeneity such as EA maturity levels, but simply identified EA as an intangible resource that led to value (Bui, 2012; Grant, 1991; Helfat et al., 2007; Helfat and Peteraf, 2003; López, 2005; Mahoney and Pandian, 1992; Vallerand et al., 2017). Notably, the few studies published (Bradley et al., 2012; Khaiata and Zualkernan, 2009; Venkatesh et al., 2007) have produced disparate results, demonstrating the need to better understand the different levels of EA maturity (Alwadain et al., 2014; Bui, 2012; Sprott, 2007; Tamm et al., 2015, 2011; Vallerand et al., 2017). Business units operating at *level 1* maturity, adhered to minimal EA practices, that were primarily driven by a few individual staff members. However, most of the business units operated within *level 2* maturity, indicating that EA practices were still being developed in those departments. Business units operating at *level 3* had clear and well-defined EA practices in place. One business unit operated within *level 4* maturity where EA had fully integrated into the business unit culture and used statistical techniques to measure EA. None of the business unit operated within *level 5* indicating that, although the business units had invested effort in EA, more momentum was required to reach the top level of maturity. Furthermore, immobility assumed that intangible resources were difficult to move across organisations. This study found that EA practices displayed less immobility at lower levels of maturity due to the dependency on individual efforts, and more immobility at higher levels of maturity, as EA was embedded into organisational processes.

RBV operationalisation is a topic of debate amongst scholars (Barney, 1991; Connor, 2002; Priem and Butler, 2001a, 2001b), as this framework did not contain any mechanisms (Connor, 2002; Priem and Butler, 2001a). This study contributed to theory by using ACMM as a supplementary theoretical framework to operationalise RBV, using mechanisms comprising of processes, communication, IT business alignment, senior management involvement, and finance (Bernard and Grasso, 2009; Daneva et al., 2007; De Carvalho et al., 2016b, 2015; Shahzada, 2010; Song and Song, 2010).

The study further examined EA and maturity as sources of *business value*. Literature revealed a wide plateau of views on the term business value (Amit and Zott, 2001; Chatain and Mindruta, 2017; Chesbrough, 2012; Hwang and Christensen, 2008; Johnson et al., 2008; Kashyap et al., 2017; Sorescu et al., 2011). This study demonstrated that as an input, EA (intangible capability) is responsible for tangible and intangible output forms of value. Output forms of value such as *hardware cost savings, software cost savings, increased revenue,* and *improved development time,* were tangible benefits (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-Belkaoui, 2003). Other forms of value such as *visualisation*, *process improvements, reduced complexity*, *improved risk management*, *enhanced customer service, improved decision-making, innovation, and enhanced customer insights,* were intangible forms of value generated by EA (Galbreath and Galvin, 2008; Kamasak, 2017; Riahi-

Belkaoui, 2003). This study found that the forms of value realised from EA were relative to the maturity level of a business unit. It found that different forms of tangible and intangible business value are obtained at different levels of maturity. This research found that at the *first* level of maturity, forms of value such as *hardware cost savings, software cost savings,* and *improved visualisation* were experienced. At the *second* level of maturity, forms of value such as *increased revenue, improved development time,* and *reduced complexity* were attained. *Process improvements, improved risk management,* and *improved customer service* were attained at the *third* level. *Level 4* maturity experienced forms of value such as *improved decision-making, innovation, and enhanced customer insights*. None of the business units were rated at *level 5*.

Under the VRIO lens (Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997), EA was considered to be a *valuable* resource due to the value outputs demonstrated above. However, it could not be considered a *rare* resource, as both this study and literature (Vallerand et al., 2017) demonstrated that it was easily acquired. Moreover, it was found that EA could be easily *imitated* at lower levels of maturity; however, it was difficult to imitate at higher levels primarily due to EA's path dependency and social complexity. Finally, individual business units easily exploited EA; however, the structure of large financial services *organisations* was problematic for EA due to the federated silo model. VRIO assumed a linear approach when assessing resources (Knott, 2015), and as EA did not meet criteria such as rarity, it could not be considered a source of *sustainable* competitive advantage, but rather a source of competitive *parity* (Barney, 1991; Li, 2009; Rothaermel, 2015; Woodruff, 1997).

Causality connects concepts in order to understand cause and effect (Yin, 2013). Causal ambiguity is created when the relationship between an input resource and its output value are not clearly understood by an organisation or its competitors (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997). However, there is a paradoxical relationship, as although it makes it difficult for competitors to imitate organisational resources, it is also difficult for organisations to understand their own resource relationships (King and Zeithaml, 2001; McIver and Lengnick-Hall, 2017; Powell et al., 2006). This study reduces causal ambiguity as it improves the understanding of the link between the EA maturity of an organisation and the business value associated with it within the South African financial services environment. However, causal ambiguity, makes some competitors forfeit resource imitation in favour of resource substitution, that could achieve similar value outputs (King, 2007; McEvily et al., 2000). The implication of this phenomenon on this study is that business units could substitute EA with other capabilities to achieve the value outcomes identified in this study.

Within RBV, the cycle of feeding outputs back into an organisation is referred to as systems perspective (Huh, 2013; Morecroft, 2002). This research partially addressed systems perspective by categorising the value outputs into tangible and intangible concepts, that would lead in turn lead to short-term and long-term value for an organisation (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984).

This research linked its outcomes to the forms of value found in RBV literature. This study found that *reduced system complexity* (Gerber et al., 2010; Kappelman et al., 2008; Lapalme et al., 2016; Rouhani et al., 2013; Schekkerman, 2011) was achievable for business units operating from EA maturity level 2 onwards. Furthermore, unlike literature that viewed *business-IT alignment* as an output value, this study viewed it as a mechanism and enabler to achieve value. Moreover, *improved system integration and standardisation* (Boh and Yellin, 2007; Richardson et al., 1990; Venkatesh et al., 2007) were attainable from level 2 maturity onwards. Finally, *efficient IT management w*as attainable across levels 1 and 2 maturities.

EA Framework implications

As discussed in section 2.4.7, an analysis of Zachman Framework, FEA, GEAF, DoDAF, TEAF and TOGAF (Browning, 2014; Cameron and Mcmillan, 2013; Department of Defense, 2010; Federal government of the United States, 2013; Harrison, 2013; Lapkin et al., 2008; Rouhani et al., 2013; Sessions, 2007; Urbaczewski and Mrdalj, 2006; US Office of Management and Budget, 2012; Zachman, 2012) was conducted using criteria adapted from literature (Leist and Zellner, 2006; Sessions, 2007; Urbaczewski and Mrdalj, 2006). This contribution is summarised in Appendix 26.

The assessment revealed that the major EA frameworks differed in terms of their *guidelines* for their procedures and processes, *business focus* in terms of business-IT alignment, *vendor neutrality* in terms of the framework's independence, the accessibility of free quality information, and *time to value* as the length of time required for a framework to start delivering business value. Hence, the selection of an EA framework has to be based on organisational specific requirements or areas of concern (Odongo et al., 2010; Rouhani et al., 2013; Sessions, 2007; Urbaczewski and Mrdalj, 2006). Although all the frameworks had strengths and weakness, TOGAF was selected as a reference for this research because it contained balanced business, application, technology, and data domains (Urbaczewski and Mrdalj, 2006) that supported the objectives of this study. This assessment is valuable to scholars researching EA frameworks.

TOGAF Framework Implications

TOGAF, the EA framework used in this study decomposes EA into business, application, technology, and data domains (Harrison, 2013). However, the literature did not show the granularity of refinements at the different levels of maturity, in order for organisations to understand where to focus their effort (Bui, 2012; Tamm et al., 2015, 2011; Vallerand et al., 2017; Wang and Zhao, 2009). Illustrated in Table 7.1, this study contributed to TOGAF literature as it uncovered that business units generally implemented EA at a coarse granularity of refinement across levels 1 and 2 maturities, generally implemented EA at a medium granularity within level 3 maturity, and a fine granularity within level 4 maturity. This outcome is valuable to scholars researching TOGAF.

Maturity model Implications

This study contributed to literature by assessing dominant maturity models. Maturity models such as QMMG assisted organisations to visualise progress over time and assess quality management (Albliwi et al., 2014), however, its implementation was highly subjective and dependent on a researcher's experience (Albliwi et al., 2014). Stages of Growth (Nolan, 1979) was used by organisations to understand and analyse complex IS problems (De Carvalho et al., 2015; Lee and Lee, 1991), however, its empirical validity was been disproven by several researchers (Benbasat et al., 1984; Drury, 1983; Peter Gottschalk, 2002; King and Kraemer, 1984; Lee and Lee, 1991). CMM produced cost saving benefits (Doss et al., 2017; Herbsleb et al., 1997; Jasmine, 2010; Müller, 2011; Paulk et al., 2006; Rosemann and de Bruin, 2005), however, scholars argued that CMM (and its derived models) was not appropriate for every type of organisation and was not mandatory for successful software development (Rosemann and de Bruin, 2005).

Although QMMG, Stages of Growth, and CMM, had strengths and weakness, CMM was selected as a reference for this study because it met the needs of this study by clearly identifying levels of maturity (Paulk et al., 1993). Moreover, empirical evidence showed that organisations adopting CMM obtained higher returns on their original investment (Doss et al., 2017; Herbsleb et al., 1997). Literature demonstrated that CMM was used as a blueprint to derive other maturity models (Burnstein et al., 1996; Paulk et al., 2006; Van Steenbergen et al., 2010), including several for EA maturity. The overall assessment in section 2.5 is valuable to scholars researching maturity models.

Conceptual implications

This study contributed to the understanding of the term business value, as literature revealed a wide plateau of views on this concept (Amit and Zott, 2001; Chatain and Mindruta, 2017; Chesbrough, 2012; Hwang and Christensen, 2008; Johnson et al., 2008; Kashyap et al., 2017; Sorescu et al., 2011).

This study found that the concept of value was not a static term, but rather a relative term, as different forms of tangible and intangible business value are attainable at different levels of maturity. Within the *first* level of maturity, tangible forms of value such as *hardware* and *software* cost savings, as well as intangible forms of value such as *visualisation*, were experienced. Within *level 2* maturity, business units experienced tangible forms of value comprising of *increased revenue* and *improved development time*, and intangible forms of value such as *reduced complexity*. Business units at *level 3* maturity experienced intangible forms of value such as *process improvements, enhanced risk management* and *better customer service*. Finally, this study revealed that within *level 4* maturity, intangible forms of value such as *improved decision-making, innovation, and enhanced customer insights* due to EA were experienced.

This view is supported in literature, where researchers stated "we propose that the difficulty of evaluating value stems from the abstract nature and nearly infinite range. As a result… it's not evaluated on a single scale, but instead on subscales composed of comparison standards that are selected at the time of judgment" (Buechel and Morewedge, 2014, p. 93).

General theoretical implications

The other implication relates to this study providing direction to literary material for academics wishing to research EA further (Denzin, 2017; Denzin and Lincoln, 2011). The literature review and references used for in study can direct researchers to academic publications relating to EA. Another contribution lies in the presentation of the quotes and direct excerpts from the individual interviews (Denzin, 2017; Denzin and Lincoln, 2011). These quotes and direct excerpts may be useful for other academics researching the concepts of EA, maturity or value (Denzin, 2017; Denzin and Lincoln, 2011). Finally, this study provides a basis for developing a comprehensive conceptual framework such as a grand theory for business value from which hypotheses could be proposed for later testing (Denzin, 2017; Denzin and Lincoln, 2011).

9.4.2 Practical contributions and implications

Similar to the theoretical significance, the practical implications of this research also relate to the identification of the forms of value that can be attained at the different levels of EA maturity. Establishing this relationship between EA maturity and business value is of particular importance to practitioners as organisations can understand the forms of value attainable at the different levels of maturity. The contribution to practice of this research not only lies in the forms of value, but also where organisations should devote their effort in order to reach higher levels of maturity. They could hence focus their efforts on the EA practices to attain the particular forms of value. Notably, this study demonstrated that value is influenced by EA, even at low levels of adoption.

This study was conducted within the South African financial services sector, across banking business units of different sizes, complexities, and maturity levels. This sector of the economy compares favourably to first world industrialised countries (Fosu, 2013; Taylor, 2012), due to its strong regulatory, compliance, risk, and legal frameworks (Falkena et al., 2004; Fosu, 2013; Luiz and Charalambous, 2009; Singh, 2004). Hence this sector is useful to practitioners seeking to obtain deeper insights into its operations. The case study approach provided a realistic account of the context for practitioners wanting to understand the way organisations move through levels of maturity and the extent to which the conclusions might apply in other contexts (Burton et al., 2014; Miles et al., 2014; Wynn and Williams, 2012). Furthermore, it provided practitioners with in-depth understanding of the forms of tangible and intangible value experienced, as organisations progress towards higher levels of EA maturity.

This research further provided insight into the mechanisms that successful organisations have deployed in order to capture value from EA. The findings of this study are beneficial to practitioners because understanding the EA practices can help them move up the maturity curve. Practitioners can further focus on EA mechanisms that are a source of long-term value, as opposed to quick wins. Hence practitioners embarking on new EA implementation efforts, as well as organisations with an institutionalised EA practice can benefit from this study.

The theoretical and practical implications of this study are therefore of importance to IS practitioners and academics involved in EA.

9.5 Biases of this research

Literature (Leedy and Ormrod, 2015, p. 185) describes bias as

> "*any influence, condition, or set of conditions that singly or together distort the data from what may have been obtained under the conditions of pure chance; furthermore, bias is any influence that may have disturbed the randomness by which the choice of a sample population has been selected… it is almost impossible to prevent data from being contaminated by some form of bias and the researcher should be sensitive towards any form of bias during his research*".

Precautions were taken to avoid bias as far as possible throughout the research. However, some biases exist within the individual interviews.

Literature (Leedy and Ormrod, 2015; Neuman, 2014) suggests that interviews rely profoundly on the skill of the interviewer, and therefore the quality of the results is also dependent on that factor. Researchers (Leedy and Ormrod, 2015; Neuman, 2014) suggest biases emerge with interviews due to its high-level of subjectivity and low level of control. Furthermore, in essence, the researcher becomes the measuring instrument and the accuracy is therefore questionable (Neuman, 2014). To moderate biases, semi-structured interviews using a standard interview protocol was used in this study (Leedy and Ormrod, 2015; Neuman, 2014).

Furthermore, the researcher was employed by one of the banks included in this study. However, to reduce biases, the specific business unit within which the researcher was employed was excluded from this study (Johnson, 2016; Lincoln and Guba, 2013).

9.6 Role of the researcher

Referred to as *positionality*, it is important for researchers to examine their backgrounds and perspectives when commencing a study. A researcher's personal, educational, and professional experience creates a lens that could influence their perspective on a study (Johnson, 2016; Lincoln and Guba, 2013). The researcher of this study is an industry practitioner. He has approximately 20 years of financial services experience and employed as a CIO by a major bank. Privately, he is an EA consultant, and non-executive board member of two large international organisations.

Researchers that possess *emic* knowledge have a pre-existing relationship with a case study organisation, share commonalities with the research participants, or have inside understandings of a research setting. In contrast, researchers that possess *etic* knowledge are not familiar with the research setting prior to commencing a study, or have minimal commonalities with the participants (Johnson, 2016; Lincoln and Guba, 2013). Noted above, the researcher is employed by one of the case study banks included in this research and has extensive years of industry experience, hence possessed emic knowledge (Johnson, 2016; Lincoln and Guba, 2013).

This study is not without its limitations, which follow in the subsequent section.

9.7 Limitations of this study

The main impediment of this study relates to the settings and participants (Maxwell, 2013; Patton, 2015). The research examined 9 business units in 3 banks across the South African financial services sector. The outcome, therefore, represented results related to participants and initiatives of these 3 organisations and may not be entirely transferable to other types of organisations or sectors (Maxwell, 2013; Patton, 2015). It would be interesting to expand this study to other organisations, sectors, or industries involved in EA.

The outcome of this study was derived by analysing qualitative responses from individual interviews, and not developed concurrently with a live project (Baskerville and Myers, 2015; McNiff, 2015). Future research should note this approach. To circumvent this limitation, an action approach is recommended by researchers (Baskerville and Myers, 2015; McNiff, 2015).

Moreover, the cross-sectional study approach allowed only a snapshot of data to be collected and analysed. Consequently, the empirical data represented ideas and thoughts that were collected during the time period of this research (Saunders et al., 2016).

Suggestions for additional research follow in the subsequent section.

9.8 Recommendations for further research

This study presented the influence of EA maturity on business value within the South African financial services environment. This research could be further expanded in the following ways.

Chapter 2.3.2 identified dynamic capabilities theory as a contending theory to RBV (Douma and Schreuder, 2013; Ludwig and Pemberton, 2011). Researchers argued that RBV is a precondition to dynamic capabilities as it builds and extends on RBV outcomes (Madhani, 2009; Teece et al., 1997). This study can be expanded by using dynamic capabilities theory, and focusing on an organisations ability to reconfigure EA in relation to outside industry forces (Bowman and Ambrosini, 2010; Ludwig and Pemberton, 2011; Teece et al., 1997).

Discussed in section 8.2, the cycle of feeding outputs back into an organisation is referred to as *systems perspective* (Huh, 2013; Morecroft, 2002). Researchers argue that this advances the traditional static RBV into the *dynamic* RBV (not to be confused with dynamic capabilities theory above), where an organisation is seen as a dynamic resource system (Morecroft, 2002). This research addressed the systems perspective by categorising the outputs into tangible and intangible concepts, that would lead in turn to short-term and long-term value for an organisation (Barney, 1991; Clulow et al., 2007; Korl et al., 2016; Penrose, 1959; Rothaermel, 2015; Wernerfelt, 1984). Further studies could assess constructs such as heterogeneity and immobility as well as extensions such as VRIO, to fully ascertain their influence once channelled back into an organisation's ecosystem.

Causality connects concepts in order to understand cause and effect (Yin, 2013). Causal ambiguity is created when the relationship between an input resource and its output value are not clearly understood by an organisation or its competitors (Barney, 1991; Bridoux, 2004; Li, 2009; Rothaermel, 2015; Woodruff, 1997). However, there is a paradoxical relationship, as although it made it difficult for competitors to imitate organisational resources, it is also difficult for organisations to understand their own resource relationships (King and Zeithaml, 2001; McIver and Lengnick-Hall, 2017; Powell et al., 2006). Hence, this study reduced causal ambiguity as it improved the understanding between the EA maturity of an organisation and the business value associated with it, within the South African financial services environment. However, causal ambiguity made some competitors forfeit resource imitation in favour of resource substitution, that could achieve similar value outputs (King, 2007; McEvily et al., 2000). The implication of this phenomenon on this study is that business units could substitute EA with other capabilities to achieve the value outcomes identified in this study. This argument requires further investigation, and is an area for future research.

This study found a relationship between the levels of EA maturity and the forms of business value experienced. This relationship could be further explored by developing additional research questions or hypotheses to assess this relationship. Such a result establishes another possible direction for future studies.

A limitation of this study related to the participants and the settings. Therefore, another possible direction for future research could be to replicate this study with different settings and participants, to observe whether the same results are obtained. Replicating the study would provide results to validate the EA value maturity relationship (Baskerville and Myers, 2015; McNiff, 2015).

Numerous studies have demonstrated the benefit of using metrics within organisations (Fenton and Pfleeger, 2014; Radjenović et al., 2013; Wallace and Sheetz, 2014). With the increasing adoption of EA, organisations experience various problems with the techniques required to measure and subsequently demonstrate the value of EA. Limited research has been conducted on EA metrics. This study identified the types of metrics used at the various levels of EA maturity. Importantly, level 4 maturity used metrics specifically designed to measure EA, such as the *number of projects that leveraged the EA repository for target state designs*, *the percentage of projects architecturally aligned*, the *percentage of reuse of common designs,* and *percentage of reuse of architectural components*. Additional research is required to extend this finding and understand the use of metrics.

Although none of the business units from this study operated within a level 5 maturity, literature shows that organisations adopting EA continuous improvement and statistical practices improve their predictability, as EA enables them to forecast scenarios and determine the optimal course of action when dealing with those scenarios (Curley et al., 2016; Grossman, 2018; Mishra et al., 2016). This relationship could be further explored by identifying the forms of value obtained by organisations operating at level 5 maturity.

Finally, this study could be extended by conducting a detailed quantitative evaluation. This would provide further awareness into the relationship between EA maturity and business value. Such a study could help quantify the value obtained or prove the effectiveness of the EA at the various levels (Baskerville and Myers, 2015; McNiff, 2015).

9.9 Closing remarks

A controversial, but still relevant article entitled "IT Doesn't Matter" (Carr, 2003), was published by Harvard Business Review over a decade ago. This article (Carr, 2003) suggested that the only way to get value from IT was to build it into the business.

This study found that business units at the lower maturity levels perceived EA as an independent technology function and used it predominately as a blueprint. Business units at higher levels of maturity have incorporated EA into their culture and made it part of their business operations. They viewed architecture as a practice that involved applying a set of tools and techniques to solve business problems. The EA practices were ingrained into the fabric of the business unit by ensuring all daily tactical operations were aligned with the future state. They placed emphasis on creating a culture of transformation and continuous evolution of driving themselves towards their specified future state goal. These findings are substantiated by the literature, which states that EA value arises through the use and integration of EA into the operations (Ross, 2006; Tamm et al., 2011; Ward et al., 2008).

The results provide strong evidence that as organisations move higher up the EA maturity curve, greater value is achieved. By improving the maturity of EA processes, clearly communicating business unit architecture, linking EA to business and IT efforts, involving senior management, and incorporating EA into financial decisions, organisations can move up the maturity curve and influence business value.

Although EA is not the panacea or “silver bullet” (Brooks, 1987, p. 10) to all issues associated with achieving value, it is definitely a vital piece to the puzzle. Literature shows that organisations which adopt EA obtain greater value than those that do not (Boh and Yellin, 2007; Kaisler et al., 2005; Li, 2009; Makadok, 2001; Ross et al., 2006; Tamm et al., 2015, 2011; Thong and Yap, 1995; Woodruff, 1997). This study demonstrated that organisations higher up the EA maturity curve achieve even greater business value. The findings presented in this research will be explored further in future studies by the researcher.

Chapter 10: References

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Appendix 1: Generic EA Benefits Table

EA Business Value	Reference
Achieve business-IT alignment	(Bricknall et al., 2006; Henderson and Venkatraman, 1993; Niemi, 2006b; Niemi and Pekkola, 2016; Pereira and Sousa, 2005; Wan et al., 2013)
Reduced cost	(Bernard, 2012; Lapkin et al., 2008; Niemi and Pekkola, 2016; Tamm et al., 2015; Wan et al., 2013)
Reduce system complexity	(Bucher et al., 2006; Gerber et al., 2010; Lankhorst, 2013a; Rouhani et al., 2013; Sessions, 2007; Wan et al., 2013)
Improve system integration	(Boh and Yellin, 2007; Richardson et al., 1990; Venkatesh et al., 2007)
Enhance IT management and strategic competitiveness	(Bernard, 2012; Cardwell, 2008; Kappelman et al., 2016; Ross et al., 2006)
Assist stakeholders visualise design	(Cardwell, 2008; Kruchten et al., 2006)
Better decision-making	(Bernard, 2012; Johnson et al., 2007; Spewak and Hill, 1993)
Improved organisational performance	(Bernard, 2012; Ross et al., 2006)
Reduced cycle time	(Bernard, 2012)
Better Information sharing and collaboration	(Boh and Yellin, 2007; Pereira and Sousa, 2005; Richardson et al., 1990; Spewak and Hill, 1993)
Improved software portability	(Richardson et al., 1990)
Better strategic agility and change capability	(Ross et al., 2006; Spewak and Hill, 1993; Tamm et al., 2015, 2011)
Improved customer responsiveness and intimacy	(Ross et al., 2006; Spewak and Hill, 1993; Venkatesh et al., 2007)
Enhanced productivity	(Spewak and Hill, 1993)
Business re-engineering	(Segars and Grover, 1996)
Economies of scale	(Venkatesh et al., 2007)
Improved business-IT alignment	(Aziz and Obitz, 2007; Gregor et al., 2007; Kappelman et al., 2016; Tamm et al., 2015, 2011)
Improved ROI from IT	(Kappelman et al., 2016; Ross et al., 2006)
Better situational awareness	(Kappelman et al., 2016)
Higher level of standardization and integration	(Bernard, 2012; Boh and Yellin, 2007; Hjort-Madsen, 2006; Ross and Westerman, 2004)
Improved data accuracy and reliability	(Ross et al., 2006; Venkatesh et al., 2007)
Resource overlap minimization	(Bernard, 2012; Boh and Yellin, 2007; Pereira and Sousa, 2005)

EA Business Value	Reference
Better legislative and regulatory compliance	(Ross et al., 2006; Winter and Fischer, 2006)
More reliable operating platform	(Boh and Yellin, 2007; Pereira and Sousa, 2005; Richardson et al., 1990; Ross et al., 2006; Spewak and Hill, 1993; Tamm et al., 2015, 2011)
Intelligent profitable growth	(Godinez, 2010)
Proactive risk management	(Godinez, 2010)

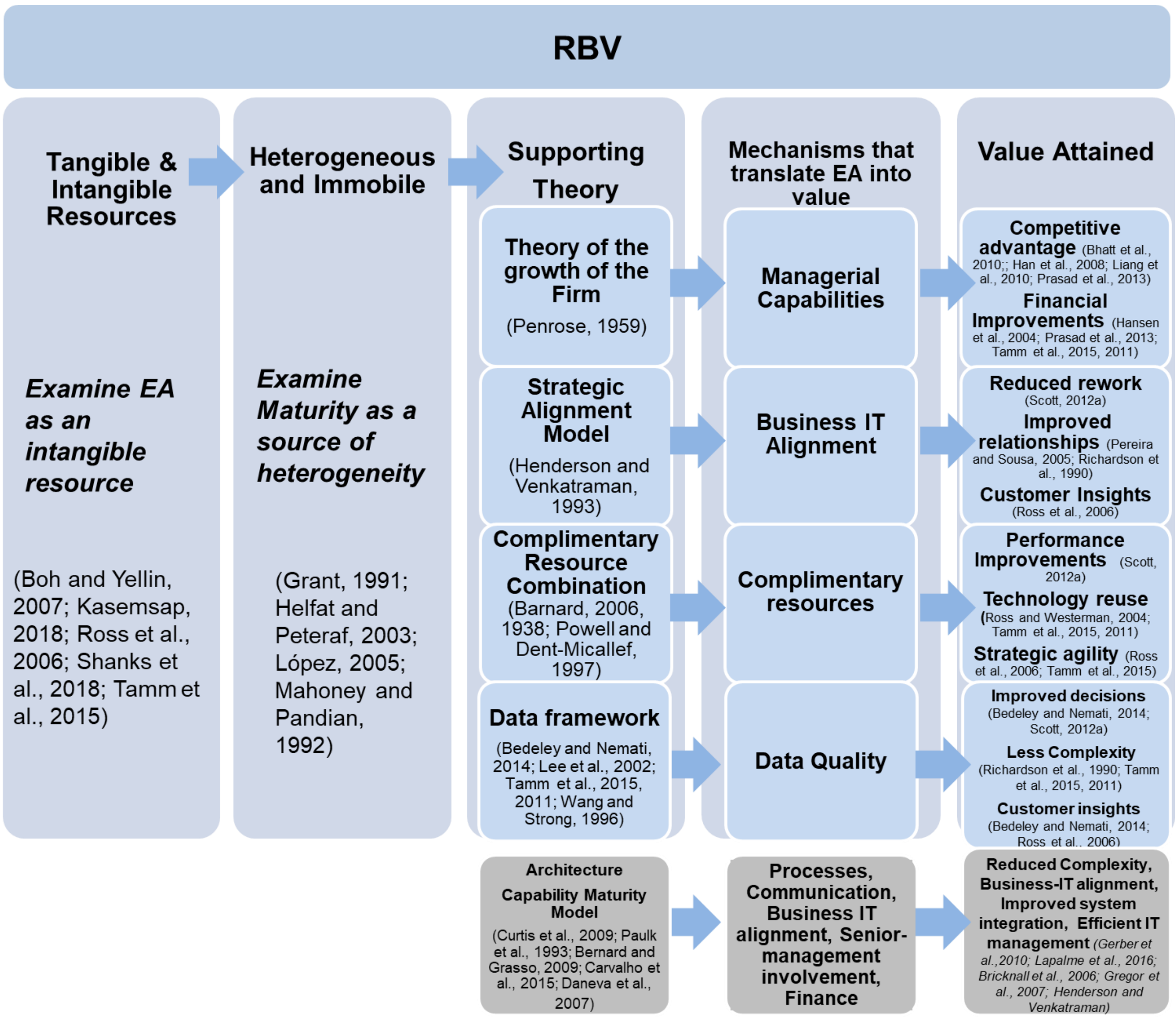
Appendix 2: ACMM Mechanisms and Characteristics

EA Mechanisms	Level 1 characteristics	Level 2 characteristics	Level 3 characteristics	Level 4 characteristics	Level 5 characteristics
1. EA Processes	Exists in ad-hoc. Some EA processes are defined. There is no unified EA process across technologies or business processes. Success depends on individual efforts.	Being actively developed. Basic EA Process program is documented. EA process has developed clear roles and responsibilities.	EA is well defined and communicated to IT staff and business management with business unit responsibilities. The process is largely followed.	EA process is part of the culture, with strong linkages to other core IT and business processes. Quality metrics associated with EA process are captured.	Concerted efforts to optimise and continuously improve EA process.
2. EA Communication	EA documentation, and standards are ad hoc or informal. Little communication exists about the EA process and possible process improvements.	IT Vision, Principles, Business Linkages, Baseline, and Target EA are identified. EA standards exist, but not necessarily linked to Target EA. Technical Reference Model and Standards Profile framework established. The business unit repository is updated periodically and is used to document EA deliverables.	Gap Analysis and Migration Plan are completed. EA standards linked to Business Drivers via Best Practices, IT Principles and Target EA. Fully developed Technical Reference Model and Standards Profile. EA aligns with the business unit and organisational EAs. EA documents updated and expanded regularly on	EA documentation is updated on a regular cycle to reflect the updated EA. Business, Information, Application and Technical EAs defined by appropriate de-jure and de-facto standards. The EA continues alignment with the business unit and organisation. An automated tool is used to improve the usability of EA. EA documents are	Defined and documented IT EA metrics are used to drive continuous process improvements. A standards and waivers process is used to improve EA development process improvements. EA documents are used by every decision maker in the organisation for every IT-related business decision.

EA Mechanisms	Level 1 characteristics	Level 2 characteristics	Level 3 characteristics	Level 4 characteristics	Level 5 characteristics
		EA. Communication about EA process via meetings, etc., may happen, but sporadic.	business unit repository Tools are used to support maintaining EA documentation. Periodic presentations to IT staff on EA content.	updated regularly, and frequently reviewed for latest EA developments/ standards. Regular presentations to IT staff on EA content.	
3. Business-IT alignment	Minimal, or implicit linkage to business strategies or business drivers.	Explicit linkage to business strategies	EA is integrated with capital planning and investment control. Explicit linkage to business drivers and information requirements	Capital planning and investment control are adjusted based on the feedback received and lessons learned from updated EA. Periodic re-examination of business drivers.	EA process metrics are used to optimise and drive business linkages. Business involved in the continuous process improvements of EA.
4. Senior-Management Involvement	Limited management team awareness or involvement in EA process.	Management awareness of EA effort. Selective management team involvement in EA process with various degrees of commitment/ resistance.	Senior management team aware of and supportive of the enterprise-wide EA process. Management actively supports architectural standards.	Senior management reviews EA and variances.	Senior management team directly involved in the optimisation of the enterprise wide EA development process and governance.

EA Mechanisms	Level 1 characteristics	Level 2 characteristics	Level 3 characteristics	Level 4 characteristics	Level 5 characteristics
5. Finance	Little involvement of strategic planning and acquisition personnel in enterprise EA process. Little or no adherence to existing standards	Little or no formal governance of IT Investment and Acquisition Strategy. business unit demonstrates some adherence to existing standards.	IT acquisition strategy exists and includes compliance measures to EA. Business unit adheres to existing standards. RFQ, RFI and RFP content is influenced by EA. Staff are actively involved in EA governance structure. Cost-benefits are considered in identifying projects.	All planned IT acquisitions are guided and governed by the EA. RFI and RFP evaluations are integrated into the EA planning activities.	business unit has no unplanned IT investment or acquisition activity.

Appendix 3: Organising Framework incorporating Supporting Theory and Mechanisms



Appendix 4: Interview Protocol

I trust that you are keeping well and thank you for agreeing to participate in this research. I have received your signed consent form in response to the letter that I have sent to you. To recap, the aim of this research is to understand the connection between EA maturity and the business value associated with it in the South African financial services environment. Recall that your participation in this is voluntary, and your anonymity and confidentiality will be safeguarded to the best of my ability by not linking any of your responses to you. I'd like to firstly check if you have any questions and are comfortable to proceed with the interview.

General
What is your position in the organisation?
Date

1. Process:
Part A: 1.1 **In what way has your business unit's EA processes been established?**
Probing questions: *Level 1: Are your EA processes ad hoc and informal.* *Level 2: Are there basic EA Process program documented with clear roles and responsibilities?* *Level 3: Is the EA process is well defined and communicated to IT staff and business management with business unit responsibilities. Is process is largely followed?* *Level 4: Is EA process is part of the culture, with strong linkages to other core IT and business processes. Are there quality metrics associated with the EA process are captured?* *Level 5: Are there concerted efforts to optimize and continuously improve the EA process?*
Part B: 1.2 In what way do these EA processes bring value to your department?

2. Communication:
Part A: 2.1 **In what way has the progression of your business unit's EA been communicated?**
Probing questions: *Level 1: Are EA processes informally documented, e.g. on emails? Little communication exists about the EA processes and process improvements.* *Level 2: Does your dept. have an IT Vision, Business Linkages, current EA that is documented. Is it linked to a target EA. Do you have EA standards in place? The business unit repository is updated periodically and is used to document EA deliverables. Communication about EA take place via meetings but may be sporadic.* *Level 3: Have you performed a gap analysis between current at target states. Are your EA standards linked to Business Drivers via Best Practices and Target Architecture? Are there fully developed EA and standards established. EA*

documents updated and expanded regularly on business unit repository. Regular presentations to staff on EA process. *Level 4: Is your EA documentation is updated on a regular cycle.* *Tools are used to support and maintain EA documentation? EA documents are updated regularly, and frequently. Regular presentations to staff on EA content.* *Level 5: Are there defined and documented EA metrics used to drive continuous process improvements. EA documents are used by every decision maker*
Part B: 2.2 In what way does EA communication help you to bring value to your department?

3. Business-IT alignment:
Part A: 3.1 **In what way has introducing EA influenced business-IT alignment in your business unit?**
Probing questions: *Level 1: is there minimal EA linkage to the business strategy?* *Level 2: Is there an explicit EA linkage to business strategy?* *Level 3: Is EA integrated with department budgeting and capital planning?* *Level 4: Is your departments department budgeting and capital planning adjusted based on the feedback received and lessons learned from updated EA.* *Level 5: EA metrics are used to optimize and drive EA and business linkages. Is business involved in the continuous process improvements of EA.*
Part B: 3.2 In what way does EA bring value in terms of achieving Business and IT alignment?

4. Senior Management Involvement
Part A: 4.1 **In what way are the senior managers of your business unit involved in the establishment and on-going development of EA?**
Level 1: Is there limited management team involvement in the EA process? *Level 2: Is there selective management team involvement in the EA process with various degrees of commitment?* *Level 3: Is the senior management team aware of and supportive of the EA process?* *Level 4: Is your senior management team directly involved in the EA review process?* *Level 5: is your senior management team directly involved in the optimization of the EA development process and governance?*
Part B: 4.2 In what way does EA bring value to senior managers in your business unit

5. Finance Strategy
Part A: 5.1 **In what way has introducing EA influenced your finance strategy?**
Probing questions: *Level 1: is there no involvement finance staff in the EA process.* *Level 2: Is there little governance of finance strategy.* *Level 3: Does your finance strategy includes compliance measures to EA.* *Level 4: All planned IT acquisitions and acquisitions are guided and governed by EA.* *Level 5: business unit has no unplanned IT investment or acquisition activity.*
Part B: 5.2 In what way does EA bring value to finance in your department?

6. EA Components (BA)
Part A: 6.1 In what way has your business unit implemented business architecture?
Probing questions: *Does your business unit have:* *A business strategy?* *Vision and Mission defined?* *Governance processes?* *Tactical goals?* *Strategic goals?* *Key business processes defined?* *Business capabilities defined?* *Relationships with internal and external stakeholders defined?*

7. EA Components (TA)
Part A: 7.1 In what way has your business unit implemented Technology architecture
Probing questions: *Does your business unit have architecture for:* *Hardware Infrastructure? Software Infrastructure?; Network Infrastructure?*

8. EA Components (AA)
Part A: 8.1 In what way has your business unit implemented application architecture

Probing questions: *Does your business unit have:* *Any architectural Patterns or Styles that are followed?* *A diagram (blueprint) of the individual systems?* *A diagram showing the interactions between the systems?* *A diagram showing the relationships to the core business processes?*

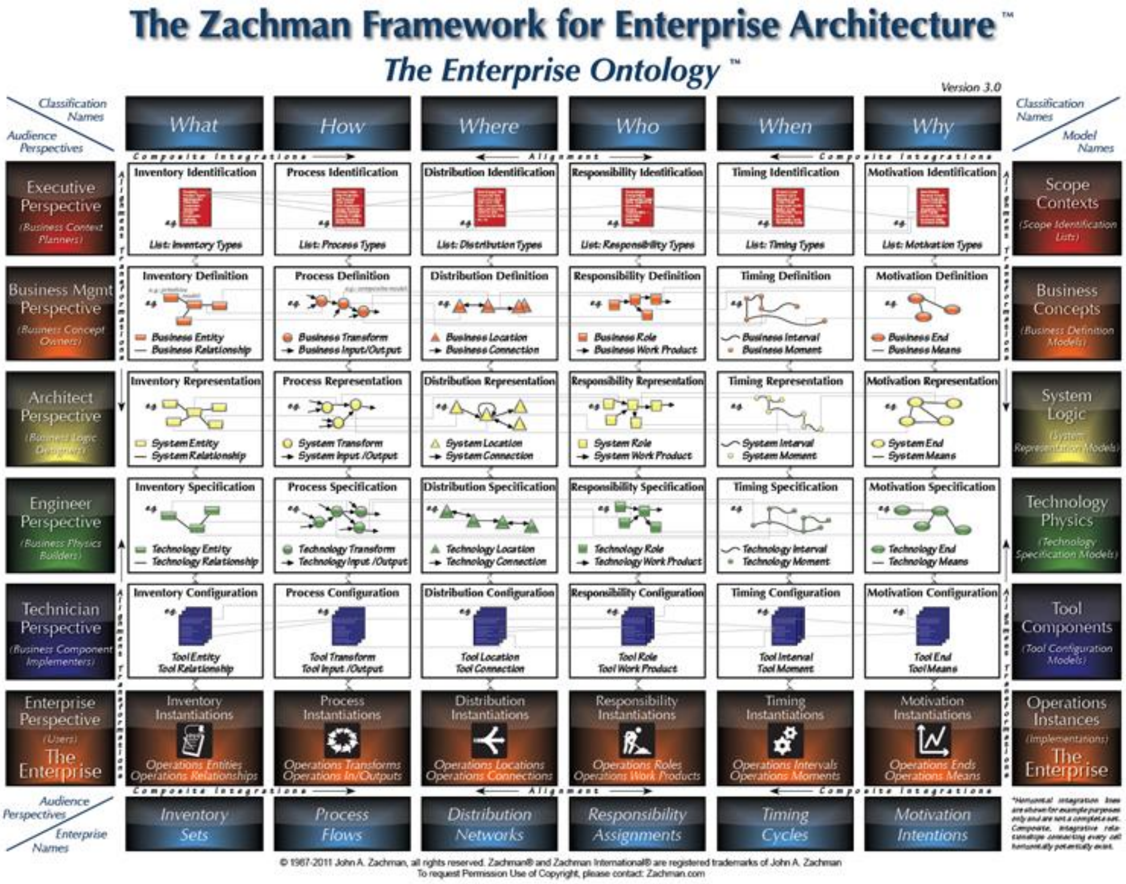
9. EA Components (data)
Part A: 9.1 In what way has your business unit implemented data architecture
Probing questions: *Does your business unit have logical and physical architecture for:* *Operational Data? Unstructured data?, Meta Data?, Master Data?, Analytical Data?*

Appendix 5: EA definitions from Literature

Author	Description	Number of unique citations aggregated from Scopus and EBSCO Host
(O'Rourke et al., 2003)	The general term architecture is defined as the design of any type of structure whether physical or conceptual, real or virtual Enterprise means a group of people organised for a particular purpose to produce a product or provide a service.	124
(Hite, 2003)	Providing to people at all organisational levels an explicit, common and meaningful structural frame of reference that allows an understanding of what the enterprise does, when, where, how and why it does it and what it uses to do it.	12
(Hoogervorst, 2004)	A coherent and consistent set of principles and standards that guides enterprise design.	151
(Kaisler et al., 2005)	EA identifies the main components of the organisation, its information systems, the ways in which these components work together in order to achieve defined business objectives, and the way in which the information systems support the business processes of the organisation. The components include staff, business processes, technology, information, financial and other resources. Enterprise architecting is the set of processes, tools, and structures necessary to implement an enterprise-wide coherent and consistent IT architecture for supporting the enterprise's business operations. It takes a holistic view of the enterprise's IT resources rather than an application-by-application view.	216
(Wegmann et al., 2005)	The design of business and IT system alignment is the domain of Enterprise Architecture (EA). Enterprise architects seek to align enterprise processes and structure with their supporting IT systems.	53
(Ross et al., 2006)	The organising logic for business processes and IT infrastructure reflecting the integration and standardization requirements of the company's operating model.	983
(Rohloff, 2006)	The fundamental organisation of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution.	44
(Grigoriu, 2006)	A conceptual blueprint that defines the structure and operation of an organisation. The intent of an enterprise architecture is to determine how an organisation can most effectively achieve its current and future objectives.	18
(Gregor et al., 2007)	A descriptive representation of the basic arrangement and connectivity of parts of an enterprise (such as data, information, systems, technologies, designs, business processes.	105
(Shah and El Kourdi, 2007)	An integrated and holistic vision of a system's fundamental organisation, embodied in its elements (people, processes, applications), their relationships to each other and to the environment, and the principles guiding its design and evolution	69
(Lapkin et al., 2008)	Enterprise Architecture is the process of translating business vision and strategy into effective enterprise change by creating, communicating and improving the key principles and models that describe the enterprise's future state and enable its evolution.	20

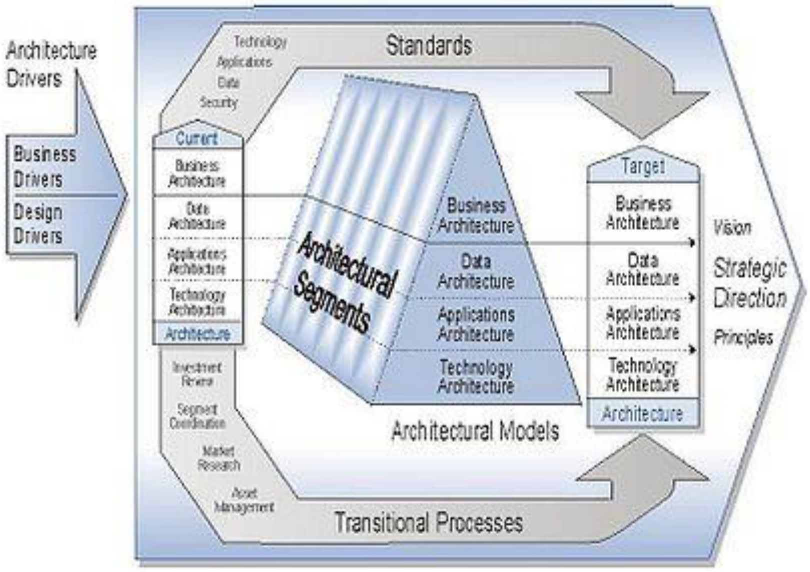
Author	**Description**	**Number of unique citations aggregated from Scopus and EBSCO Host**
(Op 't Land et al., 2009)	A coherent set of descriptions, covering a regulations-oriented, design-oriented and patterns-oriented perspective on an enterprise, which provides indicators and controls that enable the informed governance of the enterprise's evolution and success	234
(Dahalin et al., 2015)	Enterprise Architecture is a blueprint for how an organisation achieves the current and future business objectives using IT.	12
(Lin and Dyck, 2010)	A complete model of the enterprise; a master plan which acts as an integrating force between aspects of business planning such as goals, visions, strategies and governance principles; aspects of business operations such as business terms, organisation structures, processes and data; aspects of automation such as application systems and databases; and the enabling technological infrastructure of the business such as computers, operating systems and networks.	4
(Harrison, 2013)	The fundamental organisation of a system, embodied in its components, their relationships to each other and the environment, and the principles governing its design and evolution, and extends it with A formal description of a system, or a detailed plan of the system at a component level to guide its implementation and business, data, application and technology domains.	144
(Bernard, 2012)	The analysis and documentation of an enterprise in its current and future states from an integrated strategy, business and technology perspective.	271
(US Office of Management and Budget, 2012)	EA is a strategic information asset base, which defines the mission, the information necessary to perform the mission and the technologies necessary to perform the mission, and the transitional processes for implementing modern technologies in response to the changing mission needs. EA includes a baseline architecture, target architecture and a sequence plan	76
(Lankhorst, 2013b)	Coherent whole of principles, methods and models that are used in the design and realisation of an enterprise's organisational structure, business processes, information systems, and infrastructure.	122
(Kappelman and Zachman, 2013)	EA is a set of concepts and practices based on holistic systems thinking, principles of shared language, and the long-standing disciplines of engineering and architecture.	21
(Medini and Bourey, 2012)	A discipline for proactively and holistically leading enterprise responses to disruptive forces by identifying and analysing the execution of change toward desired business vision and outcomes. EA delivers value by presenting business and IT leaders with signature-ready recommendations for adjusting policies and projects to achieve target business outcomes that capitalize on relevant business disruptions. EA is used to steer decision-making toward the evolution of the future state architecture.	5

Appendix 6: Zachman Framework



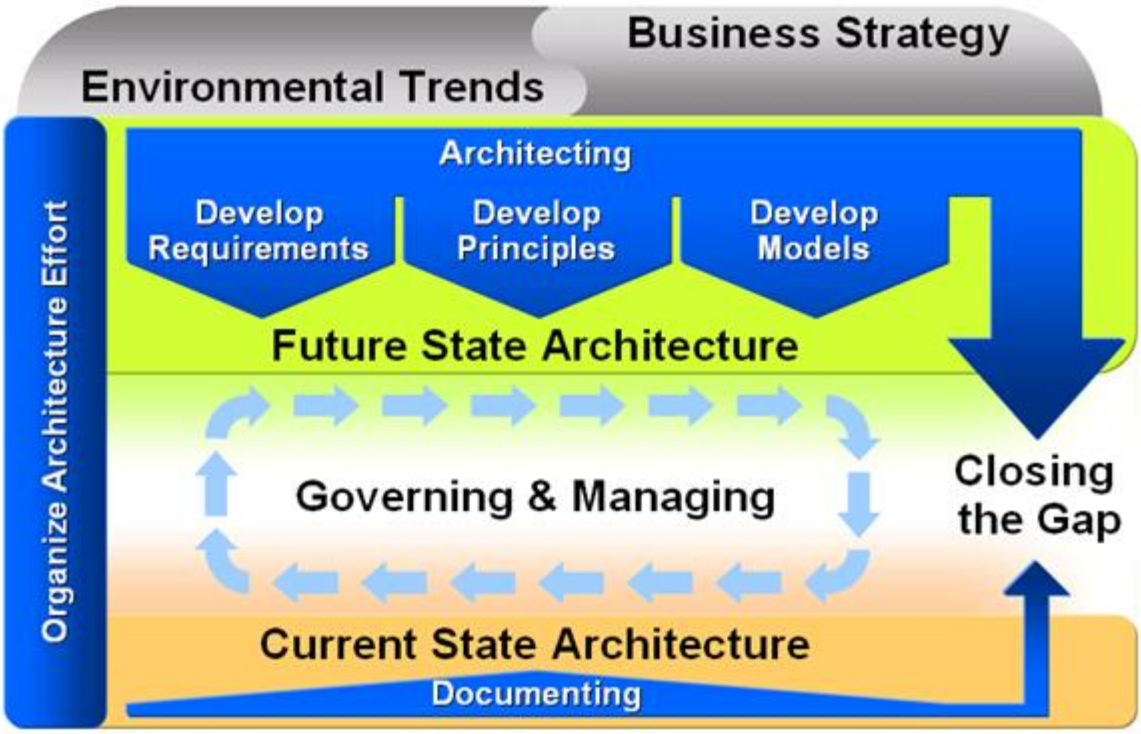
(Source: Zachman, 2012)

Appendix 7: Federal Enterprise Architecture



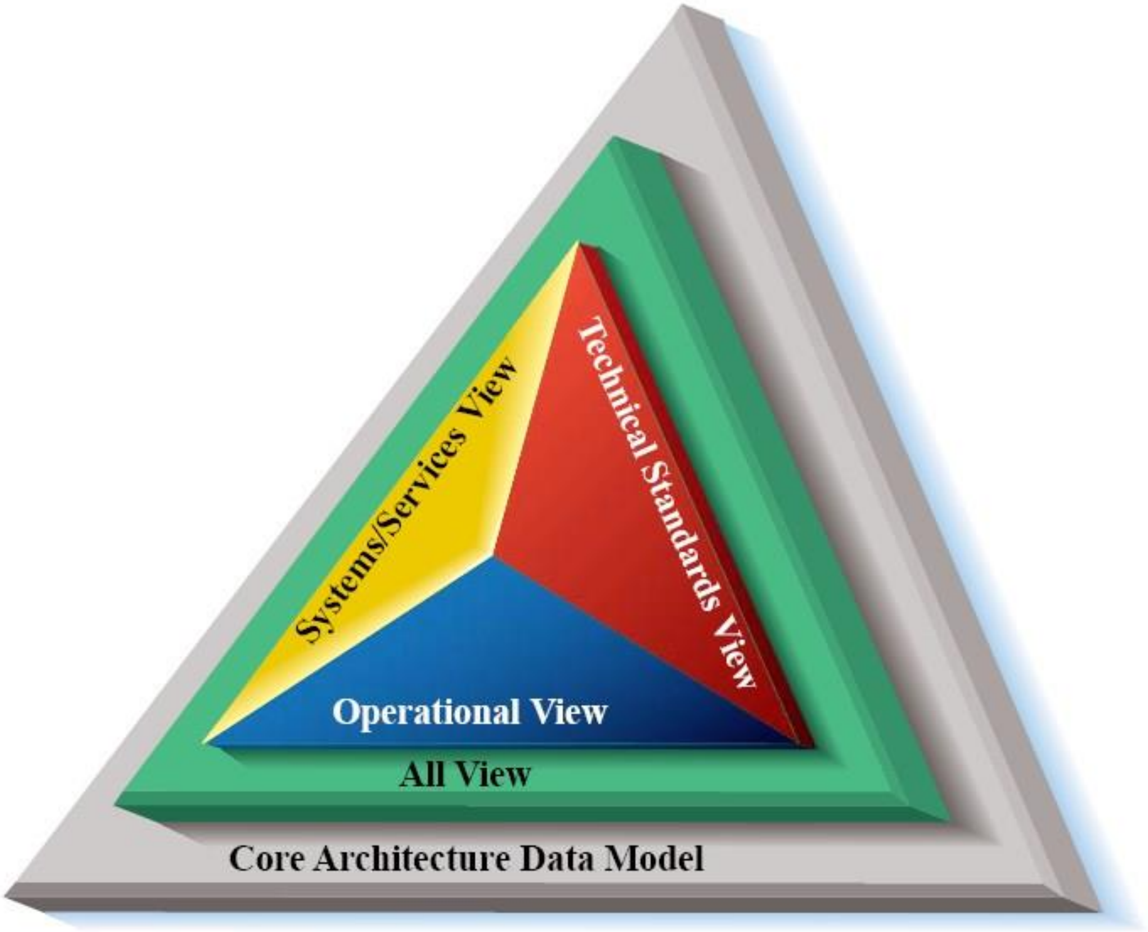
(Source: US Office of Management and Budget, 2012.)

Appendix 8: Gartner Enterprise Architecture Framework



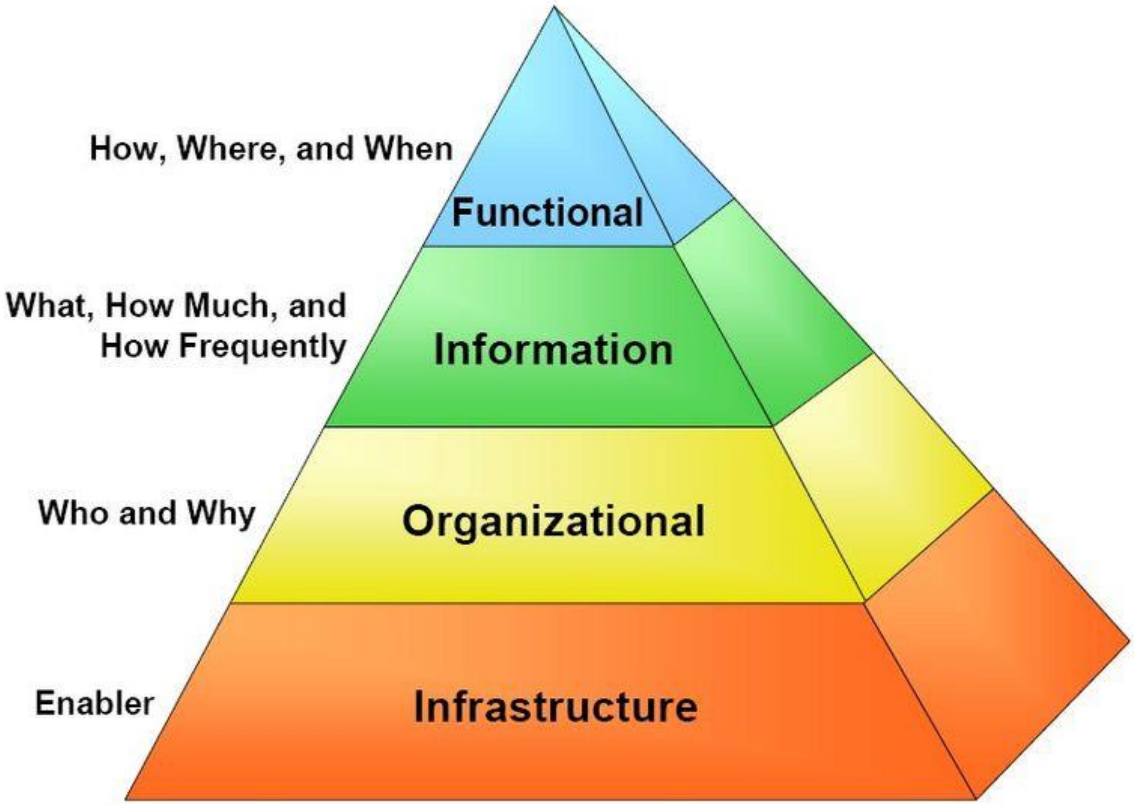
(Source: Gartner, 2016)

Appendix 9: Department of Defence Architecture Framework



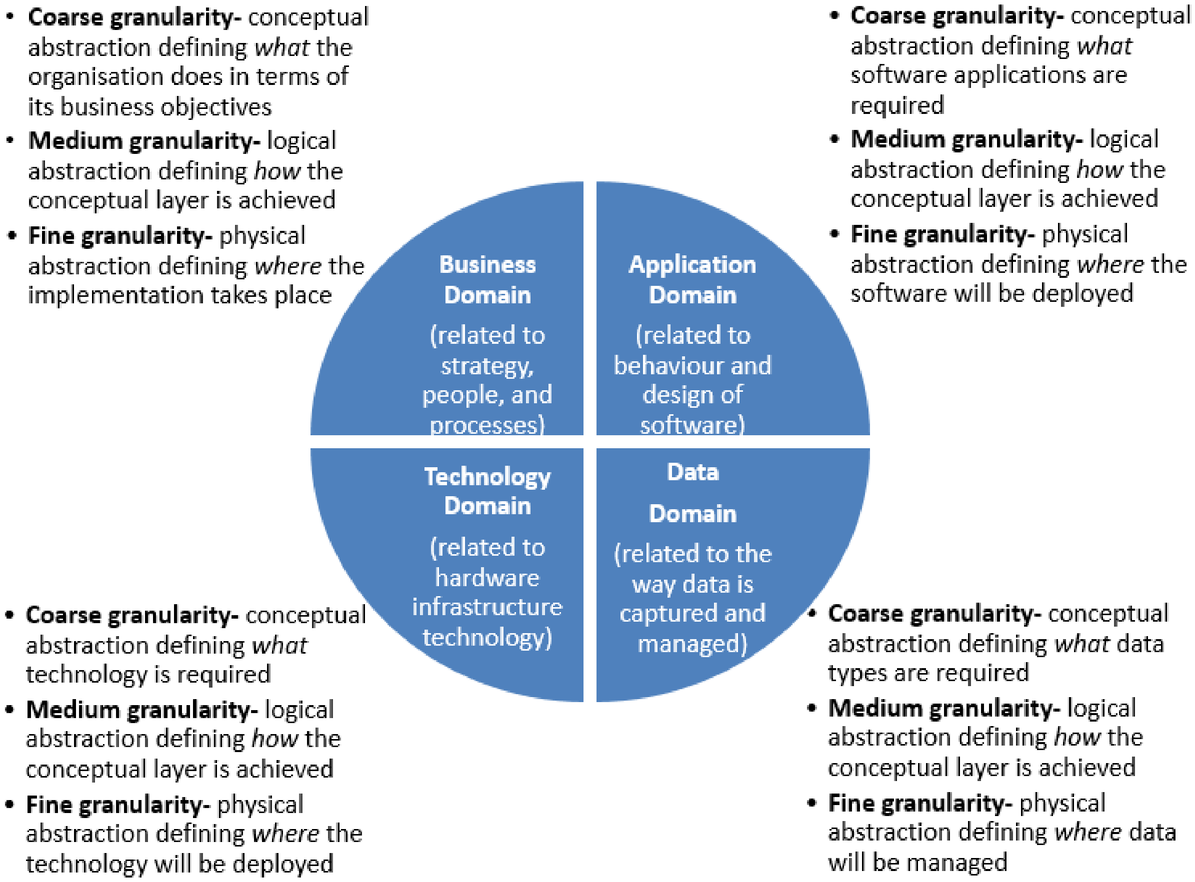
(Source: DoD, 2011)

Appendix 10: Treasury Enterprise Architecture Framework



Source: (Schekkerman, 2011)

Appendix 11: TOGAF domains and granularities



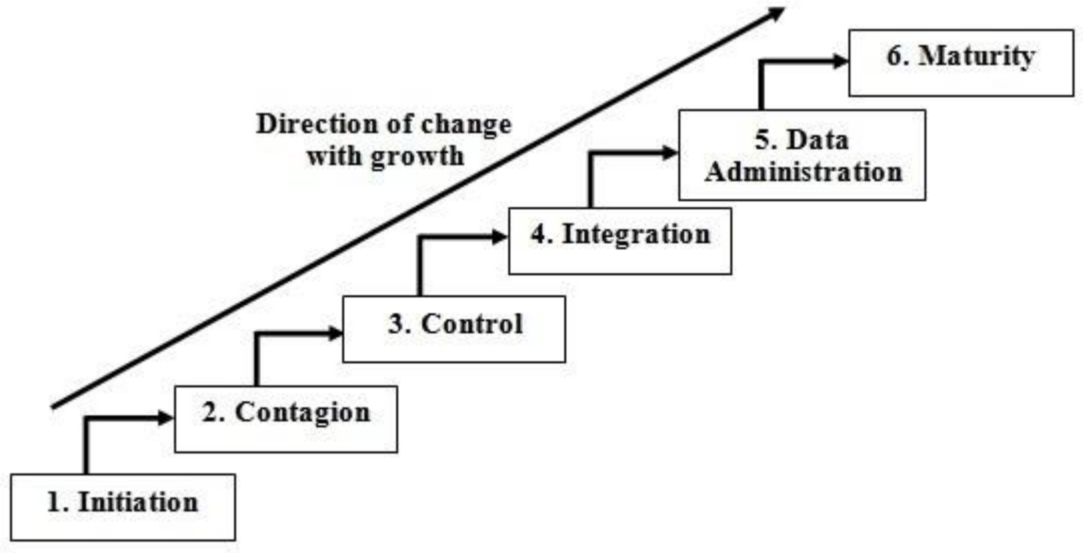
Adapted from (Harrison, 2013; O'Rourke et al., 2003; Zachman, 2017)

Appendix 12: QMMG

Quality Management Maturity Grid (Crosby)		Assessor:		Department:	
Measurement Categories	**Stage 1: *Uncertainty***	**Stage 2: *Awakening***	**Stage 3: *Enlightenment***	**Stage 4: *Wisdom***	**Stage 5: *Certainty***
Management understanding and attitude	No comprehension of quality as a management tool. Tend to blame quality department for "quality problems".	Recognising that quality management may be of value but not willing to provide money or time to make it all happen.	While going through quality improvement programme learn more about quality management; becoming supportive and helpful.	Participating. Understand absolutes of quality management. Recognise their personal role in continuing emphasis.	Consider quality management as an essential part of company system.
Quality organisation status	Quality is hidden in manufacturing or engineering departments. Inspection probably not part of organisation. Emphasis on appraisal and sorting.	A stronger quality leader is appointed but main emphasis is still on appraisal and moving the product. Still part of manufacturing or other.	Quality department reports to top management, all appraisal is incorporated and manager has role in management of company.	Quality manager is an officer of company; effective status reporting and preventive action. Involved with customer affairs and special assignments.	Quality manager on board of directors. Prevention is main concern. Quality is a thought leader.
Problem handling	Problems are fought as they occur; no resolution; inadequate definition; lots of yelling and accusations.	Teams are set up to attack major problems. Long-range solutions are not solicited.	Corrective action communication established. Problems are faced openly and resolved in an orderly way.	Problems are identified early in their development. All functions are open to suggestion and improvement.	Except in the most usual cases, problems are prevented.
Cost of quality as % of sales	Reported: Unknown Actual: 20%	Reported: 3% Actual: 18%	Reported: 8% Actual: 12%	Reported: 6.5% Actual: 8%	Reported: 2.5% Actual: 2.5%
Quality improvement actions	No organised activities. No understanding of such activities	Trying obvious "motivational" short-range efforts.	Implementation of a multi-step programme (e.g. Crosby's 14-step) with thorough understanding and establishment of each step.	Continuing the multi-step programme and starting other pro-active / preventive product quality initiatives.	Quality improvement is a normal and continued activity.
Summary of company quality posture	"We don't know why we have problems with quality".	"Is it absolutely necessary to always have problems with quality?"	"Through management commitment and quality improvement we are identifying and resolving our problems."	"Defect prevention is a routine part of our operation."	"We know why we do not have problems with quality."

Source: (Crosby, 1979)

Appendix 13: Stages of Growth



Source: (Nolan, 1979)

Appendix 14: Historical milestones on Business Value

Business Value

Objective Category

- The *objective classical theory of value* was introduced in the early seventeenth century. This theory highly focused on the production of commodities with reduced focus in their exchange environments (O'Brien 2004; King and McLure, 2014; Dobb and Dobb, 1975; Sinha, 2013; Fine, 2013)
- In the mid 17th century, Sir William Petty, a prominent economist observed that the exchange value of a commodity was influenced by the capacity of labour required to create it (Meek 1973)
- Later in the 17th century, Richard Cantillon, another influential economist separated the market price of a commodity from its intrinsic value. He concluded that the intrinsic value of a commodity is relative to the land and labour required for its production (Dobb 1975; O'Brien 2004)
- In 1776, Adam Smith, in the book *Wealth of Nations* stated that a *natural price* is determined by the cost of production. This includes labour costs, rent, and profit, and elaborated labour natural price, is the cost require to nurture workers families (Dobb 1975; O'Brien 2004)
- In 1817, David Ricardo introduced the *Labour Theory of Value*. This theory. He stated that for 'for wheat and similar products, value is calculated by the amount of labour required for production on the poorest land (King and McLure, 2014; Sinha, 2013; Fine, 2013)
- In the 1870's, Karl Marx adapted Ricardo's theory and stated that the value of goods and services is calculated by the labour socially required to produce it, as opposed to the enjoyment that its owner obtains from it (O'Brien 2004; King and McLure, 2014; Dobb and Dobb, 1975; Sinha, 2013; Fine, 2013)
- In 1960, Piero Sraffa demonstrated that as capital increases relative to scarce labour, it causes wages to increase and profits rates to decrease. He stated demonstrated "re-switching" from capital intensive methods back to labour intensive methods occurs (Kurz, 2003)

Subjective Category

- In the 1870's, *Marginal Utility and Equilibrium* theory was introduced by Jevons, Walras and Mengers. It stated that the value an individual obtains from the consumption of a good is determined by their subjective valuation of the pleasure obtained from that consumption (Mirowski, 1984; Kauder, 2015)
- In 1889, *Extended Dimensions to Utility Analysis*, introduced by Rudolf Auspitz and Richard Lieben stated that the value of an individual commodity is related to the quantities of all commodities (King and McLure, 2014)
- In the 1890's *Marginal Productivity and the Distribution of Product* theory, introduced by JB Clarke, stated that the input value into production must continue until the marginal product value is equal to the cost of the input, i.e. production must continue until breakeven point, thereafter value is achieved (Moseley, 2012; Feenstra, 2015).
- *Utility and Welfare* introduced by Pareto in the early 1900's, stated that it is impossible to make an individual better off without making another individual worse off (Hindriks and Myles, 2006; Barr, 2012; Sen, 1993.)

Appendix 15: Artefact Form

1. Process:
Part C: Are there any EA artefacts that support business processes in your business unit? If so, in what way?

2. Documentation:
Part C: Are there any EA artefacts that contribute to project documentation in your business unit? If so, in what way?

3. Business-IT alignment:
Part C: Are there any EA artefacts that support business-IT alignment in your business unit? If so, in what way?

4. Senior Management Involvement
Part C: Are there any EA artefacts that support senior management involvement in your business unit? If so, in what way?

5. Communication
Part C: Are there any EA artefacts that support business communication in your business unit? If so, in what way?

6. Finance Strategy
Part C: Are there any EA artefacts that support finance in your business unit? If so, in what way?

7. EA Components (BA)
Part C: In what way do the EA artefacts support your business unit's Business architecture If so, in what way?
Examples: Business requirement document; SWOT analysis; Capability document; Competitive strategy; Concept of Operations; Business plans; Swim lane diagrams; Business case; Strategy document Business proposal; Feasibility study; business architecture models

8. EA Components (TA)
Part C: In what way do the EA artefacts support your business unit's Technology architecture?
Examples: Technical specification; Network connectivity diagram; Network inventory; Capital equipment inventory; Network centre diagram; Cable plant diagram; Rack elevation diagram; Functional requirement; Non-functional requirement; Technical architecture models

9. EA Components (AA)
Part C: In what way do the EA artefacts support your business unit's Application architecture?
Examples: Use case; Interface diagram; Systems communication diagram; Systems interface matrix; System data flow diagram; System matrix; Systems data exchange matrix; Systems evolution diagram Class diagram; Application architecture models; Technical specification; Functional requirement; Non-functional requirement

10. EA Components (data)
Part C: In what way do the EA artefacts support your business unit's Data architecture?

Examples: Data warehouse specs; Knowledge management plan; Information exchange matrix; Transition diagram; Logical data model; Data dictionary; Data flow diagram; Data repository; Data architecture models

Appendix 16: Preliminary Thematic analysis Figures for: Bank A, business unit 1

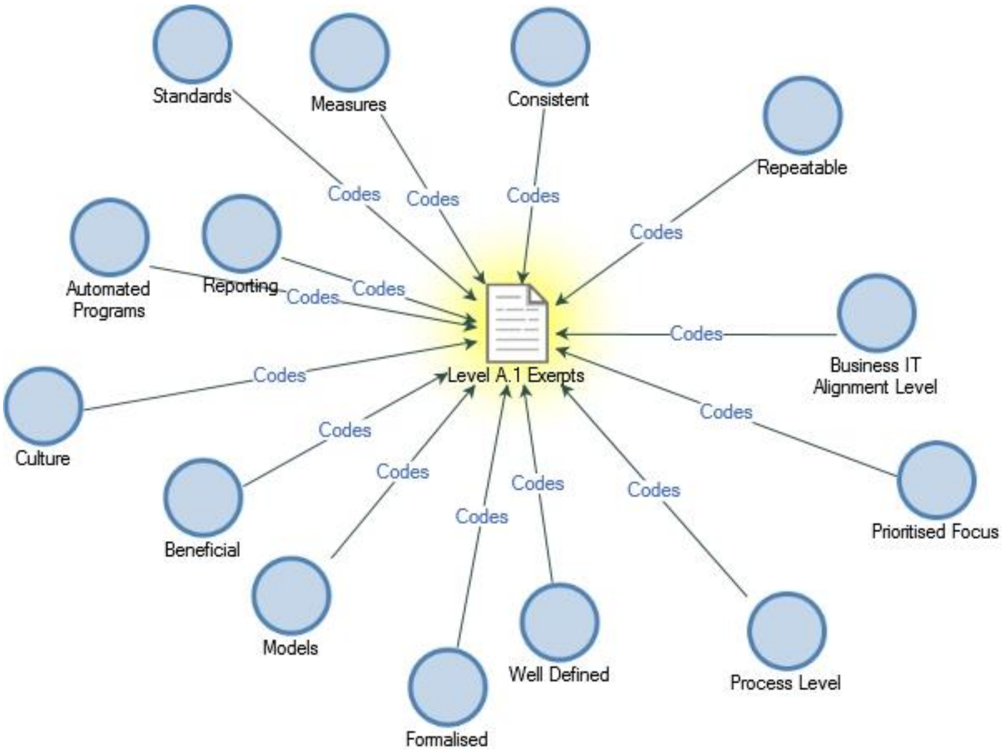


Figure: Appendix 16.1 - Preliminary mind map of levels

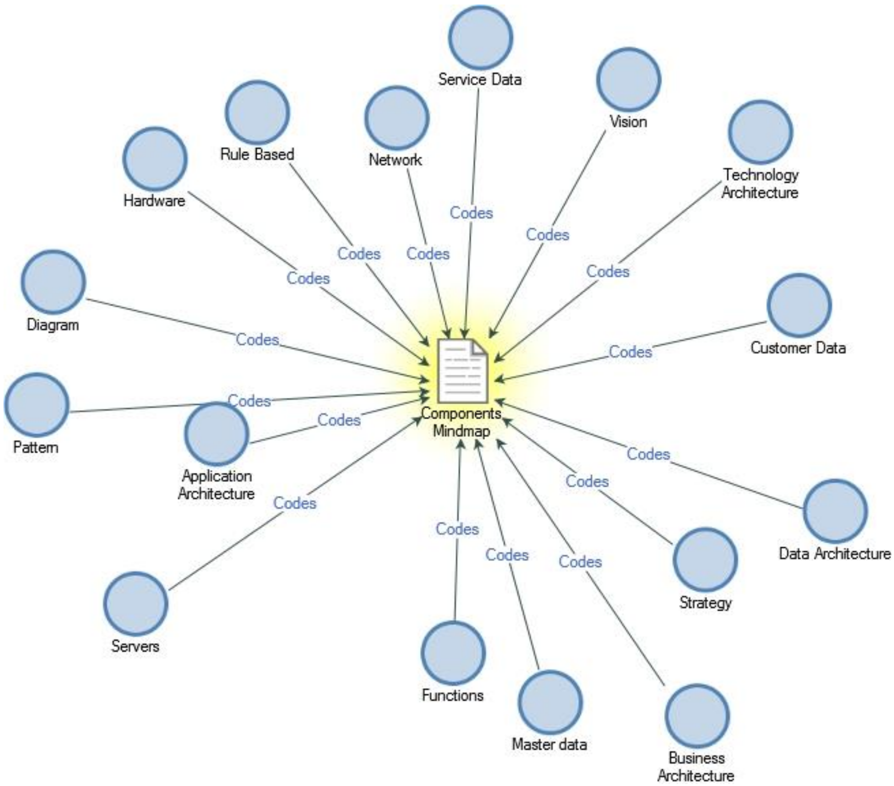


Figure: Appendix 16.2 - Preliminary mind map of Components

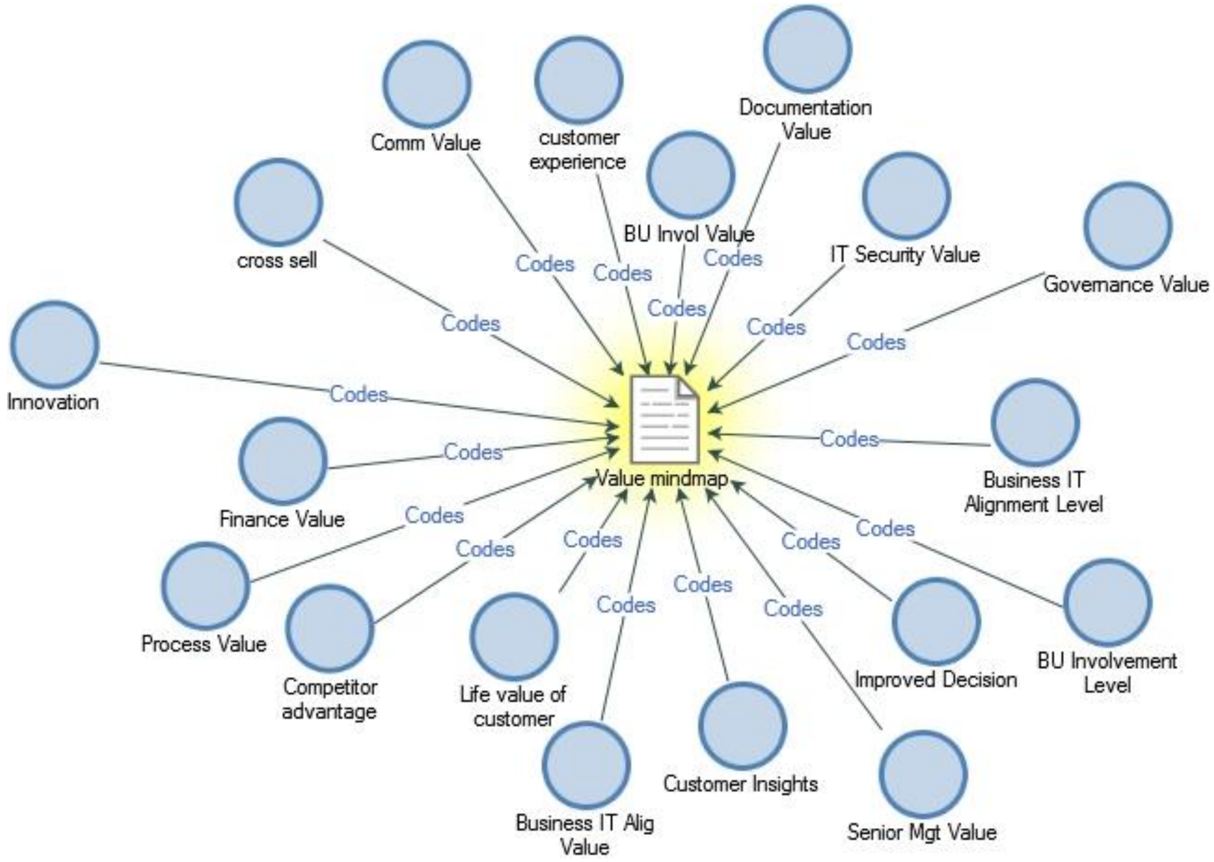


Figure: Appendix 16.3 - Preliminary mind map: Value of EA

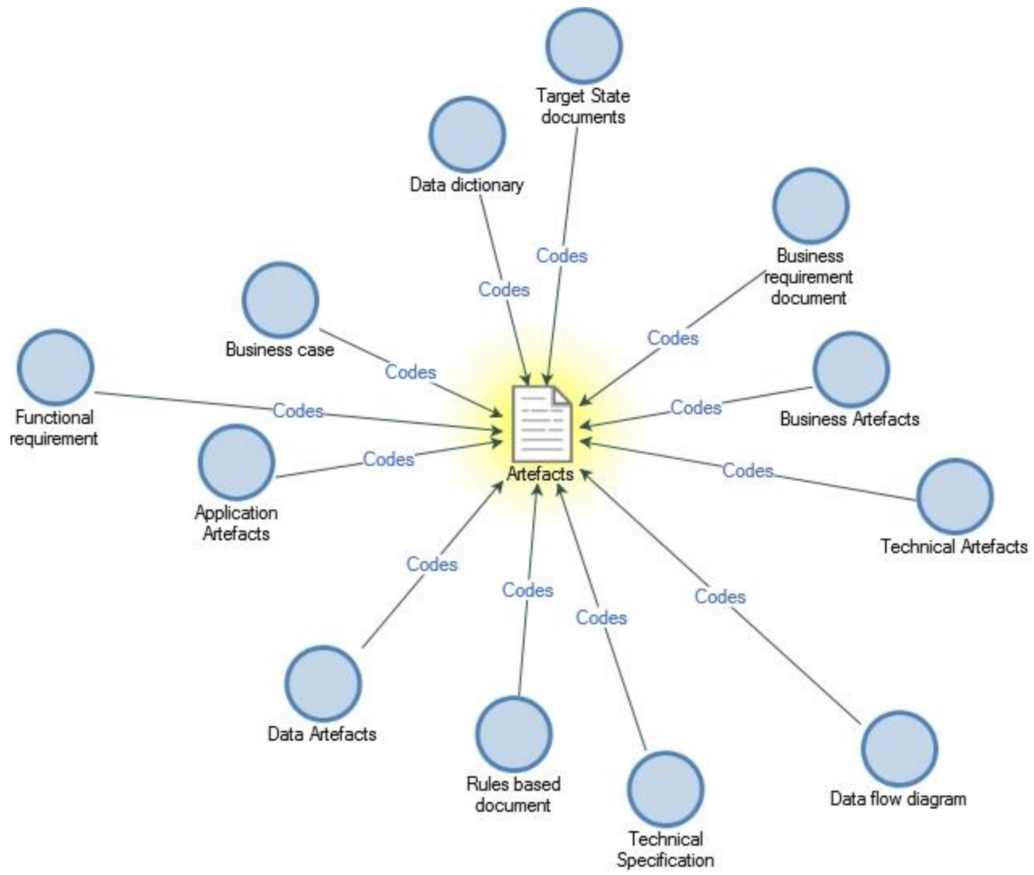


Figure: Appendix 16.4 - Preliminary mind map: Artefacts of EA

Appendix 17: Preliminary Thematic analysis Figures for: Bank A, business unit 2

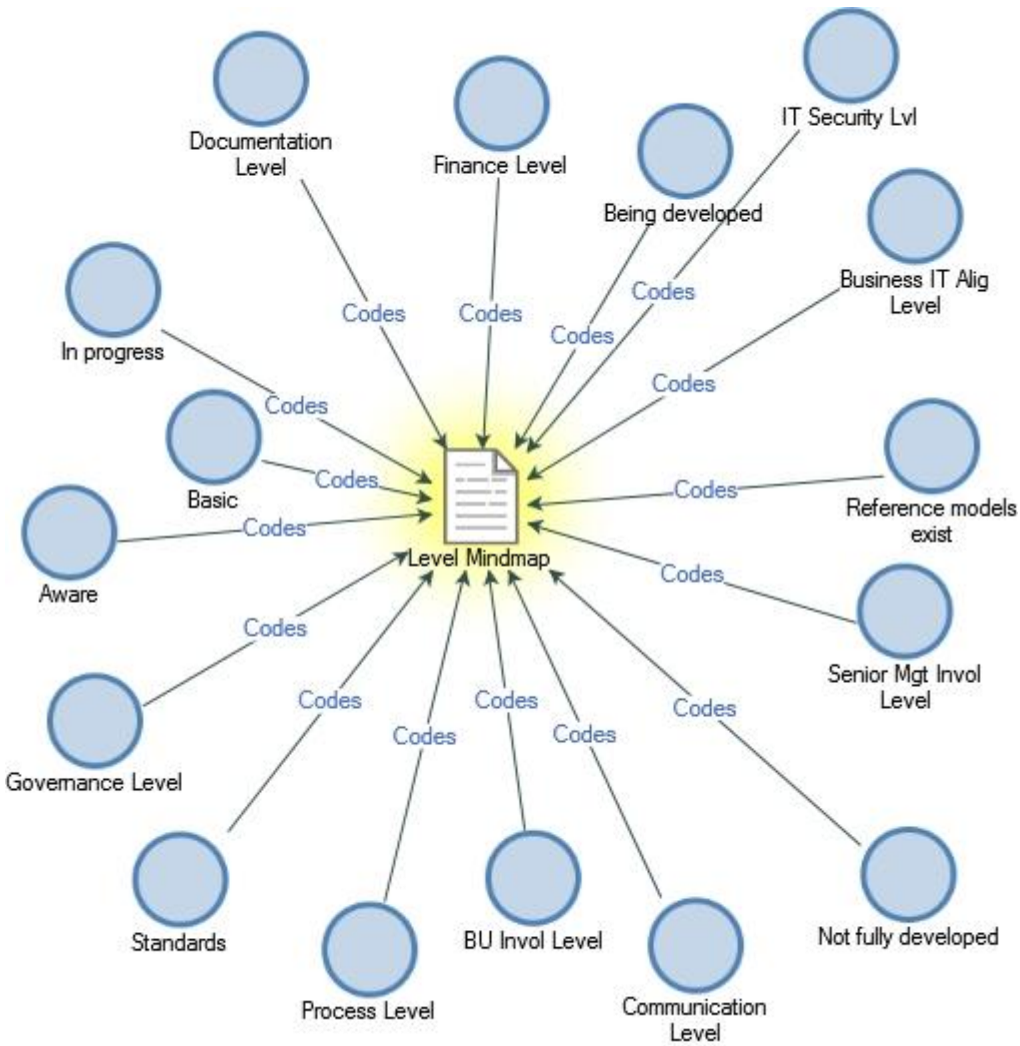


Figure: Appendix 17.1 - Preliminary mind map: Mechanisms of EA

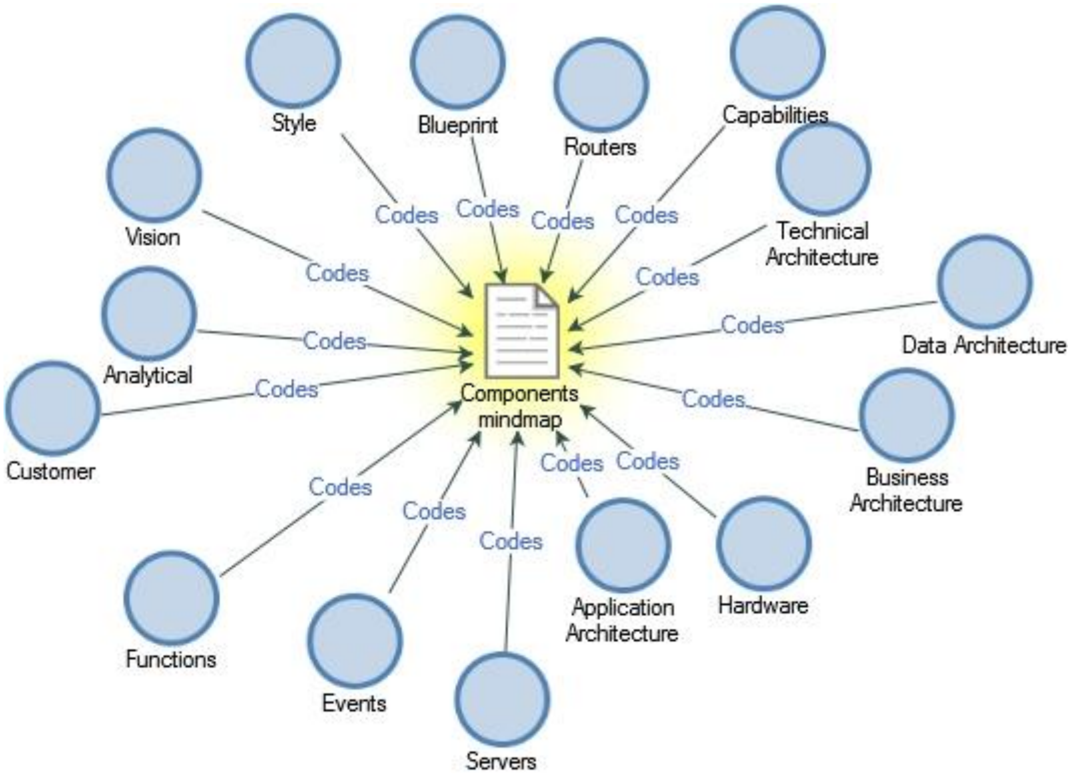


Figure: Appendix 17.2 - Preliminary mind map: Components of EA

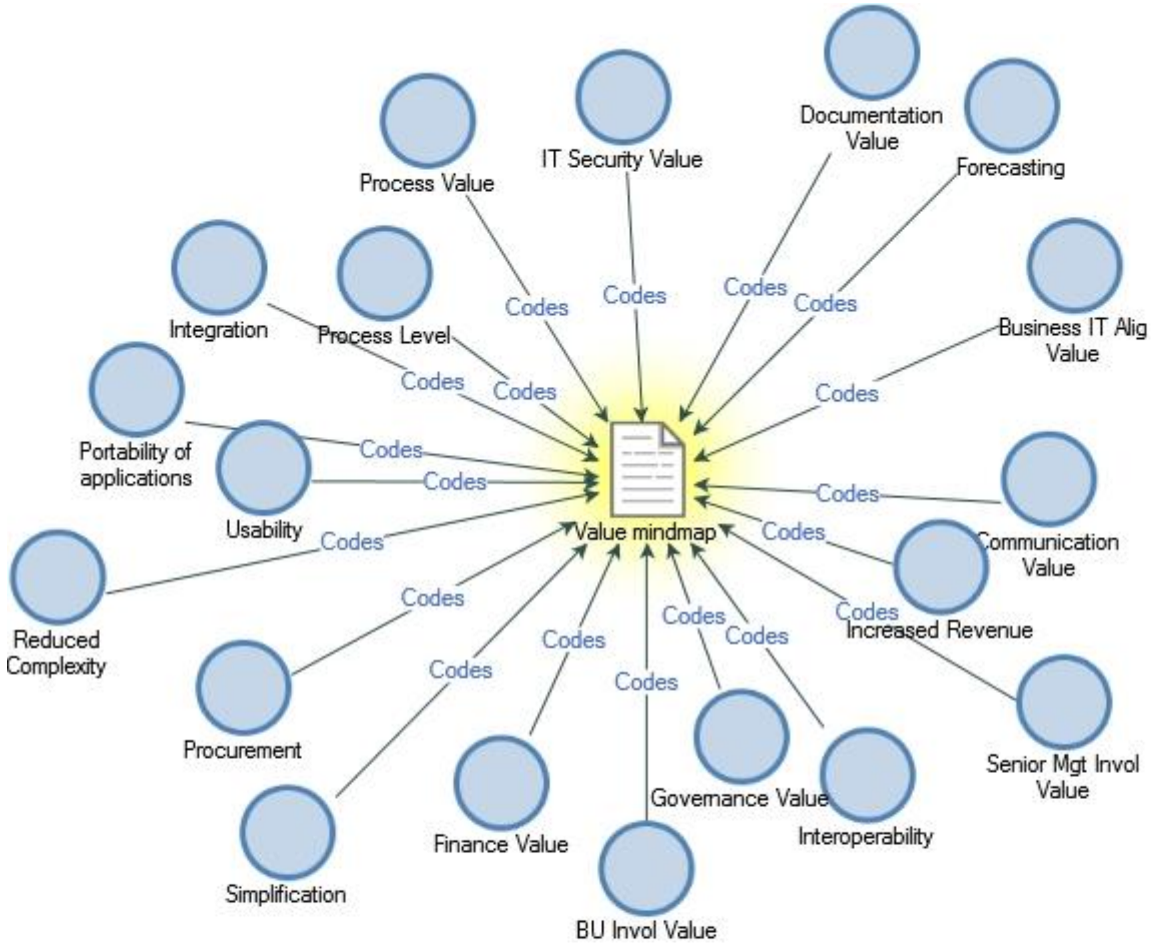


Figure: Appendix 17.3 - Preliminary mind map: Value of EA

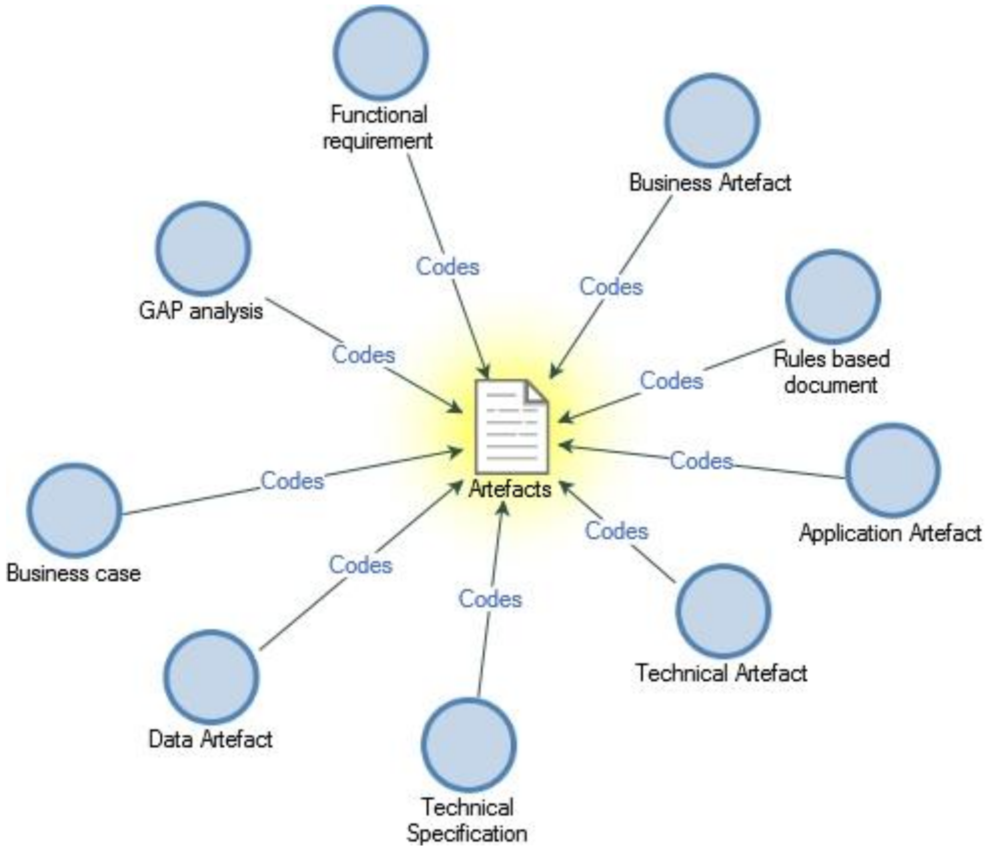


Figure: Appendix 17.4 - Preliminary mind map: Artefacts of EA

Appendix 18: Preliminary Thematic analysis Figures for: Bank A, business unit 3

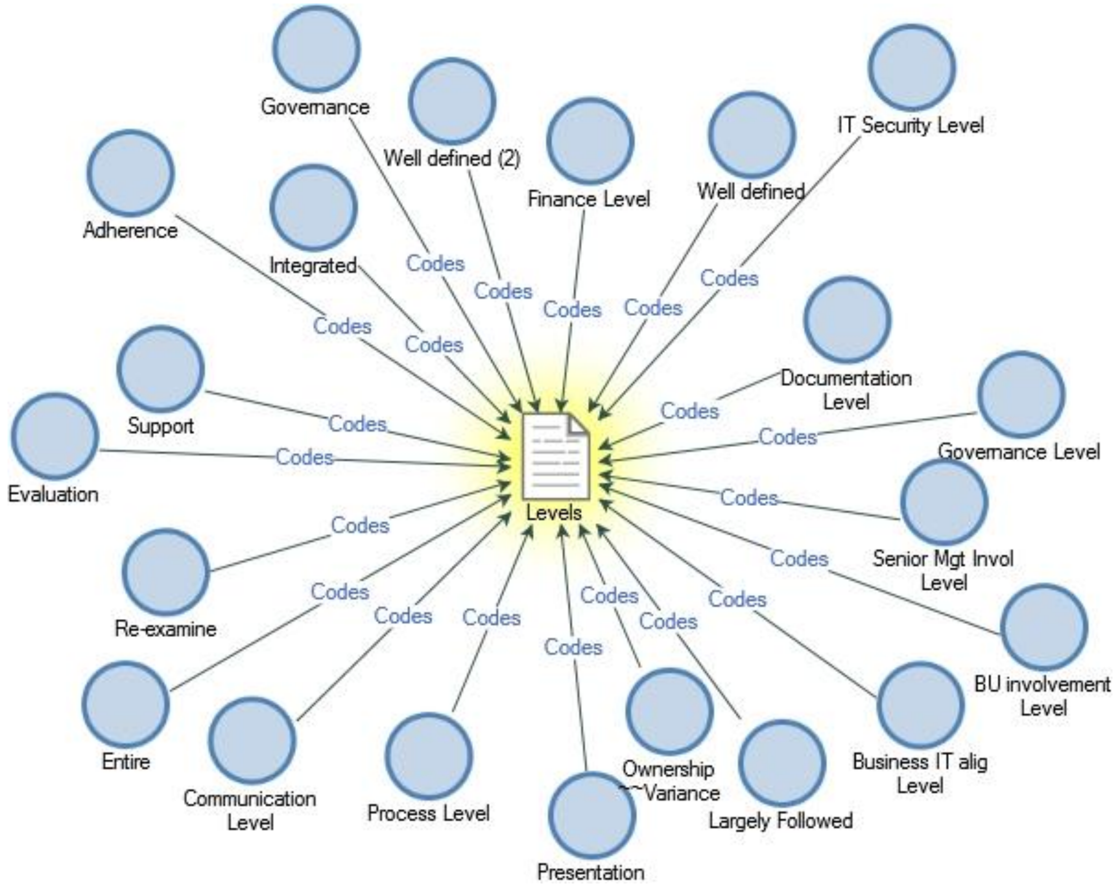


Figure: Appendix 18.1 - Preliminary mind map: Mechanisms of EA

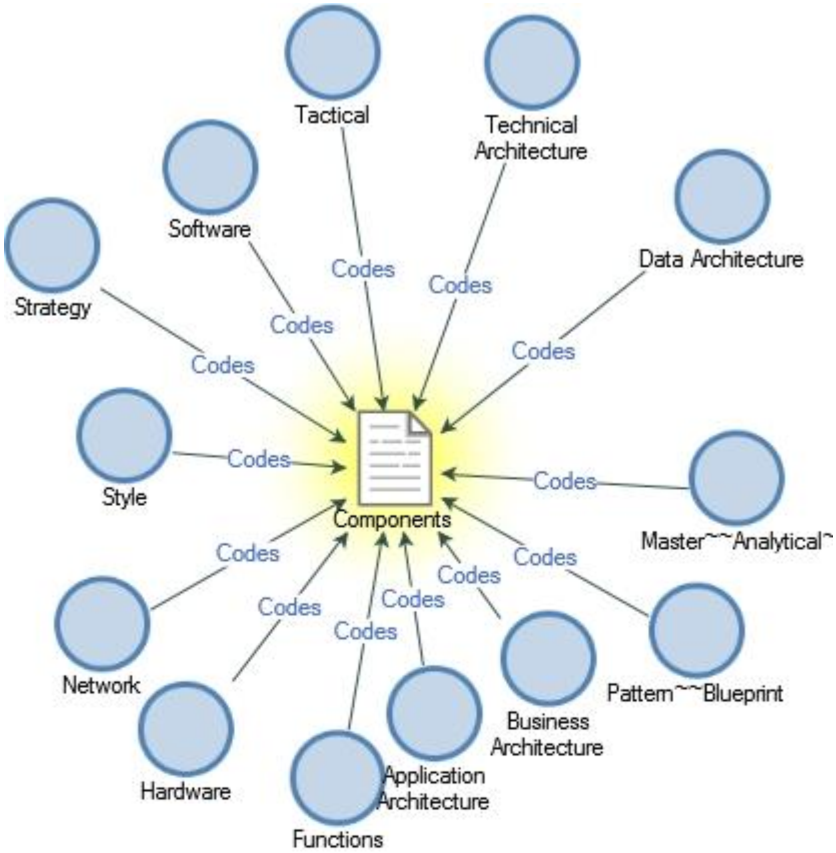


Figure: Appendix 18.2 - Preliminary mind map: Components of EA

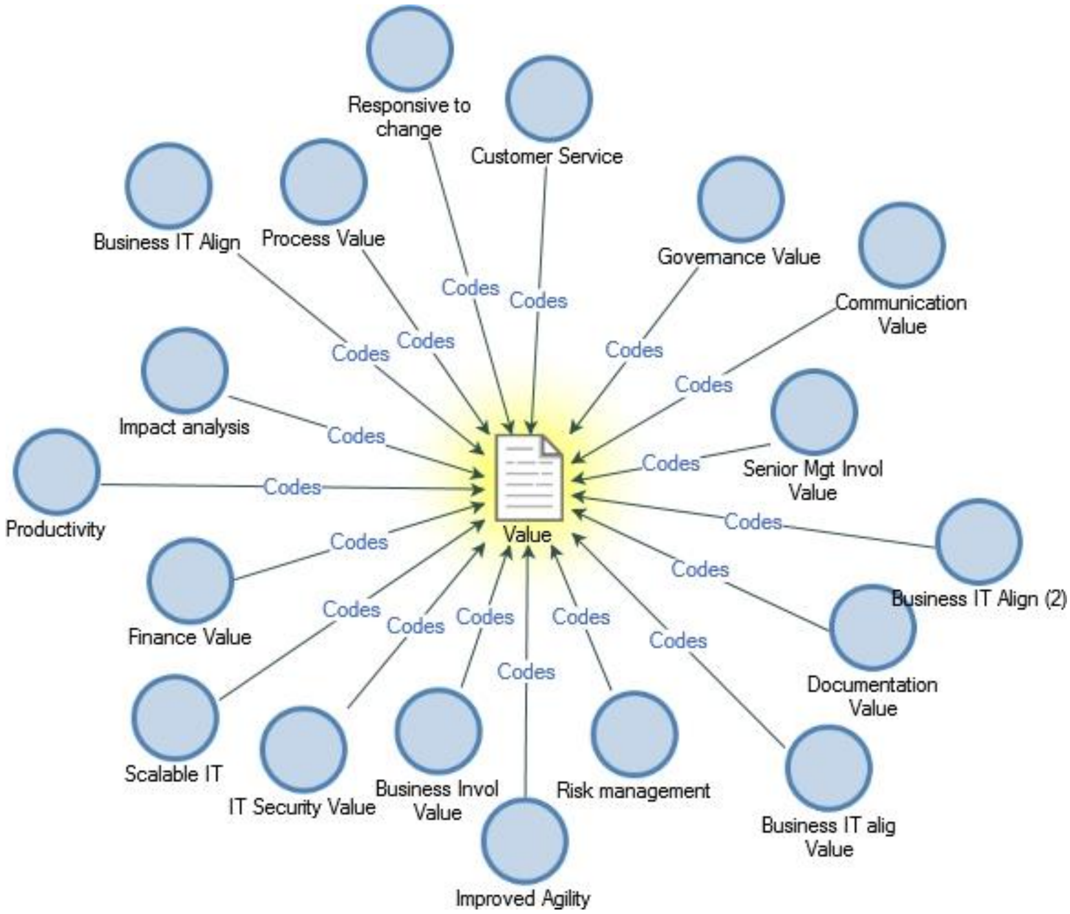


Figure: Appendix 18.3 - Preliminary mind map: Value of EA

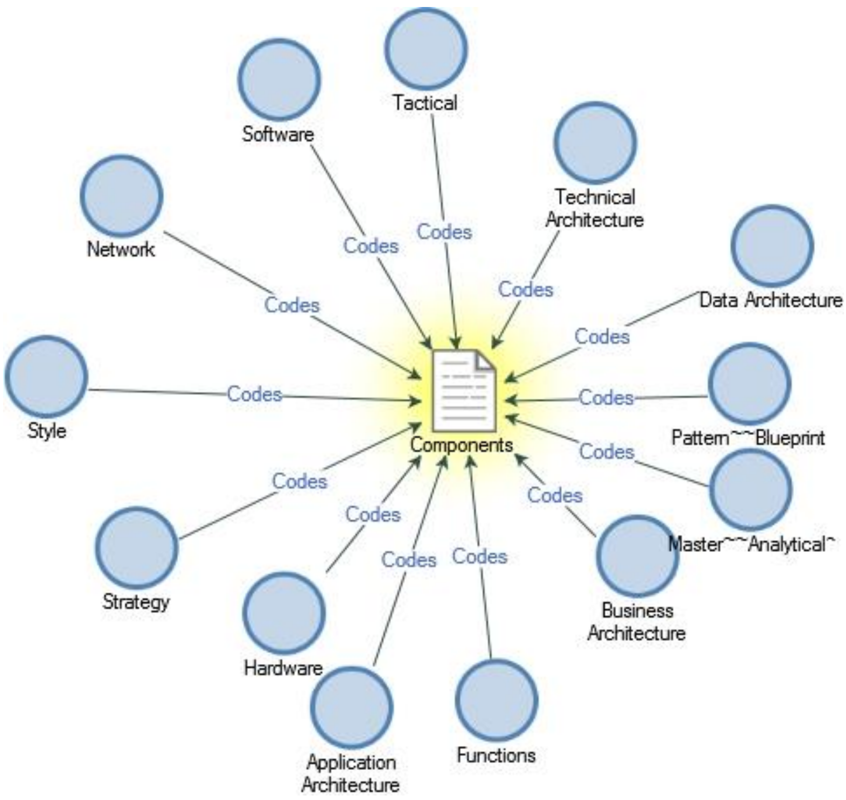


Figure: Appendix 18.4 - Preliminary mind map: Artefacts of EA

Appendix 19: Preliminary Thematic analysis Figures for: Bank B, business unit 1

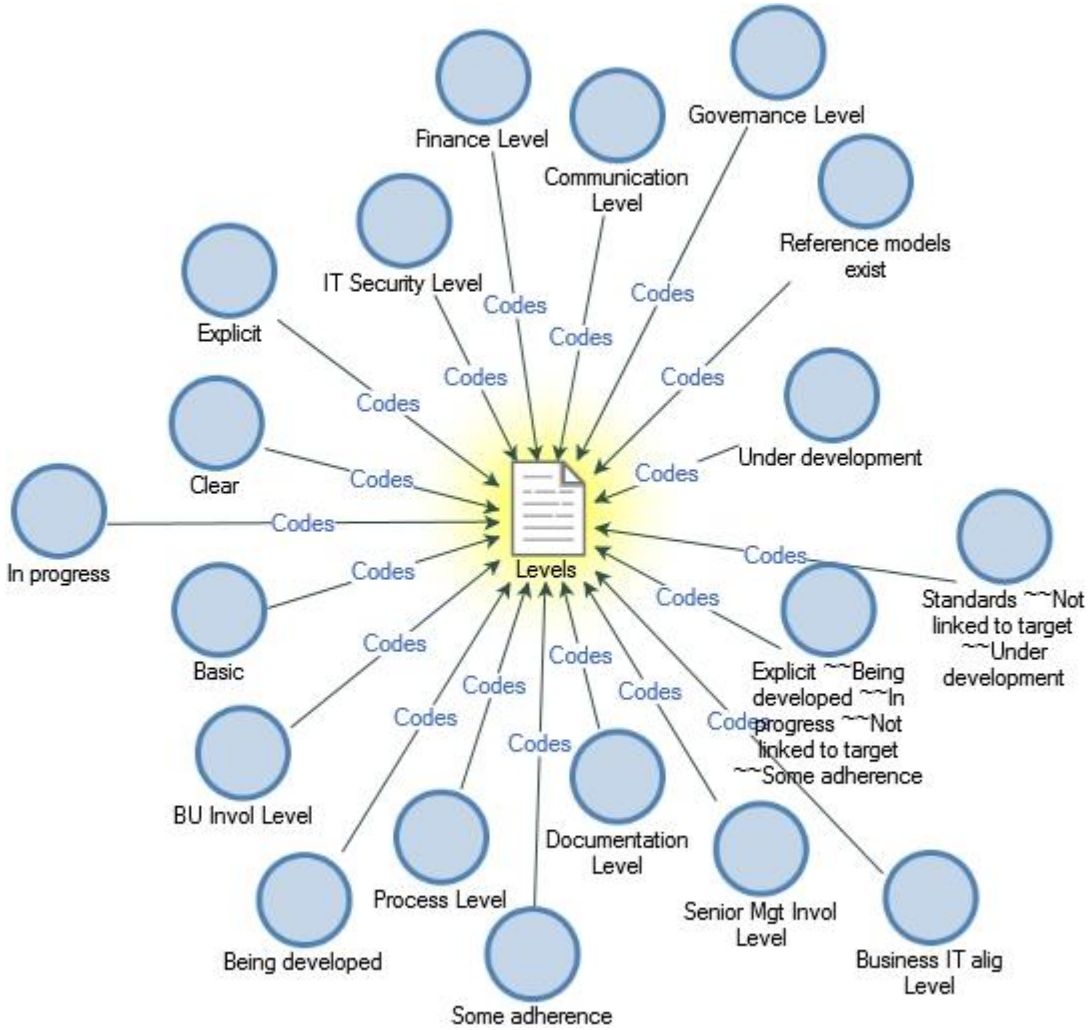


Figure: Appendix 19.1 - Preliminary mind map: Mechanisms of EA

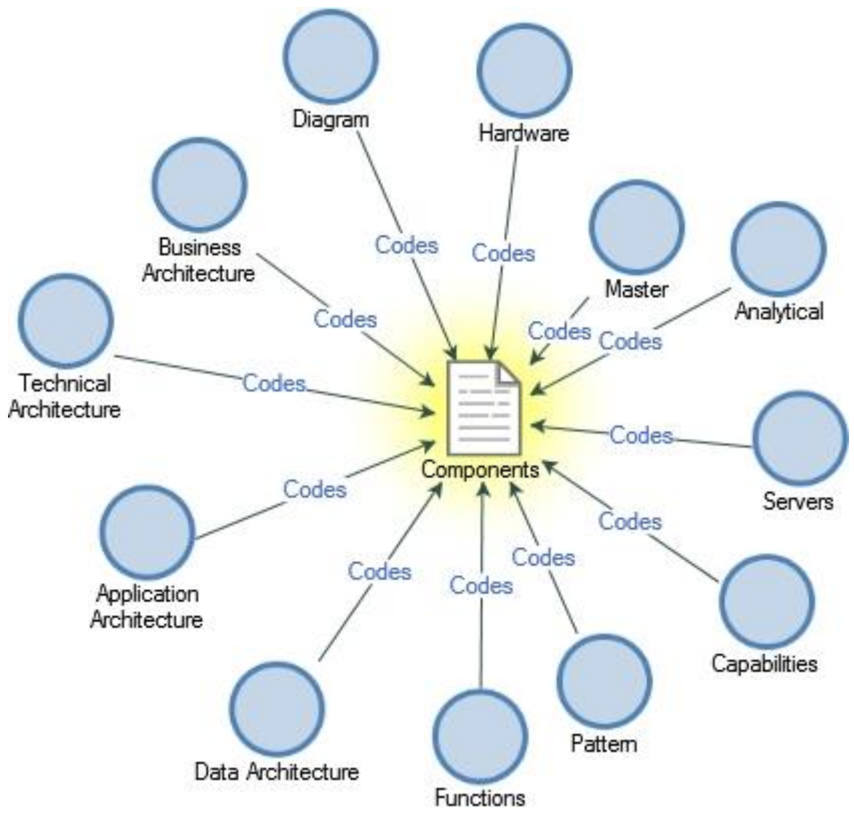


Figure: Appendix 19.2 - Preliminary mind map: Components of EA

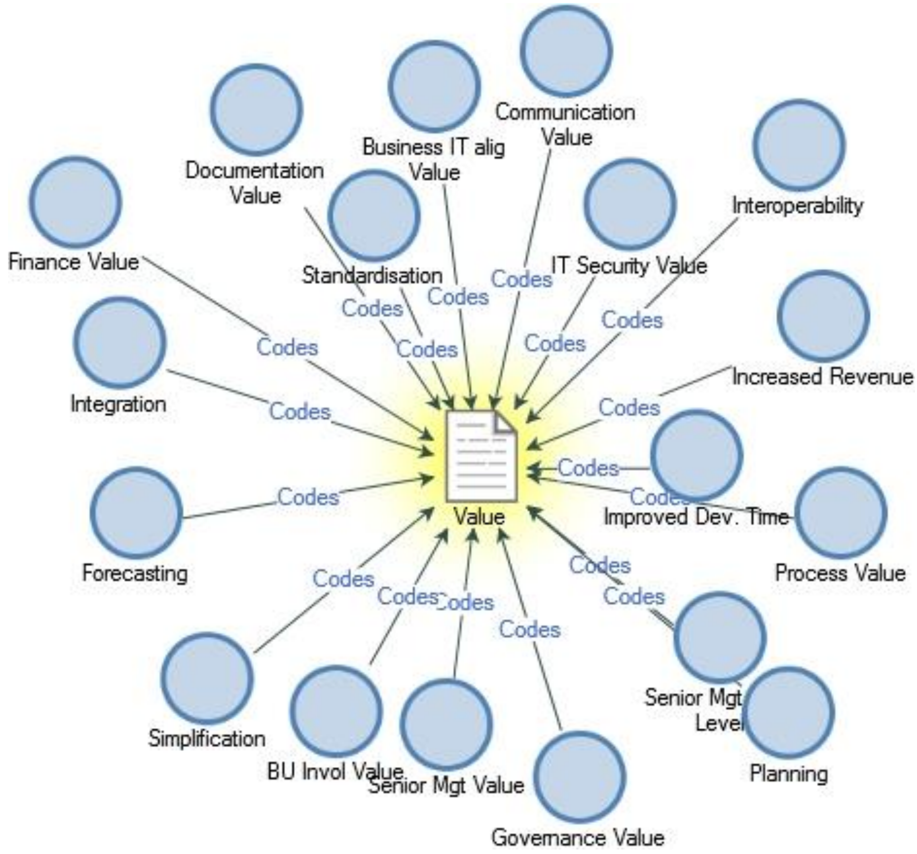


Figure: Appendix 19.3 - Preliminary mind map: Value of EA

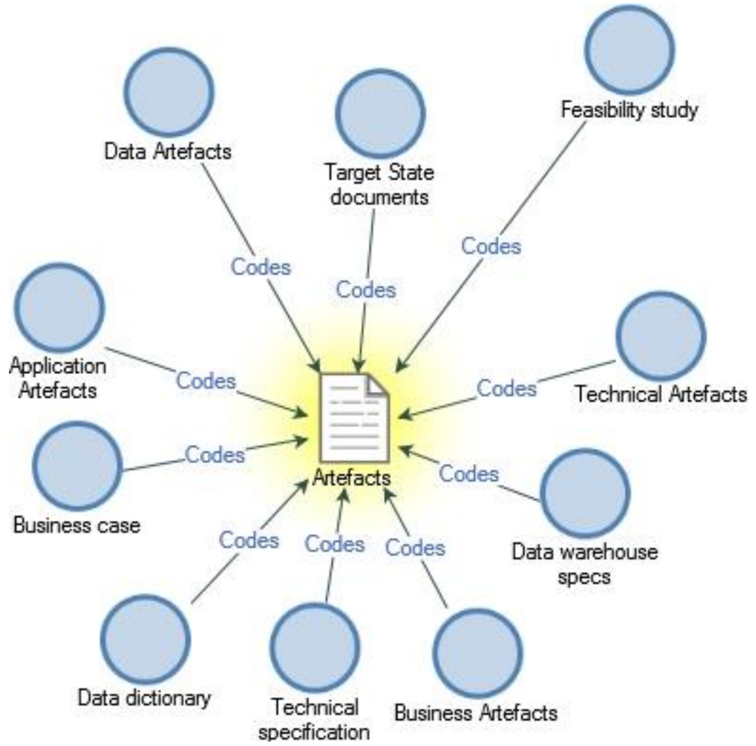


Figure: Appendix 19.4 - Preliminary mind map: Artefacts of EA

Appendix 20: Preliminary Thematic analysis Figures for: Bank B, business unit 2

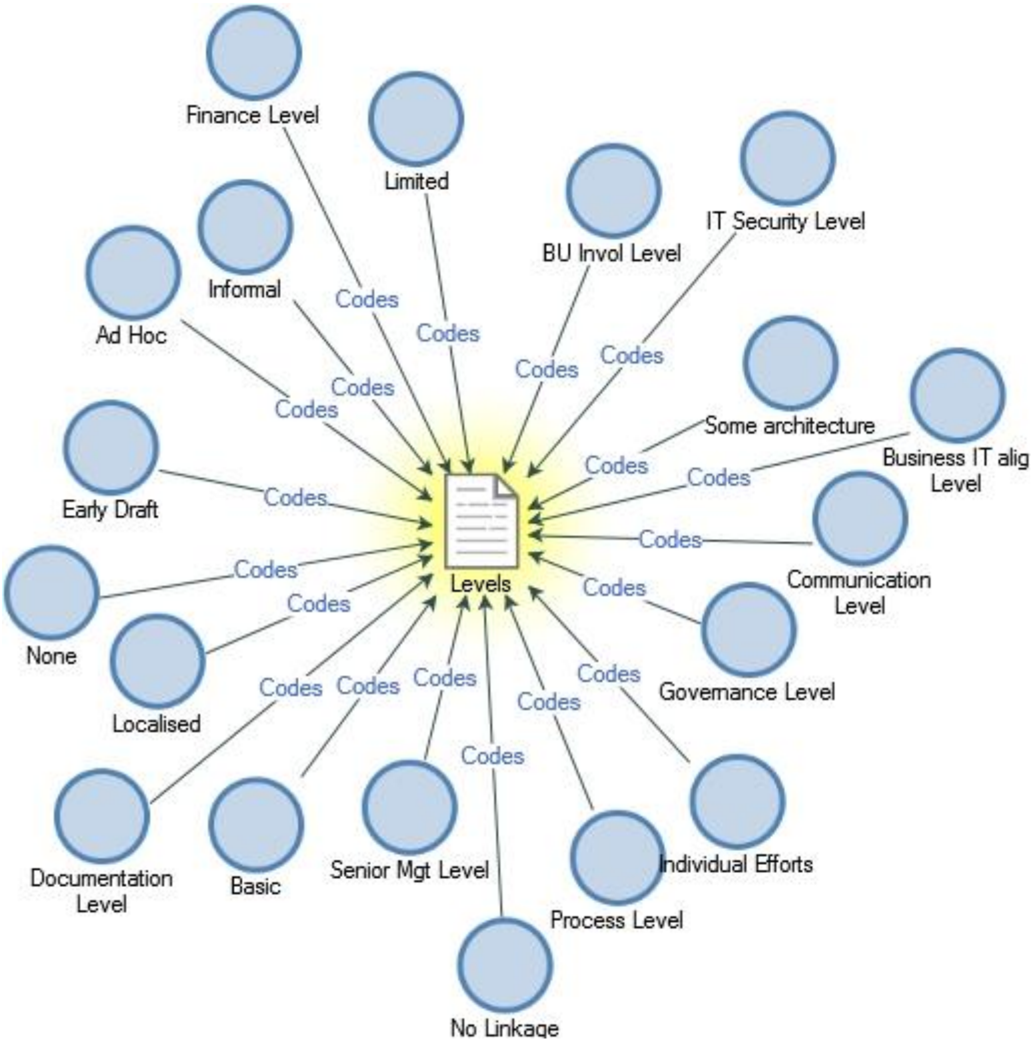


Figure: Appendix 20.1 - Preliminary mind map: Mechanisms of EA

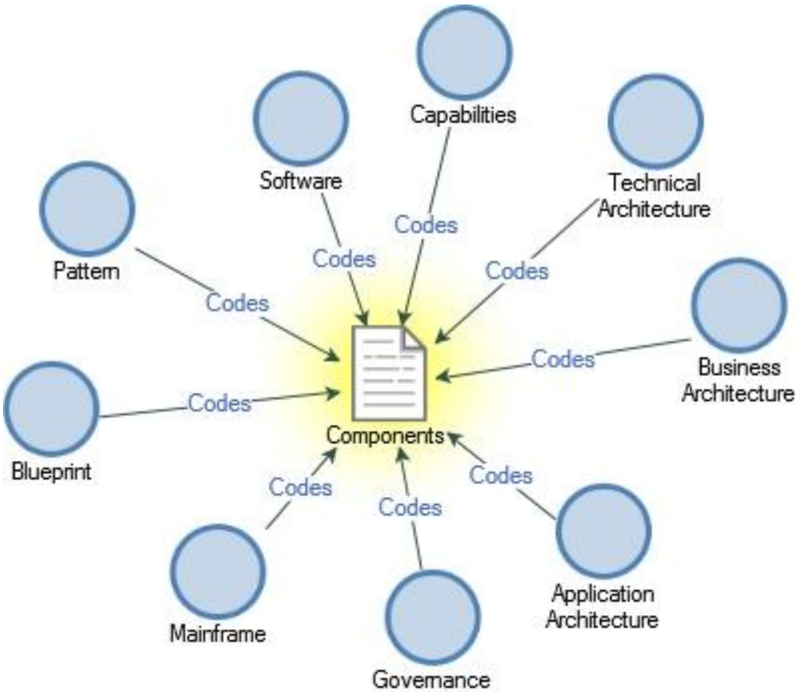


Figure: Appendix 20.2 - Preliminary mind map: Components of EA

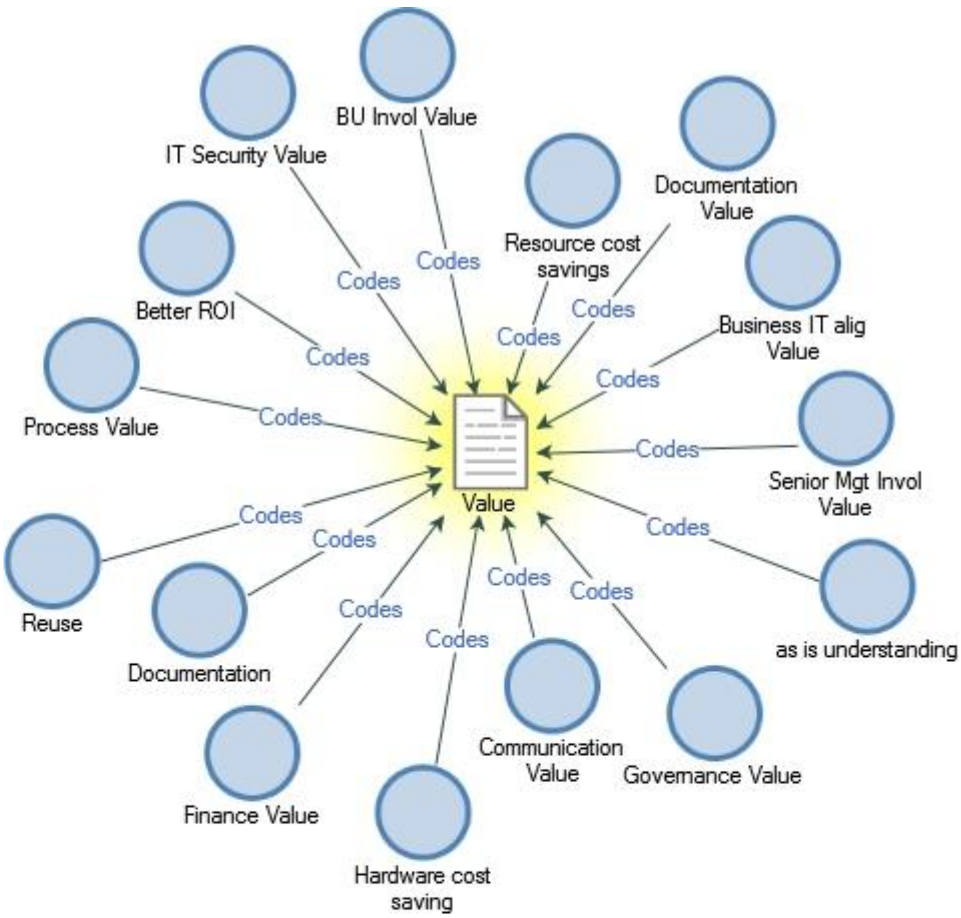


Figure: Appendix 20.3 - Preliminary mind map: Value of EA

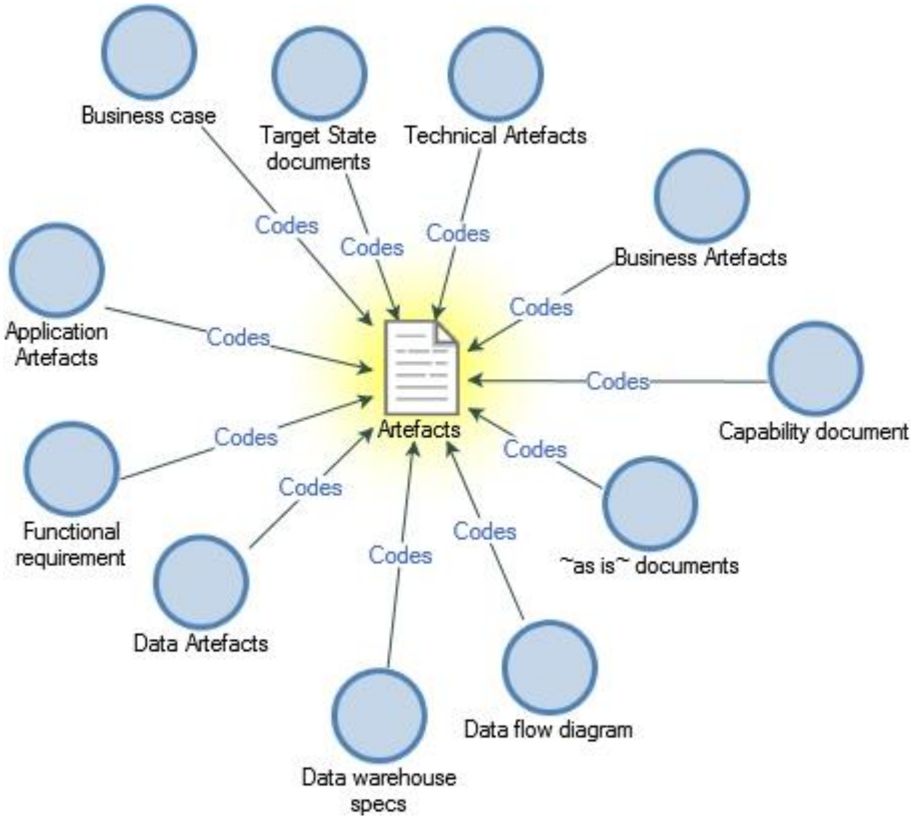


Figure: Appendix 20.4 - Preliminary mind map: Artefacts of EA

Appendix 21: Preliminary Thematic analysis Figures for: Bank B, business unit 3

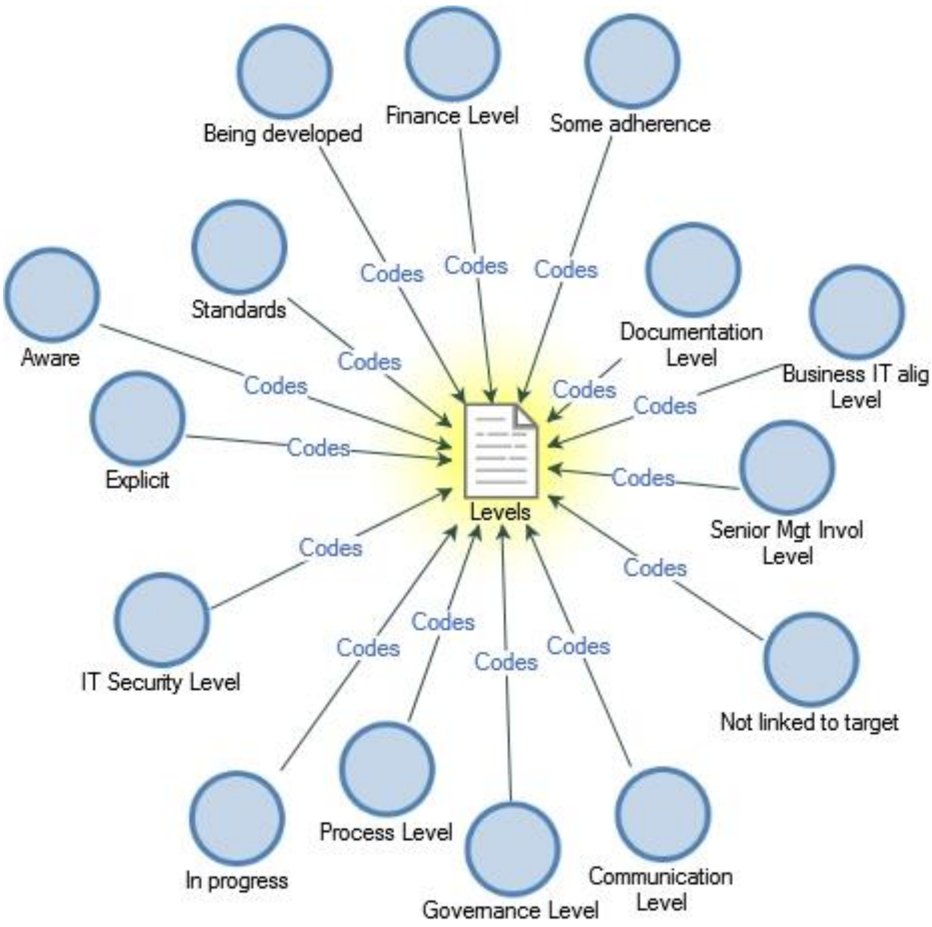


Figure: Appendix 21.1 - Preliminary mind map: Mechanisms of EA

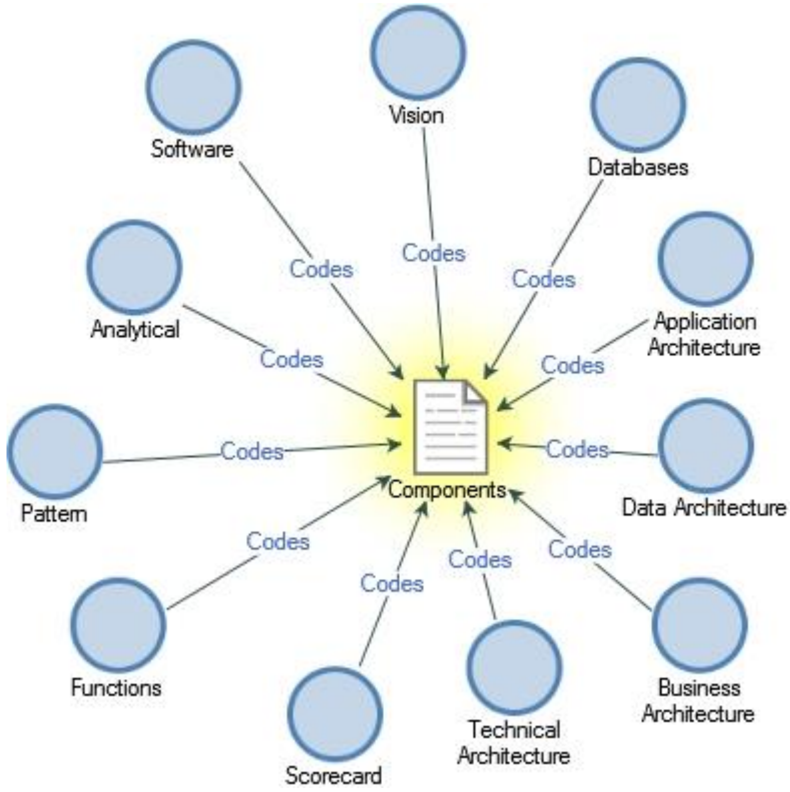


Figure: Appendix 21.2 - Preliminary mind map: Components of EA

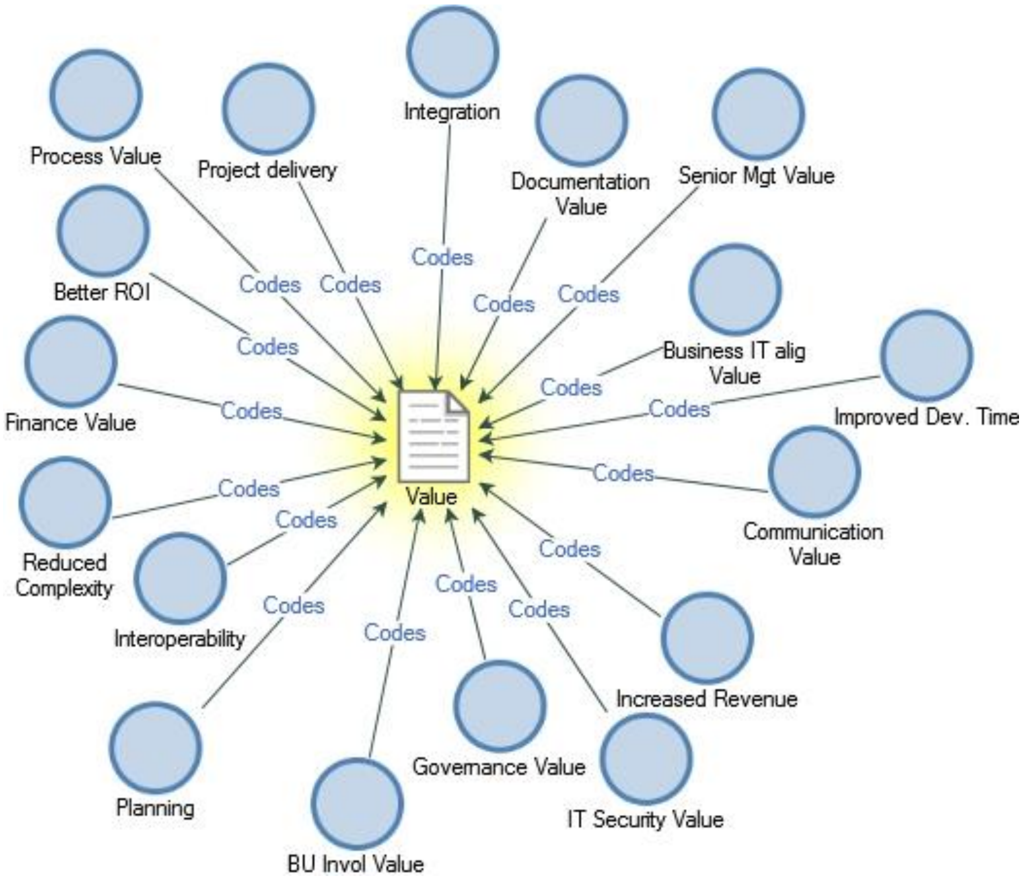


Figure: Appendix 21.3 - Preliminary mind map: Value of EA

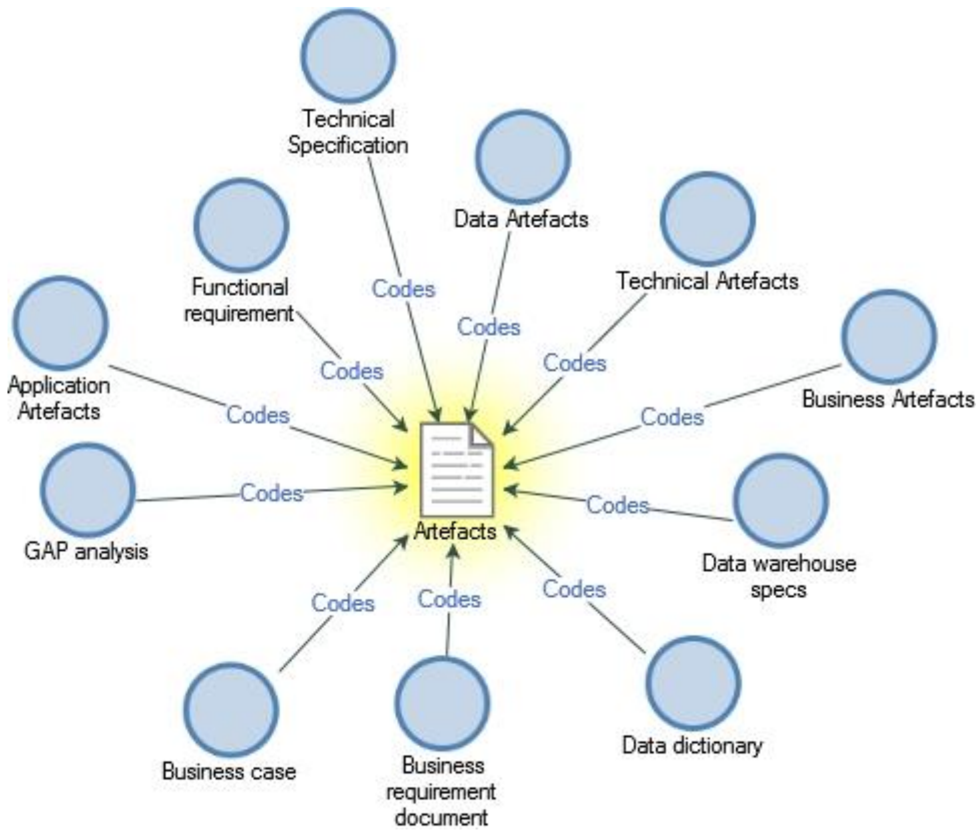


Figure: Appendix 21.4 - Preliminary mind map: Artefacts of EA

Appendix 22: Preliminary Thematic analysis Figures for: Bank C, business unit 1

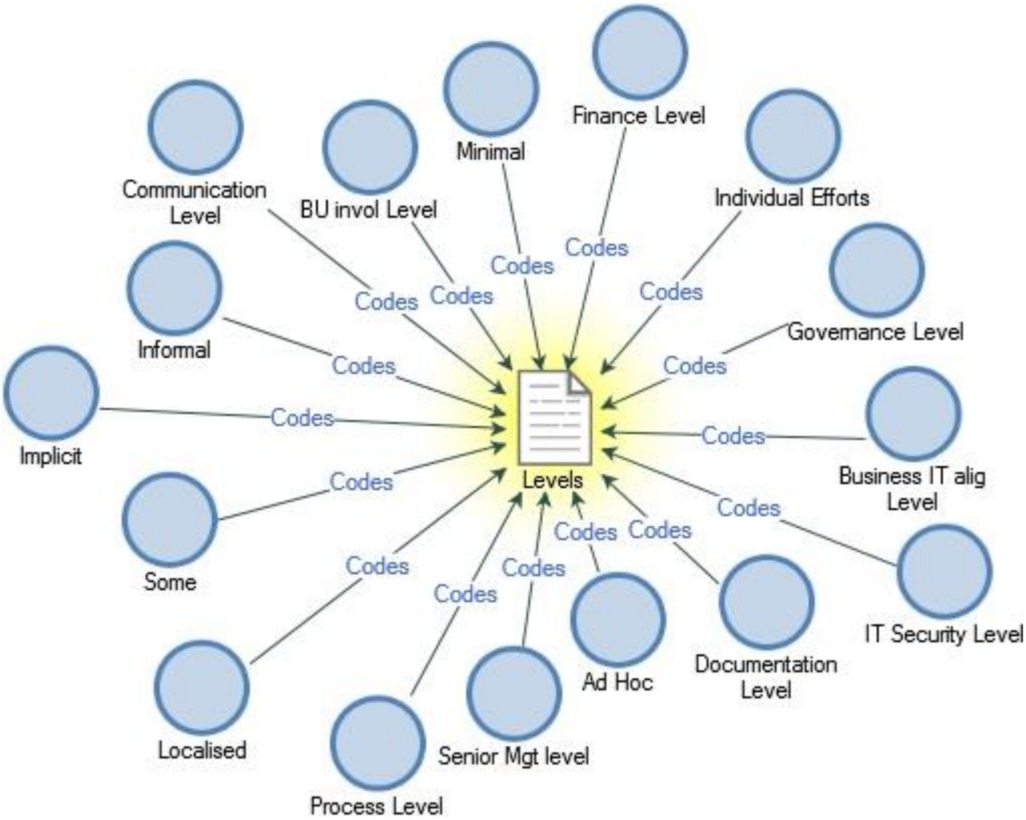


Figure: Appendix 22.1 - Preliminary mind map: Mechanisms of EA

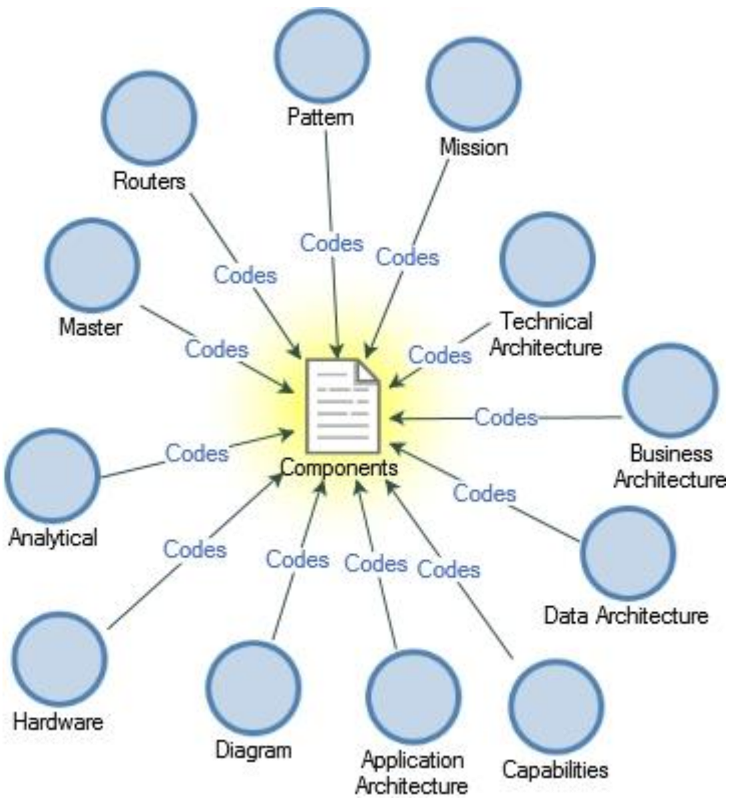


Figure: Appendix 22.2 - Preliminary mind map: Components of EA

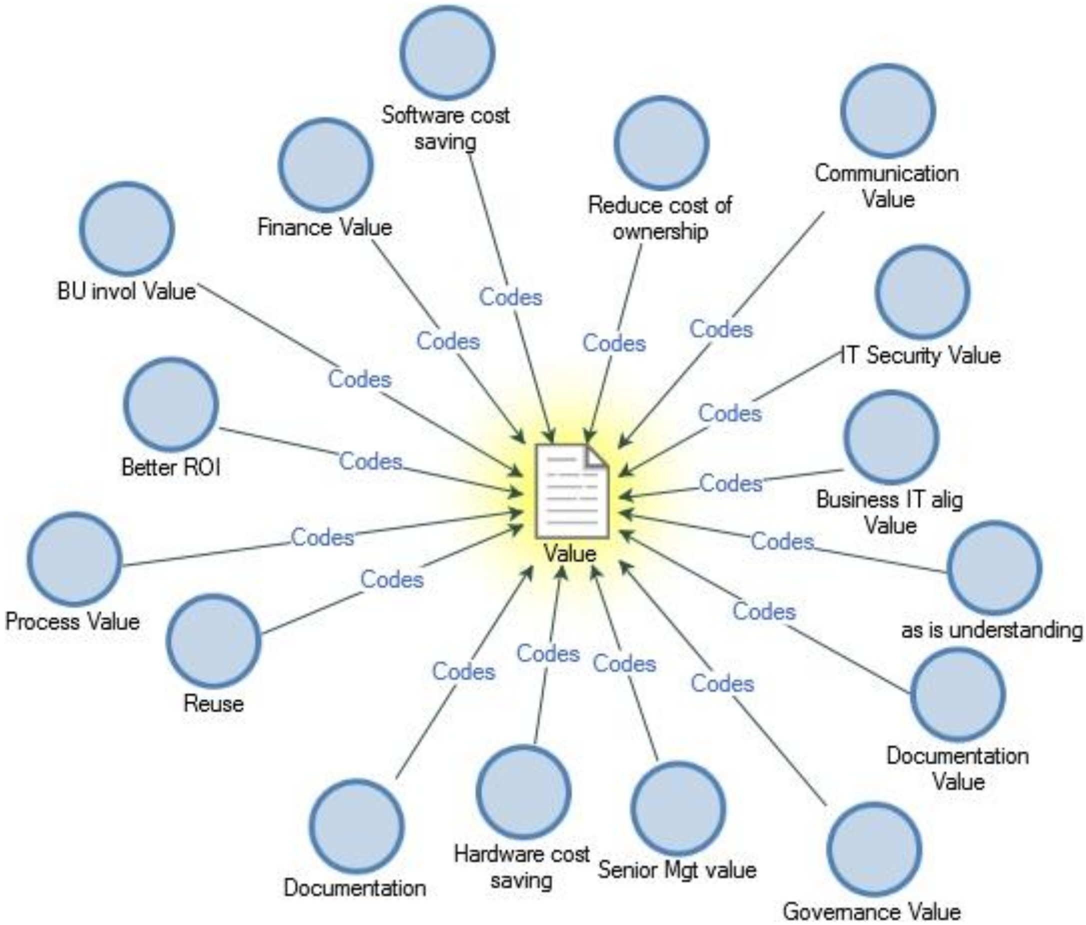


Figure: Appendix 22.3 - Preliminary mind map: Value of EA

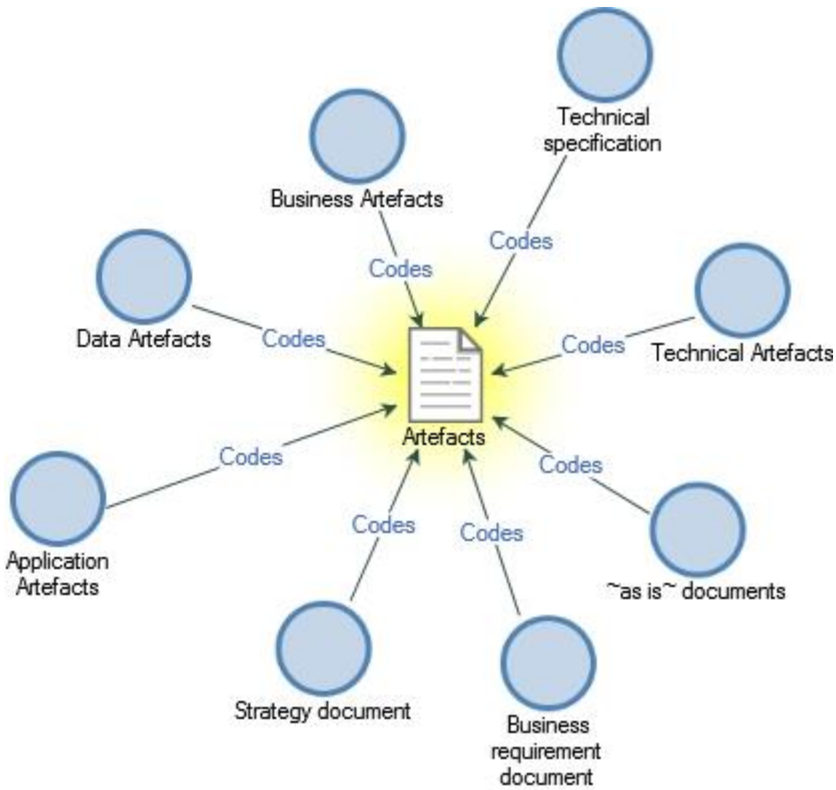


Figure: Appendix 22.4 - Preliminary mind map: Artefacts of EA

Appendix 23: Preliminary Thematic analysis Figures for: Bank C, business unit 2

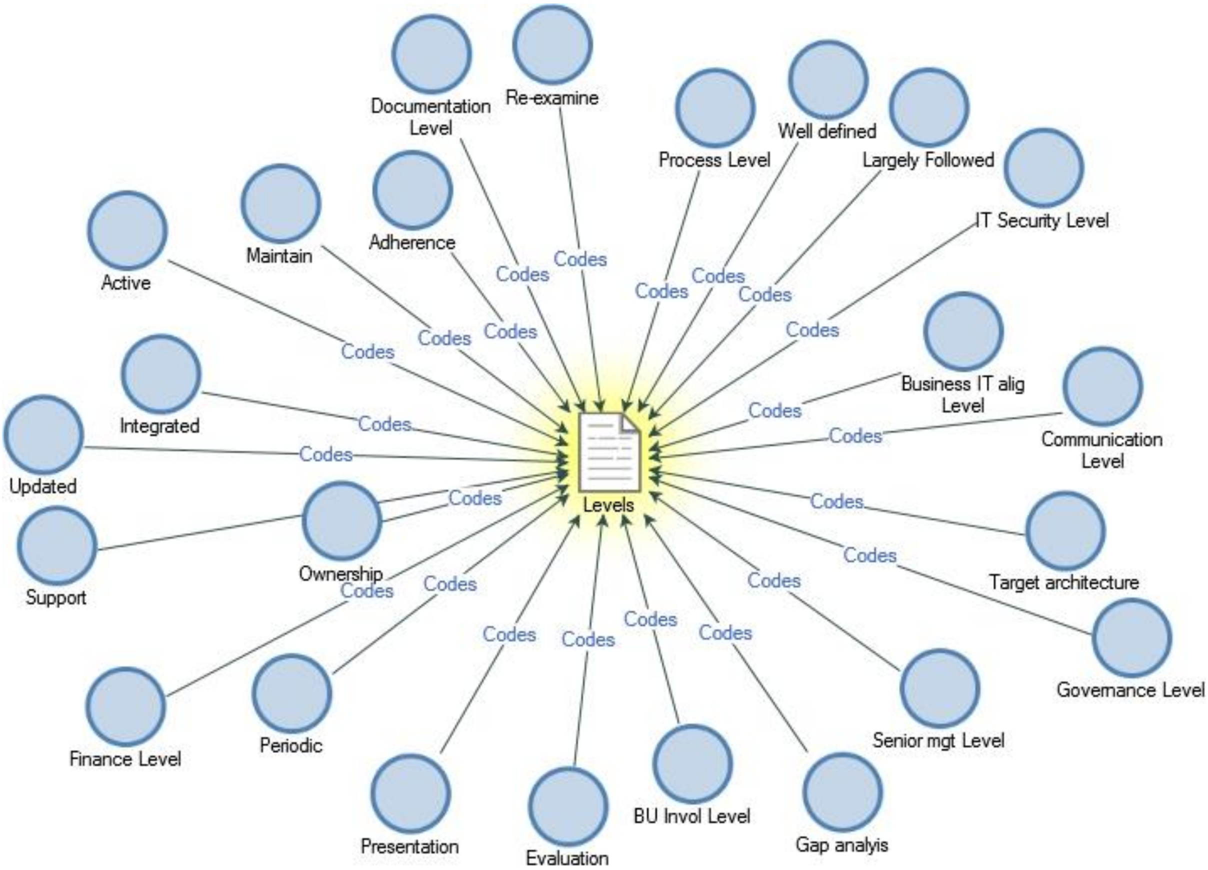


Figure: Appendix 23.1 - Preliminary mind map: Mechanisms of EA

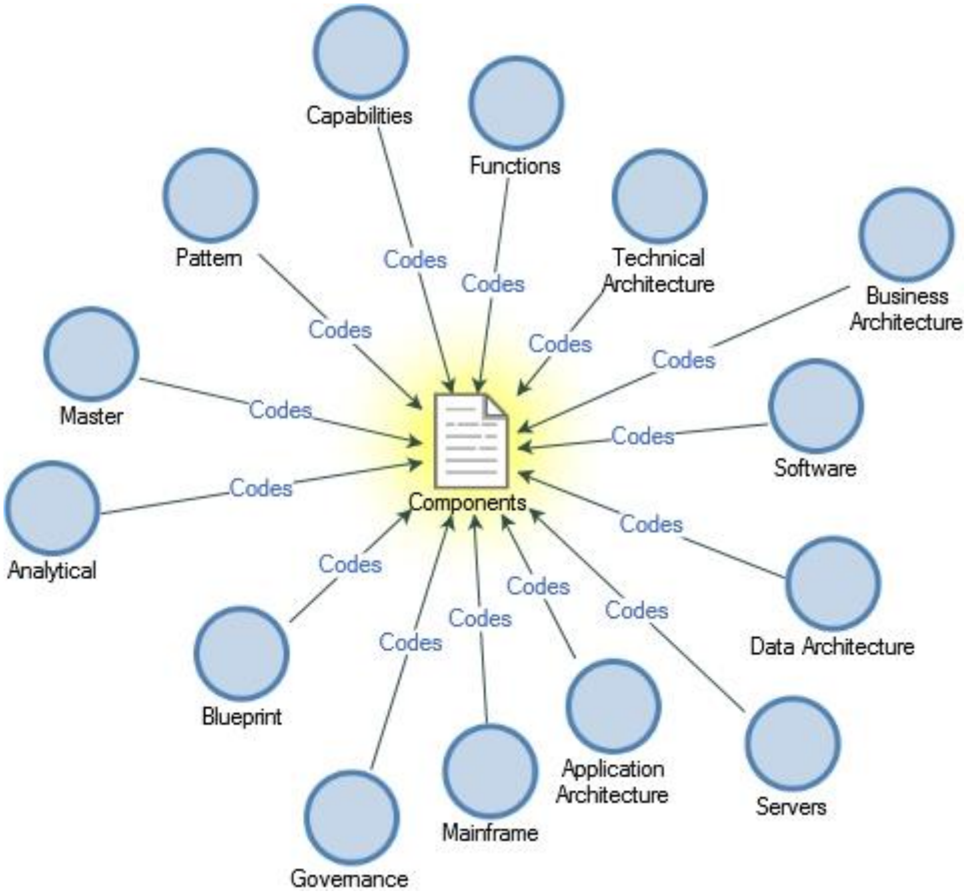


Figure: Appendix 23.2 - Preliminary mind map: Components of EA

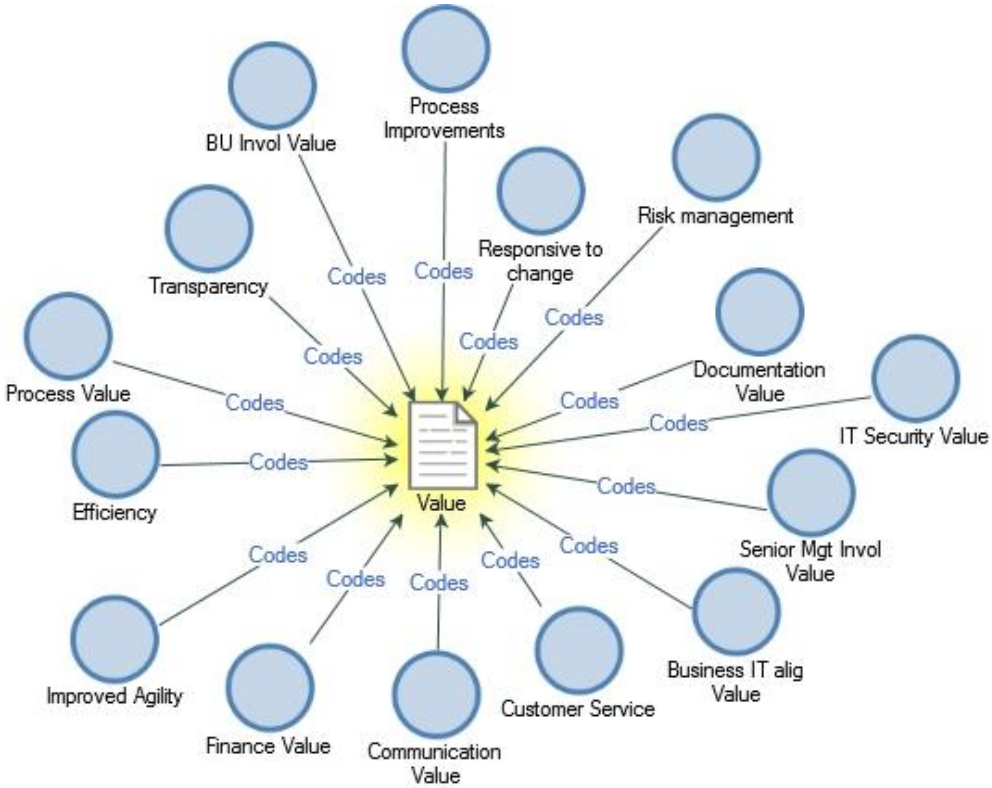


Figure: Appendix 23.3 - Preliminary mind map: Value of EA

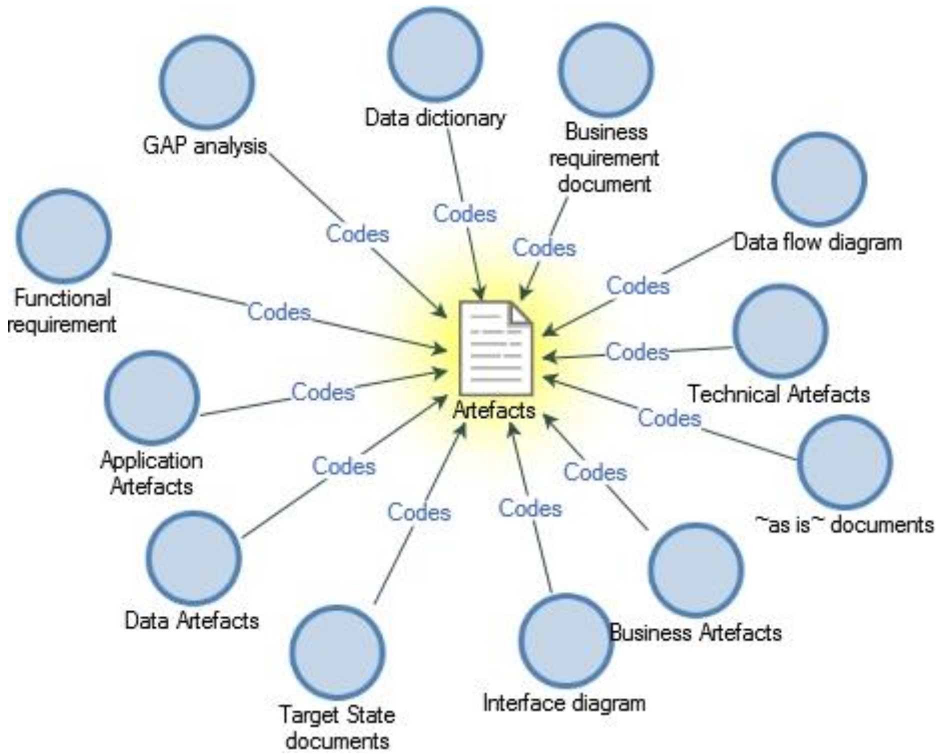


Figure: Appendix 23.4 - Preliminary mind map: Artefacts of EA

Appendix 24: Preliminary Thematic analysis Figures for: Bank C, business unit 3

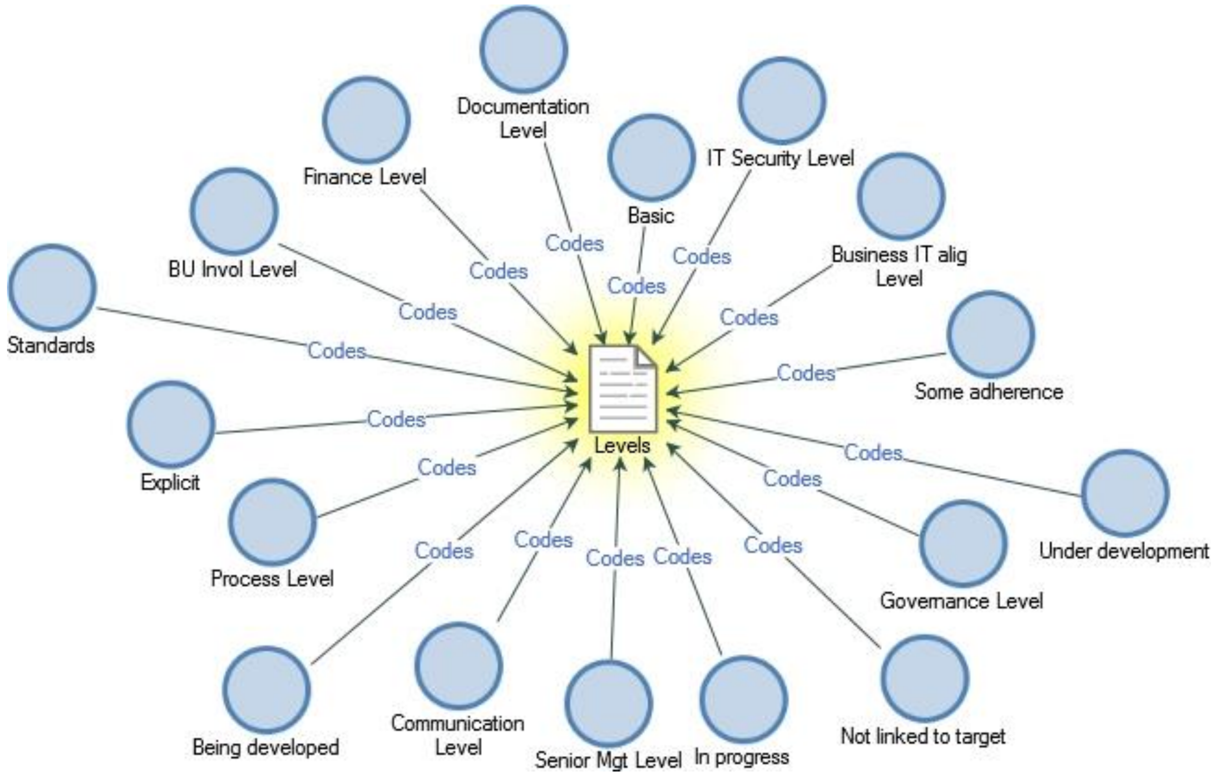


Figure: Appendix 24.1 - Preliminary mind map: Mechanisms of EA

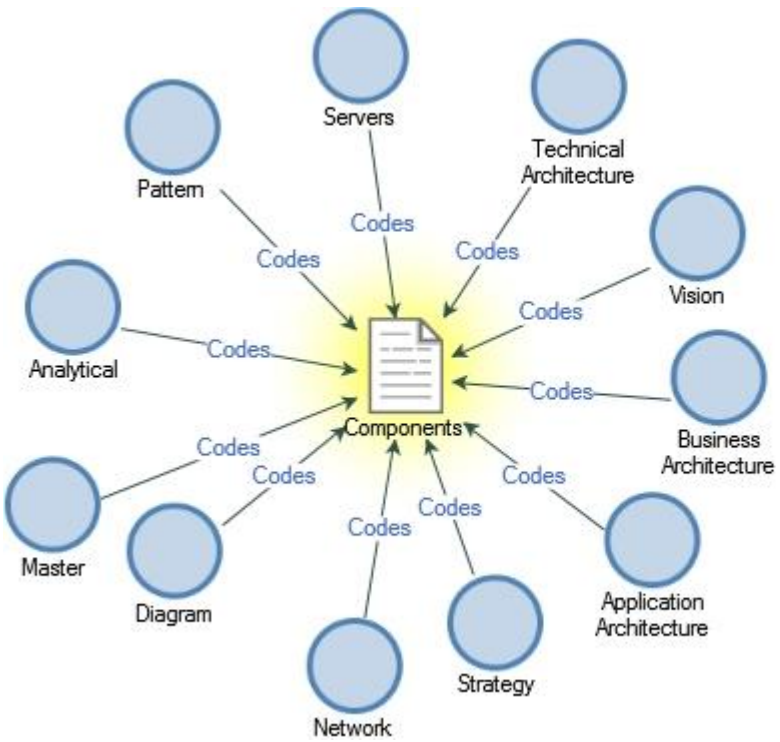


Figure: Appendix 24.2 - Preliminary mind map: Components of EA

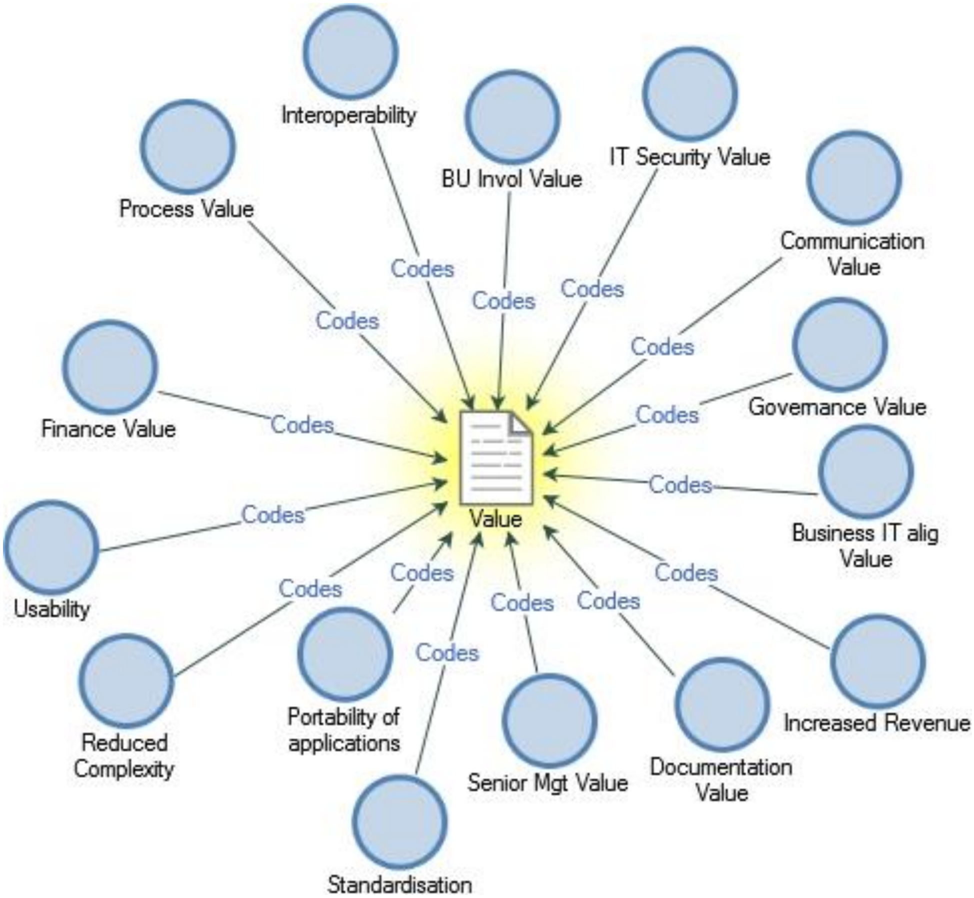


Figure: Appendix 24.3 - Preliminary mind map: Value of EA

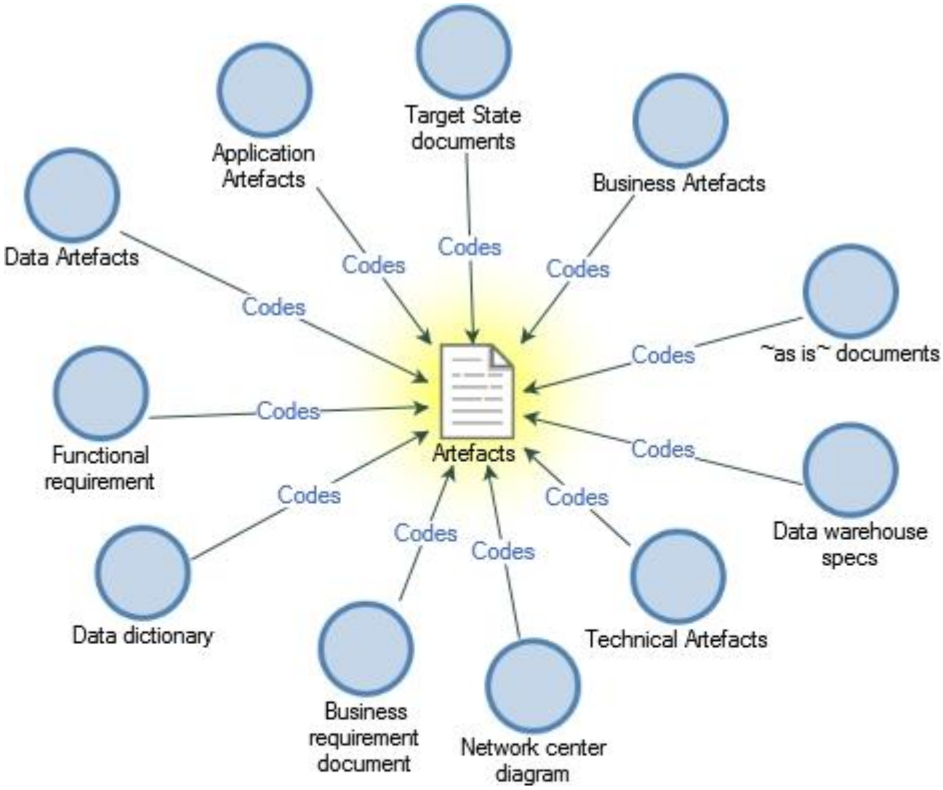


Figure: Appendix 24.4 - Preliminary mind map: Artefacts of EA

Appendix 25: Generic comments from participants

• "architecture is a set of abstract patterns and principles, guiding the design of a software system"
• “building IT systems in the same as building a house. Just like a building architect draws up plans for a house, an IT architect designs a system according to the requirements from a stakeholder”
• “a representation of the IT systems”
• "architecture is the plan of IT systems used by the bank. It shows how the various applications, hardware and software are interconnected”
• “EA is aligning the software components with the business environment”
• “is like an architecture of a building that shows the high-level design of enterprise systems”
• “a map of the system that describes the mechanisms of the system”
• “EA shows how a system is decomposed into its component parts”
• “EA is a skeleton that shows the details to develop a system design. It is like a skeleton that outlines human, so EA is an outline of a firm with the IT and business features”
• “a set of relationships between software parts, with each part related to other part”
• “the business, software and IT structures of a firm”
• “a blueprint or skeleton”
• “the framework of systems, applications, hardware, software and how they are interconnected”
• “abstracts and views of a system”
• “how a large system is decomposed into its subcomponents”
• “the big picture of the entire software system showing the functions, and their relationships with each other”
• “an abstraction of the system decomposed into the various specifications’”

The only negative comment that was received on the research was that “The research is a good start, but there is a change management part that your research does not consider of shifting people’s mind-sets to accept it”.

Appendix 26: Assessment of EA Frameworks

Table Appendix 26: Assessment of EA frameworks

EA Framework	Guidelines	Business Focus	Neutrality	Time to value
Zachman	Simple (Kang et al., 2010; Mary and Rodrigues, 2011)	Weak (Odongo et al., 2010)	Open (Cameron and Mcmillan, 2013; Lankhorst, 2013b)	Quick (Bahill et al., 2006; Leist and Zellner, 2006)
FEA	Simple (Bui and Levy, 2017; Mondorf and Wimmer, 2017)	Strong (Kappelman et al., 2008; Kappelman and Zachman, 2013)	Open (Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006)	Quick (Kappelman and Zachman, 2013; Urbaczewski and Mrdalj, 2006)
GEAF	Comprehensive (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012)	Strong (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012)	Propriety (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012)	Quick (Cameron and Mcmillan, 2013; Chew and Gottschalk, 2012)
DoDaF	Comprehensive (Mccarthy, 2006)	Weak (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006)	Open (Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006)	Long (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006)
TEAF	Comprehensive detail (Odongo et al., 2010; Urbaczewski and Mrdalj, 2006)	Weak (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006).	Open (Kappelman et al., 2008; Urbaczewski and Mrdalj, 2006)	Long (Mary and Rodrigues, 2011; Urbaczewski and Mrdalj, 2006)
TOGAF	Comprehensive (Rouhani et al., 2015, 2013)	Strong (Rouhani et al., 2015, 2013)	Open (Cameron and Mcmillan, 2013; Lankhorst, 2013b)	Quick (Langenberg and Wegmann, 2004)

Appendix 27: Forms of Value linked to each Mechanism

This table merges the value themes from Table 4.4, Table 4.7, Table 4.10, Table 5.4, Table 5.7, Table 5.10, Table 6.4, Table 6.7 and Table 6.10.

Table Appendix 27: Forms of Value linked to each Mechanism

Practice	Value theme	Refined Theme
Process	• Improved decision-making processes experienced by the business unit as a result of EA (see Table 4.4). • EA helps the business unit simplify technical complexity and enables the business strategy which improves their profitability (see Table 4.7). • EA enables people, process and technology alignment improvements that lead to customer service improvements for the business unit (see Table 4.10). • EA practices facilitate faster development time for the business unit (see Table 5.4). • EA improves the quality of technical documentation that leads to hardware and software savings (see Table 5.7). • EA processes help the business unit improve their development time and ROI (see Table 5.10). • EA enables rationalisation of applications that results in technology cost savings (see Table 6.4). • EA brings synergy across autonomous business units, improves risk and process management (see Table 6.7). • EA processes identify areas for automation, improve profitability, assist with simplification and interoperability of applications for the business unit (see Table 6.10).	• Reduced complexity • Improved development time • Customer service • Improved interoperability
Communication	• EA helps the business unit create an approach to enable innovative solutions, and better understand customer behaviour that reveals customer insights (see Table 4.4). • EA helps create a strategic view of the business unit by enabling a clear structured approach to problem solving. It further improves the portability of applications (see Table 4.7). • Clear transparent communication that leads to customer service improvements and agility experienced by the business unit (see Table 4.10).	• Customer insights • Visualisation • Reduced complexity • Improved portability • Improved Agility

Practice	Value theme	Refined Theme
	• EA enhances communication, <u>simplifies complexity</u> and <u>standardises integration</u> for the business unit (see Table 5.4). • EA helps <u>manage stakeholder</u> expectations and enables them to reach <u>consensus</u> on disagreements. <u>Hardware</u> and <u>software savings</u> further experienced (see Table 5.7). • Architectures creates a platform to improve communications. Furthermore, the EA repository facilities <u>reusability</u> that results in <u>improved development time</u> (see Table 5.10). • EA facilitates communication that lead to <u>cost savings</u>, <u>reuse</u> and <u>visualisation</u> benefits for the business unit (see Table 6.4). • EA enables a business and technology connection, <u>improves risk management</u> and <u>process efficiencies</u> (see Table 6.7). • EA creates a holistic view of the business units' applications, <u>reduces complexity</u>, <u>improves profitability</u> and <u>eases interoperability</u> of applications (see Table 6.10).	
Business-IT Alignment	• <u>Innovative</u> business <u>solutions</u> that are <u>deployed faster</u> are experienced by the business unit due to EA (see Table 4.4). • EA supports the business unit experience a <u>quicker return revenue</u> on their investments (see Table 4.7). • EA enables <u>operational</u> and <u>strategic alignment</u> that results in <u>competitive advantage</u> and <u>service improvements</u> (see Table 4.10). • The business unit experiences an <u>improvement</u> in <u>project time</u>, <u>better planning</u> and <u>communication</u> due to the EA practices (see Table 5.4). • <u>Cost savings</u>, <u>risk mitigation</u> and <u>improved documentation</u> experienced by the business unit resulting from EA (see Table 5.7). • EA helps the business unit <u>improve integration</u> across the banks systems. <u>Aligns strategies</u>, people, processes and technologies (see Table 5.10).	• Improved risk management • Increased revenue • Innovation • Improved documentation

Practice	Value theme	Refined Theme
	• EA enables the business unit to improve decision-making and enhance customer service and aid infrastructure and software cost savings (see Table 6.4). • EA improves processing times, enables risk management as well as business-IT alignment for the business unit (see Table 6.7). • The business unit experiences improved profitability and a standardisation language for business and IT stakeholders to converse (see Table 6.10).	
Management Involvement	• EA enables improved decision-making amongst senior management of the business unit (see Table 4.4). • EA converts complex technical details into simple business language that’s easy for management to understand and agree. Helps them visualise problem areas (see Table 4.7). • EA creates a common platform for management to align strategies, identify areas for improvement and be more responsive to change (see Table 4.10). • EA creates a common dialogue platform for business and IT stakeholders. It simplifies management understanding of technology due to a standardised platform (see Table 5.4). • Architecture creates a common platform and single view of initiatives for senior management. It further provides resource efficiencies (see Table 5.7). • EA creates a holistic view of the business objectives by linking them to the technologies. It further ensures quicker development time, improved returns and less integration complexity (see Table 5.10). • EA enables visualisation of systems by senior management, that leads to cost savings (see Table 6.4). • EA helps senior management improve their project selection, make informed design choices before systems are built and recognise risk (see Table 6.7). • EA helps improve profitability, reduces complexity and improves development time for the business unit (see Table 6.10).	• Improved decisions • Visualisation • Reduced complexity • Improve Integration

Practice	Value theme	Refined Theme
Finance	• EA helps the business unit improve ROI and clarify prioritisation decisions (see Table 4.4). • EA enables the business unit to simplify and visualise the impact of financial decisions. Creates a holistic view of a customer (see Table 4.7). • The business unit experiences maximum financial benefit in the shortest time enabled by EA (see Table 4.10). • EA helps align priorities, improve forecasting and enables faster system builds for the business unit (see Table 5.4). • Hardware and software cost savings experienced, improved ROI as well as a common framework created by EA (see Table 5.7). • Improved development time, inefficiency identification, rationalisation and integration benefits experienced due to EA (see Table 5.10). • EA enables cost reductions for the business unit by rationalisation and correct technology choices (see Table 6.4). • EA improves risk management, increases confidence in projects and creates process efficiencies (see Table 6.7). • The business unit experiences an increase in revenue, improved ROI and quicker launch of products from their EA implementation (see Table 6.10).	• Process improvements • Hardware cost savings • Software cost savings • Improved Revenue • Reduced complexity

Appendix 28: Conference Proceedings

This study was presented at the conferences below:

- Conference: 20th IEEE International Conference on Business Informatics (CBI), July 11-13, 2018, Vienna, Austria.
  Link: https://cbi2018.big.tuwien.ac.at/
- Conference: African Conference on Information Systems & Technology (ACIST), 09th – 10th July 2018, Cape Town, South Africa.
  Link: http://acist2018.uct.ac.za/
- Conference: South African Institute of Computer Scientists and Information Technologists (SAICSIT) Conference 2018, 26 -28 September 2018, Port Elizabeth, South Africa.
  Link: http://saicsit.mandela.ac.za/