An IT strategic decision-making framework in the midst of disruptive technologies

by

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ABSTRACT

Technological disruption enabled by the internet revolution has resulted in an exponential increase in the growth of new technologies and resultant technology disruptions in the workplace. Many firms do not grasp the new technology trends early enough to improve business processes and capitalise on these emerging technologies. Over the last five years, there has been exponential growth of technologies in the consumer space, mainly in social, mobile, collaboration, big data and cloud-computing technologies. As these technologies mature and gain momentum, they change the context in which businesses compete and the nature of competition, resulting in the blurring of the lines between digital and traditional business models across industries.

Disruptive technologies are changing the rules of competition. The rate of change in technology in the traditional enterprise space has been relatively slow in comparison. Most chief information officers (CIOs) agree that there could be significant value in utilising new technology in creating a competitive advantage in an agile world; however, in practice the adoption and implementation of newer technology occur relatively slowly.

Previous information technology (IT) research predominantly focussed on IT selection, IT risk and governance, user acceptance of technologies and IT investment criteria. However, there is very little research on factors influencing strategic IT decisions from a perspective of disruptive technologies. Business executives would generally invest in IT initiatives that can generate a return on their investment, grow their business and maintain or create a sustainable competitive advantage, but organisations are often hesitant to investment in disruptive technologies in agile business conditions.

The objective of this study was to investigate critical factors that guide strategic IT decision-making in an agile business context. This research explored relevant literature on disruptive technologies, disruptive organisations, approaches to IT decision-making, expectations of CIOs and enterprise architects in a disruptive context. During literature reviews, various factors were identified that had an influence on strategic IT decision-making in organisations. These factors were tested with experienced IT executives who made or influenced strategic IT decisions, comprising CIOs, enterprise architects, business executives and IT consultants from organisations across industries. Some of the participants were based internationally or had gained extensive experience in IT while working for global organisations.

The outcome of the data collection resulted in two contributions to the information systems discipline. The main research contribution is a framework for strategic IT decision-making (FIT framework) and a step-by-step guide on how this can used by IT decision makers in a disruptive context. The second research contribution is the BIDD model (business IT, internal IT, digital IT and digital business), which can be used to classify IT systems based on their functional purpose in organisations.

The use of the FIT framework and the BIDD model provides CIOs with a comprehensive guideline to make strategic IT decisions in the midst of disruptive technologies.

Keywords: Disruptive Technologies, Enterprise Architecture, Technology Life Cycle, Business Value Creation, Decision-making, Adoption of Technology, Consumer Technology, Digital Business.

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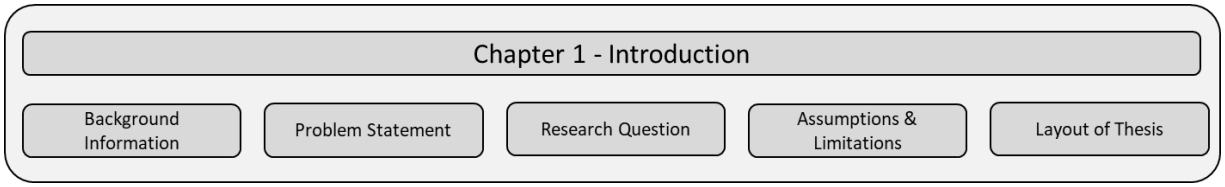
Abbreviations, Definitions, Acronyms and Approach of this Thesis

Abbreviation	Description
Agile Business	Agile business refers to organisations operating in an environment faced with continuous changes when viewed from different perspectives, e.g. enabling technologies, competitive threats, consumer expectations, emerging business models that force business to review the status quo continuously and adapt to remain competitive.
Chief Information Officer (CIO)	In this thesis CIO and information technology (IT) specialists refer to executives accountable for IT strategic planning, implementation, support and maintenance (Tucci, 2018).
Decision Framework	A decision framework helps CIOs decide what to do in disruptive business conditions and help them to get to quick decisions to fast-track execution.
Decision-making	Decision-making is the act of making a choice among alternatives (Klinger and Klein, 1991). Without a decision there is no action – leading to continuous analysis of problems with no outcome because of continuous changes in variables.
Decision-making Factors (DMF)	DMFs identified in this research are factors that influence strategic IT decision-making in a disruptive technology environment.
Disruptive Innovation	Disruptive innovation is a process where an initially inferior product or service is offered to customers. Customers are not prepared to switch because of low cost or low quality. Over time cost and quality improve and this may result in wide-scale adoption (Christensen, 2003, Christensen et al., 2015).
Disruption	A disruption is a process through which smaller companies with fewer resources successfully challenge established incumbent businesses (Christensen et al., 2015). It is a process that happens over a period, which could potentially have an impact on business models that service the needs

	of customers.
Digital	Digital refers to the creation of new business models and designs by using technology. It is the blurring of the physical and digital worlds, resulting in convergence of interactions, people, business and things. It is also characterised by digitising and automating of physical and manual tasks through the use of technology (Scheibenreif et al., 2018).
Digital Business	Digital business is the organisation or unit in an organisation whose business model is enabled by the use of technology and information (Scheibenreif et al., 2018, Narayan, 2015).
Disruptive Technology	In this thesis the term disruptive technologies refer to technologies that are both sustaining innovation and disruptive innovation that have the potential to affect incumbent businesses (Christensen et al., 2015).
Disruptive Business	Disruptive businesses are smaller, more nimble businesses that generally focus on overlooked segments of the market at a lower cost. Entrants move up the value chain as technology evolves. Disruption occurs when mainstream customers start adopting services and products as price meets performance and quality expectations (Christensen, 2003, Christensen et al., 2015).
Information and Communication Technology (ICT)	ICT is commonly also referred to as IT in this thesis and refers to technologies deployed within an organisation.
Information Systems (IS)	IS refers to the way IT is deployed within an organisation relating to people, processes and technologies. This looks at end-to-end design, implementation and management of solutions and not just the technology.
Main Research Question (MRQ)	The MRQ has to be answered to address the problem statement identified in this research.

Platform Businesses	Platform businesses are those that create value by leveraging network effects. They connect consumers and suppliers who create value by their interaction (Parker et al., 2017). For example, Uber connects drivers with riders. iPhone allows app developers to connect with phone users.
Sub Research Question (SRQ)	The SRQ is to be answered when answering the main research question.
Sustaining Innovation	Sustaining innovation is the process of incremental innovation on existing products and services to make them better for existing customers. Incumbent organisations can also face a threat from sustaining innovations that force organisations to respond. An example is Uber – where incumbent taxi operators are now introducing ride hailing apps or challenging the legality of Uber's approach (Christensen et al., 2015).



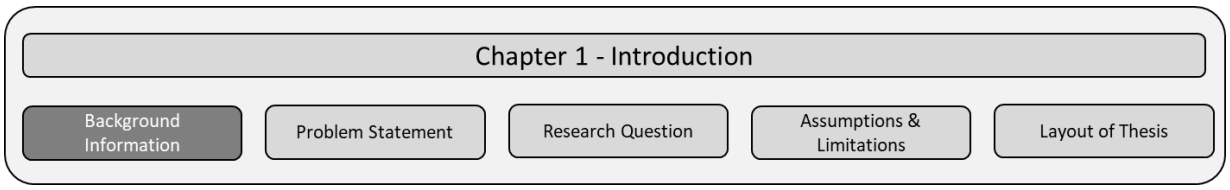
1 INTRODUCTION

The format followed in Chapter 1 is that section 1.1 provides background information on challenges experienced by chief information officers (CIOs) in making technology decisions in disruptive conditions. The problem statement and research questions that will need to be answered in this research are defined in section 1.2 and section 1.3 respectively.

The objective of this study is to understand changes in the IT landscape from a disruptive technology perspective and formulate a framework for strategic IT decision-making in an agile business environment. CIOs are recruited into organisations and are expected to play a strategic role. However, in many instances they end up very frustrated, spending most of their time addressing operational issues (Heller. M, 2012, Bongiorno et al., 2018, Varanini, 2018, Rizzo, 2018). Organisations have different strategies, core competencies and value propositions to the market and their customers. CIOs with different experience, qualifications, skills, abilities etc. are expected to step into a strategic role and make decisions about IT and IT strategy that could have a significant impact on the future sustainability of a business in a hyper-competitive environment (Rizzo, 2018, Narayan, 2015). Disruptive technologies, consumerisation, cloud, the internet of things (IoT), big data and various other technologies and service-provisioning models all make the decision-making process of a CIO more challenging (Schwab, 2016, Schmidt and Cohen, 2013, Barlow, 2013). Except for the work of Selkala (2016) and Tamm et al. (2014), little research has been done on strategic IT decision–making, which is of concern, considering the exponential increase in disruptive innovations and technologies across industries.

Brinker (2013) stated that a problem is that “Technology changes exponentially, organisations change logarithmically”. In agile business environments there are rapid and accelerating changes in technologies, but changes in organisations in terms of behaviour and thinking are difficult and slow. The challenge therefore for CIOs is to understand the impact of changing technologies and decide on what technologies to adopt that will maximise business value and allow them to compete in agile business conditions.

In this study, the researcher will evaluate decision factors and criteria to be considered by CIOs and propose a framework to guide strategic IT decision-making from the perspective of disruptive technologies.



1.1 BACKGROUND INFORMATION

1.1.1 Changes in technology landscape

The disruption caused by the internet revolution has resulted in an exponential increase in the growth of new technologies and resultant technology disruptions in the workplace (Chambers, 2015, Schwab, 2016). Many firms do not grasp the new technology trends early enough to improve business processes and capitalise on these emerging technologies (Christensen et al., 2015, Christensen, 2003).

With the rapid changes in the technology landscape, CIOs and key decision makers need to learn to manoeuvre though the plethora of emerging technologies and make quick technology decisions that may result in business model innovation and give companies the ability to compete in a digital world (Rizzo, 2018, Heller. M, 2012).

Traditional technology adoption life cycles are no longer relevant for companies operating in a hyper-competitive environment (Rogers, 2016, Burton and Allega, 2014). Previously pioneers were the first to assimilate emerging technologies into their businesses, while mainstream organisations waited and observed before taking the plunge. With the current pace of technology change, failure to react to the changing technology landscape could result in business disruption, with disastrous consequences for organisations (Christensen, 2003, O'Reilly III and Tushman, 2016).

Over the past two decades, there have been various trends in IT from an industry perspective. Technology trends in the industry have moved through the following phases described by analysts: Open source, service-orientated architecture, Web 2.0, mobility, social, big data, cloud, IoT, wearable devices, digital business etc. (Schwab, 2016, Cohen, 2015, Burton and Allega, 2014). CIOs' decision to adopt or ignore any of these trends could have a significant impact on any business if due process is not followed (Roberts and Watson, 2014, O'Reilly III and Tushman, 2016, Rizzo, 2018). In the absence of any framework or guideline for CIOs, the implication is that these technology decisions are based on individual or team experience and inherent knowledge.

1.1.2 Impact of disruptive technologies on business strategies

Disruptive and emerging technologies have the potential to lower the barriers to entry into an industry and result in the blurring of boundaries between industries, enabling agile fast-paced competitors to compete with traditional industry players (Christensen et al., 2015, Christensen, 2015, O'Reilly III and Tushman, 2016, McNish and Silcoff, 2016). Consumer-driven technologies such as mobile, social and cloud increase customers' service delivery expectations, which forces organisations to adopt digital business strategies (Schwab, 2016, Schmidt and Cohen, 2013, Rizzo, 2018). Companies that do not adapt to changing market conditions could find themselves going down the path of Kodak, Nokia, Blackberry, Blockbuster and many other organisations that obstinately focussed on the source of competitive advantage that made them successful; their inability to adapt to new technology trends in time caused their downfall (Christensen et al., 2015, Christensen, 2003, Chambers, 2015).

1.1.3 Changing expectations and demands on CIOs

Expectations of CIOs are changing. They are now expected to focus more strongly on business enablement and adding business value as opposed to being IT specialists focussed on operational issues (Rizzo, 2018, Barlow, 2013, Heller. M, 2012, Bongiorno et al., 2018). Technology is now part of mainstream business, as it attracts significant capital investment and operational expenditure, which attract attention from most business executives, to realise a return on investment (Rizzo, 2018, Heller. M, 2012). Technology also permeates every aspect of business, which implies that IT is no longer at the periphery; it dictates how business is conducted. CIOs are now faced with a challenge of motivating "why" they need to invest in IT, decide on "what" they need to invest in, make a strategic bet on "when" the time is right to invest and decide "how" they will execute the project (Sinek, 2011, Adner and Kapoor, 2016, Sutherland and Sutherland, 2014). Decision-making complexity has increased exponentially over the past few years; a wrong decision could result in the failure of an organisation (Brinker, 2013, Newell and Shanks, 2003, Sniedovich, 2012).

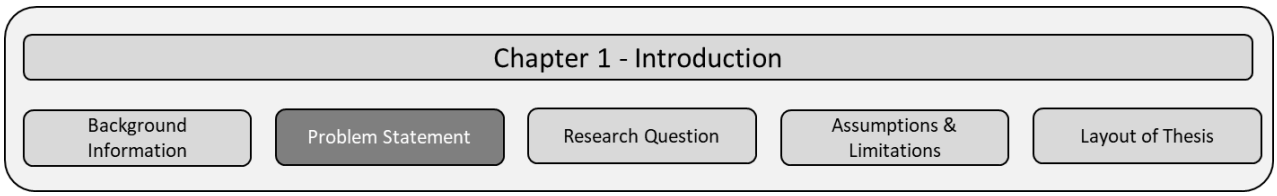
IT has traditionally been viewed as a business enabler, but with the blurring of the lines between business and IT, the traditional roles of IT departments and CIOs are being re-evaluated (Hope et al., 2011, Narayan, 2015). IT transformational plans have been shifting the focus from technology selection and implementation to the application of technology to create business value (Raskino and Waller, 2015, Rizzo, 2018, Heller. M, 2012). Chief executive officers (CEOs) and chief

financial officers (CFOs) expect more value from their IT spending and expect CIOs to do more with fewer resources (Heller. M, 2012, Barlow, 2013). In addition, business expects IT systems to be always available and have the ability to adapt rapidly to changing business conditions and market dynamics.

CIOs generally focus on technology management and governance, but the role and expectation of CIOs are changing (Rizzo, 2018, Bongiorno et al., 2018, Varanini, 2018, Potter et al., 2016). CIOs across a broad range of industries all seem to be faced with similar challenges. However, little research has been done that guides CIOs on how to address the changing expectations of them. CIOs with varying skills and experience synthesise information from various sources to formulate IT strategies that they believe are the best for the company (Varanini, 2018, Capitani, 2018 Demuru and Katinis, 2018). The absence of frameworks or guidelines for strategic IT decision-making could result in inconsistent decisions on technology choices, as these are dependent on the experience of individual CIOs.

According to Gartner's definition of the Nexus of forces, rapid changes are occurring in the social, mobile, cloud and information environments. IT leaders are grappling to understand the practical implications of these technologies in legacy business applications and business processes (Raskino and Waller, 2015, Burton and Allega, 2014). The uncertainty created by the pace of technology changes slows the adoption of new technologies in business (Brinker, 2013, Peters, 2014, Hope et al., 2011). The reactive response of CIOs results in business leaders making a significant percentage of IT and IT budget expenditure decisions outside the control of the CIO (Fitzgerald, 2016, Heller. M, 2012, Roberts and Watson, 2014). This results in IT departments reacting to business requirements and spending huge amounts of time managing IT security and bringing technology under their governance, which does not contribute to business value (Evans, 2003, Peters, 2014, Bongiorno et al., 2018).

Many organisations currently have technical CIOs that have been promoted through the ranks owing to their years of experience (Heller. M, 2012, Varanini, 2018, Maffè, 2018). With the paradigm shift in the industry from a technology perspective, the question remains whether senior leadership in IT has evolved their paradigms to accept changes brought about by new technology to create business value (Rizzo, 2018, Demuru and Katinis, 2018, Barlow, 2013 Roberts and Watson, 2014 Hope et al., 2011).



1.2 PROBLEM STATEMENT

1.2.1 The new era: Disruptive technologies and business impact

The exponential increase in technology innovation has resulted in a technology gap between businesses, industries and markets. Organisations that leverage disruptive technologies to create innovative business models can disrupt traditional businesses within mature industries (Christensen, 2003, Christensen et al., 2015). For most organisations the stakes are much higher. In the past significant investments were made in implementing large-scale core IT systems, enterprise resource planning (ERP), mainframes, email etc., which improved the robustness and predictability of organisations (Heller. M, 2012, Lapalme, 2012, Ross et al., 2006). The value derived from IT systems resides at the periphery, at the point of customer demand (Rizzo, 2018, Heller. M, 2012, Narayan, 2015). IT investments are under intense scrutiny, as they have an impact on the agility of organisations and could have a direct impact on customer satisfaction and loyalty, which could in turn have a significant impact on the future sustainability of organisations (Rizzo, 2018, Bongiorno et al., 2018, O'Reilly III and Tushman, 2016).

Traditional technology adoption life cycles no longer apply regarding disruptive technologies (Burton and Allega, 2014, Burke et al., 2016, Sutherland and Sutherland, 2014). The risk and reward proposition of disruptive technologies is different from traditional sustaining technologies (Christensen, 2015, O'Reilly III and Tushman, 2016). Companies that adopt new technologies at the appropriate time could gain considerable advantage over the early and late majority; however, they also expose themselves to a significant amount of risk. Timing is essential when it relates to decisions on disruptive and emerging technologies, especially when the life cycles of these technologies are continuously reducing (Adner and Kapoor, 2016, Schwab, 2016).

As the market evolves, supply and demand side economics in industries are changing (Parker et al., 2016). The supply of software and hardware is moving from a product-centric perspective to a service-centric approach (Evans, 2003, Rizzo, 2018, Schwab, 2016). The industry is moving away from a one-time purchase-and-install mode to a pay-per-use model, where customers can

buy what they need, when they need it and in a variety of payment models (Martens and Teuteberg, 2012, Low et al., 2011). The flexibility introduced by suppliers of IT systems and solutions provides a mechanism for CIOs to reduce risk and to solve the timing challenge. However, disruptive technologies, combined with changes in the way these technologies can be delivered to organisations, create additional levels of complexity for CIOs when deciding on their future IT strategy.

According to Gartner, significant IT spending happens outside the control of IT departments. This is driven by the consumerisation of IT trends (Fitzgerald, 2016, Raskino and Waller, 2015). Business executives are more IT-literate than ever and, in many cases, would not hesitate to procure services via readily available cloud providers or bring consumer technology into a business environment without considering internal IT risk and governance processes (Heller. M, 2012, Fitzgerald, 2016, Hope et al., 2011). The result of this is that IT departments in many organisations end up "playing catch up", trying to bring compliance and governance back into an enterprise. Newer technologies that evolve from a consumerisation perspective will need to be secured by internal IT departments to reduce significant risk to businesses.

IT users often see CIOs as bottlenecks, as they are viewed as delaying the introduction of new technologies into business (Heller. M, 2012). The challenge CIOs face is that while it is essential to build a strong foundation for IT, any investment in this area is generally not seen as value adding (Evans, 2003, Ross et al., 2006, Bente et al., 2012). CIOs have the challenging task of explaining to the organisation that with companies opening their IT systems to customers, suppliers and partners and with employees and customers accessing systems on disparate systems and networks, it is critical that organisations have appropriate levels of authentication, encryption and access control in place (Parker et al., 2016, Schwab, 2016, Bente et al., 2012). The risk of business disruption due to security breaches can create challenges for continued business operations. Theft of confidential documents and cyber security breaches can adversely affect reputation with customers and suppliers and affect an organisation's stock price or shareholder value.

Mainstream businesses in the technology adoption cycle cannot afford to take a passive approach to changes in technology (Parker et al., 2016, Burton and Allega, 2014). Business needs to scan the numerous technologies in the market continuously and invest in key technologies that can protect existing assets and help build future sustainability for organisations (Kearns and Sabherwal, 2007, Rizzo, 2018, Gans, 2016). CIOs and business executives have

now come to the realisation that the next source of competitive advantage and growth will come from emerging and disruptive technologies (Heller. M, 2012, Bongiorno et al., 2018, Rizzo, 2018).

The challenge for CIOs is one of timing (Adner and Kapoor, 2016, Raskino and Waller, 2015). Emerging and disruptive technologies can have a significant impact on companies and industries in terms of value creation and exchange (Christensen et al., 2015, O'Reilly III and Tushman, 2016, Gans, 2016). Business processes can be significantly disrupted from multiple dimensions, providing new ways and channels to service customers within significantly shorter timelines.

As technology is an enabler in achieving business objectives, the CIO's challenge is therefore to achieve business objectives by deciding on an appropriate technology strategy in a disruptive environment.

1.2.2 Decision challenges in a disruptive technology environment

The challenge for most CIOs is that the exponential increase in disruptive technologies creates additional complexity, which significantly slows down the decision process (Rizzo, 2018, Brinker, 2013, Hope et al., 2011, Evans, 2003). CIOs need to prioritise which technology and which business problem to address in a rapidly changing technology environment (Castello et al., 2018, Corso et al., 2018, Wunderlich and Beck, 2017, Heller. M, 2012). Often CIOs delay decision-making on new technologies and wait for the emergence of industry standards, sticking to traditional ways of doing business. This approach significantly increases the risk of disruption by new entrants who are not handicapped by legacy IT systems (Gans, 2016, O'Reilly III and Tushman, 2016, Christensen et al., 2015).

Rapid changes in technologies imply that factors influencing decision-making change continuously (Müller, 2017, Gans, 2016, Parker et al., 2016, Schwab, 2016, , Sniedovich, 2012). The challenge therefore for any CIO is how to make decisions in an agile business environment when confronted with a continuous stream of new technologies that could disrupt an organisation if the wrong decision is taken or no decision is taken (Rizzo, 2018, Adner and Kapoor, 2016, Shepherd et al., 2015).

CIOs often rely on enterprise architecture (EA) teams, which generally fall within their area of control, to understand business requirements and devise strategic IT plans and roadmaps that should align to business strategies (Lapalme, 2012, Gøtze, 2013, Walker, 2007, Burns et al., 2009). Although EA is a key function, most organisations question the value of EA in relation to

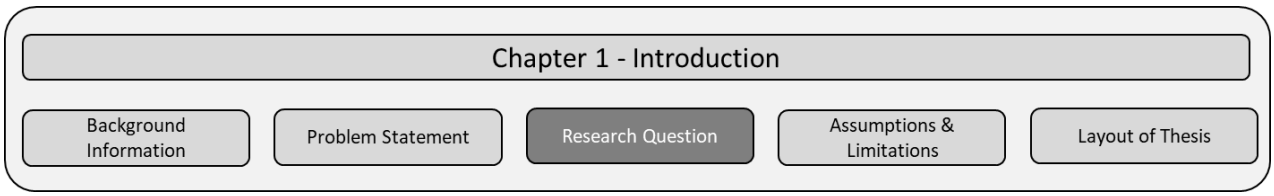
strategic road mapping and providing guidance on IT decision-making (Burton and Allega, 2014, Burns et al., 2009, Lange et al., 2012). If EAs do not help CIOs with decision-making in disruptive environments, it would be interesting to determine how strategic IT decision-making is conducted in practice.

1.2.3 Decision guidelines for strategic IT decision-making in a disruptive environment

Organisations are increasingly dependent on the use of IT in creating competitive advantage and value (Selkala, 2016). Selkala (2016) in his research indicates that CIO decisions are essential to realise benefits of IT in an organisation. However, no report of research on CIO decision-making processes could be found in existing literature.

Strategic IT decisions are generally made by senior executives in an organisation and could have a major impact on an organisation's sustainability and survival (Tamm et al., 2014). These decisions are challenging owing to uncertainties about costs and expected benefits. Moreover, in agile business conditions decision complexity increases exponentially. Strategic IT decisions could lead to costly and complex changes in organisations that could have a prolonged impact on staff, vendors and contractors and result in the implementation of major systems that will have a lasting impact on an organisation (Tamm et al., 2014). Tamm (2014) also found little research on strategic IT decision-making processes in his study.

Strategic IT decisions are the responsibility of CIOs in every organisation, although very little research seems to have been done to guide these decisions. The argument in this research is that if there is better understanding of strategic IT decision-making, it could help CIOs in making better technology-related decisions and speed up the decision process to enable organisations to complete in disruptive market conditions. Strategic IT decision-making in a disruptive environment would be influenced by various internal and external factors. The intent of this research is to understand factors influencing strategic IT decision-making and to suggest a framework to guide IT decision-making in an agile business environment, from the perspective of disruptive technologies. The assumption in this research is that CIOs are generally the custodians of strategic IT decision-making, although this does not exclude other stakeholders responsible for such decision-making.



1.3 RESEARCH QUESTIONS

To formulate a framework to help CIOs with strategic IT decision-making, various factors were considered from different points of view to understand how decisions are currently made in organisations. Decision-making is influenced by different factors, such as the personal attributes and experience of the decision maker, decision processes, characteristics of the industry, organisational characteristics, timing etc.

Organising these factors into a framework for IT decision-making creates an artefact that may assist CIOs in making optimal technology decisions in a disruptive environment. As there are numerous factors that can influence strategic IT decision-making in an organisation, the main research question (MRQ) that guides this research is the following:

MRQ:

"How can a CIO decision-making framework be constructed that can be used to guide CIOs in making strategic IT decisions in a disruptive technology environment?"

To propose a framework to guide IT decision-making in disruptive conditions, CIOs will need to understand external changes in technologies and disruptive trends before deciding on which technology choice to make. As CIOs are generally the custodians of IT, the assumption in this research is that the CIO will have to decide on technology strategies that enable an organisation to compete in agile business conditions.

The sub research questions (SRQs) defined to be answered are the following:

SRQ1:

"What are the key factors in a framework that CIOs should consider when making strategic IT decisions in an organisation in agile business conditions?"

SRQ1 is explored in Chapter 2 and Chapter 4, by analysing existing literature to understand factors that influence strategic IT decision-making in organisations. The intent of the research is

not to focus on the technology itself, but on factors to consider and the process to follow to arrive at a decision that drives action in response to a disruptive threat.

SRQ2:

"How can the suggested decision framework be refined with input from field experts based on their current experience in making decisions in a disruptive environment?"

SRQ 2 is addressed in Chapter 5, by analysing interview transcripts in greater detail to determine how CIOs and IT specialists make strategic IT decisions in the current business context. Findings from field research are correlated with factors emanating from the literature review to formulate a decision framework for CIOs from the perspective of disruptive technologies.

SRQ3:

How can the decision framework be used in practice to guide strategic IT decision-making in agile business conditions?"

SRQ3 is described in Chapter 6, showing how the decision framework can be used in practice.

To answer the MRQ, the literature review focussed on literature relating to the following high-level topics:

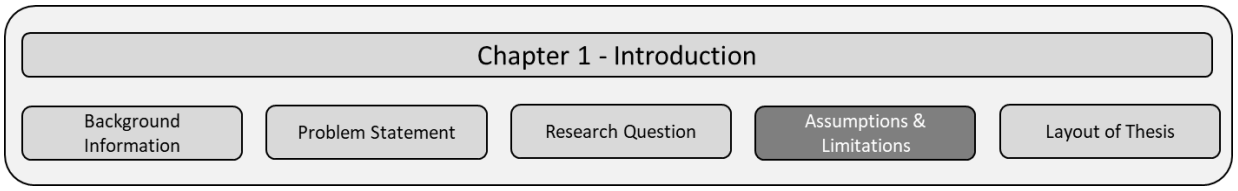
- Disruptive technologies – It is necessary to understand the nature of disruptive technologies and their impact on IT and business and to identify factors considered by successful organisations and CIOs who have embraced disruptive technologies in their business.
- Strategic decision-making: How do managers make decisions in a complex environment faced with uncertainty?
- Role of CIO – Understanding is sought of the role of the CIO in strategic decision-making related to disruptive technologies in an environment where IT is a key enabler of business success.
- EA – Generally EA has been a key function in an organisation to ensure IT and business alignment. This section explores the role of enterprise architects in influencing decision-making from a disruptive technology perspective.

As little research could be found on strategic IT decision-making, except for the work of Tamm et al. (2014) and Selkala (2016), as discussed in Chapters 2 and 4, other information systems (IS) literature was analysed to understand how decisions are made in practice. The exploratory stage

of the study analysed various topics that could influence IT decision-making, i.e. changing expectations of CIOs, decision theory, disruptive technology, EA approach and business strategic fit. Therefore, to address the MRQ, various other questions were focussed on as well, including:

- Is the expectation of the CIO in the organisation clearly defined?
- Based on organisational characteristics, are some factors more important than others?
- What is the impact of the decision process in organisations on decision-making?
- Do organisations have a way of differentiating the many IT systems used in an organisation, which may have different metrics that guide decision-making?
- Are different criteria used for the different IT systems deployed in an organisation?
- Is there an established process to identify emerging or disruptive technologies that could have an impact on the organisation?
- What factors are considered when deciding on which emerging or disruptive technology to adopt?
- Do current EA frameworks and approaches used in organisations provide sufficient guidance for CIOs to make optimal decisions?
- Do CIOs deliberately consider the impact of an IT investment on the strategic fit or value contribution to organisations' products or services?

The outcome of this research was a framework that is applicable to most organisations across a cross-section of the industry.



1.4 ASSUMPTIONS AND LIMITATIONS

The focus of this thesis is on strategic IT decision-making in agile business conditions from a perspective of disruptive technologies. Therefore, the assumption is that businesses that make use of the latest technologies will continue to exist or gain an advantage over their competitors.

Technologies are disrupting supply and demand side economics across every industry, i.e. retail, manufacturing, agriculture, mining, healthcare etc. (Christensen et al., 2015, Christensen, 2003, Gans, 2016). The assumption in this thesis is that organisations want to adopt technology to create competitive advantage and remain competitive in agile business conditions.

However, it is also acknowledged that the business strategy of some organisations may be to exploit a neglected segment of a market until it starts making losses or adopts a different strategy from mainstream competitors. This thesis does not focus on organisational strategy or provide comments on the effectiveness of strategies in agile conditions. The decision framework in this thesis provides guidance to CIOs on how to influence an organisation's strategy and how to fast-track appropriate IT decisions to offer organisations strategic choices.

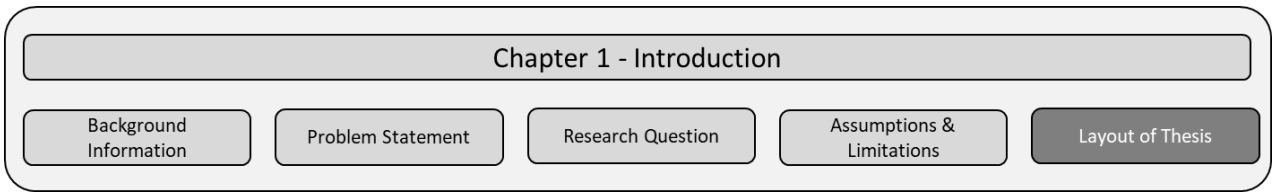
The thesis also assumes that factors influencing technology adoption are similar across different industries in South Africa. This research follows a generic approach and does not segment businesses across industries to determine the specific outcomes in different areas of specialisation. Operational IT and technology systems generally differ between industries, although the foundational systems of most organisations are similar. (However, further research might investigate finer differences between industries.) The approach adopted in this thesis is to classify systems into different categories without delving into the detailed characteristics of individual systems. Different categories of IT systems will have similar decision characteristics, which be incorporated into a framework to guide strategic IT decision-making.

An assumption in this thesis is that CIOs are generally the custodians of IT systems in an organisation. With IT permeating every facet of business, the assumption is that the strategic intent for most organisations is for CIOs to assume control of all IT systems deployed in an organisation and to be accountable for IT governance, risk and compliance.
There could be other strategic initiatives that may give organisations a competitive advantage, but this paper will only focus on IT and the use of IS in organisations to create a strategic advantage for organisations.

1.5 PUBLICATIONS FROM THIS STUDY

Appendix C contains the IEEE Africon 2017 conference submission that was accepted and presented at the Science, Technology and Innovation Conference in Cape Town. The paper submitted by Padayachee, R, Van der Merwe, A and Matthee, M (2017) was accepted and included in the Africon conference proceedings.

Appendix Q shows the presentation to master's students at the University of St Gallen, Switzerland by Prof. Alta van der Merwe. The presentation was well received, and students found the framework useful to guide strategic IT decision-making.



1.6 LAYOUT OF THESIS

A design science research (DSR) approach was used and guided the process followed in this research. The Design Science Research Model (DSRM) from Vaishnavi and Kuechler (2012) was used as a basis for this research and consisted of five key process steps, namely awareness, suggestion, development, evaluation and conclusion.

Figure 1 shows the mapping of the chapters in this thesis to the DSRM by Vaishnavi and Kuechler (2012).

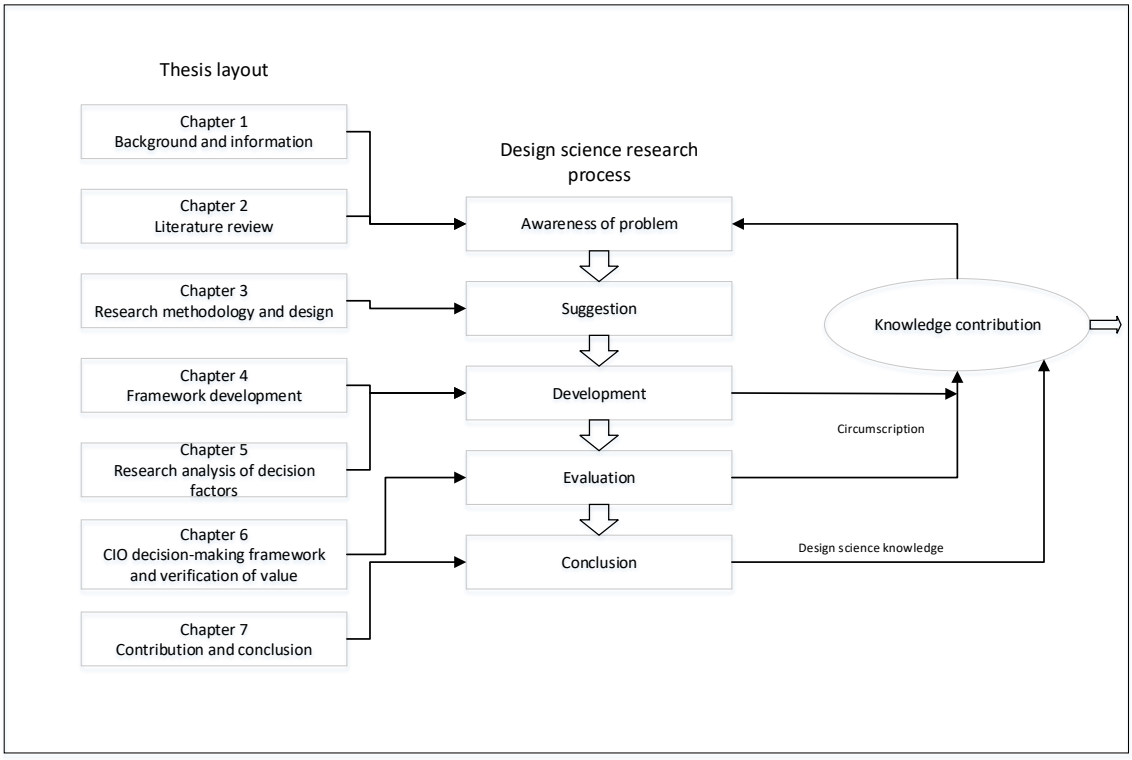


Figure 1 - Layout of Thesis

Chapter 1 – Introduction (DSRM – Awareness of problem phase)

This chapter provides an overview of disruptive changes in technology and the potential impact on organisations. The unpredictable pace of change of technology, which could have either a positive or negative impact on organisations, implies that CIOs need to think and act differently from what they did in the past. The problem statement describes the challenges experienced by CIOs in making technology decisions in agile business conditions.

Chapter 2 – Literature review (DSRM – Awareness of the problem phase)

The concept of decision-making is explored further in this chapter, highlighting differences between operational, tactical and strategic decision-making and explaining why this is key in driving action.

This chapter analyses existing literature to understand how CIOs make strategic IT decisions during periods of disruptive change. The literature review focusses on decision-making in fast-paced technology environments where time is of the essence. With the blurring of the lines between traditional IT and business or operational IT systems, IT was viewed from an organisational level, as technology often permeates every facet of business.

Chapter 2 analyses existing literature to understand strategic IT decision-making and determine if gaps exist in literature, which could be addressed by the development of a decision framework.

Chapter 3 – Research methodology and design – (DSRM – Suggestion phase)

Different theoretical frameworks, research designs and methodologies are explored to identify appropriate approaches to answer the research question identified in Chapter 1, section 1.3. The "awareness of the problem" phase of this thesis was refined through a process of abduction and deduction related to empirical data and literature reviews. As the intent of this thesis is to create a pragmatic framework for IT decision-making, a DSR approach (Kuechler and Vaishnavi, 2012) was selected to structure this thesis and the "research onion" (Saunders et al., 2009) method was used for data collection and analysis. This chapter provides the reasoning justifying the selection of the research methodology and design in this thesis.

Chapter 4 – Framework development – (DSRM – Suggestion phase)

Key factors emanating from literature reviews form the basis for creating a proposed decision framework to guide strategic IT decision-making in organisations.

This chapter describes the process steps followed in gathering primary data from interview participants relating to the factors in the proposed decision framework. As this thesis is based on qualitative analysis, the data analysis techniques used are described in detail in this section. Empirical data and key factors emerging from the literature review are summarised in Chapter 4, which forms the basis of a decision framework that will then be verified and refined in subsequent chapters.

Chapter 5 – Research analysis of the decision factors/refinement – (DSRM – Evaluation phase)

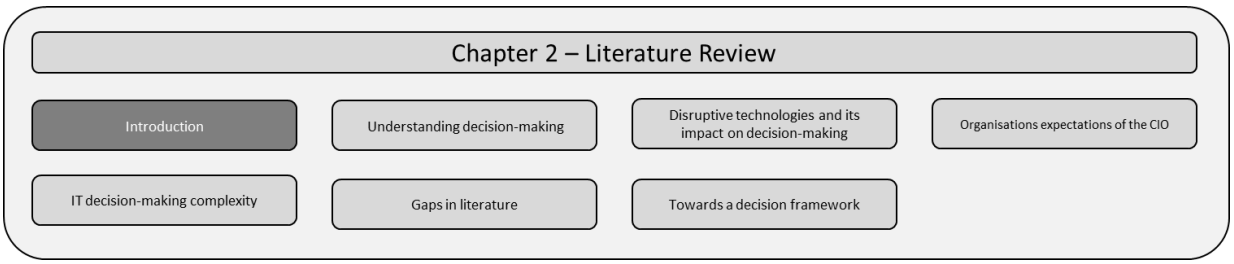
A detailed data analysis of interview transcripts was conducted to refine the decision framework further. This chapter also analyses how CIOs motivate the implementation of disruptive technologies in practice and concludes by analysing the key decision criteria based on interview results.

Chapter 6 – Final framework/verification – (DSRM – Evaluation phase)

Chapter 6 provides an overview of the framework construction and approach adopted in this thesis. A comparison is conducted between the initial decision framework suggested and the decision framework for IT (FIT) proposed in this thesis.
The FIT decision-making framework is verified in a two-step process to determine if this can be applied in practice. The first step entails checking if decision challenges identified in the data-gathering phase of the research can be addressed by the FIT framework. The second step in the verification process entailed a focus group discussion with a team of IT experts to solicit their views on the applicability of the framework in practice.

Chapter 7 – Contribution and conclusion – (DSRM – Conclusion and knowledge contribution phase)

This chapter discusses the contribution of this study to IS research and identifies areas for further research.
This chapter also discusses where research questions were addressed and provides an overall summary of the study. A description of how the FIT framework can be used as a valuable artefact in an organisational context is provided.



2 LITERATURE REVIEW

2.1 INTRODUCTION

The objective of this research is to formulate a decision framework for strategic IT decision-making in organisations. It can be argued that strategic IT decision-making happens infrequently (Tamm et al., 2014). However, in agile business environments faced with a continuous stream of disruptive technologies, decision cycle times are increasing in frequency.

The approach followed in this chapter is to analyse relevant research to understand the impact of disruptive technologies on organisations and industries and then to determine how CIOs and organisations approach strategic technology decision-making in reaction to disruptive threats.

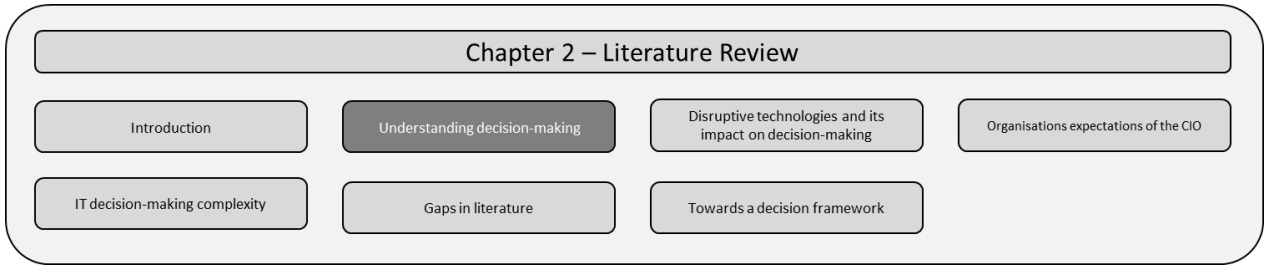
The literature review in this chapter will therefore focus on the following key topics highlighted in the problem statement: CIO challenges and expectations, decision-making and disruptive technologies in an agile environment. CIOs generally have a wide area of focus; this research focusses only on aspects that affect or influence technology decision-making in organisations in agile business conditions.

Different sources of information were used to understand decision-making in agile business conditions. Literature was gathered mainly from the following sources:

- Google Scholar – various combination of keywords on the key topics related to the MRQ used in the research. During the search process, only articles related to the search topic published after 2010 were reviewed. However, many papers on topics such as decision-making were more than 10 years old but were still relevant in answering the research question and were therefore included in the literature review.
- EBSCO Host Research Database: A similar search as on Google Scholar was conducted on this research database.
- Gartner Research and Analyst Discussions: Information from Gartner analyst reports relating to digital business, disruptive technologies, EA, decision-making, the CIO's role in business transformation, IT frameworks etc. was gathered and analysed.

- Ovum Research Database: Analyst and research information relating to IT decision-making and frameworks was sourced from Ovum for this literature review.
- Books: Disruptive technology and IT decision-making have attracted significant interest from the IS community, therefore books relating to the concepts highlighted in the main research question were purchased for analysis in this research.

The section that follows analyses the literature related to disruptive technologies, decision-making and the expectations of CIOs and EA in greater detail to understand the impact of these on strategic IT decision-making in agile business conditions.



2.2 UNDERSTANDING DECISION-MAKING

Decision-making in the context of this research focusses on how CIOs make choices or decisions in complex, practical and real-world situations. Clemen (2001) defines decision-making as “the commitment to a course of action”. Clemen used naturalistic decision-making (NDM), which is an approach intended to help one understand how experts make high-stakes decisions in an environment in which they are not comfortable, and describes decision-making as, “Decision-making is what you do when you don’t know what to do”. Aplak and Türkbey (2013) indicate that a good decision increases the chances of a good outcome and “is the process of making choices amongst alternatives according to incoming information.”

The economist Adam Smith’s contribution to economic theory recognised that “probabilities were indeterminate and/or imprecise” when making decisions. Brady (2016a) mentions that Adam Smith rejected any notion that mathematical laws and calculus could be used for decision-making in the real world. The challenge therefore for many IT decision makers is to find ways to make consistent decisions in an uncertain world where laws of mathematics or natural sciences do not apply. Sniedovich (2012) also indicates that decision-making under conditions of severe uncertainty is a challenge in many disciplines and suggests the use of non-probabilistic decision models.

Kaner and Karni (2004) view decision-making as a key operational and managerial function and an essential part of any organisation's success. An improvement in an organisational decision-making capability helps improve the success of any organisation. Decision-making quality is improved by proper knowledge management processes, which enable informed decision-making. The success of a business and its process is dependent on two aspects, i.e. actions and decisions (Kaner and Karni, 2004). The highest state of knowledge is a decision and a commitment to action.

Organisations typically have three levels of management and decision-making: strategic, tactical and operational. The strategic level is mainly focussed on decisions related to setting business goals and priorities, tactical decisions typically relate to actions and approaches to achieve business strategy and operational decisions focus on the day-to-day operations in producing products and services and on employee and customer engagement (Kaner and Karni, 2004). Figure 2 provides an overview of the differences between strategic, tactical and operational decision-making in organisations.

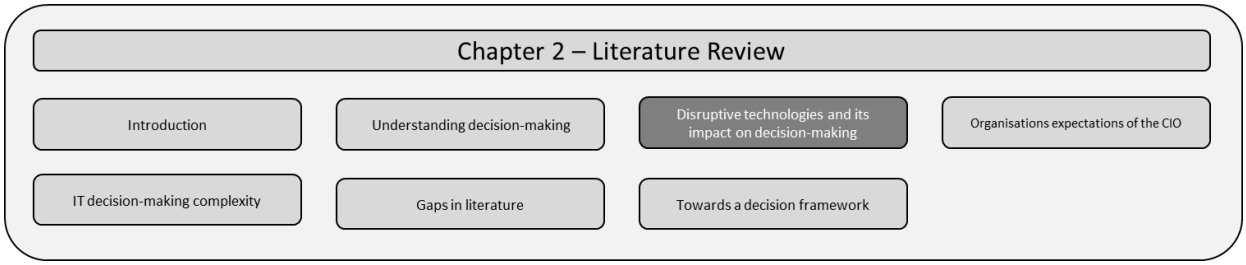
Factor	Operational decision-making	Tactical decision-making	Strategic decision-making
Level of management	Low to middle	Middle	Upper
Time frame	Immediate to days	Days to weeks	Weeks to months
Goals	To keep organisation running in accordance with tactical and strategic guidelines	To guide the organisation in the short term governed mainly by strategic guidelines	To chart long term goals and routes for the organisation
Participants in decision-making	Usually one	One or a team	Mostly teams of executive officers
Input	Immediate past performance and instructions on current performance as well as information about the goods and services provided	Concerns, schedules, revenues, profits, costs, and other economic indicators	Hypothetical policies, plans, budgets, and objectives. Information often comes from sources outside the organisation.
Output	Operational decision (e.g. production plan)	Tactical decision (e.g. increase number of workers to achieve production plan)	Strategic decision (e.g. transfer to automated production)
Repetitiveness	Decisions are repetitive and an integral part of the operational work	Decisions are often repetitive, but less frequent than operational decisions	Decisions are usually infrequent
Ease of determining success	Operational management tends to be measurable (there are fixed, well defined tasks to be performed)	Less measurable than those for operational management, since response time is longer, and cause-effect relationships are more complex	Less measurable than those of tactical management because their work is more abstract and complex and difficult to evaluate

Figure 2 - Comparison of Operational, Tactical and Strategic Decision-making (Kaner and Karni, 2004)

With the rapid advances in technology, IT has the impact of optimising or disrupting every aspect of business from a strategic, tactical or operational perspective. One of the biggest threats to

most organisations is disruption from organisations that understand how to leverage information and IT with their core business (Carlo et al., 2014, Habtay, 2012).

The next section provides an overview of disruptive technologies and disruptive innovation and their impact on IT decision-making.



2.3 IMPACT OF DISRUPTIVE TECHNOLOGIES ON DECISION-MAKING

2.3.1 Overview of disruptive innovation

Christensen (2003) introduced the concept of disruption by describing it as a process where small companies with fewer resources start by offering products and services at lower costs and quality to an overlooked segment of the market. Over time, product and service quality improves and they start encroaching on incumbent models and customers. Disruption occurs when mainstream customers start adopting products and services from the entrants' customers. Figure 3 shows the process of disruption as described by Christensen.

As the concept of disruptive innovation gained momentum, the definition became too broad and was loosely used to describe any situation where incumbent businesses fail owing to technology and process changes in the industry. Christensen (2015) proposed a refined definition of the disruption process to ensure common understanding across stakeholders. In his definition, disruption occurs in two types of situations that incumbent organisations overlook:

- Low-end foothold: Incumbent organisations focus on continually providing improved products and services to existing profitable customers. They often ignore customers at the low end of the market, creating opportunities for disruptive organisations to offer low-cost alternatives to less demanding customers.
- New market foothold: Disrupters in this context create markets where none existed previously by "turning non-consumers into consumers".

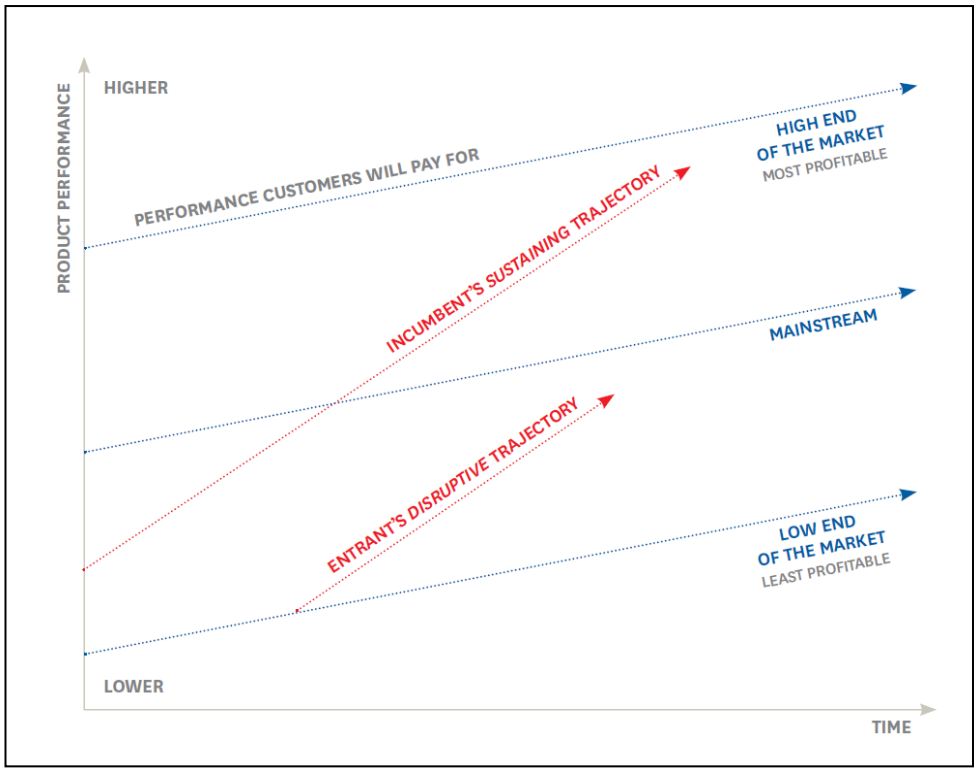


Figure 3 - The Disruptive Innovation Model (Christensen, 2003)

Airbnb is an example of "disruptive innovation" as described by the disruptive innovation theory, which uses an internet-based business model to compete with incumbents in the tourism industry. Airbnb introduced a disruptive product with key attributes that appealed to a segment of the market that required cheaper, convenient and simple accommodation. It was initially largely ignored by incumbent hotel chains who focussed on more profitable customers and improved their products by using sustaining innovation. As Airbnb refined their business model and improved the quality of their offerings, they appealed to a large set of customers in the mainstream market, which resulted in wide-scale adoption and disruption of incumbents in the industry (Guttentag, 2015).

Christensen (2003) also mentions two types of disruption in his research, as defined below:

Sustaining innovation: This is a process of incremental innovation on existing products and services to make them better for existing customers. Incumbent organisations can also face threats from sustaining innovations and this could force organisations to respond. An example is Uber; incumbent taxi operators are now introducing ride hailing apps or challenging the legality of Uber's approach (Guttentag, 2015).

Disruptive innovation: An inferior product or service is initially offered to customers. Customers are not prepared to switch owing to low cost or low quality. Over time cost and quality improve and this may result in wide-scale adoption by mainstream customers.

Disruptive technology in this thesis refers to technologies that are both sustaining and disruptive, which have the potential to affect incumbent businesses. CIOs of organisations need to assess the potential threat of both types of technology innovation and then decide on an approach that would be best suited to their organisation.

The sustainability of any organisation is dependent on its ability to predict the impact of changes in the technology landscape on its business strategies and respond at the appropriate time to avoid disruption to its continued business operations (Christensen et al., 2015, Rizzo, 2018, Adner and Kapoor, 2016, Carlo et al., 2014, Downes and Nunes, 2013). Once the implications of emerging technologies for EA plans are understood, organisations need to determine when to implement revised technology plans. Investing too early, before the emergence of a dominant design, could result in significant exposure to the wrong technologies or investing too late could result in losing market share to new entrants who have no legacy investments.

Figure 4 shows a conceptual model for business model innovation because of technology or market-driven innovation. Habtay (2012) describes the disruptive potential of technology-driven and market-driven innovation on organisations. The disruption process caused by technology-driven innovation conforms to norms described by the disruptive innovation theory (Christensen, 2013). Market-driven disruption can generally also be referred to as “low-tech” or demand-pull innovation, which begins with consumers creating demand and therefore opportunities for innovation. Market-driven demand then creates opportunities for technology innovation and investments in research and design to meet customer requirements (Habtay, 2012). Technology innovation varies on a continuum from incremental changes to existing technologies to radical or disruptive technologies that have the potential of replacing what is currently in existence (Carlo et al., 2014).

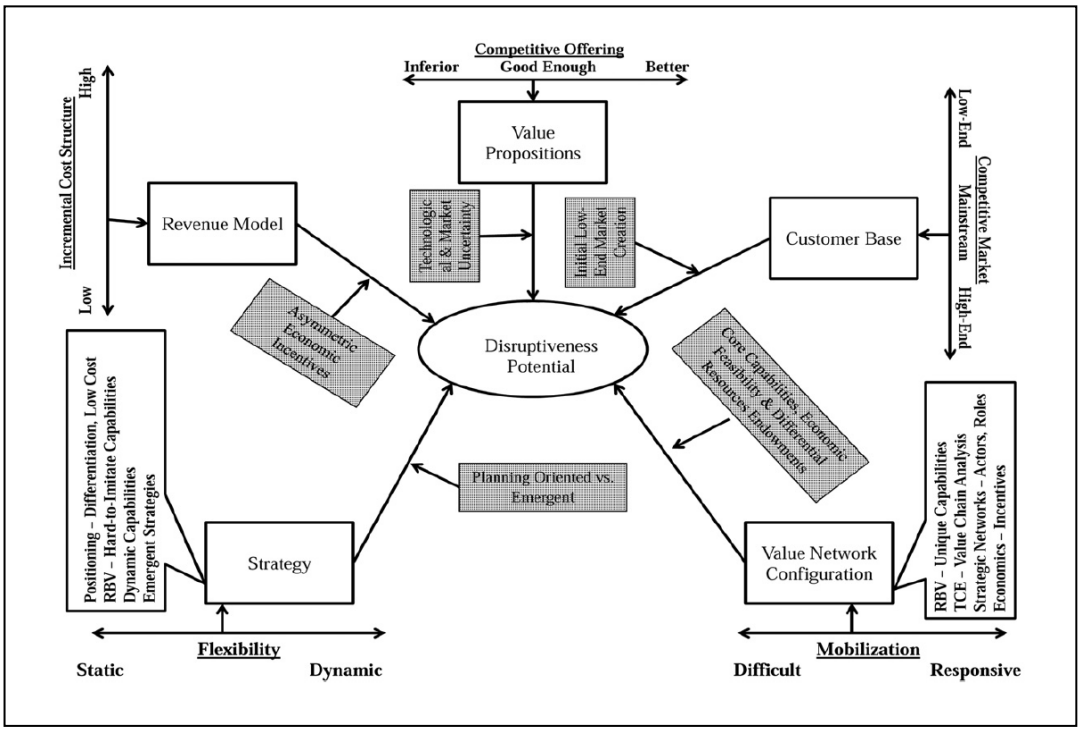


Figure 4 - Conceptual Model for Disruptive Business Model Innovation (Habtay, 2012)

Supply and demand side disruption

Gans (2016) indicates that there is a general tendency to adopt a single theory to explain how disruption may occur. Christensen's (2013) popular theory proposes that disruption generally occurs when new entrants introduce new product innovations at low cost; these serve the low end of the market. Over time, the improvement of these products meets the requirements of the high-end market and this will have an impact on incumbents that did not predict and respond appropriately to technology changes. The more organisations focus on the requirements of their current customers, the more likely they are to be disrupted.

Gans (2016) proposes two theories to explain why businesses are disrupted. Demand side theory is the most prevalent. It describes disruption from a customer or market perspective. The supply side theory that he proposes states that new innovations are extremely difficult for incumbents to adopt and create competitive market offerings, as it would require changing the architecture of their current products. Disruptions are also difficult to predict and uncertain regarding which technologies may offer appropriate rewards, therefore some organisations prefer to respond after the fact. Incumbents that have been successful would have optimised procedures, processes and capabilities to ensure that they are successful and can grow in their target market. In many cases

they have the idea that being disrupted in their target market is unlikely to occur. Theory on supply side disruptions proposes that incumbent organisations develop tacit architectural knowledge, which is difficult to replicate. Disruptive technologies would imply an architecture innovation of incumbents, which cannot easily be changed without significant organisational transformation.

The dilemma for incumbent organisations is to decide if they should react to unproven technology, when they have been extremely successful with current technology (Gans, 2016). Organisations can also not react to any disruptive technology change, therefore they may decide to wait for the emergence of a dominant technology before reacting. Gans (2016) concludes that both demand side and supply side theories find predicting disruptive events very challenging and almost impossible.

Most disruptive organisations described in existing literature are enabled using disruptive technologies or innovative use of existing sustaining technologies. Every company in almost all industries faces the risk of being disrupted by technology-enabled competitors. The expectations from company boards is for CIOs who are technology experts to understand external technology trends and influence company strategic direction. CIOs need to be aware of technology and market-driven innovation that could result in disruption and ensure that these are factored into an organisation's strategic plan.

2.3.2 Disruptive technologies overview

One of the fundamental drivers that caused an exponential change in technology was the introduction of the internet and rapid advances in communication technologies (Schwab, 2016, Parker et al., 2016, Heller. M, 2012). In the early 1990s, most internet traffic was routed though fibre-optic cables. Continuous advances in technology resulted in greater amounts of data flowing across fibre networks. Advances in network and communication technologies resulted in the internet evolving from a medium for email and web pages to an environment that enabled voice over internet protocol, video streaming, cloud computing and ubiquitous connectivity. The evolution of the internet resulted in users shifting from desktops to smartphones, tablets and wearable devices to access all available information.

Some of the fundamental technology shifts in the industry are mobility, cloud computing and the IoT (Burton and Allega, 2014, Cantara et al., 2016, Raskino and Waller, 2015). Gartner Consulting conducted a recent study of strategic trends that have the potential to disrupt consumer behaviour, industry, business and IT organisations significantly. The most popular

trends that could have a business impact are reflected in the Gartner hype cycle, illustrated in Figure 5.

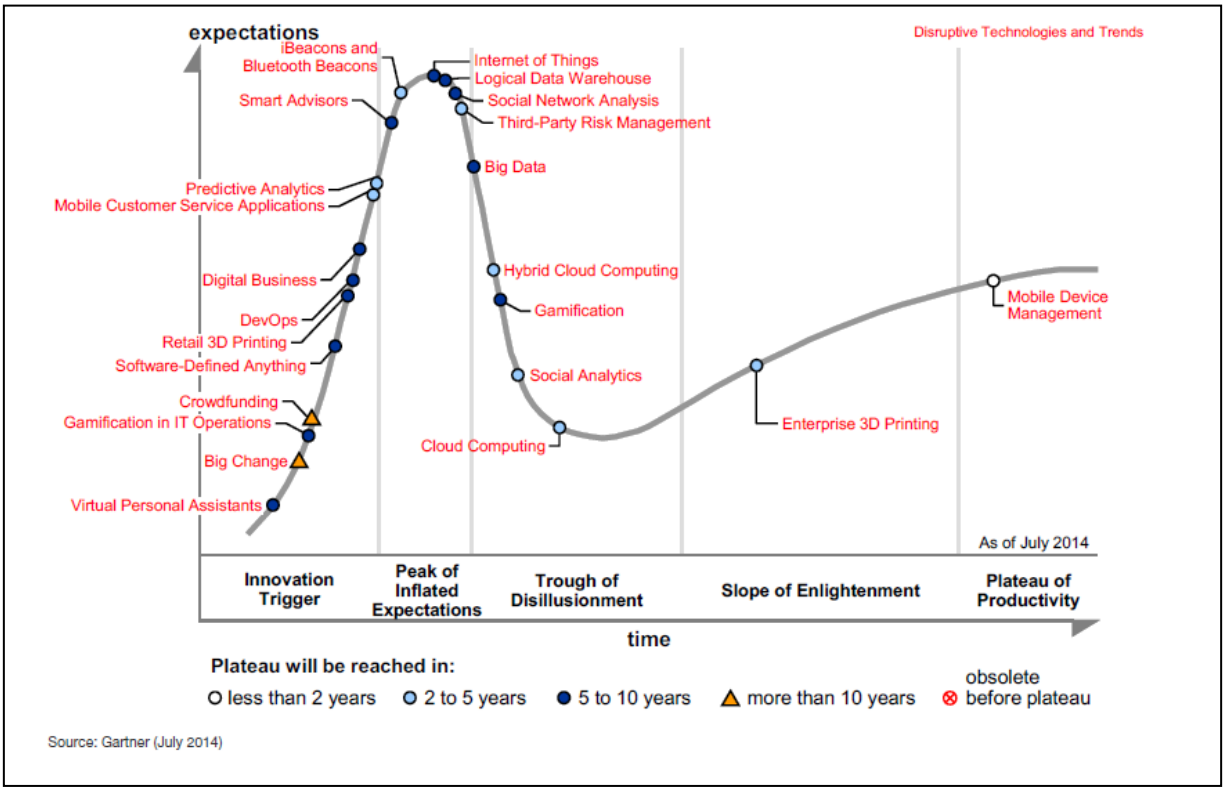


Figure 5 : Major Disruptive Technologies and Trends (Cantara et al., 2016)

Burton and Allega (2014), Gartner research analysts, indicate that these disruptive technologies could have a significant impact on businesses. CIO and EA practitioners need to understand the overall impact of these trends to determine the impact they could have on business outcomes.

A summarised view of some of the key trends are briefly described below (Cantara et al., 2016, Burton and Allega, 2014, Burke et al., 2016):

Virtual personal assistants: The mass penetration of smartphones has now enabled many applications that have previously never been possible. Typical applications could be health monitors, financial advisors, personal shoppers etc. Enterprise architects need to embrace these technologies and find other interesting ways to enable productivity while finding ways to manage security, privacy and management.

Gamification in IT operations – This entails a new approach to the management of change in IT operations. This approach entails the use of game theory and game mechanics to involve users

in solving complex problems. Considering the impact of disruptive technology on business, EA practitioners may need to evaluate the use of gamification to understand the impact of change on people, processes and technology.

Crowdsourcing/crowdfunding – This approach leverages on social networking to involve social actors to help determine the future state of enterprises or products. EAs could use crowdsourcing as an enabler to test future product offerings and marketing opportunities before any investments are made, thereby assisting business executives in decision-making. Manufacturers of products could also use crowdsourcing to obtain design ideas that would be attractive to different segments of the market before significant investments are made in new technologies or products.

Software-defined anything - There is a current trend in the industry to create an abstraction between software and hardware technologies to prevent any vendor lock-in. A good example of this is cloud computing, where users now have the choice of buying virtual servers of varying performance and capacities within minutes without any consideration of the underlying technology vendor. EA practitioners should try to understand the different technology roadmaps on the horizon before creating individual software-defined anything technology silos.

Retail 3D printing – The cost of 3D printing continues to decrease, which implies that this high-impact disruptive technology will now have a profound impact on the business models of companies. This has an impact on the offline and online business models of businesses, potentially in the areas of inventory and stock availability. Enterprise architects will now need to evaluate use cases for these technologies to determine how they could potentially integrate and change the business models of customers, partners and businesses.

DevOps – The intent of this approach is to align development and operational effort continuously by focussing on collaboration to improve business outcomes. This enables incremental release and continuous improvement, which are principles embodied in agile methodologies in software development. Enterprise architects can play a pivotal role in ensuring alignment between development and operations teams, thus effecting alignment to business strategy.

Digital business – This is a current buzzword in the technology industry where most organisations now want to focus on “digital business”. Traditional approaches to designing IT systems focussed on an “inside out” view, where EA focussed on alignment between IT and business to create value. A digital business approach follows an “outside in” view where the

needs of the customer are used as the basis for designing IT systems to create value. The digital business approach entails a new paradigm regarding EA, as enterprise architects are expected to sense towards what technology and the industry are moving and then advise and enable business to compete in a changing world.

Mobile customer service applications – These relate to the use of mobile devices and mobile applications to support business processes. Mobile devices have changed customer behaviour in many ways and businesses must adopt a mobile first approach when designing technology to support business outcomes. Enterprise architects in this case need to play a critical role in advising business and IT executives on the use of mobile technologies to improve the overall customer experience.

Predictive analytics - Although this has been a discussion point in the past, predictive analytics is reaching a stage of maturity where using big data, data mining and business intelligence, established trends are questioned and viewed in different ways. Rapid increases in processing capability have enabled data processing at speeds that were never possible previously. Some of the use cases of predicative analytics are demand prediction, identifying new types of fraud in near real time, identifying the impact of product and service deficiencies on consumer buying patterns, using IoT to obtain and analyse data in real time to add value to business and consumers. An example of this is the use of the traffic functionality in the Google Maps mobile application. Google uses location services of thousands of drivers on busy highways to determine traffic patterns in real time and then predicts appropriate traffic routes to allow drivers to reach their destination in the fastest time.

Smart advisors – This refers to functionality where large and multiple sets of data are processed to provide the most appropriate answer to users' queries based on an understanding of user needs. This type of functionality is commonly used as a self-help functionality in call centres but can be used effectively in other service industries such as the retail, financial and healthcare sectors as well. Organisations need to understand how to use these types of technologies to reduce costs, optimise business processes and serve customer needs in new ways.

iBeacons and Bluetooth beacons – These technologies generally use proximity technology and data collection to enable various services such as mobile payments, access control, inventory management, product promotion etc., which can be used to create new business models effectively and optimise business processes to serve customers.

Internet of things – With rapid advances in communication technologies and the availability of ubiquitous connectivity, physical objects can now be interconnected to provide data that can enable new technology solutions, such as smart energy, connected cars, telemetering, smart logistics etc. The use cases of IoT are endless; business and IT managers will need to understand the potential of this technology in a digital business environment.

Social network analysis – Social networking is a key technology that can have a disruptive impact on many organisations across industries. Besides leveraging of social networks and unified communications to enable inter-departmental collaboration, its mass communication ability to reach consumers can enable use cases that were never possible previously. When the game Angry Birds was released, there were over a million downloads within the first day. This could only have been possible with the use of social networks. Organisations now need to find new ways of gathering data or find ways of using social networks to enable new business models.

Big data – Understanding big data and its use can also have a disruptive impact on businesses. The speed at which data can now be processed allows business executives to have fast information at their disposal, which enables them to make decisions that could fundamentally change and optimise their businesses.

Hybrid cloud computing – Cloud processing and cloud service are other key disruptive trends that EA practitioners must leverage to enable the development of new business models. Hybrid cloud refers to the coordinated use of dedicated services, private and public cloud services to enable business outcomes. Scalability, costs and elasticity are major factors to consider when businesses compete in an agile world at hyper scale.

Gamification - This technology has huge potential to help businesses understand, predict and change user behaviour. User behaviour patterns and lessons learnt from the gaming industry can now be applied effectively in marketing, product innovation, education, customer loyalty and various other use cases in business.

Cloud computing – Cloud computing has the potential to change the technology industry fundamentally and change the technology roadmaps defined in traditional EA plans. This disruption has already had a significant impact on hardware, software and telecommunication service vendors who now all offer cloud services to their customers. IBM, which traditionally was very strong in the supply of superior hardware, recently sold off its Intel Server product line to

Lenovo, as customers can now buy servers from numerous vendors, including new entrants to the market, such as Amazon and Google. Despite the hype, the movement of services to cloud has not been as rapid as expected, as customers struggle to define their cloud migration approaches to reap the benefits of cloud. Enterprise architects have a critical role to play in helping organisations define cloud strategies and to design technology roadmaps in line with business strategies.

Mobile device management – While many enterprise architects spend time trying to define mobile strategies, these devices have already penetrated the market and are pervasive in most organisations. Mobile devices are already critical for communication, productivity, field operations, customer service and business process enablement. Enterprise architects need to evaluate mobility as an enabling technology for digital business strategies as opposed to defining mobile strategies.

Disruptive technologies are introduced on a continuous basis because of enabling technologies such as cloud, mobility and social media. Disruptive innovation generally starts off on a small scale, produced or developed at a low cost, grows rapidly by exploiting cloud mobility or social platforms, then ends up disrupting higher end markets and businesses as it evolves and gains critical mass (Christensen et al., 2015, Christensen, 2003). Enterprise architects need to develop skills in identifying potential threats in the market and proactively enable decision makers to counteract or embrace disruptive technologies in their business models before it is too late.

2.3.3 Disruptive technology and the CIO challenge

The new paradigm shift brought about by cloud, mobility, IOT and consumerism increases the complexity of the job of a CIO (Bongiorno et al., 2018, Rogers, 2016,Roberts and Watson, 2014). CIOs' accountability now extends outside the boundaries of an organisation. They now need to manage pieces of the value chain and suppliers from outside their organisation to achieve cost savings and satisfy innovation expectations. Information is no longer tied to a single application or enterprise. IOT technologies enable rich data streams on any variable that can be measured. Processing and storage of data could take place in cloud provider ecosystems across the globe. Relational databases and integration between systems in an organisation are not sufficient to yield insight required to enable businesses to compete in an agile environment, facing continuous disruption from external ecosystems (Rizzo, 2018, Castello et al., 2018, Messina, 2018).

Consumerisation of IT poses new challenges for CIOs (Rizzo, 2018, Fitzgerald, 2016, Habtay, 2012). In the past new technologies were requested by business executives requiring new systems and functional requirements from technology. However, consumerisation is driving demand exponentially. Executives are expecting technologies similar to those they use outside the work environment to be deployed within the enterprise. Examples of consumer-driven technologies are cloud storage, tablets, social networking, collaboration tools etc. This creates new demands and expectations of CIOs who have limited budgets that need to be prioritised to maintain legacy systems and fulfil business expectations. Employers have previously driven technology change in organisations that had to be accepted or controlled by IT before being adopted by business. However, the pace of change in the consumer technology space is driving business demand. Employees are now demanding newer technology within the enterprise, while IT departments are scrambling to get the many new innovations under control. Heller (2012), states that "The more your employees love technology, the more they dislike IT". This scenario was aptly captured by a statement by the CEO of a North American company: "Why is it that when I come to work each morning, I feel like I am stepping back in time" (Heller. M, 2012).

Business executives have now come to the realisation that the next source of competitive advantage and growth will come from emerging and disruptive technologies (Parker et al., 2016, Rogers, 2016). According to Gartner, more than 45% of IT spending happens outside the control of IT - this is driven by the consumerisation of IT trends. Business executives will not hesitate to procure services via readily available cloud providers or bring consumer technology into a business environment without considering internal IT risk and governance processes (Cohen, 2015, Fitzgerald, 2016, Raskino and Waller, 2015). Newer technologies that evolve from a consumerisation perspective will need to be secured by internal IT departments to reduce risk to businesses. However, security investments are generally seen as grudge purchases, as business executives and CFOs have difficulty in drawing a direct correlation between investments and business benefit. IT users see CIOs as bottlenecks, as they are delaying the introduction of new technologies into business (Fitzgerald, 2016, Heller. M, 2012).

Rapid changes in technologies imply factors influencing decision-making changes continuously. One of the challenges experienced by CIOs is that there is so much technology available, which can create distractions that slow down the decision process (Sniedovich, 2012, Schwab, 2016). CIOs need to learn to prioritise which technology and which business problem to address in a rapidly changing technology environment. In many cases making no decision is safest, however this significantly increases the risk to any enterprise of disruption by new entrants who are not handicapped by legacy IT systems (Christensen et al., 2015).

The challenge CIOs face is that while it is essential to build a strong foundation for IT, any investment in this area is generally not seen as value adding (Roberts and Watson, 2014, Rizzo, 2018, Heller. M, 2012). CIOs have the challenging task of explaining to the organisation that with companies opening their IT systems to customers, suppliers and partners and with employees and customers accessing systems on disparate systems and networks, it is critical that organisations have appropriate levels of authentication, encryption and access control in place. The risk of business disruption and theft of confidential information can adversely affect a business's reputation with customers and suppliers and affect an organisation's stock price or shareholder value.

The timing of decisions is also a challenge for CIOs (Adner and Kapoor, 2016, Christensen et al., 2015). In deciding when to adopt disruptive technologies, CIOs also need to consider the enhancement that can be gained investments in sustaining technologies, for example, improvements in processing, memory, networking and storage technologies (Adner and Kapoor, 2016, Roberts and Watson, 2014). These technologies are not disruptive by nature; however, they can significantly improve the speed of business processes, thereby enhancing enterprise value.

Evans (2003) indicates that, depending on the type of organisation, real time computing could benefit areas such as interactions with employees, partners and suppliers. CIOs will need to identify which business processes can be enhanced by providing more granular information in real time and which investments from an IT and business perspective would realise the most favourable returns. However, CIOs need to distinguish between processes that have natural frequencies that may not add additional business value by streamlining or enhancing the speed of the process. Areas that may generally benefit from real time computing are financial reporting, sales reports, security analysis and response, customer interaction, mobility and demand management.

As the market evolves, significant changes are occurring from a supplier perspective (Cohen, 2015). The supply of software and hardware is moving from a product-centric perspective to a service-centric approach (Heller. M, 2012, Evans, 2003). The industry is moving away from a one-time purchase and install mode to a pay-per-use model where customers can buy what they need when they need it and in a variety of payment models. The flexibility introduced by suppliers of IT systems and solutions provides a mechanism to CIOs to reduce risk and to solve the timing challenge. However, disruptive technologies, combined with changes in the way these

technologies can be delivered to organisations, create additional levels of complexity for CIOs when deciding on their future IT strategy.

2.3.4 Impact of disruptive technology on industries

The business environment is evolving rapidly. Technology has resulted in customers being more in control, demanding, expecting higher levels of service and expecting requests to be addressed or complied with in real time (O'Reilly III and Tushman, 2016, Rogers, 2016, Rossman, 2014, Schmidt and Cohen, 2013). Convergence in telecommunications technologies, exponential increases in processing power and mobility create opportunities for new business models and revenue streams. Collaboration between customers, partners and suppliers creates new ecosystems not possible previously to satisfy customer requirements in real time (Rogers, 2016, Parker et al., 2016). Internet and consumer technology-driven innovation has resulted in the creation of digital disruptive companies such as Alphabet, Amazon, Facebook, Airbnb, etc. Many traditional organisations are finding it difficult to transform owing to established products and service models, financial metrics and resource-related issues (Yockelson, 2017).

With the rapid advances in IT, business leaders need to learn to make the critical decision on when to transition from selling existing profitable products and services to offering new products and services that may cannibalise existing revenue streams (O'Reilly III and Tushman, 2016, Christensen et al., 2015). This jump is critical if businesses want to stay ahead of the curve in an agile world. The best indication of when to make this transition generally comes from listening to customers and understanding what their business requirements are. Over the past few years, iconic companies such as Nokia, Blackberry, Compaq, Sun Microsystems and Digital Equipment have either lost significant market share or disappeared owing to failure to anticipate where the market was heading and to respond appropriately.

Christensen (2015) states that "when thinking about how to predict disruptions, it's crucial to remember that it's not about the technology itself; disruptive innovation refers to a strategy that employs a technology, but the technology isn't disruptive." Business executives will therefore need to spend more of their time thinking about new disruptive strategies that could change the industry as opposed to just focussing on the technology itself.

Christensen (2015) also proposes two common elements for disruptive strategies. For existing over-served markets, the focus should be on products and services that are cheaper than

existing offerings. For new customers or market segments, products and services should strive to solve problems that customers are already trying to solve.

Businesses that want to stay ahead need to be continuously on the lookout for upstarts or companies that offer cheaper alternatives to their products, which are focussing on the low end of the market and then gradually move up the market as they grow their economies of scale (Downes and Nunes, 2013). When these disruptors appear, businesses should either consider acquiring these companies or creating an environment within their organisations to incubate a competing business model by embracing these new technologies (O'Reilly III and Tushman, 2016).

However, businesses also need to be aware of blind spots, where certain disruptions may emanate from completely different markets or industries that have the ability to take markets by surprise (Downes and Nunes, 2013). Global positioning system (GPS) navigation product makers were affected by this type of disruption in their industry. The introduction of smartphones with readily available free downloadable GPS applications took companies such as TomTom and Garmin completely by surprise. Free navigation apps are now preloaded on most smartphones and these products are cheaper and better than the standalone devices that were being sold. The disruption in this example came from completely different companies with different business models and from different industries. Consumers switched to new products in a matter of weeks, which left traditional GPS navigation companies stunned, as they had failed to predict the impact of this new disruptive technology.

Downes and Nunes (2013) refer to innovations that change the rules completely by wiping out traditional product lines and markets as "big-bang disrupters". In many cases these big-bang disruptions are unplanned and unintentional; they do not follow traditional market adoption models. Once these disruptors are released on the market, it is extremely difficult to fight back, requiring traditional businesses to reconsider innovations, products and business models and to adopt new market approaches to survive.

Companies need to understand that "big-bang" disrupters are completely different from traditional innovations and technologies (Downes and Nunes, 2013). They are normally cheaper than traditional products, easier to use and more integrated into consumers' current products and services. Many of them also exploit consumers' easy access to these products and ability to share information, generally using social media such as Twitter, Facebook and Instagram, without the need for traditional marketing campaigns. There are numerous examples of products

that have grown rapidly and taken incumbents by surprise. Lightning-fast adoption in many cases was driven by consumers' easy access to perfect information and user reviews on mobile devices through either social media or specialist sites such as Amazon, TripAdvisor and Google.

Figure 6 provides a good overview of the adoption of traditional technology in comparison to big-bang disrupters. Disruptive innovation is generally tested by a few trained users and then adopted by the majority without going through the traditional life cycle of technology adoption.

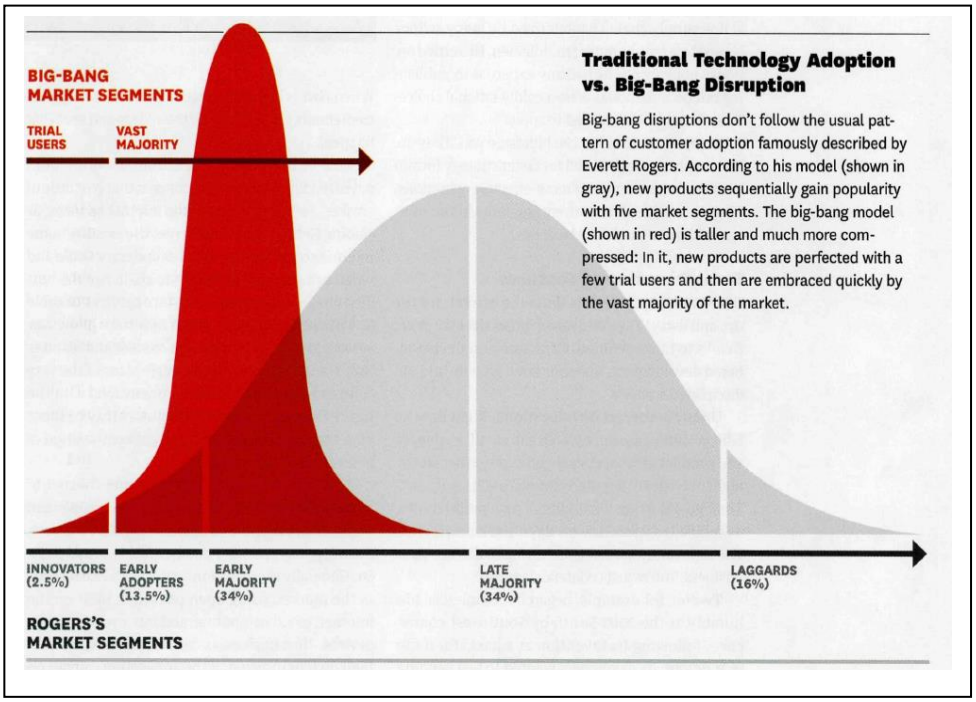


Figure 6 : Big Bang Technology Adoption (Downes and Nunes, 2013)

Downes and Nunes (2013) identify three characteristics of big-bang disrupters: unencumbered development, unconstrained growth and undisciplined strategy.

Unencumbered development

Unencumbered development arises because of low-cost experimentation on widely accepted and ubiquitous technology platforms. It does not follow traditional product development approaches and does not need budget approval to commence. Disruptive innovations such as Twitter, for example, did not start with any market segment or market offering in mind. Twitter is a good example of a disruptive technology that has disrupted almost every segment of the market, from news, information ecosystems and marketing to communication (Downes and Nunes, 2013). There are numerous other over-the-top (OTT) internet services such as Skype, Netflix, WhatsApp

and WeChat that have no underlying infrastructure costs; however, they fundamentally change the way consumers use public infrastructure services. OTT disruptive technologies are generally developed at minimum cost, leverage public cloud services and are quick to deploy to the public. Because of the low development costs, innovators are willing to experiment until a product is found that adds value and is rapidly adopted by the market.

Unconstrained growth

Disruptive technologies do not align to traditional product life cycles as defined in a typical bell curve with five customer stages: innovators, early adopters, early majority, late majority and laggards. Disruptive technologies generally tend to align to two phases, trial users and the rest of the market, across all industries (Downes and Nunes, 2013). The Apple iPad is a good example of unconstrained growth; since its launch, its global appeal across all segments of the market has resulted in millions of device sales immediately after product release.

Undisciplined strategy

Disruptive technologies often render traditional strategic models such as Porter's Five Forces model obsolete (Porter, 2008). Porter's model is used traditionally to analyse the level of competition within an industry by focussing on the following dimensions: threat of new entrants, threat of substitute products or services, bargaining power of customers, bargaining power of suppliers and intensity of competitive rivalry. Porter's model has been used extensively by business executives in deriving company strategies. However, big-bang disrupters do not align or contradict everything regarding these models. Disruptive technologies can arise from completely different markets, generally at significantly lower costs and with improved performance and can compete with mainstream products in a market segment in a very short space of time (Downes and Nunes, 2013).

Business strategies now need to consider an approach of continuous innovation to remain competitive and keep revenue from dropping. Businesses that try to compete by maintaining a more disciplined focus on the execution on current strategies, which may generally focus on customer intimacy, delivering higher quality at lower cost with the current product and service offerings, will ultimately fail (Downes and Nunes, 2013).

Yockelson (2017) identifies seven elements that differentiate disruptive providers when compared to traditional organisations:

- Incumbents need to support and service established channel/partner models: The nature of relationships between partners, customers and channel ecosystems is changing.

Traditional metrics may not be applicable, frictionless engagement among stakeholders is the norm and automation is essential to enable organisations to accelerate growth.

- Risk aversion due to fiscal/investor obligations: Traditional shareholders focus on quarterly earnings and bottom line growth. Disruptive organisations tend to focus on growth.
- Massive “in force” product/service portfolios: Incumbents support existing product and service portfolios, as these drive most business revenue, while innovating in parallel. Most effort and resources are therefore focussed on traditional portfolios rather than innovative topics. Digitally disruptive organisations start from a zero base, therefore they are continuously inventing and investing in innovative capabilities.
- Individual business unit needs/metrics: In traditional organisations, employees are aligned to go-to-market products and services and related compensation and incentives are aligned to product performance. Any competing product that could reduce revenue on existing product lines will be resisted. Disruptive organisations have no legacy and therefore metrics are aligned to core business offerings.
- Culture that promotes innovation and disruption: Traditional organisations are hierarchical in terms of structure and demands for attention. In disruptive organisations, collaboration and teamwork across the business is favoured.
- Bringing customers “along for the ride” or finding new customers: Incumbents need to maintain existing product lines and ensure they are successful. Current customer demands may make it difficult for incumbent organisations to evolve with disruptive technologies.
- Mergers and acquisitions: Traditional organisations often adopt mergers and acquisitions as an approach to compete in disruptive business conditions; however, integration into an existing business may not be successful owing to culture, partner ecosystems and business needs.

2.3.5 Disruptive technologies and impact on business IT strategies

For most organisations the stakes are much higher now - in the past significant investments were made in implementing large-scale core IT systems, ERP, mainframes, email etc., which improved the robustness and predictability of organisations (Heller. M, 2012). The value derived from IT systems now resides at the periphery, at the point of customer demand. IT investments are now under more intense scrutiny, as they affect the agility of organisations and could have a direct impact on customer satisfaction and loyalty, which could have a significant influence on the future sustainability of organisations (Parker et al., 2016, Narayan, 2015, Heller. M, 2012).

Mainstream businesses in the technology adoption cycle cannot afford to take a passive approach to changes in technology. Businesses need to scan a wide variety of technologies in the market continuously and invest in key technologies that can protect existing assets and help build future sustainability for organisations (Rizzo, 2018, Gans, 2016, Narayan, 2015).

Traditional technology adoption life cycles are no longer relevant for companies operating in a hyper-competitive environment (Burke et al., 2016, Cantara et al., 2016, Burton and Allega, 2014). Previously pioneers were the first to adopt emerging technologies into their businesses, while mainstream businesses waited and observed before taking the plunge. At the current pace of technology change, failure to react to the changing technology landscape could result in business disruption, with disastrous consequences for businesses (Gans, 2016, O'Reilly III and Tushman, 2016). The risk and reward proposition of disruptive technologies is different to deal with for traditional sustaining technologies. Companies that adopt new technologies early could gain considerable advantage over late adopters; however, they might also expose themselves to a significant amount of risk.

Puehse (2015) identified common causes of failure in organisations that caused them not to achieve success by becoming bigger, better and faster than their competition. Causes of innovation failure can be found below, as described by Puehse (2015):

- They have a single-dimension view of the innovation funnel, which causes wasted time and budget on the wrong topics.
- The collaboration power of consumers and employees is not harnessed.
- Organisations are too focussed on internal employee-centred activities when changes are happening externally.
- The incremental impact on their portfolio is recognised too late.
- Consumers compensate and adopt to mediocre ways current products and services meet their requirements.
- Disruptive innovation is rare; most innovation is sustaining or offers incremental improvements on existing products and services. It is easy to miss opportunities to fulfil un-serviced requirements of customers. Innovation must be "transformational", otherwise it may not change consumer habits.
- Organisations generally focus on incremental innovation on the primary function of a product. However, there may be un-intentional benefits, or the full potential of a product may not be recognised.

The challenge for CIOs is to differentiate between good, bad and excellent innovation, which is driven by uniqueness, relevance and endurance of the value proposition (Puehse, 2015).

Digitalisation is the next wave of disruptive innovation that can fundamentally transform mechanisms for value creation, economic fundamentals, dynamics within industries and the nature of competition (Bughin et al., 2018, Rogers, 2016, Schwab, 2016, Raskino and Waller, 2015, Schmidt and Cohen, 2013). Disruptive digital technologies enable instantaneous, frictionless connectivity to people, devices, machines and physical items anytime and anywhere. During the period 2016 to 2017, connected devices produced over 90% of the total data produced. Insights derived from the abundance of data can create new sources of competitive advantage and business models for incumbent organisations or create digital competitors that can leverage the power of information to disrupt industries. Figure 7 provides a view of how digital disruption is affecting incumbent business models and creating new business models.

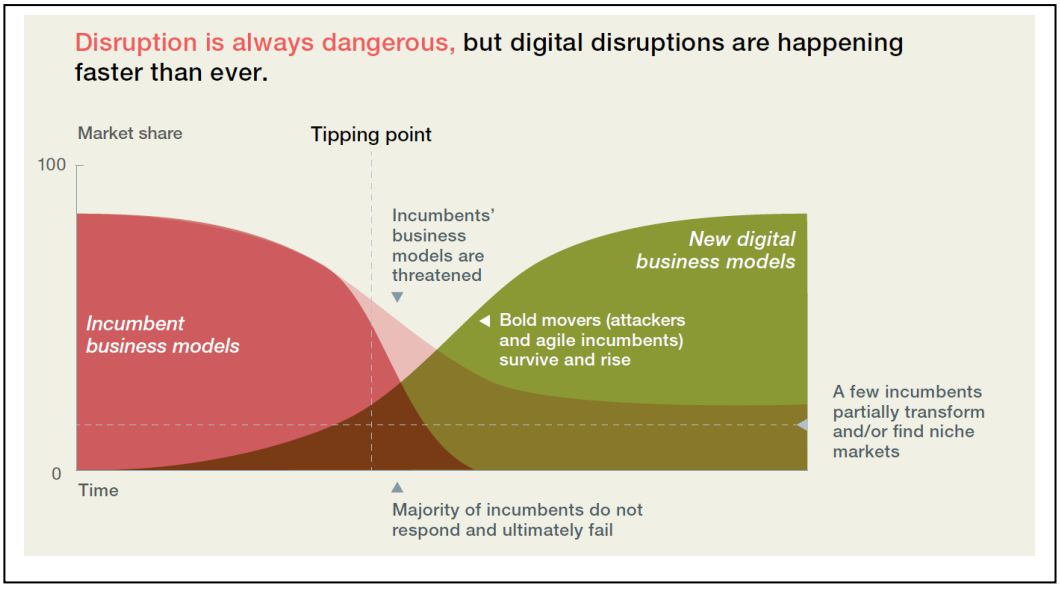


Figure 7 - Impact of Digital Disruption on Business (Bughin et al., 2018)

Bughin et al. (2018) indicate that many incumbent businesses have digital strategies that do not reflect industry dynamics, economic fundamentals or the changing nature of competition. In their research, Bughin et al. (2018) found that companies underestimate the increasing momentum of disruption, behavioural changes expected, impact of technologies driving disruption and scale of disruption bearing down on them. Figure 7 indicates that most incumbent organisations do not respond in time and few incumbent organisations manage to transform partially or find opportunities to serve a niche market with their products and services.

Petrick and Martinelli (2012a) state that for companies to drive innovation or more specifically disruptive innovation, they would need to have a deep understanding of non-obvious problems they would have to address in future. This understanding can be gained by scanning external environments, identifying market and technology trends and then predicting future problems and challenges that may need to be addressed from an end user or customer perspective. For successful businesses that are dominant in current markets this approach may be a challenge, as this requires questioning current paradigms about strategy in existing competitive landscapes.

Strategic road mapping enables companies to create an external view that challenges their current strategic perspectives (Petrick and Martinelli, 2012a). Companies will need to develop a vision of the future based on understanding of user experience, which will be enabled by a connected world. Innovation will need to change from a perspective of enhancing current products and services to an “outside-in” view of how products and services will enhance user experience.

Developing outside views for strategy development is a challenge for companies, as business executives would have perfected strategies based on market trends in periods of stability (Adner and Kapoor, 2016, O’Reilly III and Tushman, 2016, Christensen et al., 2015, Petrick and Martinelli, 2012a). Business executives relax in a comfort zone and will generally not recognise new realities or changes that do not align with existing paradigms or will ignore these. The implication of this behaviour is that companies often find themselves playing catch-up when their world is disrupted by innovation and this is often too late.

Petrick and Martinelli (2012a) suggest two distinct phases to enable strategic road mapping, i.e. problem-finding and problem-solving. Problem-finding focusses on prediction and understanding of future scenarios and innovations, while problem-solving will focus teams on finding solutions to future scenarios and innovations. This needs to become a continuous process driven by a strong leadership call to action. The call to action drives companies to determine strategic options in either responding to threats or enabling the new vision. Steve Jobs and Apple, for example, did not respond to a competitive threat, but had a very strong vision of the future where the consumer was at the centre of technology solutions. Leadership vision at Apple created the platform for strategic road mapping, which resulted in Apple completely disrupting the technology landscape on a global scale, with the resulting demise of many companies that dominated the market previously.

To succeed in a dynamic world, businesses need to learn how to anticipate, capture and lead through market disruptions. Organisations need to immerse themselves in market transitions and make tough decisions, either to find ways of disrupting the market or disrupt themselves in the process. According to Cisco's CEO, it is difficult to gain market share in a market that is not in transition, which is a reason why organisations need to transform their businesses to capture growth and must think differently about the future of IT (Chambers, 2015).

As the pace of disruption varies across industries and businesses, company executives realise that they cannot immediately exit existing business models and are exploring dual strategies in response to disruptive digital threats. Many organisations are exploring mechanisms to digitise existing businesses while simultaneously exploring innovative new business models (Bughin et al., 2018). Figure 8 illustrates the challenge for incumbent business in an environment where the pace of chance is unpredictable. Business leaders are faced with a challenge of determining where to focus their energy, when to make a change or make strategic bets on re-inventing or disrupting existing business models etc. In an environment of uncertainty, business leaders need to learn to execute, adapt and iterate continuously.

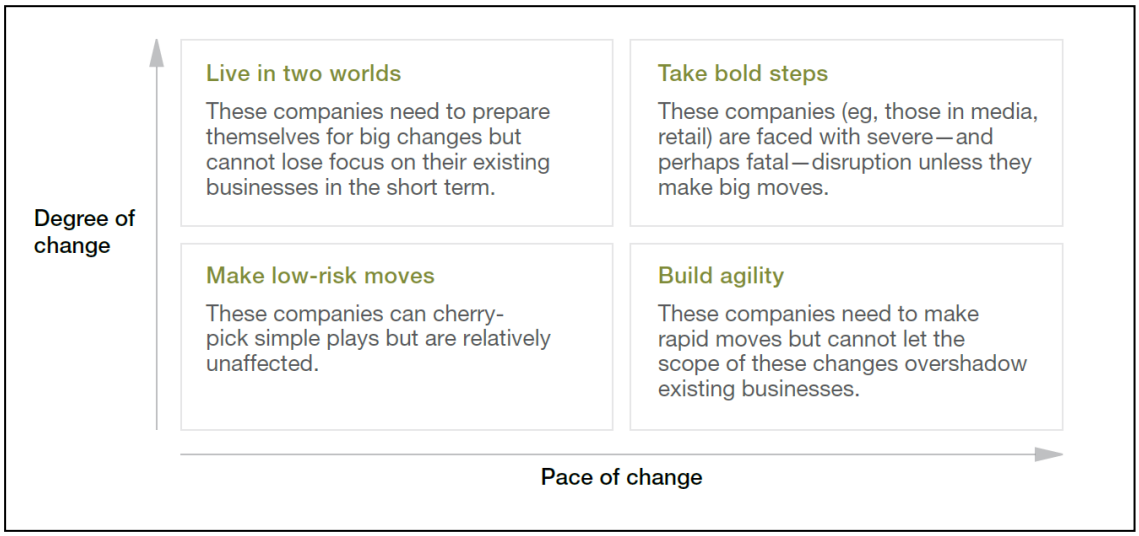
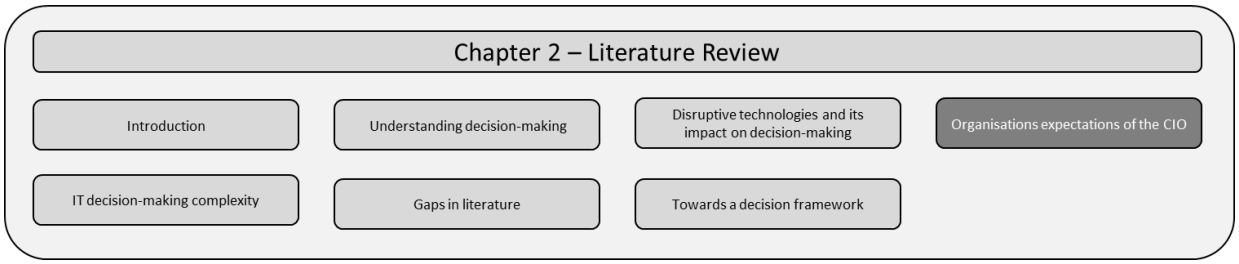


Figure 8 - How Companies Can Respond to Change (Bughin et al., January 2018)

The challenge for CIOs, who are generally the custodians of IT in organisations, is to understand and fast-track IT decisions in a disruptive technology environment, which can significantly influence business strategy in agile market conditions.

The following section in this chapter reviews literature on decision-making in a disruptive technology environment. The literature review first seeks to understand if the role and

expectations of CIOs have changed within a disruptive technology environment and identifies factors that influence decision-making in a disruptive context.



2.4 ORGANISATIONS' EXPECTATIONS OF THE CIO

This section explores organisations' expectations of CIOs regarding maintenance and providing stable IT services at the lowest cost or being a catalyst for strategic business model innovation.

Understanding the level at which CIOs are expected to operate and add value will have an influence on strategic IT decision-making. This will also provide a view of how strategic IT is to an organisation and if the function can influence strategy formulation, especially considering disruptive technologies in the market. It will be important for CIOs to understand if organisations' expectation of them is to provide stable IT services at the lowest cost, improve the efficiency of business processes or use IT as a differentiator and as a source of competitive advantage.

2.4.1 Traditional expectations of CIOs

Effective use of IT is key to the success of any large or small organisation. IT underpins most business processes, facilitates information exchange and provides management insight into the operations of the business.

Traditionally CIOs were employed to manage enterprise IT, which supports business processes and business strategy. The focus of CIOs has mainly been on activities shown at the bottom of the iceberg in Figure 9. However, real value that arises from CIO activities, decisions and IT strategies is realised at the tip of the iceberg when systems are used by staff in executing their responsibilities in an organisation or in fulfilling the needs of customers.

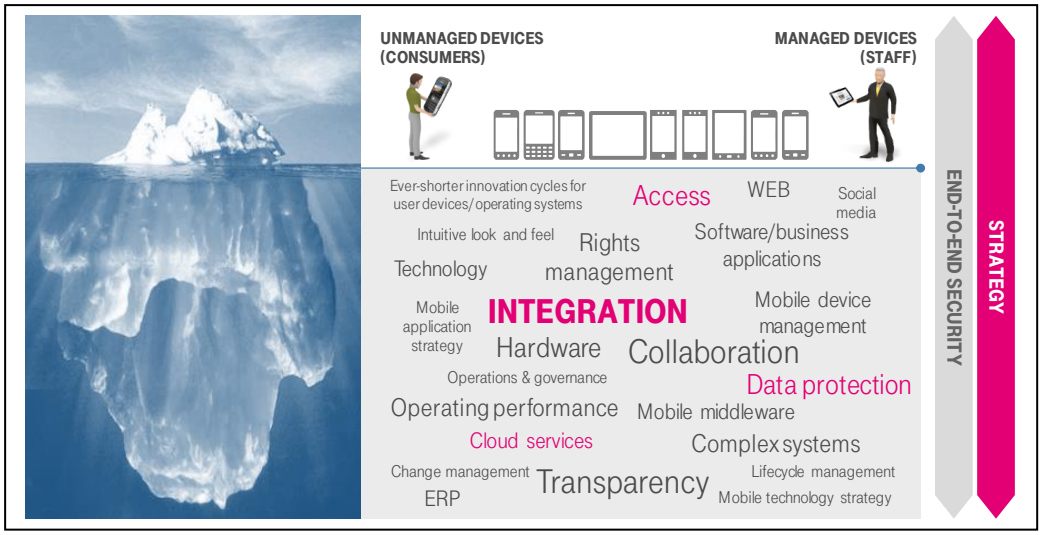


Figure 9 – Value Creation at the Tip of the Iceberg (Source: T-Systems International)

Traditional CIOs focus on maintaining the status quo, i.e. ensuring costs are reduced or optimised and service levels are being maintained (Heller. M, 2012, Barlow, 2013). Decisions are taken from an IT-centric perspective, with very limited attempts to re-align IT to enable new business models. If CIOs focus mainly on technical issues and neglect the broad organisational context, they will not be taken seriously by business. IT reduces itself to driving commodity services and cost savings instead of being a strategic business enabler. In this scenario, enterprise architects under the guidance of CIOs focus on cost reductions by focusing on IT rationalisation initiatives and managing enterprise IT standards (Roberts and Watson, 2014, Peters, 2014, Heller. M, 2012).

Sinha et al. (2017) state that for CIOs to be effective they need to review their role in enterprise strategy development by focussing on the following:

- Think like a designer – Adopt a customer-centric approach to reframe business strategy.
- Connect the dots – Bridge the gap between technology and business strategy.
- Practice entrepreneurism – Relentlessly pursue outcomes, linking technology choices to value propositions.

In agile business conditions, CIOs, CEOs and business leaders need to align continuously to refine business strategies and to use technology to achieve business outcomes. IT is becoming a strategic asset for enterprises to create new revenue opportunities, effect differentiation in the industry and reshape business models (Sinha et al., 2017).

2.4.2 Changing expectations of CIOs

The business environment is evolving rapidly. Technology has resulted in customers being more in control, demanding, expecting higher level of services, expecting requests to be addressed or complied with in real time (O'Reilly III and Tushman, 2016, Rogers, 2016, Rossman, 2014, Schmidt and Cohen, 2013). Collaboration between customers, partners and suppliers creates new ecosystems, which was not possible previously, to satisfy customer requirements in real time (Rogers, 2016, Parker et al., 2016).

Expectations of CIOs are changing; they are increasingly expected to focus on business enablement and adding business value, as opposed to being IT specialists focussed on operational issues (Rizzo, 2018, Bongiorno et al., 2018, Capitani, 2018). Technology is now part of mainstream business, as it attracts significant capital investment and operational expenditure, which attracts attention from most business executives who want a return on investment on IT spending. Technology also permeates every aspect of business, which implies that IT is no longer at the periphery - in most companies, it dictates how business is done (Heller. M, 2012). CIOs are now faced with a challenge of motivating "why" they need to invest in IT, deciding on "what" they need to invest in, making a strategic bet on "when" the time is right to invest and deciding "how" they will execute the project (Gans, 2016, Cohen, 2015, Nooraie, 2012, Sinek, 2011). Decision-making complexity has increased exponentially over the past few years. The wrong decision could have a significant impact on an organisation. Many organisations find themselves at a tipping point, redesigning business models and trying to find new ways to compete in disruptive business conditions (Rizzo, 2018, Rogers, 2016, Schmidt and Cohen, 2013).

The new dimension of IT value contribution is moving towards business model innovation (Parker et al., 2016, Guttentag, 2015, Heller. M, 2012). Business model innovation implies a complete review of skills and capabilities of IT resources to yield results on the new paradigm. The paradigm shift required implies that the focus must move away from deploying IT to finding new ways to change business processes or business outcomes with technology. If CIOs change their mindset from technology innovation to business model innovation, their focus would move from project delivery to business change management and process reengineering. In the paradigm of business model innovation, CIOs need to understand how the introduction of new technology can drive or support new business models and revenue streams. The CIO's mindset must move from how to secure, govern, standardise and introduce new technologies such as iPhones, iPads, IoT

etc. to finding ways in which these technologies can change business models and to driving technology acceptance among business executives and users (Heller. M, 2012).

Heller (2012) sees the dichotomy in expectations of CIOs regarding cost and innovation as a spiralling challenge that is difficult to address in an agile environment. CIOs are expected to solve the evolution of IT through optimisation, but are simultaneously expected to drive radical organisational changes in line with technology (Bongiorno et al., 2018, Rizzo, 2018, Gans, 2016). CIOs were initially expected to maintain systems supporting business processes in organisations, such as payroll, finance, human resources, customer relationship management (CRM) etc. However, as organizations expanded, different operating models and governance structures resulted in duplication of systems, data centres, processes etc., which had to be supported by CIOs. As the maturity of organisations increased, CIOs were expected to increase business value by focusing on end-to-end process integration. The era of IT adding value by focusing on internal activities such as implementing an enterprise service bus and relational databases to tie organisations and systems together was surpassed by external expectations to create seamless customer interactions, enable collaboration across ecosystems, drive network effects etc. (Rizzo, 2018, Parker et al., 2016, Heller. M, 2012, Ross et al., 2006).

2.4.3 CIOs' challenges

IT is currently undergoing significant change. There is a drive for IT to be more consolidated, centralised and increasingly outsourced, together with increasing expectations from business for IT to provide added value and to lead product innovation and business transformation (Rizzo, 2018, Cohen, 2015). One of the challenges facing CIOs is to ensure that they have the right skills and capabilities to realise organisations' strategic ambitions (Rizzo, 2018, Wunderlich and Beck, 2017). IT staff are expected to have a wide range of skills, such as business understanding, technology expertise, project management, executive communication and leadership skills.

An additional complexity that is becoming prevalent in agile business conditions is that organisations deploy IS in businesses without clear definition of ownership and governance of these systems (Bongiorno et al., 2018, Swanepoel, June 2015, Narayan, 2015). This may pose a risk to an organisation, as these systems may not be optimally deployed, supported and maintained, which could result in businesses not achieving their strategic objectives using these technologies.

Heller (2012), in her research involving thousands of CIOs, found that most organisations are still plagued by the same challenges. She identified key challenges that are common across the industry:

- Most CIOs focus on succession planning; however, once they resign, most organisations recruit CIOs from outside the organisation.
- IT is strategic to most organisations and can create a competitive advantage for businesses; however, CIOs are rarely appointed to the board of an organisation.
- Most organisations want CIOs to be a strategic enabler to business, but in practice CIOs spend most of their time on operational issues.
- In the information age, the role of the CIO should become easier, as business executives and employees are familiar with technology, but the opposite is true.
- Most companies are still not sure of how they should hire CIOs and what they expect them to do.

Heller (2012) framed her observations as the CIO paradox, which highlights key challenges as follows:

- Size and complexity of technology
- Conflicting timelines between technology innovation and large IT implementation projects
- Conflicting timelines between business changes and technology deployments
- Discomfort that senior executives have with technology they do not understand
- User resistance or acceptance of technology and reliance on technology for productivity.

Werner Boeing, CIO of Roche diagnostics, used a metaphor of cross-roads to communicate and address the multidimensional challenges in his business (Heller. M, 2012). The analogy uses three lanes to represent three modes of IT operation for global organisations. The first lane had trucks, the second had taxis and the third had motorcycles. In this analogy, trucks represented commonly accepted and foundational certainties about a business that apply at a global level and are typically delivered by large-scale projects. These are typically material master management, vendor management and customer relationship management systems, which are the fundamentals of most businesses. The taxi lane in this analogy represents business processes and projects that are specific to certain regions or countries and do not adhere to a global standard. These could typically relate to customer relationship management in regions, adherence to country-specific legislation etc. The maturity and complexity of local markets also play a role in determining region-specific projects or business processes. Taxi lanes represent standardisation on a regional level; however, they are more flexible than truck lanes. The

motorcycle lane in this analogy represents innovation that is achieved via an agile approach through failing fast, proof of concepts and experimentation. In this lane, governance, rules and policies are relaxed to encourage trial and error by employing new ideas. As ideas mature, projects move from motorcycle to taxi and then to truck lanes. Boeing follows this approach to bring innovation to the core of the enterprise (Heller. M, 2012).

One of the challenges experienced by CIOs is that they adopt a macro-level approach to IT without considering the characteristics of organisation design in their IT strategies (Roberts and Watson, 2014, Heller. M, 2012, Ross et al., 2006). Organisations may be segmented by geography, products, services, markets etc., with each segment having specific requirements of IT functionality, or they may leverage synergies off shared platforms. CIOs need to understand the organisation, characteristics and nuances of business units when choosing technologies or deciding on strategic IT initiatives to add business value.

Another CIO paradox in existence is that many CIOs were appointed to be strategic, yet in reality most of their time is spent on operational issues. Heller. M (2012) states that this issue exists because many CIOs' organisations view them as an overhead function. The mindset of an overhead functional team is significantly different from a team that focusses on profit and loss. Another reason is that many CIOs have grown into their positions from an operational perspective and need to broaden their approach (Rizzo, 2018, Roberts and Watson, 2014).

Common challenges facing CIOs are the existence of legacy systems, under-investment in technology and poor integration of applications (Roberts and Watson, 2014, Heller. M, 2012). The result of this is that most effort and budget are spent on maintenance and upgrades, with very little effort being focussed on enabling business change. With the exponential increase in consumer technologies, business executives are more "tech savvy", which should make the job of a CIO easier when introducing new technology. However this has the opposite effect of increasing expectations of what CIOs need to deliver in organisations (Fitzgerald, 2016, Potter et al., 2016, Rizzo, 2018, Roberts and Watson, 2014).

Ron Kifer, CIO of Applied Materials, suggests that one of the ways to address the strategy versus operations dilemma is to identify all things that are contextual or commodity-related and those things that are strategic or core issues to an enterprise (Heller. M, 2012). CIOs need to find a way to manage contextual items, for example finding someone else who can do it well and allow the CIO and IT team to focus on core items that cannot be dealt with better by someone else (Cohen, 2015, Raskino and Waller, 2015). Outsourcing of IT services has its own challenges and

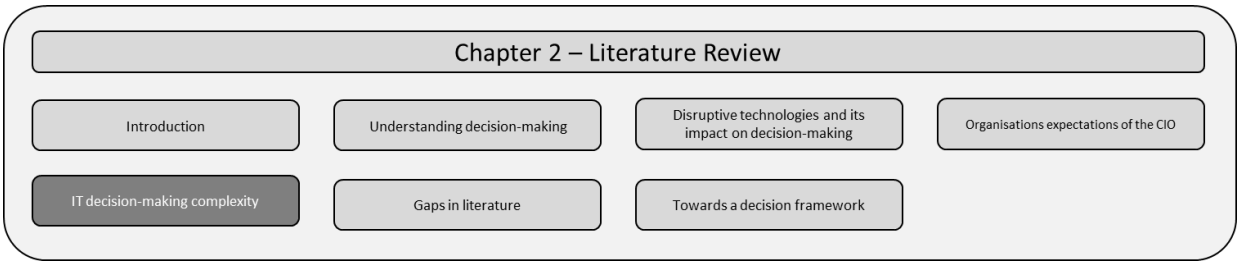
risks but needs to be managed to ensure that this approach does not take up too much of a CIO's time. Outsourcing to mature, managed service providers has the added advantage of exploiting service providers' tools, mature processes and metrics for commodity items that are generally core to the service providers' business.

The challenge experienced by CIOs over time is that initially they looked after IT in large-scale datacentres. This moved outside the data centre with client/server architecture; however, systems in the data centre still had to be supported. With consumerisation, consumer technology, which in most cases still requires large-scale data-centre and sometimes distributed client server architectures, must still be supported. With the move to universal computing where identity and external ecosystems must be supported, the CIO's challenge is becoming exponentially more complex (Heller. M, 2012). The reality of the situation is that as IT moves outwards, from datacentre to the hands of the consumer, the pace of technology change becomes increasing faster. While CIOs and IT departments spend most of their time supporting legacy systems and focusing on bringing innovative consumer technology under the control of IT, the expectation gap between IT and business widens (Bongiorno et al., 2018, Rizzo, 2018, Narayan, 2015). The result is that CEOs and business executives often do not realise the value of IT to business. Spending time on contextual and commodity services only deepens this divide. CIOs need to find ways of effectively outsourcing commodities, while focusing on fast and effective delivery of new technology to business.

The challenge for CIOs is therefore to find a way to manage complexity, identify and respond to disruptive technologies, enable digital business strategies and use IT to create a sustainable competitive advantage for business. The pervasive nature of IT in organisations implies that any strategic IT investment decision needs to satisfy the needs of multiple stakeholders. "In many organisations, competing agendas, poor interdepartmental communication, and a paucity of information regularly turn IT spending decisions into something akin to a barroom brawl" (Deloitte, 2014, P1). Key stakeholders in most organisations have different definitions and expectations of "IT value" and view investment decisions through their own strategic lens, which could in many cases result in poor IT investment decisions that do not serve the needs of the organisation (Deloitte, 2014).

To overcome strategic IT investment decision challenges, forward-thinking CIOs are using decision analysis methodologies, portfolio optimisation and visualisation tools in an effort to create discipline in the IT spending decision process and satisfy expectations of multiple stakeholder groups (Deloitte, 2014). CIOs are taking steps to eliminate poor IT decisions by

creating planning frameworks to understand return on investment and how to meet stakeholder needs. The absence of consistent frameworks to enable CIOs to achieve this challenging objective implies that they would have to rely on experience and intuition and hope for the best outcome.



2.5 IT DECISION-MAKING COMPLEXITY

The challenge facing most organisations is the ability to execute business strategy successfully (Barlow, 2013, Evans, 2003, Hamel and Breen, 2007, Hope et al., 2011, Roberts and Watson, 2014 , Sutherland and Sutherland, 2014). The CIO's role is becoming more strategic in agile market conditions where there is a realisation that for organisations to survive, they need to understand and adopt digital business models. In a disruptive environment with numerous emerging technologies and the absence of any dominant design, the critical competence of any CIO is decision-making (Aplak and Türkbey, 2013, Sniedovich, 2012, Kaner and Karni, 2004, Clemen, 2001). The wrong decision could expose any organisation to significant risk or result in it being disrupted, with a loss of market share to agile new competitors.

Technology is evolving at a speed far greater than the lifecycle of typical assets in an organisation (Rizzo, 2018, Schwab, 2016, Rogers, 2016). The implication is that any decision taken today, based on thorough analysis, could be the wrong decision within the next few weeks.
With IT becoming pervasive in organisations, it is becoming apparent that not all IT systems should be treated equally (Bongiorno et al., 2018, Rizzo, 2018, Fitzgerald, 2016). Based on literature, multiple descriptions of IT systems start to emerge, such as engineering tool (Melville et al., 2004), legacy (Mingay et al., 2016), monolithic IT (Mingay et al., 2016), commodity, foundational (Ross et al., 2006), contextual or non-differentiating (Heller. M, 2012), shadow IT (Fitzgerald, 2016), operational, strategic, core, sustaining, business to consumer (Irani et al., 2003), digital (Ross et al., 2006) and others (Rizzo, 2018, Capitani, 2018, Wunderlich and Beck, 2017, Schwab, 2016, Parker et al., 2016, Christensen, 2015). Systems with different characteristics and functions in an organisation will have different decision criteria, which should be considered in motivating investment decisions.

2.5.1 Factors influencing decision-making

Considerable IS research has been conducted on technology acceptance, adoption, and the alignment between technology and business. The focus of research has been predominantly on people, processes and technology; however people were highlighted as key to ensure successful execution of any strategy (Varanini, 2018). Many organisations fail, not because they did not have a strategy, but because they failed at executing it. The quality of any leader in an organisation is often related to the ability to make timeous decisions in times of change and to follow through on focussed execution (Kaner and Karni, 2004).

Often EA is used as a function to support CIOs in formulating IT strategies and assisting in strategic IT decision-making. The quality of EA plans are dependent on the different stakeholders in an organisation. An effective EA plan is a summary of key decisions taken by business executives, enterprise architects, CIOs and solution architects, which reflect the current state and future strategy of the organisation (Burke, 2012, Lapkin and Allega, 2008, Kearns and Sabherwal, 2007). The best plan, however, can only be effective if leadership decides to execute the plan.

Key factors that influence the quality of decisions in organisations are briefly described below:

- The decision maker
- The context of the decision
- Decision criteria
- Timing
- Impact of decisions on people
- Decision process and decision effectiveness.

2.5.1.1 The decision maker

All organisation are made up of a collection of individuals who are unique in terms of personality, education, experience, values and beliefs and will most probably have different approaches to decision-making. Different people in the same context, with the same information, may make different decisions based on factors such as confidence, risk tolerance, social factors and the impact of the decision on themselves as individuals (Etzioni, 2014, Klein, 2008, Hamel and Breen, 2007, Turpin and Marais, 2006, Klinger and Klein, 1991). In an uncertain technology environment, enterprise architects and CIOs are expected to make sense of various internal and external factors and decide on or propose a recommended way forward for enterprises. The quality of an enterprise architect will have an impact on the quality of an EA plan. The execution

of EA plans is then dependent on CIOs and business executives. Implementation decisions may vary between organisations, which may have positive or negative outcomes for organisations.

2.5.1.2 The context of the decision

In an uncertain technology environment, where unrelated events such as disruptive technologies may have a huge organisational impact, the context of the decision may be quite complex. Situational factors, business priorities and unknown disruptive competitors will have an impact on the timing and quality of decisions for organisations. In these types of situations, CIOs and enterprise architects will need to consider scenario planning and then choose the best option, based on their understanding of future outcomes (Cohen, 2015, Burke, 2012, Sniedovich, 2012).

2.5.1.3 Decision criteria

When considering investment alternatives, a variety of criteria should be evaluated to enable informed decision-making (Tamm et al., 2014, Aplak and Türkbey, 2013). Frank et al. (2013) proposed a multi-criteria approach, which incorporates the following three main criteria:

- Strategy of the organisation, which encompasses market considerations
- Product or service quality, which considers client requirements and expectations
- Economic factors, which cover financial measures and investments.

Companies generally make decisions based on economic factors and often ignore qualitative or strategic considerations (Frank et al., 2013). If companies do consider qualitative criteria in their decision process, generally they do not adhere to a structured or well-defined methodology.

Depending on the nature and size of the organisation, decision criteria may be based on local or international requirements, centralised or federated governance structures, policies, procedures and standards (Adner and Kapoor, 2016, Mingay et al., 2016, Roberts and Watson, 2014, Nooraie, 2012). These factors add to the complexity within which enterprise architects and CIOs must operate in formulating effective EA plans to meet strategic business objectives.

2.5.1.4 Timing

Time is critical in any decision on technology, people, processes and business strategy (Adner and Kapoor, 2016, McNish and Silcoff, 2016). In the context of disruptive innovation, in most cases competition may appear from a wide range of sources. In the early stages of the disruptive

technology lifecycle, there will be an absence of any standards or references to guide decision-making (Christensen et al., 2015, Christensen, 2003). In an uncertain world, acting too soon or too late could have disastrous consequences for any organisation. In a volatile environment, enterprise architects and CIOs may be risking their careers if they make the wrong decision. This could be a reason why there is reluctance to make decisions in an unknown environment (Adner and Kapoor, 2016).

The challenge for most businesses is the timeous identification of shifts and understanding what dangers they may pose to incumbent organisations (Adner and Kapoor, 2016). The biggest challenge facing most businesses is timing. There have been organisations that have adopted disruptive technologies and changed the industry overnight, e.g. Uber, Airbnb, Twitter etc. However some disruptive technologies, such as cloud, high-definition (HD) TVs and MP3s, have taken decades to unfold.

For CIOs, the identification of disruptive technologies and trends may be relatively easy, yet determining when the technology transition will affect industries remains unknown (Adner and Kapoor, 2016). The first fear of organisations is being ready too late and missing the technology shift. Examples of organisations that have been disrupted by being ready too late are Blockbuster and Blackberry, which failed to recognise the technology shift to video streaming and touchscreen technologies in their industries. The second fear is getting ready too early and depleting resources before the technology shift occurs. There are numerous examples from the dot-com crash in 2001, where organisations crashed because they migrated to the internet and online business models too early. However there were many organisations that later surfaced leveraging the same technologies, renamed the Web 2.0 revolution.

To understand disruptive technology shifts in the industry, there are two distinct considerations for CIOs and businesses, i.e. the technology itself and the broader ecosystem that supports it (Adner and Kapoor, 2016). The second consideration is the competition between old and new ecosystems that may exist, which affects the rate of adoption of new technologies. The maturity and strength of the components of the ecosystems play a significant role in the adoption of disruptive technologies. Some examples of ecosystems playing a critical role in technology adoption are light-bulb technologies and HD TVs. New light bulbs using new technologies can be plugged into existing sockets, benefitting from existing ecosystems. This results in immediate displacement of older technologies. HD TVs, however, did not gain traction until HD cameras, the latest broadcast standards, production and post-production processes became available. Both

technologies caused shifts in their respective industries once the related ecosystems of complementary elements reached a certain level of maturity.

Adner and Kapoor (2016) also highlight the criticality of ecosystems in disruptive technology adoption. Newer technology adoption can be held back by their ecosystem, while old technology adoption can be accelerated by the improvement in theirs, even if the older technology itself has not improved. The success of new technologies is dependent on how quickly ecosystems develop for users to realise the benefits of the new technology.

CIOs who are expected to play a strategic role in an organisation will have to scan the external market continuously to identify disruptive technologies and technology trends that could have an impact on current business models. CIOs and enterprise architects currently spend most of their time analysing newer technology without considering timing, the impact of ecosystems and the impact on business models. Failure to get the timing of decisions right could have negative financial implications for the organisation and its sustainability in a disruptive technology environment. Figure 10 provides a framework to assist in external analysis when deciding on disruptive technology strategies in organisations.

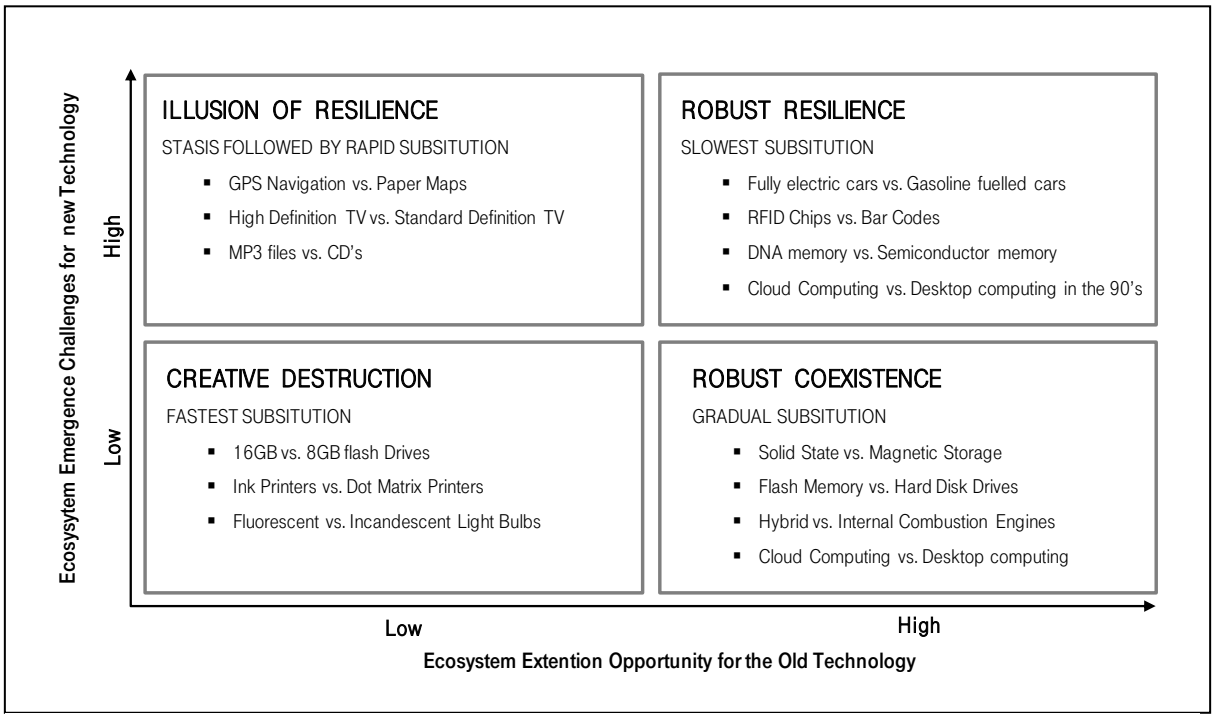


Figure 10 - Framework for Analysing the Pace of Technology Substitution (Adner and Kapoor, 2016)

As IT evolves over time, technologies supporting business processes also change, which influences an organisation's innovation process (Carlo et al., 2014). Generally, organisations have three types of innovation processes (Carlo et al., 2014):

- **Base innovation**: Includes changes in the underlying IT platforms that support or enable IS services or processes.
- **Process innovation**: Includes changes in tools, methods, teams and organisations in delivering services and products to customers.
- **Service innovation**: Looks at new uses of IT to support technical or administrative core business functionality or business processes serving customers.

The timing of innovation adoption has an impact on perceived radical change, uniqueness, acceptance and value contribution in an organisation. As markets tend to understand the value of radical and disruptive technologies over time, these may not be seen as radical or may result in refinement of existing processes (Carlo et al., 2014).

2.5.1.5 Impact of decisions on people

People in an organisation operate in a social world and any decision may have an impact on themselves personally or on people with whom they work (Arkhipova and Bozzoli, 2018, Capitani, 2018, Castello et al., 2018, Varanini, 2018). Changes in technology or strategic direction of enterprises could have a detrimental impact on people and their continued employment in organisations and these are some of the factors that could affect the quality of decisions taken.

Eisenhardt (1989) investigated decision-making in high-velocity environments. His findings indicated that many people find it difficult to make decisions when they are faced with uncertainty. Nevertheless, most strategic decisions need to be made in uncertain environments. Individuals have the natural tendency to procrastinate when they have limited information, but in times of uncertainty fast decisions are required to keep pace with changes and to ensure strong organisational performance. Research also established that emotions play an integral role in strategic decision-making. Frustration, distrust and loyalty influenced organisational politics, while confidence and anxiety were key factors influencing the pace at which decisions were made (Eisenhardt, 1989).

Newell and Shanks (2003) proposed that if decisions need to be made in times of uncertainty, instead of referring to various sources of information related to the topic under consideration, an alternative approach to decision-making is to identify the piece of information that is the best predictor of success and then use this as the basis for decision-making. This approach is referred

to as “take the best approach”, which according to Newell is rather simplistic, but does result in fast decision-making and, in most cases, is the correct decision. Although Newell’s approach to decision-making seems irresponsible, enterprise architects and business executives need to find ways to make decisions in the quickest possible time to avoid “analysis paralysis” or default to procrastination when strategic decisions need to be made.

A key consideration when deciding on disruptive technologies in an organisation is the peer-to-peer conflict that is likely to arise among different stakeholders (Castello et al., 2018, Sherif et al., 2006b). With the introduction of new technology, the focus is generally on vertical relationships relating to adoption, acceptance and use of technology. Disruptive technologies generally influence work practices, peer-to-peer relationships, business processes etc. However, horizontal relationships and peer–to-peer co-operation are often not considered (Sherif et al., 2006a). Stakeholders who perceive their role to be enhanced or empowered by innovation would support a technology, whereas stakeholders who perceive their role to be diminished will resist a technology.

Sandström et al. (2014) argue that the reason why incumbent organisations fail to respond to disruptive technologies and innovations can be explained by the resource dependency theory. This theory argues that existing customers control an organisation’s allocation of resources, leaving little time and limited investments required for new disruptive technology considerations. The challenge for most CIOs is therefore to motivate why an organisation needs to invest in technologies that may not address the needs of a company’s largest and profitable customers.

Some recommendations to address resource constraints and to focus on disruptive innovation topics is to keep any disruptive initiative separate from the rest of the organisation (Gans, 2016, O’Reilly III and Tushman, 2016, Christensen, 2015, Narayan, 2015). Even so, significant integration effort could be required in respect of the operating model of the business.

2.5.2 Decision process and theories

Decision-making can be described as a choice between alternatives and generally in conditions that could be controlled (Turpin and Marais, 2006, Klinger and Klein, 1991). Klein (2008), Klinger and Klein (1991) and Clemen (2001) observe that not all decisions are made in a structured way where all options are evaluated by comparing similar dimensions, using systematic evaluation techniques to arrive at an optimal decision. Findings indicate that in an unstable environment, characterised by a continuous stream of disruptive technologies, choosing the right technology

for an organisation becomes complex. Understanding and adapting decision approaches in organisations is important to fast-track the life cycle of IT initiatives.

Turpin and Marais (2006) investigated the decision process for senior management decision-making based on different management styles and the use of decision support systems to aid decision-making. They found significant variation in decision-making styles, although common themes emerged, such as intuition, sensitivity to context and presentation of information. The use of decision support systems was not generally used in the intended way. Turpin and Marais (2006) view this as an indication that understanding of the decision-making process and modelling is not aligned with practice.

Turpin and Marais (2006) reviewed various views and theories on decision-making and categorised common decision models as follows:

2.5.2.1 The rational model

Kaner and Karni (2004) indicate that in a rational decision-making model, there is an assumption that decision makers are rational. Kaner and Karni (2004) indicate that there are five steps involved in knowledge creation before a decision is taken:

- Recognition and definition of a problem
- Search for alternatives
- Gathering and analysis of data
- Evaluation of alternatives
- Decision and selection of the preferred alternative.

From research in quantitative analysis, Simon (1977) suggests a four-step rational decision model, which considers intelligence, design, choice and review:

- Intelligence: Finding occasions to make a decision
- Design: Inventing, developing and analysing possible courses of action
- Choice: Selecting a course of action from those available
- Review: Assessing past choices.

In a rational approach, subjective expected utility is calculated as a way of ranking alternatives to assist in choosing the best option (Turpin and Marais, 2006, Kaner and Karni, 2004, Eisenhardt and Zbaracki, 1992). This approach assumes that decision makers are fully informed on all

possible alternatives, which enables them to make the right decision. This model is applicable to an ideal scenario, where detailed information is available on alternatives, resulting in an objective choice of alternatives. Brady (2016b) also mentions that economist Adam Smith acknowledged that real world decision-making is uncertain and disagreed with approaches that based decision-making on mathematically expected utility calculations.

The rational approach also aligns to classic decision models such as multi-attribute utility analysis and decision analysis (Klinger and Klein, 1991), which entails systematic analysis and analytics of evidence to decide on an optimal course of action. Decision makers are encouraged to find as many alternatives as possible, determine objective evaluation criteria, rate alternatives and calculate scores to determine the best option.

This approach may seem feasible for IT decision-making but is not practical in real world agile business conditions where time is of the essence. The rigorous process approach may be seen to produce the best results. However, it takes too long and lacks flexibility in dealing with ambiguity and fast-changing environments (Klinger and Klein, 1991).

2.5.2.2 The process-orientated view

The process-orientated view is based on prior research on bounded reality, which describes the "satisficing" approach to decision-making (Turpin and Marais, 2006). This assumes that managers do not always have complete information and that optimal choices are not always required. Alternatives are evaluated sequentially and if an alternative meets implicit or explicitly stated minimum criteria, then it is said to " satisfice" and the search is terminated (Turpin and Marais, 2006, Newell and Shanks, 2003, Eisenhardt, 1989). This approach may not result in the optimal technology decision for an organisation but may result in quicker decision-making in a disruptive technology environment.

2.5.2.3 The incrementalist view

This process follows an approach of incremental actions keeping the strategy open to adjustment (Turpin and Marais, 2006). This process starts from the status quo to solve problems rather than working towards a goal. Etzioni (2014) states that it would be beneficial for social actors to assume that whatever their first decision is, it is going to be wrong and they will have to revise this repeatedly until they achieve the desired outcome.

2.5.2.4 The garbage can model

The garbage can model is based on the work of Cohen, March and Olsen (1972) and describes decision-making in an "organized anarchy" (Turpin and Marais, 2006). This view is similar to the political view, described in section 2.5.2.6, in that it does assume deliberate manipulations in decision-making and within an environment with multiple goals and views. In a garbage can approach, decision-making is an outcome or interpretation of different independent streams in an organisation. Typical streams consist of problems in need of solutions, different solutions that could address multiple issues and participants with different priorities and viewpoints. Streams meet at a point symbolised by the garbage can. When a decision is made, the garbage can is removed, without necessarily addressing all the problems in the can. Decisions made will be totally dependent on the participants involved. Etzioni (2014) mentions that an important rule in decision-making is to ensure that decisions are structured in a way that allows them to be reversed or modified easily.

2.5.2.5 The organisational procedures view

Das and Teng (1991) describe this view as the "avoidance model"; this is a systematic process that aims to maintain the status quo, limiting innovation. This model views decisions as a result of standard operating procedures that are adhered to by organisational subunits. This approach is typical in organisations that are excessively governed by longer decision-making timelines (Turpin and Marais, 2006).

2.5.2.6 The political view

Decisions are made to further an individual’s or group’s self-interest. Influence and power have an effect on decision-making, which results in decisions being made that may be good for a group of people, but not necessarily for the organisation (Etzioni, 2014, Klein, 2008, Turpin and Marais, 2006).

2.5.2.7 The individual differences perspective

The individual differences perspective focusses on the individual’s decision-making style, experiences, preferences and behaviour in making decisions (Etzioni, 2014, Klein, 2008, Turpin and Marais, 2006, Clemen, 2001, Klinger and Klein, 1991). Different managers may arrive at different decisions in line with their style and preferences. The behavioural economics theory

shows that because of previous experience, people are hard-wired and have cognitive biases that limit their intellectual capabilities (Etzioni, 2014). Training does little to change this. Therefore, this may limit individuals' ability to make objective decisions.

2.5.2.8 Naturalistic decision-making and recognition-primed decision

NDM seeks to understand decision-making in its natural context (Turpin and Marais, 2006). Behavioural studies recognise that a decision maker is influenced by previous experience when deciding in the current context (Etzioni, 2014, Klein, 2008, Turpin and Marais, 2006, Clemen, 2001, Klinger and Klein, 1991). This model is based on users' experience, helping them understand what to expect and to determine the course of action to follow to make them succeed. Experience is a key factor in helping to decide and if a typical situation is not recognised, then further information would be required to make a decision.

Klein (2008) identified the following features that favour an NDM approach:

- Ill-defined goals and ill-structured tasks
- Uncertainty, ambiguity and missing data
- Shifting and competing goals
- Dynamic and continually changing conditions
- Action-feedback loops (real-time reactions to changing conditions)
- Time pressure
- High risks
- Multiple stakeholders
- Organisational norms.

Figure 11 provides an overview of the NDM decision approach. On the surface, this approach may seem to enable quick decision-making; however consistency of decision-making will vary between social actors within an organisation. Different CIOs may arrive at different IT decisions even though the organisations' strategic direction and key performance indicators (KPIs) may be the same. However, this is an approach used to make decisions in agile conditions, which CIOs need to understand when motivating IT investment decisions.

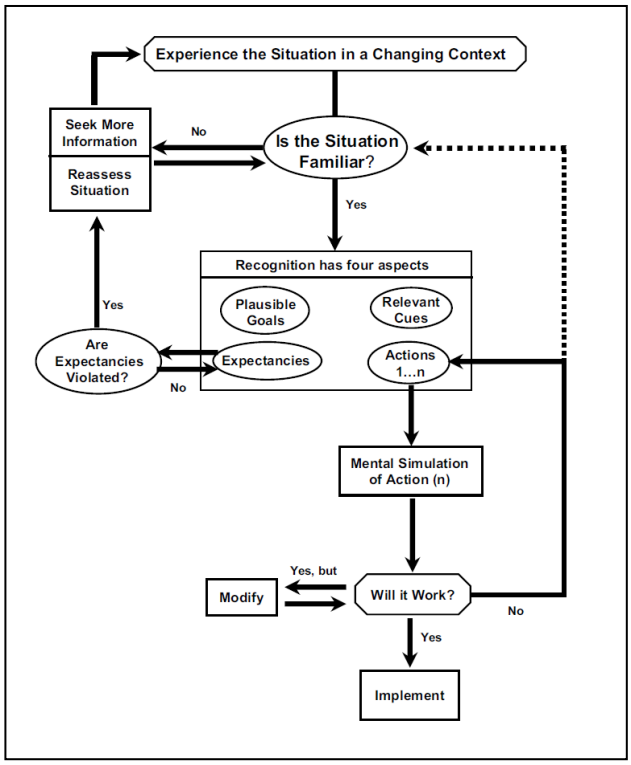


Figure 11 - Naturalistic Decision-making Approach (Klinger and Klein, 1991)

2.5.2.9 The multiple-perspective approach

This model focusses on analysing problems from multiple perspectives - technical, organisational and individual - to gain full understanding of the problem (Turpin and Marais, 2006). From a technical perspective, it is often found that different analysts or modelling projects may arrive at different technical views, even though they may claim to present an objective or rational view of the problem. In this model, the decision maker is encouraged to obtain as many views as possible to gain understanding of the problem.

As in the organisational procedures and individual differences perspective approaches, it requires engagement with as many role-players and stakeholders as possible. Decisions that emanate from this model consider as many perspectives as possible and are generally endorsed by multiple stakeholders. Hall et al. (2003) advise that the ethical and aesthetical perspective should be considered as well.

Turpin and Marais (2006) conclude that generally decision processes have two broad phases: a divergent or exploratory phase and a convergent phase (Figure 12). The divergent phase involves brainstorming and creativity to identify alternative solutions. This phase is affected by the stakeholders involved, personalities and the experience of individuals, use of multi-disciplinary

teams etc. The convergent phase seeks to reduce alternatives based on different models described and to make a final decision.

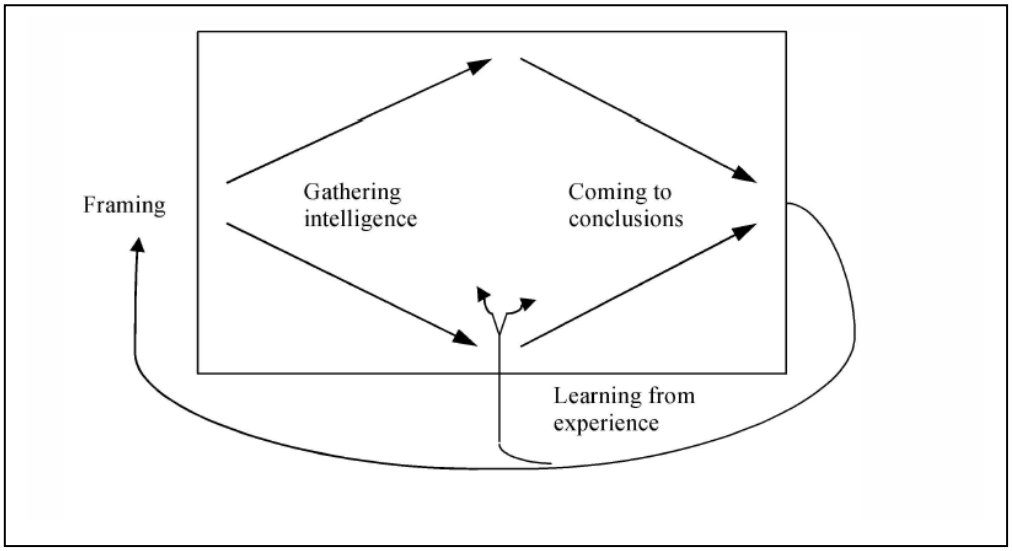


Figure 12 – Stages of Decision Process (Turpin and Marais, 2006)

The overall decision-making process is dependent on various factors such as time, complexity, environment and context. In fast-changing technology environments, decision makers do not generally have the luxury of time to follow a deliberate process and tend to rely on intuition, although this may not result in the best decision for groups or organisations.

Because of the varying approaches to decision-making across organisations and the dependency on social actors in the system, it is key for CIOs to understand the prevailing decision process to enable quick decisions with a bias towards action.

2.5.3 Role of enterprise architecture in IT decision-making

In this section the researcher tries to understand current approaches to EA, the changing expectations of EA in disruptive business conditions and its role in IT decision-making.

2.5.3.1 Theory and frameworks defining enterprise architecture

Based on a literature review on EA frameworks, four common approaches emerge, which are often used in organisations. CIOs often rely on EA teams to guide IT strategy and decision-making, as they are often generalists in IT. The following section briefly describes the common frameworks in the context of disruptive technologies.

2.5.3.1.1 Zachman's framework

Zachman's framework seems effective in documenting and describing existing enterprise products, services and architecture (Zachman, 2002), but it does not provide any indication of whether current architecture is effective or provides guidelines for the creation of a new architecture within agile market conditions. Although it does provide a comprehensive guideline on types of artefacts that may be relevant for the different users in organisations, it does not seem to be a complete solution to help guide decision makers on acceptable approaches to follow in agile market conditions. It is predominantly internally focussed and becomes relevant once decisions have been made on IT investments.

2.5.3.1.2 The Open Group Architecture Framework

Although the Open Group Architecture Framework (TOGAF) is commonly described as a framework, the most important component that is generally used is ADM, which is a well-defined process for creating EA (Sessions, 2007). TOGAF is also complementary to the Zachman framework, which is excellent in documenting architecture artefacts, while TOGAF offers a process for creating such artefacts. TOGAF follows a very structured approach, which aims to achieve business IT alignment via an iterative process. The process starts at the highest level in any organisation by obtaining buy-in from company executives and defining an architecture vision aligned to business requirements. Through a structured process, it follows the ADM methodology, until a detailed technology architecture is defined, which will support the overall company strategy.

TOGAF offers an excellent framework to define good EA aligned to business. There are also various market factors and technology drivers that may have an impact on EA and business strategy; however, no guidance is offered on how these can be accommodated in the ADM approach.

2.5.3.1.3 Federal enterprise architecture

In comparison to Zachman and TOGAF, federal EA seems to be the most complete methodology. It encompasses a well-defined architectural process similar to TOGAF and a comprehensive taxonomy, like the Zachman framework (Sessions, 2007).

FEA also addresses six sub-domain architecture reference models similar to TOGAF, namely strategy, business, data, application, infrastructure and security (CIO Council, 2013). However, FEA seems more comprehensive, as it addresses a more complete approach regarding EA development and implementation. Some of the basic steps are as follows:

- Context of EA in organisations
- Reference models for addressing the four architectural models: business, data, application and technology
- Process for the development of EA
- Transitional process for moving from current mode of operations to future mode of operations as defined in EA plans
- Like Zachman, provides a taxonomy for the classification of different artefacts described in EA plans
- Guidelines for measuring and monitoring success of EA plans in deriving business value.

FEA therefore provides a very comprehensive approach to building EA. However, as in most EA plans, it follows an iterative approach that aligns to changing business drivers as markets change. One of the steps defined in the FEA model is to research and leverage other organisations or service providers that have similar needs or may have implemented solutions that can be leveraged in the enterprise under consideration. The approach in the framework is to consider a partnership first approach to speed up implementation times. Although this framework does consider the external technological environment, it does not consider the significant impact disruptive technologies may have on business strategies and the process to change EA plans that is driven from a technology perspective is not clear.

2.5.3.1.4 Gartner methodology

The Gartner approach is different from the other traditional frameworks discussed, as it does not provide any rigorous guidelines and methodologies to follow in developing an EA plan for an organisation. Gartner is a highly regarded global IT research and consulting company that is trusted by many business executives and CIOs. It has a team of research analysts that analyse trends in technology and business that collaborate through a networked community to provide predictions and best practice advice to IT executives.

Gartner has a team of practitioners that advise IT leaders on strategy and strategy implementation as opposed to a research approach, which focusses on processes, taxonomy, artefacts and EA plan formulation. Lapkin and Allega (2008) state that Gartner views EA as a

“verb” with a largely process focus, as opposed to EA being a “noun”, where the focus is on producing deliverables rather than on meeting strategic imperatives.

Gartner does not follow a step-by-step process of creating EA. One of the frequently used quotations from a Gartner analyst is, “Just enough enterprise architecture, just in time” (Sessions, 2007). The Gartner approach focusses more on strategy and less on engineering. The company focusses more strongly on the destination, where an organisation is going and its approach to getting there. Once alignment is reached on the future vision, all architectural effort and decisions are then focussed on achieving business outcomes.

Wilson (2012) states that EA success is a result of understanding how to use frameworks and of tailoring current EA frameworks to yield business outcomes. Gartner’s view on EA frameworks is that there is no perfect fit solution for any organisation and that frameworks must be tailored and prioritised for organisations to realise value. Frameworks are important, as they bring structure and discipline to the EA practice; however they must be customised per organisation to aid adoption and implementation. EA is a process of understanding and translating business vision and strategy into enterprise change (Burke, 2012, Lapalme, 2012, Lapkin and Allega, 2008, Sessions, 2007).

Gartner recognised that the lack of a structured approach was a challenge for enterprise architects who realised the value of focusing on business outcomes. For enterprise architects to be successful, they should define business outcomes and provide effective planning to enable business outcomes. Enterprise architects have traditionally turned to existing EA frameworks, though these often describe the journey and not the destination (Burke, 2012).

Gartner’s view is that EA will develop in a series of stages, each stage building on a subset of a framework that matches a specific business outcome. Gartner has introduced a concept of stage planning to provide structure to enterprise architects to create a business outcome-driven EA, as shown in Figure 13. The expectation is that EA practitioners must follow an iterative approach by targeting, framing and planning each stage in a journey to address business outcomes (Burke, 2012).

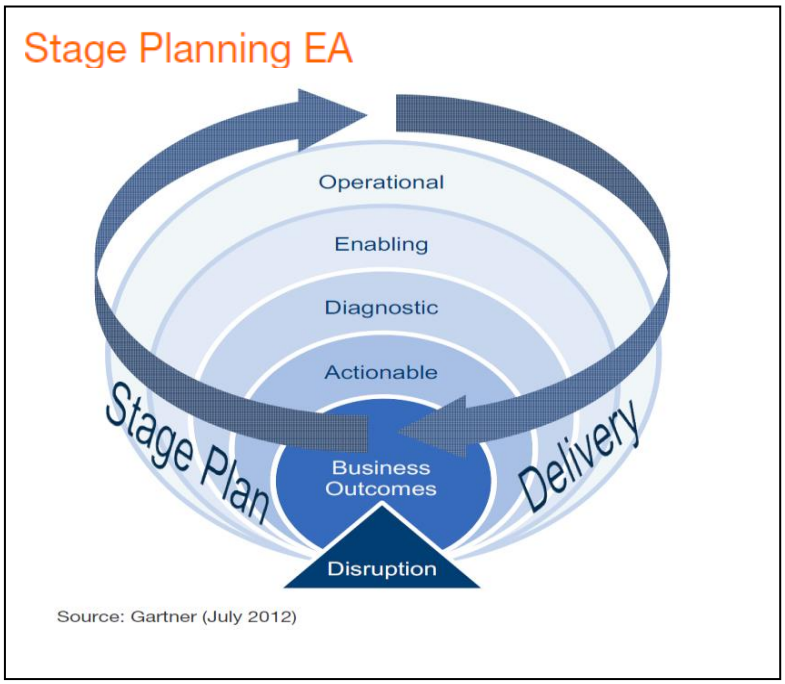


Figure 13 : Gartner's Stage Planning Approach to EA (Burke, 2012)

Gartner's intent is to shift the focus of enterprise architects from "what enterprise architects do" to "what impact EA has on business" (Lapkin and Allega, 2008). The objective of this approach is to get enterprise architects to focus on real problems (Burke, 2012) as opposed to focussing on understanding the complexity of industry-accepted EA frameworks.

Gartner proposes a three-step practical approach for EA practitioners to create effective stage plans (Burke, 2012):

- Align EA to the highest priority business outcomes.
- Streamline EA development to address only the highest priority business outcomes.
- Define a process to execute and achieve deliverables in the most efficient way.

Gartner's practical approach is shown in Figure 14.

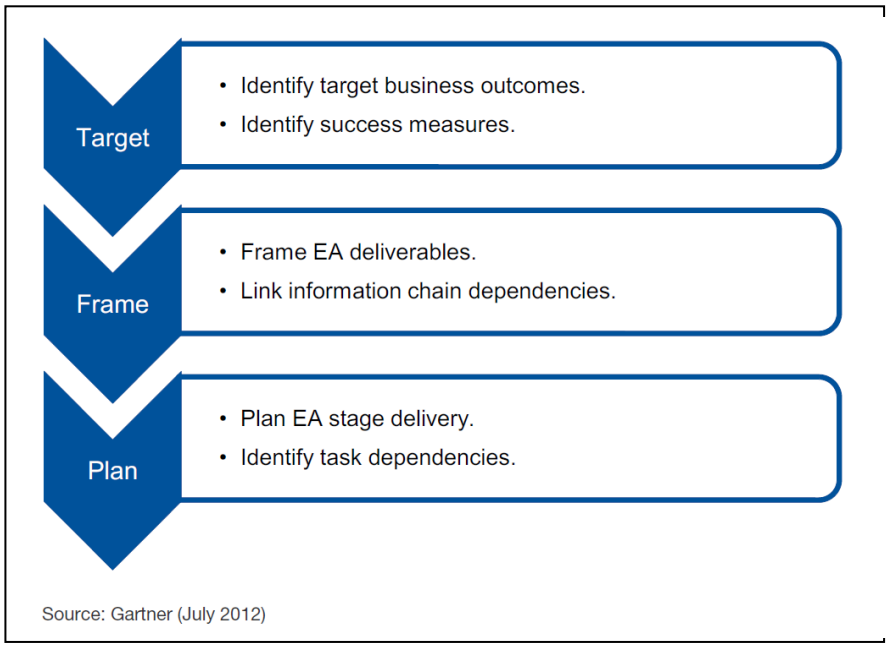


Figure 14 : Gartner's Three-step Approach to EA (Burke, 2012)

EA stage planning: Target business outcomes

In most organisations, enterprise architects have struggled to articulate their value to business. Business disruptions frequently occur, which may affect businesses positively or negatively. Positive disruptions generally provide opportunities for businesses to leverage new technologies and increase market share, while negative disruptions may result in business reacting to competitor innovations (Burke, 2012, Christensen et al., 2015, Kearns and Sabherwal, 2007). By adopting a stage planning approach, enterprise architects are expected to identify business disruptions and define approaches to address business disruptions. Enterprise architects are also expected to define their role in achieving desired business outcomes, which can result in direct correlation of EA value to business (Burke, 2012, Walker, 2007).

EA stage planning: Frame EA deliverables

This stage focusses enterprise architects on collecting relevant data that is essential to address defined business outcomes, as opposed to collecting data that is readily available. Enterprise architects are expected to focus on outcome-oriented deliverables, which are defined as measurable, actionable, diagnostic, enabling and operational. Only deliverables that help achieve target business outcomes or are actionable are considered in this approach (Burke, 2012).

EA stage planning: Plan EA development

In this stage, the focus shifts from creating EA plans to achieving business vision and outcomes. EA efforts are expected to focus on creating specific deliverables to achieve business outcomes. Using project management techniques, enterprise architects are expected to identify tasks related to deliverable frameworks that can help achieve business outcomes and eliminate all unnecessary activities. Gartner's stage planning methodology helps enterprise architects to focus continuously on business outcomes, define deliverables, processes and measurements to ensure effective EA programme delivery (Burke, 2012).

The four prevalent methodologies in EA practice have become a de facto standard in enterprises. Each has its own strengths and weaknesses; however, none of them provides a complete solution for most organisations. In reality it seems that enterprises follow a blended approach, which uses bits and pieces from different approaches to suit specific business needs (Sessions, 2007). The success of EA planning and execution is heavily dependent on strong executive support. Each of the above four approaches has the same underlying objective, which is to reduce IT complexity and costs, while increasing business value and competitiveness.

2.5.3.2 Maturity assessment of EA as a discipline in the IS field

With the increasing rate of change in industry driven by advances in IT, businesses rely on EA as a tool for the management of change and complexity (Burton and Allega, 2014, Gromoff et al., 2013, Bente et al., 2012, Lapalme, 2012, Walker, 2009). EA attempts to provide a model of the enterprise that is easily understood by all involved in managing change. The conceptual language used attempts to reduce complexity, reduce misunderstanding and enable those concerned to focus on priorities to be executed (Veasey, 2001). Hite (2003) identifies EA as a critical success factor for organisations to apply IT effectively to meet organisations' goals.

EA also provides an effective roadmap for the implementation of newer technologies in enterprises. It provides an effective description of the current state of an enterprise, an overview of the future state of an enterprise and a transition and transformation plan. Its holistic approach helps identify inter-project impacts and synergies between solutions and reduce silos between divisions by enabling understanding of benefits that can be shared by common and integrated systems (Narayan, 2015, Bente et al., 2012, Lapalme, 2012).

Research indicates that no common definition of EA exists (Kotusev et al., 2015). For EA as a discipline to become commonly accepted, it is imperative that there be consensus in

understanding and implementation of EA in business. There are differing views on whether EA should be used to describe organisations' operating models or be aligned to future strategy (Lapalme, 2012). However it seems that the commonly accepted approach is to view EA as a description of an enterprise from an IT perspective (Kotusev et al., 2015).

Kotusev et al. (2015) find in their study that EA in many organisations does not describe current states, future states and transition plans. Literature and practical application of EA in enterprises often differ from organisation to organisation, which has a detrimental impact on EA in practice.

Kotusev et al. (2015) also conducted a comparison of three approaches to EA management, i.e. the Massachusetts Institute of Technology (MIT) approach, dynamic architecture approach (DYA) and the traditional approach. Although each of these seeks to facilitate alignment between business and IT, the deployment and approach are different in the three approaches. Traditional approaches to EA seem more proactive, as they clearly describe current and future states and provide clear guidelines for future IT initiatives. The MIT approach is a combination of the proactive and reactive approaches, but does not provide any details on achieving the future state, which leaves sufficient room to adapt future changes in technology and business strategy. The DYA approach, however, is completely reactive, as it lacks any planning and allows full freedom to adapt as business strategies change.

Considering the different approaches to EA as described in management literature, organisations have different options to choose from when creating EA plans instead of only following traditional approaches. The different EA approaches and lack of a generic model often result in widely differing implementations across organisations, which results in businesses not placing reliance on EA as an enabler to organisation strategy (Gans, 2016, Heller. M, 2012, Hope et al., 2011).

Burke (2009) states that there are different approaches to EA and enterprises must adopt the right approach to suit their needs. Enterprises generally do not align to a single approach and use a combination of approaches to meet their business requirements. Four commonly found approaches were identified, which will be briefly discussed below:

Traditional: In this scenario, a very strong centralised governance structure exists, and decision-making is centralised. Business strategy is clear, with EA plans aligned to strategy being defined and prescriptive (Burke, 2009). Many standard EA frameworks, such as that of Zachman and the TOGAF, align to a traditional approach to EA. This approach may work well in stable organisations in stable market conditions. However, in dynamic conditions with changing

business conditions where enterprises must continuously adapt business strategies, this approach may not be effective.

Federated: This approach is commonly found in large complex organisations with a federated governance model within divisions. IT managers or CIOs in these divisions have autonomy in decision-making regarding EA and IT systems in use to support business requirements. In these types of organisations, group-level IT departments predominantly focus on defining group-wide commonly shared IT systems to achieve some level of process and information standardisation, interoperability and collaboration (Burke, 2009). In these types of scenarios, a single EA rarely exists, which could result in duplication of effort unless a strong group-level governance structure is implemented.

Managed diversity: This is also a characteristic of large organisations with weak governance models in place. Single EA plans and technology roadmaps do not exist or are not enforced. Often these organisations follow a managed diversity approach to reduce complexity by defining a small number of standard options that project team and IT managers can choose from to meet their business requirements (Burke, 2009). This approach can create some level of standardisation and cost benefits to organisations; however the lack of control diminishes the value of EA to business.

Middle-out: This approach is mainly applicable to large organisations where the objective of EA is to enable information exchange and interoperability without dictating underlying technology choices (Burke, 2009). This aligns with approaches based on service-orientated architecture, where messaging standards and interfaces are defined for projects, business units and partners to adhere to. This type of approach is suited to organisations where decision-making is not centralised, and IT investments are not under direct control of the centralised EA team. This allows flexibility for technology choices while still maintaining some element of standardisation across the organisation. However, this approach is not ideal, as costs may increase owing to lack of economies of scale and synergies across business. Changes to standards or changes in technology will also be more difficult to implement across the organisation in a middle-out approach.

Burke (2009) also states that most organisations rarely apply a single framework or approach to EA. The lack of a commonly accepted approach is an indication of low levels of maturity of EA as a discipline and could explain why business executives do not place reliance or value EA plans in guiding strategic business decisions. Although there seems to be sufficient capability and

capacity of enterprise architects within the industry, the absence of any measures to correlate the EA contribution to business KPIs makes it difficult to quantify EA's value to business.

With the rapid changes in technology and the impact of disruptive technologies on mature industries and organisations, research shows that business executives rarely rely on EA plans to guide them in making strategic business choices (Müller, 2017, Bente et al., 2012, Nooraie, 2012). Unless enterprise architects learn to accept rapid changes in both business outcomes and technology and adapt EA plans accordingly, they will fail in achieving their objective of adding value to business. Zachman, TOGAF and FEA have excellent approaches to defining EA plans and documenting relevant artefacts for effective technology roadmaps; however, plans or roadmaps do not add value unless they are implemented and can enable businesses to compete in an agile world.

Burton and Allega (2014), Gartner research analysts, looked at EA from different perspectives, such as people, processes and tools, identified different disciplines and displayed the maturity of each discipline in a Gartner hype cycle view, as shown in Figure 15. Based on Gartner's research conducted in the IT industry on a global basis, EA frameworks are in the "trough of disillusionment", as the application of traditional approaches has failed to add business value or help businesses make sense of the new technological world.

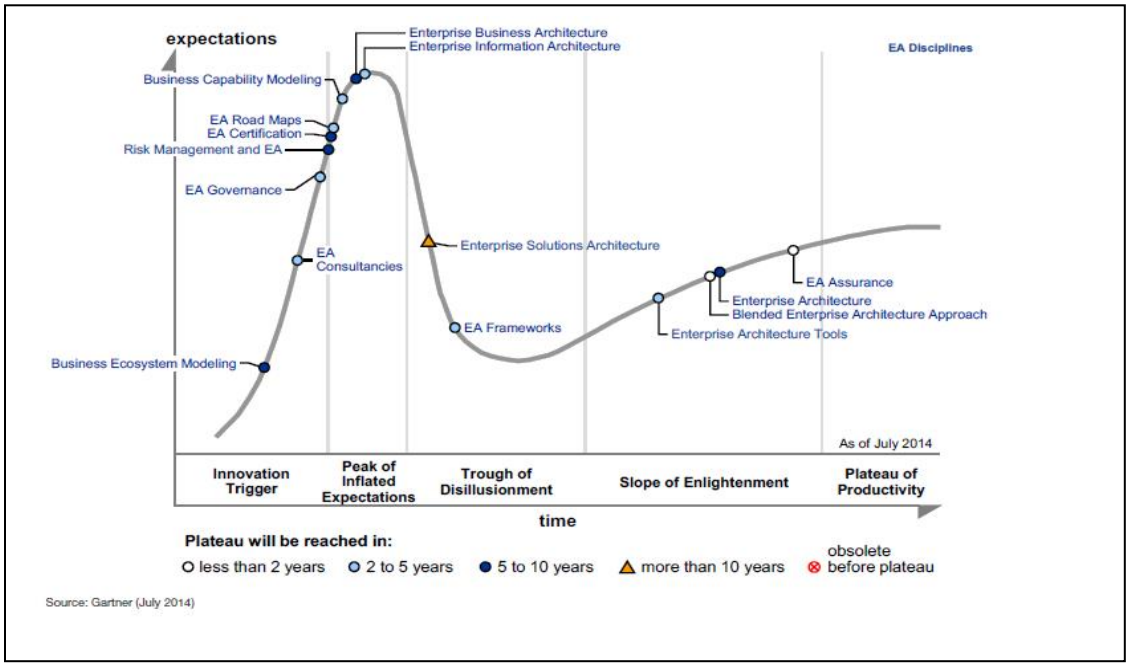


Figure 15 : EA Discipline Maturity Assessment Hype Cycle (Burton and Allega, 2014)

Ross et al. (2006) describe four states of architecture maturity, as shown in Figure 16:

- Business silo architecture: This is where organisations try to maximise individual business unit or functional needs.
- Standardised technology architecture: This focusses on improving efficiency by increased centralisation of technology management and standardisation.
- Optimised core architecture: This provides common data and process standardisation across an organisation aligned to an operating model.
- Business modularity architecture: Companies try to maintain global standards while allowing local differences by reusing loosely coupled IT business processes.

The different architecture states offer organisations different levels of flexibility at local or global level.

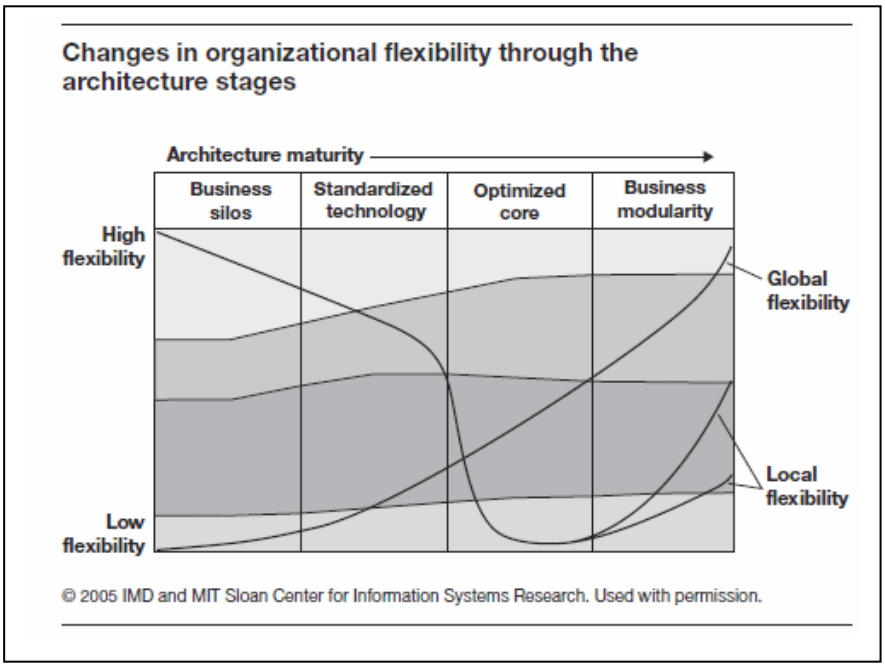


Figure 16 - Changes in Organisational Flexibility through Architectural Stages (Ross et al., 2006)

IT maturity needs to go through the different stages to be implemented successfully owing to the changing management requirements. The changes required in moving from one stage to another often exceed the organisation's capacity to change. Ross et al. (2006) indicate that there are significant benefits for organisations and the rating of CIOs as they move through the different levels of architecture maturity with regard to responsiveness, risk management, managerial satisfaction and strategic business impact.

2.5.3.3 Comparison of EA and disruptive technologies maturity assessments

Burton and Allega (2014) assessed EA in relation to some of the key disruptive technologies in the market and showed this on a hype cycle, as indicated in Figure 17. This study indicates that in all cases, EA practitioners are significantly behind the hype regarding disruptive technologies. This finding reflects the changes in mindset that are required of enterprise architects to be relevant in the digital world and for them to aid CIOs on strategic IT decision-making from a disruptive technology perspective.

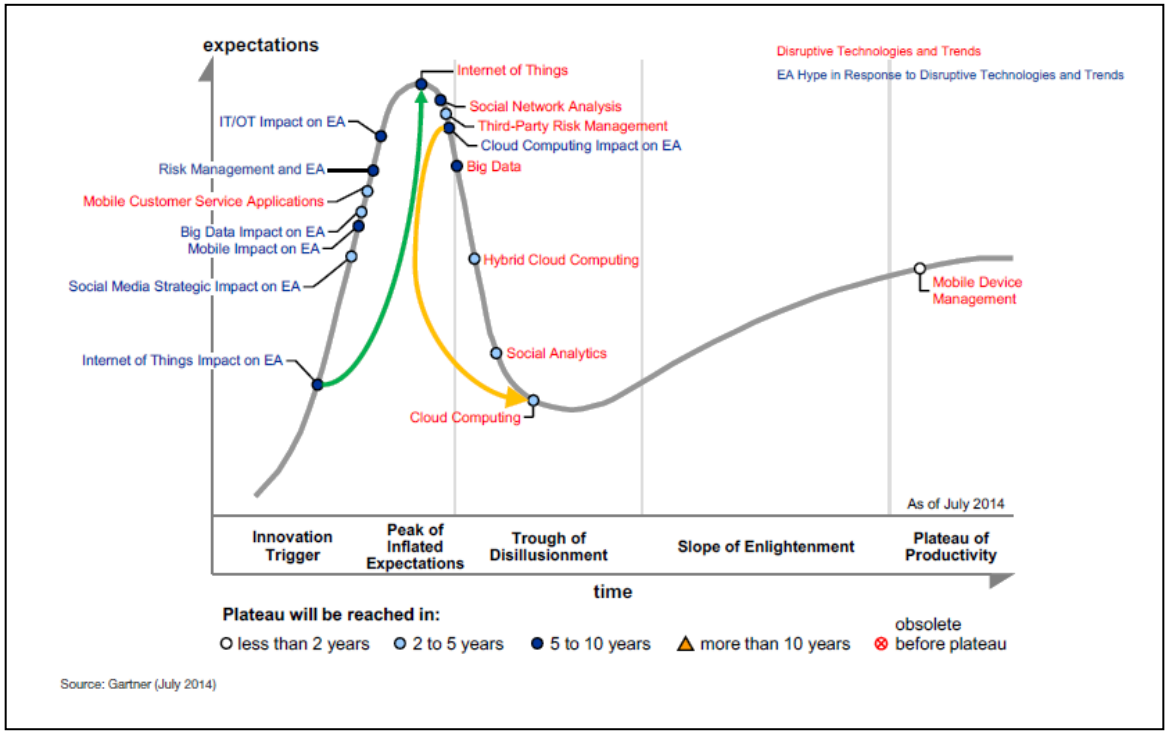


Figure 17 : Disruptive Technology vs EA Hype Cycles (Burton and Allega, 2014)

2.5.3.4 Enterprise architecture challenges

Over the last 50 years, businesses have become increasingly dependent on IT to support day-to-day business operations and to help enable business strategies. IT has become a significant source of competitive advantage for most businesses and helped enable new business models to achieve business strategies (Schwab, 2016, Heller. M, 2012, Evans, 2003).

Over time, the addition of new applications, systems, retention of legacy applications and system interfaces resulted in the IT landscape changing significantly. It has become characterised by a significant level of complexity (Bente et al., 2012). This generally results in increased costs and impedes business agility, which increases the frustration of business executives who need to change to compete in an agile environment (Peters, 2014, Roberts and Watson, 2014, Heller. M, 2012, Evans, 2003).

Organisations that evolved over time will find it difficult to adapt legacy systems to meet the expectations of customers in an agile environment (Gans, 2016, Parker et al., 2016, Narayan,

2015). In many instances, a complete review of organisations' IT landscape may be required to compete in the new world. Failure to transform and change in line with technology changes could open opportunities for new competition and eliminate businesses that are slow to react.

Ross et al. (2006) struggled with the concept of EA and came to the realisation that EA is more about the enterprise than about IT architecture. IT architectures and EA efforts have been historically ineffective, as they were remote from the realities of business and focussed on unnecessary detail that was not useful, except to a limited group within some IT departments (Narayan, 2015, Ross et al., 2006). Organisations are still dependent on EA; however, its restrictive and bureaucratic approach results in EA often being viewed simultaneously as an asset and a liability by business executives.

Many managers question the value of EA and view it as a hurdle as opposed to an enabler to fast-track the achievement of business outcomes. A recent Gartner survey indicates that many CIOs did not see the value of enterprise architects in an environment of continuous disruptive innovation, as they were too rigid in their approach, focussed on policies and procedures and their heavy-handed governance requirements (Blosch et al., 2016a). However, even though some CIOs did not have enterprise architects in their organisations, they had limited success in transforming their organisations through innovation and the use of disruptive technologies.

The current business environment is characterised by uncertainty and a rapid pace of change, whereas most EA efforts follow a strategic approach over a longer-term horizon stretching into the future (Bente et al., 2012). Traits displayed by traditional EA approaches reflect similar approaches to a waterfall software development approach, which implies long review and approval cycles for strategic IT programs. An EA approach should try not to focus too far into the horizon, otherwise enterprise architects tend to lose touch with reality. In today's agile business environment, technology and the business context could change rapidly over a very short time. Any long-term initiative runs the risk of addressing problems that may not be there when the project is completed or where the project is out of touch with reality (Narayan, 2015, Bente et al., 2012).

In many larger organisations, IT complexity arises from a silo organisational structure, where each business unit has its own IT budget to invest in IT (Bente et al., 2012). In these circumstances, if IT governance is weak, duplicate systems and lack of organisational standards could result in a jungle of systems with duplicate data and limited integration, which could further constrain the agility of organisations in an agile environment.

Bente et al. (2012) view the mandate of EA in an organisation as follows:

- Controlling IT complexity
- Managing the IT landscape as an asset
- Aligning business and IT
- Ensuring the business value of IT.

Most businesses across industries expect IT to be stable, agile, adaptable and efficient (Bente et al., 2012). The definition of these terms could be wide, but key expectations are as follows:

- **Stability:** IT should be reliable, resilient and available.
- **Agility:** IT should be responsive to changes in market dynamics and customer requirements by enabling the quick introduction of new solutions and products with consequent changes in business processes.
- **Adaptability:** IT should facilitate rapid changes to regulations, mergers and acquisitions, new business contexts etc.
- **Efficiency:** IT should exceed business service expectations at the lowest possible cost.

In most organisations, this represents expectations in an ideal world. In reality IT in most organisations remains sluggish, expensive and inflexible (Bente et al., 2012). Some of the main reasons for the complexity of IT are complexities originating from business itself, legacy IT systems and technology changes over time (Roberts and Watson, 2014, Heller. M, 2012, Evans, 2003). Although the quality of IT hardware, software and systems integrators would have improved significantly over time external to the organisation, approval to implement newer systems can only be obtained once financial KPIs such as return on investment can be justified. This results in IT improvising on existing systems to satisfy business expectations, which introduces further complexity over the longer term (Parker et al., 2016, Bente et al., 2012, Ross et al., 2006). The result of this scenario is that many executives do not see IT as adding value to business. According to Gartner, significant IT spending is done outside of IT, which is an indication of businesses trying to implement technology outside the governance framework of IT. This ultimately results in additional complexity (Fitzgerald, 2016, Cohen, 2015). von Urff Kaufeld et al. (2009:p1) characterise this reality as follows: "the explosive growth in IT has created many expectations in numerous organisations for IT to be the one-stop solution and miracle ‘saviour’ to any business problem. This has increased pressure on IT professionals and executives to deliver on often unrealistic expectations and promises.”

Expectations of EA have evolved in agile market conditions and it seems that enterprise architects have not transformed in line with business expectations (Gøtze, 2013, Lapalme, 2012).

2.5.3.5 Business expectations of enterprise architecture

Enterprise architects perform a critical role in defining technology roadmaps, which enables organisations to achieve their strategic objectives (CIO Council, 2013, Sessions, 2006). However, the perception of the value of enterprise architects is extremely low among CIOs and business stakeholders. In most cases this is caused by conflicting objectives and unclear expectations (Burton and Allega, 2014, Lapkin and Allega, 2008). IT is generally viewed through different frames, depending on the stakeholder and his or her interest in IT. For example, business owners will be predominantly interested in functional features, convenience of use and financial KPIs, whereas IT engineers would be interested in technology specifications and implementation guidelines (Wunderlich and Beck, 2017, Potter et al., 2016). Enterprise architects' role is therefore to ensure that they provide a holistic view of a system from different perspectives, depending on the stakeholder group. An enterprise architect's role is also to map relationships between enterprise strategic goals, IT investments, products and services and KPIs.

As businesses expand and IT becomes increasing more strategic to create differentiation, the role of EA becomes critical in ensuring that IT remains an asset to business. Enterprise architects need to ensure that any changes to IT align to business objectives and create value, while duplications and excess costs must be eliminated (Bente et al., 2012, Ross et al., 2006).

Blosch et al. (2016a) suggest that EA must be used as an internal management consulting competence that is agile, flexible and focussed on business outcomes. The rapid pace of technology changes implies that few established best practices are available to CIOs to adopt to ensure success. Organisations need to adopt agile approaches that are open to continuous experimentation and test new technologies to determine what works in enabling business strategies. Enterprise architects can perform a consulting role in assisting business executives and CIOs to shape business strategy and develop practical roadmaps to achieve business objectives (Blosch et al., 2016a).

Enterprise architects should break down strategic plans into shorter-term deliverables that enable businesses to realise incremental value for the duration of the project, as opposed to only realising value at the end of a project (Narayan, 2015, Bente et al., 2012). IT initiatives should still align to longer-term business vision; however shorter-term strategies allow incremental changes

in projects to align to changes in the external business context and technology changes. This enables enterprise architects to demonstrate value to business as projects progress, as opposed to only when the project is completed. This approach requires a mindset change in enterprise architects who focus on long-term strategic plans to an incremental approach, and instead of rigorous planning, to exploratory activity (Narayan, 2015, Bente et al., 2012). However, the risk of this approach is that enterprise architects may move to the other end of the spectrum, focus on operational incremental improvements and ignore strategic planning. One of the key expectations of EA is to simplify IT. Enterprise architects are expected to reduce the complexity and cost of IT while enabling business change to improve competitiveness.

EA can perform a critical role in assisting organisations to identify and respond to disruptive threats and shape business strategies. Geschickter et al. (2017) conducted research among industry leaders and identified best practice approaches used to identify and implement high-impact emerging technologies, as shown in Figure 18, which can be used as a guideline for enterprise architects in a disruptive environment to influence business strategies.

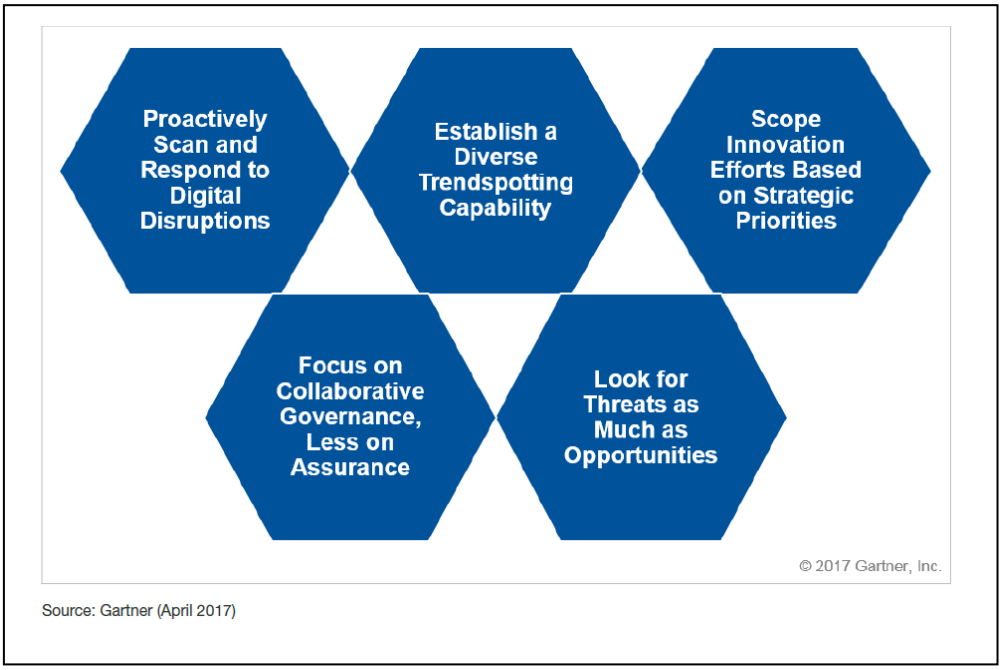


Figure 18 - Best Practise Approaches for Enterprise Architects in Disruptive Environments (Geschickter et al., 2017)

2.5.3.6 Enterprise architecture and business strategy

In an agile business environment, technology innovations are relentless (Blosch et al., 2016b). Successful companies have made IT an asset rather than a liability (Ross et al., 2006).

Innovative organisations will need to learn and experiment with new technology innovations to gain competitive advantage. EA must evolve to support and guide organisations in their digital innovation strategies. They may need to own or support innovation processes and provide a conduit to the organisation, systems and processes (Blosch et al., 2016b) in achieving strategic objectives.

While there are rapid changes in the business world in a disruptive environment, top-performing firms focus on creating a stable foundation for execution. Core processes are digitised and embedded in a stable base (Ross et al., 2006). Organisations that have digitised their core processes have higher profitability and faster times to market (Raskino and Waller, 2015). Findings show that a stable foundation makes top-performing companies more efficient and agile than competitors. Companies decide what makes them great and then create a high-quality, low-cost core, which provides consistency in a turbulent environment. Top companies first define their operating model and then define processes and infrastructure that would be critical to support their current and future business strategy. The focus is on establishing a solid foundation on which to build. A solid foundation is a mechanism that enables companies to compete in agile market conditions.

Building a strong foundation implies automating many of the basic routine activities to ensure that they are reliable and predictable, without detracting any management attention from higher-order activities and customer interaction (O'Reilly III and Tushman, 2016, Narayan, 2015, Ross et al., 2006). Ross et al. (2006) found that many companies are spending time on smaller projects that do not support enterprise-wide objectives, focussing on cutting IT costs without determining how to increase value.

Manufacturing companies would need accurate and transparent information on customer orders, finished goods, products shipped, raw materials, work in progress, invoices, payments etc., to perform their basic operational activities. Any errors in any part of this process could have a ripple effect across the organisation and on customers. It is important that these types of routine basic functions take up very little management attention to allow managers to focus on key business imperatives and customers. This is where the focus on a strong technology foundation helps companies perform basic functions well and gives them capabilities to distinguish them from competitors.

Ross et al. (2006) describe the foundation for execution in most companies as follows:

- Basic infrastructure services

- Employee hiring and recruitment
- Purchasing
- Desktop support
- Telecommunications
- Email and collaboration
- Basic transaction processing - sales, accounts payable
- Unique and distinguishing business capabilities.

Companies become more agile by creating a strong foundation for execution, which implies automating basic processes to create rigidity in their operations. Less management time and effort are wasted on mundane activities. Companies need to focus on building strong IT capabilities and not on building IT solutions (Rogers, 2016, Peters, 2014). When faced with disruptive technologies in agile market conditions, managers have a good idea of what systems and processes in their organisation will not change, but they might not be able to predict what may change in future. In this scenario, digitising and automating stable processes will allow them time to focus on unpredictable changes.

Bente et al. (2012) suggest that applications in an enterprise should be classified in different categories, as shown in Figure 19, and be viewed differently from an enterprise decision-making perspective. CIOs must adopt different attitudes, depending on the quadrant in which the application currently is. Rigorous and stringent quality gates should not be enforced for applications classified in the “Stars” and “Wild Cats” categories, as this could be a future source of growth or competitive advantage for companies.

As applications migrate and mature through the different stages in the quadrant, EA standards can be increasing enforced. Applications classified in the “Wild Cats” and “Stars” categories also benefit significantly from an agile software development methodology, as it enables quick introduction of new features and capabilities that can be tested in agile market conditions.

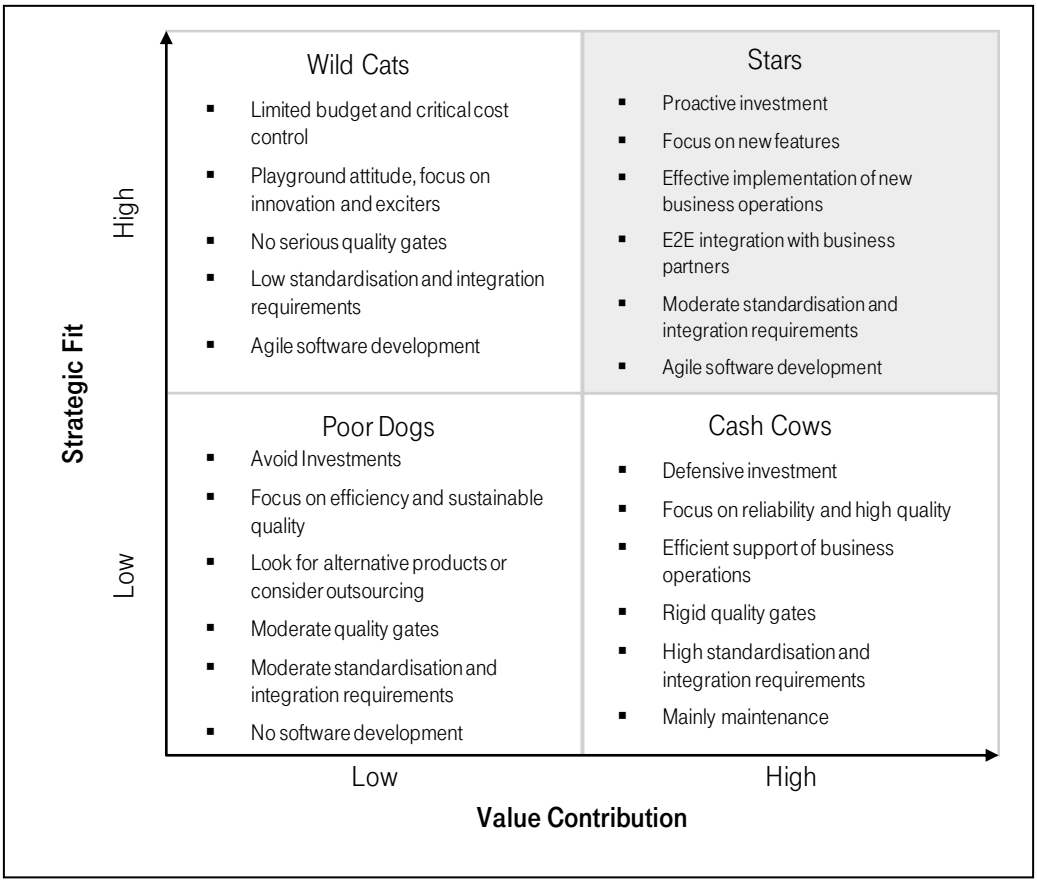
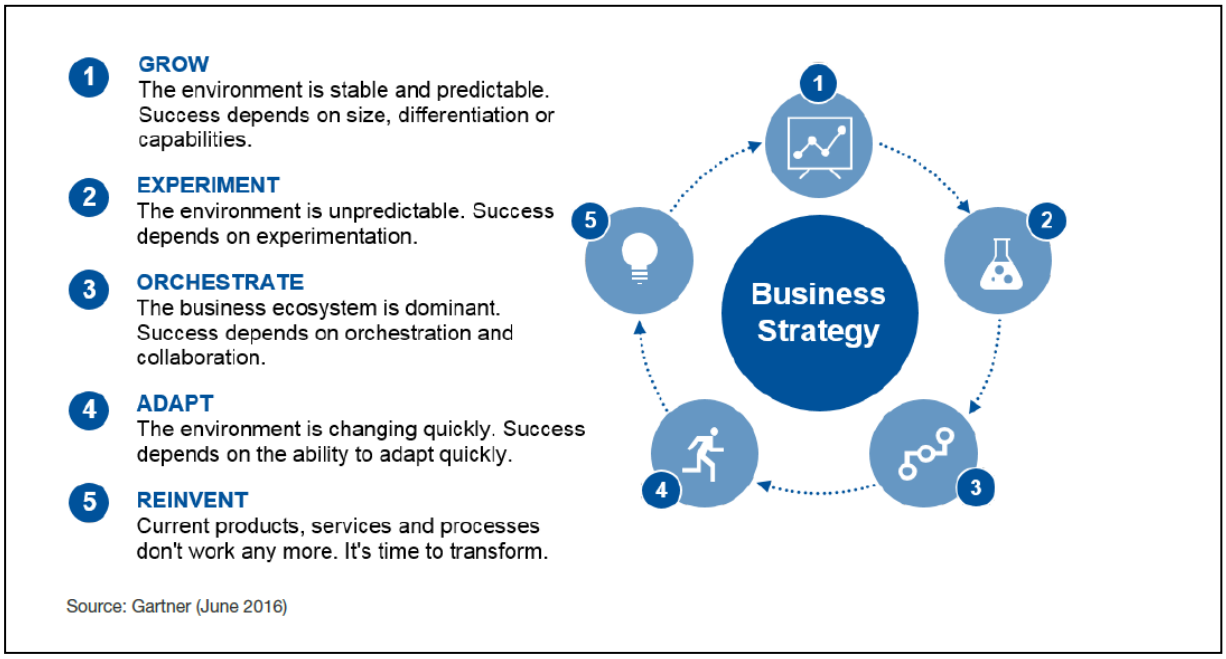


Figure 19 - Strategic Fit vs Value Contribution (Bente et al., 2012)

To assist CIOs in a disruptive environment, reframing enterprise architects helps create a management consultant competence, which has the following benefits (Blosch et al., 2016a):

- Agile delivery approaches linked to business outcomes
- A flexible, iterative approach to innovation
- A focussed approach to addressing business problems
- Rebranded EA practice.

Figure 20 provides an overview of how business strategy and outcomes should influence an organisation's approach to EA. The current rigid "one-size-fits-all" approach to EA based on traditional frameworks may not be a recipe for success in disruptive conditions. As EA can be a key enabler in strategic IT decision-making in organisations, CIOs need to re-assess their current EA approaches, which can help ensure more informed decision-making.



2.5.4 Influence of business operating models on IT decision-making

Ross et al. (2006) came to the realisation that enterprise architects need to focus efforts on a higher level, i.e. at an enterprise level, and understand the enterprise logic for its core processes, with the related IT architecture reflecting standardisation and integration of its operating model.

Ross et al. (2006) describe an organisation's operating model as "the organisation logic for business processes and IT infrastructure reflecting the integration and standardisation requirements of the company."

The role and expectations of IT vary across a business and are dependent on numerous factors, such as company strategy, industry, demographics, leaders' profiles, the company's global and

Figure 20 - Business Strategy-focussed Enterprise Architecture (Blosch et al., 2016a)

geographical footprint, risk tolerance etc. (Bongiorno et al., 2018, Rizzo, 2018, Varanini, 2018, Wunderlich and Beck, 2017, Potter et al., 2016, Walsham, 2012). Different business units may have different expectations of IT, although one business unit generally tends to dominate (Young, 2016). The challenge for CIOs is to understand business expectations of IT, i.e., maintainer, enabler or driver, and then optimise operating and delivery strategies accordingly, as indicated in Figure 21.

Organisational attributes and classification determine applicable IT governance and operating models. IT delivery models need to be explicitly defined, as these affect processes, governance, funding models and decision-making in organisations (Young, 2016). Explicit operating models also make it easier for CIOs to define an overall transformation roadmap that links organisational architecture, the IT delivery model and business expectations of IT.

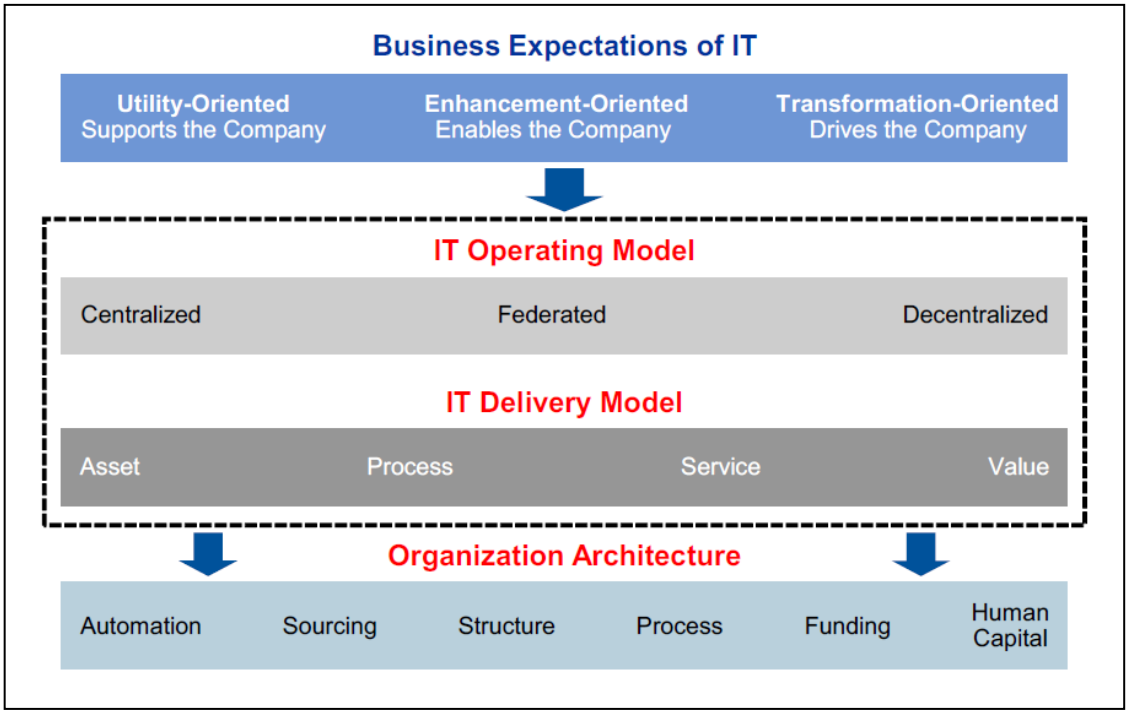


Figure 21 - Business Expectations of IT and IT Model Hierarchy (Young, 2016)

Recent researchers into disruptive technologies have spent more time assessing the impact on business models: how companies create, deliver and extract value in executing their business strategy (Sandström et al., 2014). An explanation for the change in focus to business and operating models is that there are a growing number of organisations that are being disrupted by organisations creating value by finding new ways to use technology. The focus has moved from implementing technology that has the best characteristics and functionality to finding new ways to use technology (McNish and Silcoff, 2016, Peters, 2014). Christensen (2015) argues that both technology and business model innovation can cause disruption; “disruptive Innovation is a business model problem, not a technology problem”.

The general approach to IT execution is to align business strategy with IT (Ross et al., 2006). However, this is an elusive goal, as business strategies continuously change in response to

competitive threats or to seize new opportunities. Ross et al. (2006) recommend that to support a company's strategy, it is best to define an operating model first. An operating model defines the necessary business process integration and standardisation to deliver services and goods to customers. The operating model provides a more stable base, which drives the foundation for execution. Amazon has been successful, as it has a mature foundation for execution, which enables it to add additional products to its portfolio by leveraging its underlying infrastructure. An operating model will result in a commitment to a predefined way of doing business.

Key dimensions of an operating model are standardisation and integration (Ross et al., 2006). Standardisation results in defining how activities will be executed, irrespective of who is performing them. This results in efficiency and predictability across an organisation and yields enhanced throughput. This approach limits innovation and may entail replacing existing systems and process that may be performing well in certain instances. Integration refers to the sharing of data between systems. Integration often results in improved customer experience by sharing data between systems, making it possible to link different business processes and eliminate duplication of effort. Integration results in a better management IS, which enhances decision-making and speeds up the overall flow of information across an organisation.

An operating model has four characteristics related to integration and standardisation, as shown in Figure 22. Companies should align to one of these characteristics to clarify their intended service delivery models to customers (Ross et al., 2006). Ross et al. (2006) describe the four operating models as follows:

- Diversification (low standardisation, low integration)
- Coordination (low standardisation, high integration)
- Replication (high standardisation, low integration)
- Unification (high standardisation, high integration).

The logic is that business strategy changes, depending on market conditions and competitive pressures, therefore it is important to ensure that the operating model is clearly defined, and a strong IT foundation is established to support agile business strategies. However, it must be noted that the foundation for execution cannot save a company if the business and market strategy is not viable (Evans, 2003, Peters, 2014, McNish and Silcoff, 2016, Gans, 2016).

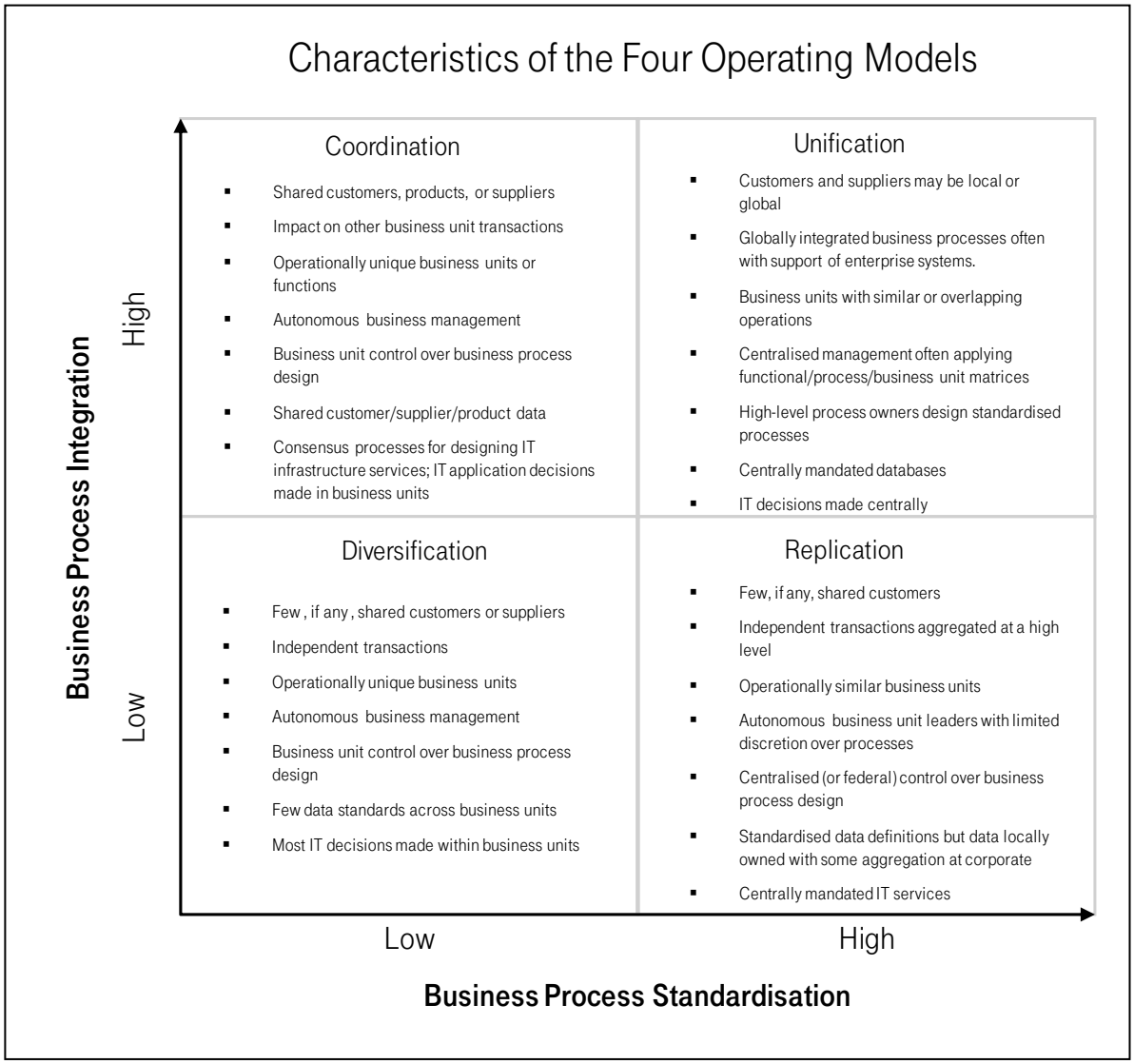


Figure 22 - Characteristics of the Four Operating Models (Ross et al., 2006)

When faced with a continuous stream of disruptive technologies, organisations should focus on defining their operating model and then appropriately align their architecture states, according to Ross et al. (2006). Although this may seem like a contradiction, research indicates that having a solid foundation can significantly increase an organisation's agility and flexibility in disruptive market conditions.

2.5.5 Existing strategic IT decision-making frameworks

In IS literature, there seems to be growing interest in understanding strategic IT decision-making in the IS field. Despite the impact of disruptive technologies on industries and organisations, no studies were found in the literature consulted that addressed how strategic IT decisions should be made within a disruptive technology environment. However, the literature reviewed revealed four studies that addressed strategic IT decision-making. These will be briefly analysed below.

2.5.5.1 CIO decision-making – Issues and a process view.

Selkala (2016) observed that organisations' operations are increasingly dependent on IT, which is a central factor for an organisation's value creation. IT is only useful to organisations if optimally utilised. Selkala (2016) could find little research on the CIO decision-making process, as most CIO-related research focussed on IT governance, IT and business alignment and IT investments describing concerns of CIOs. CIOs across organisations perform similar activities, e.g. determining key issues, IT governance and IT value creation, which all require decision-making. No research could be found to guide decision-making processes for CIOs.

Selkala (2016) focusses on CIO decision-making processes and suggests that key IT management issues should be "managed with a good and solid process that takes into consideration the organisational benefits". Key issues to be addressed by CIOs are mainly related to cost reductions and change management. Ongoing tasks include IT platform development and alignment of IT with business (Selkala, 2016).

The IT decision-making model proposed by Selkala (2016) is shown in Figure 23. This approach identifies an open issue and then through a structured iterative process makes a decision to address the identified issue. The outcome produced by the process defined in the model makes it easier to communicate the way issues will be addressed by the CIO (Selkala, 2016). The process description also defines what action will be taken and what information is needed for making decisions.

Figure 23 focusses on the decision-making process CIOs follow in entities to address identified issues in a context of conflicting values. This study focusses on guiding CIOs on "how" to arrive at a decision that could be implemented in an organisational context by following a structured process.

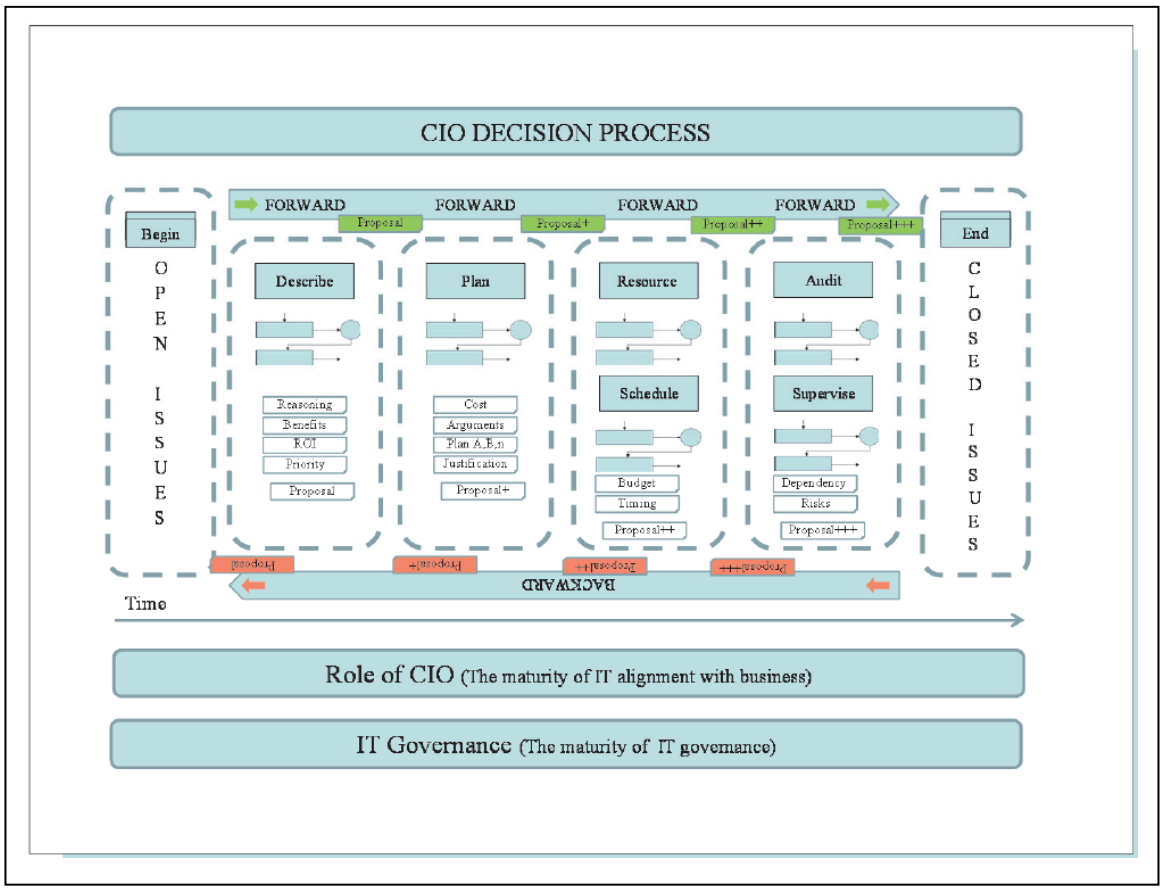


Figure 23 - The CIO Decision-making Process (Selkala, 2016)

2.5.5.2 Model of strategic IT decision-making process

Senior executives in most organisations need to make strategic IT decisions, which are often important, though infrequent (Tamm et al., 2014). These decisions are challenging because of uncertainty about aspects under consideration, as well costs and expected benefits. Tamm et al. (2014) found little research on IT decision-making processes, even though these decisions have a significant impact on staff, contractors, systems and business processes. The premise in this study was that if the decision-making process is understood better, it will be possible to "make better decisions, reduce cost overruns, and/or explain why some major IT-related projects have struggled to realise expected benefits."

Tamm et al. (2014) conducted a review of strategic decision-making and found significant studies focussing on this topic in management literature. This review considered 49 empirical studies on strategic decision-making from 1980 to 2012, which were published in management literature. By comparing management literature on strategic decision-making with 40 relevant IS studies,

decision context, the top management team and decision-specific characteristics were identified as factors affecting strategic IT decision-making. These concepts influence the nature of the strategic decision process and the strategic decisions flowing from the process. Figure 24 shows the strategic IT decision-making model (SITDM Model) by Tamm et al. (2014).

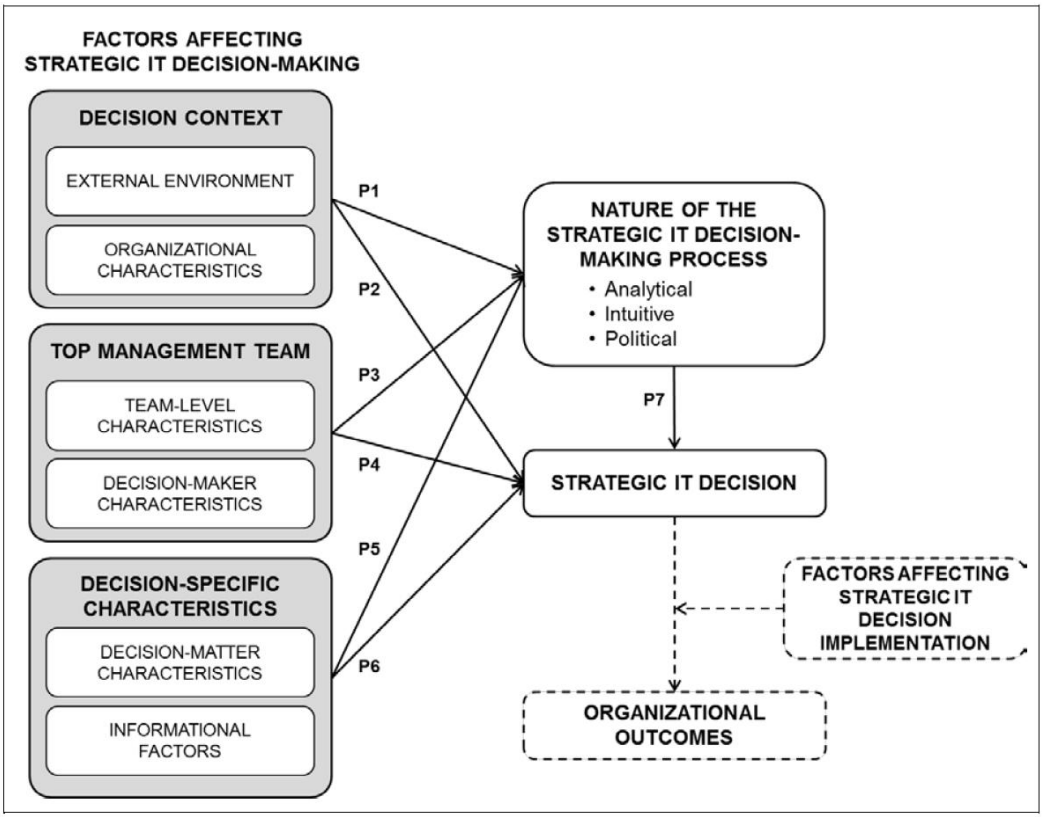


Figure 24 - A Strategic IT Decision-Making Model (SITDM Model) (Tamm et al., 2014)

The SITDM model focusses on strategic IT decision-making in an organisational context and does not consider the impact of disruptive technologies on organisational strategies and their impact on decision-making. In agile business conditions the factors identified in the SITDM model are still applicable, although it may be necessary to consider additional factors to create a comprehensive framework for strategic IT decision-making in a disruptive environment.

2.5.5.3 Factors influencing strategic decision-making processes

Strategic decision-making is a complex process and decision-making is one of the most important functions of managers in any organisation (Nooraie, 2012). Nooraie (2012) contends that despite

numerous studies attempting to aid managers in making better decisions, there is still little understanding of strategic decision processes and factors affecting these. “Strategic decisions are long term, highly unstructured, complex and inherently risky and have great impact on the future of organisations” (Nooraie, 2012: p2).

Nooraie’s (2012) findings classified factors affecting strategic decision-making into four major categories:

- Decision-specific characteristics
- Internal organisational characteristics
- External environmental characteristics
- Management team’s characteristics.

The focus of Nooraie’s (2012) research was on strategic decision-making in a dynamic global context and not on strategic decision-making in the context of IT or disruptive technologies. The factors identified will be applicable to CIOs and business executives who are accountable for business strategy. However, additional factors may need to be considered to guide decision-making in a disruptive technology environment.

2.5.5.4 Driving disruptive innovation: Problem-finding and strategy-setting in an uncertain world

Petrick and Martinelli (2012) developed a 10-step strategic road-mapping method to help companies develop an external view of the future, which can assist in driving change. In a disruptive context, executives need to develop an understanding of non-obvious problems that will need to be addressed in the future. This requires companies to scan external environments, identify trends and visualise future challenges from an end user or customer perspective. Figure 25 provides an overview of the strategic road mapping framework proposed to develop an external view, which will drive strategy setting and execution in a disruptive innovation environment.

Strategic road mapping provides a framework for dialogue that can provide future scenarios to guide strategic decision-making and focus on the following main conversations (Petrick and Martinelli, 2012a):

- Fundamental strategic challenges facing the firm
- What new opportunities may present themselves in the future
- New possibilities for delighting customers and the market
- What actions will be needed and by when.

Incumbent organisations that are successful may find this approach extremely difficult, as they may believe that they already understand the competitive landscape and drivers that have shaped their strategy. Incumbent organisations will tend to view the external environment from a traditional perspective and will have a decision bias supporting existing processes and capabilities (Petrick and Martinelli, 2012).

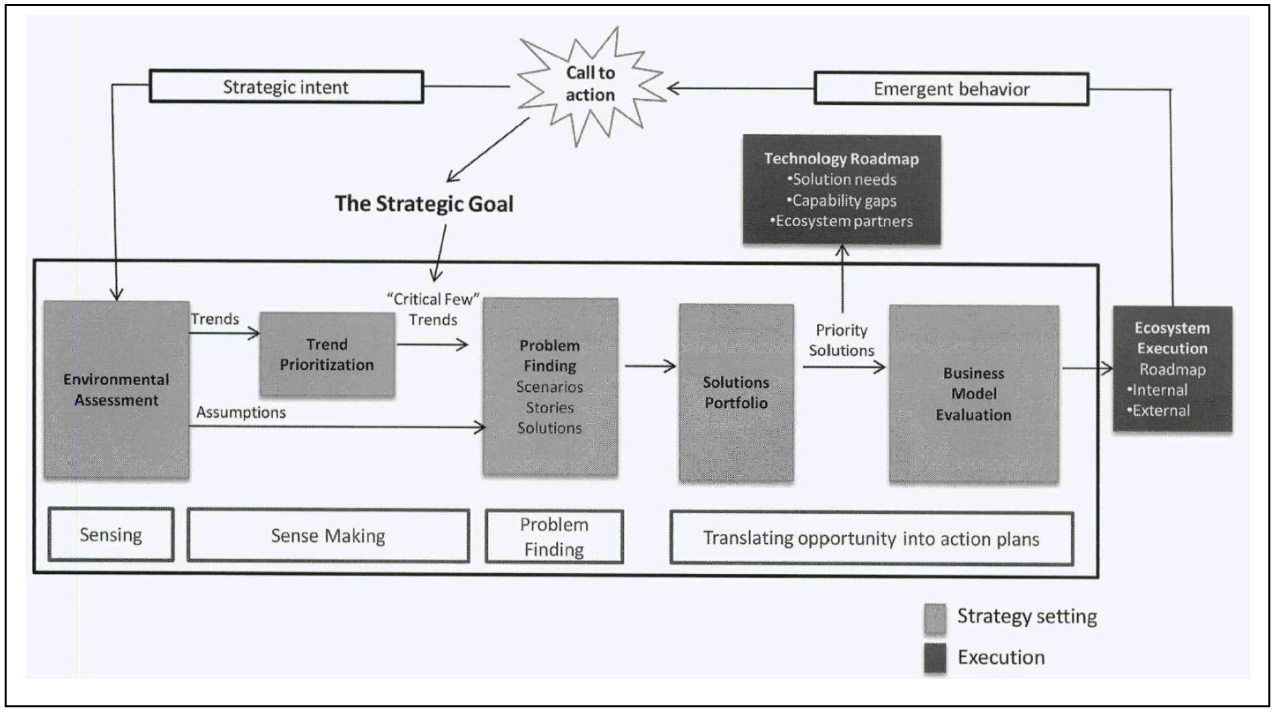
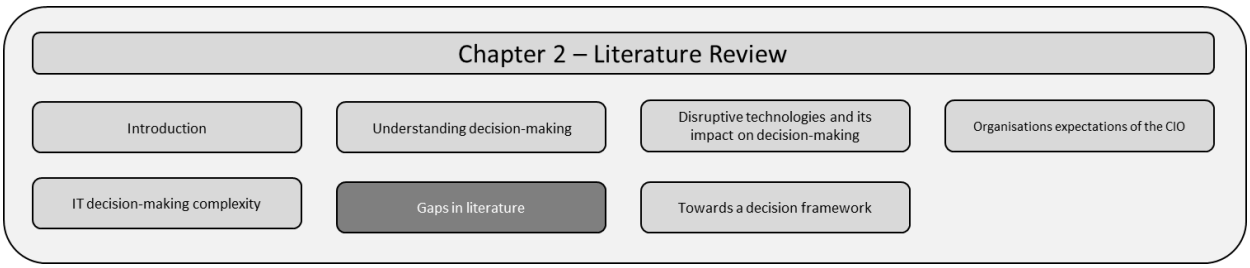


Figure 25 - Strategic Road Mapping to Translate Strategy into Action (Petrick and Martinelli, 2012)

The process defined starts with a "call to action", which is often initiated by a visionary leader in an organisation or an external competitive threat. The method thereafter recommends a series of steps that consider environmental factors, technology roadmaps, business model evaluation and execution in an ecosystem.

The method proposed defines a logical process to follow when faced with disruptive threats and provides decision considerations to implement disruptive innovation. Strategic road mapping provides a framework to facilitate the right dialogue to "illuminate possibilities of the future" (Petrick and Martinelli, 2012). The framework is more process-focussed; however some of the factors mentioned can be useful for CIOs to consider when making strategic IT decisions.



2.6 GAPS IN LITERATURE

As was shown in this chapter, although several studies could be found on topics such as disruptive technologies, IT governance, role of the CIO, decision theory, IT and EA value creation etc., little research could be found on strategic IT decision-making in agile business conditions from a disruptive technology perspective. The gap in the current literature is that most research on decision-making focusses on a topic, process or technology without consideration of contextual factors or disruptive technologies that have a direct impact on strategic IT decision-making in an organisation.

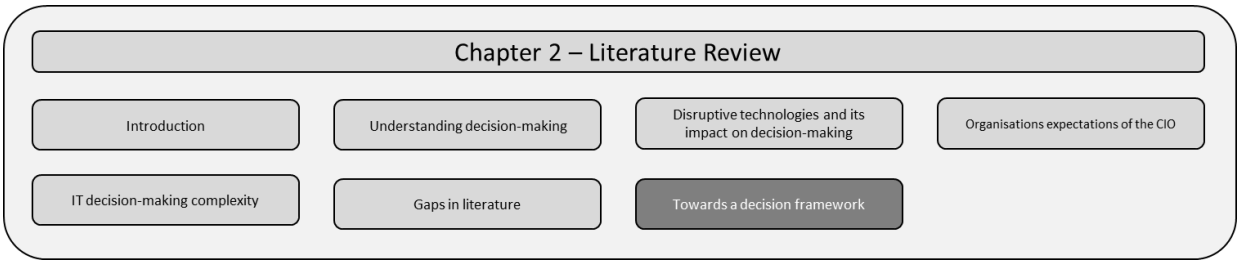
Numerous case studies were available on disruptive organisations such as Amazon, Google, Uber, Airbnb, Apple etc. that used technology as a means to create business model innovation, which resulted in disruption of long-standing reputable organisations (McNish and Silcoff, 2016, Parker et al., 2016, Christensen et al., 2015, Guttentag, 2015). Little information could be found on the choices available to these organisations during their early phases and how decisions were taken before they disrupted the industry.

After analysing previous research on IT decision-making in disruptive environments, various factors emerged as key considerations for motivating new technology investments. Decision-making is influenced by factors such as personal attributes, the experience of the decision maker, decision processes, the characteristics of the industry, organisational characteristics, timing etc. However no framework was found that could be used as a guide to strategic IT decision-making.

Strategic IT decision-making is a key executive function required to ensure the success of an organisation. This was highlighted in previous studies on strategic decision-making processes (Nooraie, 2012, Tamm et al., 2014, Selkala, 2016), but the impact of disrutive technologies was not considered in the proposed frameworks.

No studies were found in the literature consulted that provided a comprehensive framework to guide CIO strategic IT decision-making from a disruptive technology perspective, therefore the

literature review for this thesis focussed on identifying factors emanating from IS and management theory that could answer the main research question in this thesis.



2.7 TOWARDS AN IT STRATEGIC DECISION-MAKING FRAMEWORK IN THE MIDST OF DISRUPTIVE TECHNOLOGIES

By combining previous research on strategic decision-making from management theory, IS research on strategic IT decision-making, disruptive innovation theory and literature reviews related to disruptive technologies, digital business strategies and changing expectations of CIOs, it would be possible to propose a framework to guide strategic IT decision-making from a perspective of disruptive technologies.

The objective of the literature review was to understand previous research contributions in answering the research question in this thesis.

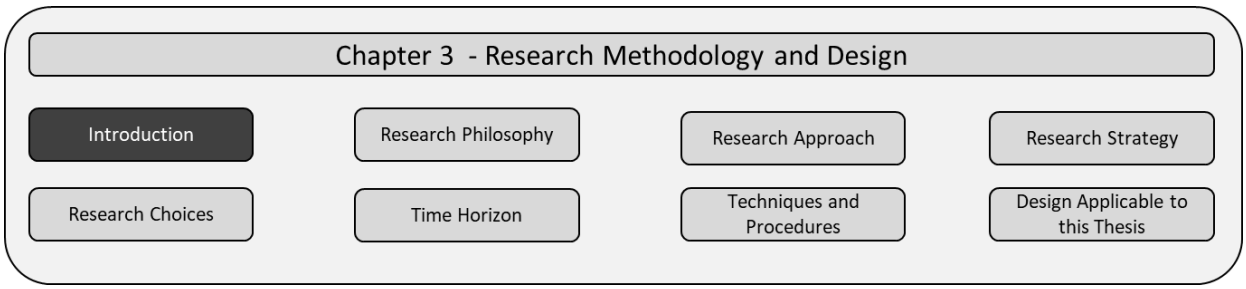
MRQ:

"How can a CIO decision-making framework be constructed that can be used to guide CIOs in making strategic IT decisions in a disruptive technology environment?"

In constructing the framework on strategic IT decision-making, the following questions were used in Chapter 4 to analyse and synthesise the literature covered in Chapter 2:

- Why: Why should organisations consider or react to disruptive threats or innovation?
- Who: Who (CIO or business executives) should react, make strategic IT choices or drive organisational transformation from a disruptive technology perspective?
- What: What should be considered when making technology decisions in a disruptive environment?
- How: How can decisions be fast-tracked in organisations in an environment faced with a continuous stream of disruptive technologies?

It is suggested that these questions give suitable guidance on identifying decision-making factors to be included in a holistic decision-making framework. This will be done in Chapter 4.



3 RESEARCH METHODOLOGY AND DESIGN

3.1 INTRODUCTION

This chapter focusses on the research design, methodology and approach followed in answering the research questions in this study. The intent of this research is to create a framework for strategic IT decision-making that could be used by IT practitioners in their work context. To achieve the objectives set out in the research, it is imperative that a structured approach is followed, to ensure alignment to ontological assumptions and defined epistemological preferences of the researcher.

It is also important to ensure alignment of terminology used, as there is often inconsistency across different frameworks and researchers. For the sake of clarity, it is appropriate to differentiate between the terms research methods and methodology, which are used interchangeably in most research papers.

Research methods refer to the method and processes used to obtain, interpret and analyse data. This includes surveys, interviews and both quantitative and qualitative data (Saunders et al., 2009).

Research methodology is rather related to the theory of how research is undertaken and this is based on a set of philosophical assumptions that influence the methods adopted (Saunders et al., 2009). Methodology is also linked to attitude, understanding and choice of strategy used to answer the research question (Greener and Martelli, 2015).

There is currently a vast array of research methods and methodologies governing IS research. Because of inconsistent definitions regarding methods, methodologies, theoretical elements, philosophical approaches and how they relate to each other, it is important for the approach adopted in any research to be clearly articulated (Crotty, 1998).

Crotty (1998) indicates that the following two questions must be answered in developing a research proposal:

- What methods and methodologies will be followed in the research process?
- How does the researcher justify the choice of methods and methodology used in the research process?

The answers to the above questions provide some perspective on the researcher's view regarding the creation and characteristics of human knowledge, which provides guidelines for observers on how to interpret and use the knowledge created.

The choice of research design influences the credibility of research findings and reduces the possibility of obtaining incorrect research results (Saunders et al., 2009). Two key considerations in research design are reliability and validity.

- Reliability is determined by the choice of data collection techniques and analysis procedures to produce consistent research results in different circumstances. Reliability is highly influenced by participant or observer error and bias, which need to be considered when data is analysed.
- Validity assesses if the findings relating to the variables under consideration are real and valid (Saunders et al., 2009). An important consideration in research is external validity regarding generalisation of research findings. This considers whether the research results are applicable to a particular setting, context or population or if the results are equally applicable or can be generalised to other context or populations. To improve validity, researchers may consider testing research results in other settings or contexts before generalising or otherwise they may give clear information on the context in which the findings are applicable.

Researchers' views on the nature of the world and how it operates influence the choice of process and approach in a research study. An objectivist view is that social entities and organisational culture exist independently of social actors or the people who interact with these entities (Saunders et al., 2009). Similar organisational structures and governance will result in the creation of similar social entities, irrespective of the people who are in these organisational structures. A subjectivists view is that organisational culture changes, based on the actions of people or social actors, and can be influenced to a desired state as required. This view implies that a change in people and leadership in an organisation can change the organisational culture (Saunders et al., 2009).

Saunders et al. (2009) indicate that most approaches entail the following stages: clarifying and formulating a topic, literature review, research design, data collection, data analysis and finalising the write-up. Saunders et al. (2009) introduced the concept of the research onion to describe

research approaches and philosophies that influence research strategy and methods used to conduct research, as depicted in Figure 26.

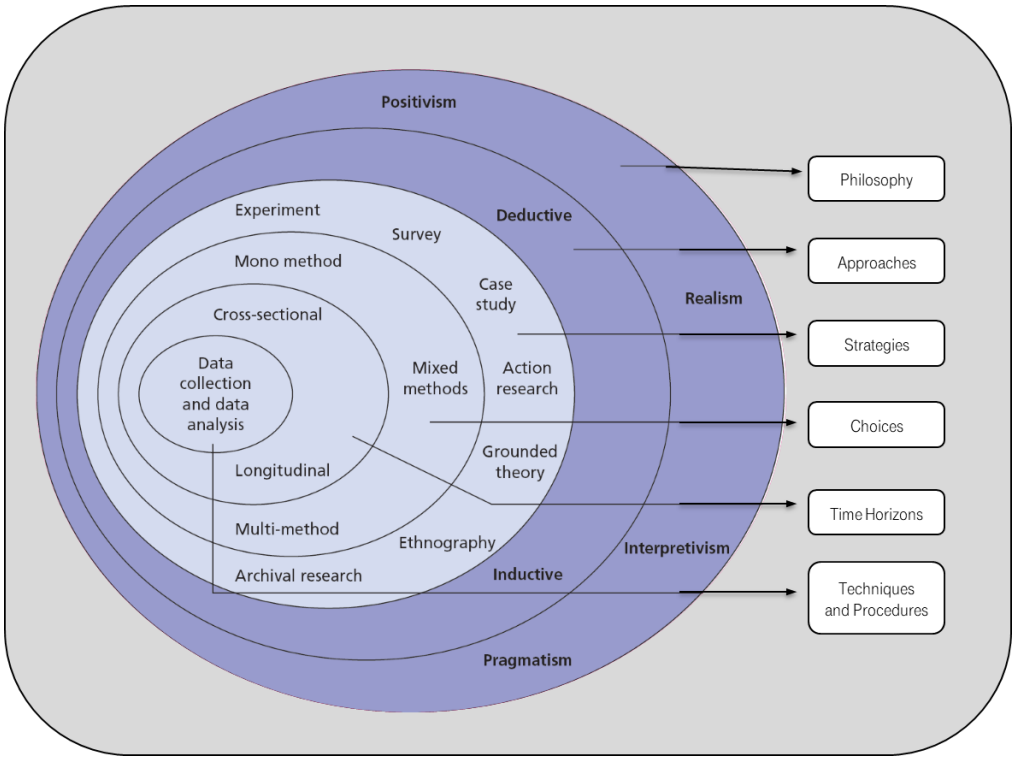


Figure 26 - Research Onion (Saunders et al., 2009)

The research onion proposed in Figure 26 provides a structured approach to define the research methodology and design followed in this thesis and is described in further detail in the next section.

3.2 RESEARCH PHILOSOPHY

Before embarking on research, it is necessary to determine the research philosophy applicable, which relates to the development and nature of knowledge that is being created. The research philosophy adopted influences assumptions underpinning the research strategy and methods

used in gathering data for the research. The choice of philosophy implies practical considerations, such as the researcher's view on epistemology and the process through which this is developed (Saunders et al., 2009). The benefit of understanding philosophical approaches is that it gives researchers an overview of assumptions that they generally take for granted. These assumptions can then be examined and challenged and can influence a change in behaviour if required (Saunders et al., 2009).

Various publications on research philosophies have identified different approaches, characteristics and paradigms that can be used in IS research. Guba and Lincoln (1994) have analysed four approaches that are competing for acceptance as a paradigm of choice in qualitative studies: positivism, post-positivism, the critical approach and constructivism. Orlikowski and Baroudi (1991) argue that there may be theoretical differences among IS researchers, but there is consistency in research philosophies, which binds researchers together. Orlikowski and Baroudi (1991) identified positivist, interpretive and critical approaches as common approaches. They indicated that no philosophy dominates, although there is a prevailing set of assumptions about what determines acceptable IS research. Myers (2013) distinguishes between positivist, interpretive and critical approaches, but mentions that in the practice of social research, distinctions are not always clear. Saunders et al. (2009) identify positivism, interpretivism, realism and pragmatism as dominant approaches, as indicated in the research onion.

On a high level, there are researchers who prefer dealing with facts and figures, which is a more positivist approach, and there are others with a more interpretive approach who prefer to research feelings and activities regarding a social phenomenon (Myers, 2013, Saunders et al., 2009, Orlikowski and Baroudi, 1991). The approach followed in a positivist philosophy is to develop a hypothesis using existing theory, which will be tested by using observable factual data, resulting in further development of theory. Positivism is the most dominant philosophical approach in business and management disciplines (Orlikowski and Baroudi, 1991). The assumption is that reality is objective and is measurable in a certain context independent of the researcher. The general approach is to define the research subject in terms of dependent and independent variables and to attempt to find relationships and trends between variables (Myers, 2009). Positivist approaches generally entail the testing of a hypothesis in the research design, while an interpretative approach entails the exploration of a particular research topic or theory rather than testing it (Myers, 2013). Realism is like a positivist approach, which is based on factual data independent of human feelings or interpretation (Saunders et al., 2009). Critical realism argues that human experience is based on factual, observable data and then individual

interpretation of the data. Direct realism is based on factual data that is gathered in the research process and excludes interpretation or values in data analysis.

Another aspect that should be considered is the impact of the values of the researcher in the different stages of a research project. Values influence judgement, behaviour, action, choice etc., therefore in interpretive studies different researchers may prefer different research methods and produce different results based on their personal values.

An interpretive approach is more strongly aligned to the requirements of business and management research, as the focus is rather on differences in interpretation and influence on human behaviour. The researcher generally adopts an empathetic approach in observing the behaviour of individuals, in a set of circumstances under a specific time horizon (Saunders et al., 2009).

Interpretive research approaches are more suited to theory building, but can also be used to test relevant theoretical frameworks (Myers, 2013). Theory building studies are used in the exploratory phase of a research process where the researcher is trying to find out what is going on. In interpretive studies, researchers are also subjects in the research process, as they also interpret the social situations as the people being studied. Interpretive researchers view the world from the perspective of people, which implies allowing multiple perspectives of reality, as opposed to the positivist approach (Greener and Martelli, 2015). The social phenomenon being studied has meaning in its context, which creates the socially constructed reality of the research subjects and the researcher. The outcome of an interpretive study is more context-bound, which is closely linked to the research and research methods employed. A good theory in this approach is one that helps the researcher understand the meaning and intentions of research subjects in a certain context (Myers, 2013).

The pragmatist philosophy is that the most important consideration is to design a research methodology to define the research question clearly. Research design will be further influenced by researchers' assumptions about the way the world works, different philosophies defining what constitutes acceptable knowledge and one's values and research paradigms. The choice of research method will be influenced by researchers' views on ontology, epistemology and axiology; however, the pragmatist view is that the research question influences ontology, epistemology and axiology (Saunders et al., 2009).

As opposed to a positivist or interpretive research philosophy, the critical research approach is to evaluate and transform the social reality under consideration critically (Orlikowski and Baroudi, 1991). Where it is similar to the interpretive approach, it assumes that social reality is shaped by experience and based on history. Social construction is further influenced by power relationships within groups of people, such as economic, cultural and political groups (Adebesin et al., 2011). People may, however, deliberately act in ways to change their reality in terms of social and economic circumstances. This is of often hindered by the social, cultural and political situation (Myers, 2013). Critical researchers often use qualitative or action research methods to obtain deeper insight into unstated assumptions, centres of power etc. (Adebesin et al., 2011).

3.3 RESEARCH APPROACH

The dilemma regarding management research over the past decade has been trying to determine how to be both methodologically and theoretically rigorous. Saunders et al. (2009) describe the concept of Mode 1 and Mode 2 approaches when conducting management research. Mode 1 is a more theoretical approach, with very little focus on the application of this research by practitioners. Mode 2 focusses more strongly on the creation of practical knowledge and tries to maintain a balance between theory and practice in the creation of knowledge. Management and business research therefore need to ensure that knowledge that has been created advances theoretical understanding of phenomena under study and at the same time addresses practical business or managerial issues.

Research indicates that there is a gap between basic or pure research (Shapiro et al., 2007) and practical application of research, as illustrated in Figure 27 (Saunders et al., 2009). For management and business research to be effective, the "lost in translation" impact must be considered in the entire research process. One's feelings, beliefs and skills will inevitably influence the research process and outcome; however, attention should be paid to addressing the potential research gap that may arise in the research process to ensure that research results make a valuable contribution to management, business and institutions.

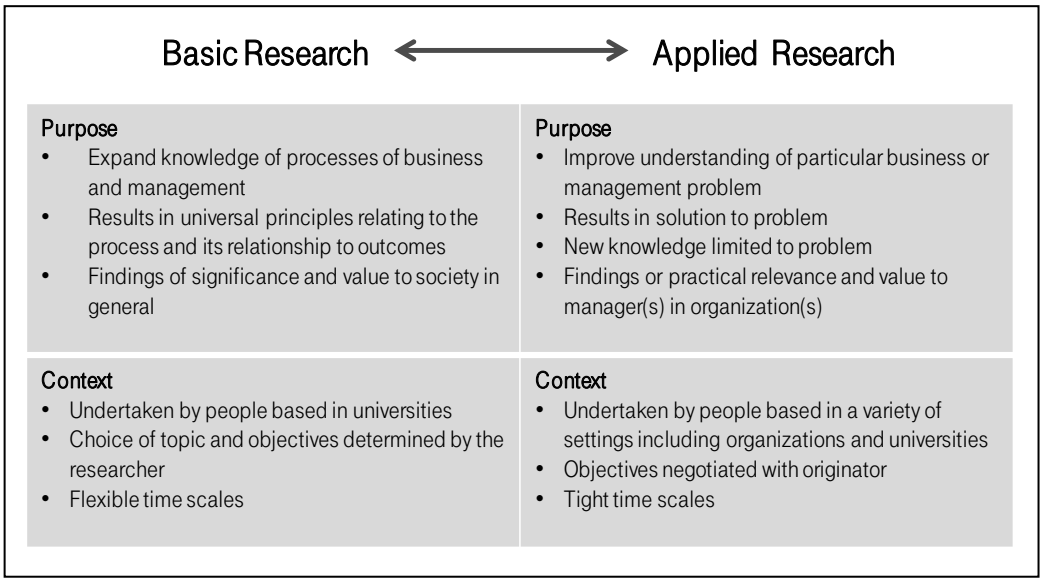


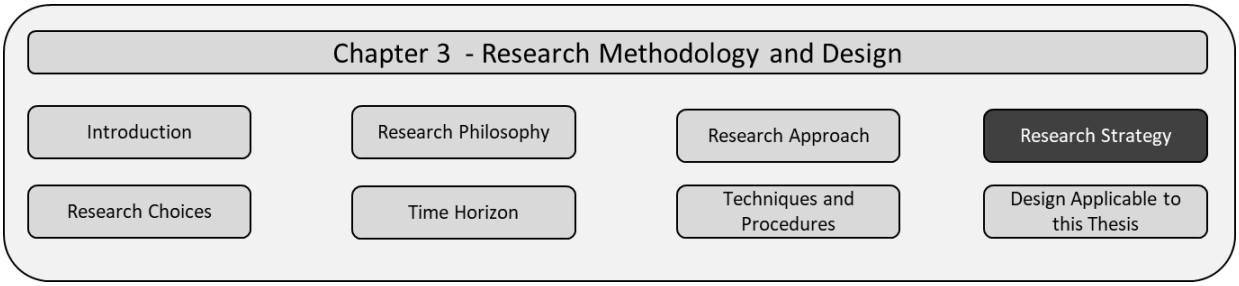
Figure 27 - Basic and Applied Research (Saunders et al., 2009)

Research approaches to theory testing or theory building generally entail a choice between or a combination of inductive and deductive reasoning (Myers, 2009). The choice of research approach is key when determining the design of the research project and presenting the results of the research (Saunders et al., 2009). When using deductive reasoning, researchers generally start with relevant theory about a topic that could be used to formulate one or more hypotheses (Greener and Martelli, 2015). This hypothesis is then tested by gathering empirical data, which is analysed to confirm the validity of the hypothesis and applicability of the relevant theory in addressing the problem identified in the research question (Myers, 2009, Greener and Martelli, 2015). In an inductive reasoning approach, the researcher gathers information about a topic, which is then analysed to identify patterns that could lead to a hypothesis. The hypothesis is then developed further into theory, which can be used to address the problem identified in the research question (Myers, 2009).

The major differences between inductive and deductive reasoning are shown in Figure 28 (Saunders et al., 2009). It is also possible to conduct research using a combination of both deductive and inductive approaches and depending on the nature of the research problem, it may be advantageous to follow a combined approach (Saunders et al., 2009).

Deduction Emphasises	Induction Emphasises
• Scientific principles • Moving from theory to data • The need to explain causal relationships between variables • The collection of quantitative data • The application of controls to ensure validity of data • The operationalisation of concepts to ensure clarity of definition • A highly structured approach • Researcher independence of what is being researched • The necessity to select samples of sufficient size in order to generalise conclusions	• Gaining an understanding of the meanings humans attach to events • A close understanding of the research context • The collection of qualitative data • A more flexible structure to permit changes of research emphasis as the research progresses • A realisation that the researcher is part of the research process • Less concern with the need to generalise

Figure 28 - Difference between Deductive and Inductive Research Approach (Saunders et al., 2009)



3.4 RESEARCH STRATEGY

Research strategies are generally used for exploratory, explanatory or descriptive studies and may be suited to either deductive or inductive approaches (Saunders et al., 2009). The choice of research strategy will be determined by its ability to answer the research question, meet research objectives, philosophical assumptions, availability of time and existing knowledge on a topic.

Typical research strategies used are the following (Saunders et al., 2009):

- Experiment
- Survey
- Case study
- Action research
- Grounded theory

- Ethnography
- Archival research
- DSR.

A summary of each of the research strategies is described below. The DSR approach will be discussed in more detail, as it is applicable to this thesis.

Experiment: It originates from a natural sciences perspective, which is based on precision to obtain successful experimental results. The purpose of experiments in management research is to understand causal links between dependent or independent variables or social actors.

Survey: Surveys include data collection processes such as marketing surveys, political polls, opinion surveys etc. Survey research relates to the process of collecting data to advance scientific knowledge in management research (Pinsonneault and Kraemer, 1993). Surveys are commonly used in deductive business and management research, which is used for exploratory and descriptive research (Saunders et al., 2009). The disadvantage of this approach is that it requires a smaller number of questions to ensure a suitable response from participants and is not as wide-ranging as other research strategies.

Case study: Case studies are most useful when researchers want to study the relationship between the context and the phenomenon of interest in its natural setting (Pinsonneault and Kraemer, 1993). Case study research strategies are generally used for exploratory or explanatory research and can provide detailed understanding of the context and processes being analysed (Saunders et al., 2009).

Action research: Action research is undertaken when the researcher and practitioners work together to address a business challenge to drive change in an organisation (Saunders et al., 2009). Research in this case is more about action; the researcher is immersed in the organisation to address a problem, as opposed to a consultancy approach, which focusses on analysis, description and recommendations to address an organisational issue.

Grounded theory: Grounded theory is useful in exploring a range of management and business issues. It focusses on theory building through a combination of inductive and deductive approaches (Saunders et al., 2009) and is useful in understanding and predicting behaviour. This approach involves the process of data collection before the conceptualisation of a theoretical framework.

Ethnography: This is predominantly an inductive research strategy, which requires the researcher to integrate as far as reasonably possible within the social context to be able to describe and explain the social world from the perspective of the inhabitants.

Archival research: This strategy uses documents and administrative records as the main source of research data. The use of historical data implies that this is aligned to analysis based on the use of secondary data, which may not necessarily provide sufficient or relevant data to answer the research question.

Design science research

Design science is a more pragmatic approach and could generally be regarded as the link between practice and IS research (Peffers et al., 2006). This paradigm generally produces artefacts that can solve real world problems. Van der Merwe et al. (2018) propose a definition of an IS research artefact as “anything that is delivered by a rigorous research and development process and that can be shown to fulfil an identified need”. Adebesin et al. (2011) define design research as a “problem solving paradigm, with the aim of creating innovations”. The epistemological assumption of this paradigm is based on “knowing through making” (Kuechler and Vaishnavi, 2012) and ontologically assumes multiple, contextually situated world states (Adebesin et al., 2011).

Design science has been accepted as an appropriate research methodology and strategy that can be used in the IS field of study (Van der Merwe et al., 2018). However, the general challenge is how to structure the research to ensure validity and build a strong argument supporting the research topic.

Two commonly used frameworks in IS research proposed by Vaishnavi and Kuechhler (2012) and the model proposed by Peffers et al. (2006) will be briefly described as methods of structuring DSR.

The intention of Peffers et al. (2006) was to design a process for DSR in IS that attempts to align it with other research disciplines, provides a process for conducting DS research and provides a conceptual model of what DSR should be. A six-step model for guiding DSR for information systems was defined as follows (Peffers et al., 2006):

- Problem identification and motivation: Involves a clear definition of the research problem and a motivation of why a solution to the problem will add value. It is highly recommended that the problem be analysed in a fair amount of detail to ensure that the solution addresses the complexity of the identified problem.
- Objectives of the solution: Highlight the objectives of the solution that will be required to address the research problem. Objectives should indicate why the proposed solution would be better than what exists currently.
- Design and development: This phase entails the development of a potential solution that can address the identified problem. This approach requires an understanding of related theory, which could lead to the construction of a framework, model or proof of concept to be tested.
- Demonstration: This phase entails demonstrating the defined artefact, framework or methodology that can be used to solve a problem. This could entail testing, simulation, experimentation etc. to illustrate how the designed artefact could address the defined problem.
- Evaluation: This stage involves observation and measurement of the suitability of the defined artefact in addressing the identified problem. The researcher needs to identify suitable mechanisms to measure the performance of the artefact in addressing the issue. This could result in a further iteration of the suggested solution or progression to the next stage, with suggestions for additional research or investigations for researchers.
- Communication: This step entails appropriate communication of the problem statement, proposed artefacts, robustness and uniqueness of the design and applicability of this solution to stakeholders.

Another commonly used framework by design science researchers, is the approach proposed by Vaishnavi and Kuechler (2004). The DSR approach suggested describes key phases applicable to the construction of an acceptable research artefact and research contribution in the IS field, as shown in Figure 29.

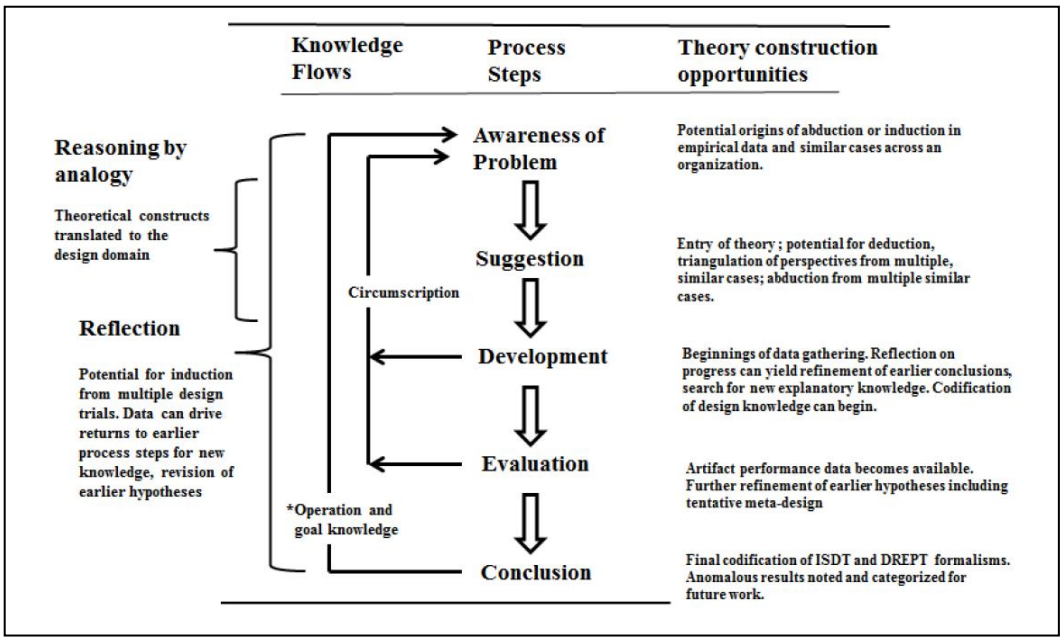


Figure 29 - Design Science Research Model (Kuechler and Vaishnavi, 2012)

This methodology consists of the following five phases (Vaishnavi and Kuechler, 2004):

1) Awareness of the problem: Identification of a research problem or phenomena that arise from experience, disruptive trends, literature or related industries. Challenges in other disciplines can also be used to develop a research proposal that will ultimately address problems in the researcher's field.

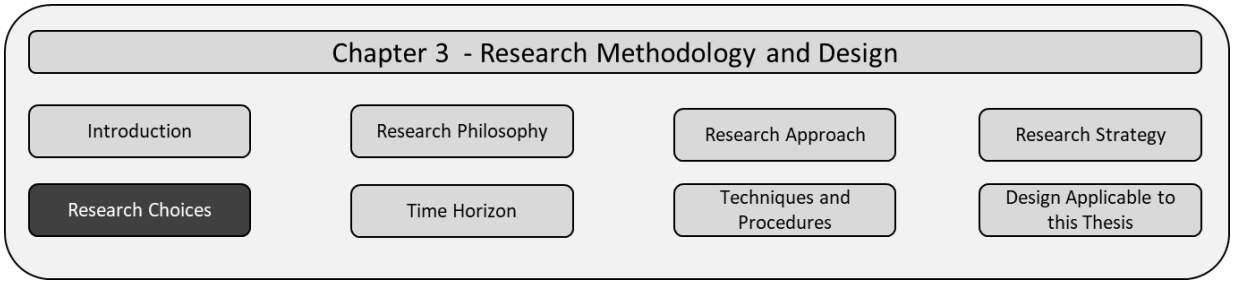
2) Suggestion: This is a creative step that follows the research proposal, where initial suggestions or prototypes are created that could potentially address the research challenge. This step is often criticised because of non-repeatability by other researchers and is dependent on experience and context.

3) Development: The suggested design is then further enhanced and implemented during this phase. The output generally suggests a design of the artefact and does not include the construction of the artefact.

4) Evaluation: The artefact is evaluated against criteria that are defined in the "awareness of problem" phase of the research proposal. Any deviation observed through either qualitative or quantitative approaches needs to be noted and explained. Additional information is generally obtained in this phase, which could change the original thinking and assumptions of the

researcher. Deviations noted are then fed back to the suggestion phase through a process of circumscription, which could result in another round of suggestion and testing. Van Der Merwe et al. (2018) state that the notion of iteration is key in DSR methodology and it is possible to go through several cycles of awareness, development and evaluation.

5) Conclusion: This marks the end of the research cycle and entails the finalisation of the research report. The results follow the satisficing approach and are deemed good enough even though there could be minor deviations in the observed artefact during the different circumscription processes.



3.5 RESEARCH CHOICES

Saunders et al. (2009) refer to the way researchers combine qualitative and quantitative research approaches, analysis and techniques as research choices. Business and management research methods generally use the terms quantitative and qualitative to differentiate between data collection and data analysis techniques.

Quantitative techniques generally focus on numbers and use data collection techniques such as questionnaires, with a preference for analysis techniques using graphs, statistics and numerical data (Saunders et al., 2009). Qualitative techniques, on the other hand, prefer a non-numeric approach (words) and use data collection techniques such as interviews and data analysis procedures that generate non-numeric data, e.g. data categorising (Saunders et al., 2009).

Researchers have a choice of using either single or multiple methods for data collection and analysis techniques in answering the research question, as shown in Figure 30.

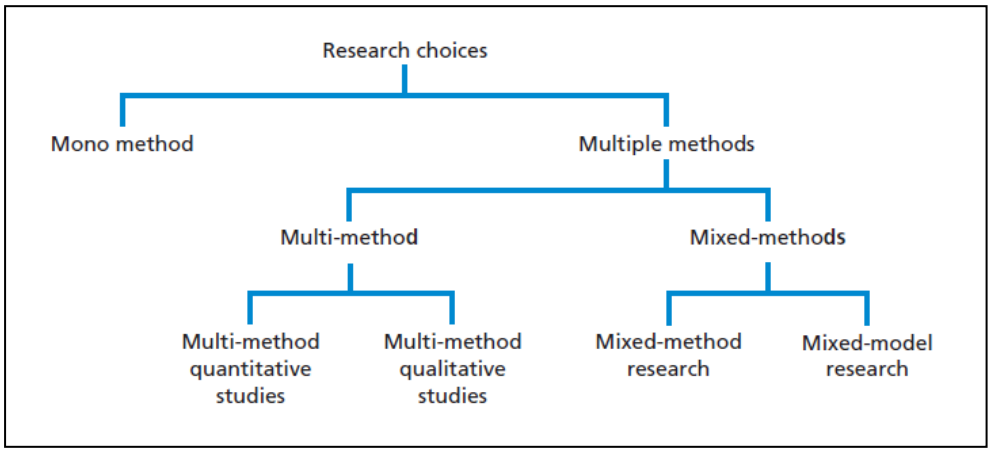


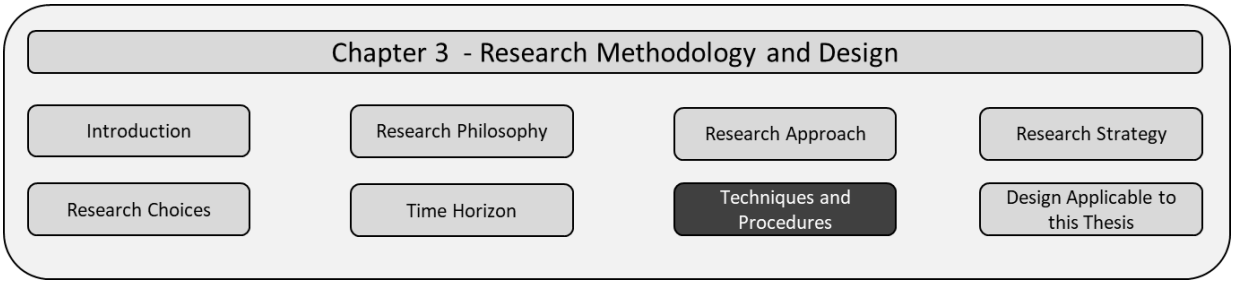
Figure 30 - Research Choices (Saunders et al., 2009)

In a mono-method approach, researchers generally use a single technique for data collection and analysis. Multi-method approaches may use different data collection and analysis techniques that align to either a qualitative or quantitative paradigm. This approach is advantageous, as it may provide greater opportunities to use the best approach in different phases of the research study, which can answer the research question better and increase the validity of the research findings. A multi-method approach may use different data collection and analysis techniques, which align to either a qualitative or quantitative paradigm. A multiple method approach can be further broken down into either a mixed-methods or multi-methods approach. A multi-method approach may be either quantitative or qualitative in both collection and analysis; however, techniques and procedures are kept separate. A mixed methods approach combines data collection approaches, but analytics techniques are kept separate for quantitative and qualitative data. Mixed model research combines qualitative and quantitative approaches in all phases of the research process. This implies that quantitative data may be converted and analysed qualitatively and vice versa.

Recently there has been growing interest in the use of qualitative research, therefore various researchers have tried to determine quality criteria for qualitative research (Bryman et al., 2008). The findings of Bryman et al. (2008) indicate a preference for using qualitative and quantitative research criteria for evaluating the quality of mixed research methods. Nevertheless, no conclusive results were offered indicating that one method is better than the other, although there seems to be consensus that using a combination of methods does improve the overall quality of social research.

3.6 TIME HORIZON

A research question regarding the time horizon is whether the research is done at a particular point in time (cross-sectional) or over a longer period (longitudinal). Considerations regarding the time horizon are directly related to the research problem and are not influenced by the choice of research strategy or research method (Saunders et al., 2009). Cross-sectional research is generally more popular among students because of time constraints and the need to understand the characteristics of a phenomenon at a particular point in time. Longitudinal studies are more popular outside business research and are used to study changes in events, behaviour, patterns etc. over a period. The main purpose of longitudinal research is to study changes over time.



3.7 TECHNIQUES AND PROCEDURES

An important consideration in social research is the use of primary and secondary data sources. Primary sources are data that has been collected by a researcher directly and has not been published. Common primary data collection sources in qualitative studies are interviews, participant observation, field work and documents (Myers, 2013). The choice of data collection will depend on the availability of data, the research question and the research problem being investigated. Interviews are generally the most important, as these provide rich information on people, roles and context. The choice of research methods will also dictate the use of certain mandatory data collection techniques, but will not necessarily prescribe how to use them. Primary data adds credibility to research and results in the creation of new information that is unique to a research proposal. Secondary data sources are information that has been published, e.g. from books, articles, journals etc. (Myers, 2013).

3.7.1 Interviews

Three basic types of interviews are generally used as a primary data source, i.e. structured, semi-structured and unstructured (Myers, 2013).

- Structured interviews: In this case questions are predefined and strictly adhered to, in most cases within a specified time. This type of process requires little deviation among participants to ensure consistency of results. Structured interviews are ideally suited to market research, telephonic interviews, political polling and generally in public places such as malls etc. (Myers, 2013).
- Semi-structured interviews: During the interview process, pre-defined questions are used, although these are not strictly adhered to. Additional questions may be asked during the interview process. Improvisation is recommended, as it explores additional insight that may arise during the interview process. One advantage of unstructured interviews is the free flow of information on areas the interviewee considers important and related to the topic under research.
- Unstructured interviews: This method takes a more generalised format. Interviewers may have some open-ended questions and the interviewee can give general views on a topic. There is also no strict adherence to time. In the interview process, it is key to give the interviewee an opportunity to talk freely. If there is a pause in the conversation, the interviewer needs to improvise by asking questions related to the subject. Consistency among interviewees is not essential in this case.

In the case of using interviews for social research, there is no prescribed number of interviews to be conducted for the research to be deemed valid. It is recommended to conduct interviews until a point of saturation is reached, where no additional insights emerge (Myers, 2013).

Another technique that can be used in interviews is focus groups, which are based on group interviews. Most qualitative researchers prefer the use of individual one-on-one research techniques. Focus groups are used when researchers want to obtain insight into a topic of interest based on the experience of the group and to stimulate discussion that could result in additional insight into the topic.

3.7.2 Participant observation and fieldwork

Fieldwork is also a primary data source and an effective way of obtaining qualitative data. This entails observing participants in a situation to obtain information on behaviours and actions in a certain context or environment, generally in their natural setting (Myers, 2013). Fieldwork can be in the form of observation, where the researcher is only an observer in a situation, or participant

observer, where the researcher does participate in a situation to gain additional insight or clarification.

3.7.3 Using documents

In addition to interviews and fieldwork, the analysis of documents such as blogs, emails, diaries, newspapers, photographs etc. could be used as a source of primary data. In certain cases, the only source of primary data may be documents, for example when a participant is incapacitated or deceased. In certain cases, documents may be the primary actor or source of information, e.g. legal contracts between organisations or the will of a deceased person.

3.7.4 Data analysis techniques

There is a clear distinction between the data gathering and data analysis phases of qualitative research. However, from a hermeneutic perspective, researchers' bias influences data-gathering and the nature of questions asked determines the nature of answers that will be received (Bryman and Bell, 2011). There is a close relationship between data-gathering and data analysis, although one follows the other. It is therefore important to consider analysis techniques when conducting research to avoid obtaining large volumes of data from different sources that cannot possibly be included in the final thesis. Applying correct data analysis techniques will result in interpreting data to obtain meaningful insights into data, which can be useful to the intended audience (Myers, 2013). In qualitative studies, researchers often collect large volumes of rich data, which presents a problem in terms of conducting true analysis that can result in meaningful insight for business managers (Bryman and Bell, 2011).

Key recommendations that are required for comprehensive qualitative data analysis are as follows (Greener and Martelli, 2015):

- Data derived from interviews (structured, semi-structured, unstructured, individual or group) will need to be transcribed before analysis.
- In deductive and inductive approaches, it is recommended to identify themes, ideas and categories related to theory testing or theory development.
- The researcher should code or find meaning, themes or insights within collected data relating to categories or the topic under investigation.
- It is necessary to employ constantly comparative or iterative methods to determine how data and insights fit into themes or categories until a point of saturation is reached.
- Understanding of the influence of bias, lens and language in communication and interpretation of ideas is required.

- Generally, summaries, log books and contextual notes provide additional details and observations on interview transcripts.

The different analysis techniques that provide different ways of analysing qualitative data may differ between researchers, based on the researcher's paradigm and philosophy and may result in theory that may not be as reproducible as experimental scientific research. Therefore it is important for qualitative analysis researchers to be transparent and rigorous in their approach to justify the outcomes of their research (Greener and Martelli, 2015).

Bryman and Bell (2011) and Greener and Martelli (2015) identify various qualitative content analysis techniques. Summaries of some of the more common qualitative data analysis techniques are given below:

- Semiotics
- Hermeneutics
- Historical analysis
- Analytic induction and grounded theory
- Coding.

Semiotics

Semiotics is commonly referred to as the "science of signs", which is the use of symbols to depict certain phenomena, which can be used in quantitative analysis of data as well (Bryman and Bell, 2011). The receipt or interpretation of the message is, however, dependent on the bias, lens, cultural knowledge etc. of the recipient, therefore in semiotic research it is important to understand the rules or criteria that can be used to link symbols to recipients.

Hermeneutics

Hermeneutics has its origins in the analysis of theological texts where the focus is on understanding and interpretation of texts. This is aligned to an interpretive epistemology where the intent is to extract meaning from texts from the perspective of the researcher, in a specific social or historical context (Bryman and Bell, 2011).

Historical analysis

Historical analysis is the analysis of documents and artefacts that can be used to understand the history of an organisation or industry (Bryman and Bell, 2011). Typical documents that can be included in the analysis are letters, diaries, financial reports, meeting minutes etc. This concerns the study of historical information, but also the context in which it is interpreted.

Analytic induction and grounded theory

Two of the most frequently cited qualitative analysis strategies are grounded theory and analytic induction (Bryman and Bell, 2011). Grounded theory and analytic induction are iterative processes that consist of a cycle of analysis and data collection. Analytic induction is an analysis approach where data is analysed in an iterative cycle until there is no deviation from the proposed hypothesis. Analytic induction is a very rigorous approach, as any finding inconsistent with a hypothesis requires reformulation of the hypothesis and further data collection and analysis. Grounded theory is one of the most influential strategies in qualitative data analysis, though implementation and analysis may vary between studies and researchers (Bryman and Bell, 2011). Bryman and Bell (2011) define grounded theory as theory that was derived from data analysed through an extensive research process. Two key points related to grounded theory is that it is theory from data and it is an iterative or recursive approach in view of the strong correlation between data collection and data analysis.

Coding

Coding is one of the most common approaches in qualitative content analysis. It is a strategy of searching for relevant themes aligned to predefined categories or initial categories that are further refined during the analysis (Bryman and Bell, 2011). Identifying themes is an activity found in qualitative analysis approaches such as grounded theory, narrative analysis, critical discourse analysis and qualitative content analysis. Themes are sometimes referred to as codes or could be multiple codes. The approach used will need to be defined during the analysis phase of the research (Myers, 2013). This is a process where collected data is grouped into common components and given names. The initial data set is enhanced as additional data is gathered, which may result in the emergence of new codes. This analysis approach caters for different levels and types of codes to exist within collected data (Bryman and Bell, 2011).

Codes assist in identifying common themes, relationship between themes, summarising paragraphs, sentences or large pieces of text. A key consideration for successful coding is to ensure alignment to an overall storyline or analytical thread that links major themes in the research being conducted. A storyline helps define how data should be organised and how codes should be structured (Myers, 2013).

Coding is a key process that entails the review of transcripts and labelling or coding of key points that could have potential theoretical significance for the topic being researched. Coding is a form of shorthand using labels and codes to separate, sort and organise data that is analysed to

create theoretical knowledge (Bryman and Bell, 2011). In qualitative analysis, codes are in a constant state of flux and evolve as new insights emerge from analysed data. Bryman and Bell (2011) describe three approaches to coding:

Open coding: This is where data is examined, classified, categorised, compared to create themes and concepts, which may be grouped into categories for further analysis.

Axial coding: This process generally follows open coding and entails organising and linking codes in new ways, taking into consideration context, patterns, events etc.

Selective coding: This involves the process of identifying core categories and identifying their relationship to other categories. Core categories could form the basis of the overall storyline of the research.

Coding is one of the most common methods used for the analysis of qualitative data. Some of the more common tools in coding are listed below:

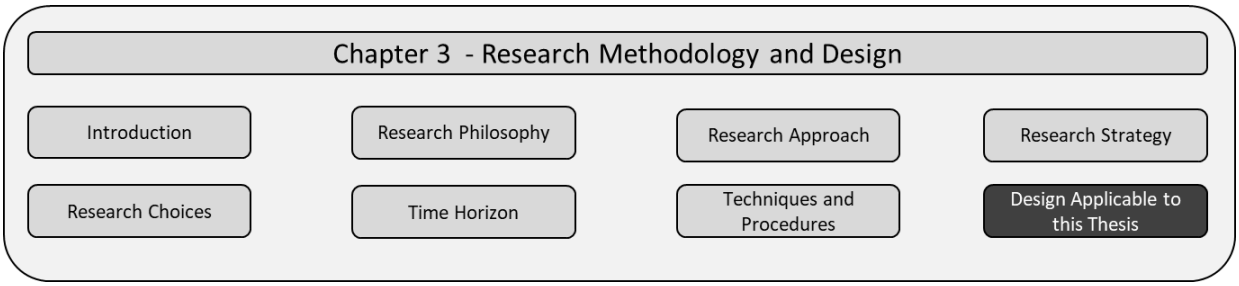
- **Theoretical sampling**: This is a process where the researcher collects, codes and analyses data and then determines what additional data should be collected based on emerging themes from the study. The course of the study is determined by themes emerging, therefore it is an ongoing process as opposed to a single-phase research process (Bryman and Bell, 2011).

- **Theoretical saturation**: This relates to two phases in data analysis in a grounded theory approach, i.e. coding of data and collection of data. The coding process ends when no further themes or concepts emerge from data and the collection process ends when new data does not provide any further insight on the topic being researched (Bryman and Bell, 2011).

- **Constant comparison:** This is generally an implicit process of ensuring that there is continuous alignment between collected data, concepts and categorisation to ensure that logic is not lost during the collection or analysis phase of the research (Bryman and Bell, 2011).

It is preferred that researchers keep a "code book" that summarises a list of codes relating to a particular questionnaire or research topic of interest (Greener and Martelli, 2015). This ensures quick access to codes, respondents and questionnaires, especially when dealing with large volumes of qualitative or quantitative data. One of the criticisms of coding in qualitative data analysis is the loss of context of what is being said and the distortion of the overall narrative due to fragmentation of data (Bryman and Bell, 2011). However, coding is a credible and accepted

qualitative analysis technique (Bryman and Bell, 2011), which forms the basis of analysis for this research.



3.8 RESEARCH DESIGN APPLICABLE TO THIS THESIS

Based on literature reviews conducted, a research approach based predominantly on the "research onion" method of Saunders et al. (2009) was designed for this study. Figure 31 depicts key aspects considered in this research design and a summary of the approach chosen follows.

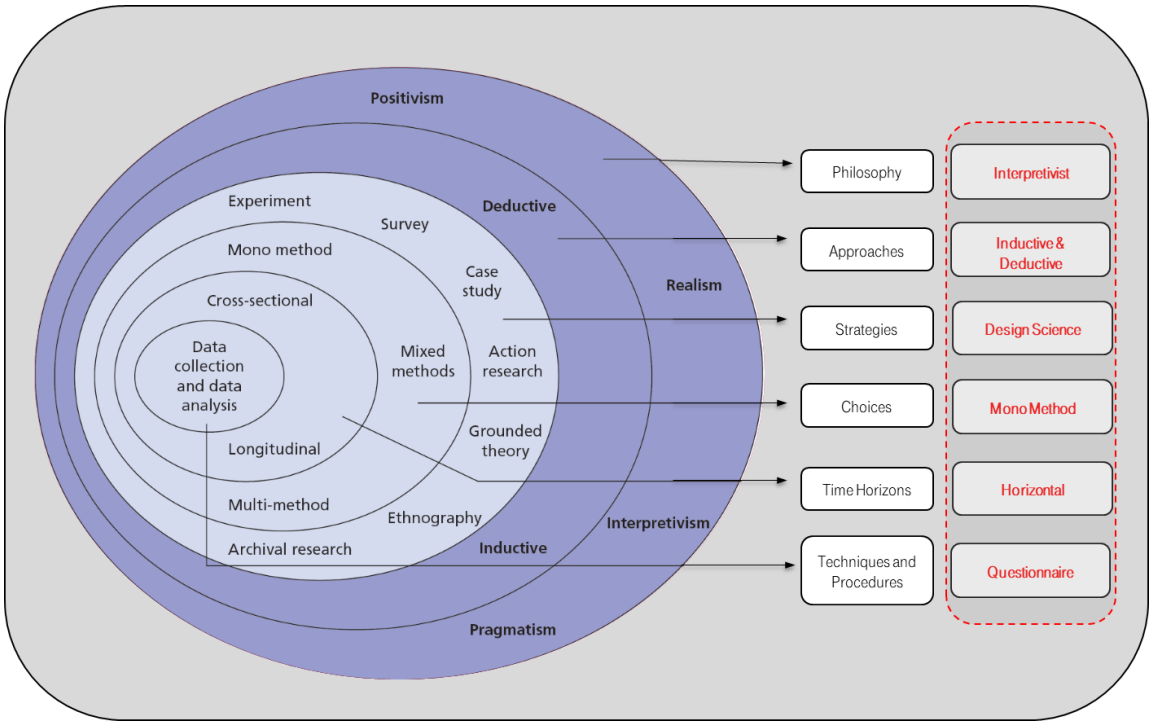


Figure 31 - Research Design Applicable to this thesis (Adapted from Saunders et al., 2009)

3.8.1 Research philosophy

An interpretive philosophical paradigm was selected for this research, as it aligned with the objectives of the study and the views of the researcher. As the objective of this research was to create a strategic IT decision-making framework, it was essential to understand differences in interpretation, views of stakeholders from multiple perspectives and ways in which decisions were made in practice in certain circumstances. The researcher's view is that organisational culture changes are based on the actions of people or social actors and can be influenced to a desired state as required. This view implies that a change in people and leadership in an organisation can change the organisational culture. Organisational culture, decision-making, actions etc. can be influenced to a desired state by the action of individuals, which may then result in quicker decision-making in organisations.

When analysing the behavioural aspects of users when these relate to the introduction of new technologies, quantitative and qualitative analysis techniques should focus simultaneously on the structures in existence as well as the context and interpretation of the agents. Technology does not determine behaviour; however, people's interpretations are influenced by resources, training and accepted norms in an organisational context. Therefore, for IS researchers, it is critical to understand the duality of structures and their evolution over time and space to produce any conclusive results for the phenomena under study. Any successful technology implementation will depend on the alignment of social and technology structures (DeSanctis and Poole, 1994), which could lead to a process of organisational change. This holistic research approach will offer a thorough presentation of ideas for researchers to provide guidelines for successful technology decision-making and implementations.

3.8.2 Research approach

The approach adopted in this study was to ensure that knowledge created advanced theoretical understanding of the phenomena under study and at the same time addressed practical business or managerial issues. The intent of this research was to address the "research-practice gap" (Rousseau, 2006), where managers and CIOs rely on previous experience and not on available theoretical knowledge. The reason for this research gap is that most theoretical knowledge in social research is unknown to technology-driven disciplines and generally in a form that cannot be applied in practice.

This study addresses some of the principles of basic and applied research that align to the concepts outlined by Saunders et al. (2009), as indicated in Table 1. The output of this research was to create a practical guideline that CIOs can use in the execution of their accountabilities. Aspects relating to basic and applied research that were applicable to this study are found Table 1.

Table 1 - Basic and Applied Research Principles Applicable (Saunders et al., 2009)

Basic Research	Applied Research
• Expands knowledge of processes of business and management • Results in universal principles relating to the process and its relationship to outcomes • Findings of significance and value to society in general	• Improves understanding of particular business or management problem • Results in solution to problem • Findings or practical relevance and value to manager(s) in organization(s) • Tight time scales

The intent of this study was to understand the business challenges regarding strategic IT decision-making, identify factors that could influence decision-making and propose a practical solution that could add value to CIOs and organisations in strategic IT decision-making.

A combination of deductive and inductive approaches was used in this study owing to the nature of the problem being researched. An inductive research approach was used, as no relevant theoretical models were identified that could address the challenges identified in the research question. In the verification of the framework a deductive approach was used.

3.8.3 Research strategy

In this study, a DSR process was selected, which entailed the development of a potential solution that could address the identified problem statement. This approach required understanding of related theory, which could lead to the construction of a framework, model or proof of concept to be tested.

The design science approach is useful in exploring a range of business and managerial issues and focusses on theory building through a combination of inductive and deductive approaches (Saunders et al., 2009). The DSR framework selected for this research was based on the model

proposed by Vaishnavi and Kuechler (2004). The DSR approach selected follows key phases, as shown in Figure 32.

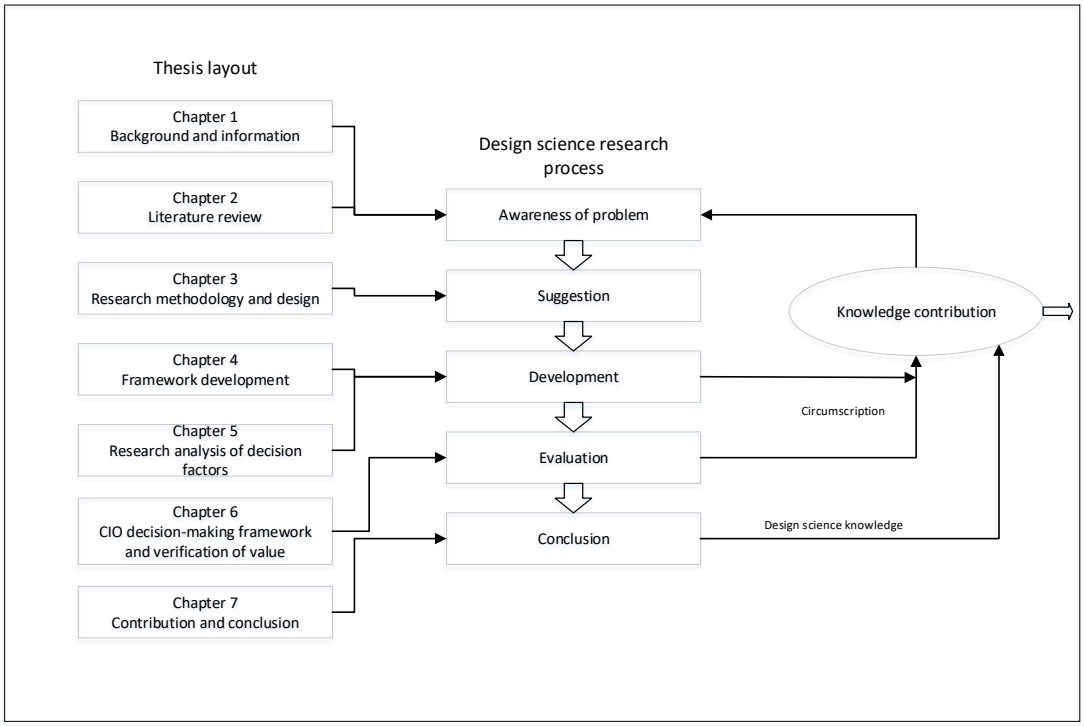


Figure 32 - Design Science Research mapping (adapted from Vaishnavi and Kuechler, 2004)

A summary of the approach followed in this research is shown in Figure 32, relating to the five phases of the DSR model described below:

1) **Awareness of the problem**: Chapter 1 described the research problem or phenomena that arose from experience, disruptive trends, literature and examples of disruptive organisations that are disrupting mature industries and organisations. An exponential increase in technology driven from a consumerism perspective has the potential to disrupt traditional organisations; however business adoption of technology seems logarithmic and slow. The focus of this research was on analysing the impact of disruptive technologies and trends on strategic IT decision-making. The problem statement and main research question were defined in the awareness phase of this research, with the intent of establishing how a framework could be created that could guide strategic IT decision-making from a disruptive technology perspective.

Chapter 2 explored relevant literature on organisations' expectations of the CIO, decision-making theory, disruptive technologies and existing decision frameworks to establish whether a holistic

framework existed that could be used to guide strategic IT decision-making from a disruptive technology perspective. Common themes and factors that influenced decision-making emerged from literature, but did not exist in a holistic framework.

2) **Suggestion**: Chapter 3 focussed on the research methodology and research design for this thesis to ensure that the approach followed resulted in an unbiased presentation of research findings and results, which would be used to create a strategic IT decision framework for CIOs. Chapter 4 was a creative step where an initially suggested framework was created that could potentially address the research challenge.

3) **Development**: The outcome of the literature review from Chapter 2 and input from Chapter 3 resulted in the development of a suggested strategic IT decision-making framework in Chapter 4. The framework constructed was based on an extensive literature review from literature sources listed in section 4.1. The proposed framework was verified using primary research and was subsequently refined in Chapter 5.

4) **Evaluation**: The proposed strategic IT decision-making framework was further refined in Chapter 5, using interview data. The data analysis of interview transcripts provided a rich source of information, which was constantly compared to results from literature reviews conducted in Chapter 2. Deviations noted were then fed back to the suggestion phase through a process of circumscription, which resulted in another round of suggestion and testing through an iterative approach. Chapter 6 defined the final framework and provided a step-by-step guideline on how to apply the framework in practice. The strategic IT decision-making framework was evaluated with a focus group consisting of five IT industry experts to understand whether this framework could be applicable in practice.

5) **Conclusion**: This marked the end of the research cycle and entailed the finalisation of the research report. The results followed the satisficing approach and were deemed good enough even though there were minor suggestions during the different circumscription processes that predominantly focussed on suggestions to include additional policies and procedures, which were out of the scope of this phase of the research.

3.8.4 Research choice

Because of the nature of the data collection done, the research approach was mainly qualitative. However, this research adopted a mono-method research approach, where different data

collection and analysis techniques were used. The advantage of the selected approach was that it provided greater opportunities to use the best approach in different phases of the research study, which could yield better answers to the research question and increase the validity of the research findings.

A qualitative data collection approach was conducted, using a combination of literature reviews and semi-structured interviews. Interview transcripts were coded and analysed using a combination of qualitative and quantitative analysis techniques. This implies that during the data analysis phase, qualitative data was converted and analysed quantitatively to obtain additional insight into the phenomenon being analysed.

3.8.5 Time horizon

The time horizon used in this study was based on a cross-sectional or horizontal approach. The intent of this study was to obtain a view from CIOs and IT specialists at a particular point in time, which was based on their historical experience and perspective. It would have been interesting to observe if the proposed guideline improved the quality of strategic IT decision-making in future. Such analysis was not possible owing to time constraints and is not part to the scope of this research.

3.8.6 Techniques and procedures

As this was an interpretive study, the qualitative analysis approach that was adopted informed and influenced the data collection technique used and the data analysis process applied. A combination of primary and secondary data sources was used as data collection technique for this research. Interviews were predominantly used as the primary data source, as these were deemed most appropriate to provide a source of rich information on people, contexts and roles to answer the research question defined in this thesis. Secondary data sources used in this research were mainly from books, articles, research papers and journals.

An open coding approach was used where data was examined, classified, categorised and compared to create themes and concepts, which were grouped into categories for further analysis. A key consideration was to ensure alignment to an overall storyline or analytical thread that linked major themes in the research being conducted.

3.8.6.1 Primary data collection techniques used in this research

Figure 33 shows how data collection was conducted for this research. Various factors that influenced strategic IT decision-making were identified from literature reviews conducted in Chapter 2. These were used to structure an interview guide, which was used in discussions with CIOs during the interviews.

Semi-structured interviews

Data collection for this research was conducted via semi-structured interviews. During the interview process, pre-defined questions were used, although these were not strictly adhered to. Additional questions were asked during the interview process to gain deeper insight in aspects of the framework that were relevant to the research question. The use of semi-structured interviews allowed for the free flow of information in areas the researcher considered important and related to the topic under research.

Figure 33 shows the approach followed in constructing the semi-structured interview guide for this research. The formulated questions were based on information contained in Chapters 1, 2 and 4, as shown in Figure 33. The interview guide constructed was forwarded to interviewees prior to the interview to ensure sufficient preparation up front. The interview guide consisted of questions in the following format (Myers, 2013):

1) Short questions that required interviewees to provide quantitative data that could be used to compare the congruency of open discussions to high-level quantifiable data. These questions were presented in a way that could result in additional detailed responses from interviewees in justifying some of the quantitative answers.
2) Questions requesting respondents to recall their experience during previous IT decisions to understand decision processes and the timelines from idea to implementation, as well as to obtain opinions on the effectiveness of decision processes in agile business conditions or in times of disruption.
3) Broad open-ended questions were also presented to solicit views on certain components of the framework to determine the applicability of concepts in a CIO decision framework and to understand whether additional artefacts or factors should be considered in the framework.

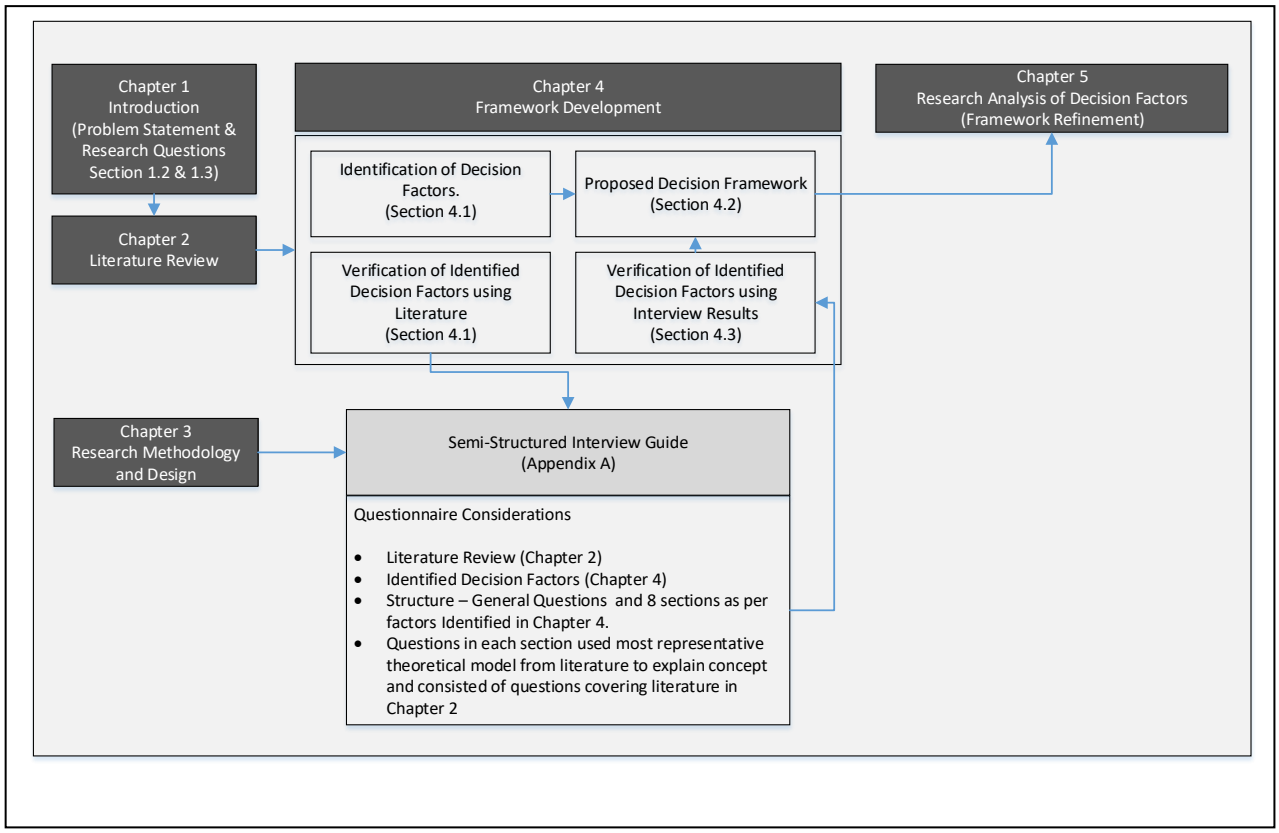


Figure 33 - Interview Guide Construction

3.8.6.2 Questions asked during the interviews

The problem statement described in Chapter 1 was used as a basis to determine the questions asked during the interview process. The literature review related to the problem statement identified various factors that influenced strategic IT decision-making in organisations when confronted with a continuous stream of disruptive technologies.

To address the main research question, the following questions were included during the interviews:

- Is the expectation of the CIO in the organisation clearly defined?
- What are the factors or criteria that are generally considered when making strategic IT decisions?
- Based on organisational characteristics, are some factors more important than others?
- How does the decision process in organisations affect decision-making?
- Do organisations have a way of differentiating or classifying the many IT systems used in an organisation?
- Are different criteria used for the different classification of IT systems?

- Is there an established process to identify emerging or disruptive technologies that could affect the organisation?
- What factors are considered when deciding on which emerging or disruptive technology to adopt?
- Do current EA frameworks and approaches used in organisations provide sufficient guidance for CIOs to make optimal decisions?
- Do CIOs deliberately consider the impact of an IT investment on the strategic fit or value contribution to an organisation's products or services?

For the results to be meaningful, various questions were asked to identify trends that were correlated with relevant literature to formulate a generic framework for IT decision makers.

3.8.6.3 Participant selection and interview process

Participant selection

In conducting this research, a diverse group of people that influenced strategic IT decision-making was identified. The organisation in which participants were employed at the time was not the key focus of this research; insight into strategic IT decision-making and insight into IT focus areas were the issues being assessed.

Twenty-five interviewees across industries were identified to participate in this research to assist in obtaining a view of the process, approach and factors considered in making strategic IT decisions. The participants selected had experience in organisations or industries such as mining, media and entertainment, the financial, manufacturing, IT and telecommunications fields and the public sector. The sample included participants currently based in the United Kingdom, Germany and the Netherlands, with significant IT consulting experience in global organisations.

This population represented a cross-section of organisations in industries that have been or may be affected by disruptive technologies. Some of these organisations are in more mature industries and have entrenched IT and operational support systems. Disruptive technologies may have less of an impact on their business models; however it would be essential to understand their approach to technology decision-making and its impact on their business strategy. Factors and guidelines for decision-making in stable industries such as mining will be different from those in volatile industries such as IT and telecommunication, however there could be similarities in IT decision-making that can be analysed and incorporated into a decision framework.

The intent was to obtain diverse views and a wide variety of opinions on strategic IT decision-making (Myers, 2013). This research predominantly focussed on three groups of employees:

- Enterprise architects: Participants who performed enterprise architecture functions or influenced strategic IT decisions in organisations were identified and interviewed for this research.
- CIOs or IT managers: Most medium to large organisations have dedicated IT teams that are responsible for IT planning and support across the organisation. Key IT decision makers from the different organisations were approached to participate in the interviews.
- Business executives: Many businesses in South Africa have their IT departments reporting to a business executive who is part of the management board of the company. These executives generally manage IT as one of the portfolios under their control and are also accountable for IT strategic planning and budgeting. In some organisations business units are accountable for IT systems that are focussed on delivering services to end customers and these systems fall outside the domain of traditional CIOs. Some of the interviewees selected for this research were business executives who had influence over IT or the choice of IT systems used in organisations.

Interview process

Identified participants were contacted telephonically or via email. The purpose and intent of the study were outlined to participants prior to scheduling formal appointments with them. Prior to the actual interview, a copy of the research questionnaire (Appendix A) and a copy of the conference paper as presented at the IEEE Africon 2017 conference (Appendix C) were sent to each of the participants for their perusal to provide additional background on the topics to be discussed in the interview.

At the start of the interview, participants were given an overview of the problem statement and a high-level summary of the proposed decision framework. This assisted in ensuring that the discussion was focussed on strategic IT decision-making and that participants provided sufficient insight into their experience of IT decision-making.

The discussions focussed on the factors identified to be included in the decision framework and participants were encouraged to share their experience by way of examples as far as possible to obtain a true reflection of how they made strategic IT decisions. Many of the participants provided examples based on their current positions. In some of the categories under discussion, participants referred to examples in their previous work context to answer some of the questions asked during the interview. This provided a rich source of information, as it provided insight into additional complexity that might need to be considered in strategic IT decision-making, which was factored into the final decision framework.

During the interviews, participants were asked to provide insight and express their views on how IT decisions should be made in a disruptive business environment that could have assisted them in overcoming challenges they experienced or to speed up the decision processes in their area of accountability.

As participants had significant experience in diverse roles and disciplines within IT from a service provider, vendor and industry perspective, the responses provided a comprehensive overview of strategic IT decision-making and factors that they had considered in the past when making decisions. On average interviews lasted 90 minutes and in some cases, follow-up discussions were held if participants indicated that they had relevant artefacts that could add additional value to this research. All interviews were digitally recorded and transcribed for use in the analysis of the results.

After 14 interviews, the point of saturation was deemed to have been reached, as no further insights on factors that influenced strategic IT decision-making were forthcoming in addressing the problem statement in this research.

3.8.7 Data analysis

Data analysis first entailed the review of existing literature to identify key factors that influenced strategic IT decision-making. The identified factors were used as a basis for discussions during the interviews with CIOs. Data from interview transcripts was thereafter analysed, using thematic coding analysis.

Coding was used as a qualitative content analysis technique for this study, which entailed searching for relevant themes aligned to predefined categories that were further refined during the analysis (Bryman and Bell, 2011). A summary of collected data that was analysed in this research can be found in Appendix D to Appendix P. The collected data was analysed qualitatively using ATLAS.ti to reach conclusions and extract theoretical insights, which form the basis of the proposed framework.

The data collection and analysis approach followed the recommendations of Greener and Martelli (2005) to ensure comprehensive qualitative data analysis, which was as follows:

- Data derived from structured and semi-structured interviews were transcribed before analysis.

- Key themes, ideas and categories were identified relating to the development and testing of the strategic IT decision framework.
- The researcher used coding or find meaning, themes and insights in collected data relating to categories of the topic under investigation.
- Constant comparative or iterative methods were employed to determine how data and insights fit themes or categories, until a point of saturation was reached.
- Summaries and contextual notes were made to provide additional details and observations on interview transcripts.

A thematic coding analysis process was used where collected data was grouped into common themes and given names. The initial data set was enhanced as additional data was gathered, which resulted in the emergence of new codes. The analysis approach catered for different levels and types of codes within collected data (Bryman and Bell, 2011).

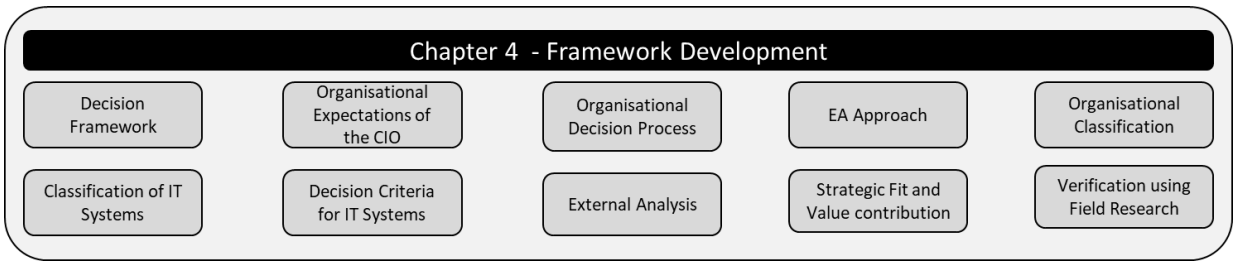
An open coding process was used, which resulted in codes being in a constant state of flux and evolving as new insights started to emerge from analysed data. The coding process assisted in identifying common themes, relationship between themes, summarising paragraphs, sentences and large pieces of texts. A key consideration during the coding process was to ensure alignment to an overall storyline or analytical thread that links major themes in the research being conducted. The storyline helped define how data should be organised and how codes should be structured (Myers, 2013).

During the data analysis process, a "code book" was created, which summarised the list of codes that related to a particular questionnaire or research topic of interest (Greener and Martelli, 2015). This ensured quick access to codes, respondents and questionnaires, especially when dealing with large volumes of qualitative or quantitative data.

The data collection and coding analysis process ended when theoretical saturation was reached, and no further themes or concepts emerged. New data collected during further interviews did not provide any further insight on the topic being researched (Bryman and Bell, 2011).

3.9 CONCLUSION

In this chapter the research design was discussed. The research project is an interpretive study that follows a design science approach. The components of the framework are first identified using a literature review and then verified and refined through interviews. Chapter 4 proposes a decision framework based on data analysis of literature reviews, which is verified by CIOs. Each of the factors in the decision framework is refined by detailed analysis of data from interviews in Chapter 5.



4 FRAMEWORK DEVELOPMENT

Chapter 2 explored existing literature and decision frameworks to answer the main research question in this research. Research on existing CIO decision frameworks (Selkala, 2016, Tamm et al., 2014, Petrick and Martinelli, 2012) acknowledged the critical nature of CIO decision-making, but was silent on the impact of disruptive technologies and their influence on decision-making in agile business conditions. While ICT has become pivotal in assisting in value creation for most organisations, value can only be derived from the effective use of technology (Rizzo, 2018, Heller. M, 2012, Roberts and Watson, 2014). Technology on its own adds no value or could be a liability to an organisation.

The purpose of this research is to create a framework to guide IT decision-making from a perspective of disruptive technologies. Several studies could be found on topics such as disruptive technologies, IT governance, the role of the CIO, decision theory, IT and EA value creation etc., but little research could be found on strategic IT decision-making in agile business conditions from a disruptive technology perspective. The gap in current literature is that most research on decision-making focusses on a topic, process or technology without consideration of contextual factors or disruptive technologies that have a direct impact or that influence strategic IT decision-making in an organisation.

4.1 FRAMEWORK DEVELOPMENT PROCESS

As no studies were found that provided a comprehensive framework to guide CIO strategic IT decision-making from a disruptive technology perspective, Chapter 4 uses the literature review for this thesis, conducted in Chapter 2, and focusses on identifying factors emanating from IS and management theory that could answer SRQ1, as shown below.

SRQ 1:

"What are the key factors in a framework that CIOs should consider when making strategic IT decisions in an organisation in agile business conditions?"

The process to develop the decision framework is shown in Figure 34, which will be elaborated on in greater detail in the sections that follow.

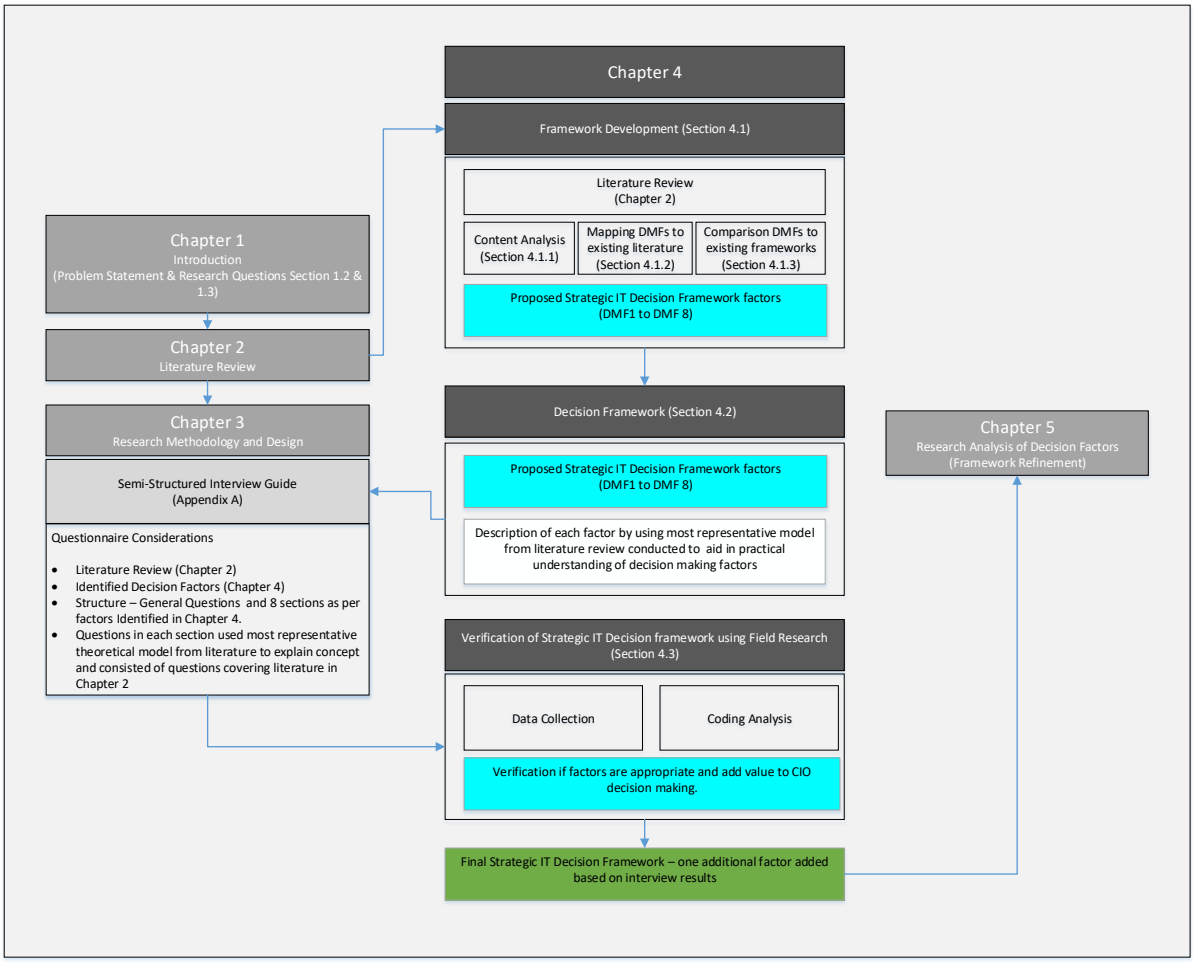


Figure 34 - Chapter 4 Framework Development Process

4.1.1 Content analysis

Through a process of content analysis, the following basic questions were considered to analyse the literature reviewed in Chapter 2

- Why: Why should organisations consider or react to disruptive threats or innovation?
- Who: Who (CIO or business executives) should react, make strategic IT choices or drive organisational transformation from a disruptive technology perspective?
- What: What should be considered when making technology decisions in a disruptive environment?

- How: How can decisions be fast-tracked within organisations in an environment faced with a continuous stream of disruptive technologies?

Figure 35 indicates the process followed in analysing relevant literature on strategic IT decision-making and lists key topics that emerged in answering the above questions. Figure 35 also indicates the section in Chapter 2 that mentions topics that have an influence on strategic IT decision-making in a disruptive environment. Relevant management and IS literature reviews indicate that decision-making is influenced by various factors, such as personal attributes, experience of the decision maker, decision processes, characteristics of the industry, organisational characteristics, timing etc. Research also highlighted the importance and increased the researcher's understanding of important issues such as the challenges CIOs face, the role of EAs in decision-making, decision complexity, external analysis, disruptive technologies etc. in making strategic IT decisions in organisations.

Key topics were thereafter consolidated into strategic decision factors, which form the basis of the decision framework proposed in this chapter. The consolidation process considered the underlying characteristics and implications of the topics that emerged from literature on strategic IT decision-making. The consolidated factors therefore represent a higher level of abstraction of the key topics identified and are represented as decision-making factors (DMF) in this thesis.

This deductive content analysis led to eight factors, which are described as DMF for strategic IT decision-making, as described below:

- **DMF1: Organisational expectations of CIO** – Understanding the role of the CIO in an organisational context and expectations of the organisation's multiple stakeholders about contributing to business value.
- **DMF2: Organisation decision process** – Understanding decision processes in an organisation and the influence of stakeholders in decision-making.
- **DMF3: EA approach** – Understanding of IT EA and its relevance for and influence on strategic IT decision-making.
- **DMF4: Organisational classification** – Understanding the nature and characteristics of an organisation and how these influence strategic IT decision-making.
- **DMF5: Classification of IT systems** – Understanding if all IT systems used in an organisation are treated equally when strategic IT decisions need to be made.
- **DMF6: Decision criteria for IT systems** – Understanding what decision criteria will be applicable if IT systems are classified differently in an organisation.

- **DMF7: External analysis** – Understanding the impact of disruptive technologies and external factors on strategic IT decision-making in an organisation.
- **DMF8: Strategic fit and value contribution** – Understanding if CIOs consider the strategic nature of IT systems and how this contributes to business value when motivating strategic IT decisions.

Tables 2 to 5 show how each of the literature sources covered in Chapter 2 relates to these factors. In addition, Figure 36 shows the relationship between the four IT decision-making models discussed in section 2.5.5 and the DMFs identified in literature.

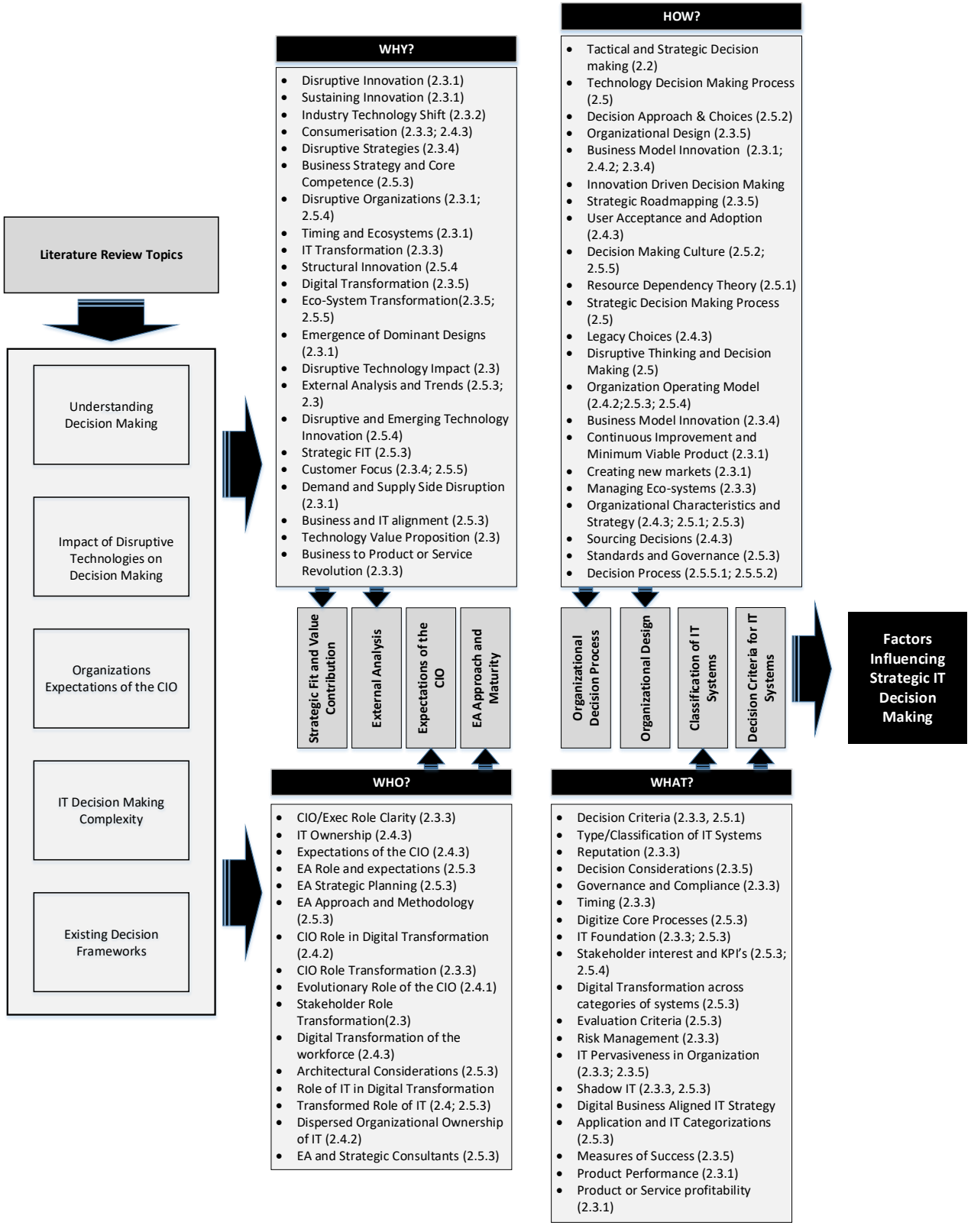


Figure 35 - Literature Review Process and Findings

4.1.2 Mapping DMFs to existing literature

The researcher followed an additional step by checking all literature sources in this thesis to determine if the content analysis approach and resultant consolidated factors were represented in literature references used. The results of this analysis can be found in Tables 2 to 5.

Interpretation of various literature sources indicates that the consolidated factors identified (DMF1 to DMF8), had an influence on strategic IT decision-making. Tables 2 to 5 provide an indication of where identified decision factors were construed as influencing strategic IT decision-making, which could be used to answer SRQ1 of this thesis.

Table 2 - IS Literature Analysis of Role of CIO in Strategic IT Decision-making

Reference	***Title***	***Decision Factors***							
		DMF1	***DMF2***	***DMF3***	***DMF4***	***DMF5***	***DMF6***	***DMF7***	***DMF8***
(Bongiorno et al., 2018)	CIOs and the Digital Transformation: A New Leadership Role	Y		Y		Y	Y	Y	Y
(Varanini, 2018)	Human Being in the Digital World: Lessons from the past for Future CIO's	Y	Y			Y	Y	Y	Y
(Rizzo, 2018)	CIO and the Digital Challenge	Y	Y	Y	Y	Y		Y	Y
(Maffè, 2018)	Future of the CIO: Towards an Entrepreneurial Role	Y		Y		Y	Y	Y	Y
(Capitani, 2018)	CIO's: Drivers or Followers of Digital Transformation?	Y	Y	Y		Y	Y	Y	Y
(Demuru and Katinis, 2018)	CIOs at the Centre of a New Humanism	Y						Y	
(Castello et al., 2018)	The New Relations among Things, Data and People: The Innovation Imperative	Y		Y	Y	Y	Y	Y	Y
(Arkhipova and Bozzoli, 2018)	Digital Capabilities	Y					Y	Y	
(Messina, 2018)	Designing the New Digital Innovation Environment	Y	Y	Y	Y	Y	Y	Y	Y
(Corso et al., 2018)	Conceiving and Implementing the Digital Organization	Y		Y	Y	Y		Y	Y
(DeLone et al., 2018)	Digital IT Governance	Y	Y	Y	Y	Y	Y	Y	Y
(Walsham, 2012)	Are we Making a Better World with ICTs? Reflections on a Future Agenda for the IS Field	Y		Y	Y	Y			Y

(Overby et al., 2006)	Enterprise Agility and the Enabling Role of Information Technology						Y	Y	Y
(Wunderlich and Beck, 2017)	We've Got the Power. The Relevance of IT Leadership and Organisational IT Capabilities in the Fully Digitized Business Era	Y				Y	Y	Y	Y
(Potter et al., 2016)	Six Strategies to Manage and Lead Business Unit IT	Y	Y	Y		Y		Y	Y
(Fitzgerald, 2016)	How the PMO can Make the Best of Shadow IT	Y	Y		Y	Y		Y	
(Barlow, 2013)	The Changing Role of the CIO	Y		Y		Y	Y	Y	Y
(Heller. M, 2012)	The CIO Paradox: Battling the Contradictions of IT leadership	Y	Y	Y		Y	Y	Y	Y
(Roberts and Watson, 2014)	Confessions of a Successful CIO: How the Best CIOs Tackle their Toughest Business Challenges	Y		Y		Y	Y	Y	Y
(Hope et al., 2011)	The Leader's Dilemma: How to Build an Empowered and Adaptive Organization without Losing Control	Y	Y					Y	Y

Table 3 - IS Literature Analysis on Strategic IT Decision-Making

Reference	***Title***	***Decision Factors***							
		DMF1	***DMF2***	***DMF3***	***DMF4***	***DMF5***	***DMF6***	***DMF7***	***DMF8***
(Sniedovich, 2012)	Black Swans, New Nostradamuses, Voodoo Decision Theories, and the Science of Decision Making in the Face of Severe Uncertainty		Y						
(Kaner and Karni, 2004)	A Capability Maturity Model for Knowledge-Based Decision-making		Y						Y
(Tamm et al., 2014)	A Model of Strategic IT Decision-Making Processes		Y		Y		Y	Y	
(Frank et al., 2013)	A Framework for Decision-Making in Investment Alternatives Selection		Y				Y		Y
(Aplak and Türkbey, 2013)	Fuzzy Logic-based Game Theory Applications in Multi-		Y				Y	Y	

	criteria Decision-making Process								
(Etzioni, 2014)	Humble Decision-making Theory		Y						
(Brady, 2016)	A Study of Adam Smith's Original Contributions to Economic Theory and Decision Making under Uncertainty		Y						
(Martens and Teuteberg, 2012)	Decision-making in Cloud Computing Environments: A Cost and Risk-based Approach		Y				Y		Y
(Turpin and Marais, 2006)	Decision-making: Theory and Practice		Y						
(Dean and Sharfman, 1996)	Decision Process Matter? A Study of Strategic Decision-Making Effectiveness		Y						Y
(Isen, 2001)	An Influence of Positive Affect on Decision Making in Complex Situations: Theoretical Issues with Practical Implication		Y				Y		
(Eisenhardt, 1989)	Making Fast Strategic Decisions in High-velocity Environments		Y						
(Klein, 2008)	Naturalistic Decision Making		Y						
(Klinger and Klein, 1991)	Naturalistic Decision Making		Y						
(Clemen, 2001)	Naturalistic Decision Making and Decision Analysis		Y						
(Cohen, 2015)	Sourcing Decision Framework: 10 Steps to Better IT Sourcing Decisions		Y				Y	Y	Y
(Newell and Shanks, 2003)	Take the Best or Look at the Rest? Factors Influencing" One-reason" Decision Making		Y						Y
(Domegam, 1996)	IT in Customer Service. A "Scalogram" Model for the Adoption of Information Technology		Y		Y	Y	Y		Y
(Low et al., 2011)	Understanding the Determinants of Cloud Computing Adoption						Y		Y
(Venkatesh et al., 2002)	User Acceptance Enablers in Individual Decision Making about Technology: Toward an Integrated Model		Y						

(Müller, 2017)	Digitalization Decisions at the Board Level	Y	Y	Y		Y	Y	Y	Y
(Nooraie, 2012)	Factors Influencing Strategic Decision-making Processes		Y		Y		Y	Y	Y
(Akinci and Sadler-Smith, 2012)	Intuition in Management Research: A Historical Review		Y						
(Smith and Tushman, 2005)	Managing Strategic Contradictions: A Top Management Model for Managing Innovation Streams		Y				Y	Y	Y
(Eisenhardt and Zbaracki, 1992)	Strategic Decision Making		Y						
(Elbanna, 2006)	Strategic Decision-making: Process Perspectives		Y						
(Shepherd et al., 2015)	Thinking about Entrepreneurial Decision Making: Review and Research Agenda		Y					Y	
(Lin, 2007)	Information Technology Capability and Value Creation: Evidence from the US Banking Industry	Y	Y	Y		Y	Y		Y
(Rivard et al., 2006)	Resource-based View and Competitive Strategy: An Integrated Model of the Contribution of Information Technology to Firm Performance	Y	Y	Y	Y	Y	Y		Y
(Melville et al., 2004)	Review: Information Technology and Organizational Performance: An Integrative Model of IT Business Value		Y	Y	Y	Y	Y	Y	Y
(Klein, 2017)	Sources of Power: How People Make Decisions		Y						

Table 4 - IS Literature Analysis on Enterprise Architecture impact on Decision-Making

Reference	***Title***	***Decision Factors***							
		DMF1	***DMF2***	***DMF3***	***DMF4***	***DMF5***	***DMF6***	***DMF7***	***DMF8***
(Lapalme, 2012)	Three Schools of Thought on Enterprise Architecture			Y				Y	Y
(Walker, 2009)	Architecture in Turbulent Times	Y	Y	Y	Y	Y	Y	Y	Y
(Sessions, 2006)	A Better Path to Enterprise Architectures			Y			Y		Y
(Gøtze, 2013)	The Changing Role of the	Y		Y					Y

	Enterprise Architect								
(Sessions, 2007)	A Comparison of the Top Four Enterprise-Architecture Methodologies			Y	Y		Y	Y	Y
(Zachman, 1996)	Concepts of the Framework for Enterprise Architecture			Y	Y	Y			
(Kotusev et al., 2015)	Consolidating Enterprise Architecture Management Research			Y	Y	Y	Y		Y
(Walker, 2007)	A Day in the Life of an Enterprise Architect			Y					Y
(CIO_Council, 2013)	Federal Enterprise Architecture Framework Version 2		Y	Y	Y	Y	Y		Y
(Lapkin and Allega, 2008)	Gartner Clarifies the Definition of the Term "Enterprise Architecture"			Y					Y
(Burton and Allega, 2014)	Hype Cycle for Enterprise Architecture, 2014			Y			Y	Y	Y
(Burke, 2012)	Stage Planning a Business Outcome-Driven Enterprise Architecture			Y					Y
(Wilson, 2012)	Taming Your EA Framework with Business Outcomes			Y					Y
(Brian Burke, 2009)	What Is the Right Approach to Developing an Enterprise Architecture?			Y					Y
(Zachman, 2002)	The Zachman Framework for Enterprise Architecture			Y					
(Pereira and Sousa, 2005)	Enterprise Architecture: Business and IT Alignment			Y					Y
(Hite, 2003)	Information Technology: A Framework for Assessing and Improving Enterprise Architecture Management (Version 1.1): GAO-03-584G			Y					
(Gromoff et al., 2013)	Newer Approach to Create Flexible Business Architecture of Modern Enterprise			Y					Y
(Kearns and Sabherwal, 2007)	Strategic Alignment between Business and Information Technology: A Knowledge-based of Behaviours, Outcome, and Consequences	Y		Y					Y
(Veasey, 2001)	Use of Enterprise Architectures in Managing Strategic Change			Y					Y

(Burns et al., 2009)	Building Value through Enterprise Architecture a Global Study			Y			Y		Y
(Lange et al., 2012)	A Comprehensive EA Benefit Realization Model			Y					Y
(Bente et al., 2012)	Collaborative Enterprise Architecture: Enriching EA with Lean, Agile, and Enterprise 2.0 Practices	Y	Y	Y	Y	Y	Y	Y	Y
(Ross et al., 2006)	Enterprise Architecture as Strategy: Creating a Foundation for Business Execution		Y	Y	Y		Y	Y	Y
(Narayan, 2015)	Agile IT Organization Design: For Digital Transformation and Continuous Delivery		Y	Y	Y	Y		Y	Y
(Sutherland and Sutherland, 2014)	Scrum the Art of Doing Twice the Work in Half the Time	Y	Y	Y	Y		Y		

Table 5 - IS Literature Analysis on Disruptive Technologies

Reference	***Title***	***Decision Factors***							
		DMF1	***DMF2***	***DMF3***	***DMF4***	***DMF5***	***DMF6***	***DMF7***	***DMF8***
(Corsi and Di Minin, 2014)	Disruptive Innovation ... in Reverse: Adding a Geographical Dimension to Disruptive Innovation Theory							Y	
(Petrick and Martinelli, 2012)	Driving Disruptive Innovation		Y					Y	Y
(Carlo et al., 2014)	Early vs. Late Adoption of Radical Information Technology Innovations across Software Development Organizations: An Extension of the Disruptive Information Technology Innovation Model							Y	
(Habtay, 2012)	A Firm-Level Analysis on the Relative Difference between Technology-Driven and Market-Driven Disruptive Business Model Innovations				Y		Y	Y	Y
(Sherif et al., 2006)	Managing Peer to Peer Conflicts in Disruptive Information Technology Innovations		Y						
(Puehse, 2015)	Southeast Asia: See Tomorrow,		Y					Y	Y

	Today - How to Achieve Breakthrough through Co-creation and Lean Innovation								
(Barakat and Parhizgar, 2015)	The weakness of Entrepreneurial and Venture Approach to Disruptive Innovation	Y	Y			Y		Y	Y
(Christensen et al., 2015)	What is Disruptive Innovation		Y					Y	Y
(Downes and Nunes, 2013)	Big-Bang Disruption		Y					Y	Y
(Chambers, 2015)	Cisco's CEO on Staying Ahead of the Technology Shifts		Y					Y	Y
(Christensen, 2015)	Disruptive Innovation is a Strategy, not just Technology	Y	Y					Y	Y
(Lyytinen and Rose, 2003)	The Disruptive Nature of Information Technology Innovations		Y	Y			Y	Y	Y
(Adner and Kapoor, 2016)	Right Tech, Wrong Time		Y			Y	Y	Y	Y
(Mingay et al., 2016)	The Most Common Barriers to Adopting Bimodal, and How to Overcome Them		Y				Y	Y	Y
(Guttentag, 2015)	Airbnb: Disruptive Innovation and the Rise of an Informal Tourism Accommodation Sector			Y	Y	Y		Y	Y
(King and Baatartogtokh, 2015)	How useful is the theory of disruptive innovation?		Y					Y	Y
(Ebersold and Glass, 2015)	The Impact of Disruptive Technology: The Internet of Things							Y	
(Satell, 2015)	Let's Stop Arguing about Whether Disruption Is Good or Bad		Y						
(Conole, 2015)	MOOCs as Disruptive Technologies: Strategies for Enhancing the Learner Experience and Quality of MOOCs							Y	
(Dahlberg et al., 2015)	M-Payment - How Disruptive Technologies Could Change the Payment Ecosystem							Y	
(Sinek, 2011)	Start with Why: How Great leaders Inspire Everyone to Take Action	Y	Y						Y

(Gans, 2016)	The Disruption Dilemma		Y	Y	Y	Y	Y	Y	Y
(Schwab, 2016)	The Fourth Industrial Revolution					Y	Y	Y	Y
(Christensen, 2003)	The Innovator's Dilemma		Y		Y		Y	Y	Y
(Parker et al., 2016)	Platform Revolution: How Networked Markets Are Transforming the Economy and How to Make Them Work for You					Y	Y	Y	Y
(O'Reilly III and Tushman, 2016)	Lead and Disrupt: How to Solve the Innovator's Dilemma	Y	Y		Y		Y	Y	Y
(Raskino and Waller, 2015)	Digital to the Core	Y			Y	Y	Y	Y	Y
(Rogers, 2016)	The Digital Transformation Playbook	Y			Y		Y	Y	Y
(Schmidt and Cohen, 2013)	The New Digital Age: Reshaping the Future of People, Nations and Business							Y	
(Evans, 2003)	Business Innovation and Disruptive Technology: Harnessing the Power of Breakthrough Technology... for Competitive Advantage	Y	Y	Y	Y	Y	Y	Y	Y
(Rossman, 2014)	The Amazon Way 14 Leadership Principles behind the World's most Disruptive Company			Y	Y		Y	Y	
(Peters, 2014)	Growth Hacking Techniques, Disruptive Technology - How 40 Companies Made It Big		Y				Y	Y	
(Hamel and Breen, 2007)	The Future of Management	Y	Y	Y		Y	Y	Y	Y
(McNish and Silcoff, 2016)	Losing the Signal: The Spectacular Rise and Fall of The Blackberry		Y				Y	Y	Y

4.1.3 Comparing the DMFs with existing strategic IT decision-making frameworks

Figure 36 shows the relationship between existing frameworks and literature as discussed in Chapter 2. The results indicate that the common decision factors identified are prevalent in some of the existing decision frameworks and appear in literature related to strategic IT decision-making in a disruptive technology environment. However, no frameworks were found that covered all factors that could be used to construct a framework for CIO strategic IT decision-making.

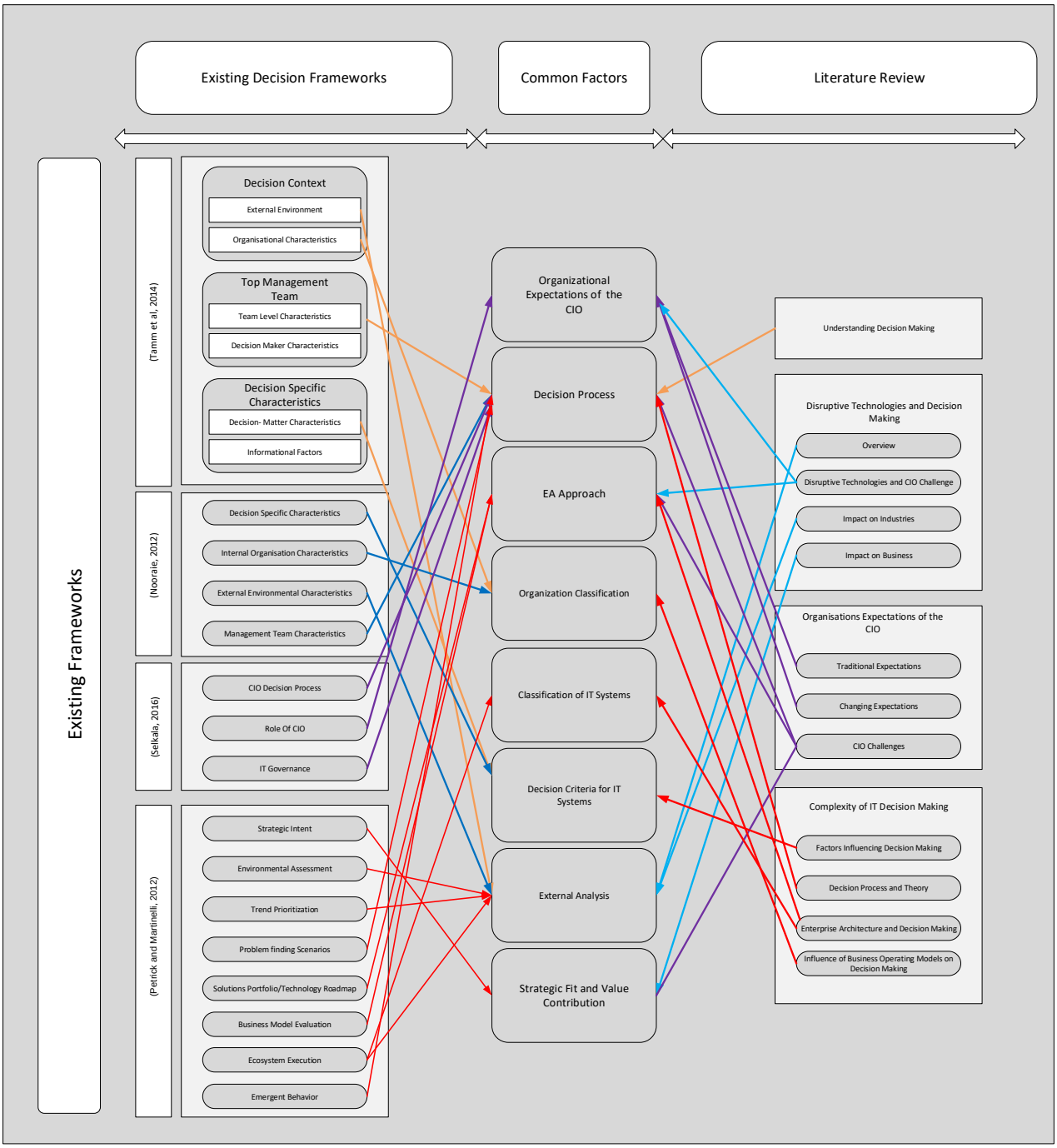
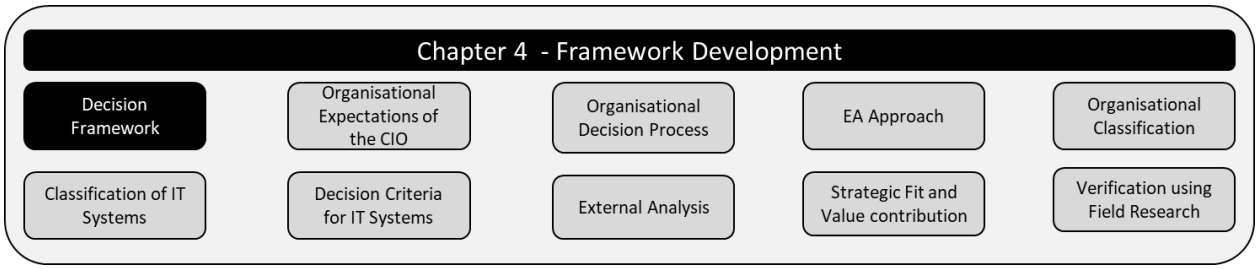


Figure 36 – Decision-making Factors - Consolidation of Results

The outcome of the literature review phase identified factors that form the basis of the strategic IT decision framework, which can be used to guide CIO strategic IT decision-making in agile business conditions from a perspective of disruptive technologies. The factors identified will be briefly described in the next sections of this chapter.



4.2 DECISION FRAMEWORK

Based on the literature review conducted in Chapter 2 and Chapter 4.1, key factors emerged that influenced strategic IT decision-making as listed in Figure 37. The factors listed form the basis of the proposed decision framework, which can be used to provide a high-level overview of the key considerations for CIOs when making strategic technology decisions in an agile business environment. The factors are listed based on the researcher's understanding of the level of tactical or strategic importance of a factor. These factors were further verified using primary research, as described in section 4.3 of this thesis.

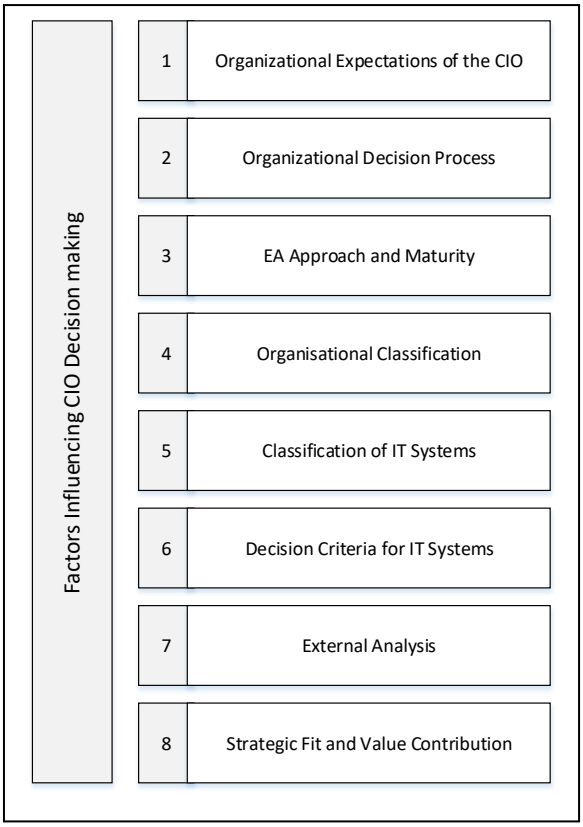
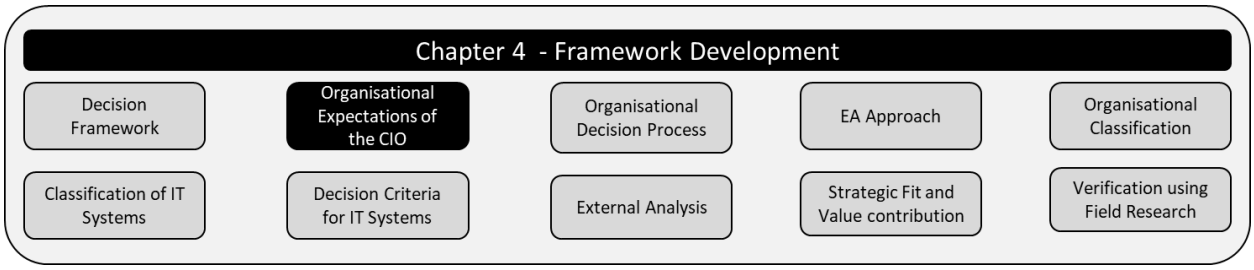


Figure 37 - Factors Influencing CIO Strategic IT Decision-making

In order to provide an overview of decision considerations and contextual factors that need to be considered in making strategic IT decisions in a disruptive environment, each of the factors of the decision framework is summarised in this section.



4.2.1 DMF 1: Organisational expectations of the CIO

In Chapter 2, various publications highlighted the changing expectations and role of the CIO in fast-paced agile market conditions, as indicated in Table 3-6. To ensure common understanding of the decision factors in the decision framework, a model that best describes the concepts highlighted in literature was chosen to explain key concepts emerging from literature. The approach followed in the selection and verification of DMF1 is shown in Figure 38.

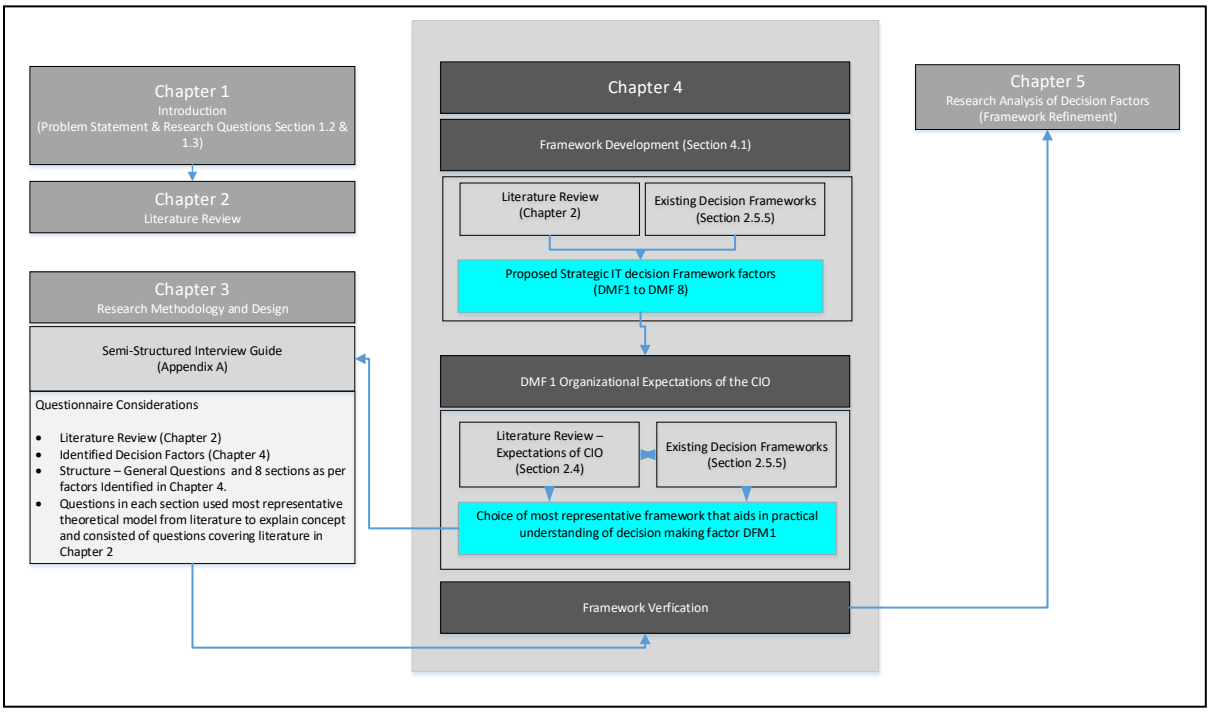


Figure 38 - DMF1 development and verification process

The role of the CIO is changing from an integrator to an orchestrator (Heller. M, 2012). It has moved from a paradigm of managing all the pieces of IT supporting business processes to orchestrating different pieces of solutions from both the internal and external environments to an organisation to make business processes work.

In IT's role as an orchestrator, CIOs need to learn how to deliver services in a cloud, consumer and consumption-based computing world. One of the key success factors in surviving in the new paradigm is having a very disciplined architecture, governance and belief system (Heller. M, 2012). A belief system refers to general rules and guidelines for decision-making in an organisation, e.g. no capex expenditure, procuring everything as a service, dedicated on premise or public clouds, common user desktop images etc. Governance results in creating a very disciplined environment where organisational beliefs or rules are implemented.

DMF1 in the proposed framework is a high-level analysis of the organisation's expectations of the CIO in the context of the industry and enterprise aligned to Figure 39.

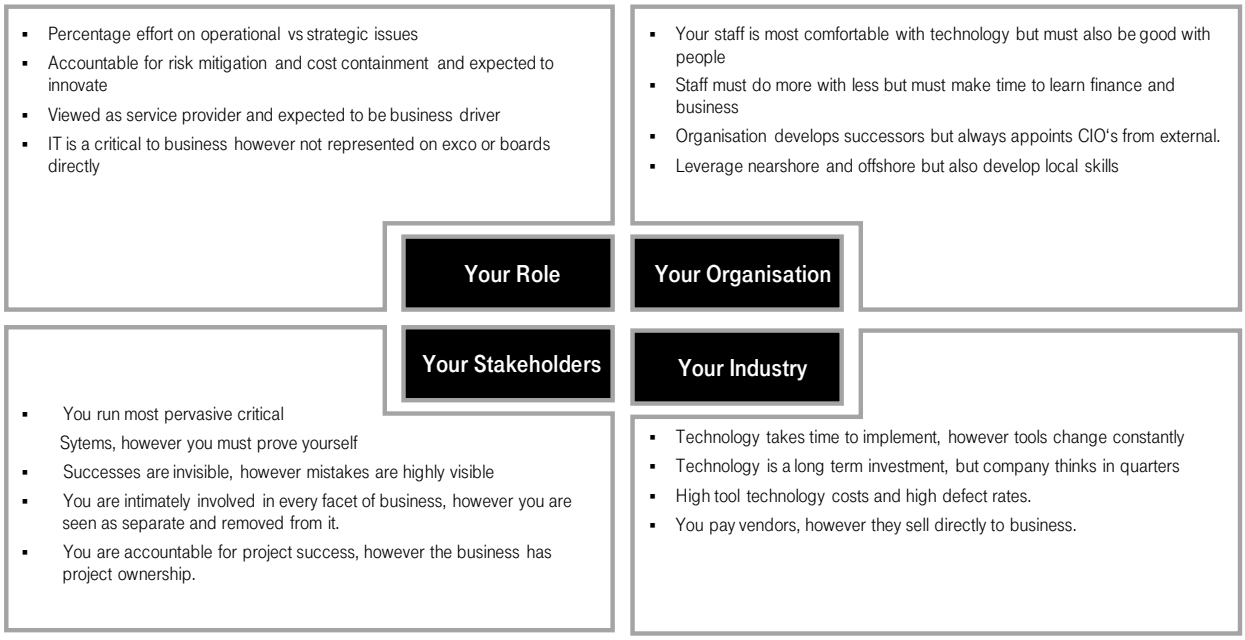


Figure 39 - Organisational Expectations of the CIO (Heller. M, 2012)

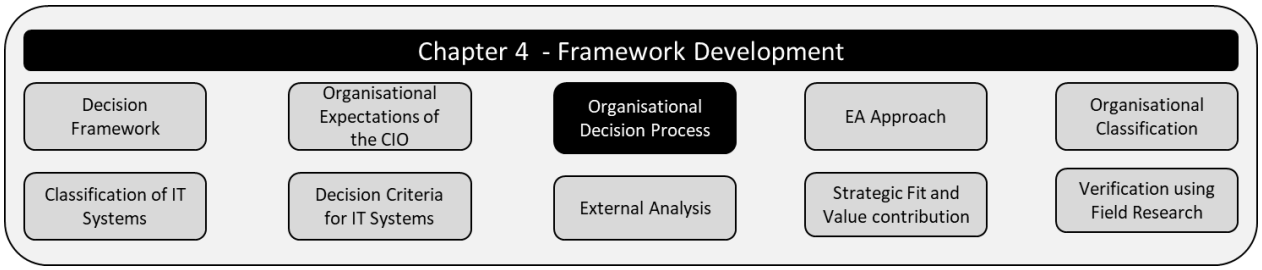
The intent of this analysis is to understand, on a high level, the expectations of the CIO in the context of role, organisation, stakeholders and industry. The organisations' expectations of the CIO will determine the strategic nature of the CIO's role and provide clarity on expectations in a disruptive technology context.

In a disruptive environment, most CIOs are confronted with similar challenges across industries. There are numerous examples of organisations that have been disrupted by technologies and companies from unrelated industries, therefore it is imperative that CIOs in their role first adopt a macro overview of technology trends before making the final technology selection decision for their organisations.

Typical challenges facing CIOs across industries are the following (Varanini, 2018, Roberts and Watson, 2014, Heller. M, 2012):

- IT is strategic to most organisations and can create competitive advantage for most businesses, yet CIOs are rarely appointed by the board of an organisation.
- Most organisations want CIOs to be strategic enablers of business, but in practice CIOs spend most of their time on operational issues.
- In terms of succession planning, most CIOs focus on succession planning, but once they resign, most organisations recruit CIOs from outside the organisation
- In the information age, the role of the CIO should become easier, as business resources are familiar with technology, but the opposite happens.
- Most companies are still not sure on how they should hire CIOs and what they expect them to do.
- There is inadequate understanding of the principle that legacy begins the day one puts something in.
- CIOs need to innovate while simultaneously focussing on security and cost containment.
- The focus over the past two decades has been on efficiency and productivity. This has been achieved by introducing new technologies, such as office productivity software, email, collaboration tools and ERP systems enabling business process changes. Outsourcing of IT services introduced further optimisation of IT. The latest trends in IT, such as cloud, mobility and consumerisation, have created new opportunities with increased business expectations.
- CIOs are still struggling to get to grips with how to manage consumerisation of technology in the business context. Businesses see IT as standing in the way of progress. The previous approaches employing standardisation and consolidation do not work in the new technology paradigm. Many CIOs focus on orchestrating and deploying technology in business to create a similar experience to technology use at home, but this is not really innovation.
- The challenge for CIOs is that they cannot provide visible business value through standardisation, consolidation, business process changes and deploying consumer-type technology in business.

The new dimension of IT value contribution is moving to business model innovation. Business model innovation implies a complete review of skills and capabilities of IT resources to deliver on the new paradigm. According to the CIO of Boeing, " People believe IT is about technology but [it] is really a behavioural science - understand the behaviours of your company's staff, leaders, and customers - and facilitating the adoption of a new vision" (Heller. M, 2012). If CIOs change their mindset from technology innovation to business model innovation, their focus would move from project delivery, business change management and process reengineering to the introduction of new technology that can drive or support new business models and revenue streams. CIOs' mindset must move from how to secure, govern, standardise and introduce new technologies such as iPhones, iPads, IOT etc. to finding ways in which these technologies can change business models and drive technology acceptance among business executives and users.



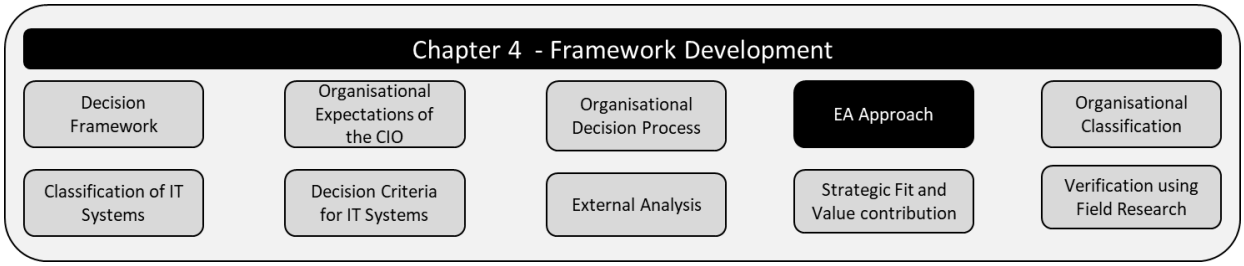
4.2.2 DMF2: Organisational decision process

The literature review in Chapter 2 investigated different theoretical models for senior management decision-making in organisations. Research found significant variation in decision-making styles. Nevertheless, common themes were found, such as intuition, sensitivity to context and presentation of information. Figure 40 provides an overview of common theoretical approaches to decision-making from management literature, which should be considered when making IT-related decisions. Turpin and Marais (2006) conducted research on common approaches to decision-making, which was used as a basis to summarise existing literature on decision theory.

Decision Making Theory	
Rational Model	Ranking of alternatives to choose. Decision makers fully informed on all possibilities
Bounded Rationality and Satisficing	"Satisficing" Process orientated view. Managers don't have complete information. Optimal choice not required. Options considered sequentially. If meets minimum criteria then it suffices
Incrementalist Approach	Process of incremental actions keeping strategy open to adjustment. Starts from status quo, rather than working towards a goal
Organisational Procedures View	"Avoidance Model" – systematic process which strives to maintain status quo at the cost of innovation. Decisions are a result of standard operating procedures by organisation sub units.
Political Model	Decisions further individual or group self interest. Politics and power influence decisions – decisions good for the group not necessarily for the organisation
Garbage Can Model	Decision making in "Organised anarchy". Manipulations in decision making, pluralistic environment with multiple goals. Decisions made do not address all problems in the Garbage Can.
Individual Differences Perspective	Focus on individuals decision making style, experience, preferences and behaviour. Different managers may arrive at different decisions
Recognition-Primed Decision Model	Decision maker is influenced by previous experience. Experience helps them understand current context and to determine course of action. If situation is not recognised, then more information is needed
Multiple Perspective Approach	Analyses problem from multiple perspective – technical, organisational and individual. Obtain many technical views, views from stakeholders and individuals. Decision outcomes generally endorsed by multiple stakeholders.

Figure 40 – Summary of Common Decision Theories

In many organisations, CIOs can influence technology decisions, but need final approval from executive committees, business stakeholders and governance boards, depending on the monetary value of technology investments or delegation of authority. In cases where CIOs do not have the authority to make final decisions, it is imperative that they understand how decisions are made in their organisation and to which decision approach the organisation subscribes. Neglecting to understand the organisation's approach to decision-making or the company culture could result in extended delays and frustration for enterprise architects and CIOs who are expected to add strategic value to business in a disruptive technology environment. Extended decision-making could render technology obsolete or it could be considered legacy by the time new technology is implemented and adopted by users in an organisation. Decision speed is critical in high-velocity environments; understanding organisational decision approaches can assist CIOs in fast-tracking strategic IT decision-making.



4.2.3 DMF3: EA approach

In Chapter 2, various publications highlighted the changing expectations of enterprise architects in fast-paced agile market conditions, as indicated in Table 3-6. To ensure common understanding of the decision factors in the decision framework, a model that best describes the concepts highlighted in literature was chosen to explain key concepts emerging from literature. The approach followed in the selection and verification of DMF3 is shown in Figure 41.

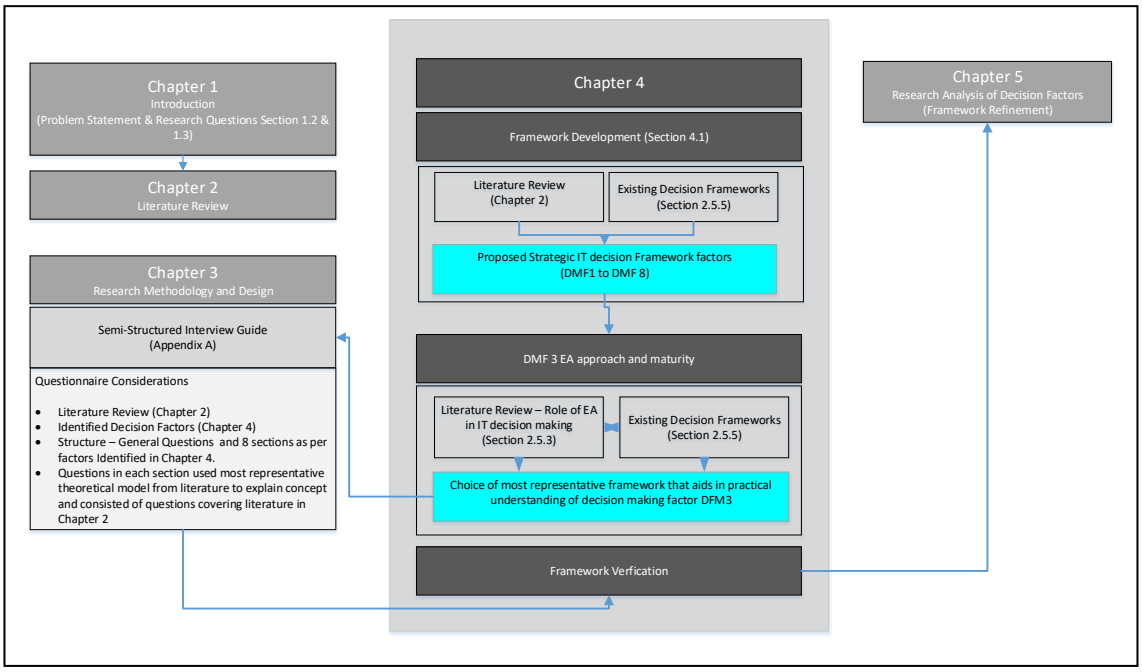


Figure 41 - DMF3 Development and Verification Process

EA is generally a function in most organisations whose primary objective is to create a technology strategy aligned to business strategy. This function generally falls under the leadership of CIOs who are expected to provide guidance and recommendations on technology decisions in an enterprise. Great frustration has been attached to the relevance of this function during times of disruptive change. Many EA practitioners still subscribe to the Zachman framework; however, this methodology may lead to frustration. Zachman's framework seems effective in documenting and

describing existing enterprise products, services and architecture, but gives no indication of whether current architecture is effective and gives no guidelines for the creation of a new architecture based on changing market dynamics.

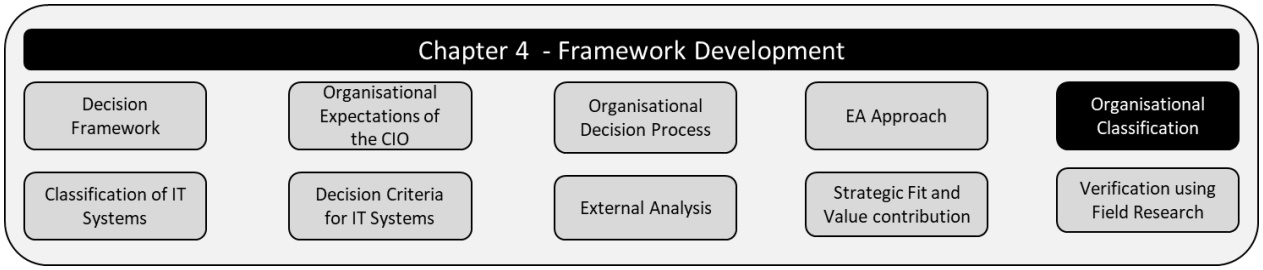
As digital and disruptive technologies permeate the core of most organisations, the role of EA will need to be adapted to add more value in influencing strategic IT decision-making. For CIOs to be successful, they need EA teams to evolve their thinking and mindset in adding value to business (Burke et al., 2016).

The model used in Figure 42 shows three distinct schools of thought that have started to emerge and to which organisations tend to gravitate in a disruptive environment. Understanding the prevailing schools of thought in an organisation will assist CIOs in understanding the current mindset in organisations and help them develop transformation plans to optimise decision processes in a disruptive environment. The model proposed by Lapalme (2012) explains the evolving expectations of EA in organisations and summarises concepts highlighted in the literature review in chapter 2.

Understanding of existing approaches to EA in an organisation will help CIOs in realigning this capability to assist in decision-making in disruptive conditions. CIOs who are expected to perform a more strategic role in an organisation will gravitate towards an enterprise ecological adaption approach to EA, as this forces enterprise architects to consider the impact of disruptive technology on the organisation's architectural plans (Lapalme, 2012).

	Enterprise IT Architecting	Enterprise Integrating	Enterprise Ecological Adaptation
Motto	Enterprise architecture is the glue between business and IT	Enterprise architecture is the link between strategy and execution	Enterprise architecture means for organizational innovation and sustainability
Objectives and concerns	Effectively enable the enterprise strategy Support IT planning reduce costs Enable business	Effectively implement the enterprise strategy and execution Support organizational coherence	Innovate and adapt Support organizational coherence Encourage system-in-environment coevolution
Principles and assumptions	Apply a reductionist (mechanistic) stance Don't question business strategies Design organizational dimensions independently Don't worry about non-IT dimensions; they're not your concerns	Apply a holistic (systemic) stance Don't question business strategies and objectives Manage the environment Jointly design all organizational dimensions	Apply a holistic (systemic) stance System in environment coevolution Environment can be changed Jointly design all the organizational dimensions
Skills	Have technical competence and engineering knowledge	Facilitate small group collaboration Apply systems thinking	Foster dialogue Apply system and system in environment thinking Facilitate larger group collaboration
Challenges	Convince the organization to accept the designed plans	understand the organizational systemic dynamics Collaborate across the organization Encourage systems thinking and paradigms	Foster sensemaking Encourage systems thinking and system in environment paradigm shifts Collaborate across the organization
Insights	Permits the design of robust and complex technological solutions Fosters the creation of high quality models and planning scenarios	Permits the design of comprehensive solutions Enables significant organizational efficiency by eliminating unnecessary contradictions and paradoxes	Fosters organizational innovation and sustainability
Limitations	Can produce inadequate or unfeasible solutions for the larger organizational context Struggles with solution acceptance and implementation barriers Susceptible to "perfect" designs that support unsustainable strategies	Susceptible to "perfect" designs that support unsustainable strategies Requires a paradigm shift from reductionism to holism	Requires many organizational preconditions for management and strategy creation

Figure 42 - EA Schools of Thought (Lapalme, 2012)



4.2.4 DMF4: Organisational classification

In Chapter 2, various publications highlighted the influence of the characteristics of organisational design on strategic IT decision-making in fast-paced agile market conditions, as indicated in Table 3-6. To ensure common understanding of the decision factors in the decision framework, a model that best describes the concepts highlighted in literature was chosen to explain key concepts emerging from literature, as shown in Figure 43.

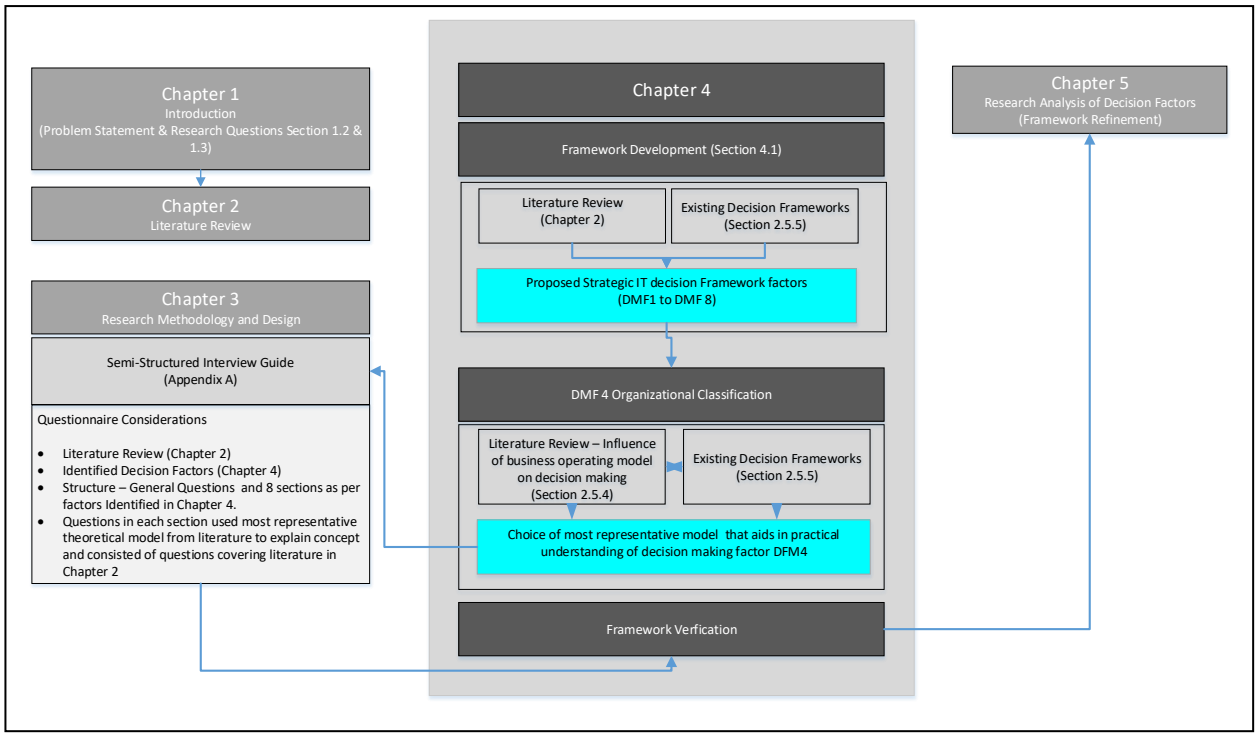


Figure 43- DMF4 model selection and verification process

Organisational classification in terms of geography, design, governance, context and strategy translates into an operating model that is a key factor to be considered when making strategic IT decisions. IT generally supports and enables business strategies, therefore the focus should be placed first on business before focussing on EA and technology strategies. Ross et al. (2006) struggled with the concept of EA and came to the realisation that EA is about the organisation

rather than about IT architecture. IT architecture and EA efforts have historically been ineffective, as they were remote from the realities of business and focussed on unnecessary detail that was not useful, except to a limited group in some IT departments.

Ross et al. (2006) recognised that EA needs to focus efforts on a higher level, i.e. at an enterprise level, to understand the enterprise logic for its core processes, with the related IT architecture reflecting standardisation and integration of its operating model. Research indicates that as there are rapid changes in the business world in a disruptive environment, organisations create a stable foundation for execution. Core processes are digitised and embedded in a stable base, which makes these companies more efficient and agile than their competitors. Building a strong foundation implies automating many of the basic routine activities to ensure that they are reliable and predictable, without detracting any management attention from higher order activities and customer interaction. Companies decide what makes them great and then create a high-quality, low-cost core, which provides consistency in a turbulent environment.

Top companies first define their operating model and then define processes and infrastructure that would be critical to support their current and future business strategy. Successful companies have made IT an asset and not a liability. Customers who have digitised their core processes achieve higher profitability and faster times to market. Many companies spend time on smaller projects that do not support enterprise-wide objectives or focus on cutting IT costs without determining how to increase value (Ross et al., 2006).

Understanding the characteristics of an organisation and its operating models (Figure 44) provides guidelines on the appropriate technology strategy to deploy in the organisation. This understanding will not necessarily provide a framework for IT decision-making from a technology perspective; however, it will provide key input in defining the technology strategy for an organisation in agile business conditions. Figure 44 can be used as a guide to understand organisational characteristics and related operating models, which can influence technology decisions.

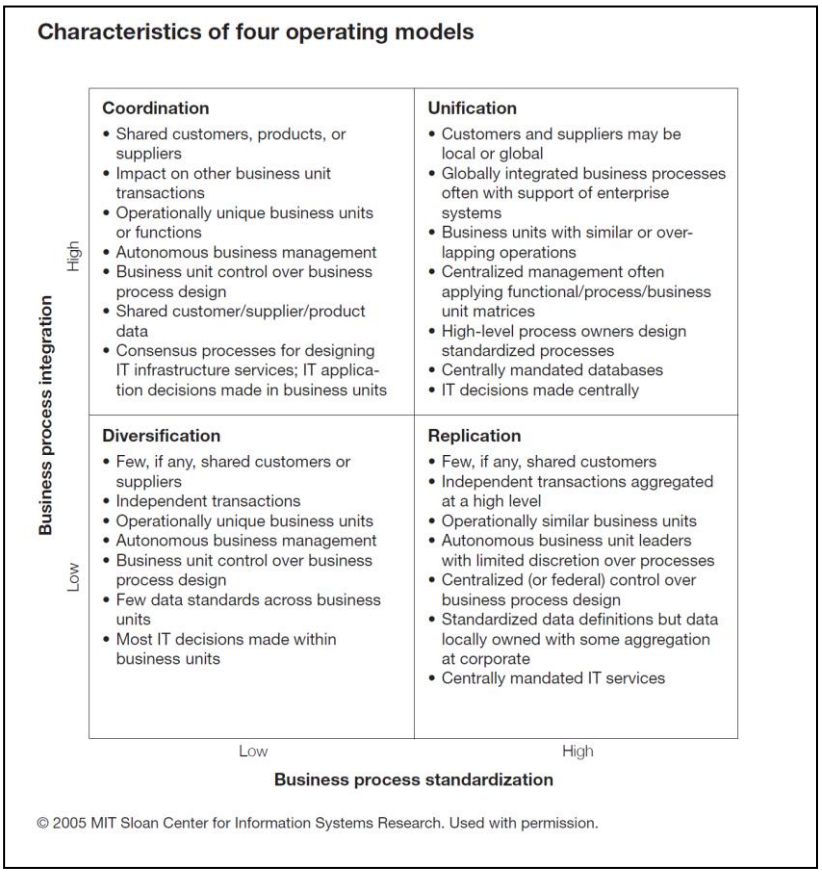
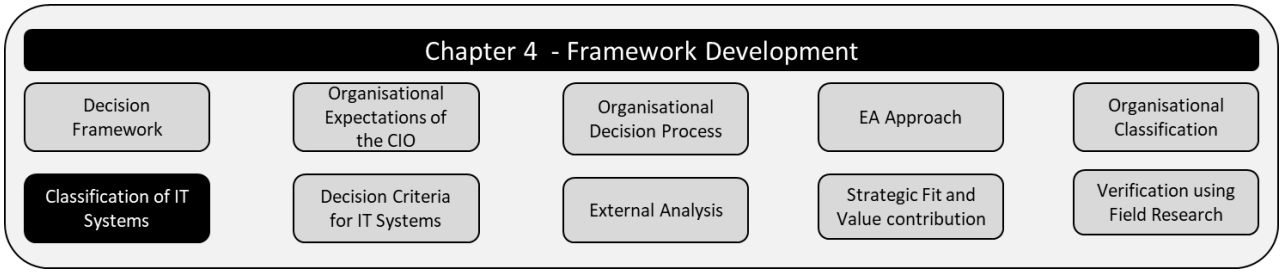


Figure 44 - Organisation Operating Model Characteristics (Ross, 2006)



4.2.5 DMF5: Classification of IT systems

Heller (2012) indicates that it is a fallacy if CIOs believe that their role is to ensure the alignment of IT and business. IT and business have merged, resulting in no clear distinction between them. Technology has become the cornerstone of business and failure to embrace technology in the core of a business could result in business disruption or obsolescence.

Classic or traditional business models are being reviewed critically to avoid disruption from competition in unrelated industries, enabled by disruptive technologies. As IT permeates the core

of most businesses, CIOs and company executives try to find ways of using technology to digitise products and services, to leverage online channels and achieve global reach.

In the traditional CIO paradigm, CIOs were employed to cater for the IT needs of the internal organisation. Basic responsibilities included the provision of desktops for employees, networks between branch offices, internet services, email, payroll etc. IT systems and technologies used in creating products or services delivered to external customers generally fell under the control of business unit executives.

With convergence, there is a dilution of accountability and blurring of the lines between CIOs and business unit executives that can sometimes lead to confusion on who makes the decision on common technologies. In most instances, separate infrastructure and systems are not required to service the needs of the internal organisation and for the provision of services to customers.

The literature review in Chapter 2 highlighted that as IT permeates the entire organisation, there is a distinction between the different uses of IT in organisations that have different characteristics, ownership and decision criteria. CIOs were traditionally employed to focus on traditional IT technologies supporting the internal operations of a business. However, the introduction of disruptive technologies has enabled improved efficiency and speed of doing business and in many cases transformed products, services and the market reach of organisations. To differentiate between different IT systems in an organisation, business IT, internal IT, digital IT, digital business (BIDD) model is proposed as interpreted from various publications on IT system classification.

Based on literature reviews, the four types of IT systems used in organisations, as shown in the BIDD model in Figure 45, are as follows:

Business IT: IT systems used in this quadrant generally support business processes to deliver core products and services to end customers. In traditional businesses, systems in this quadrant were often niche or proprietary; however, as IT permeates all parts of business, commodity IT hardware and software can be used in this quadrant.

Internal IT: Most organisations have traditional IT systems such as networks, data centres, servers, end user devices, enterprise resource planning systems, etc., which fall in the internal IT quadrant of the BIDD model.

Digital IT: Technology is often used as an enabler to reduce costs, improve efficiencies and improve the speed of doing business in a disruptive environment. For example, systems in this quadrant are used to eliminate paper-based systems, improve

utilisation of resources, provide real time information to enable better decision-making or use mobility to enable employees to work from anywhere at any time.

Digital business: IT systems that fall in the digital business quadrant of the BIDD model are often focussed on the customer. Systems are deployed to improve services delivered, offer alternative products, enable multichannel engagement or enable real time customer satisfaction.

The BIDD model is an original contribution and is refined in Chapter 5, section 5.2.3, using primary research.

The BIDD model in Figure 45 shows typical IT systems used in an organisation categorised into four quadrants. Each of these would have different decision criteria and, in many cases, follow a different approval process. In many organisations CEOs do not differentiate between business IT and internal IT and assume CIOs are accountable for everything IT-related. This can result in CIOs being perceived as not adding value to business or not using IT to create sustainable competitive advantage for a business. Business unit executives who are accountable for business IT systems sometimes maintain the status quo and focus on cost reduction. They may thus miss digitising opportunities to transform business models by leveraging disruptive technologies.

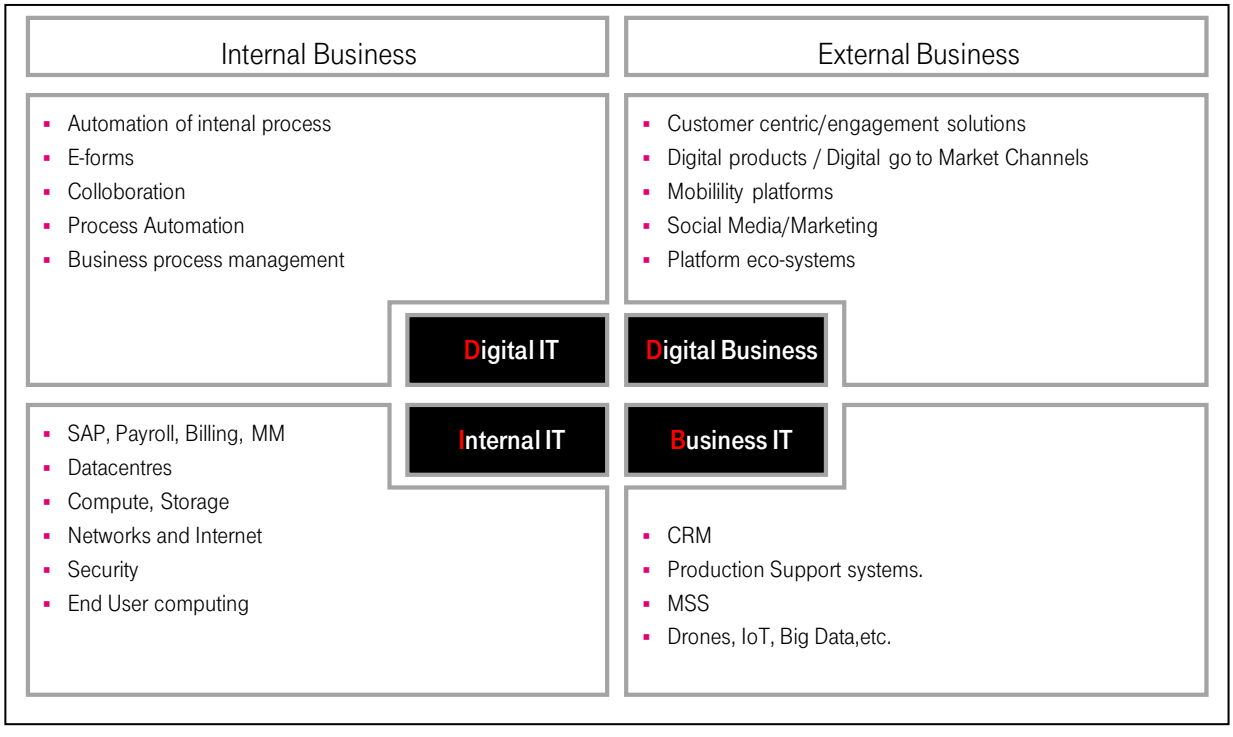
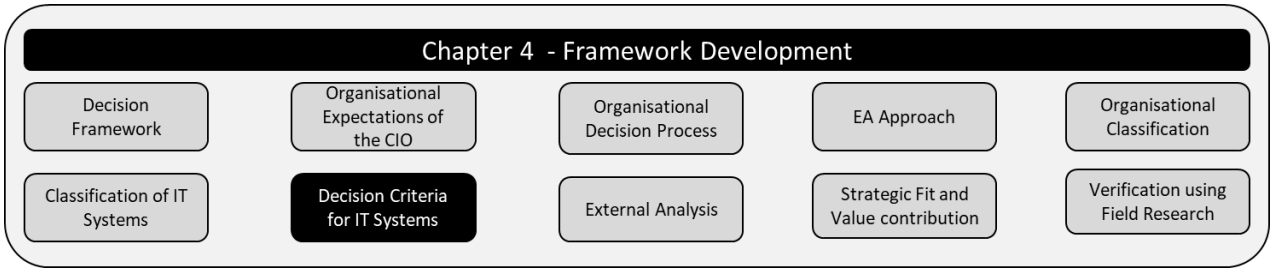


Figure 45 – Example of Classification of IT Systems – BIDD Model



4.2.6 DMF6: Decision criteria for IT systems

The literature review highlighted that different IT systems as classified by the BIDD model proposed in this research had different decision criteria and often followed different decision processes. After the classification of different IT systems into the four defined quadrants of the BIDD model, it is essential to understand whether different decision criteria are used in selecting technologies in the different areas of an organisation.

Certain financial KPIs would be common in each of the quadrants. It would be interesting to understand the ranking in terms of importance of the different criteria used. The KPIs shown in Figure 46 were extracted from different research studies and will be tested in subsequent phases of this research to determine if they are applicable to strategic IT decision-making and would be useful to CIOs.

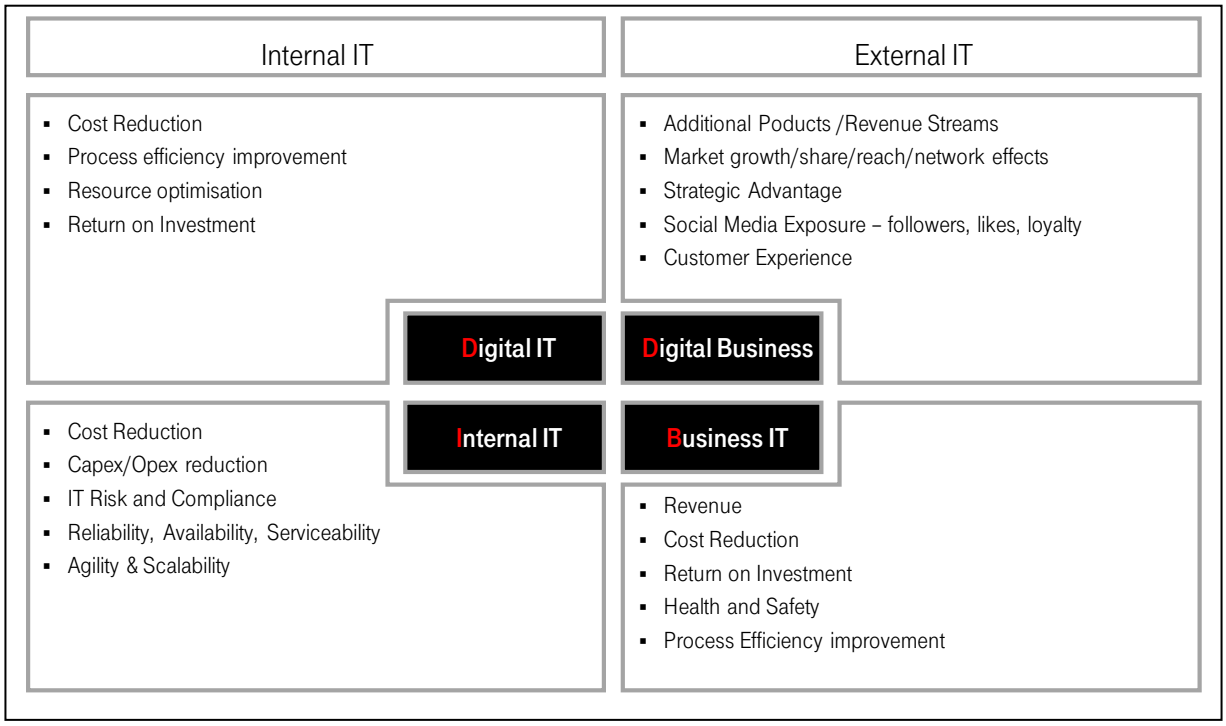
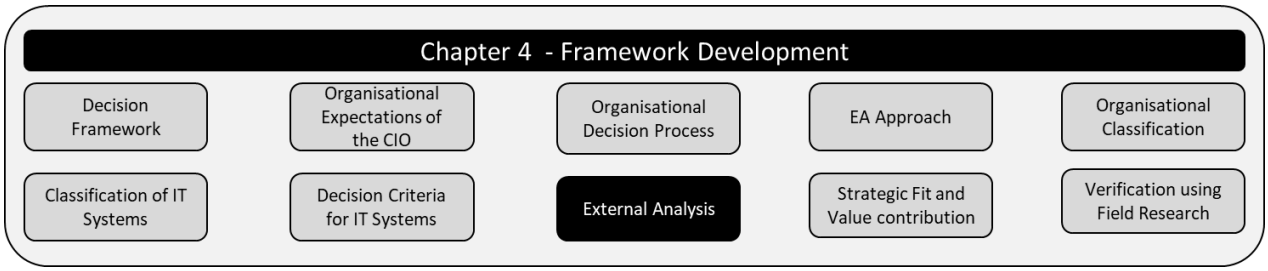


Figure 46 - BIDD Model - Decision Considerations for IT Systems

CIOs will need an understanding of the categorisation of IT systems deployed in an organisation and the key decision criteria that will be considered in any investment decision. This will enable CIOs to understand the different value propositions of technologies in the different quadrants and position business cases accordingly to fast-track decision-making in an organisation.



4.2.7 DMF7: External analysis

In Chapter 2, various publications highlighted the influence of timing and external analysis on strategic IT decision-making in fast-paced agile market conditions, as indicated in Table 3-6. To ensure common understanding of the decision factors in the decision framework, a model that best describes the concepts highlighted in literature was chosen to explain key concepts emerging from literature. The approach followed in the selection and verification of DMF7 is shown in Figure 47.

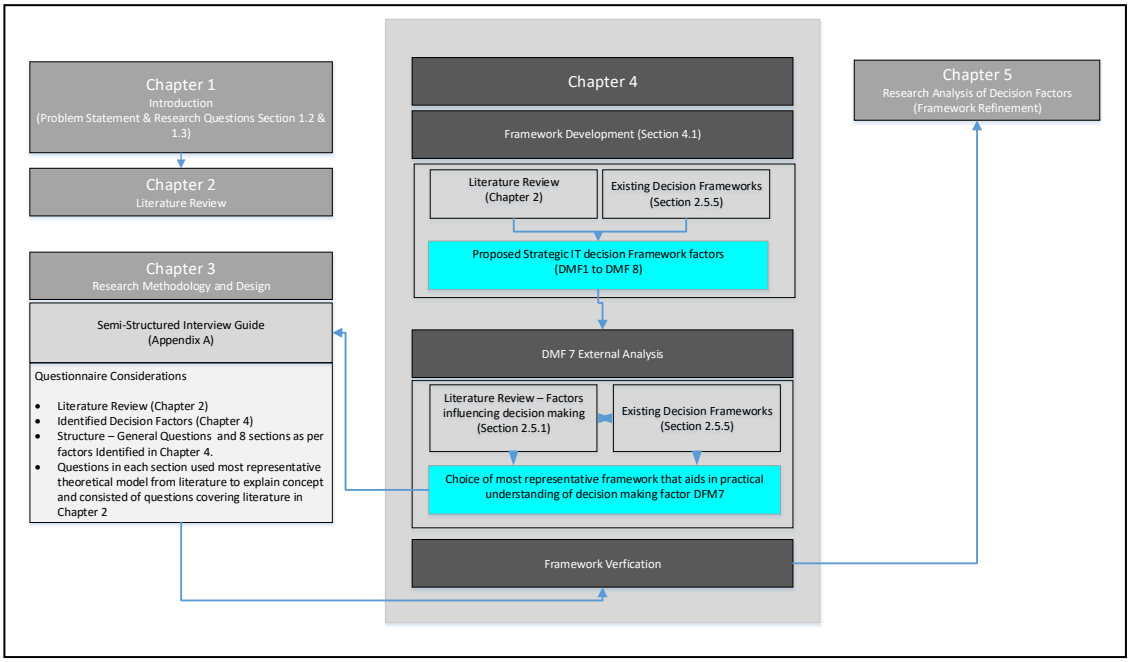


Figure 47 – DMF7 Development and Verification process

Adner and Kapoor (2016) proposed a framework, as shown in Figure 48, for analysing the pace of technology substitution and the impact of ecosystems on technology decision-making, which was used a basis for explaining the concepts outlined in DMF7. The challenge for most businesses is the timeous identification of these shifts and understanding what dangers they may pose to incumbent organisations (Adner and Kapoor, 2016). The biggest challenge facing most businesses is timing. There have been organisations that have adopted disruptive technologies and changed the industry overnight, e.g. Uber, Airbnb, Twitter etc., whereas some disruptive technologies, such as cloud, HD TVs and MP3s, have taken decades to unfold.

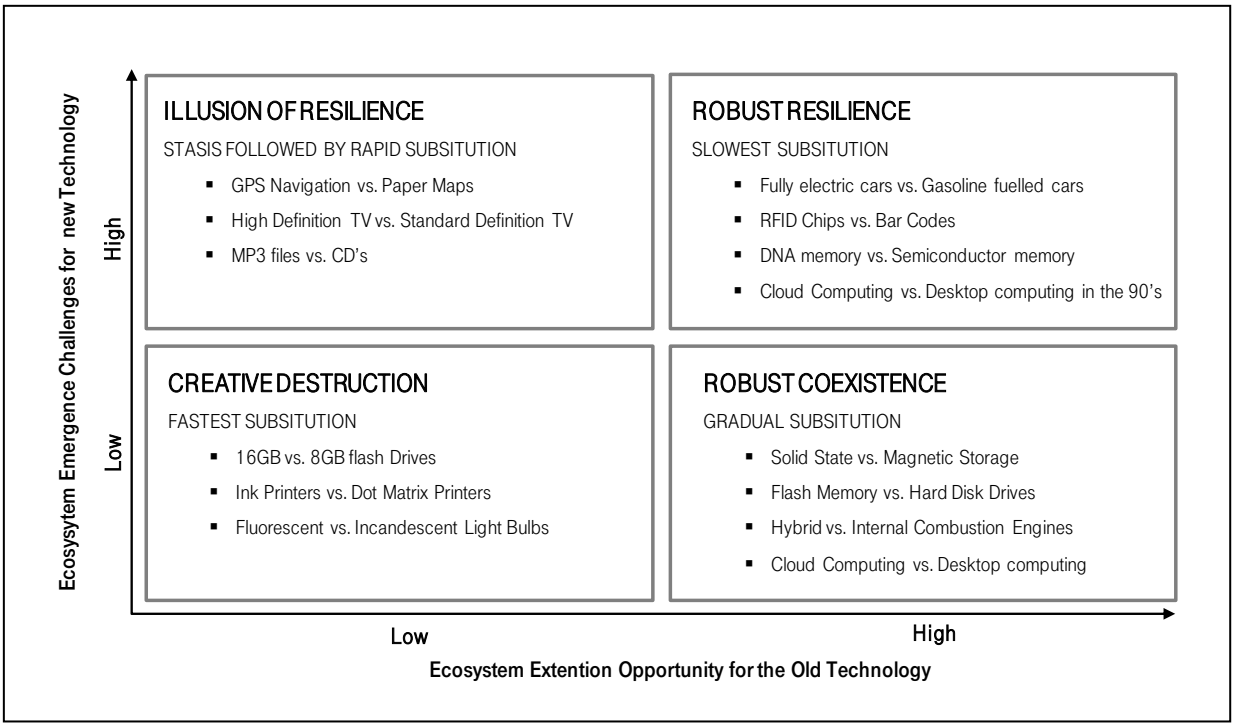


Figure 48 – Framework for Analysing Pace of Technology Substitution (Adner and Kapoor, 2016)

For CIOs, the identification of disruptive technologies and trends may be relatively easy, but determining when the technology transition will affect industries remains unknown (Adner and Kapoor, 2016). The first fear of organisations is being ready too late and missing the technology shift. The second fear is getting ready too early and depleting resources before the technology shift occurs.

To understand disruptive technology shifts in the industry, there are two distinct considerations for CIOs and businesses (Adner and Kapoor, 2016):

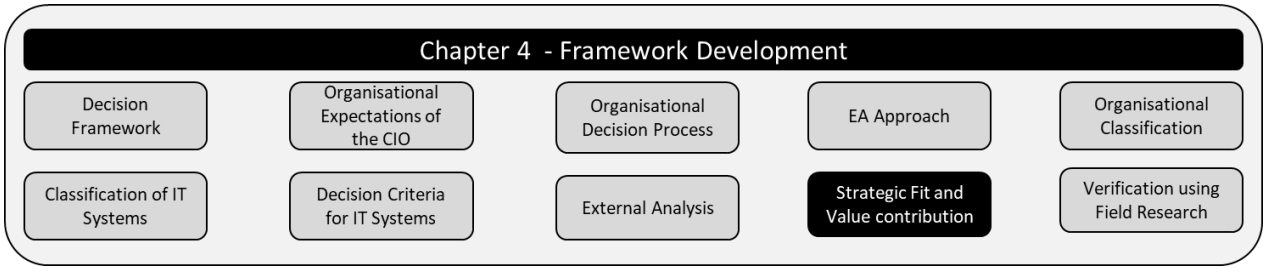
- The technology itself and the broader ecosystem that supports it

- The competition between old and new ecosystems that may exist, which affects the rate of adoption of new technologies.

The maturity and strength of the components of the ecosystems play a significant role in the adoption of disruptive technologies. Some examples of ecosystems playing a critical role in technology adoption are light bulb technologies and HD TVs. New light bulbs using new technologies can be plugged into existing sockets, leveraging existing ecosystems. This results in immediate displacement of older technologies. HD TVs, however, did not gain traction until HD cameras, the latest broadcast standards, production and post-production processes became available. Both technologies caused shifts in their respective industries once the surrounding ecosystems of complementary elements reached a certain level of maturity.

Adner and Kapoor (2016) also highlight the criticality of ecosystems in disruptive technology adoption. Adoption of newer technology can be held back by the ecosystem, while old technology adoption can be accelerated by the improvement in its ecosystem, even if the older technology itself has not improved. The success of new technologies is dependent on how quickly ecosystems develop for users to realise the benefits of the new technology.

CIOs who are expected to play a strategic role in an organisation will have to scan the external market continuously to identify disruptive technologies and technology trends that can affect current business models. CIOs and enterprise architects currently spend most of their time analysing newer technology without consideration of timing, the impact of ecosystems and the impact on business models. Failure to get the timing of decisions right could have negative financial implications for the organisation and its sustainability in a disruptive technology environment.



4.2.8 DMF8: Strategic fit and value contribution

In Chapter 2, various publications highlighted that understanding strategic fit and the value of applications and systems had an influence on strategic IT decision-making in fast-paced agile market conditions, as indicated in Table 3-6. To ensure common understanding of the decision

factors in the decision framework, a model that best describes the concepts highlighted in literature was chosen to explain key concepts emerging from literature. The approach followed in the selection and verification of DMF8 is shown in Figure 50.

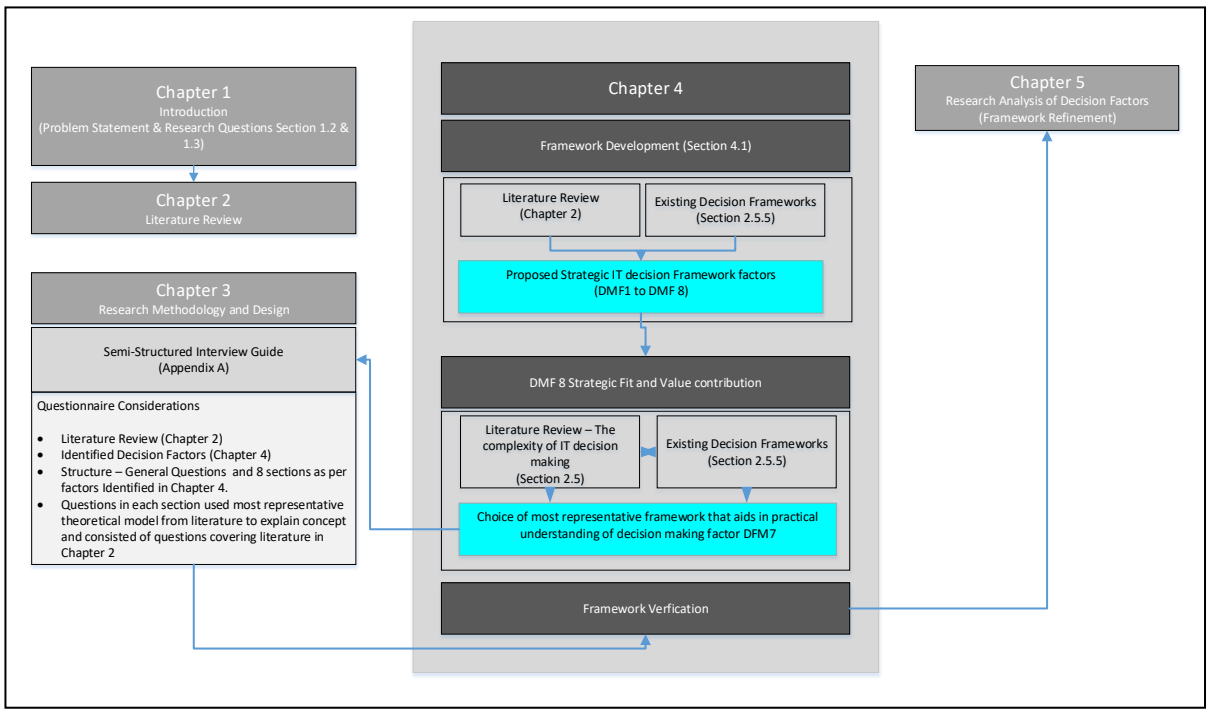


Figure 50 – DMF8 Development and Verification Process

The final factor considered in the decision framework will be an assessment of technology in the context of the business strategy. In current disruptive environments, IT can play a critical role in influencing business strategy. Investment decisions must also be aligned with prevailing business objectives. Financial accounting standards and methodologies is a mature discipline, which has not evolved to cater for investments in disruptive market conditions. Traditional return on investment models may not be applicable in technology-driven industries, as it may be difficult to predict future revenue streams accurately. Organisations such as Facebook, Twitter, WhatsApp and Amazon may not have existed if traditional financial investment models had been used during the early stages of their development, as revenue generation was a secondary consideration and the source of revenue was uncertain.

The challenge is that if traditional accounting principles cannot be used as a measure of future success for future technology investments, CIOs will need to find other ways of justifying business value. The impact of technology investments on non-financial KPIs becomes increasingly important in a disruptive environment. This becomes a challenge because of the

number of stakeholders involved and difficulty in quantifying qualitative value that may be derived from using pervasive IT systems.

IT is generally viewed through different frames, depending on the stakeholder and his or her interest in IT. For example, business owners will be predominantly interested in functional features and convenience of use; however, IT engineers would be interested in technology specification and implementation guidelines. Enterprise architects' role is therefore to ensure that they provide a holistic view of a system from different perspectives, depending on stakeholder group interests. In disruptive conditions, the role of an enterprise architect is to map relationships between enterprise strategic goals, IT investments, products and services and key performance indicators.

To understand strategic fit and value contribution, technology in an enterprise should be classified into different categories, as shown in Figure 51, and be treated differently from an enterprise decision-making perspective (Bente et al., 2012).

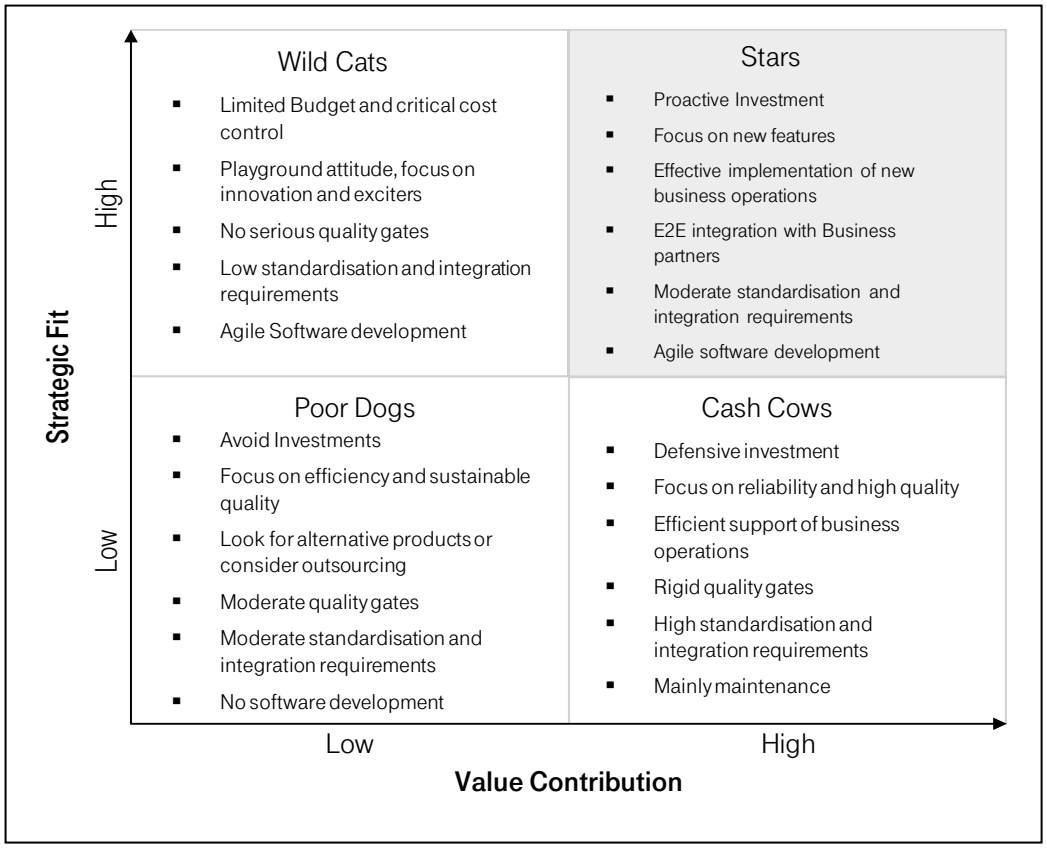
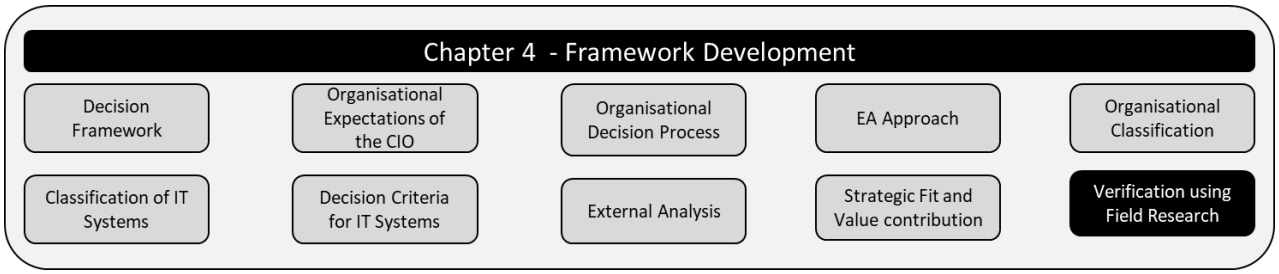


Figure 51 - Strategic Fit vs Value Contribution (Bente, 2012)

The classification of IT systems and new technologies into the different quadrants can provide guidance to CIOs on strategic fit and value contribution derived, which will influence approaches to decision-making, system development and implementation.



4.3 VERIFICATION OF THE STRATEGIC IT DECISION-MAKING FRAMEWORK USING FIELD RESEARCH

4.3.1 Data collection process

To verify the proposed strategic IT decision-making framework, views were solicited from various stakeholders in organisations across industries on the factors identified in section 4.2 to determine if these can be used to guide strategic IT decision-making in a disruptive environment.

For the results to be meaningful, general questions as well as questions related to the factors in the decision framework were asked, as shown in Appendix A. The questions asked were used to determine if the factors in the framework were sufficient to guide strategic IT decision-making and if any additional factors should be included in the decision framework.

During the interview process, participants were given an overview of the problem statement and a high-level summary of the proposed decision framework. This assisted in setting the context for the discussion and ensured that the discussion was focussed on strategic IT decision-making. The interview questionnaire was used to guide the discussion on factors influencing decision-making as identified in the decision framework and to ensure that participants provided sufficient insight into their experience regarding IT decision-making. Participants were encouraged to share their experience by way of examples as far as possible to obtain a true reflection of how strategic IT decisions were made.

During the interviews, participants were asked to provide insight and recommendations on how decisions should be made in a disruptive technology environment that could have assisted them in overcoming challenges that they experienced or to speed up the decision processes in their area of accountability.

4.3.2 Data analysis

The qualitative analysis approach adopted to interpret data that would result in meaningful insights was aligned to key recommendations from Greener and Martelli (2015), which described the following steps:

- Data derived from interviews (Individual structured and semi-structured) was digitally recorded and transcribed before analysis.
- Key themes, ideas and categories were identified relating to theory testing or theory development.
- The next phase was coding or finding meaning, themes and insights within collected data relating to categories or the topic under investigation. A key consideration was to ensure alignment to the overall storyline or analytical thread that links major themes in the research.
- Constant comparative or iterative methods were employed to determine how data and insights fit into themes or categories until a point of saturation was reached.
- Understanding of the influence of bias, lens and language in communication and interpretative of ideas was necessary.
- Contextual notes and artefacts were used to provide additional details and observations on interview transcripts.

Atlas.ti version 8.1 was used as a tool to analyse the data, using coding. The coding process ended when no further themes or concepts emerged from data and the collection process ended when new data did not provide any further insight into the topic being researched (Bryman and Bell, 2011).

Primary data was analysed through multiple iterations to obtain relevant themes, factors, criteria and relationships between factors from the research data. An open coding approach was adopted during this phase to generate key concepts that could be analysed further in subsequent iterations of data analysis. The purpose of this coding process was to confirm and identify factors considered by CIOs when making strategic IT decisions. The coding process identified key phrases, sentences and themes relating to the role of CIOs, decision-making, IT strategy development, prioritisation and how CIOs execute their responsibilities and accountabilities in adding value to their organisations. During this phase codes were kept to a minimum, while ensuring that the meaning of the defined codes was not lost in the translation process.

Some of the considerations in coding were based on the following approach (Bryman et al., 2008):

- What does the item of data represent?
- What is the data about?
- What topic does the item of data represent?
- What question does the item of data answer or suggest?
- What are people doing or say they are doing?
- What events are going on?

The coding process highlighted the repetition of key phrases that described roles, accountabilities and factors influencing IT decision-making in agile business conditions. Care was taken to ensure that CIOs' narrative regarding their approach to creating value within their organisation was maintained (Bryman et al., 2008). A list of codes identified and their frequency of occurrence during the coding process is shown in Figure 52.

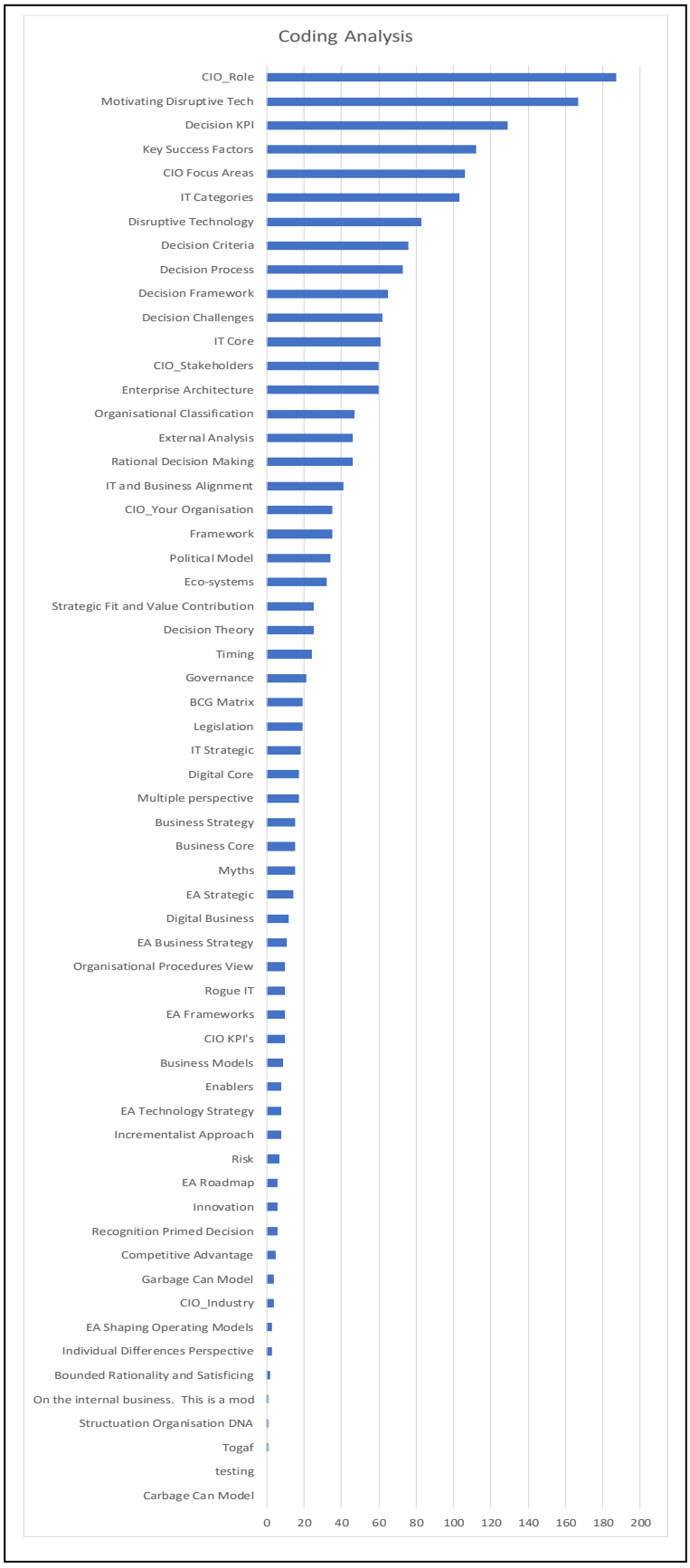


Figure 52 - Phase 1 Codes

The DMFs defined in section 4.1 of this research guided the next phase of analysis on codes identified in Figure 52. The approach followed was to determine if each of the codes could be logically mapped to the DMFs in the framework. During the mapping process, certain codes were found to be linked to multiple factors, as show in Figure 53. Interview transcripts were analysed in greater detail to understand the context, intent and relationships between defined codes. During this process, factors identified in Figure 52 were analysed in the context of the proposed decision framework to determine if factors could be consolidated into the identified DMF or if new factors should be introduced into the decision framework. After the detailed coding exercise, nine key factors were identified that influenced strategic IT decision-making. The additional factor identified during the analysis related to governance, risk and compliance (GRC). This was then included as the ninth factor in the strategic IT decision-making framework.

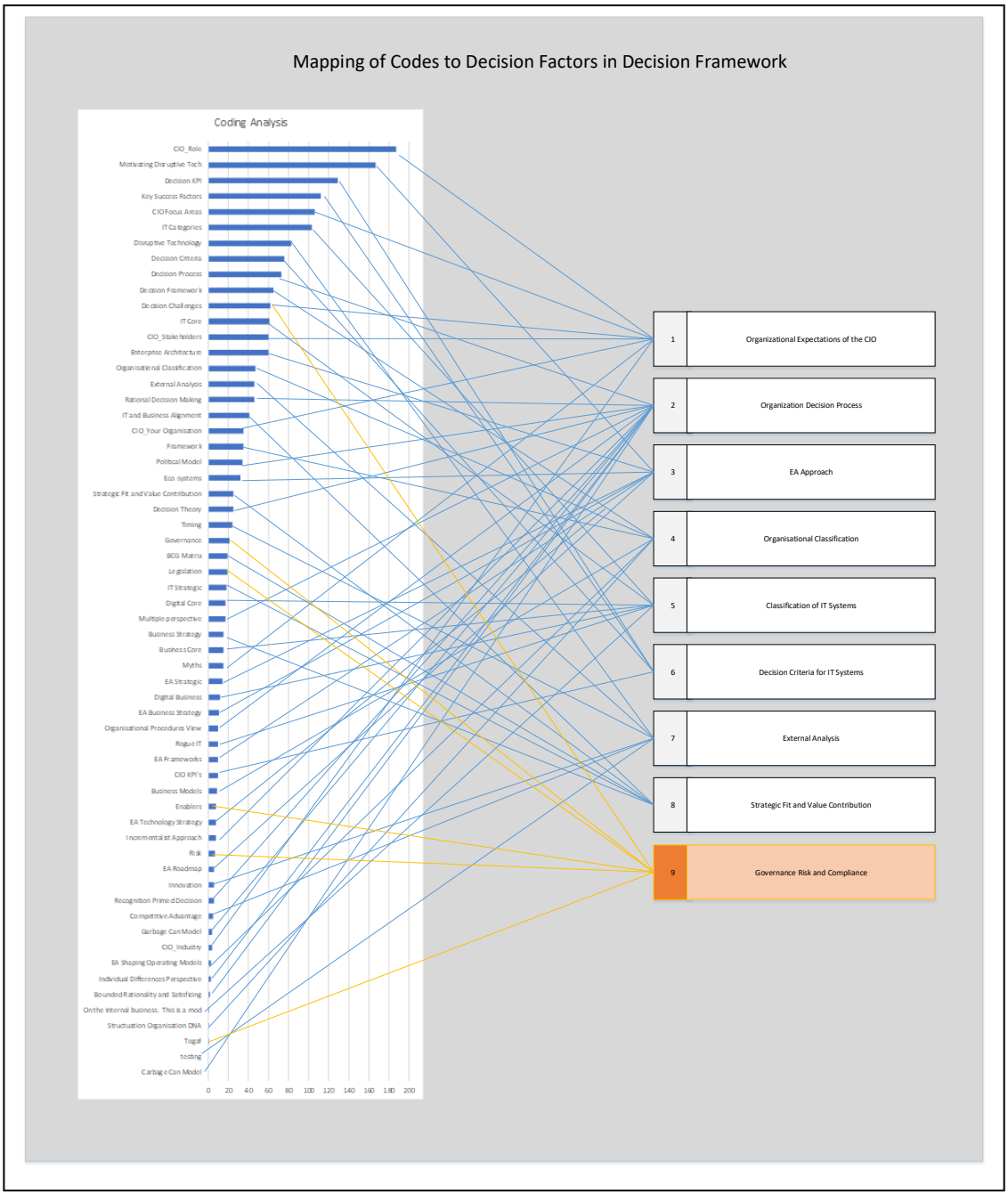
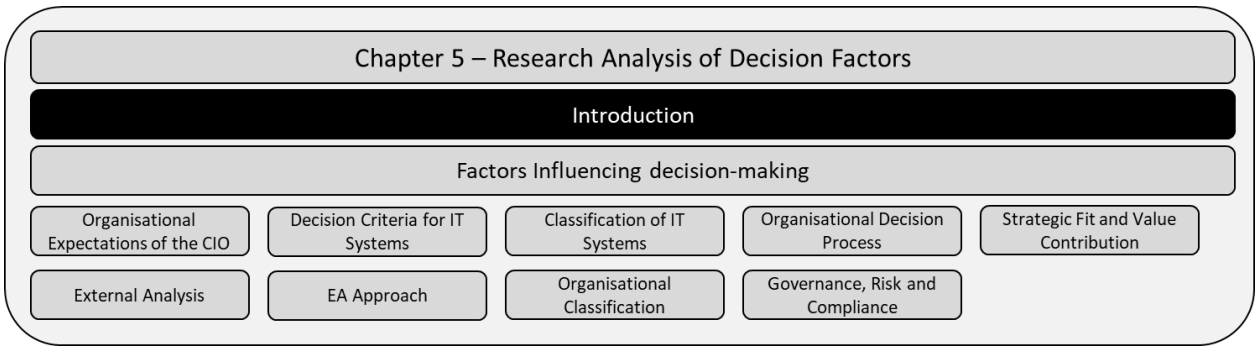


Figure 53 - Phase 2 Data Analysis Results

4.3.3 Summary of data analysis results

The intent of consolidating and categorising factors was to verify that the framework developed in section 4.1 correlated to the outcome of the data analysis without losing the context and essence of the interview results. The consolidation process entailed a process of elimination, i.e. each unique code was analysed to determine if its meaning could be related or explained when combined under a factor identified in the proposed decision-making framework given in section 4.1. During the analysis, some codes did not fit the proposed framework, as they were rather related to GRC. This was then added as an additional factor into the strategic IT decision framework.

The outcome of the literature review and analysis of interview results with IT decision makers revealed that the factors identified in the framework developed in Chapter 4 formed the basis of a comprehensive framework that could assist CIOs with strategic IT decision-making in a disruptive technology environment. The nine key factors influencing strategic IT decision-making were then further analysed in Chapter 5, to identify criteria considered in each of the factors in the framework.



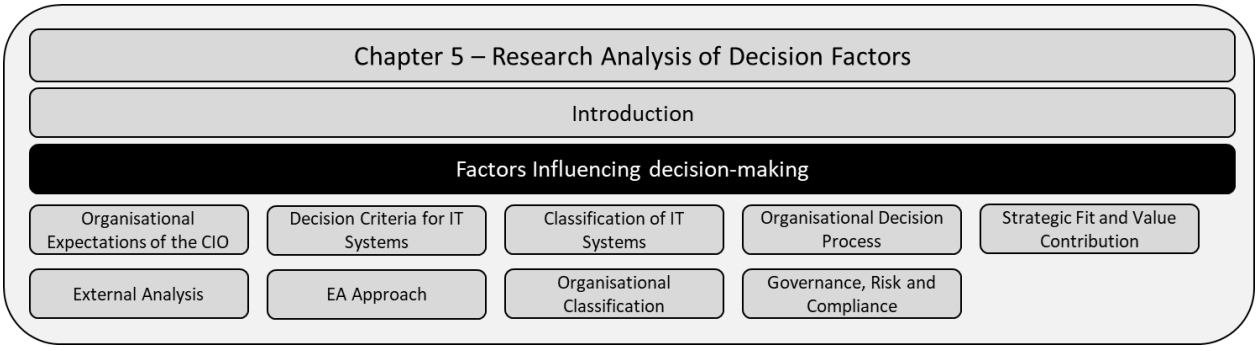
5 RESEARCH ANALYSIS OF DECISION FACTORS

5.1 INTRODUCTION

Chapter 4 in this thesis constructed a strategic IT decision-making framework, which can be used as a guide for CIOs when making strategic IT-related decisions from a disruptive technology perspective. The proposed framework was formulated from existing literature and decision frameworks and confirmed by field experts from across organisations and industries. As a semi-structured interview process was followed, participants went into detailed discussions on how they made strategic IT decisions in a disruptive technology environment. The details of discussions with interviewee participants are described in this chapter.

Chapter 4 addressed SRQ1 in this thesis:
SRQ1:
"What are the key factors in a framework that CIOs should consider when making strategic IT decisions in an organisation in agile business conditions?"

The focus of this chapter is on addressing SRQ2 in this thesis:
SRQ2:
"How can the decision framework be refined with input from field experts based on their current experience in making decisions in a disruptive environment?"



5.2 ANALYSIS OF FACTORS INFLUENCING DECISION-MAKING

The key factors of the decision framework defined in Chapter 4 are shown in Figure 54 in order of importance as identified by interview participants. This chapter reports on the analysis of the interview data, as shown in Appendix D to Appendix P, where questions were asked according to the eight decision factors. Chapter 5 therefore serves to evaluate the decision factors in greater detail to refine the developed framework further.

The next section describes the results of further data analysis on interview transcript data aligned to the nine key factors of the decision framework identified in Chapter 4.

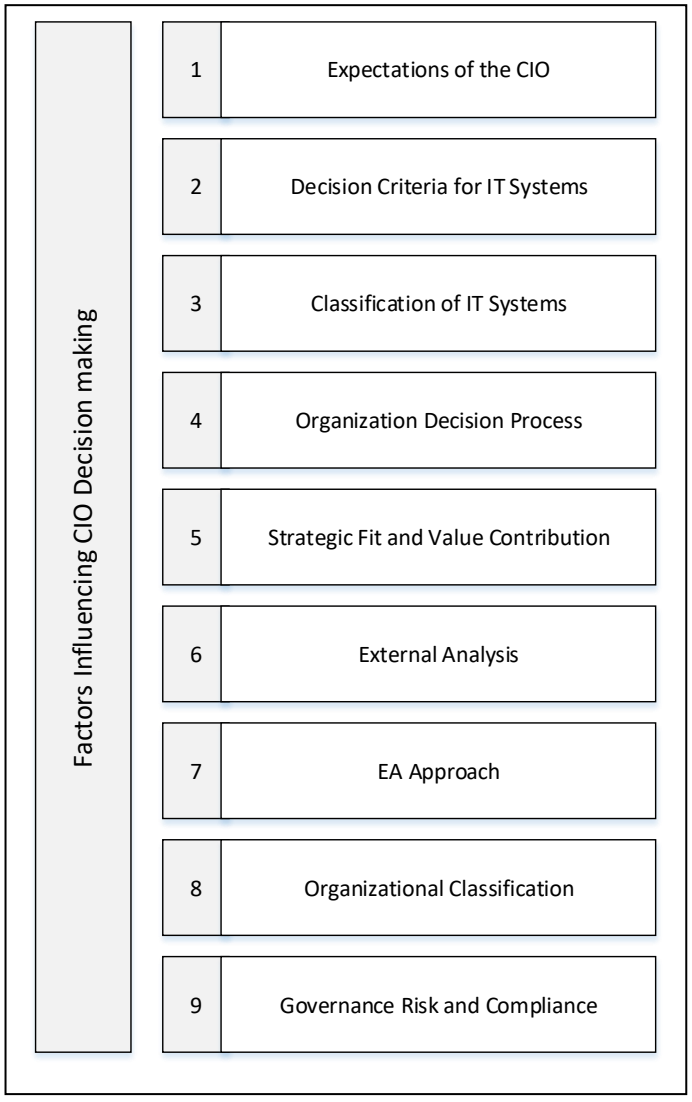
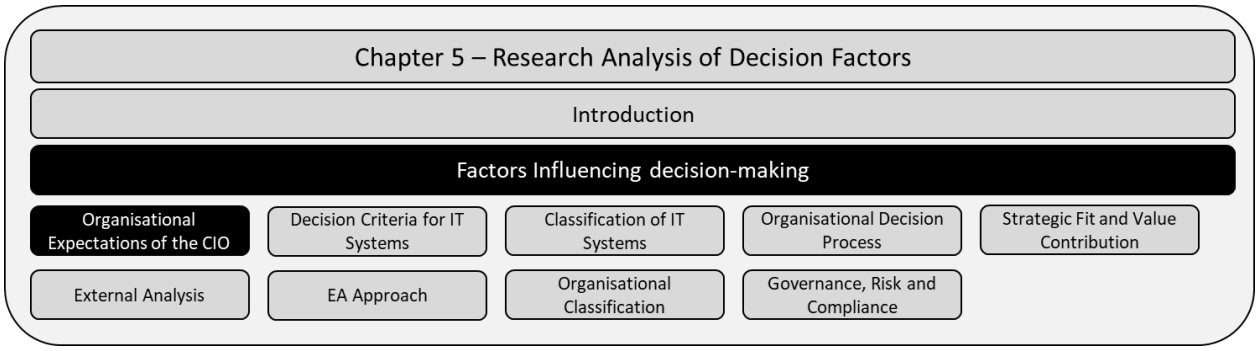


Figure 54 - Factors Influencing Strategic IT Decision-making

The following section analyses the decision-making factors in greater detail and identifies key criteria that influence activities and decisions made by CIOs in carrying out their mandate in an organisation. The information presented is based on the analysis of interview transcripts to understand how the decision factors identified in Chapter 4 influence strategic IT decision-making.



5.2.1 Organisational Expectations of the CIO

This section explored the role of CIOs and the activities and priorities on which they spent most of their time. The questions were structured to determine if there was a correlation between how strategic they deemed their role to be in an organisation and their actual time allocation based on what they were focussed on in their organisations.

Participants were asked various questions about their role and expectations of them in their organisations, based on the analysis of Heller (2012) on the CIO paradox. Questions were asked on 1) the role of the CIO, 2) organisations' expectations of the CIO, 3) stakeholders' expectations of the CIO and 4) industry expectations of the CIO. Semi-structured interviews were conducted where questions guided the discussions and participants were asked to express their view and experiences on the different facets of their role in an organisation and its influence on strategic IT decision-making. The questions were structured to obtain answers reflecting their views on the strategic nature of the CIO's role and the focus areas for CIOs, based on their understanding of the role. Participants were also asked to rate the percentage of time spent on different activities. This quantitative data was used to enrich the qualitative data. These questions can be found in Appendix A.

Most participants viewed the role of a CIO as strategic and critical to the success of their businesses, but mentioned that the majority of CIOs were spending time on operational management or "keeping the lights on". Interviews clearly highlighted the gap between ambition and reality. CIOs are very clear in terms of what needs to be done for technology to become a

strategic enabler and create strategic advantage, but there seems to be a disconnect in terms of what is being implemented or where most CIOs' time and effort are being consumed.

A statement by a senior IT management consultant on his interactions with various CIOs, *"They talk strategy, they want to do strategy, they want a strategic plan, but all they focus on is continuous service improvement"*, is a good summary of many of the participants' sentiments on the role of the CIO.

The interviews focussed on understanding what CIOs considered key factors for them to be successful in their role, especially when viewed from an agile business environment. The results of the analysis in Figure 55 do not depict the percentage of time spent on the activities identified; they are an indication of the number of times priorities were mentioned in the thematic coding analysis. Figure 55 provides an overview of organisational expectations and CIO priorities in adding value to business in a disruptive technology environment.

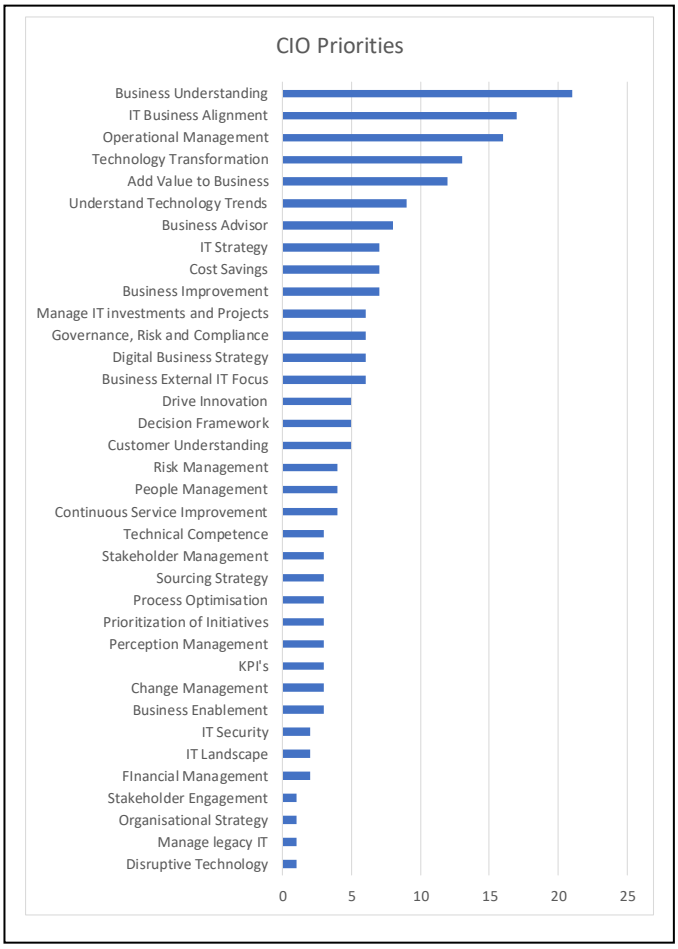


Figure 55 - CIO Priorities- Data Analysis

A key success factor that was common in many of the discussions was understanding of business and aligning to business strategy. In many of the cases, discussions on strategy related to IT strategy rather than business strategy. Many CIOs therefore view themselves as business enablers, i.e. supporting business managers to implement their strategy to grow the overall business:

> *Business sets the strategy, whatever it is and there's a demand statement to IT and then in terms of the way you make a call, you look at keeping the lights burning, improving business operations. There's regulatory topics and then there's transformation. So, linked to the business strategy.*

The key focus areas emanating from the analysis relate to business understanding, business alignment and adding value to business. This indicates that many of the CIOs view themselves as an organisational unit separate from the business, as opposed to being fully immersed in the business.

Most CIOs understand the importance of focussing on customers. This relates to consumers of IT services as opposed to consumers of the organisation's products and services. Some of the business executives interviewed viewed IT as a critical support function to enable stability, agility and sustainability of the organisation, "keeping the lights on", whereas traditional IT departments were often viewed as cost centres that had to "do more with less" on a continuous basis.

Some relevant quotations from the interviews illustrating the operational focus of CIOs are as follows:

- *They really are classically orientated – we are doing this five-year strategy for this company. I got absolutely no strategic direction from a single IT person in the whole organisation. Not one single initiative. Then I went to the COO and I said listen this is all I have been given. There is nothing strategic here; this is just polishing the shoes. That is all.*
- *… because every organisation gives too little budget to IT. So, you are always fighting fires. So, he has got no time to be strategic. So, in fighting fires, it drives him to do continuous improvement things like outsourcing.*
- *And that is why it is very bad to promote technical guy to CIO. Because if you have grown up in tech; you start. You left school and got into tech, because you love software and you love internet, and you love all that stuff. You do not love business.*

Nowhere are you ever - Even if you become CIO along that path, are you ever going to start loving business.

The outcome of the analysis clearly indicated the importance of CIOs focussing on business understanding as a key priority for them to be successful in their role as a CIO and in enabling business success.

In only two of the interviews conducted did business customers feature extensively in the discussions. In most discussions, the focus was mainly on understanding the business and strategy as determined by company business executives and therefore aligning IT in enabling business strategy. Comments from a banking CIO highlight the role of IT in business:

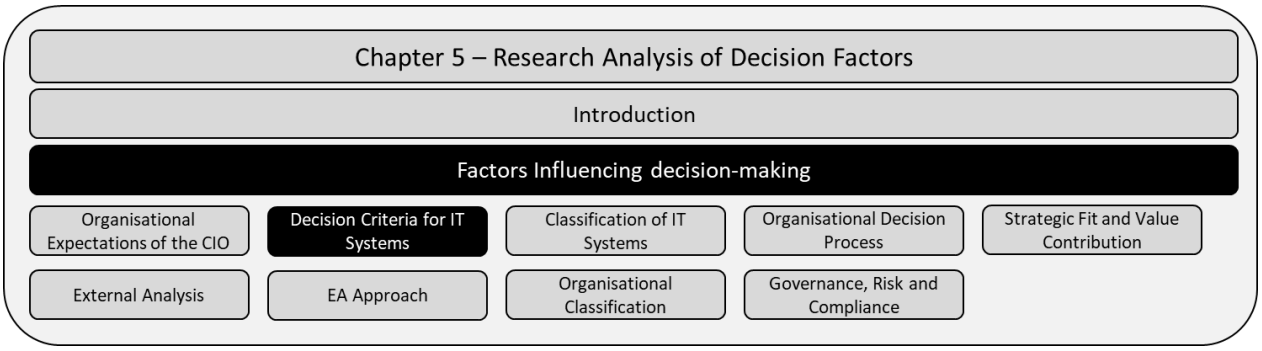
… if you look at it, that is also probably where the biggest part of your capital goes in, is transform the business. We ran an analysis over the last couple of years. Certainly, in terms of the change of organisation and certainly where we are going, that is where the bigger part of our investment is, is transform the business because the mandate of a bank is changing. New business units are coming in. Policies are changing. You need the technology to deal with that and that is where transformation come[s] in. It is also about significant changing in your business models. There, once again, is when it comes to transform the business especially if I look at, and that is why it is so important when I speak about the business model is your culture.

For organisations to compete in a disruptive environment, stability of the operational environment was identified as critical:

From a decision-making point of view there's certainly, and I see you've put those four quadrants, what I always look at is in terms of what is that you need to keep the lights burning? Those are things that you don't need to debate about. Decision-making, the initial investment on keeping the lights burning gets made and you just repeat it down here. Then you get those that you can improve the business. It's those fundamentals that you put in and you say let's leverage upon it to further bring in efficiencies, economies of scale.

An interesting observation was that most of the CIOs interviewed did not focus on technology. Discussions revolved around how technology enables business to be successful. Disruptive

technologies identified in the literature review stage of this research rarely featured. "Disruptive technology" was mentioned least often in the data analysis as well.



5.2.2 Decision criteria for IT systems

The questions revolved around the criteria used to determine areas of focus or consideration when making decisions on classic IT or disruptive technologies in an organisation. Questions asked, which can be found in Appendix A, focussed on understanding if different criteria were used in making strategic IT decisions on systems classified according to the BIDD model described in section 4.2.5. To differentiate between different IT systems in an organisation, the author of this thesis has proposed the BIDD model as interpreted from various publications on IT system classification. The BIDD model is an original contribution in this research and was used as a basis for discussions with interview participants to understand if different decision criteria were used for systems in the different quadrants of the model. (See section 4.2.5 for a discussion of the model.)

The two most prominent factors that featured in almost every discussion were stability of operations ("keeping the lights on") and financial considerations. Financial considerations can be broken down further into revenue, costs and profit. Most CIOs did not differentiate between the different types of innovation or technology when evaluating criteria that will influence decision-making. Nevertheless, financial considerations were the key determining factor in all decisions.

Thematic analysis of interview transcripts identified 50 factors considered by CIOs when evaluating technology or the implementation of technology in an organisation, as shown in Figure 56. The bar chart shows the number of times a decision criterion was mentioned during the interviews with CIOs.

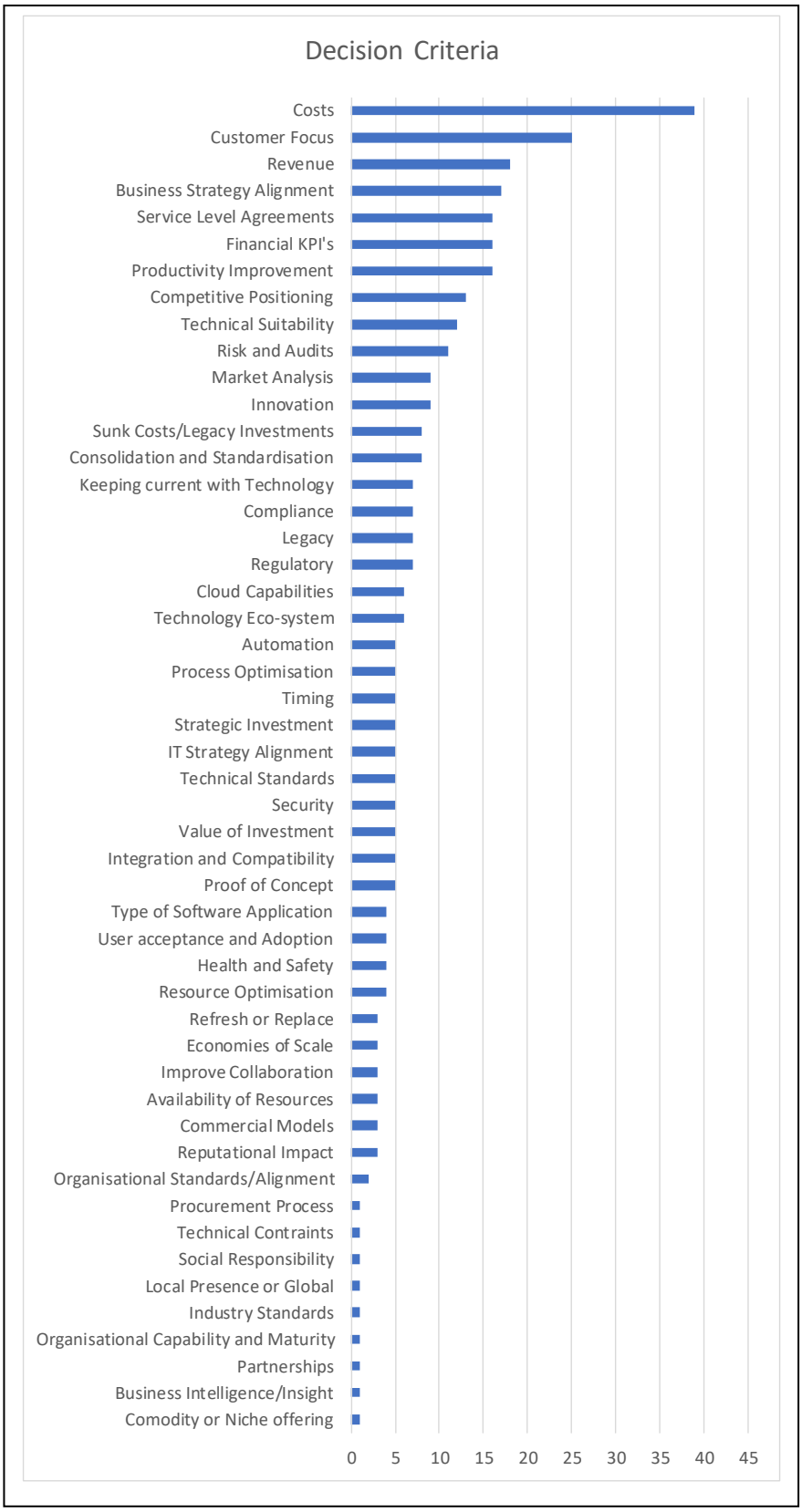


Figure 56 - Decision Criteria for IT Systems

The analysis highlighted the complexity in CIOs' decision-making in the execution of their mandate. The common categories in interviews were costs and customer focus. "Customer" in almost every discussion referred to internal organisational users of technology as opposed to external customers who consume products and services. An iterative approach was followed as interviews progressed. CIOs were asked about the applicability of some of the criteria identified in previous interviews with them if anything was missed during a discussion. In every discussion, the criteria mentioned were acknowledged to be applicable to them as well, although these were not mentioned in their interviews.

The factors identified were common across all industries. However some of the factors, such as health and safety, were more critical in industries such as mining, where safety incidents could result in the loss of lives or revoking of mining licences.

The following section briefly summarises some of the discussions with CIOs on the most pertinent decision criteria depicted in Figure 57.

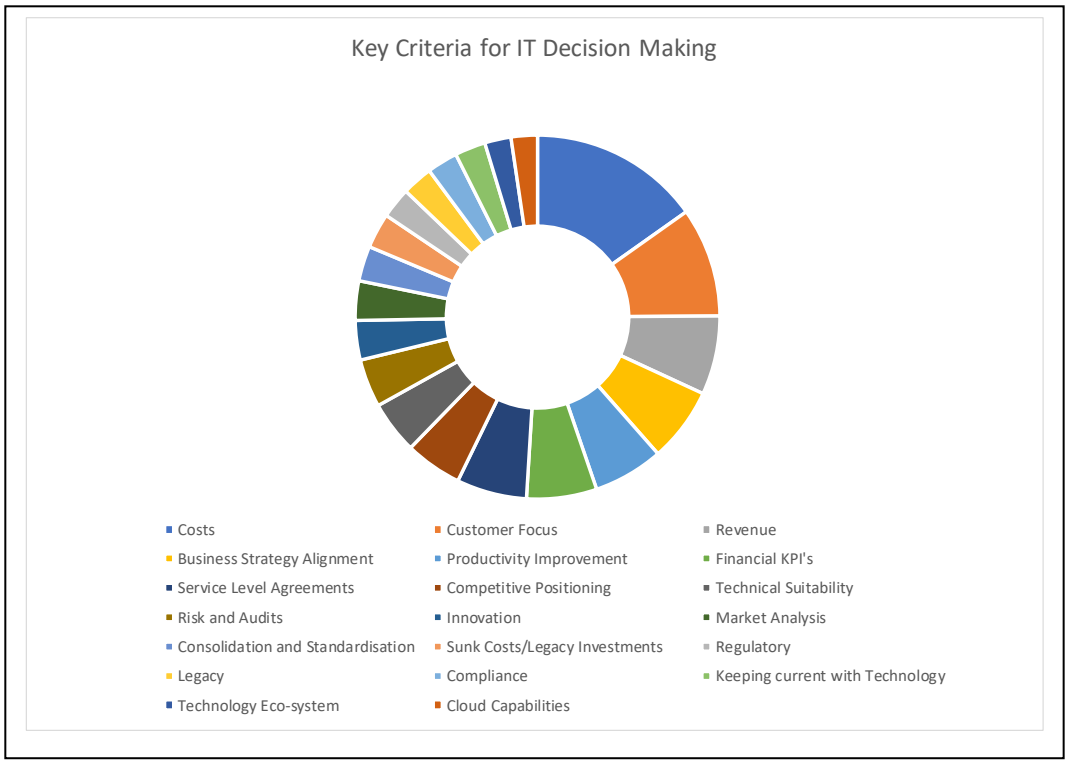


Figure 57 - Key Decision Criteria

5.2.2.1 Costs

The universal challenge experienced by CIOs in most organisations was that IT was viewed as a cost centre that had to "do more with less" on an annual basis to allow the organisation to be more competitive. IT in general was viewed as a critical enabler to the business, not as a source of competitive advantage. In many instances, IT was viewed as a commodity offering, with the expectation that IT should always be available and in many cases invisible to the business:

> *I think it always boils down to cost. As much as we want to say we want to be disruptive, we need to be disruptive within budget.*

The statement above from one of the CIOs identifies the challenge CIOs experience in responding to disruptive threats in the industry.

Another comment from a CIO on how they go about reducing costs was as follows:

> *Of course, wherever else you could automate, where you save people you would reduce – you would improve your costs situation on the long run. So those were the business drivers.*

One of the CIOs from a leading multimedia organisation mentioned that one of the mechanisms he uses to invest in disruptive technologies is to fulfil business savings expectations. He will not declare any additional savings and would rather use these to fund additional investments.

The sentiment in most discussions was that a CIOs success was generally based on cost savings, which explained why most CIO effort was focussed on internal activities as opposed to reacting to external disruptive technology threats.

5.2.2.2 Customer focus

CIOs predominantly viewed business as the customer and generally placed huge focus on ensuring IT fulfils business expectations. CIOs in technology-driven industries, such as retail, multimedia and banking, shifted the focus from internal organisational expectations to focussing on changing customer experience:

The other thing that has changed is, and rather belatedly, is the lens that used to be applied to investments – particularly in terms of IT – is now very much centred on client experience and deriving value for the client.

Many CIOs adopted a design thinking approach (Sinek, 2011), where the customer is the centre of the universe, with less focus on technology and more on business requirements. In disruptive environments, CIOs acknowledge the changing lens required to build IT on expectations of customers as opposed to opinions of internal IT staff. Two statements from a banking executive and the CIO of a retail bank summarise the change in perspective:

And it is very much an outside-in approach, where we have become very good at asking our own staff and ourselves questions where perhaps we are sort of pre-programmed with an answer which may not necessarily be the one that our client would give us.

That is the centre of our – let us call it – design approach. So, design thinking have – let us call it – definition. But if you put the client at the centre of what we are doing and design with their needs in mind, with the ability to anticipate that those needs in a digital universe, are likely to meander change a lot more frequently than perhaps they might have done in the past, simply being afforded with the avenue of choice of doing something which you could only do in one of two ways. Now you can make a payment, you can create banking relationship, you can service some of that stuff in a number of different ways.

The statements below typically show the role of the CIO in enabling business to achieve strategic objectives:

CRM, so the business strategy is consumer engagement, understanding the consumer. In my KPI it is, deploy CRM across the board.

… putting the client at the centre of that, put the analytics; some of the artificial intelligence or the smarts around that – almost that decision point, to be able to provide the client with a value in whatever their chosen interaction is.

5.2.2.3 Revenue

Revenue as a decision criterion also featured strongly in discussions with CIOs on factors influencing decision-making. CIOs indicated that depending on the value of IT investment required, larger investments generally need CEO, CFO and board approval:

> *"They say right, is there a cost benefit here or a revenue upside of what you're doing. If there is, yes, and depending on the amount that you're asking for, it goes to certain levels in the organisation as well."*

One of the CIOs interviewed said:

> *They talk about three things and two of them were finance; making money, save money and then compliance.*

Executive management in every organisation considers finance the most important criterion for any IT-related decision. The challenge for most CIOs therefore is to find ways to justify IT investments by linking benefits to either an increase in revenue or a decrease in costs.

All CIOs interviewed acknowledged the challenge posed by disruptive technology and disruptive organisations, but struggled to find mechanisms to justify any investment without financial justification. A banking executive interviewed mentioned that they overcame this challenge by creating a central innovation budget, which was separate from the IT budget. To obtain funding from the innovation budget, teams had to submit a motivation to an innovation board that made the final decision on which project was approved to receive the necessary funding. Although this approach addressed the budget challenge, not all ideas were approved, and this tended to stifle innovation over the longer term.

Executives were also asked about their views on how they responded to disruptive organisations emanating from unrelated industries or those that were not constrained by legacy IT investments. Some CIOs saw them as a threat, while others saw this as an innovation opportunity:

> *It could be a case of, here's a revenue opportunity for us to, to leverage, because we think they're going to be highly successful, and let's invest in them.*

Some CIOs viewed disruptive, more agile organisations as an opportunity to observe whether certain technologies or products were going to be successful and then invest in or acquire these organisations if the idea proved successful. In disruptive technology environments, CIOs tend to analyse the market and competitive landscape thoroughly before spending their scarce budgets on testing newer technology in their organisations.

5.2.2.4 Business strategy alignment

Most CIOs interviewed saw their roles as aligning and enabling organisational strategy using technology. From a disruptive technology perspective, the view was that CIOs need to introduce the latest technology to enable strategies such as going digital, multi-channel banking or retail, or doing "*stuff faster, smarter or cheaper.*"

The quotation below from a strategic IT management consultant, who has been consulting to organisations for the last 19 years, summarises the general approach to IT strategy:

> *We are doing the final five-year strategy of this organisation tomorrow. I got absolutely no strategic direction from a single IT person in the whole organisation. Not one single initiative. Then I went to the COO and I said listen this is all I have been given. There is nothing strategic here; this is just polishing the shoes. That is all. … Then I was dished out nine strategic initiates in five minutes from the COO. Then I went back to the CIO and I said right this is what they want; here is the strategic initiatives. How are we going to make it happen? Then I had to take each one of those and break them down – on what has got to be done, right from investigation to this to that, to deployment and to the time lines. Suddenly they had nine strategic initiatives over the next five years. But it took the COO five minutes to tell me the strategic initiatives. And IT have never heard of them."*

The statement below from a senior IT executive at a large mobile operator explains the role of the CEO and CIO in organisational strategy development:

> *The CEO – a CEO is looking out and he is scouting and saying where is my market going? Okay the market is changing. Right? The CIO is not looking out – he is looking at technology, change, keeping the lights on, running the operation, sitting and engaging with the technical guys about technology. But he is not looking out – He might see a potential that technology can bring many remedies to the table. But*

the CEO, he will look for something totally out. The CEO sits there and says shucks, we are making clothing, it is the wrong space to be in. I am going to change this business; tomorrow I am going to make – I am going to make tents. Why? Because a lot of natural disasters. Clothing is hard to sell. So, he changes the business. He comes back and says to IT I want you to reorganise everything; I don't care how.

Another pertinent quotation from the CIO of a multi-media organisation explains the role of the CIO in business and IT alignment:

The CIO influences the effectiveness of the business, by bringing in new channels; increasing market share and stuff like that. The CEO affects the business in terms of saying well guys we are closing now this business, we are going to go into this business because of competition or opportunities identified …

5.2.2.5 Productivity improvement

One of the areas on which most CIOs spend time is improving the productivity of their businesses. The challenge for CIOs is generally two-fold – firstly they need constantly to "do more with less" - less headcount and a lower budget - and secondly, they need to use IT to optimise their business processes.

To motivate any technology investments, one of the key factors considered in established organisations is how the new technology enables business productivity by either decreasing costs or increasing revenue.

An ex-CIO of a global mining organisation, who is now working for a global IT organisation in the Netherlands, describes the role of productivity in decision-making:

How do you reduce your costs – In mining everything gets measured in productivity state. So how many tons per person do you mine? Or how many grams per ton? So, everything in mining is based on how do you improve productivity. So that is how we measure efficiency. How many tons did you produce per man, and you have got all these people underground. So, automation – You would improve your productivity by automation for example. You would have less people in the plant or – If we had improvements underground where those machines which they drill with, we need that light weight machines and so forth. Every time you produce machine like that, then

you reduce it by 2 x 2 people kind of thing. So that would give you more efficiencies and so on. Productivity is a topic that IT automation or implementation can enable. By introducing these technological changes, we could improve in some plants, our recovery rate to 86%. Which means that immediately you save six to eight percent of product, and it is, in monetary terms, one hell of an improvement.

CIOs acknowledged that unless they could demonstrate how disruptive technology could improve productivity, it was extremely difficult to convince stakeholders to approve newer technology. An observation from interviews was that established organisations focussed on what made them successful in the past; technology that enabled stability of operations or incremental innovation linked to the organisation's core capability was viewed favourably by executives. CIOs therefore focussed effort on what was expected or acceptable to the organisation as opposed to focussing on disruptive technology or disruptive organisations.

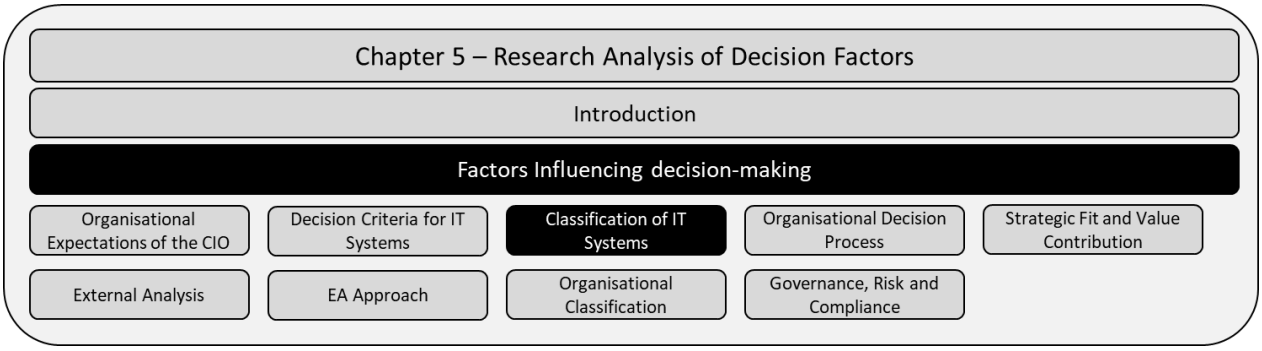
5.2.2.6 Other evaluation criteria

Various other criteria were identified throughout the interview process, as shown in Figures 56 and 57. Many of the criteria identified can be consolidated as part of the major criteria described in this section. To provide a framework for IT decision-making, it was decided to show them separately to preserve the intent of each of the criteria in influencing decision-making.

Decision criterion that seem to be gaining prominence in South Africa following recent media articles relating to state capture are the following:

- GRC
- Legislation
- Audits
- Reputation impact.

A CIO in the financial services industry mentioned that reputational impact was increasingly becoming a discussion point at investment committees and generally supported motivations for IT investments in the organisation.



5.2.3 Classification of IT systems

Questions explored in this section of the interviews explored the roles and accountabilities of CIOs for different IT systems deployed in an organisation according to the BIDD model classification. (Refer to Chapter 4 section 4.2.5 for additional information on the BIDD model.) Questions discussed in this section can be found in Appendix A.

Almost all organisations use technology (programmable logic controllers, control systems, manufacturing execution systems, points of sale, customer relationship management etc.) to produce goods or services. In a classic IT context, systems (computers, networks, data centres, enterprise resource planning, etc.) were deployed to support and enable the internal operations of a business. With rapid advances in IT, there is a blurring of boundaries between traditional IT systems and business technology systems deployed in organisations. Exponential advances in enabling technologies such as the internet, broadband connectivity and processing power enable organisations to manipulate large quantities of real time data from traditional and business IT systems, to obtain insights that could enhance current competitive advantages or result in transient competitive advantages.

During the literature review phase of this research, IT in most organisations could be classified into internal business IT and external business IT, as illustrated in Figure 58. In the interviews CIOs were presented with the classification as defined in this research and asked to express their views on the applicability of this categorisation in their organisational context.

One of the CIOs described challenges in their organisation regarding decision-making due to the different classification of IT systems:

> *Basically, what we do, I think it works from a maturity perspective, some of the CIOs just operate on a technical side. That thinking means you surround yourself with*

technical people. At the end of the day from my view is that if I am doing something, yes there's IT for IT which I need to invest in technology to make sure that my systems are running effectively. This is your more your demand and capacity planning, that is your IT for IT. You can govern that differently. But very much there is IT for business. What I am doing is, I am doing it for the business. If I don't get the governance for business taking ownership, then we've lost the plot. Because at the end of the day, what typically happens, it is a very convenient mechanism for business to say, it is an IT issue. But at the end of the day, who needs to motivate for them? Not me as a CIO, no. I can't motivate, I need a business partner.

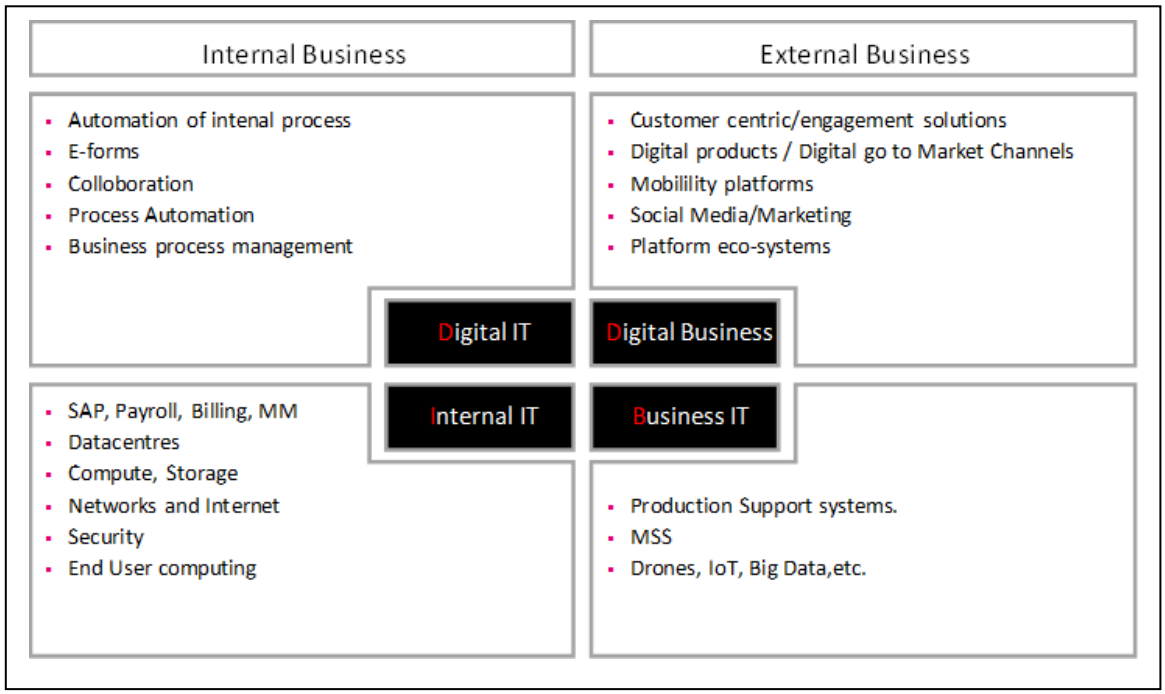


Figure 58 - Classification of IT Systems (According to the BIDD Model)

A comment from a CIO of huge multimedia organisation describes his view on the usefulness of the proposed BIDD model:

I mean I'm, looking at the quadrants that you've put down, I never looked at it from that angle before. It's actually adding so much of value, like personally what I'm doing, even going forward with projects, and I'm going to be deploying and looking at new projects, I can actually use this information to guide me more, and you know, getting user adoption, lobbying, getting approval et cetera, et cetera.

The CIO of a large manufacturing organisation offered the following response to the BIDD model:

> *I like the BIDD model by the way, I ranked the quadrants in terms of value, so my top was external business, my second focus was internal business, and my third jointly was IT core and business core*.

Another pertinent comment from a CIO on the BIDD model was as follows:

> *In other words, it will actually demarcate areas, this classification, different areas, and drive the focus required for the different areas as opposed to focussing on one big kind of block*. *That model is very good, I think. the core and digital offerings. Like we went through here, it explains it very well*.

Most CIOs agree with the classification according to the BIDD model to define roles, accountability, criticality, value etc. of different systems in an organisation. CIOs expressed different views on some of the systems shown in the different quadrants in the example in Figure 58, though they understood that actual IT applications and systems in the quadrants may vary between organisations and industries. However, there was consensus that the BIDD model provided a good framework to classify applications.

A business executive from one of the big four banks in South Africa agreed with the classification, but made the following comment regarding accountability for internal and business IT systems deployed at the bank:

A while ago we had it under one roof, but there's definitely, there's business operations. So, operating the product and servicing the client, and then, the IT operations is making sure the technology capabilities keep up and running in those categories.

Regarding the role of the CIO in the formulation of IT strategy linked to the quadrants in the BIDD model, his comments were as follows:

> *Where the CIO is still in a sense mandated to think about the next logical step for the business that we run, and that can include disruptive changes. But also, under the digital side of the business, we have appointed a chief digital officer who reports directly to the CEO.*

However, an IT executive in the same bank who is accountable for digital transformation was adamant that the CIO of the bank was fully accountable for all technology deployed in the bank. This further illustrates the point that with blurring of the boundaries between business and internal IT systems, accountabilities need to be clearly defined to leverage maximum value out of systems deployed in an organisation.

The CIO from the largest multimedia organisation in South Africa made the following comment when asked about the role of the CIO in the digital business quadrant of the BIDD model:

> *The reality, realities at the moment is no ... right now, in this organisation it's the expectation, the right expectation I would think is yes, IT should play in that space*.

A suggestion from a CIO in a financial services institution was to adopt a design thinking client-centric approach perspective in the BIDD model:

> *Because in a sense, if you take a client view, you actually going to have components out of this entire spectrum that will be deployed in a manner that supports that client experience*.

In his experience, IT classification followed a multi-layer approach, which starts with front-end client interaction systems; followed by the application of security and decision patterns and finally with traditional IT systems, which are typically back-end systems. The CIO agreed with the classification as defined in the BIDD model, but had a different perspective on the application of the BIDD model, which was then incorporated into the final decision framework for CIO decision-making.

Some participants also mentioned that classifications of systems will help them determine where they need to focus to add most value to the organisation and their peers. Although they believe that they add value to the organisation, this is often not recognised by their peers in the organisation:

> *I'm quite clear on this, because with my performance reviews my boss would give me performance reviews which were good, and then you get your peer review by your other directors in the company. I mean they say my people are complaining about the systems being down, and then they judge you against that, what the people complain*

about. Not about the fact that you've brought down, in one year together their teams, the measurements from 30 days to once a week, you know, that kind of stuff.

Further data analysis was conducted on the interview transcripts with the focus on analysing the views of participants on the classification of IT according to the BIDD model. The data analysis process followed can be seen in Figure 59. Thirty-five codes were identified, which were then grouped into the four defined categories.

The findings of the analysis revealed that most CIOs acknowledge that although they spend a significant amount of time focussing on maintaining internal IT systems, their focus should move to enabling digital business using technology for their organisations. The analysis also revealed that most CIOs do not spend time on business IT, as this has traditionally been managed by operational managers or business executives. This finding correlates with the literature review conducted, which illustrates the convergence of traditional business IT with internal IT in most organisations. In the digital business quadrant, convergence often results in the introduction of IT systems and processes that support the functional requirements of internal business users and support the delivery of products and services to the external market.

The following section of this analysis describes the key characteristics of systems in the different quadrants of the BIDD model.

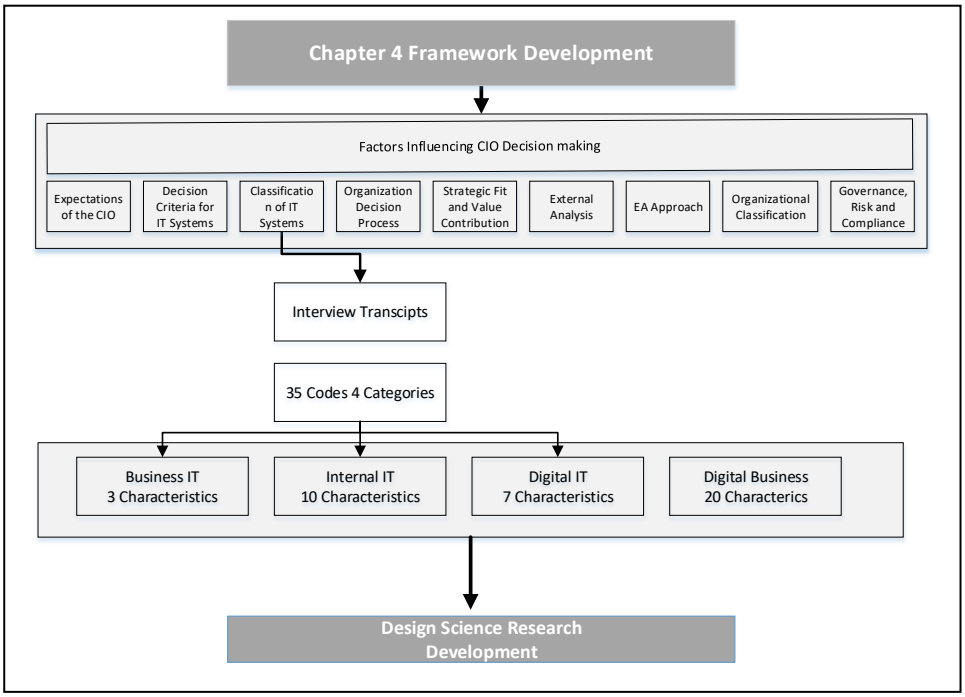


Figure 59 - Detailed analysis - Classification of IT

5.2.3.1 Business IT

Technology in this quadrant mainly relates to systems deployed in an operational or production environment, which enables the production of goods and services. Traditional manufacturing execution systems are merging and integrating with IT systems, enterprise networks, cloud computing, IoT technologies etc., but rarely fall under the accountability and control of CIOs in an organisation.

A comment of a business executive at one of the top four banks in South Africa, summarises the intent of the bank in trying to get business IT under the control of the CIO:

> *"The intention is that, I mean if you, if you ask anybody what the strategic intent in the bank is, that all IT should be run by IT. So, it's not currently, everybody will find a loophole if not to roll it through IT".*

Except for the CIO in a large multimedia organisation, business IT systems did not fall under the control of CIOs. All participants acknowledged the existence of business IT in an organisation and mentioned that these systems are generally managed by business executives with separate budget allocations for the support, maintenance and upgrading of these systems.

The following comment from a mining CIO explains the business perspective of IT relating to production and engineering systems:

> *For those kind of decisions, we had a steering committee comprising of, of strategic directors, financial directors, you know, and IT steerco. That was really the body that made decisions around any IT systems. But the business, the production guys, engineering guys, they weren't really involved in those, those forums, they didn't want to attend those kinds of things. To them IT is just a, a cost centre, you know.*

One of the CIOs interviewed mentioned that he was accountable for GRC, therefore he ensured that standards and policies were defined for the entire organisation that had to be complied with when any technology was purchased or implemented.

5.2.3.2 Internal IT

In most organisations, CIOs are mainly accountable for providing users with tools and systems to support the internal operations of a business. IT systems in this quadrant are critical in providing platforms that enable collaboration and workflow within organisations and systems that support business processes enabling an organisation to interact and transact with customers. A CIO described the approach to building internal IT:

> *When you're looking at building the IT architecture, you want resiliency, what you don't want to do is have to forklift every three, four years, etcetera. You want the flexibility, adaptability, scalability, those are many elements. So, and you don't want to constrain users there suddenly, so you want the ability to burst when required, you want this ultimately, you want this elasticity, then you can stretch in any domain or dimension you want. Think about, why Office 365 taken off so much, because it gives you that flexibility. Our world has changed, you see it's busy changing from a constrained model to a surplus model and you've got to think surplus.*

Key characteristics of IT systems in this quadrant are as follows:

- Ensure IT systems availability and adherence to service level agreements.
- Systems need to be scalable in line with business demand.
- IT systems should be reliable and resilient.
- Systems must be adaptability and flexible.
- Typically, classic IT systems, networks, datacentres, email, collaboration systems, ERP, etc. form the platform or foundation that enables basic business operations.

Most CIOs acknowledge that this quadrant of the BIDD model consumes most of their time and although it is a critical part of the business, it is a commodity service offering that is expected to become cheaper on an annual basis. Businesses expect systems in this quadrant always to be available, despite being generally invisible to the organisation.

A comment from a CIO in a large multimedia organisation provides a view of technologies in the internal IT quadrant of the BIDD model:

> W*hen you get all the products and stuff, they've got no meaning, they're just black boxes. So, whether they use a Cisco router, or a Huawei router is neither here nor there. There is no, the subtleties in terms of, it's not a rage, in the olden days we used*

to compare products and we're comparing products to say, well, which product can go one kilometre faster than the other one or something like that. It's no longer like that game, it's about the value that they add in totality, so the right way of seeing it is starting from the business side, so there's always that push mechanism, but I think the business pull mechanism dominates because you want the solution.

A CEO and group executive of multiple organisations, who was previously a CIO, described the value of systems in this quadrant as follows:

If you look at it, the solutions that people want, this layer becomes obstructed, so no one cares anymore about any individualised device or system. Because I can now consume whatever services I want to consume, from a movie through, all the way through to actual business thing on any device form, so the same thing appears on laptops, cell phones, tablets, PC screens, TVs and now at this stage I played with a smart TV the other day, so if you obstruct to that level, so that's a non-issue, it's now a widget, complete command as widget, next layer, coms. The entire layer is completely commoditised.

5.2.3.3 Digital IT

With advances in technology, CIOs are finding new ways to optimise business processes and reduce operational costs. Participants believe that business expects IT to reduce costs continuously, while driving innovation to simplify and automate internal processes to reduce the costs of servicing a customer.

Most CIOs interviewed drive initiatives in their IT strategy, which enables their businesses to become more agile, fosters seamless "anytime, anywhere" collaboration among employees and automates and digitises tasks to eliminate paper-based processes.

Key attributes of systems in this quadrant are the following:

- Pay for consumption as opposed to owning systems.
- Processes are automated or digitised.
- Manual and paper-based systems are eliminated or digitised.
- The focus is on big data analytics.
- IT systems drive innovation.
- The mindset shifts from a constrained to a surplus model for provision of systems.

- Generally, these systems fall under the accountability of CIOs and EAs.

Pertinent quotes from some of the CIOs on digital IT systems are the following:

> *… e-forms and those sort of things, and process automation, that's going to drive your costs. Business process management, that's going to help your tracking and management of your data.*
>
> *Then they realise, why must I keep it on my media server? when I want it I will get it and that suddenly changes us from a hoarding mentality through to a more consumption orientated mentality, you want the flexibility on your platform to be able to do all of those things.*
>
> *You want, or maybe can bring into your model internal analytics and enriched analytics, external clients can use it as well, but you may not want to share too much with them you know.*
>
> *With regard to digitalisation, we built a business around a very simple and uncomplicated process, supported by low cost IT alternative to support that process.*

CIOs also stated that innovation and value that are visible to users are derived mainly from digitalisation initiatives deployed within their environment.

5.2.3.4 Digital business

CIOs were asked their views on disruptive technology and the value of using disruptive technology in their organisations. In many cases this was viewed as nothing different from evaluating newer technologies that enabled innovation in organisations. CIOs were expected to evaluate newer technologies continuously and facilitate the adoption and acceptance of these technologies in an organisation.

The majority of CIOs interviewed expressed an overwhelming desire to spend more time and energy on activities that enabled digital business as defined in the BIDD model. Most CIOs indicated that “keeping the lights on” demanded most of their attention currently, which implied that very little time was invested in enabling digitising initiatives in their organisations. Figure 60 illustrates views expressed by most CIOs regarding their current time allocation in relation to

where they perceive they can add most value to their organisation. A comment from one of the CIOs articulates the intent of most CIOs in the digital business quadrant:

> *"… regarding digital business, a reality at the moment is no ... the organisation expectation is yes, IT should play in that space*.

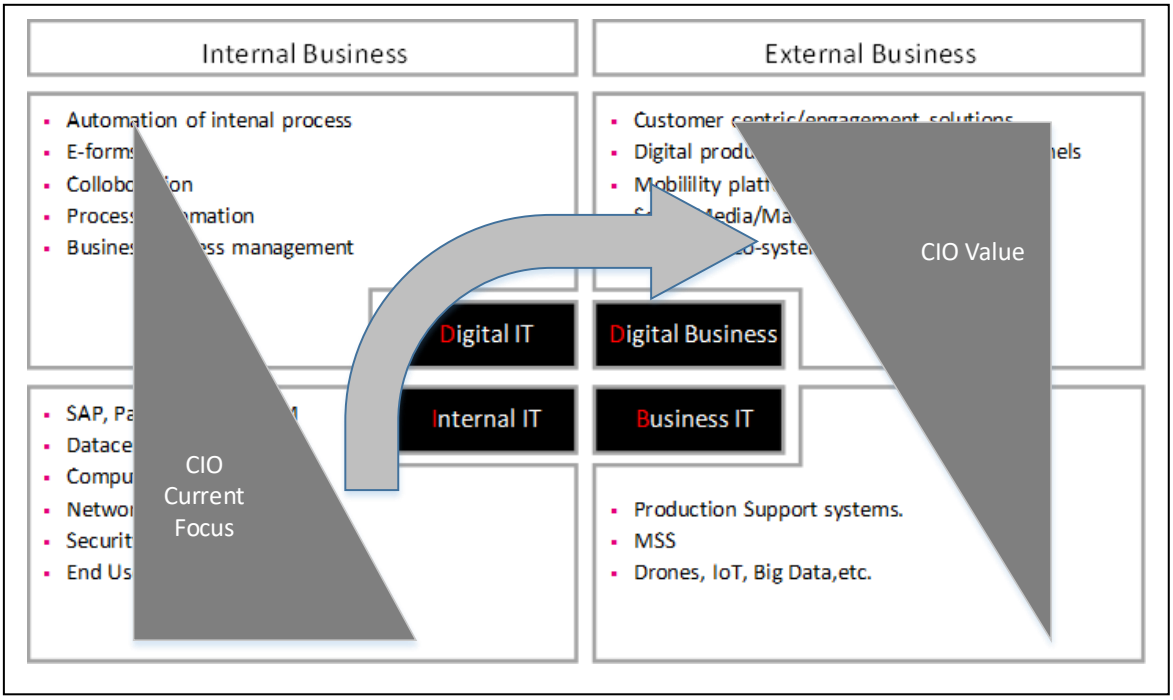


Figure 60 - CIO Strategic Intent

Key attributes of systems enabling digital business are the following:

- Generally, they fall under the function of the chief data officer or the chief marketing officer.
- Services are consumed as a service as required.
- The focus is on understanding customer behaviour and gathering customer information.
- Systems in this quadrant are mainly customer-facing.
- The focus is on understanding or ensuring customer satisfaction.
- The system enables the provisioning of a digital alternative product to customers.
- The system enables multichannel business or multichannel product sales.
- The system enables an organisation's digital business strategy.
- Systems focus on enhancing customer experience.

- IT systems deployed enable organisational innovation.
- The system enables new go-to-market strategies.
- The system generates new revenue streams.
- The system provides personalised customer experience.

Discussions with CIOs highlighted that disruptive technologies enabled transient competitive advantage of organisations or disrupted incumbent organisations that failed to adapt to changing market dynamics. A business executive in a financial services organisation made the following comment regarding accountability for digital business:

> *Where the CIO is still in a sense mandated to think about the next logical step for the business that we run, and that can include disruptive changes. But also, under the digital side of the business, we have appointed a chief digital officer.*

A banking CIO described the approach within their organisation to transform IT to enable digital banking:

> "*The next time the guy comes in and asks for something other than a personal loan, best I know what he or she has with us. To then make the next experience a personal one. We have taken a conscious bet for digital repository, to obtain a 360-degree view of the client, to a process capability, to build an extension of technology – not technology, security solution that lends itself to digital using a sign-on; a decision capability which says I score you at a customer level and not at a product level*.

One of the EAs interviewed highlighted the importance of linking digital business to customer satisfaction:

> *Now if I look at this model, the customer comes up very important, customer satisfaction should be very important because the customer brings you money. That's your digital business. So, I think it is important to define what business you are in. If you as a company, if you haven't defined what business am I, you are going nowhere because you going to plan and discuss the digital areas, mobility, digital, input channels everything to connect to the client but you not going to focus on what's my business? The business core is what brings in, what gives you money for tomorrow to retire, that needs to be supported by the right digital business technology. Your digital business enablement is almost, it's just supporting all of that stuff, it's the enablement.*

CIOs indicated that by using disruptive technologies in enabling digital business, new customers and new markets can be targeted with different channels to market. One of the comments from a financial services business executive explains this concept:

> *So, we have to then say if we are going to put a digital alternative into the market place, we also have to meet the needs of a middle market as well as an upper affluent wealth individual. So, it is how do you take digital instruments like a private wealth app, like what we are doing with the new banking app coming down. How we then reposition and redirect to a secure site to enhance that experience, whilst we build an account opening function, which is as simple and digitally elegant, as the account opening and the liquidity through the front door. But we are delivering on some of the more complex middle market and up value proposition, which are in a sense also inherently digital.*

Digital business also enables organisations to compete with entrenched mature organisations within an industry. A banking executive commented on the strategy adopted by a new disruptive bank in competing with them for market share:

> *They have a branch-based strategy. This is what guys don't understand. It is in essence branch led. But what they did within the branch is they enabled immediate digital enablement as part of that process.*

When asked about how they reacted to competitive threats in the market, his response was as follows:

> *I suppose that's what your digital capability is supposed to do for you, but obviously, as a staff member you want to just have that little more information and, and good information, you know, enriched analytics and those sort of things.*

Findings in this research indicate that classification of systems according to the BIDD model is an important consideration and forms the basis of a strategic IT decision framework. Figure 61 provides a summary of attributes of systems deployed in the various quadrants of the BIDD model. Results from the interviews indicated that different categories of IT systems are deployed within an organisation; however, most CIOs do not differentiate between systems. The view of most CIOs is that categorisation according to the BIDD model can be useful in formulating a

strategic IT decision-making framework. The BIDD model as suggested in section 4.2.5 is therefore enhanced by the input from CIOs during interviews and is given in Figure 61.

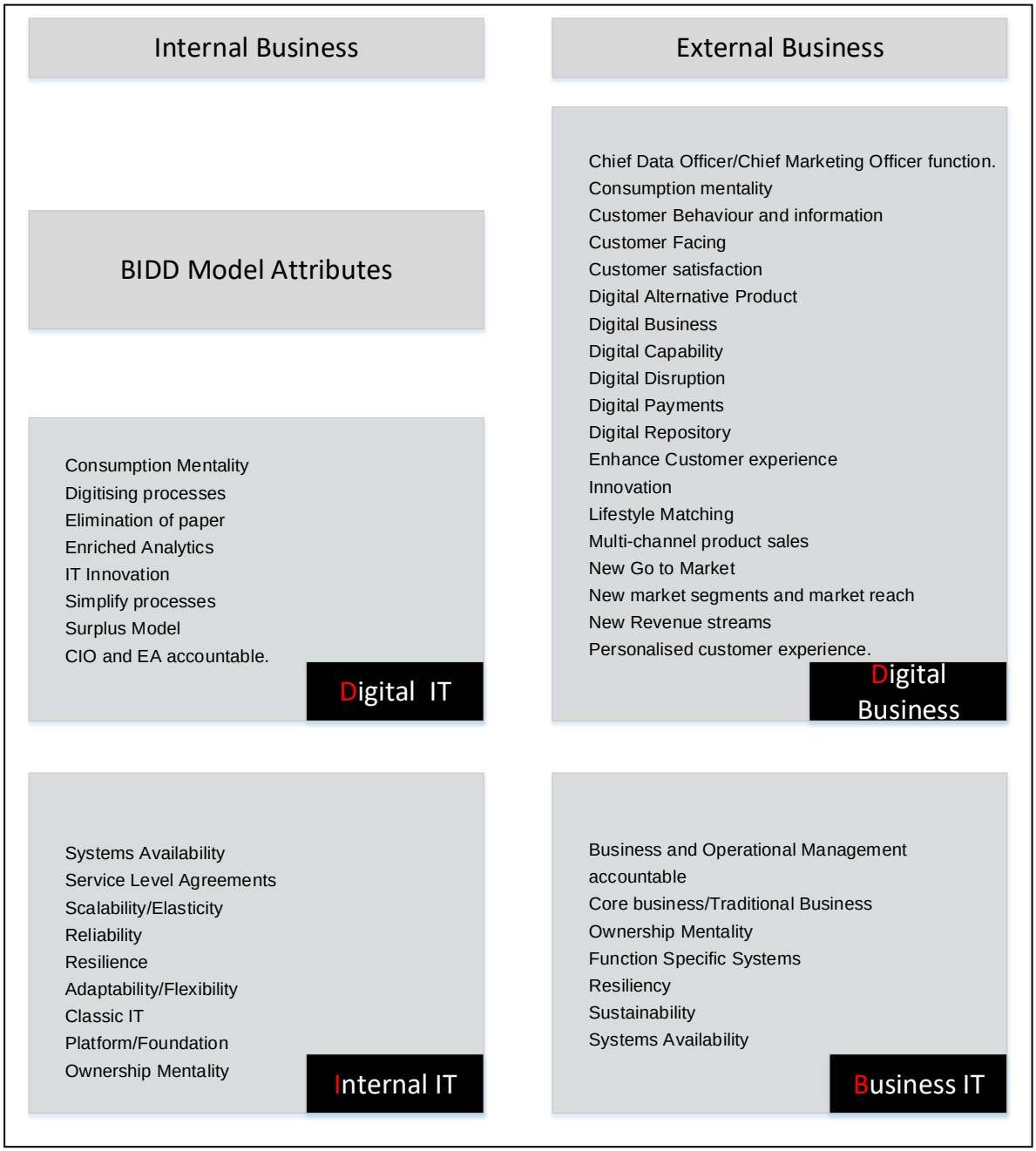
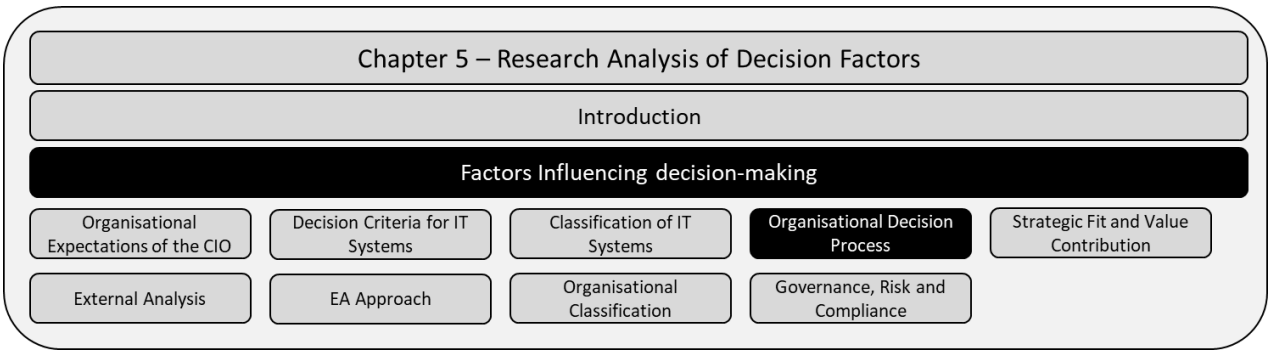


Figure 61 – Research Contribution - BIDD Model Attributes



5.2.4 Organisational decision process

This part of the interviews explored decision processes within organisations, challenges experienced, how decisions were made on disruptive technologies and related approval processes. An interesting observation was that in almost every conversation, there was very little discussion on the technology, software or hardware, that was being considered or had been deployed. Discussions rather revolved around customer requirements, financial issues, strategic alignment, stakeholder management etc. This illustrates the changing expectations of CIOs in organisations: they do not need to understand the technical details of a selected technology, but need to focus more strongly on leveraging technology to add value to business. Despite an abundance of technical solutions currently in the market that can perform various functions, adoption, implementation and acceptance generally remain a challenge. A pertinent comment from a CIO is as follows:

> *You know, nine times out of ten, a technology solution, it's always going to have the promised versus the actual functionality and those sorts of things. Whether we use it to a full capability is another debate*.

Another relevant CIO's comment is as follows:

> *A lot of this is about emotions and politics, but, there's little about technology nowadays.*

The decision process described in many organisations is extremely complex and this seems to have been compounded by the exponential growth in disruptive technologies. During the interview process, the researcher explained relevant decision theory as identified in the literature review phase of this research and asked participants if this could assist them in fast-tracking decisions and improving their effectiveness in their environment.

The group CIO and CEO of a large multi-media organisation commented as follows on the proposed framework and decision theories:

> *I knew nothing about, you know, all of the stuff that we just mentioned now. It was a whole new learning curve for me, but I mean, if you had this kind of framework down, it makes it so much easier.*

CIOs in every organisation expressed frustration with decision processes and long lead times to obtain approval in their organisations. Some organisations explored various options to fast-track decisions, but were not always successful because of organisational culture or resistance to change. All CIOs agreed that current approaches were not optimal and there was an intent to change in agile conditions. Notwithstanding this, most organisations reverted to traditional approaches whenever decisions had to be made.

A comment from one of the participants summarises the general views expressed during interviews:

> *I have to be honest with you. It's, it's a very, very difficult process right now, especially when you have multiple stakeholders from multiple business units.*

Appendices D, E and F show comments from some of the CIOs on challenges experienced in their environment. This is not an exhaustive list; only those that highlighted challenges about people, process and technology were selected and shown in the appendices.

Key challenges identified in this research are listed below. These highlight the need for a decision framework to assist CIOs in speeding up decision processes in organisations.

People-related decision challenges:

- CIOs/executives want to exercise control at the expense of growth.
- IT is viewed as an expense and non-core to business.
- Tailoring motivations is based on individual stakeholder needs.
- Lobbying key stakeholders is required to solicit support.
- Ecosystem complexity, governance, escalations and multiple organisational engagements require attention.
- Resistance is experienced from stakeholders who are not included in decision-making.
- Change management and resistance from IT staff need to be dealt with.

- Resistance to new technology resulting in early retirement/refresh of systems needs to be managed.
- Business executive bias towards core business systems is encountered.
- Decisions have to be taken by committee members who do not share the same interests or have different expectations of IT.
- People who shout the loudest get what they want – this introduces complexity in enterprise landscapes.

Process-related decision challenges:

- Unclear or poorly defined approval processes.
- Process complexity in an environment with multiple stakeholder and multiple business units.
- Organisational bureaucracy and red tape.
- Rigid procurements processes that are not supportive of agile partnerships.
- Legacy governance processes that need re-alignment to new ecosystem requirements in disruptive environments.
- Extended approval processes linked to differing stakeholder interests and KPIs.
- A one-size-fits-all approach when involving strategic partners, which causes additional delays.
- IT that strives to become agile, while ecosystems supporting IT do not change fast enough.
- Extended approval processes resulting in implementation of technologies that could be obsolete before the end of a project.
- CIOs resorting to threatening tactics to overcome decision process challenges.

Technology-related decision challenges:

- Often technology decisions are based on emotions, politics and preferences as opposed to functionality.
- Technology selection and implementation are dependent on executives' understanding of implications to business and bias towards action.
- Technology functionality and business requirements are not synchronised in disruptive conditions.
- Inability to choose between many technologies that offer similar functionality hampers progress.
- Misalignment is evident between EA plans, disruptive technology and business life cycles.

- Business IT technology investments are prioritised over traditional IT technologies.
- Reputational impact as a key business consideration is often not understood in disruptive technology conditions.
- There is lack of dominant designs and standards in disruptive conditions.
- A legacy mindset hinders disruptive technology decisions and implementation efforts.
- Business executives fail to translate the impact of disruptive technologies on business to internal IT technology requirements.
- Technology requirements are linked to hype, which is misaligned to business functional requirements.
- Disruptive technology benefits are often uncertain and not easily mapped to traditional financial KPIs, which hinders decision-making.

After gaining understanding of challenges in IT decision-making, CIOs were asked for their views on available theoretical models and decision approaches, as highlighted in Section 2.5.2 and Section 4.2.2. A further data analysis of interviews transcripts was conducted, as indicated in Figure 62, to explore comments on each of the identified approaches to determine if this could be used as a practical guide to assist in CIO decision-making.

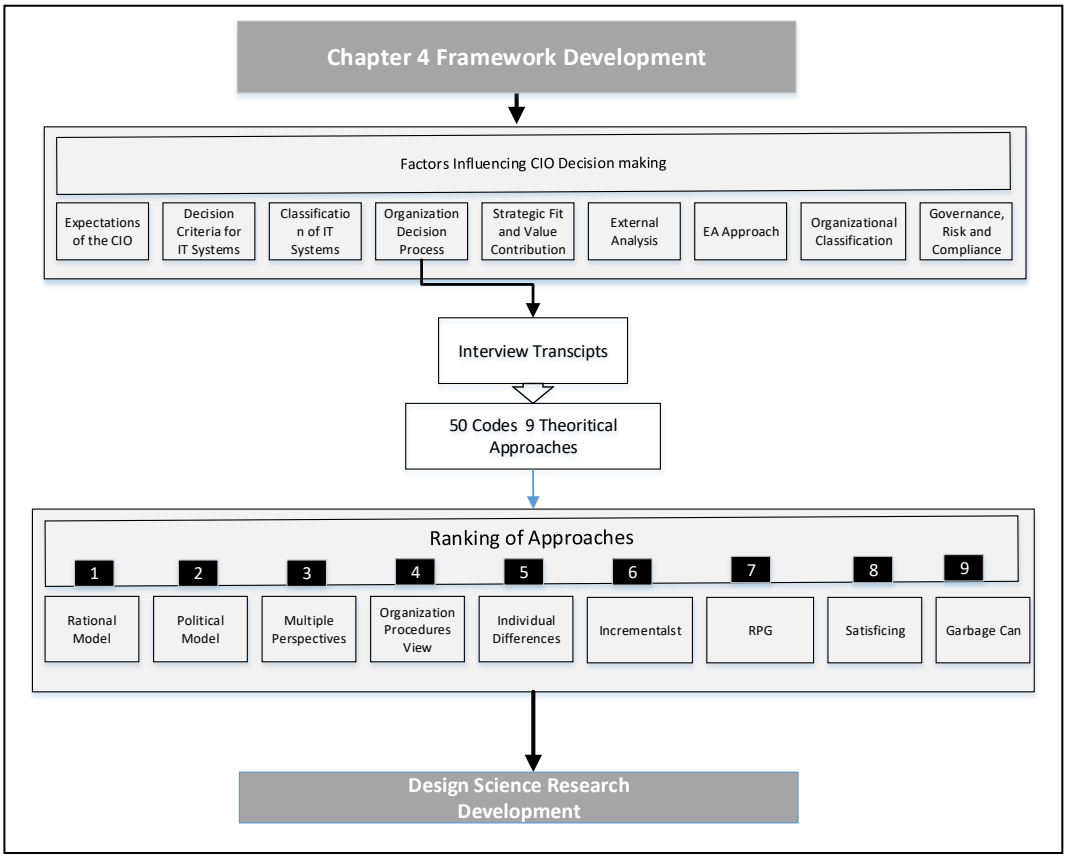


Figure 62 - Data Analysis Organisation Decision Process

Respondents were asked which decision theory aligned to their approach to strategic IT decision-making. The results of the data analysis are shown in Figure 63. The figure shows the dominance of certain approaches and displays the number of times participants indicated the approaches used in their organisations for motivating IT-related decisions.

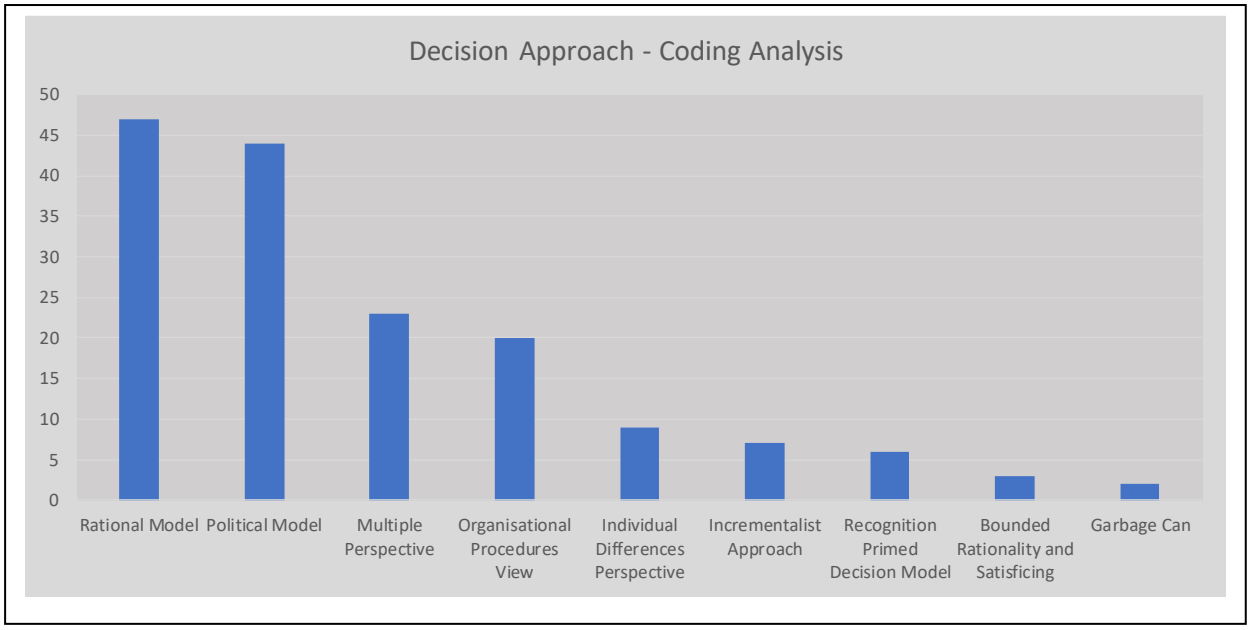


Figure 63 - Data Analysis - Decision Approach

All organisations subscribe or gravitate towards a default approach that has been entrenched in the organisational culture. The approach followed seems logical in most situations, irrespective of criteria applicable to the technology under consideration. CIOs confirmed that no guideline exists for decision-making on disruptive technologies. Nevertheless, in most organisations the governance process regarding financial allocation and approval is clearly defined.

A comment from a CIO on how he approaches decision-making is as follows:

> *The things that I would discuss with them is, what are your pain points within this organisation? What would you expect from IT to make your life a little bit easier, in terms of, whether it's your financial ERP system, whether it's consolidating financial reports from multiple operating companies, et cetera, et cetera, et cetera.*

A global CTO for a large multinational based in the UK made the following comment on theoretical approaches identified in this research:

CIOs may influence decisions that way but where he got time, he may want to take a rational approach ... fundamentally I think all of those are valid and it will be situational.

The following section briefly describes comments linked to code groups identified in this phase of the research.

5.2.4.1 Rational model

The rational model assumes decision makers are rational and seek to understand all possible alternatives to a problem, which enables them to make the right decision. Most organisations follow a rational approach to decision-making, irrespective of technology or the value of the investment being considered. The advantage of this approach is that it ensures that organisations make an informed choice, which is generally based on the best technology available at a particular time and in most cases acceptable to different teams in an organisation. The disadvantage is that the process followed is generally long, which could result in the right technological choice, but the timing of implementation could be wrong. In this approach, when a technology decision is eventual made, there could be newer alternatives on the market which may be more suitable for the organisation.

In South Africa, some of the traditional banks are being disrupted by newer banks that use technology as a source of competitive advantage. Capitec is a good example of a disrupter in the financial service industry that initially targeted clients in the low end of the market, focussing on providing unsecured lending to clients that did not meet the lending criteria of major banks. It now poses a serious threat to banks in South Africa and in 2017 was one of the top four banks in South Africa by market capitalisation.

A banking executive from one of the traditional banks who is now accountable for digital transformation describes the approach followed in deciding on the latest technology to optimise their business:

We just replaced the whole payment engine. So, obviously it is determined on what the overall need is. We then build up basically a request for information or a request for proposal, and that covered detailed technology, capabilities, business strategic items, functionality, product capabilities et cetera, et cetera.

The same executive also mentioned that the process to obtain approval on the choice of technology and the vendor for implementation of the technology took approximately a year, which he acknowledged was extremely long, considering the strategic nature of this application to the business:

> *If somebody gets something new, you know. If you go through this entire process rationally, it may take a year, but you don't have that time. You know, so, how do you now make a quick decision?*

Once a technology decision was made, an approval process had to be followed to obtain the necessary approval to proceed with implementation.

> *At that stage, we've made a technical decision, then its more about the business case, so the business will present this - it is what we're going to go and achieve out of this capability. If there are any technical questions, then the CIO will present and so and so.*

The example of the bank indicates the challenge experienced by CIOs in transforming banking using technology, especially when this is approached from a legacy or traditional IT perspective.

The discussions then focussed on the approach taken to speed up the decision process within banking to enable the bank to compete with disruptive competitors. The outcome of discussions was that CIOs needed to find adaptive ways to achieve a decision. In many cases it became clear that traditional formal approaches needed to be reviewed in agile environments.

> *So, we have got a couple of things. To speed up the rational process we have got discretionary allocations and thresholds for group executive members … So, you can deal with some of those disruptive trends without going through the formal process.*

The frustration expressed by the former CIO of a public institution explains the challenges facing CIOs when choosing technology based on the rational model:

> *You know there was one project, in one of the municipalities where, the guy says the process is so long, once you get it approved, even if technology changes in the side, they delivered because they got a decision. So, they ignore any changes and*

executed projects … then even though you may finish it, the technology implemented is now obsolete.

A CEO and group CIO of a large multi-media and publishing organisation, which owns multiple related companies in South Africa that operate in a high-tech industry faced with numerous disruptive threats, explained the process followed within their organisation when choosing technology:

So, we evaluate like three, four, five products, even sometimes up to ten. We shortlist that to maybe three, and then from there we do a scoring on the scoring matrix. It's a unified or an open transparent way of scoring. In most instances, me as the CIO, I don't participate in the scoring. I only get involved in the final decision and recommendation to board.

In addition to the rigorous processes followed internal to the organisation, this CIO also mentioned that they used advisors such as Gartner to verify that their decision is the correct one:

I let the business score in terms of which of those three or two products they feel will add the most value in their business. Based on that I will decide, but however, I will also benchmark it against Gartner.

Another CIO who is accountable for IT in a digital publishing company described the process in their organisation in deciding on new disruptive technologies:

I mean, XXX is a big company, they chose an application to handle all the cognitive AI capability. I was not part of scoring, however, once the final request comes through, I will then sit down and evaluate it. Even if I have to take two to three months to evaluate the product, the application, whatever that might be. Make sure that it meets all the requirements from a group level, then it's, I'm happy to sign it off to actually proceed.

Organisations that follow the rational approach to decision-making generally have a low risk tolerance. CIOs and architects follow a rigorous approach to ensure that the technology decision they make is the "correct" one. The CIO of a state-owned organisation described the approach within their organisation when making decisions as follows:

…Then we shortlist it, so they were invited to present, we had business sessions and we had technology sessions with them. We had given them opportunity to test their capability or demonstrate their capability in our environment. Then we actually went to reference sites. So, we went and visited the reference sites that they would allocate us to. Then also, not only reference sites that they provided, we also did our own desktop analysis with parties that were prepared to share. Then non-reference sites that use it as well, because obviously they're going to send you to a reference site that, that they're hoping is going to give you a, a good review.

There was general agreement among all participants interviewed that the rational approach to decision-making produced the best results, but they expressed frustration with the delays inherent in following such a structured approach. To most CIOs this is the only approach in existence in choosing any technology for use within their organisation:

A lot of it would be rational, in terms of looking at alternatives; choosing the right technology; making sure you have all the information. It is a long-term decision. It is not something you do in an agile approach.

Findings in this research show that the rational decision-making approach has the following characteristics:

- There is a strong correlation to delegation of authority.
- This approach generally has long lead times.
- A business case is critical when following this approach.
- It generally adheres to compliance requirements.
- The rational decision-making approach generally follows a formal request for proposal process.
- This is ideal for the procurement of commodity type services and technology.
- It requires a key decision maker or sponsor to fast-track decisions.
- Proofs of concept or demonstrations are part of the evaluation process.
- During the evaluation process an objective scoring matrix is generally utilised.
- Cross-functional teams are normally included in the evaluation process.
- This approach ensures the technical suitability of a solution.

5.2.4.2 Political model

In the political model, decisions are made to further individual or group self-interest, which may be good for the group but not necessarily for the organisation.

Based on findings in this research, interview participants' responses were unanimous that in all organisations, decisions were less about technology but more about people and politics. A surprising finding during the research was that the political model is ranked second when it comes to decision-making in most organisations across industries. This highlights that CIOs should not only understand technology, but should be excellent at dealing with people and different personalities in an organisation.

Appendix F lists some of quotations from interviews with CIOs that express the importance of politics in decision-making in organisations.

Key characteristics of political decision-making approaches that emerged from this research are listed below:

- Pressure from a senior executive or sponsor is key in obtaining traction and speeding up decision-making.
- The approach results in informal influence on formal decision approaches such as a rational approach.
- Lobbying is a prerequisite to obtain approval in formal governance structures.
- Emotions and politics have a greater influence on decision-making than technology functionality or specifications.
- Technology decisions are dependent on people rather than organisational strategy or architecture. Change in people may result in different technology decisions.
- People who shout loudest get what they want.
- Self-interest is prioritised over organisational interest.
- Technology ownership is used as a proxy of power in organisations, resulting in conflict between business units or executives.
- Conflict between IT governance models and business governance models results in conflicts of interests. An example is centralisation of IT systems to cloud-based models, which may not suit autonomous business models.
- Stakeholder buy-in is key in decision-making and IT project success.
- External ecosystem influence on multiple stakeholders in organisations may result in delayed decision-making.
- "Strategic decision" is used as a reason to bypass defined decision processes.

The challenge for most organisations facing the threat of disruption is managing people during change. Decisions seem to be made that favour individual or group personal interests. This approach relies heavily on the power and influence of individuals in the organisation to make decisions; this may result in decisions that are in the best interest of a group but not necessarily best for the entire organisation.

The research clearly indicates that politics is an extremely important factor when making or influencing decisions; this is more important than the technology functionality or specifications. CIOs are acutely aware of this and highlight that it is sometimes extremely difficult to be effective in their role if they do not have an established network of key influences or supporters in an organisation. The following statement from a mining CIO explains the importance of having an executive sponsor to support IT initiatives in an organisation:

> *At the other end of the day I had to implement SAP systems and so forth, where none of these guys were really interested, okay. The only way I got approval for things was because they had a new CEO from United States who really pushed for us to get improved systems and he supported it, but none of the rest of the, the business guys, in fact they all, they all did not approve it. We really had to steamroll them to get systems implemented. We, of course, we need them to enforce adoption and stuff like that.*

5.2.4.3 Multiple-perspective approach

Decisions that emanate from this model consider as many perspectives as possible and are generally endorsed by multiple stakeholders. Different analysts may arrive at different technical views and solutions, even though they may claim to present an objective view or rational view.

In disruptive fast-changing technological environments, CIOs seem to rely more strongly on the multiple-perspective approach, which seems to be a compromise between a rational approach and the political model approach. This approach entails viewing problems from multiple perspectives, organisational, technical and individual, and obtaining as many views from stakeholders as possible (Turpin and Marais, 2006). Solutions and decisions are therefore supported by multiple stakeholders; however, it does take a long time to reach consensus on a topic.

During the interviews, participants were asked about stakeholders that are critical to enable faster decision-making in organisations and their role in the process. Figure 64 provides a high-level summary of the responses received from interview participants. An interesting observation is that in some organisations, business managers refer to actual product or service owners, whereas in larger enterprises, divisional CIOs are sometimes referred to as the business managers.

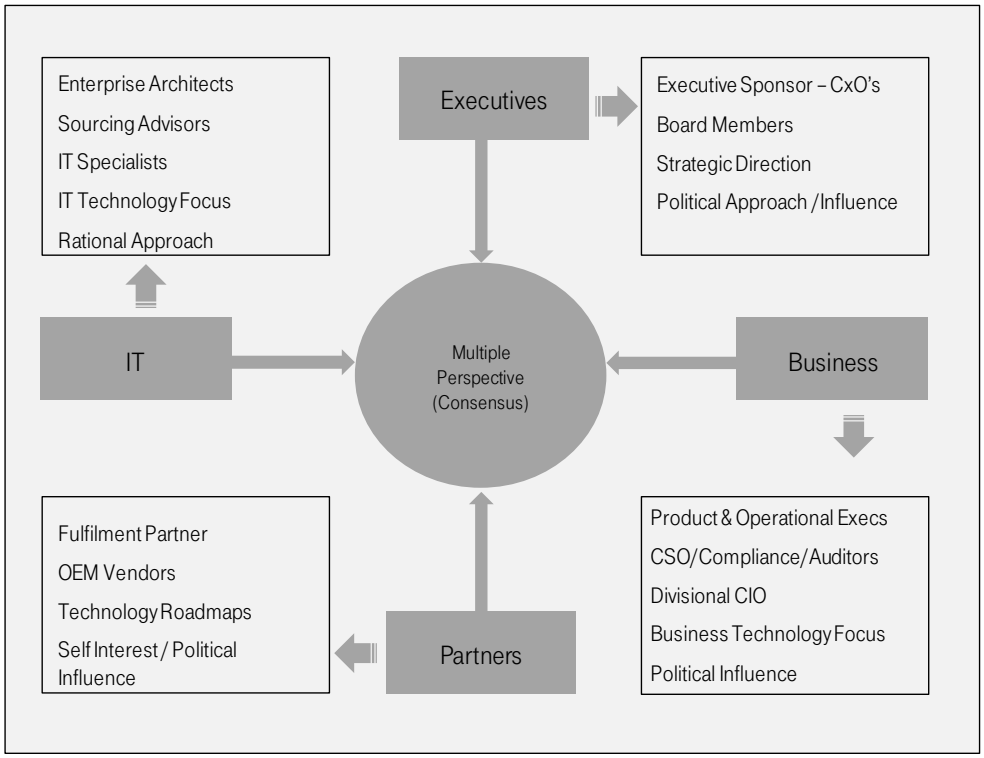


Figure 64 - Multiple Perspective - Stakeholder Map

In this research, multiple stakeholders were interviewed who represented role players from the different stakeholder groups according to Figure 64. An interesting finding in this research was that accountability for IT decisions was not clearly defined between the office of the CIO or technology units external to the IT organisation. A comment from a divisional technology executive illustrates this disconnect:

> *The influencers can be a number of stakeholders, from architecture to business et cetera, et cetera. Your decision makers are definitely your technology division at the end of the day.*

The comment from a CIO of a large multinational company shows a different perspective on who takes accountability for technology decisions:

They (business) would be influencers, but the decision maker at the end of the day, because he signs responsibility with the auditors is the CIO. He will make sure this place runs et cetera, et cetera. It's his head on the block at the end of the day.

Another characteristic of the multiple perspective approach is that many organisations form cross-functional task teams and rely on committees to make recommendations and decisions on IT choices and investments:

Obviously, I would decide that but I think also in terms of organisational governance. This is where it is fundamental is that if you make investment decisions in IT, you need proper governance. A lot of organisations have IT investment committees and we have that as well. It is not a committee of technologists, it is a committee of business people.

However, reliance on task teams and committees adds additional complexity and governance and therefore slows down the decision process in organisations. A comment from one of the CIOs highlights the challenges when using the multiple-perspective approach:

I have to be honest with you, it's a very, very difficult process right, especially when you have multiple stakeholders from multiple business units.

Many of the CIOs nevertheless viewed the multiple-perspective approach as the best way for CIOs to succeed in a disruptive technology environment. This approach ensures buy-in and support from key stakeholders in an organisation, which is required for the successful implementation, adoption and acceptance of newer technologies. Some comments from CIOs on the multiple-perspective approach to decision-making are as follows:

- *I think it was multiple perspective approach that would be more suitable in an environment which is faced with continuous disruption.*
- *Multiple perspective approach combined with rational maybe would have helped the decision, if she understood how Hanna integrates with the data platform a bit better.*
- *The way it works is, we give everybody a fair opportunity as well. Any project that we target, we get representation from each of the business units.*
- *From a disruptive side, could probably be multiple perspective approach.*

5.2.4.4 Organisational procedures view

In the organisational procedures view decision approach, decisions are generally the result of executing standard organisational procedures and governance processes. Rules are coded into organisational culture, which results in repeatable and consistent results at the expense of innovation. Organisations that follow this approach generally avoid taking risks and strive to maintain their status quo (Turpin and Marais, 2006).

In response to the question, *"Is the decision process in your organisation clearly defined?"*, most participants agreed with this statement, but also mentioned that the processes are too complex, involve "red tape" or take too long to execute:

> *Problem of organisations, one of the problems of organisations is, they get tied up unduly in terms of red tape and governance which means they end up with a camel type environment and they make no decisions.*

> *But don't get me wrong, the problem is not that IT can't change. The problem is not that the CIO doesn't know how to be disruptive. We are, we have been restricted by the red tape here.*

In discussions with CIOs, it was remarkable that many of the responses received during the interviews indicated that organisations avoid making decisions unless they are forced to or there is a compelling reason to change. Although CIOs understand the need to fast-track decisions, they seem to be constrained by organisational bureaucracy:

> *Then you have this organisation that's not helping you. Part of this is to also understand, I mean you've, the organisation has an avoidance approach. How do you position it maybe in a different way to get a decision quicker?*

> *Why re-invent the wheel? If it works, why change it?*

All research participants worked in environments where organisational culture was shaped predominantly by the CEO or managing director of the organisation. CIOs were asked if they influenced or tried to influence organisational strategy from a technology perspective. Most responses were negative. They tried but were not successful in many cases:

A lot will then tell you whether a board or a group executive is biased towards action; or whether it is a simple case of – whether it is not understanding or just simply being arrogant in thinking that the position is secure. You may have those decisions deferred indefinitely.

CIOs were also asked if their decisions about technology choices were becoming easier with the commoditisation of services and exponential increase in newer disruptive technologies. The comment below summarises the challenges experienced from a technical perspective – besides organisational stakeholders striving to maintain the status quo, IT teams are struggling to decide because of the abundance of choices available from a technology perspective:

The more and more technology you have, the more complex the decision-making is. And it is trying to figure out okay how do you now make a call? Because the easiest and safest way is not to make any decision. Then you are in your comfort zone.

Risk avoidance was another key topic that was mentioned by a few of the participants interviewed. In an environment where organisations face the risk of being disrupted by new entrants to the market or losing their strategic advantage to technology-driven competitors, companies are afraid to move out of their comfort zone. In the financial services industry, reputational impact is a huge concern to incumbents, which results in key stakeholders adopting a zero-risk approach:

We're trying to maintain the, you know, the reputational, the reputation of the organisation at the cost of what? We're suppressing innovation, we're suppressing digitalisation. We're not, we're not being disruptive. We say we are disruptive, but we're not disruptive.

Discussions with CIOs thereafter focussed on understanding how they succeeded in carrying out their responsibilities in a zero-risk tolerance environment. Some CIOs used the reputational risk to their advantage, justifying their investment by linking their business case and motivations to legislation and compliance risks:

It would be easiest for me to be honest with you, the easiest way for me to get EXCO to approve something is if I link it back to, to legislation.

In lengthy discussions with CIOs on challenges external to the IT team that prevented the CIO and his team from transforming the business, it also became evident that IT teams were unsure about the future in a disruptive technology environment and therefore it was convenient to lay the blame on business for not making decisions. The outcome of these discussions indicated that there was a problem; all CIOs acknowledged that they could add more value if decisions were made more quickly, yet they were uncertain of what the solution to this problem was.

5.2.4.5 Individual differences perspective and recognition primed decision model

This approach to decision-making indicates that different managers may arrive at different decisions because of their style and preferences. Because of previous experience, people are hard-wired and have cognitive biases that limit their intellectual capabilities (Etzioni, 2014). Training does little to change this. Experience is a key factor in helping to decide and if a typical situation is not recognised, then further information would be required to make a decision.

This part of the discussion focussed on how an individual's experience, skills, preferences, education etc., had an impact on decision-making in an organisation. During the discussions, it became clear that most responses indicated an overlap between the individual differences perspective and multiple-perspective approach. The multiple-perspective approach acknowledges individual preferences and style, which may result in different decisions, therefore it involves as many stakeholders as possible in the decision-making process. Based on the results of various CIO discussions, it was clear that this approach should be considered a separate approach to organisation decision-making:

> *Obviously, you're going to get some changes based on personal preferences, but you're not going to go and change the entire design.*
> *"That's why I'm saying to you now, depending on, on who your stakeholders are you might have to adopt a slightly different approach.*

The recognition-primed decision model recognises that a decision maker is influenced by previous experience when making a decision in the current context (Turpin and Marais, 2006, Klein, 2008). This model is based on users' experience, helping them understand what to expect and to determine the course of action to follow to make them succeed.

Before you take a proposal to a client you need to understand the decision-making style, the social style. So, the preference style of that person, you need to understand if he is more an analytical person because you need to have more detail in the presentation.

Results of interviews clearly reveal that in any organisation, individual's skills, experience, social style and education had an impact on decision-making in organisations. The ubiquitous nature of IT and its growing importance in shaping organisational strategy, culture and competitive advantage imply that there are a growing number of stakeholders who are influenced by newer systems being deployed in organisations. Most CIOs seem to be frustrated with the extended time required to make decisions, especially in a fast-changing technology environment where every stakeholder has a different requirement from IT. To overcome these challenges, CIOs generally adopt a multiple perspective approach, involving many stakeholder groups to solicit buy-in in the organisation.

However, most CIOs acknowledge that from a disruptive technology perspective, the previous approaches may not be suitable in a disruptive technology and agile business environment. Discussions during the interview also focussed on how CIOs were addressing decision challenges in their environment. Some of the ideas discussed aligned to categories in the decision-making framework proposed in Chapter 4, but they were inconsistently applied. The approaches CIOs were adopting to fast-track decisions will be briefly described below.

5.2.4.6 Incrementalist approach, satisficing and garbage can

These three decision-making approaches were grouped together because of the low prevalence of this approach in discussions with CIOs. The incrementalist approach entails incremental actions towards a strategy, yet keeping the strategy open to adjustment. In a garbage can and satisficing approach, decision makers may not have all the required information to make a decision, but if minimum criteria are met, then a decision is taken even though it may not address all issues.

Figure 63 shows that in most organisations the incrementalist, satisficing and garbage can approaches were not popular and were rarely described by participants compared to the more traditional approaches to decision-making. During the interviews, these approaches were discussed, and participants were asked if this could aid in decision-making in agile environments. Most participants talked about following agile approaches in software development and project management compared to historical waterfall approaches. Regarding decision-making,

participants often referred to following an agile approach when deciding on newer disruptive technologies, which aligns to the fail fast approach.

CIOs were asked to describe or recommend approaches that should be adopted to enable quicker decision-making in their environment. Recommendations from CIOs did not provide differentiation between the incrementalist, satisficing and garbage can approach; however after analysing responses, it was evident that they aligned with the above-mentioned three approaches. These approaches will therefore be grouped under agile approaches to decision-making in disruptive environments.

5.2.4.7 Agile decision-making approaches in a disruptive technology environment

This section briefly describes findings in this research on suggestions from interview participants on how decisions can be fast-tracked in a disruptive technology environment. In many cases, the recommendations in Appendix G were in the initial stages of being tested in parts of the organisations or an approach that CIOs believed would help in improving decision-making in their organisations. A summary of key recommendations from CIOs for agile decision-making in disruptive technology environments can be found below:

- Implement slimmer governance processes to enable quick turnaround times.
- Consider modular decision approaches aligned to agile methodologies.
- Consider allocating discretionary funds for disruptive technology considerations.
- Review delegation of authority for CIOs and business executives
- Streamline procurement and partner on-boarding processes.
- Brainstorm ideas and conduct quick proofs of concept to determine the value and feasibility of implementation.
- Implement change management for people to move from a waterfall to an agile methodology mindset.
- Make decisions based on risk assessments of systems in the different quadrants of the BIDD model. Disruptive technology investments may be smaller and pose lower risk when compared to foundational IT core systems.
- Take into consideration that internal IT and business IT systems of the BIDD model would generally be long-term decisions, therefore not suitable for agile approaches. Classification of systems is key in determining the decision approach.
- Cycle though ideas, understand the economics of ideas and obtain funding linked to ideas considered for implementation.

- Shorten the architecture process to get to good enough, to get to execution quicker, get to the build phase and learn as you go.
- Ensure fit-for-purpose design of systems instead of the best system.
- Take bets, test, find paths and go and explore.
- Check if the technology meets functional requirements; if yes, then execute.
- Simply drive forward – adopt the Lego block approach.
- Consider systems that can adapt, and scale as required.

Findings in this study indicate that although the intent of most CIOs is to fast-track decisions on the use of disruptive technologies in their organisations, no formal guidelines exist to assist with decision-making. However, four broad categories of decision-making approaches are common across organisations – technical, people, process and agile. Agile approaches are a new school of thought that is starting to emerge when deciding on disruptive technology in agile business conditions. Figure 65 shows a summary of the findings on organisational decision approaches. In Figure 65, decision approaches that are linked to people in an organisation (political, multiple-perspective, individual difference perspective and recognition primed decisions) are grouped together as a people approach to decision-making.

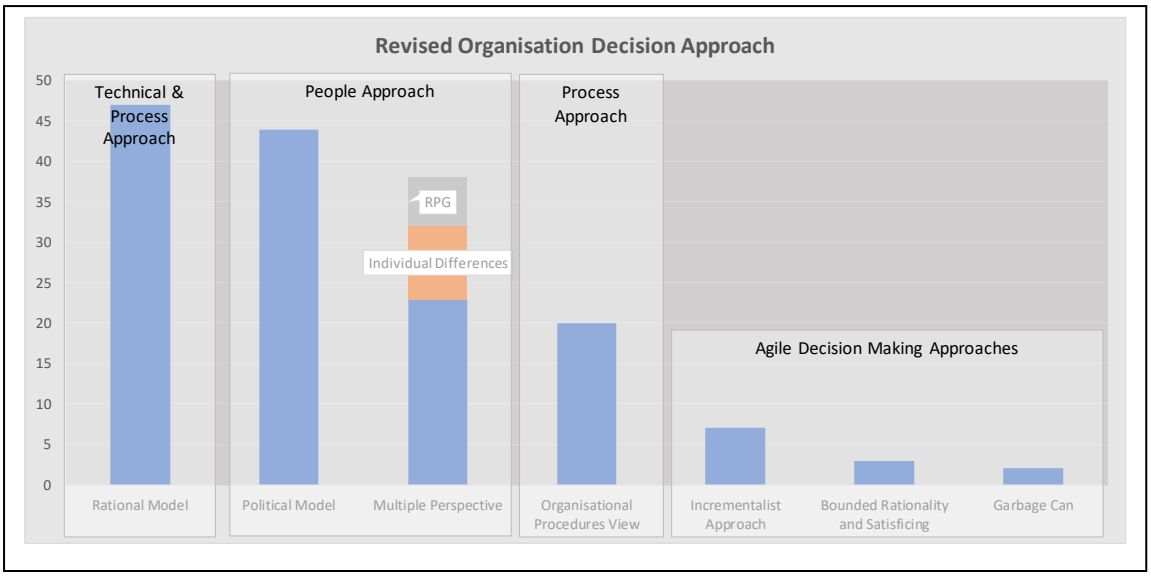
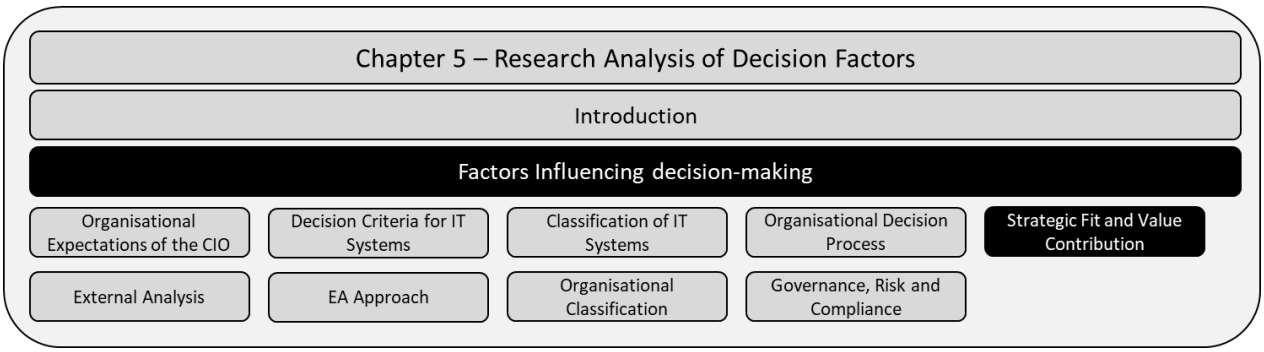


Figure 65 – Summary of Organisation Decision Approaches



5.2.5 Strategic fit and value contribution

Strategic fit and value contribution were identified as factors in the proposed decision framework that influenced strategic IT decision-making. This entails the assessment of technology in the context of the business strategy. In the current disruptive business context, IT can play a critical role in influencing business strategy; however, investment decisions must also align to prevailing business objectives.

In this part of the research, questions focussed on approaches participants had adopted to obtain approval on digital and disruptive technologies in their organisations. In every discussion, finance (revenue contribution or cost reduction) was always mentioned as a critical factor for technology investment in a company. However, from the literature review it was evident that traditional return on investment models may not be applicable in technology-driven industries, as it may be difficult to predict future revenue streams accurately. Organisations such as Facebook, Twitter, WhatsApp and Amazon may not have existed if traditional financial investment models had been used during the early stages of their development, as revenue generation was a secondary consideration and the source of revenue was uncertain.

As indicated in section 4.2.8, to ensure common understanding of the decision factors in the decision framework, a model that best describes the concepts highlighted in literature was chosen to explain key concepts emerging from literature. The strategic fit and value contribution model (Bente et al., 2012) was chosen and discussed with interview participants to understand if this model could be of value when motivating technology investments. The model suggests that technology in an enterprise should be classified in different categories and be treated differently from an enterprise decision-making perspective (Bente et al., 2012). The classification of IT systems and new technologies into the different quadrants can provide guidance to CIOs on strategic fit and the value contribution derived, which will influence approaches to decision-making, system develop and implementation.

The model shown in Figure 66 uses the Boston Consulting Group's (BCG) matrix to classify organisations' IT systems according to strategic fit and value to an organisation. The BCG model was adapted and super-imposed onto the BIDD model to provide a description of strategic fit or value of the different systems in an enterprise.

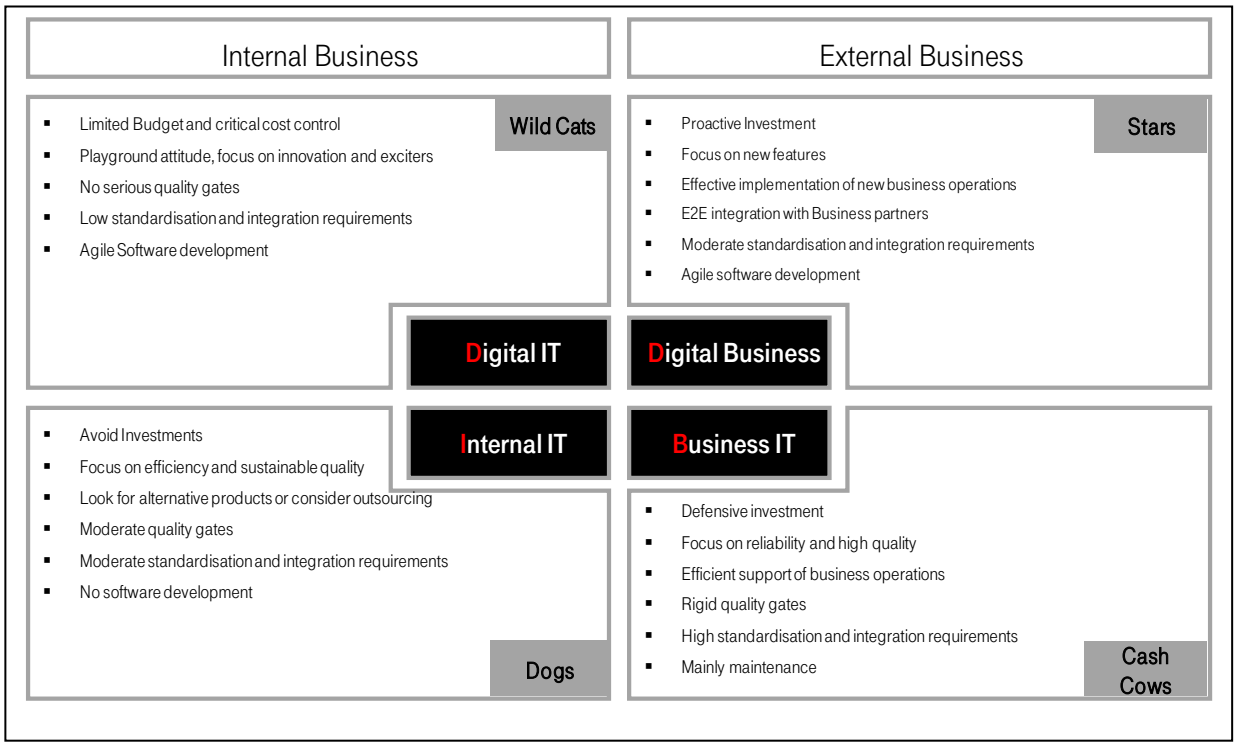


Figure 66 – Strategic Fit and Value Contribution (Adapted from Bente et al., 2012)

Discussions with participants revolved around the practical application of the model in different organisations. The intent of these discussions was to understand if this classification of systems could provide an overview to CIOs on areas on which to focus, investments to prioritise and decision approaches that could help CIO decision-making in agile environments. Questions discussed during the interview process are shown in Appendix A.

The results of these discussions highlighted three main topics that are important for CIOs and could assist in decision-making:

- Classification of systems according to the BCG matrix
- IT and business alignment
- Strategic fit.

5.2.5.1 Classification of systems – BCG matrix

The general sentiment from most participants was that some form of classification was used in organisations to justify investments. Approaches used varied between organisations and were influenced predominantly by the previous experience of CIOs.

Participants acknowledged that a formalised approach could assist CIOs in prioritising and motivating IT investments. Pertinent comments from CIOs relating to the use of a model can be found in Appendix H.

Some of the views expressed by CIOs in using the application classification according to Figure 66 are listed below:

- The BCG matrix is commonly used in organisational strategy development, though certain system owners may not like the use of the terms “cash cow” and “dogs”.
- An interesting comment from a CIO was that disruptive technologies classified in the “digital business” and “digital IT” quadrant of the BIDD model could end up being the cash cow for an organisation.
- Another CIO observed that disruptive technologies could start of as “wildcats” and evolve to “cash cows” for organisations.
- Certain foundational systems, such as ERP systems, may be classified as “poor dogs”, as they may not be directly correlated to revenue; however, system failure could cause the complete shutdown of a business. For strategic IT decision-making, classifying systems and linking them to strategic fit are important for justifying investment decisions.
- Most CIOs plan to implement the classification according to the BIDD model and BCG matrix, as they believe this could highlight areas of focus and speed up investment decisions.
- A suggestion from a CIO was that for organisations with multiple organisational units or companies, it may be useful to create an application map per operating unit to create understanding of priorities; this can assist in decision-making.
- Another suggestion was that application classification according to Figure 66 should be done every few years, to uncover duplication and determine if systems in use still add value.

A valuable comment from one of the CIOs on the use of the BCG matrix was that systems that fall into the different categories may vary based on the maturity of the system and the organisation at a particular time. What was apparent was that systems that could be classified as

a cash cow in one organisation might be a dog in another. The value of this framework is the dialogue that this approach could stimulate in an organisation in a typical multiple-perspective decision approach.

One of the risks identified by a CIO in the financial services sector was that if quadrants were not defined in a guideline, it could lead to incorrect interpretation of the model and wrong decisions being taken about systems in an organisation. This insight was also incorporated into the final guideline for CIO decision-making:

> *The risk that you have here is that, you know, it's like Maslow's hierarchy, people have adapted it and adopted it and stuff like that, but people have assumptions about it. My assumption for a poor dog is, you either make changes to get it into one of those or you bin it. We can't bin IT core.*

Another key theme that emerged in these discussions was the importance of business alignment when motivating IT systems.

5.2.5.2 IT and business alignment

Most participants mentioned that it was easier to justify financial investments in systems that contributed directly to business KPIs, such as revenue generation, cost reduction, process optimisation etc., compared to IT core systems that indirectly enabled business.

However, there did not seem to be any consistent way of mapping IT systems to value contribution. This seemed to occur on a case-by-case basis:

> *We don't look after the IT here, we're on the business side. What happens is we prioritise in line with the Group IT priorities, we then determine the cluster priorities from the cluster priorities we determine the strategies in terms of what we need to achieve out of our specific areas.*

Most of the discussions with participants focussed on how IT must align with business to add value. However, no formal or defined approach was forthcoming in any of the discussions. Interactions with business seemed opportunistic or accidental in nature based, on a specific need at a particular time.

What was also clear from the discussions was that in many organisations there is a clear differentiation between the role of the CIO and the IT departments and departments that focus on business IT. In these circumstances, it is key that roles and mandates are clearly defined, as this could lead to conflicting priorities.

5.2.5.3 Strategic fit

An interesting observation from most of the discussions was that IT strategy and execution followed a traditional and consistent approach across most organisations. Strategies and priorities were set by the board. These were then filtered down to IT to evaluate and implement technologies that enable business to implement its strategy. This top-down approach to IT strategy was prevalent in all discussions with participants and seemed to be the dominant approach in established organisations:

> *Group priorities are determined by the Board and the Exco. They'll do an environmental scan, they'll do an analysis of what you promised the shareholders, you know, so what's a ROE uplift or what are we promising from a revenue perspective. Then what's the strategy to go and get that, then I'll have a look at it and from that, obviously, it's from a business side, how do we achieve our financial targets both from a ROE costing account ratio as well as revenue targets. Then we'll have to say okay, so what are those enablers that, that we need to go and get those. Nine times out of ten it's got a technology implication to it as well.*

Participants were also unanimous that linking IT systems to business strategy and linking IT contribution to business value enable quicker decision-making on upgrading or implementing new systems and technologies:

> *Classifying systems to strategic fit and value will absolutely speed up investment decisions for us. Absolutely, once you have a goal and you know what you're going to do, you're not going to look at IT as just costs.*

Other comments arising from the discussion were that classification according to the BCG matrix does help in defining “what” systems fit “where” in an organisation, but that CIOs will need to define “why” this is relevant to decision-making.

Another valuable comment from one of the participants was that the framework was useful, but could be improved further, following suggestions that were made. These will be considered in future research on decision frameworks:

> *Within that framework, that is where you take your decisions. I am just trying to think that could perhaps have a sort of building blocks, or maturity but give something to that effect that logically shifts your decision-making from one point to another, as opposed to saying it is this or that or that.*

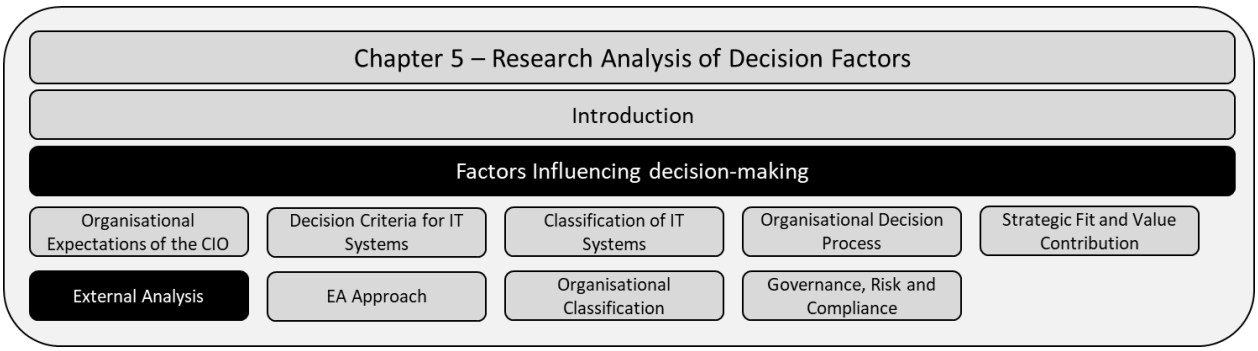
Challenges also mentioned by participants were that defining systems according to the BCG matrix would help them, but value was often measured in financial key performance indicators. When motivating investments they must identify key stakeholders and show them how a system will add value:

> *Motivating for strategic stuff, well that is where you got to leverage trends and create the story line that you talked about. So, let us say for example - you have got to say to the company – where does it fit in? The customer – where does it fit in. The stakeholders – where does it fit in? You keep going. It might fit in somewhere into the economy. You put a value map and it shows you how it is going to add all the value. So, it is going to have value for everyone, but you don't always know what the time will be to realise the value.*

> *In terms of especially some of – like your billion-dollar idea. Because when you are motivating to a CFO, the CFO wants to see the Rands and cents. Making money, saving money.*

There was general agreement that determining the strategic fit and value contribution of any IT initiative was key in obtaining support from business and IT stakeholders in an organisation.

The outcome of the discussion with CIOs indicated that in a disruptive technology environment, it is key to understand how a disruptive technology or innovation influences or aligns to business strategy or creates value for a business. If this cannot be clearly articulated by CIOs, then decision-making on initiatives would default to financial KPIs as the key decision factor.



5.2.6 External Analysis

The literature review in Chapter 2 highlighted the influence of timing and external analysis on strategic IT decision-making in fast-paced agile market conditions. When deciding on disruptive technologies, it was clear that factors external to the technology under consideration were important considerations in the decision process. CIOs need to understand the rate of change of substitute technologies and the emergence of industry standards or dominant designs and must decide on the timing of technology decisions. The model that best describes and encapsulates literature on external factors that should be considered in disruptive technology decision-making was discussed in section 4.2.7 and is shown in Figure 67.

The theoretical concepts and examples shown in Figure 67 (Adner and Kapoor, 2016) were discussed and participants were asked about their relevance and whether they can assist with CIO decision-making. Questions asked during the interviews are shown Appendix A.

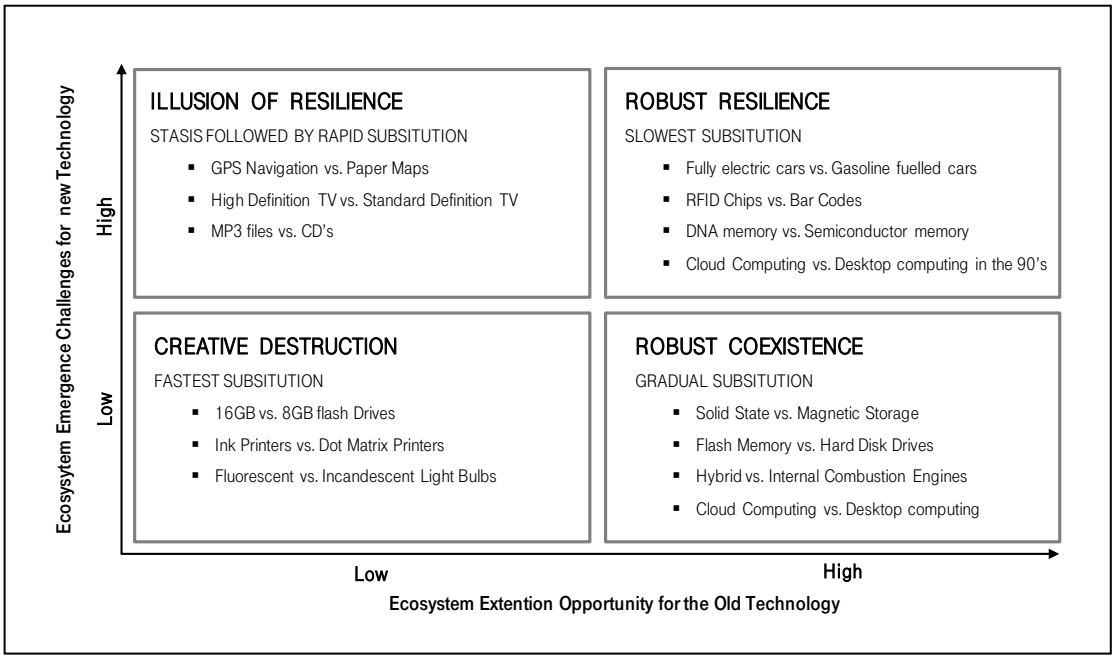


Figure 67 – External Analysis (Adner and Kapoor, 2016)

Figure 67 was used only to illustrate concepts emerging from literature and to ensure common understanding of the decision-making factor under discussion. Once common understanding had been reached, this part of the discussion explored the importance of analysing external trends and their influence on organisational IT strategy and decision-making:

> *In fact, PPS' strategy, their mission – no their vision is to be the best IT service provider in the insurance industry. Their internal IT division is to be the best IT service provider in the insurance industry. You can only be that if you can compare yourself to others.*

During this part of the interview, participants were asked about disruptive and emerging technologies and their impact on IT and business strategies. Discussions revolved around technology management in organisations – in line with Martec's law: "technology is changing exponentially while most organisations evolve logarithmically" (Brinker, 2013).

During discussions, CIOs indicated that when deciding on strategic IT investments, understanding of external factors was critical in deciding and motivating disruptive technologies. As a semi-structured interview approach was adopted, the researcher allowed an open discussion and a free flow of information on external analysis and its relevance to decision-making.

Key themes that emerged from these open discussions with CIOs on the impact of external analysis on strategic IT decision-making are listed and briefly discussed in the sections below:

- Disruptive technology misconceptions
- Impact of disruptive technologies on business
- Industry analysis
- Timing
- Ecosystems
- Risk and complexity
- Current investments and sunken costs
- Enablers.

5.2.6.1 Disruptive technology misconceptions

Results from interview discussions on disruptive technologies highlighted different views from participants on this topic. An interesting observation was that some participants mentioned that it

was not their role to understand how such disruptions may affect an organisation's strategy, while some believed these would never affect their organisation or industry. Comments from CIOs can be found in Appendix I, but views from some participants on the impact of disruptive technology on their organisation or industry are listed below:

- There are high barriers to enter the industry, therefore the risk of disruption is low.
- Most innovation is incremental – therefore there is a low risk of being disrupted.
- Some of the technologies used by competitors are not relevant in South Africa.
- There is nothing new about disruptive technology; it is old technology being used in a different way.
- Local market conditions and regulations will not allow some of the disruptive technologies.
- Participants have too much capacity, demand is slow and competition is high, therefore new entrants will struggle.
- Customer-driven businesses are more prone to disruption. Businesses such as mining do not rely on technology.
- Strategy does not come from IT.

However, further discussions with these participants resulted in most of them acknowledging that disruptive technologies can affect them.

5.2.6.2 Impact of disruptive technologies on business

Most participants stressed the importance of understanding external disruptive changes and how these may affect their business decisions and strategies. Participants could explain the importance, but were vague in terms of explaining how they determined what to implement and when to implement these technologies:

> *"Yes, look I think it is important, your external analysis is always important, that is what we need to keep us relevant. That is fundamental. I think this is important where you have your Foresters and your Gartner's and all the other guys, but we also talk very much to the other central banks in terms of what they are doing, from emerging technology perspective.*
>
> *Look, absolutely, I think technology is growing so fast today that the thing is the life cycle of systems are getting shorter. There's new advents. But once again it needs to come back in terms of what is it that I need for my business. It doesn't mean that*

as the new technology comes in, I need to kick out what I have. It is about the value I am going to get out of it.

"I think it is, I talk about big data, everybody is talking about big data. The thing is, once again, yes, we need to be relevant. We need to make sure that our environments are ready for it. Certainly, you can go and look at it in some of the other areas. But the fundamental question is, what data do I want?".

Appendix J shows some of the comments from participants on the impact of disruptive technologies on their businesses. Discussions were also clear that disruptive technologies and how organisations should respond are immediate considerations. Most organisations are aware of the impact of disruptive technologies and are considering how to approach this topic; however, there is currently no standard way of approaching it.

In contrast to comments in section 5.2.6.1, some of the CIOs expressed concerns about the impact of disruptive technologies on businesses listed below:

- Disruption is coming – technology plays a big part in how we do business.
- If one does not want to be disrupted, one has to know what is happening out there.
- Almost every organisation is going to be disrupted; it is just a matter of time.
- Platform business models are changing the competitive landscape.
- It is not about technology anymore, but how to use technology to create advantage.
- Ecosystems are increasingly important in reacting and responding to disruptive technology threats.
- The business world is moving from a constrained model to a surplus model; mindsets have to change.
- Technology layers are becoming opaque; the focus is on functionality and services.
- Disruptive technology adoption implies a change in the business operating model and IT operations model.
- There is acknowledgement of the power of data to enrich decision-making, as well as the need to understand what data will be required beyond what is currently used.

All participants understood the importance of being aware of disruptive technologies and were cognisant of the potential impact on their current business if this was not considered in IT decision-making. Many of the participants mentioned that analysing external environments was critical in decision-making. Discussions thereafter focussed on how CIOs kept in touch with technology changes, especially when "there is so much technology out there".

5.2.6.3 Industry analysis

Even though all participants acknowledged that external analysis of industry trends was an important consideration and had an impact on strategic IT decision-making, they had different approaches to staying abreast of technology in the external market. The approach followed in many organisations was in general unstructured, without any clear owner in an organisation whose responsibility was to ensure that the organisation either adapted or reacted to a disruptive external threat.

Comments from participants also highlighted the complexity of trying to implement current initiatives while trying to balance the impact of new technology on approved initiatives. Participants had different approaches regarding industry analysis; some of the comments can be found in Appendix K; however, this was generally identified as an area in need of improvement.

A summary of key approaches used in analysing the industry, as mentioned by participants, is listed below:

- CIOs have a strong responsibility to understand best of breed technologies and trends and use these to guide the organisation.
- Vendors and business partners can play a key role in advising CIOs on trends that assist in informed decision-making.
- Some organisations have innovation teams that are part of business; these keep abreast of technology trends and disruptions and influence business strategy.
- Requests for information or request for proposals from the market are based on an identified need.
- Research organisations such as Gartner, Frost and Sullivan etc. should be used.
- Conferences and discussions with similar businesses that are not competing in the same geography can be useful.

5.2.6.4 Timing

Participants were also questioned on the relevance and influence of timing on decision-making. In some cases, participants needed additional explanation of how timing can influence technology decisions to understand how it could be relevant. However, once the concept was understood, participants were unanimous that it should be a consideration when it comes to decisions on

disruptive technologies. A global mining CIO cautioned that in certain industries, such as mining, it may not be a factor because of the long life span of a mine:

> *From a mining perspective, and I am really talking about mining here – whether good or bad. But more of the effort would be on functionality.*

Some of the other discussions focussed on the time it takes to execute IT projects and the importance of proper planning:

> *We failed in the execution because what happened is, we haven't spent enough time understanding the needs and to do a proper design. If you understand that, it makes your execution simpler. Your execution then goes faster. What tends to happen, we take short cuts in the initial one and we easily spend a lot of money or it may not give us what we want.*

A group technology executive from a large multimedia company indicated that timing was critical in their business and made the following comment on this topic:

> *When you or your partner take a service to the customer is a function of timing. For example, how can I offer help to someone unless they're in trouble? I mean the best time to sell your wheel spanner is when your wheel has fallen off isn't it? Because now you desperate, you're willing to, probably willing to pay anything you want for a wheel spanner. Let's assume I have a huge security platform that I'd like to sell, the best time is after the fact isn't it.*

During the discussions, the model proposed by Adner and Kapoor (2016) was discussed with the aid of practical examples. Participants were then asked if they believed timing should be considered in decision-making and if this could be useful in a decision framework. The consensus from all participants was that it is important and should be a factor; however, the current reality is that most focus is placed on functionality.

5.2.6.5 Ecosystems

Most responses from participants did not reflect ecosystems as an important criterion in decision-making. However, when discussing the model proposed by Adner and Kapoor (2016) with the

aid of practical examples, participants acknowledged that this should be an important consideration, especially from a disruptive technology perspective:

> *In terms of where we are going, if you would take some of these disruptive technologies, I think they are focusing very strongly on eco systems. I think ecosystems are becoming far more important, so the ecosystems is becoming a seven or an eight out of ten.*

Many of the respondents viewed external analysis and ecosystems as similar in nature, therefore when questioned on these topics, they provided similar responses to both questions.

Key themes that emerged in the discussion on ecosystems and their impact on decision-making are the following:

- Need to understand the risk of implementing new technology on existing business.
- Need to consider support, logistics, local presence and local skills when evaluating disruptive technologies.
- Understanding of the complexity of environment and integration into existing systems.
- Standardisation of technologies and systems related to emerging industry dominant standards or dominant designs.
- Consideration of partners and partner ecosystems of new systems and technologies.
- Knowledge of whether business and technology enablers support the use of disruptive technologies.
- Current investments and sunken costs in existing tools and infrastructure. In certain instances, they are required to use assets for as long as possible or wait until the end of a financial depreciation period before considering new investments.

5.2.6.6 Risk and complexity

Risk and complexity of integration featured as a strong consideration that had an impact on decision-making. Some organisations have risk and compliance officers, who assess risks from multiple perspectives before offering recommendations such as accept, mitigate or resolve. Organisations that subscribe to governance frameworks such as King III and IV generally have risk and audit committees, which can delay decision-making if the impact of disruptive technologies and organisational impact cannot be readily quantified:

For example, from a strategy point of view, we are not saying cloud is not important but what we are saying is, deal with the cloud, given the nature of your business, the things where there is low risk, it is a low-hanging fruit, go for it. The more complex it becomes, your environment becomes more complex and integration, that is where you really need to consider the ecosystems.

5.2.6.7 Current investments and sunken costs

Generally existing investments are a dilemma for CIOs, as these determine the cadence for technology changes in organisations when viewed from a financial perspective. Assets generally depreciate over a three to five year period, which makes it extremely difficult for CIOs to motivate why existing assets need to be impaired in favour of unproven disruptive technologies. In these scenarios, non-financial decision criteria become key in motivating alternative investment decisions:

Instead of going Hana as a disruptive technology, maybe the option is to invest more in existing technology and improve performance of existing technology. So that's where the decision process is to say, it's not about the technology, you can look at it, you can choose the best thing, the best Hana, but maybe the timing is not right, maybe the eco system doesn't support it and maybe extending and investing in something that you currently have might make more sense.

5.2.6.8 Partners, partner ecosystems, standardisation, dominant designs

Some responses from participants indicated that ecosystems are critical in their environment when evaluating the implementation of disruptive technologies. This implies that CIOs or organisations who want to be innovators or early adopters of disruptive technologies will experience challenges in motivating investment decisions owing to limited and immature ecosystems and lack of standards and dominant designs, which generally emerge during the mainstream phase in a technology life cycle:

If you're on AWS then you might want to have everything on AWS, like Google apps et cetera, et cetera, but if you're already using, predominantly Azure, then you're going to stick with that Microsoft.

When we evaluate technology, we evaluate from a qualitative and a quantitative perspective. What sort of partnerships do they have? How long have they been around, what's the size of their balance sheet, what is the cost that we're going to be charged, you evaluate the organisation as well. Then you will start saying, well what is the other products and services do they offer? Can it be extended, who are they operating with?

A very good one is digital signatures, you know, the legal side of it says yes, you can use digital signatures, however, the environment can't handle those advanced digital signatures. So as a result, you can't really offer them.

Elon Musk – He is playing everywhere, a real disrupter. He's challenging traditional thinking, that's what he does, especially with the electric cars. Here again, is a good example how he's building the ecosystem, the batteries stations, along the highways, that's what he said he's focusing on now. He says it's the battery it's not the engine - he says there are a million guys building electric engines. He's building these solar roofs, battery packs, and you can go and stop and get your battery replaced along the highway. He understands that if he doesn't get that ecosystem right, his car is not going to sell.

You know in mining, we will not implement anything if it does not fit the ecosystem.

5.2.6.9 Enablers

Participants also discussed the critical role of enablers when conducting an analysis of ecosystem readiness for the implementation of disruptive technologies in organisations. Sentiment from participants was that if the right enablers were not in place from idea to implementation, IT initiatives had a slim chance of success. Some comments from participants are:

I would say, generally speaking, in the African context, or continent context, basically the issue that we have is around broadband. I mean, broadband number one is too expensive, and there is not enough broadband in certain areas. Cloud adoption becomes difficult, right, specifically around broadband.

The other issue would be legislation as well, putting stuff in the cloud, typically it's very limited. You've got AWS, Microsoft Azure, which is your public cloud, and, organisations are sceptical to put data outside of the country. So that becomes a bit of a bottleneck as well, where your CFO, CEOs etc., are not comfortable storing the data out of country. And it then becomes an issue.

It's going to tie back to what you promised the shareholders, you know, so what's a ROE, uplift or what are we promising from a revenue perspective. Then what's the strategy to go and get that, then I'll have a look at it and from that, obviously, it's from a business side, how do we achieve our financial targets both form a ROE costing account ratio as well as revenue targets. Then we'll have to say okay, so what are those enablers that, that we need to go and get those. Nine times out of ten it's got a technology implication to it as well.

What also fascinates me about South African organisations is most of them – because they are mostly in service industries, do not have an R&D budget. I do not know how any company trying to get ahead in technology doesn't have a R&D budget.

All participants agreed that in current disruptive conditions, external analysis is becoming a critical enabler for business sustainability and success. The approach proposed based on literature was considered relevant and could be an important artefact that could assist in fast-tracking decision cycles within their organisation. Discussions with participants indicated that there are five key strategic factors to be considered when conducting external analysis, as illustrated in Figure 68, which complements the model proposed by Adner and Kapoor (2016), which was incorporated into the final decision framework proposed in this research.

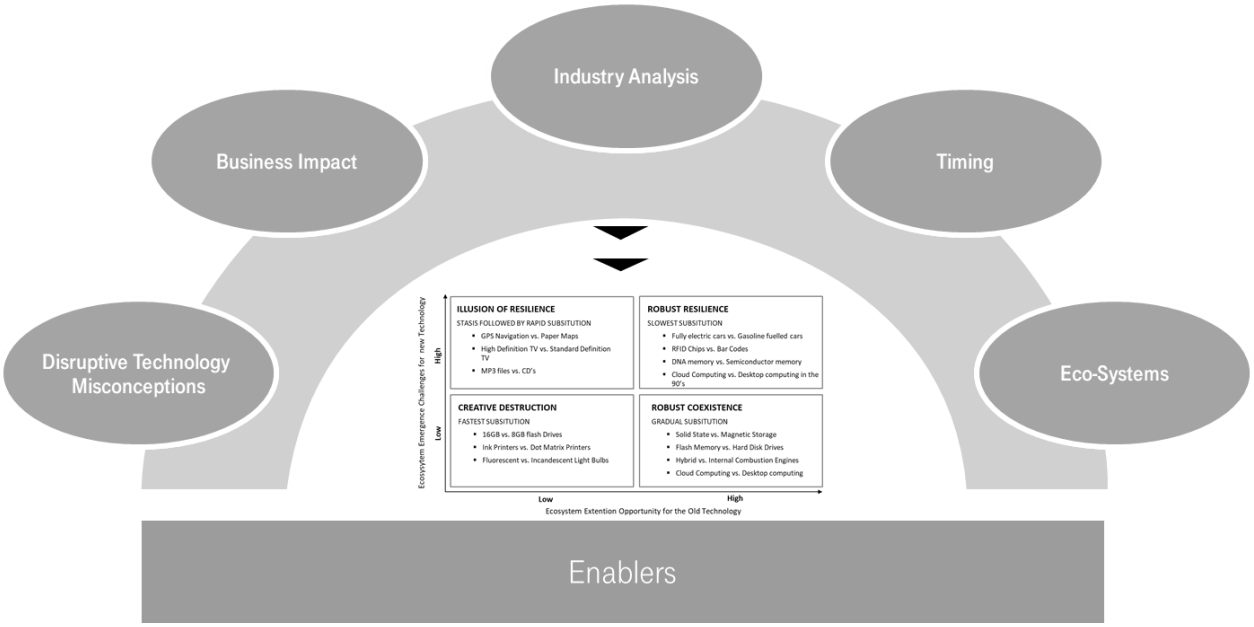
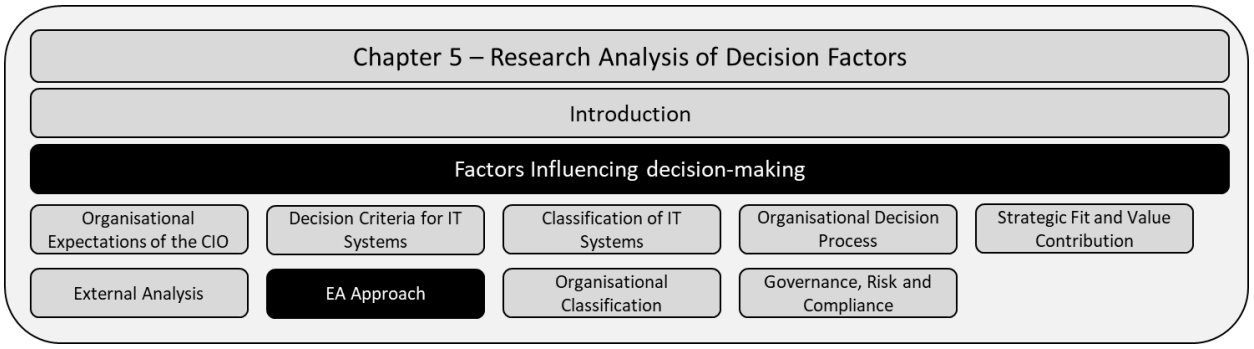


Figure 68 - External Analysis Key Factors



5.2.7 Enterprise architecture approach

Discussions in this phase of the interview explored the role of EA in strategic IT decision-making in a disruptive technology environment. Many organisations have established EA practices that perform an advisory function to ensure business IT alignment.

Most CIOs rely on enterprise architects to provide guidance and recommendations on technology decisions in an enterprise. However, great frustration has been expressed relating to the relevance of this function during times of disruptive change. Many EA practitioners still subscribe to the Zachman framework; however, this methodology can lead to frustration, as this seems effective in documenting and describing artefacts, products, services and architecture, which may not be applicable in a disruptive technology environment faced with rapid changes.

Questions asked explored the role and expectations of EA in a disruptive environment. During the semi-structured interviews the different schools of thought regarding EA were discussed and questions in Appendix A were explored to understand the role of EA in disruptive conditions.

The following section of this analysis describes the main approaches to EA in organisations linked to strategic deliverables and decision-making. The process of data analysis of interview transcripts is illustrated in Figure 69. Through the analysis process, 19 codes related to key approaches and topics mentioned were identified, which were then further analysed in a focus group session.

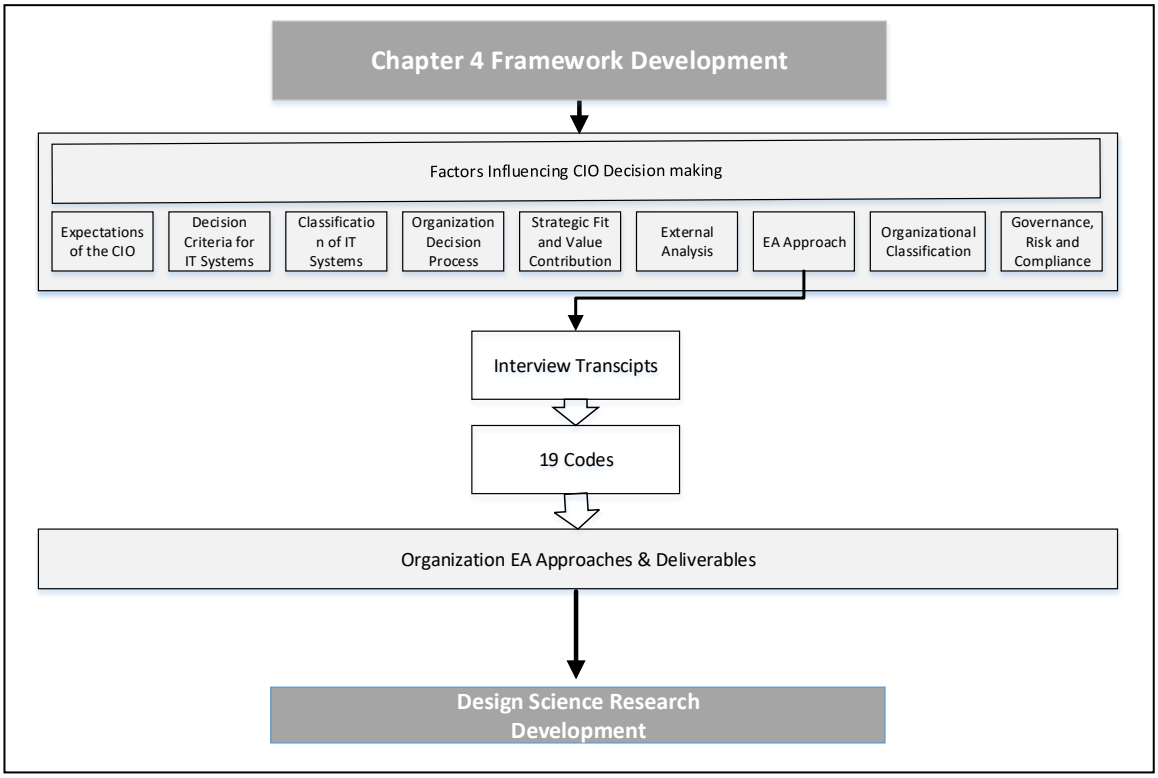


Figure 69 - Organisational EA Approaches

The results of the interview discussions in this part of the research highlighted three main areas of interest relating to the influence of EA in strategic IT decision-making:

- Value and contribution of EA to strategic IT decision-making
- EA approach in agile business conditions
- EA approach – role in decision-making

5.2.7.1 Value and contribution of EA to strategic IT decision-making

Participants were asked questions about the value of EA to organisations and its contribution to strategic decision-making on disruptive technologies. In general participants mentioned that EA is an important function in an organisation, though its contribution to strategic decision-making is limited. In most cases they are involved in consulting, design and planning related to classic IT systems in organisations. Once decisions are made about systems to implement, EA plays a vital role in ensuring successful planning and implementation in organisations. The summary below provides a view of some of the comments from participants on the contribution of enterprise architects in organisations from a disruptive technology perspective. Appendix L provides a view of some of the comments from participants on the value of EA in organisations.

Value of EA in organisations:

- EA frameworks provide guidance, although classic EA frameworks do not fully address business strategies in the modern age.
- In disruptive conditions Gartner seems to be adding more value to CIOs, a view that is current and aligns to the latest trends in the industry.
- Enterprise architects often still have legacy mindsets aligned to legacy systems that need to evolve in disruptive conditions.
- Some CIOs implemented EA frameworks such as TOGAF, as it seemed the right thing to do, but did not derive value from it when making strategic IT decisions in agile conditions.
- Enterprise architects often perform tasks aligned to business expectations that prevent them from exploring disruptive technologies or being proactive.
- There was also a view that the focus was predominantly on internal IT systems, according to the BIDD model categorisation.
- It was mentioned that traditional approaches are very theoretical and take too long. The mindset should change to good enough designs in planning and those responsible for them can then learn and adapt during the execution phases of projects.
- Strict governance and control from enterprise architects who want to control everything design-related slow down the pace of change and do not add business value.
- For some strategic IT system decisions, EA did not play a role, but would be involved in execution.
- Enterprise architects often do not have a mandate, are not agile or proactive, yet they see themselves as an having an important function, as they can stop or delay initiatives by enforcing governance.

- In disruptive conditions, where organisations tend to procure and implement available cloud-based services, the need for EA detailed designs is minimised.

Participants were also asked to comment on the current focus, deliverables and approaches followed by enterprise architects in organisations based on their current and previous experience. Results of the data analysis of the interview transcripts shows the focus areas for EAs as indicated in Figure 70. The data analysis revealed that in most organisations, the focus of EAs is predominantly on internal activities, in line with general expectations of CIOs.

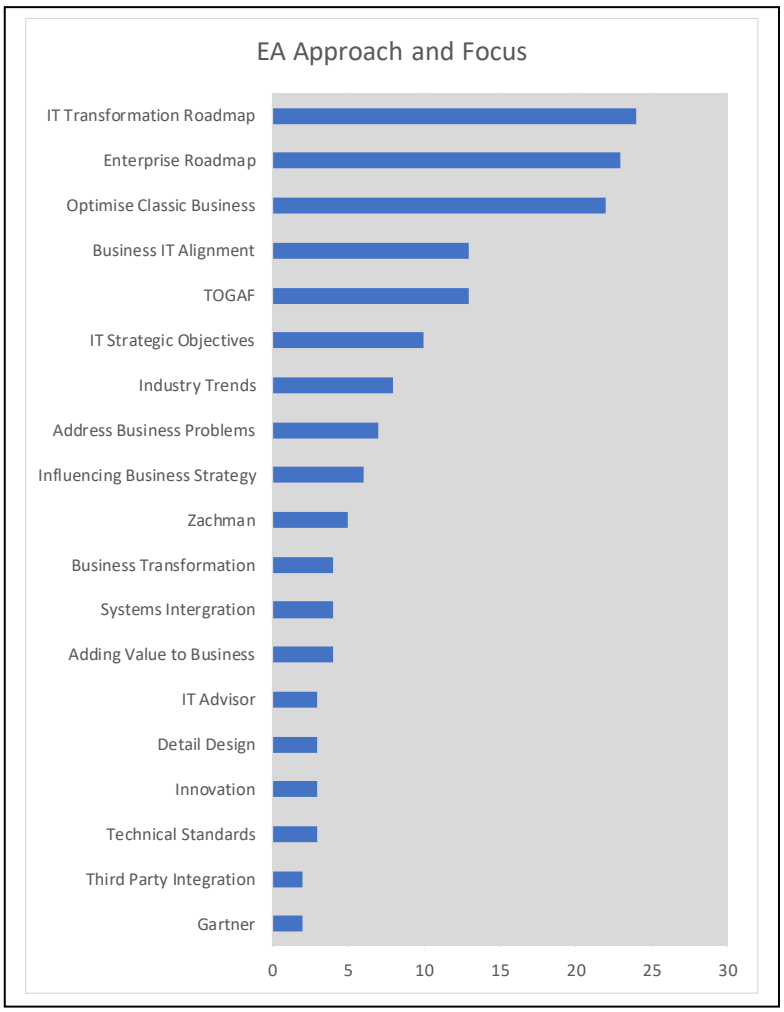


Figure 70 - EA Approach and Focus

5.2.7.2 EA Approach in agile business conditions

As the emerging school of theory by Lapalme (2012) provided a good summary of changing expectations of EA in dynamic market conditions, this was presented and discussed with participants. Key points regarding the application of the theory in disruptive technology environments indicated that this approach could add value to CIOs and businesses and address some of the challenges identified in section 5.2.7.1. Detailed comments can be found in Appendix M.

- The enterprise ecological adaption approach provides a strategic “outside-in” view, which is better aligned to business expectations.
- All three approaches are important in disruptive conditions.
- The enterprise ecological approach seems to be the preferred approach, though it is rarely implemented in organisations.
- Most organisations are still trying to implement and improve enterprise IT architecting approaches, which adds little value in agile conditions.
- Expectations of EA teams must be clearly defined to improve perceptions of value. All three approaches have different requirements in agile conditions.
- Organisations need to adopt a hybrid approach to EA and align resources accordingly. All three approaches are important and interlinked.
- Enterprise IT architecting is an “old school” approach that supports traditional business models.

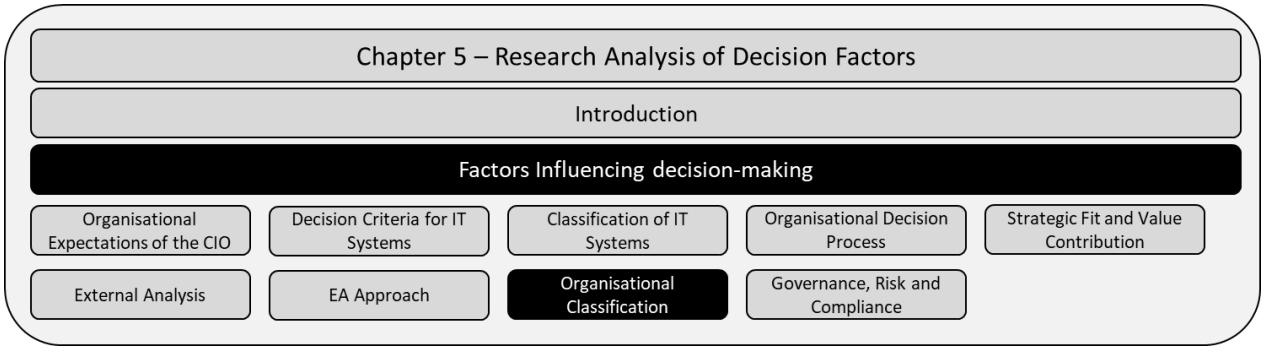
In summary, most participants agreed with the concepts contained in the model, showing schools of thought as depicted by Lapalme (2012). In a high-velocity disruptive technology environment, participants expect the role of enterprise architects to be aligned to an enterprise ecological adaption approach. It is clear that all approaches are important for the organisation’s sustainability.

5.2.7.3 EA approach – role in decision-making

Comments from participants indicated that EA plays a key role in decision-making in all quadrants of the BIDD model. Expectations of enterprise architects must be clarified upfront and can be linked to the BIDD model, to ensure a fair assessment of their value contribution to business. Participants also indicated that expectations of enterprise architects may be strongly linked to the “expectations of the CIO” and “classification of IT systems” factors of the decision framework, as proposed in this research.

In current business conditions, CIOs who are expected to perform a strategic role in an organisation will tend to rely more on enterprise architects to perform a consulting role from a technical perspective, thereby giving CIOs time to focus on business. However, to add value in disruptive conditions, enterprise architects should make time available to focus more strongly on the "enterprise ecological adaptation" method of architecture. Comments from participants on the importance of EA in providing input to strategic IT decision-making are found in Appendix N. A summary of key points is listed below:

- EA focus should be aligned to organisational strategy and industry trends and link the impact to internal architectural domains.
- Enterprise architects should be leaders in consulting services, advising on operational and strategic decision-making.
- Enterprise architects should have good business understanding, while technical architects should have good technical understanding. The focus of enterprise architects should be on business outcomes.
- EA adds value in terms of setting organisational standards and advising on implementation strategies.
- Enterprise architects should provide a balanced view regarding initiatives to ensure the stability of core IT systems while advising on strategic IT initiatives.
- Legacy approaches are not disruptive and focus on creating structure. EA should be strategic in agile conditions.
- Agile approaches with strong solution and integrations skills are required to provide strategic EA in disruptive conditions.



5.2.8 Organisational classification

The literature review in Chapter 2 highlighted the impact of organisational classification based on characteristics, operating model, design, governance, nature of business etc. on strategic IT decision-making. As indicated in section 4.2.4, IT generally supports and enables business strategies, therefore the focus should first be on business before focussing on IT architecture.

High-performance companies first define their operating model and then define processes and infrastructure that would be critical to support their current and future business strategy.

To ensure common understanding of literature on organisational classification, the “organisational operating model characteristics” of Ross et al. (2006) - Appendix A - were chosen to be discussed with participants during this part of the interviews and they were requested to express their views on whether understanding organisational classification could be useful in a framework to assist with CIO decision-making. Ross et al. (2006) were chosen, as their views best represented some of the concepts emerging from literature regarding organisational classification and its impact on IT decision-making.

Discussions with participants in this section of the interviews focussed on understanding organisational characteristics and their influence on decision-making in a disruptive environment. A typical large enterprise may have many companies or operating/business units with many CIOs delivering complementary or competing products and services. The decision process followed in a large enterprise will be significantly different from that in smaller, agile companies.

The intent of the questions asked in the interviews was to establish the extent to which classification of organisations according to certain characteristics influences business decisions. Understanding the characteristics of a business or the mandates of IT specialists and CIOs in different parts of a business will provide an overview of key KPIs that create business value. IT decisions and implementation plans will generally be supported if these result in business value creation for the organisation as a whole and for parts of the organisation that may be affected. Questions asked during the interviews can be found in Appendix A.

Data analysis, shown in Figure 71, was then conducted on interview transcripts to identify key characteristics that need to be considered when making IT decisions in an organisational context.

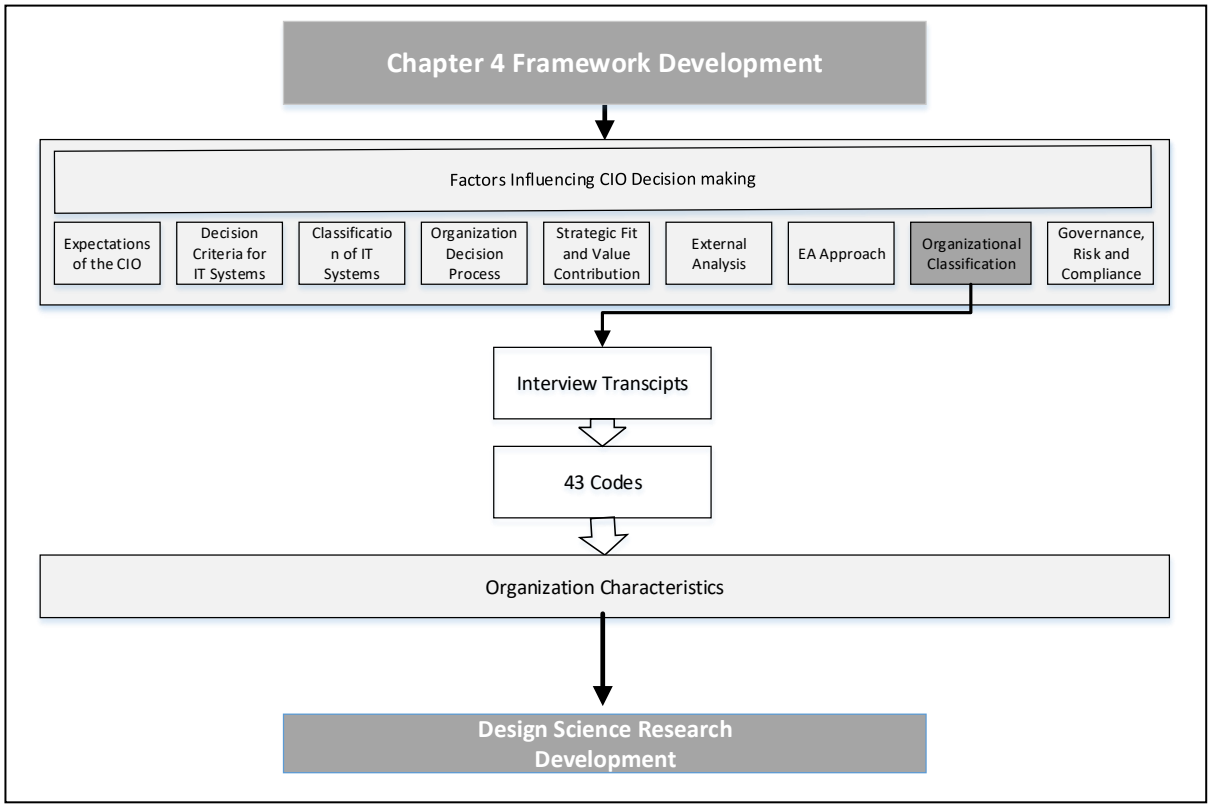


Figure 71 - Organisational Characteristics - Data Analysis

5.2.8.1.1 Organisational characteristics

Participants indicated that for CIOs to be successful, it is imperative that they understand the characteristics of an organisation before focussing on the detailed merits of systems features and functionality. Key attributes that need to be considered by CIOs can be found in Figure 72. The top five considerations will be briefly discussed below:

- Common platforms: For disparate business units or companies, the implementation of common platforms could create economies of scale benefits while enabling autonomous business units to flourish in agile conditions.
- Nature of business: CIOs need to understand the nature and characteristics of a business, which will determine relevant IT strategies. Separate business units without shared customers or processes may not need integrated IT systems and may have different approaches to disruptive technologies.
- Governance: Centralised or federated governance structures may be required to allow agility in disruptive business conditions.

- Standards: Based on the characteristics of an organisation, CIOs may consider implementing enterprise-wide standards for core systems, e.g. ERP, collaboration, licencing, while allowing divisional CIOs to deviate from standards for business unit-specific IT systems.
- Operating models: Business units with different operating models, products and services to market will have different decision processes, which need to be understood to speed up decision processes.

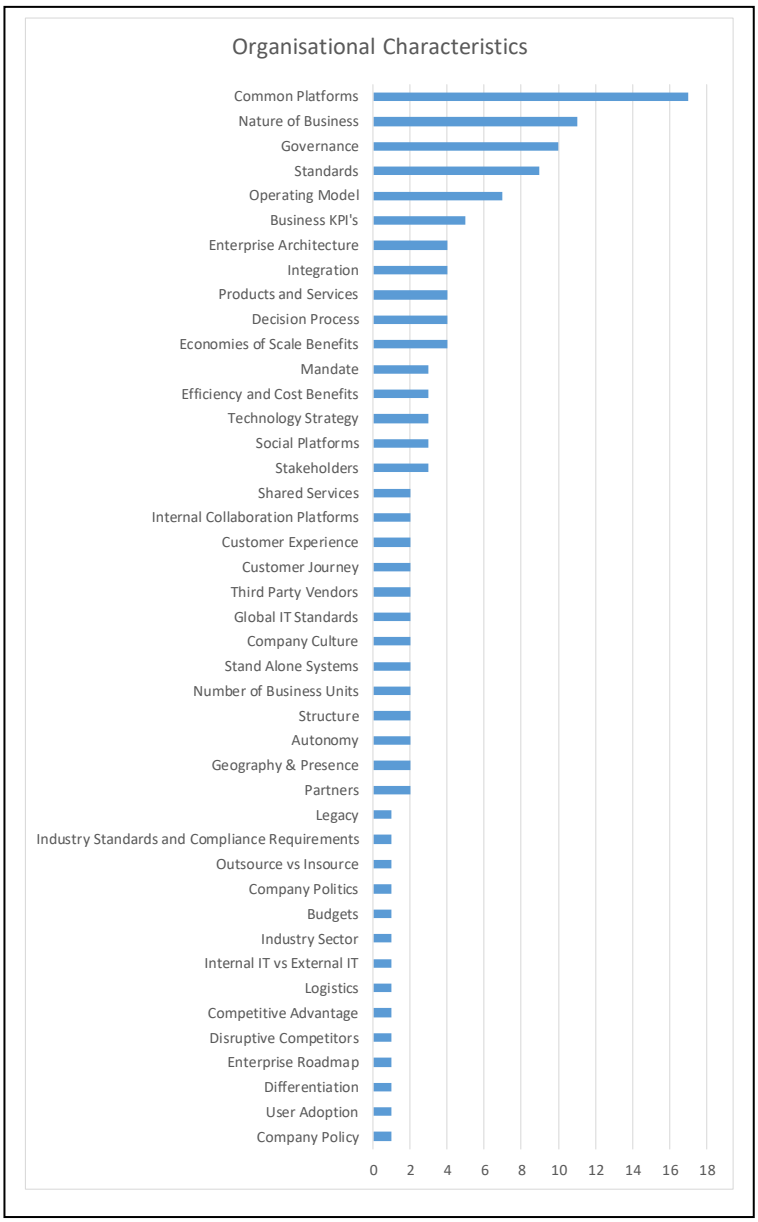


Figure 72 - Organisational Characteristics

5.2.8.1.2 Influence of organisational classification on decision-making

In the discussion with participants, it was clear that organisational classification according to characteristics, governance, culture etc. had a significant impact on IT decision-making in organisations. A recurring theme that emerged in discussions was the importance of creating a platform that could be leveraged across multiple business entities. Appendix O shows some of the comments from participants regarding decision-making in a complex organisational structure or a federated IT governance model. A summary of findings is listed below:

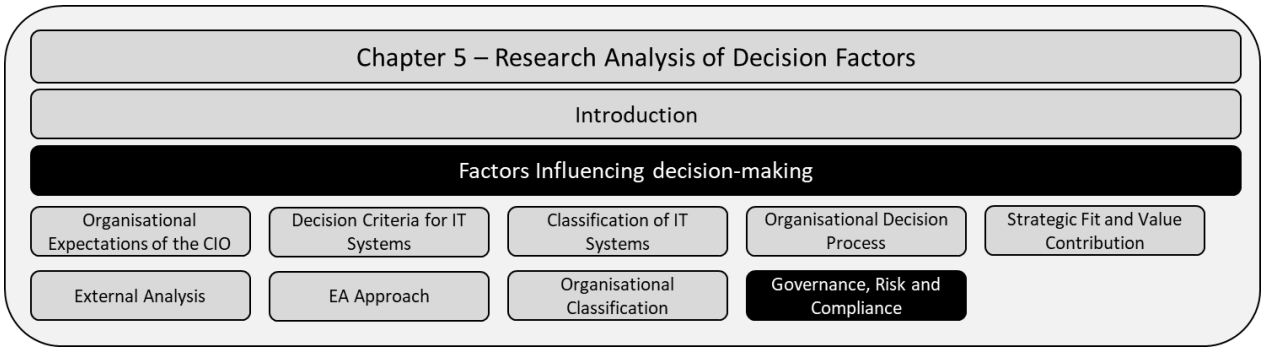
- Multiple business units with multiple stakeholders significantly impede IT decision-making.
- Understanding of the organisational business model and culture are fundamental considerations for any CIO.
- In disruptive conditions each business unit achieving financial targets does not guarantee long-term success.
- Multiple perspective decision approaches are mostly likely to succeed in a federated business model.
- Incorrect IT decisions could disrupt the operating model of different business entities.
- Defining effective IT strategies in an organisation with multiple business units or companies is extremely difficult in disruptive conditions.
- Understanding organisational ecosystems and defining holistic EA aids in defining group IT strategies.
- Obtaining user adoption and acceptance of new technologies can be a challenge if IT decision-making is centralised at group level without obtaining buy-in from key stakeholders.
- To ensure effective IT decision-making, it is important to include representatives from different business units.
- Organisations with different structures and business models, such as pipeline or platform, will have different decision approaches.
- In a typical organisation, back office systems may be centralised; however, the nature of individual organisational units should determine the level of decision-making autonomy.

5.2.8.1.3 Organisational classification – contribution to decision framework

Most participants indicated that it is important for all CIOs to consider organisational characteristics if they are expected to perform a strategic role in an organisation. Some pertinent

comments from participants can be found in Appendix P. A summary of key findings is listed below:

- Understanding organisational characteristics as one of the factors in the decision framework will create structure and can help in creating uniformity across multiple groups.
- Organisational characteristics can assist in creating strategy around generic platforms, reuse opportunities and leverage synergise from systems deployed across the group.
- Organisational characteristics can facilitate the identification of integration opportunities with associated benefits.
- Organisational characteristics create visibility and empower organisational units, which speeds up decision process.
- Considering organisational characteristics allows diversification of decision-making to create unique value and unification to achieve common value.
- Organisational characteristics determine the levels of governance required, based on organisational design.
- Organisational characteristics show CIOs the importance of understanding organisational design and culture when making strategic IT decisions.



5.2.9 Governance, risk and compliance

The topic of GRC was not part of the originally proposed decision framework proposed in section 4.2 in this research. However, during discussions with participants, this topic appeared as a recurring theme in most conversations during the interviews – see section 4.3. Although this may not seem to be a factor that influences strategic decision-making, it is a critical factor that must be considered in any IT system implementation in an organisation. It was also observed that participants who spent most of their time on internal IT systems as defined in the BIDD model, or in operational and tactical IT strategy execution, focussed more strongly on risk as a key factor to guide or influence decision-making. Participants who were business executives or driving digital transformation strategies did not mention governance, risk and compliance in their interviews.

Further data analysis (Figure 73) was conducted on all original interview transcripts to determine how GRC influenced decision-making in organisations.

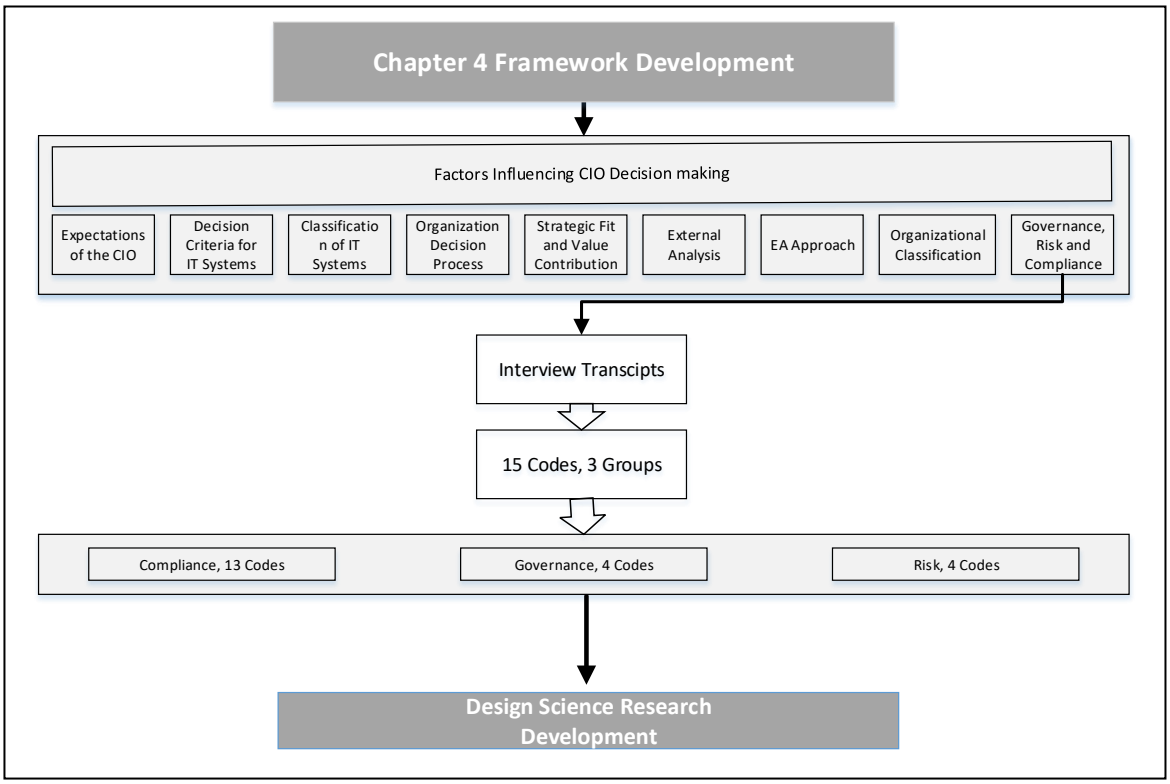


Figure 73 - GRC – Results of Data Analysis

5.2.9.1 Governance

Many of the participants interviewed expressed a desire to play a more active role in influencing organisational strategy using disruptive technology. Most indicated that their measure of success was ensuring that “the foundation was stable” and they needed to “keep the lights on” at the lowest cost.

To comply with their primary accountability in an organisation, CIOs expressed the importance of implementing proper governance and operational processes in line with the IT infrastructure library (ITIL) framework:

Every CIO has a different definition of what a strategy is, of what digitalisation is, and how an IT organisation should look like. But CIOs operate in legal parameters. They have a fiduciary duty and obligation to ensure that we operate in best practice in the interest of the organisation.

Participants also clearly realised that they have a fiduciary accountability to ensure that IT and systems implemented comply with the laws and regulations of the country or the industry in which they operate. They are accountable for ensuring that best practice governance processes are in place to make sure that the organisation or its people are not compromised through the introduction of disruptive technologies and systems.

The following comments from participants clearly express the role of CIOs in enforcing IT-related governance across the organisation:

It's an organisational legal requirement, for any IT infrastructure, you need to comply to King IV and ITIL.

The decision guideline we use at moment, is based on the King IV best practice, and governance and framework that we follow.

CIO's accountability lies with what is legislation and King IV, which is your IT law.

For governance, we subscribe to King IV and for architecture we use TOGAF.

Disruptive technology decisions are made by business. IT would make the architectural decisions. IT would lay the platform and say listen this is the standards that you are going to operate on. This is the environments that you are operating on. If you couple it on that, you are fine. If there is any significant change then it must come through the architectural governance and get approval.

The results of data analysis indicated that from a CIO perspective, COBIT, King IV and ITIL are important considerations in decision-making, as indicated in Figure 74. Frameworks identified are operational in nature. Nevertheless, the consistent message from participants was that any strategic IT decision must consider and be aligned to organisational governance and processes.

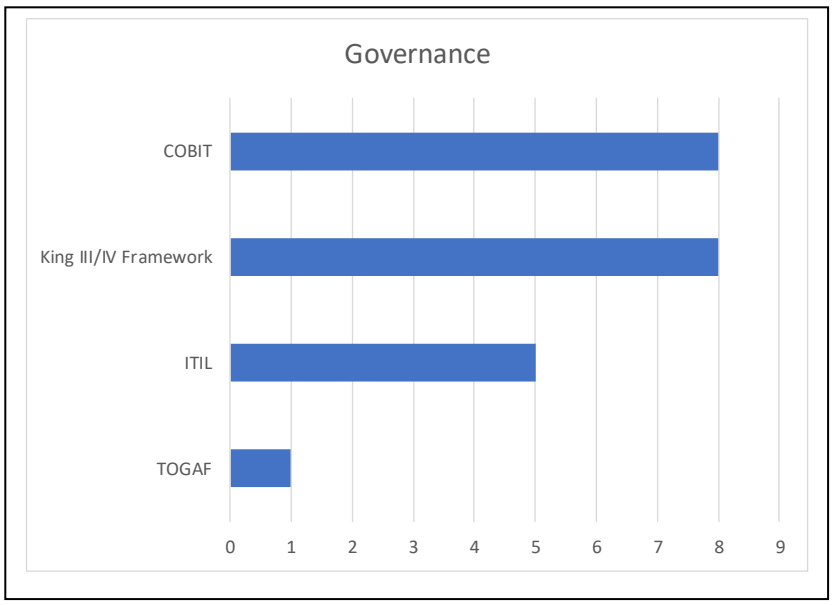


Figure 74 - Influence of Governance on Decision Making

5.2.9.2 Risk

A view expressed by some of the participants was that they are held accountable if the failure of IT systems causes an organisational or production impact. Moreover, they experienced challenges in justifying additional investments in traditional IT systems, but were expected to reduce allocated IT budgets.

Participants agreed that motivating investments is challenging if these do not relate directly to additional revenue streams or to business strategy. In certain circumstances CIOs had to highlight business impact in terms of downtime and loss of revenue to obtain approval to go ahead with a decision:

> *In motivation for items in internal IT in the BIDD model, it may be relevant to highlight business impact, loss of revenue, risk etc. to speed up decision process.*

> *In some organisations they don't take the CIO seriously. That is why he must resort to those below the belt tactics to get support.*

> *We're supposed to business partners, not policemen.*

Participants were asked for their views on how decisions can be fast-tracked in an agile disruptive environment faced with continuous risk and uncertainty. Views from participants indicated that in a disruptive environment, risk tolerance of organisations must increase, otherwise an organisation will not survive:

> *Because most of that decision stuff is all about the risk, and how to overcome that and safety-first thinking, because there is no time in the modern era to satisfy every risk as a mitigator. Sometimes you just have to accept risk.*

> *To a large degree it depends on your diversity and your risk appetite, and the type of industry. So, for another industry you might have to take on some new technologies, and really hope for the best, because you want to get the best. Therefore, you would risk these things.*

Figure 75 indicated some of the key considerations that have an impact on IT decision-making mentioned by participants in the discussions. A mining CIO mentioned that health and safety was a critical factor for any investment decision in the mining industry. Mines risk losing their mining rights if there is a health and safety risk, therefore they will not tolerate any risk in this area. To mitigate risks, participants expressed the need to evaluate all IT risks continuously in an environment, conduct regular IT audits and ensure that business continuity and disaster recovery plans are defined and implemented.

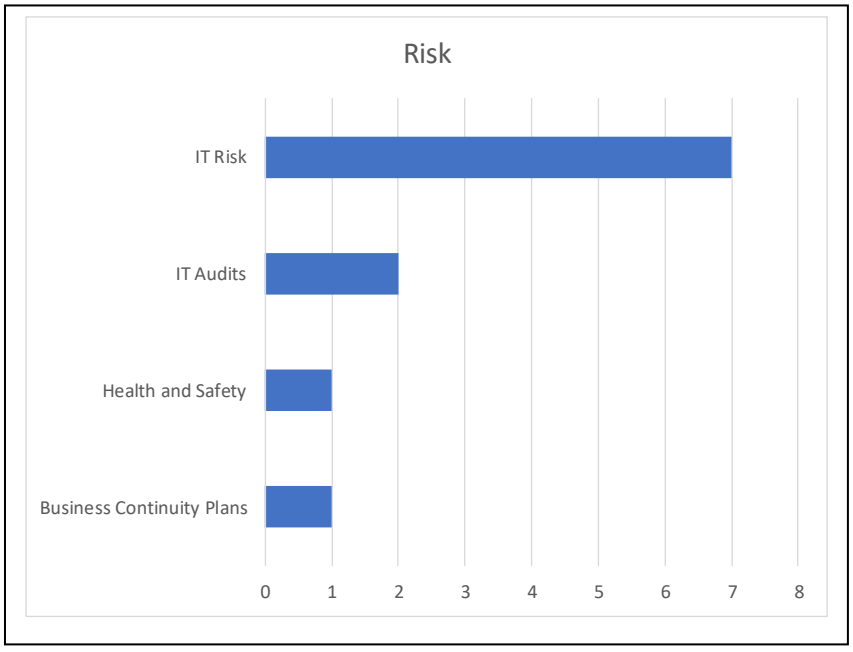


Figure 75 - Influence of Risk on Decision-making

Participants also mentioned that although risks may not be a strategic decision-making criterion, generally no new system will be implemented in their environment without a proper risk assessment being conducted. It was therefore a recommendation from participants to include risk as a critical success factor in a decision framework.

5.2.9.3 Compliance

Participants had differing views on the strategic nature of compliance in decision-making. While most participants agreed on the critical role of compliance in influencing decisions and the future of projects in an organisation, they could not relate examples where compliance helped increase revenue share or customer satisfaction or helped organisations to react to disruptive threats. Participants nonetheless agreed that it was the task of the CIO to ensure compliance for the business in all conditions:

> *Remember I told you upfront, a CIO's accountability lies with what is legislation and King IV, which is your IT law.*

The view from most participants was that compliance was a necessary consideration for any organisation to comply with industry best practices, legislation, governance, standards etc. They also acknowledged that in some cases, best practices and standards may not have evolved or may not be relevant in agile disruptive technology environments. Organisations need to maintain the necessary processes to keep all parts of their businesses current – processes, people and technology.

Discussions also revealed that compliance may not necessarily be a strategic factor to influence a decision in a disruptive environment, but has the potential to delay or stop necessary investments. The comment below was made by a COO of a large telecommunication company on the importance of compliance in technology decisions for a company:

> *She didn't realise the law didn't allow digital forms. She went and put it in her strategy and wrote all these nice papers about everything, and then it never materialised because you can't. Whereas if you took time to understand the context, it was the wrong strategy at that time.*

Participants also shared examples where compliance expedited decisions in their organisations because of deadlines that had to be met, as indicated by the following comments:

You know, it's quite interesting, when you've got a hard deadline it seems to be quicker. So that selection process wasn't too bad at all, because we had to meet the authenticated collection deadlines in the industry.

I've seen another one where there was a compliance implication and that was done quickly, but sometimes projects can drag on. You know, also what sort of prioritisation it has in the organisation - people tend to focus where there's a big penalty at the end of it.

Well this one we didn't have an option because there's compliance - because I'm just saying, you know, things that are, client facing and regulation get priority.

Participants were asked about their views on how investment decisions are motivated if these relate to compliance risks and if decision criteria as identified in section 5.2.2 will still apply:

Regulatory compliance is necessary. Those there, your business case is very different. You're not going to look at a financial return on investment. Those are regulatory compliance and if you don't comply the implications are huge. Those have different decision-making criteria.

As compliance is a broad topic, participants were asked to indicate the key topics that need to be evaluated when making IT investment decisions in an organisational context. Figure 76 provides an indication of key aspects mentioned in the interviews. One of the interview participants referred to compliance as a gatekeeper – if certain minimum conditions are met, then a decision proceeds to the next quality gate.

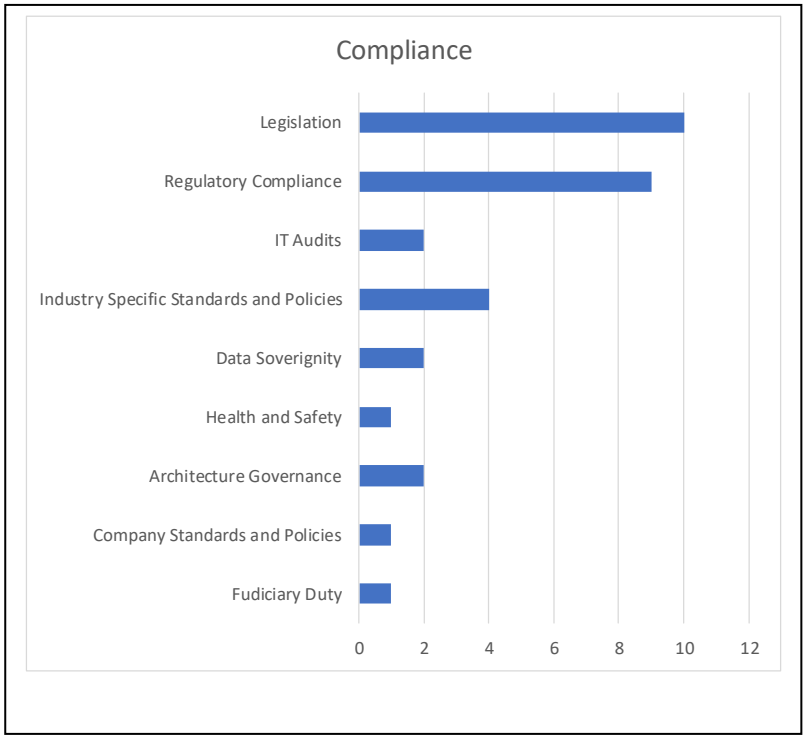


Figure 76 - Influence of Compliance on Decision-Making

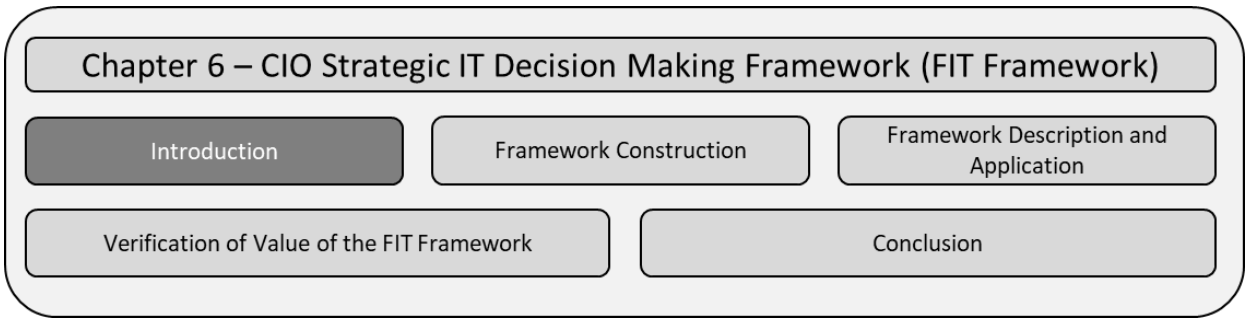
5.2.10 Conclusion

In Chapter 5, a detailed data analysis on interview transcripts was conducted to answer SRQ2 in this thesis:

"How can the decision framework be refined with input from field experts based on their current experience in making decisions in a disruptive environment?"

The decision framework was refined by analysing each of the factors in detail and providing a description of how it influenced strategic IT decision-making.

Chapter 6 presents the final decision framework and implementation guidelines for CIOs on how to use it in an organisational context. The decision framework is also tested in a focus group of industry experts to verify its value in guiding strategic IT decision-making.



6 CIO DECISION-MAKING FRAMEWORK

6.1 INTRODUCTION

The objective of this research was to propose a framework to guide CIO strategic IT decision-making in an agile business environment faced with a continuous stream of disruptive technologies. Technology is changing at an exponential rate, which is driven by cloud, consumerism, IoT etc.; however, the rate of technology change within organisations is relatively slow. The technology management challenge facing CIOs is in deciding which technology to select for use within an organisation in an exponentially changing technology environment as shown in Figure 77.

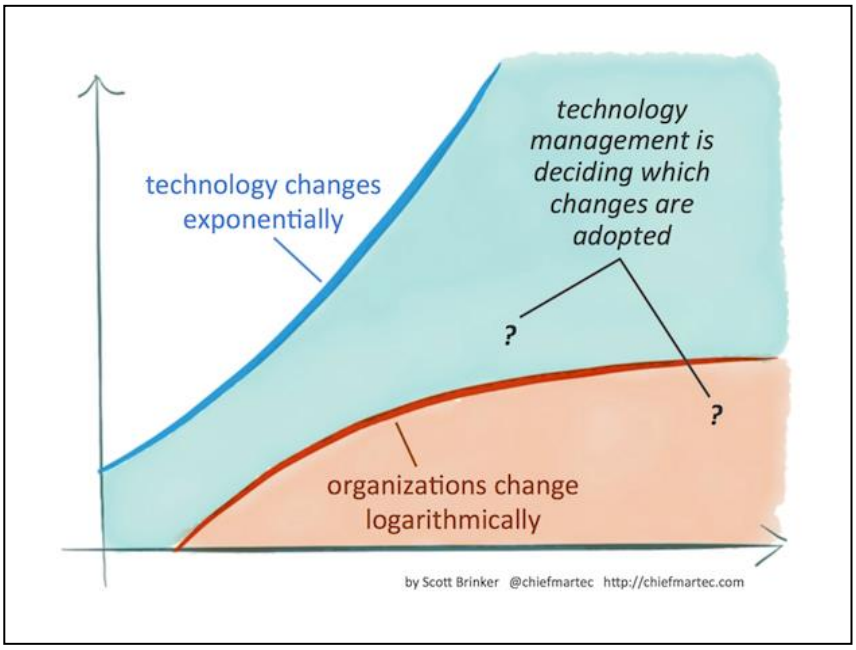


Figure 77 - Martec's Law: Technology Changes Exponentially (Brinker, 2013)

Technology is now part of mainstream business, as it attracts significant capital investment and operational expenditure, which attracts attention from most business executives to realise a

return on investment. Technology also permeates every aspect of business, which implies that IT is no longer at the periphery. In most companies, it dictates how business is done. CIOs are now faced with a challenge of motivating “why” they need to invest in IT, decide on “what” they need to invest in, make a strategic bet on “when” the time is right to invest and decide “how” they will execute the project. Decision-making complexity has increased exponentially over the past few years. The wrong decision could affect the sustainability of an organisation. IT is a disruptive force that has the potential to influence all organisations across all industries.

Many organisations find themselves at a tipping point, redesigning business models and trying to find new ways to compete in disruptive business conditions. Most organisations expect CIOs to play a more strategic role and help define and implement digital business strategies to avoid being disrupted by newer, more agile competitors. CIOs need to build IT capabilities as a core competence to drive digital business strategies.

The challenge for CIOs therefore is to find a way to manage complexity, identify and respond to disruptive technologies, enable digital business strategies and use IT to create sustainable competitive advantage for business. The absence of a decision framework to enable CIOs in achieving this challenging objective in disruptive market conditions implies that they would have to rely on experience and intuition and hope for the best outcome. In many cases making no decision is safest, resulting in businesses sticking to traditional ways of doing business. This approach significantly increases the risk to any enterprise of disruption by new entrants that are not handicapped by legacy IT systems.

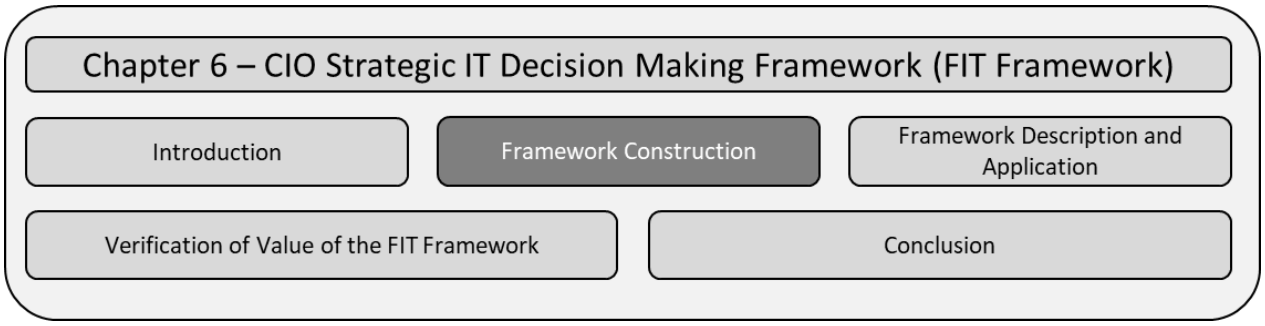
Mainstream businesses that have already invested in IT systems to achieve business outcomes cannot afford to take a passive approach to changes in technology. Businesses need to scan the large number of technologies in the market continuously and invest in key technologies that can protect existing assets and help build future sustainability for organisations.

Rapid changes in technologies imply that factors influencing decision-making change continuously. The challenge for any CIO is how to make decisions in an agile business environment when confronted with a continuous stream of new technologies that could have a significant impact on an organisation if the wrong decision or no decision is taken.

The gap in current literature is that most research on strategic IT decision-making focusses on a topic, process or technology without consideration of contextual factors or disruptive technologies that have a direct impact on strategic IT decision-making in an organisation.

After analysing previous research on IT decision-making in disruptive environments, various factors emerged as key considerations for motivating new technology investments. Literature reviews indicated that decision-making is influenced by various factors, such as personal attributes, the experience of the decision maker, decision processes, the characteristics of the industry, organisational characteristics, timing etc. No framework was found that could be used as a guide for strategic IT decision-making amid disruptive technologies.

Chapter 6 shows the process of constructing a strategic IT decision-making framework using existing literature and primary research. A guideline is also provided on how CIOs can use this framework in practice. The final section in this chapter verifies the applicability of the decision framework in a focus group exercise with CIOs.



6.2 FRAMEWORK CONSTRUCTION

Figure 78 provides an overview of the layout of this thesis using a DSR approach to arrive at a decision framework that could guide CIO strategic IT decision-making in an agile business environment from a perspective of disruptive technologies.

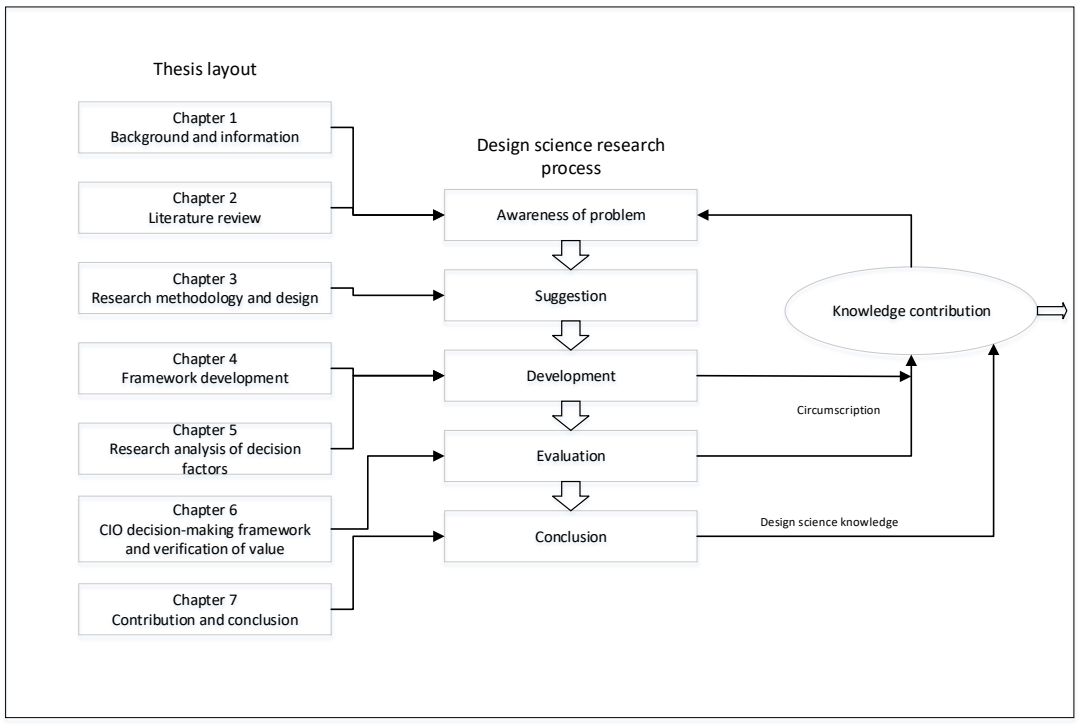


Figure 78 - Layout of Thesis

In creating a framework to guide IT decision-making, the main research question that was defined to be answered in this thesis is:

MRQ:

"How can a CIO decision-making framework be constructed that can be used to guide CIOs in making strategic IT decisions in a disruptive technology environment?"

Three additional SRQs to be answered to create a framework are the following:

SRQ1:

"What are the key factors in a framework that CIOs should consider when making strategic IT decisions in an organisation in agile business conditions?" *(Note: This was answered in Chapter 4)*

SRQ2:

"How can the decision framework be refined with input from field experts based on their current experience in making decisions in a disruptive environment?" (Note: This was answered in Chapter 5)

In Chapter 6 the focus is on answering SRQ3:

SRQ3:

How can the decision framework be used in practice to guide strategic IT decision-making in agile business conditions?"

The process of constructing the framework to answer MRQ and SRQ1, 2 and 3 is shown in Figure 79. A comprehensive literature review was conducted in Chapter 2, which resulted in the identification of eight factors influencing strategic IT decision-making, as shown in Figure 80. Each factor addressed aspects of IT decision-making regarding technology or strategic choices in an organisational context.

The factors shown in Figure 80 were thereafter confirmed in a semi-structured interview process with 14 industry professionals comprising business executives, CIOs, IT consultants, IT advisors and enterprise architects based in South African organisations and internationally in global organisations. During the verification process an additional factor was identified (GRC), which was included as a ninth factor in the final strategic IT decision framework, as shown in Figure 81.

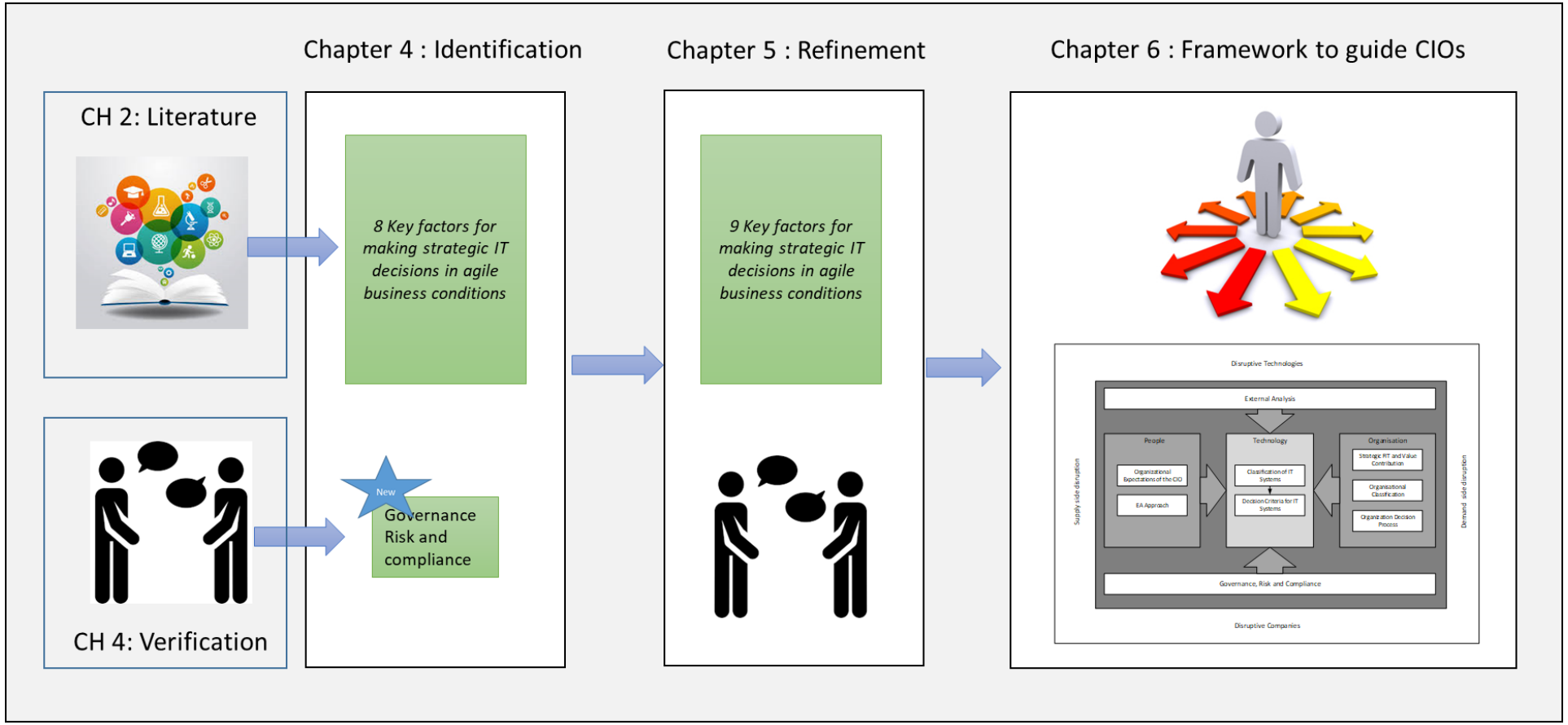


Figure 79 - Decision Framework Construction

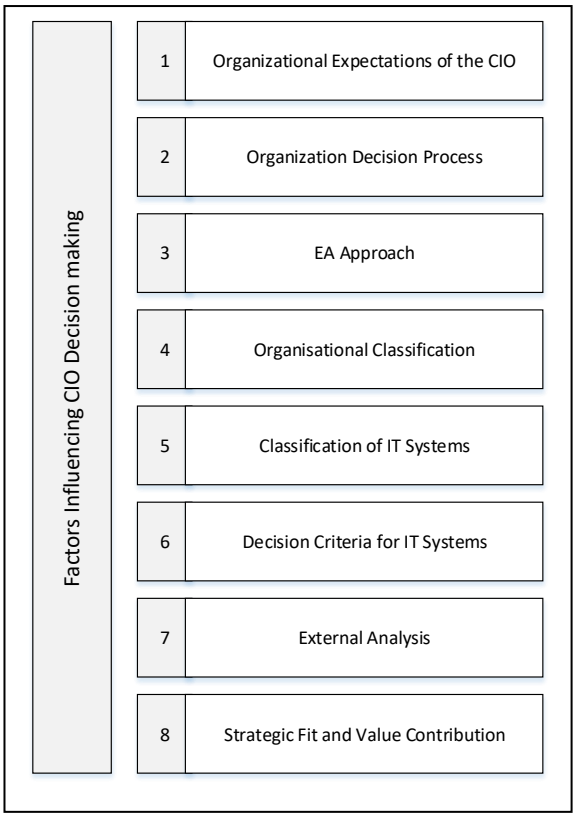


Figure 80 - Decision Factors based on Outcome of Literature Review (Chapter 4)

In Chapter 5, detailed data analysis was conducted to understand how each of the factors influenced strategic IT decision-making. In this way, the framework was refined with input from field research.

The outcome of this research resulted in a framework as shown in Figure 81, which is proposed as a FIT strategic decision-making tool for use by CIOs.

6.2.1 FIT framework

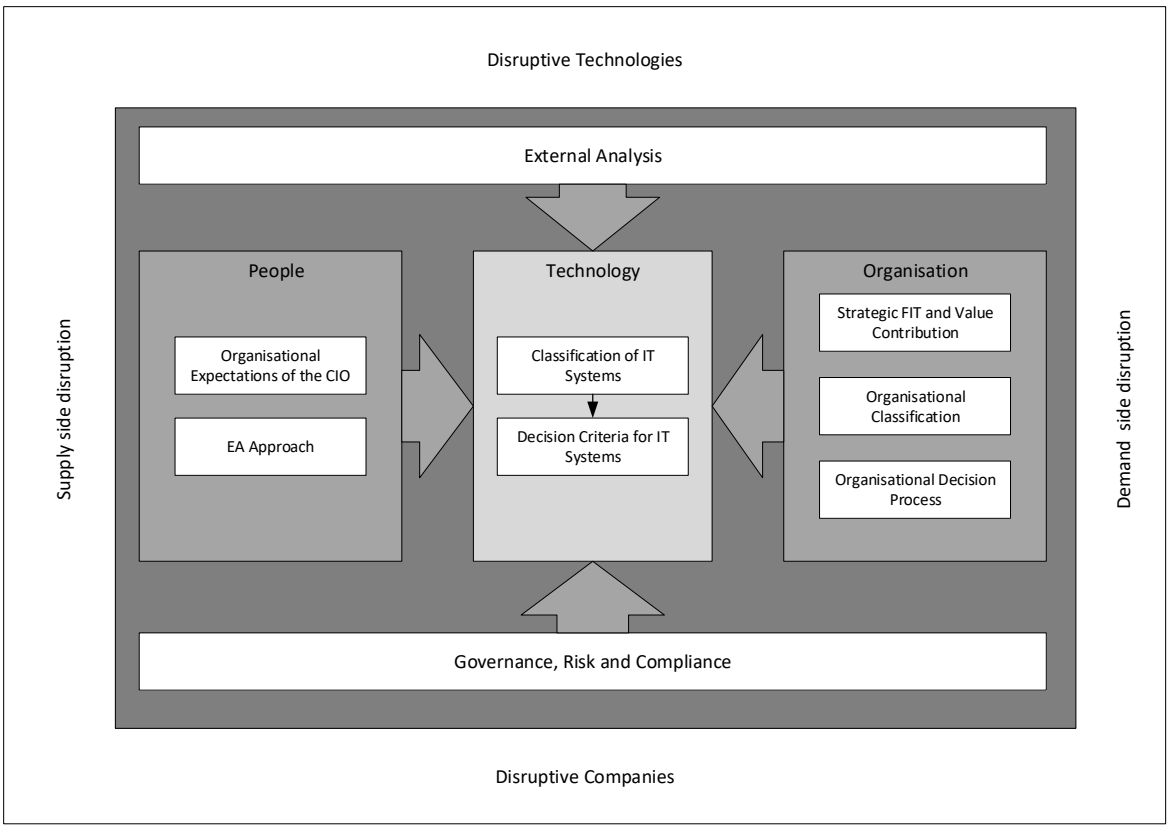


Figure 81 – FIT Decision-Making Framework

Organisations exist in environments faced with continuous disruption, which can generally be classified into four categories: supply side disruption, demand side disruption, disruptive technologies and disruptive companies. In a disruptive context, CIOs are expected to make strategic IT decisions on a continuous basis to achieve business outcomes and ensure the sustainability of their businesses.

The framework provides guidance to CIOs on aspects to consider when making strategic IT decisions. The framework indicates that technology-related decisions are influenced by people, organisations, external factors and GRC requirements, as shown in Figure 81.

The results of this research indicate that many CIOs focus mainly on technology-related aspects when making decisions based on prior experience, although each of the decision factors in the FIT framework can influence strategic IT decision-making.

Because of the pervasive use of IT in organisations, the FIT framework should be used as a guide, with the IT classification model referred to as the BIDD model in this study. The BIDD model is described in further detail in the next section.

6.2.2 BIDD model

During literature reviews, it was clear that in creating a strategic IT decision framework, IT systems should be classified based on their primary function in organisations. As IT permeates all functional areas in business and is often a source of competitive advantage, there is a blurring of boundaries between traditional IT and business technology. Organisations need to understand the classification of IT systems, as well as their role in creating value and servicing end customers and should define the accountability of IT departments and business executives regarding the implementation, support and use of these systems.

IT systems deployed in organisations enable business and its employees to deliver products and services to end customers. There are distinctions between IT systems used to service internal business processes and IT systems that enable external business processes. In many organisations ownership and accountability for internal and external IT systems are different, which creates challenges for decision-making in an environment where IT becomes commoditised and permeates organisational boundaries and ecosystems.

To differentiate IT systems and their characteristics in organisations, the researcher proposed the BIDD model shown in Figure 82.
In using the FIT framework defined in Figure 81, the different decision factors identified should be compared to the BIDD model shown in Figure 82. In an environment faced with continuous introduction of disruptive technologies, the choice of technology is dependent on understanding "how" technology creates value to customers as opposed to understanding "what" the technology does. The section that follows explains how the FIT framework and the BIDD model should be used in an organisational context to help CIOs take strategic IT decisions from a disruptive technology perspective.

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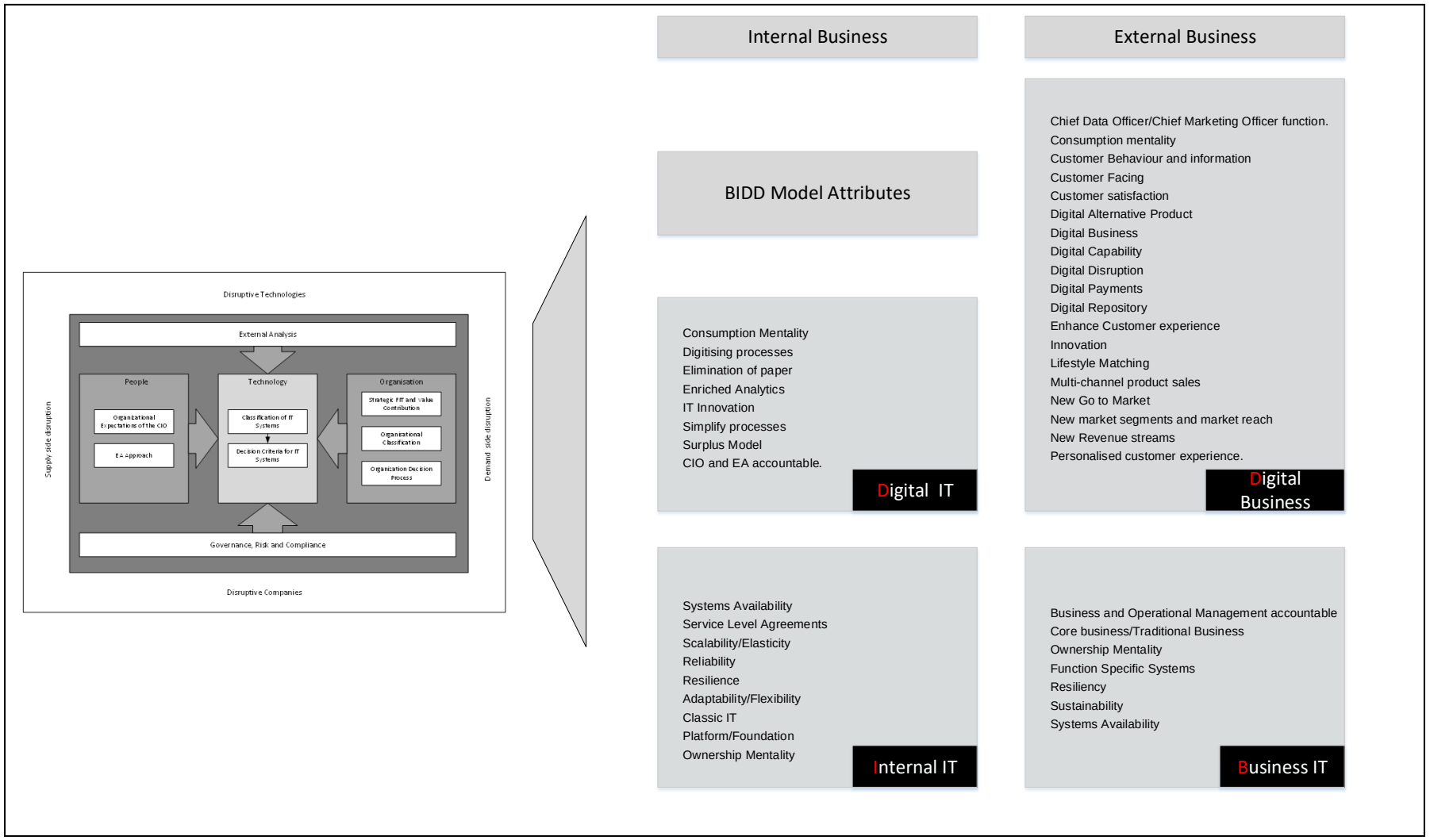
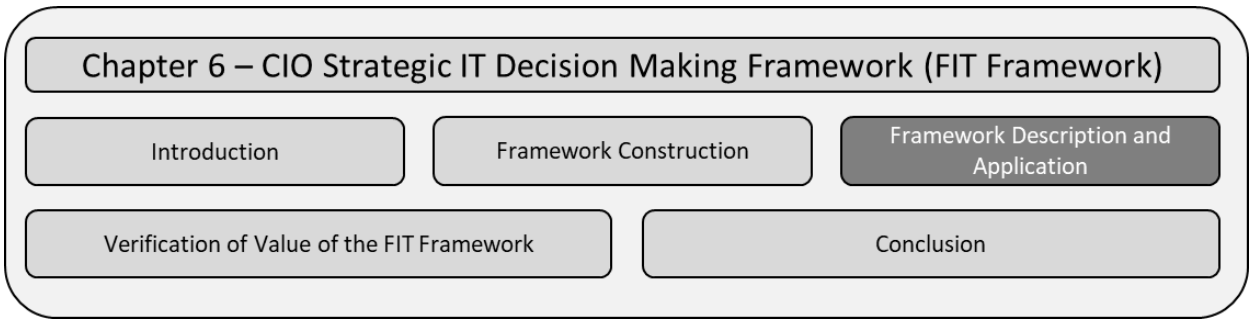


Figure 82 - BIDD Model



6.3 DESCRIPTION AND APPLICATION OF THE DECISION FRAMEWORK

6.3.1 Introduction

The following section provides a description of each of the factors in the FIT decision-making framework and outlines a generic description of the application of the decision framework in a typical organisation. The FIT framework description in this section highlights the nine factors and gives CIOs an overview of "why" a technology is required, "how" the framework should be applied and "what" a CIO should do with the information to speed up decision processes to select, invest and implement the chosen technology.

The framework is a guideline on factors to consider; it is not prescriptive and all steps may not be applicable in all scenarios. It is important to understand the different facets influencing decisions and to make an informed decision on whether a factor is applicable or not.

Figure 83 shows a nine-step guideline describing the practical implementation of the FIT decision-making framework in an organisation. The steps in the guideline do not need to be executed sequentially – analysis can be executed in parallel. Care must be taken to ensure that sufficient consideration is given to the topics identified to ensure that the CIO can justify a decision to different stakeholders in an organisation.

Generally, CIOs and enterprise architects spend huge amounts of time focussing on technology specifications and functionality. The framework proposes that CIOs consider other factors as well, as they are all equally important for a decision to be made on a new technology investment.

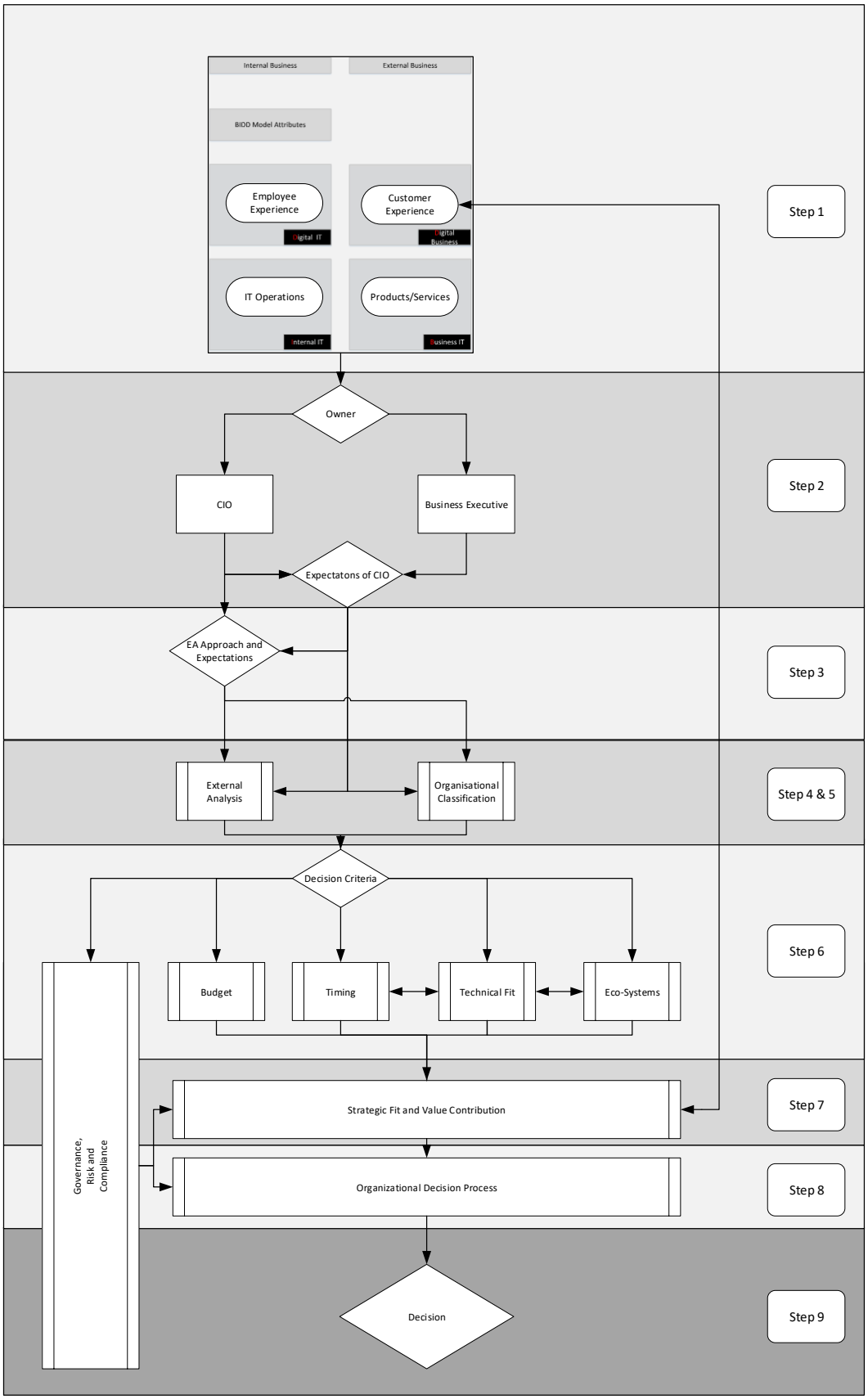


Figure 83 - Application of Decision Framework

6.3.2 Implementation method for IT decision framework

The nine steps proposed in Figure 83 are:

- Step 1 – Use the “classification of IT systems” model (BIDD model) to understand the functional use of IT systems in the organisation.
- Step 2 – Understand the “organisations’ expectations of the CIO”. Who is the functional owner and what are the expectations of the CIO?
- Step 3 – Determine the “EA approach” suitable for a disruptive technology environment. What are the expectations of enterprise architects in deciding on a technology?
- Step 4 – Perform an “external analysis”. Understand external competing technologies and technology strategies and how these could affect current IT strategies.
- Step 5 – Consider the “organisational classification”. What is the organisation’s operating model and what systems, people, process and customers are shared?
- Step 6 – Identify “decision criteria” for systems classified according to the BIDD model. What are key criteria that will determine if a technology is selected to be implemented?
- Step 7 – Understand the technology contribution to “strategic fit and value”. How does the chosen technology fit the organisation’s strategy and how does it add value to customers identified in step 1?
- Step 8 – Consider the “organisational decision process”. What is the process to follow when motivating a decision and how does the organisation decide?
- Step 9 – Ensure decision success (compliance with GRC).

6.3.3 Discussion of steps in implementing the FIT framework

6.3.3.1 Step 1 – Classification of IT systems (BIDD model)

A critical component in the framework is to understand the technology landscape and classify systems based on their purpose in an organisation. The framework categorises all IT systems used in an organisation into four distinct categories. Each of these have different decision criteria and, in many cases, follow a different approval process. In many organisations CEOs do not differentiate between external business IT and internal IT and assume CIOs are accountable for everything IT-related. This can result in CIOs being perceived as not adding value to business or not using IT to create sustainable competitive advantage for a business. Business unit executives who are accountable for business IT systems sometimes maintain the status quo and focus on cost reduction. In the process they may miss digitising opportunities to transform business models by leveraging disruptive technologies.

IT and business have merged, resulting in no clear distinction between IT and business (Heller. M, 2012). Technology has become the cornerstone of business and failure to embrace technology in the core of a business could result in business disruption or obsolescence. IT permeates most organisations as company executives try to find ways of using technology to digitise products and services, leverage online channels and create global reach.

Traditionally, CIOs were employed to cater for the IT needs of the internal organisation. Their basic responsibilities included the provision of desktops for employees, networks between branch offices, internet services, email, payroll etc. IT systems and technologies used in creating products or services delivered to external customers generally fell under the control of business unit executives. With convergence, there is a dilution of accountability and blurring of the lines between CIOs and business unit executives that can sometimes lead to confusion on who makes the decision on common technologies. In most instances, separate infrastructure and systems are not required to service the needs of the internal organisation and to provide services to customers.

Classifications of systems also helps in determining the CIO focus areas that will add most value to the organisation and their peers. This approach will assist in creating awareness among stakeholders on IT ownership and where most time and budget are spent. Company executives will need to decide if current investments support organisations' strategic intent in an agile business environment.

Figure 84 shows a simplistic overview of IT systems classification based on current research and key attributes highlighted by CIOs. Organisations may have other ways of classifying systems. It is important to understand which systems support the internal operations of a business and which systems support end customers and, in some instances, may be used to service both internal and external business requirements.

The intent of this classification is not to focus on underlying technology such as Microsoft, IBM, AWS, SAP, Cisco etc., but to indicate what the technology enables regarding functionally or business processes.

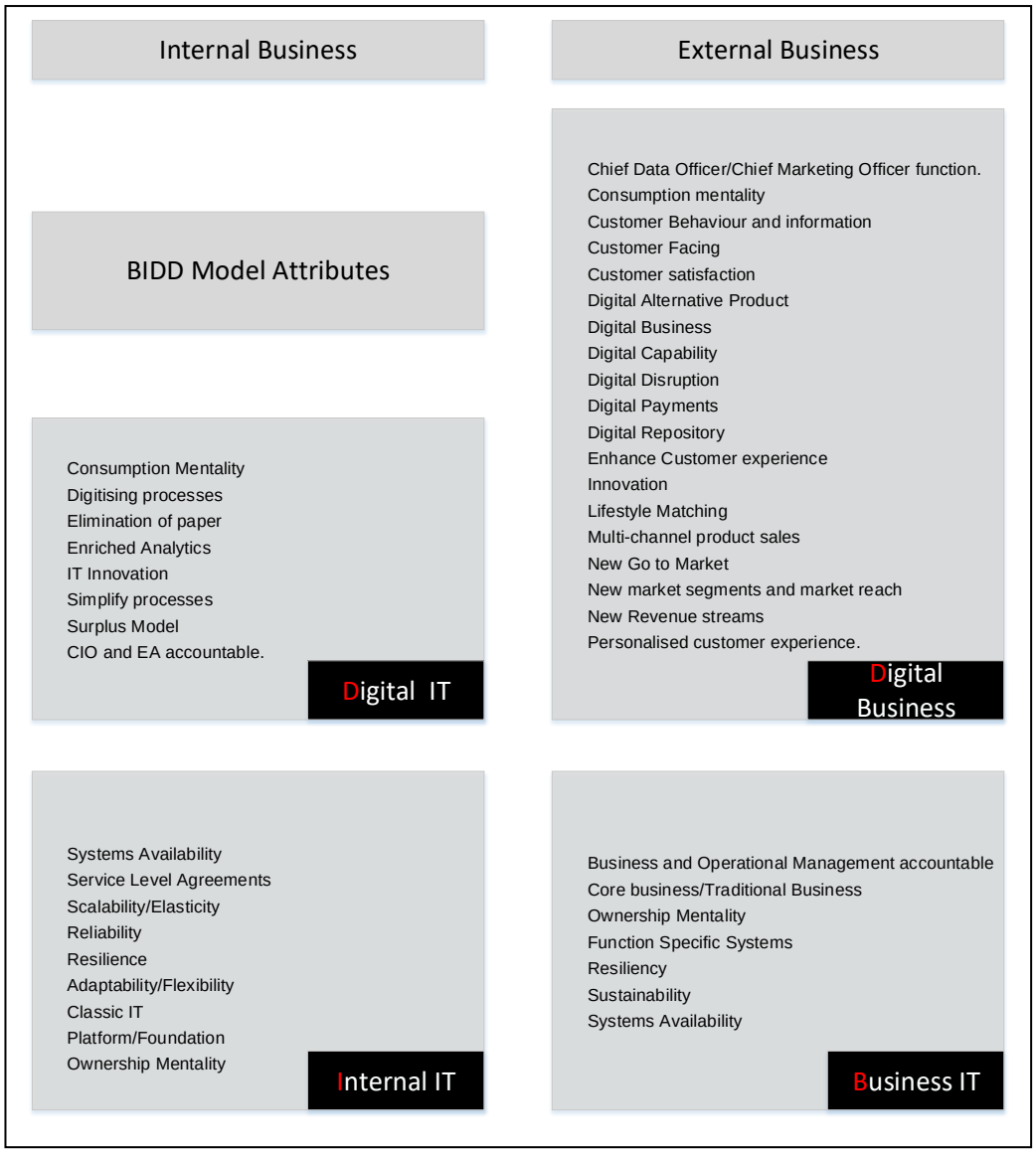


Figure 84 - Classification of IT Systems - BIDD Model

The BIDD model classification can assist CIOs in guiding technology investment decisions and areas of focus. Owners of systems can be strategic in each quadrant of the model, as all systems deployed will generally be key in operating a business.

The following section briefly describes the different quadrants of the BIDD model:

Internal IT

CIOs are generally employed within organisations and are mainly accountable for internal IT, providing users with tools and systems supporting the internal operations of a business. IT

systems in this quadrant are critical in providing platforms that enable collaboration and workflow in an organisation and systems that support business processes that enable an organisation to interact and transact with customers.

Previously IT was a specialised skill that required a team of experts to plan, build and run IT services. Currently most internal IT systems are commoditised and are expected to be seamless to business, i.e. IT must always be available; only failure of systems attract attention from senior executives and customers. This often reflects negatively on IT teams.

Key characteristics of IT systems in this quadrant are the following:

- The focus is mainly on systems availability and adherence to service level agreements.
- Systems need to be scalable, in line with business consumption demands.
- IT systems must be reliable.
- Systems should be resilient, with appropriate disaster recovery procedures in place.
- Systems should be adaptable and flexible to cater for changing business models or priorities.
- Systems are predominantly classic IT systems, i.e. ERP, end user computing, collaboration, networking, data centre services and application support services.
- Systems in this quadrant form the underlying platform or foundation to support the operations of the business.

Most CIOs acknowledge that this quadrant of the BIDD model consumes most of their time and although it is a critical part of the business, it is generally a commodity service offering that is expected to become cheaper on an annual basis. Business expects systems in this quadrant to be constantly available, despite being generally invisible to the organisation.

Digital IT

To remain competitive in a disruptive technology environment, CIOs are expected to find new ways to optimise business processes and reduce operational costs. The view from CIOs is that business expects IT to reduce costs continuously, while driving innovation, to simplify and automate internal process and to reduce the cost of servicing a customer. Business executives expect CIOs to drive initiatives in their IT strategy that enable their businesses to become more agile, foster seamless “anytime, anywhere” collaboration among employees and automate and digitise tasks to eliminate paper-based processes.

Key attributes of systems in this quadrant are the following:

- Systems owners must move from a mindset of owning all aspects of systems deployed to providing services as needed based on consumption requirements.
- Systems enable the digitising of business processes.
- Systems deployed can result in the elimination of paper-based systems and processes.
- The systems provide enriched analytics of available data to enable better decision-making.
- These systems focus on IT innovation related to internal IT systems.
- Systems deployed focus on simplifying processes, e.g. by enabling mobile user interfaces to traditional systems.
- Moving away from a mindset of IT system resources is limited or constrained to a mindset of unlimited cloud-based system provisioning.
- Generally, the systems fall under the accountability of CIOs and enterprise architects.

Innovation and value that are visible to users are derived mainly from digitalisation initiatives. Systems in this quadrant are often driven by consumerisation, where business executives expect changes to internal IT to be in line with changes in the consumer space. The challenges for CIOs are that they are accountable for IT security, risk and governance, which implies that the internal pace of technology change is often impeded by internal processes. This often leads to frustration among internal business users regarding the speed of IT in delivering value to business.

Business IT

Many organisations have systems deployed that are used to service the needs of end customers. In many cases niche solutions were deployed to address specific business processes and fell under the accountability of business executives. The evolution of IT and its pervasiveness across business and systems imply that most niche technology solutions can be replaced by commoditised IT solutions. This would simultaneously create additional sources of competitive advantage for an organisation. Convergence of technology often poses a problem in terms of accountability in organisations, which often impedes decision-making and can result in duplication of systems and costs.

Technology in this quadrant mainly relates to systems deployed in an operational or production environment that enable the production of goods and services. Traditional manufacturing execution systems are merging and integrating with IT systems, enterprise networks, cloud computing, IoT technologies etc., but rarely fall under the accountability and control of CIOs in an

organisation. CIOs need to identify and acknowledge their existence in an organisation, define their role in influencing decisions in this quadrant and define a roadmap to migrate ownership of these systems to the CIO.

Digital business

IT systems that fall in this quadrant of the BIDD model focus predominantly on customer value creation. Technology in this space focusses on obtaining customer insight, simplifying customer engagement with organisations, increasing revenue streams, increasing customer loyalty etc.

Figure 85 uses the iceberg analogy to illustrate technology value creation in an organisation. Most time and budget are generally spent on maintaining systems below the surface of the water, while value is visible at the tip of the iceberg. Consumerisation, digitalisation, mobility etc., create new expectations from customers. This forces companies to adapt to avoid disruption. CIOs who focus predominantly on technology at the bottom of the iceberg will not be seen as adding value to an organisation. Organisations that wish to compete in a disruptive technology environment will need to evaluate and adopt technology in an agile approach to create value and satisfy customer needs.

CIOs are generally expected to evaluate newer technologies continuously and orchestrate implementation, adoption and acceptance of these technologies in an organisation, whereas most CIOs currently only focus on “keeping the lights on”.

Figure 85 - IT Value Creation (T-Systems)

CIOs will need to assess whether current systems in the digital business quadrant of the BIDD model enables the strategic intent of an organisation in an agile business context. Some of the key attributes of systems enabling digital business are the following:

- These systems are generally owned by the chief data officer/chief marketing officer function.
- The preference is to pay for services consumed as and when required (consumption mentality).
- The focus is on understanding customer behaviour and gathering customer information.
- These are predominantly customer-facing/interaction systems.
- The systems focus on improving customer satisfaction.
- These systems enable the creation of digital alternative products, services and digital business capability.
- The systems enhance customer experience.
- The systems drive products, services and business model innovation.
- Multichannel engagement occurs to match the lifestyle of customers.
- The systems enable access to new market segments and market reach.
- New revenue streams are created.
- The systems offer a personalised customer experience.

Technologies in the digital business quadrant of the BIDD model will offer organisations transient competitive advantage and help them adapt to changing market dynamics.
Classification of IT systems in an organisation will provide a macro-view to CIOs and business executives on how IT is currently deployed to create value for business and customers. This approach will also clarify roles and accountability for systems in different quadrants, which may assist in identifying areas of focus aligned to business strategy.

The analysis in Step 1 should determine the impact of new technology on the following key areas:

- Customer environment – Is technology driving changing customer needs, expectations, experience, fulfilment methods, reach etc.?
- External business environment – How does technology affect an organisation's products and services to customers, e.g. customer interaction, changing expectations of products and services, changing business processes, online and offline requirements, etc.?
- EA strategies – What are the trends and which part of the businesses-sustaining technologies or current business models may be affected? Can the organisation's business model be influenced by technology-driven platform organisations or market disruptors?

Disruptive technologies identified should be mapped to the BIDD model to understand their impact on internal and external IT requirements. It is critical that the initial IT decision process starts with an analysis of customer needs, which may be overtly visible or an opportunity to create value for customers.

For example, a financial institution may identify a need to investigate Bitcoin and Blockchain technologies as a mechanism to compete with Fintech or to transform current business models, in response to disruption faced by financial intermediaries, because of a reduction in the cost of peer-to-peer transactions. In this case, mapping of the customer journey to the BIDD model will result in new IT demands in all quadrants of the model. Typical considerations are the following:
Digital business – What systems and processes will be required to service customers in a digital business world? What mechanisms can be used to attract customers to use the new product and services available and increase networks' effects?
Business IT – What is the impact of technology on an organisations' current products and services? How will a digital payment or transaction mechanism integrate with traditional transaction systems?

Digital IT – What internal process will be affected and how would employees be engaged in a Bitcoin-enabled peer-to-peer environment?
Internal IT – What is the impact on internal IT strategies if businesses embrace Blockchain as a strategy? What is the impact on hosting, cloud strategies, security, integration etc.?

Figure 86 provides a high-level guideline for CIOs on how to apply decision factor “classification of IT systems” of the FIT framework practically in an organisational context. It shows CIOs “why” this factor should be considered, provides guidance on “how” to use the framework and “what” to do with the information obtained from the analysis.

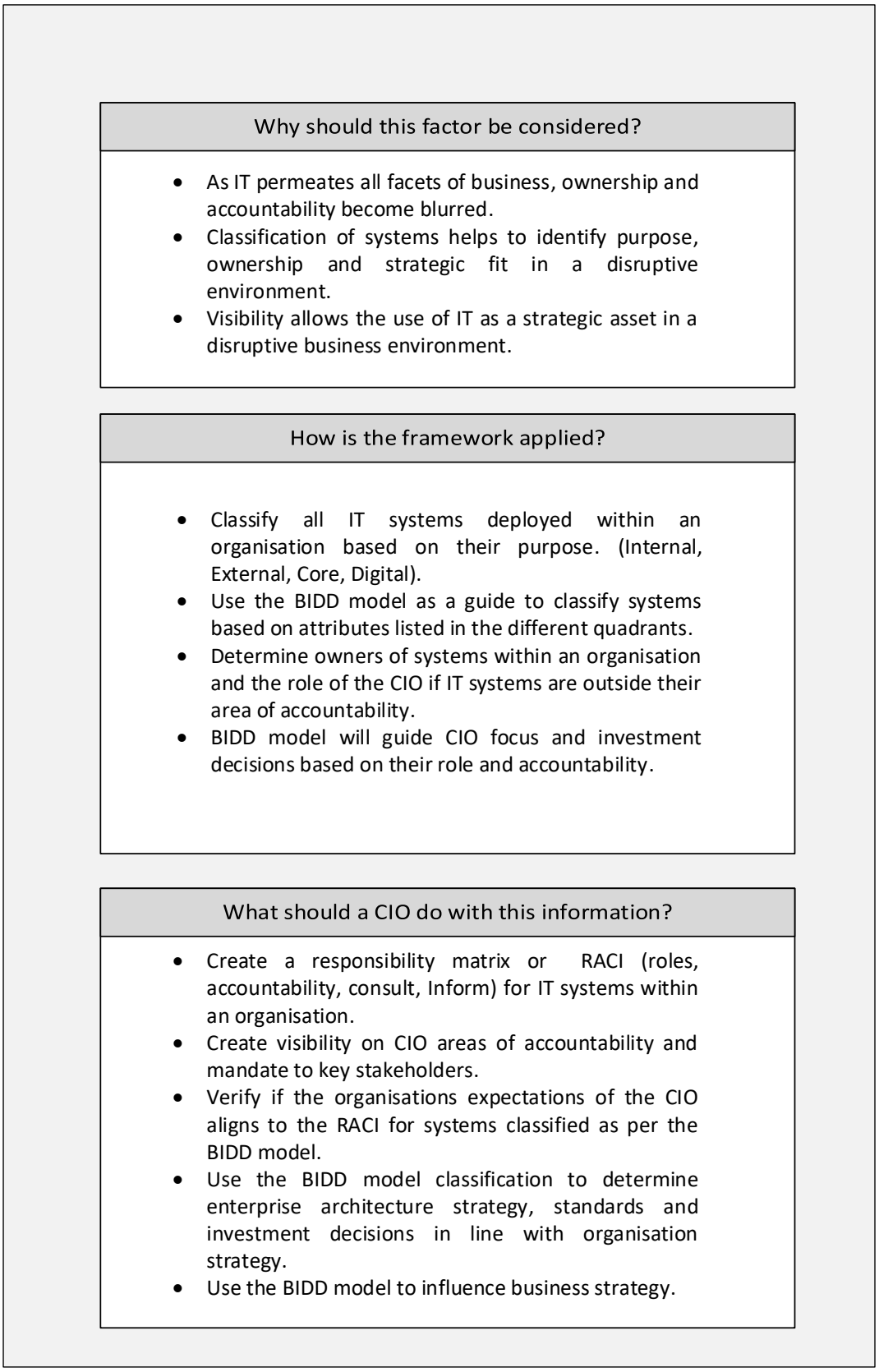


Figure 86 - FIT Framework Application Guideline - Classification of IT systems

6.3.3.2 Step 2 – Organisational expectations of the CIO

IT systems deployed in organisations should be viewed from the perspective of the CIO and from an organisational perspective. Organisations use IT across their business operations to create products and services to pursue business objectives (Swanepoel, June 2015). However, technology ownership in organisations is not generally defined and business executives are often reluctant to take ownership of IT systems within their business areas. If ownership and accountability are vague within organisations, the convergence of independent and disparate systems due to commoditisation and the pervasive nature of disruptive technologies will result in a decrease in the ability of organisations to leverage IT as a strategic resource to compete in agile business conditions.

CIOs in any organisation need to review and understand expectations of them in agile business environments faced with disruptive technologies. CEOs in many organisations assume CIOs are accountable for all IT systems in organisations, though this is generally not the case. Once the expectations and accountability of CIOs have been defined, they can focus on their area of accountability to add value to organisations. From a CIO perspective, they should not assume accountability for all IT systems in organisations without creating visibility of ownership, as this could have an impact on their ability to influence decisions or their effectiveness as the CIO.

Often business executives and CIOs do not have a common understanding of ownership and accountability with regard to IT systems and how these can be leveraged as a strategic asset in an organisation (Swanepoel, June 2015). Business executives often assume ownership of IT systems used in servicing end customers, which may result in power struggles in organisations if ownership is not clarified.

Figure 87 describes a structured approach in clarifying the expectations of CIOs in an organisational context, which will result in a list of priorities to enable them to be successful. Expectations should be clarified in the context of the BIDD model, which will guide priorities and focus areas for the CIO and his team. Although CIOs may aspire to perform different roles in an organisation, they need to prioritise their primary accountabilities before offering to assist in other areas of the business.

In assessing the expectations of the CIO in the context of the BIDD model, CIOs will be able to assess their value contribution against the organisation's expectations of them. They will be able

to determine if they are currently focusing on the right priorities or if their priorities need to change to satisfy expectations. This will also help them in making appropriate decisions if they want to play a more strategic role in an organisation, e.g. if most of their time is spent on “keeping the lights on” or internal IT and they are required to focus more on digital transformation (digital business), they may decide to outsource non-differentiating activities and focus all effort on customer-focussed system implementations.

Figure 87 and Figure 88 provide a high-level guideline for CIOs on how to apply the decision factor “organisational expectations of the CIO” of the FIT framework practically in an organisational context. Figure 88 shows CIOs “why” this factor should be considered; provides guidance on “how” to use the framework and “what” to do with the information obtained from the analysis.

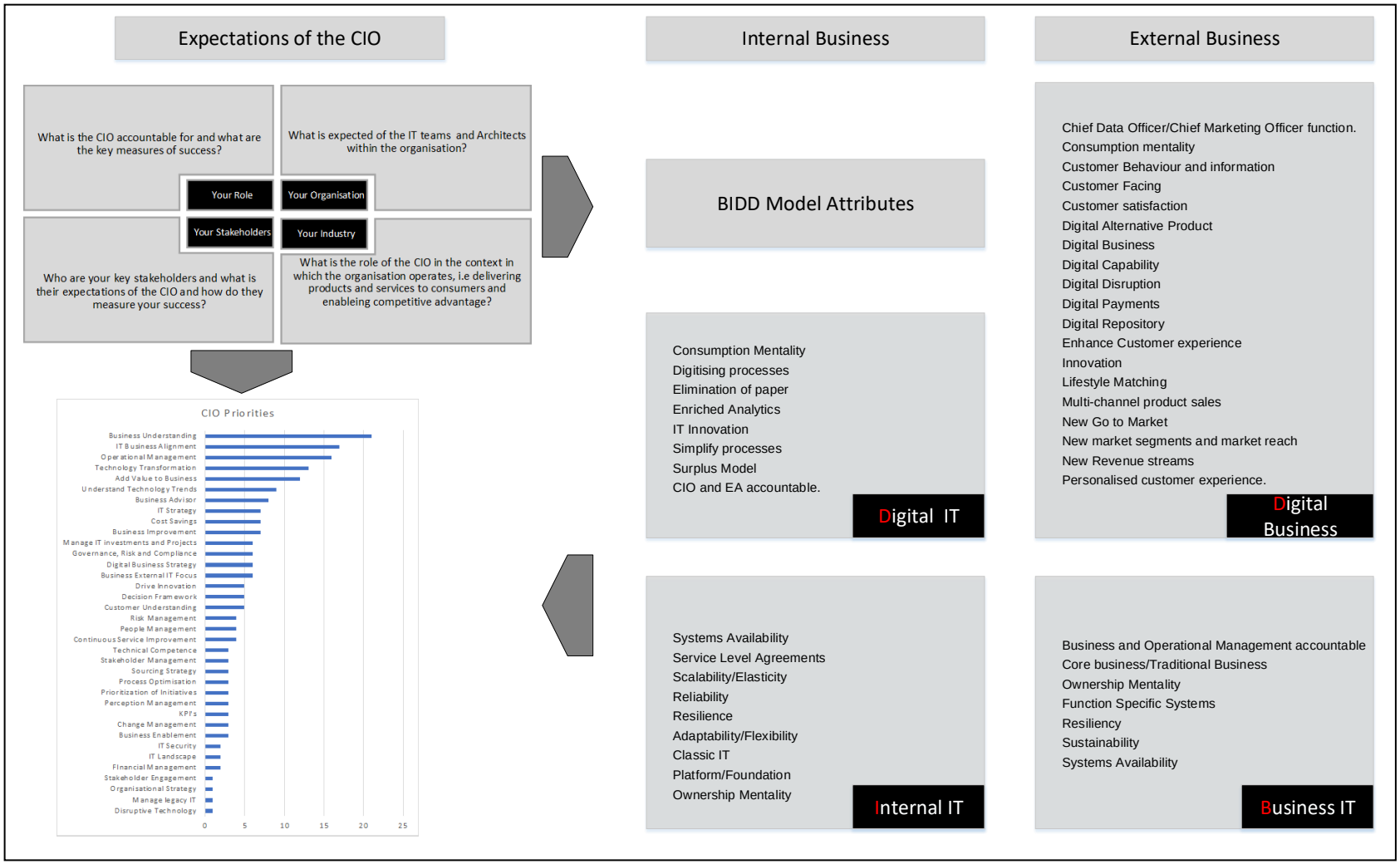


Figure 87 - Expectations of the CIO

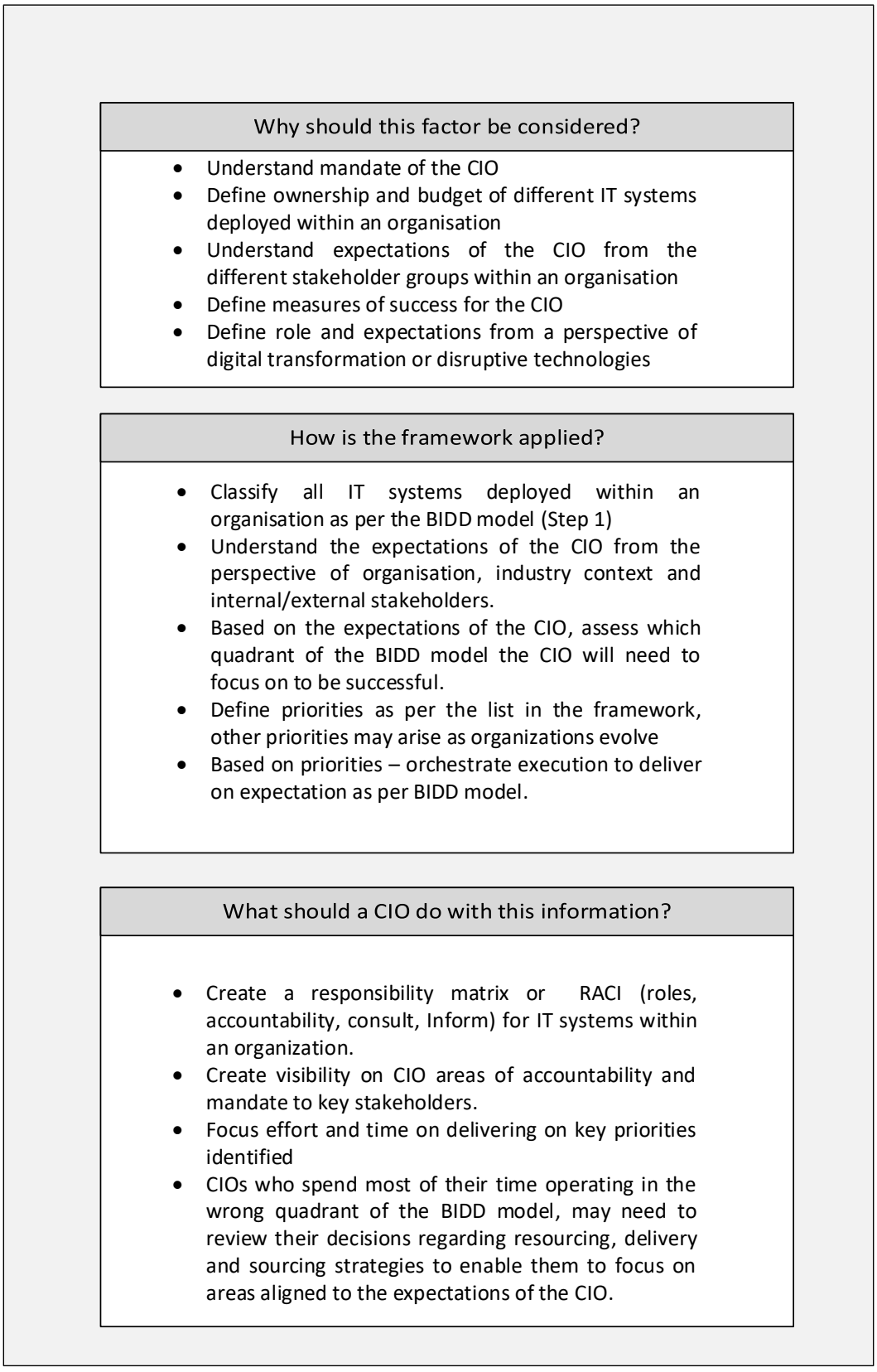


Figure 88 - FIT Framework Application guideline - Organisational Expectations of the CIO

6.3.3.3 Step 3 – Enterprise architecture approach

IT systems and landscapes are evolving at a rapid pace owing to the continuous emergence of disruptive technologies and disruptive competitors. EA is a relatively mature discipline, which is primarily accountable for defining IT strategic roadmaps aligned to business strategy.

This step would generally follow step two – once the expectations of the CIO are clarified, CIOs and business stakeholders would need to clarify what the expectation is of EA as a discipline and enterprise architects regarding disruptive technologies under consideration. Many organisations have established EA practices that perform an advisory function to the CIO in ensuring business and IT alignment. As most organisations generally have the EA functions reporting to the CIO, it follows that the expectations of the CIO will drive activities and the focus areas for enterprise architects.

Most CIOs rely on enterprise architects to provide guidance and recommendations on technology decisions within an enterprise. There has been great frustration about the relevance of the EA function in times of disruptive change. Many EA practitioners still subscribe to the Zachman framework; however, this methodology can lead to frustration, as the traditional application of this framework is primarily effective in designing, documenting and describing artefacts, products, services and architecture, and does not consider the impact of disruptive technologies on traditional EA. In disruptive technology environments, traditional EA approaches may not be applicable, as organisations move from an ownership and constrained mentality to a consumption and surplus mentality.

EA is key to the success of any organisation. CIOs need to understand how to leverage this capability in agile business environments characterised by a continuous stream of disruptive technologies. The different schools of thoughts proposed by Lapalme (2012) provide a good summary of the changing expectations of the EA function that CIOs can use as a reference in determining how to leverage this function in enabling strategic IT decision-making.

In this step CIOs need to understand the changing expectations of EA and determine whether approaches suggested can assist them in achieving their strategic intent. As discussed in Step 2, most CIOs are not accountable for all IT systems deployed in an organisation, therefore this would influence the expectations of enterprise architects, which must be clearly defined.

Figure 89 illustrates the practical application of the framework, where a new system or user requirement is assessed via the BIDD model, which will determine organisations' expectations and deliverables of enterprise architects.

Enterprise architects are key in ensuring that any IT system selection and implementation are successful, therefore they would need to be guided on where to focus to add most value to an organisation.

The main considerations in this step are as follows:

- What are the changing expectations of the customer and how will the organisation transform to accommodate changes in the customer environment?
- What are the technology implications for the business in meeting customer expectations?
- What is the technology implication on the different quadrants of the BIDD model and are the system owners defined?
- What is expected of enterprise architects in assessment, selection and implementation of new disruptive technologies, considering the approaches shown in Figure 89?
- What is the expectation of enterprise architects from IT system owners in assessing the different factors identified in the decision framework?

Applications classified according to the BIDD model should be used as a guide to determine the EA approach and focus (Figure 89) in a disruptive technology environment. It is important to note that all three approaches are equally important in supporting the operations of a business, therefore in agile business conditions a singular approach is not advisable in view of the dynamics of supply and demand and the pace of change of enabling technologies.

Figure 89 and Figure 90 provide a high-level guideline for CIOs on how to apply the decision factor "enterprise architecture approach" of the FIT framework practically in an organisational context. Figure 90 shows CIOs "why" this factor should be considered, provides guidance on "how" to use the framework and "what" to do with the information obtained from the analysis.

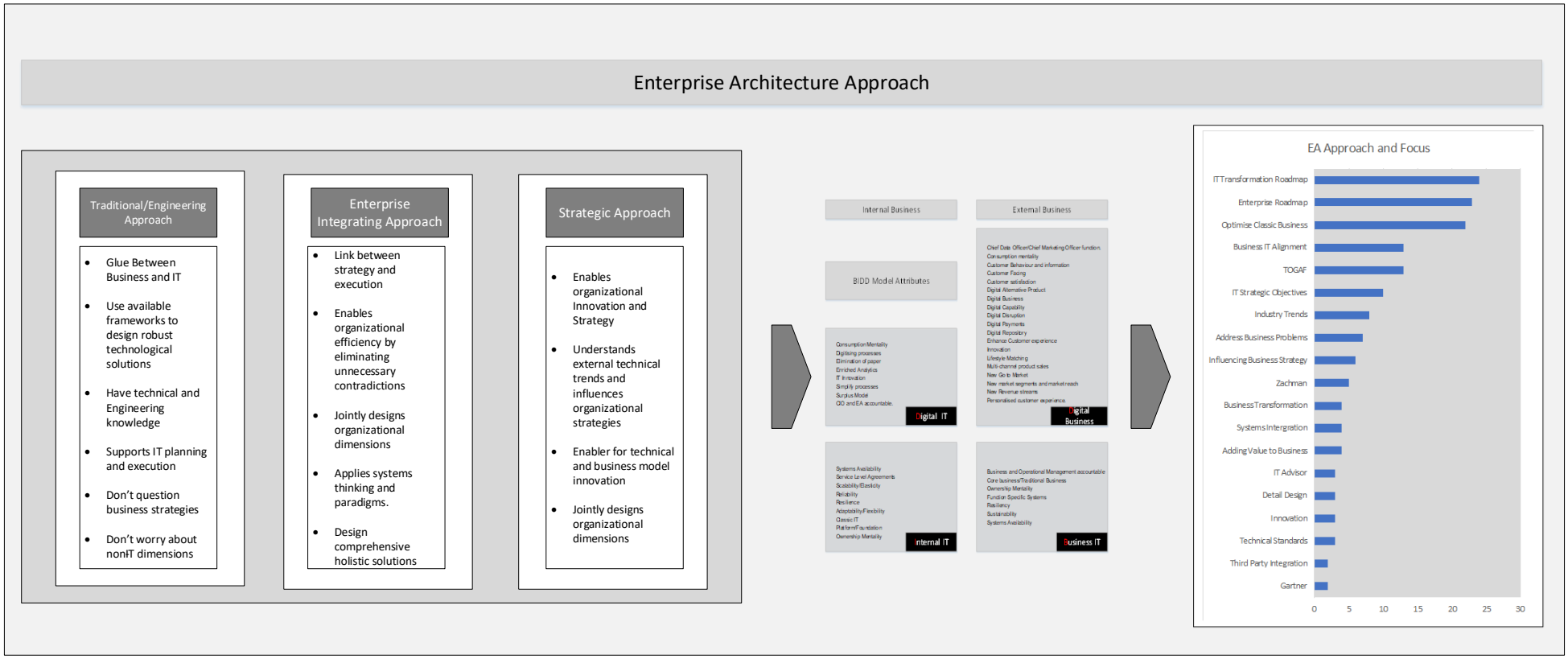


Figure 89 - Determining EA Focus (Adapted from Lapalme, 2012)

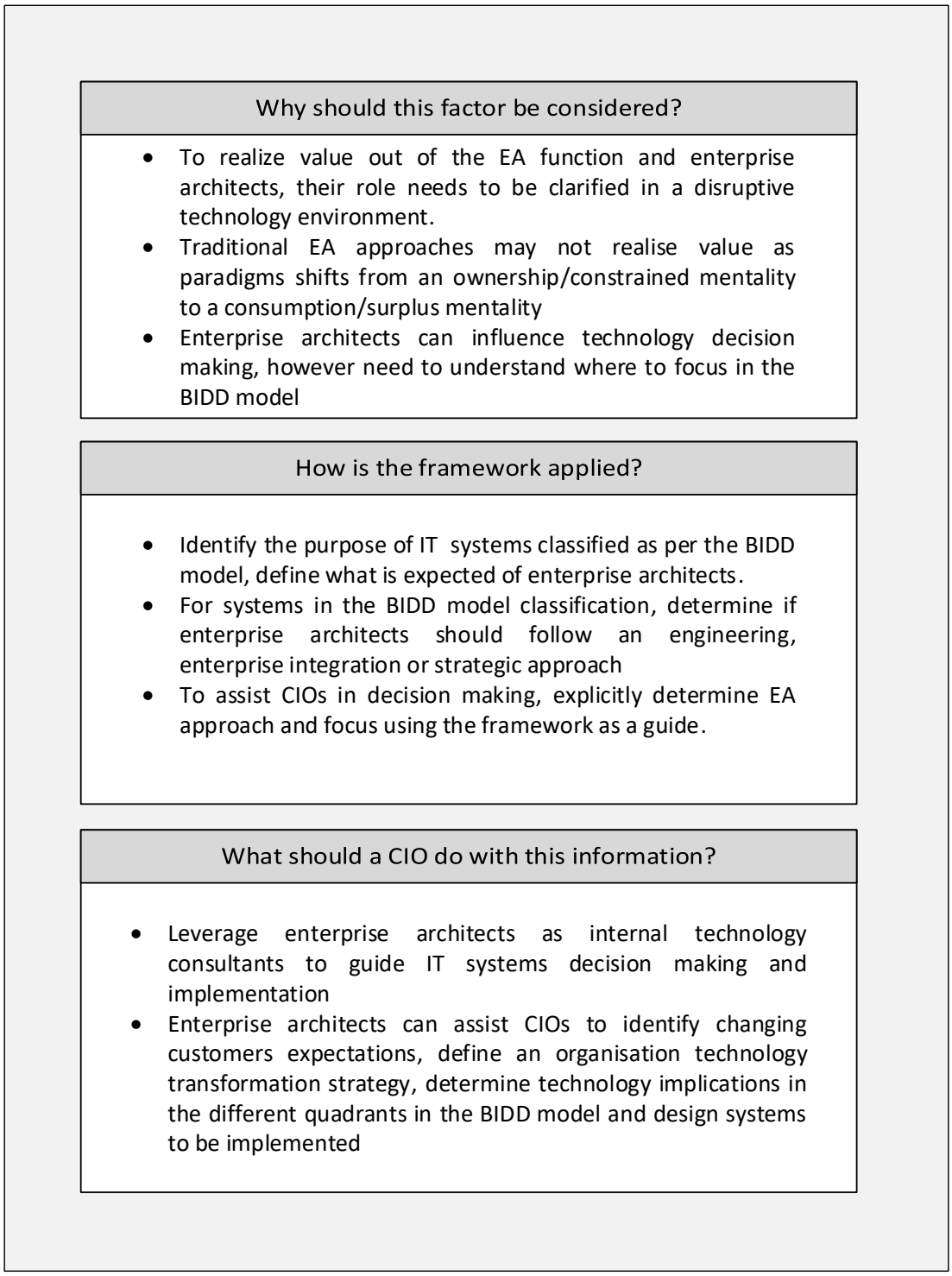


Figure 90 - FIT Framework application guideline – Enterprise Architecture Approach

6.3.3.4 Step 4 – External analysis

Consumerisation trends have had disastrous consequences for established organisations owing to their failure to identify shifts in the industry and respond timeously. Disruptive technology trends such as mobility, social networking, cloud, big data and analytics etc., have resulted in the creation of global organisations such as Google, Amazon, Ali Baba, Uber, Airbnb, etc., using platform business models and leveraging network effects to disrupt all industries globally.

In an environment faced with continuous changes and advances in IT, where functionality often exceeds user or organisational requirements, CIOs need to focus more strongly on value extraction as opposed to technology functionality and specification.

In an agile business environment, which is continuously being reshaped by disruptive technologies, CIOs will need to analyse external trends and their influence on organisational IT strategies. The life cycle of disruptive technologies does not align to traditional IT investment and depreciation periods, which implies that CIOs need to adopt different approaches to IT sourcing, implementation and life cycle management.

IT has become pervasive in organisations and creates new sources of competitive advantage across industries. CIOs are expected to understand changes in the technology landscape and factor these into an organisation's IT and business strategies.

CIOs and IT specialists who are expected to perform a strategic role in an organisation must continuously scan the external market to identify disruptive technologies and technology trends that may have an impact on current business models. CIOs and enterprise architects currently spend most of their time analysing newer technology without considering timing, the impact of ecosystems and the impact on business models. Failure to get the timing of decisions right could have negative financial implications for the organisation and its sustainability in a disruptive technology environment.

External analysis is an important factor for decision-making, as it shifts the focus from a technology or system to external factors that could affect its selection. The model proposed by Adner and Kapoor (2016) provides a good illustration of key considerations when conducting external analysis related to disruptive technologies:

- Ecosystem extension opportunity for old technology – can investment in technology ecosystems extend the life and functionality of current technology investments?
- Ecosystems emergence as challenges for new technology – is the timing right to implement the new technology? In some cases, the technology may be perfect, but value cannot be extracted because the environment or ecosystems are not ready.

As indicated in Figure 91, systems identified in the BIDD model should be assessed in terms of timing, ecosystems and dominant designs when selecting or recommending investments in new technologies.

Step 4 does not focus on the specific technology under consideration, but on external aspects that affect the timing of implementation. In a disruptive environment characterised by exponential changes across a large number of technologies, choosing the best technology may result in unnecessary delays, leading to organisations losing their window of advantage.
In this step, the following aspects must be assessed:

- What value will be created for the organisation or customers by selecting and implementing a technology?
- Are the technology ecosystems ready for the implementation of the new technology? Examples are –
    - LED light bulbs can immediately displace incandescent or fluorescent light bulbs, as they use the same ecosystems.
    - HD TVs took several years to displace standard definition TVs owing to lack of HD cameras and content to leverage the value of the newer disruptive HDTV.
- Can investments in existing technologies and ecosystems create additional value required and therefore delay the implementation of a disruptive technology?
  Examples are –
    - Investments in on-premise infrastructure to create private and hybrid clouds with comparable functionality to public clouds might delay the move to hyper-scale clouds.
    - Radio frequency identification chips were introduced as a disruptive technology to barcodes; however, investments in barcode technologies resulted in increased functionality, which resulted in the co-existence of both technologies.
- When is the right time to implement a new technology to create value for an organisation?
- Is the technology under consideration aligned to the dominant design in the industry, which may result in network effect benefits?
- What is the level of complexity of the environment and integration to existing systems?

- Are partners and partner ecosystems ready?
- Are business and technology enablers available?
- What current investments and sunken costs in existing tools and infrastructure are involved? In certain instances, CIOs are required to use assets for as long as possible or wait until the end of a financial depreciation period before considering new investments.

Figure 91 and Figure 92 provide a high-level guideline for CIOs on how to apply the decision factor “external analysis” of the FIT framework practically in an organisational context. Figure 92 shows CIOs “why” this factor should be considered, provides guidance on “how” to use the framework and “what” to do with the information obtained from the analysis.

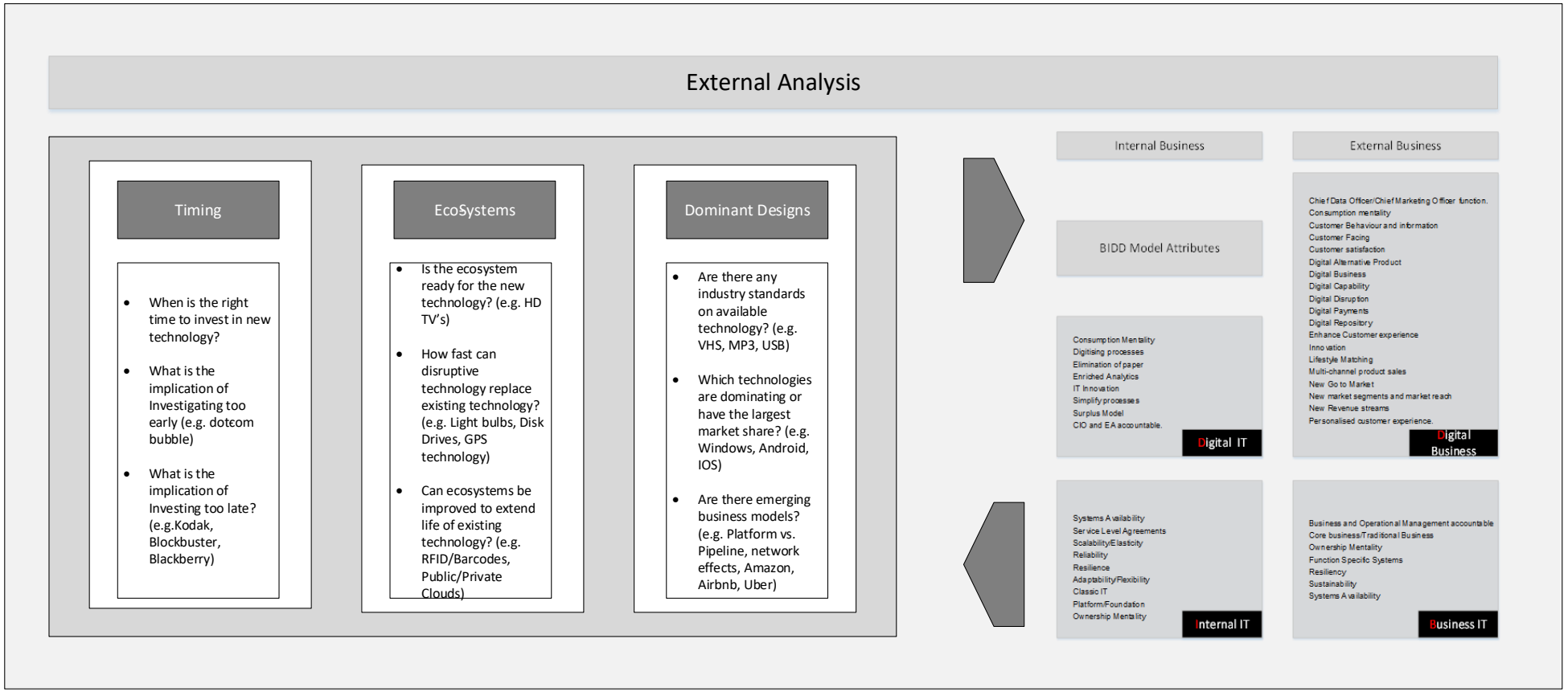


Figure 91 - External Analysis for IT Systems (Adapted from Adner and Kapoor, 2016)

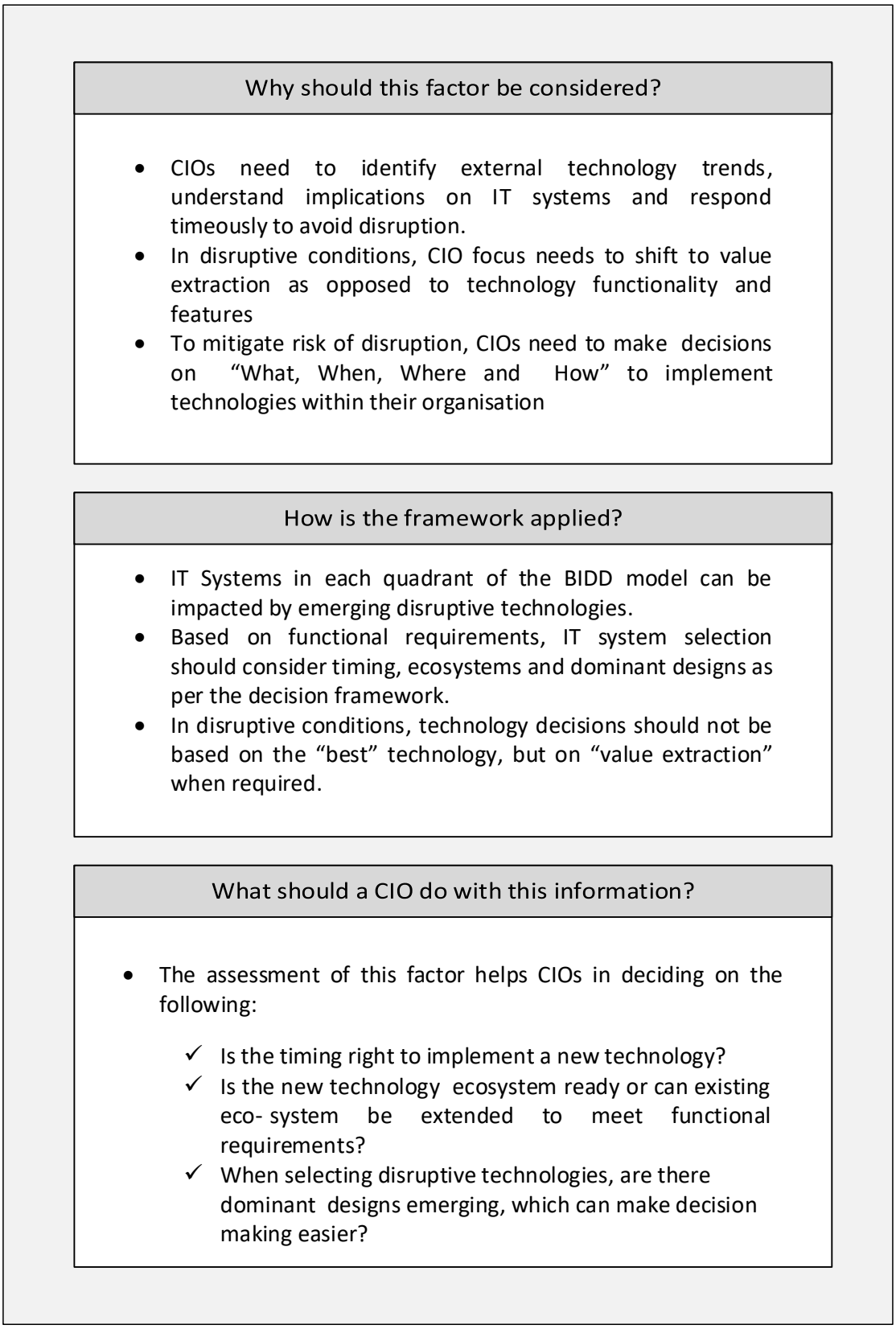


Figure 92 - FIT Framework Application Guideline – External Analysis

6.3.3.5 Step 5 – Organisational classification

Step 5 assesses the classification of an organisation and the extent to which it can have an impact on decision-making in organisations. Larger organisations may have multiple business units or companies working independently or have a high degree of sharing customers, processes, services etc. Different governance processes may result in differing decision processes across organisations; for example, individuals may be mandated to make decisions, or this may be delegated to committees.

Technology-focussed CIOs and enterprise architects may become frustrated by the complicated processes or "red tape" in organisations, resulting in failure to carry out their mandates, which prevents them from adding value to their organisation. Some organisations with multiple divisional CIOs who are accountable for IT in their respective divisions may have a federated governance model. In these types of organisations, the role of the group CIO may be one of providing overall IT standards, policies, shared IT services etc., while business unit-specific systems selection and implementation are left to the decision of divisional CIOs. In this scenario, decision-making on disruptive technologies may be a challenge owing to multiple stakeholder interests. It is crucial for roles and accountabilities to be clearly defined in advance to prevent unnecessary delays in the overall organisation adapting to changes in the market.

Figure 99 in Section 6.3.3.8 describes typical decision processes in an organisation that influence IT decision-making. Section 6.3.3.8 clearly indicates that IT decision-making is influenced by organisational politics, individual preferences and interests, as opposed to IT functionality and specifications. Organisational classification, characteristics and governance models can hinder any IT decision, which will impede an organisation's ability to leverage disruptive technologies to gain competitive advantage in agile business environments.

Organisational classification is therefore an important consideration in influencing successful IT investment decisions. For CIOs to be successful, it is imperative that they understand the characteristics of an organisation before focussing on the detailed merits of systems features and functionality. Figure 93 shows that understanding organisations' customers, geography, processes, targets, governance etc., assists in determining on which systems and which quadrant of the BIDD model CIOs will need to focus in maximising value from IT for the organisation.

Different types of organisations may have multiple BIDD models for each of the business units, with an overall model for the group showing common and group-specific IT systems, which will assist in identifying focus areas and accountabilities for the different CIOs.

For tactical and operational IT decision-making, organisational classification may not be applicable, although it is an important consideration.

Figure 93 and Figure 94 provide a high-level guideline for CIOs on how to apply the decision factor “organisational classification” of the FIT framework practically in an organisational context. Figure 94 shows CIOs “why” this factor should be considered, provides guidance on “how” to use the framework and “what” to do with the information obtained from the analysis.

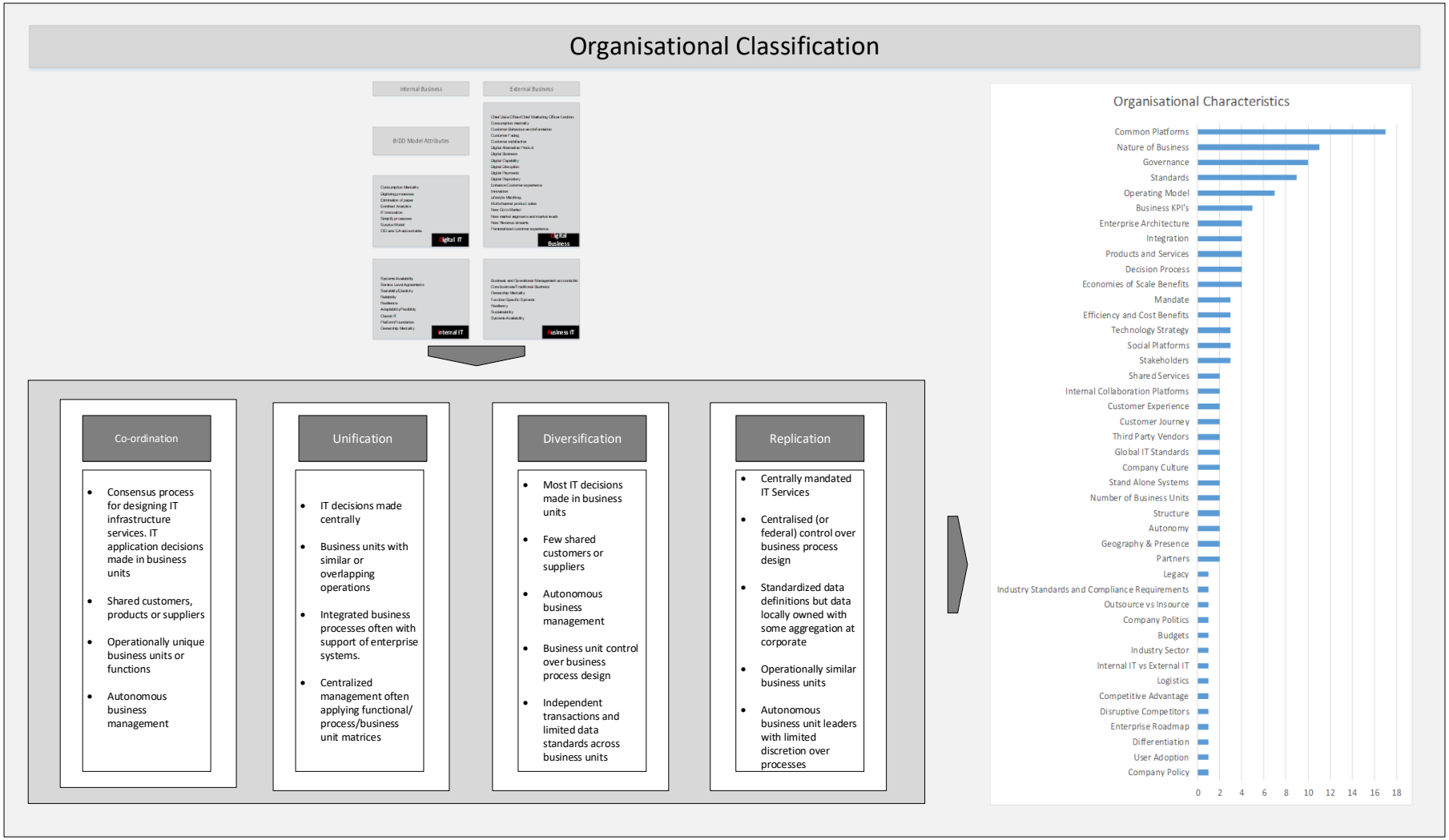


Figure 93 - Understanding Influence of Organisational Characteristics on Decision-making (Adapted from Ross et al., 2006)

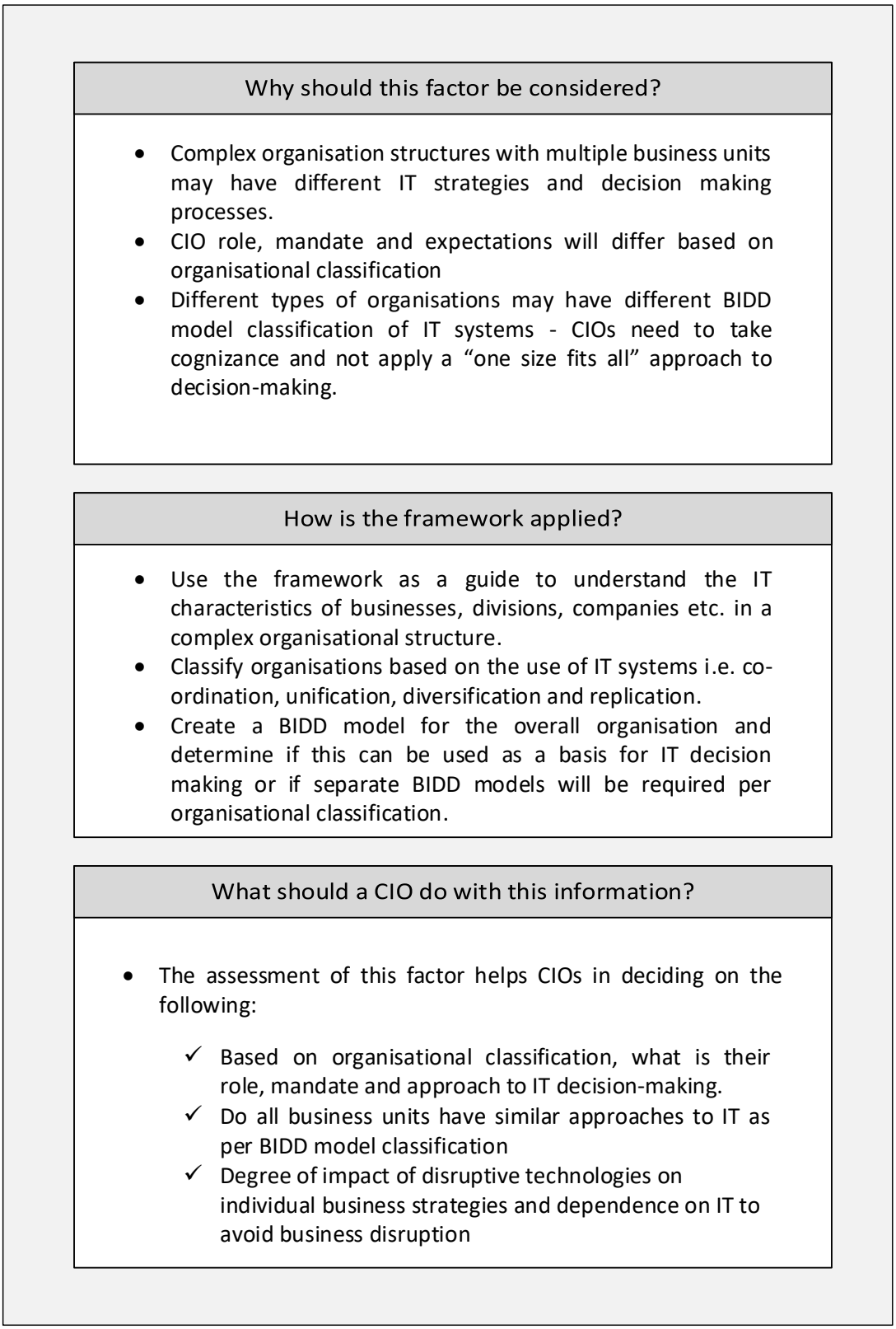


Figure 94 - FIT Framework Application Guideline – Organisational Classification

6.3.3.6 Step 6 – Decision criteria for IT systems

In traditional pipeline businesses models, financial indicators are a key factor in measuring the success of a business or investment. The results of research conducted in this study indicate that finances (costs, revenue, financial KPIs) feature as a critical decision criterion for all IT systems among CIOs. Notwithstanding this, it may not be the most important when selecting disruptive technologies that may have an impact on current business models and value propositions to staff and customers.

Some of the most valuable technology-driven companies in the world (Apple, Amazon, Uber, Airbnb, Google, Bookings.com etc.) have adopted platform business models and are disrupting companies across all industries. The measures of success in the start-up phase of these companies were not financially driven – typical decision criteria to measure success were network effects, number of participants on platforms, value units, the quality of interactions, conversion of consumers to producers, etc.

Step 6 involves a discussion and identification of key criteria that will be applicable in deciding on the selection and implementation of disruptive technologies. In this process, generic criteria may be applicable across industries. Some of the factors, such as health and safety, will be more critical in industries such as mining were safety incidents could result in the loss of lives or revoking of mining licences.

CIOs will need to define criteria that are important for systems classified in the different quadrants of the BIDD model. Organisations that rely on the use of disruptive technologies to enable new business models or create a strategic competitive advantage may place less emphasis on financial issues in decision-making; however, business executives will need to understand the potential value contribution of each investment before investing in new technology.

CIOs also need to acknowledge that some innovations may be incremental and not disruptive. Therefore, when motivating the implementation of new technologies, there are basic questions that need to be answered to obtain support for investments:

- How will this investment reduce the cost of doing business?
- Will this investment improve revenue for the organisation?
- What value will this add to customers or will it improve market share?
- Will this investment improve productivity in the organisation?

- What will the impact be on the overall financial KPIs of the business?

The segmentation of IT systems in organisations into internal, external and digitally driven technologies according to the BIDD model provides a guideline to CIOs on what criteria could be applicable in motivating IT investment decisions. The list of decision criteria shown in Figure 95 can be used by CIOs to determine if it will be applicable to a system under consideration and to ensure that this is addressed in motivating investment decisions. CIOs will need to understand how the different criteria identified answer the five basic questions above.

CIOs need to understand the technology landscape internal and external to their organisation and educate stakeholders on the impact of disruptive technologies on their business. The criteria identified have different levels of importance relevant to different stakeholder interests in an organisation and can be used to create awareness and solicit support for decision-making and the implementation of disruptive technologies; alternatively executives will revert to traditional financial measures, which are lag indicators when making decisions.

Figure 95 and Figure 96 provide a high-level guideline for CIOs on how to apply the decision factor “decision criteria for IT systems” of the FIT framework practically in an organisational context. Figure 96 shows CIOs “why” this factor should be considered, provides guidance on “how” to use the framework and “what” to do with the information obtained from the analysis.

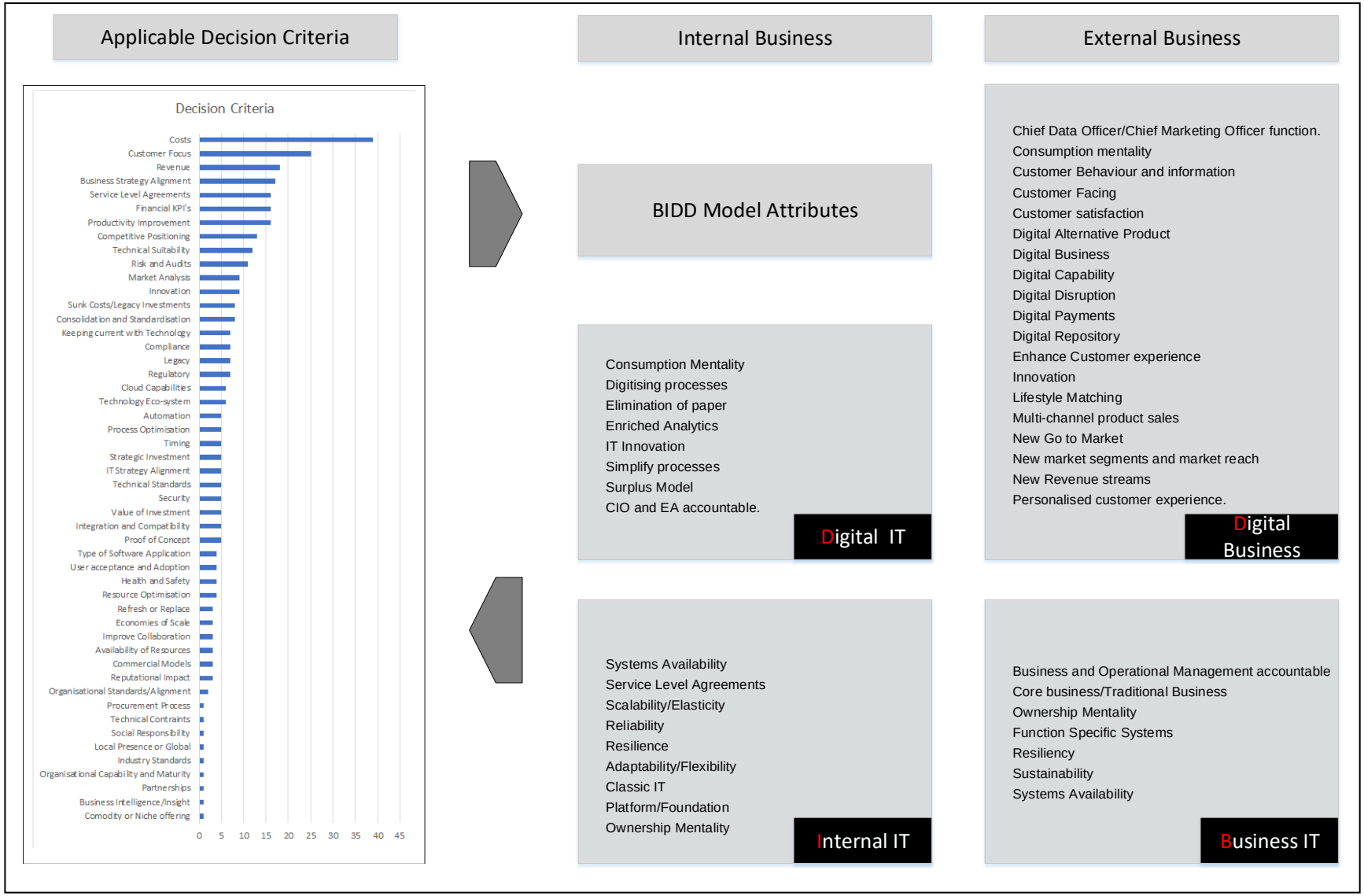


Figure 95 - Understanding Applicable Decision Criteria

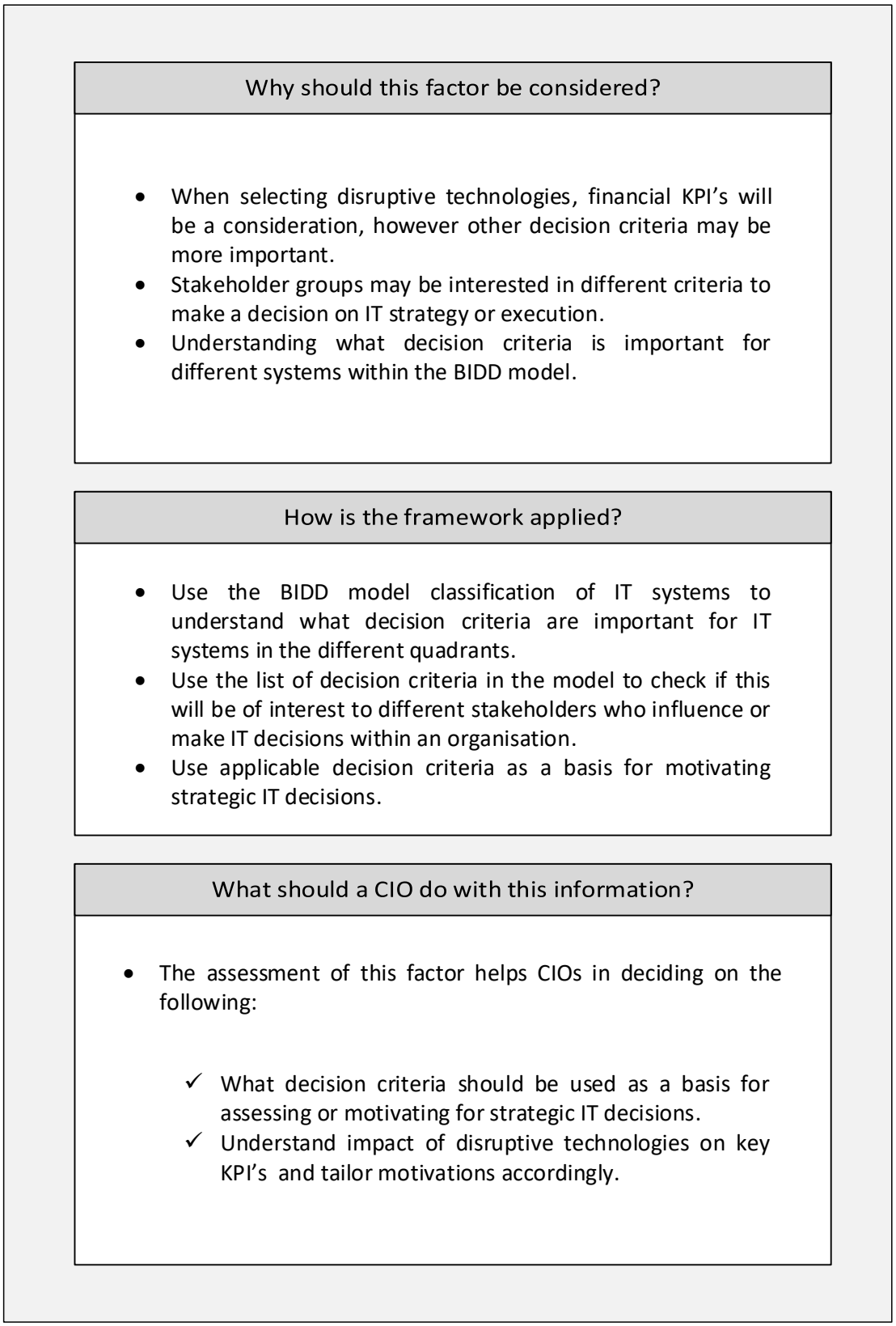


Figure 96 - FIT Framework Application Guideline – Decision Criteria for IT Systems

6.3.3.7 Step 7 – Strategic fit and value contribution

Often business strategies and priorities are set by the board. These are then filtered down to IT to evaluate and implement technology that enables businesses to implement their strategies. Linking IT systems to business strategy and linking the IT contribution to business value enable quicker decision-making on implementing IT strategies. This approach supports the process defined in Step 6, where other criteria must be considered in motivating disruptive technologies.

Disruptive technologies supporting customer journeys may have technology and process implications across an organisation's IT landscape as defined in the BIDD model. It is therefore important to map how technology investments in systems in each quadrant of the BIDD model contribute directly or indirectly to an organisation's strategy or customer value. Failure to link a technology investment to a value unit, which may be financial or non-financial, will have a low probability of obtaining support or success in the organisation.

Section 6.3.3.1 describes the importance of classifying IT systems according to the BIDD model to highlight focus areas for CIOs. This section of the decision framework links different systems to strategic fit and value contribution to an organisation.

The adapted strategic fit and value contribution model shown in Figure 97 can be used when motivating technology investments. The mapping of IT systems according to the framework can provide guidance to CIOs on strategic fit and the value contribution derived, which will influence the approach to decision-making, system development and implementation.

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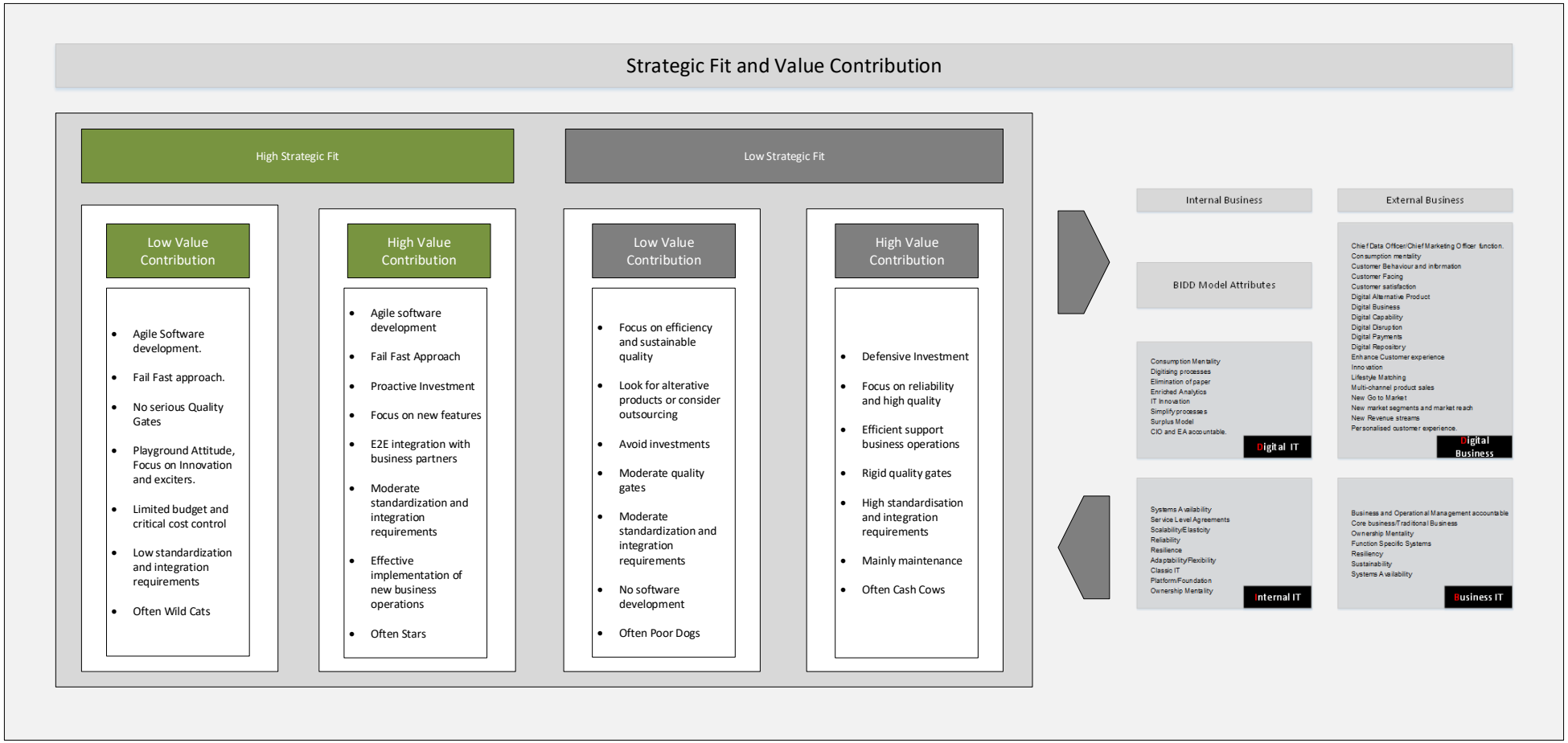


Figure 97 - IT Systems Strategic Fit and Value Contribution (adapted from Bente et al., 2012)

The model shown in Figure 97 can be used to classify an organisation's IT system according to strategic fit and value to an organisation. A caution in using the BCG matrix terminology in the adapted model is that systems that fall into the different categories may vary, based on the maturity of the system and organisation at a particular time. Systems classified as a "cash cow" in one organisation may be a "dog" in another. The value of this framework is the dialogue that this approach could stimulate within an organisation in a typical multiple-perspective decision approach.

Another important consideration in applying the model is to understand the different perspectives of IT systems that exist within an organisation. As mentioned previously, IT systems in each quadrant of the BIDD model may be strategic within a specific quadrant; however, when viewed from an organisation perspective they may not be as strategic. The value of using the FIT framework is that it aligns IT systems to business strategy, which helps in motivating IT investments.

Linking IT systems to business strategy and linking the IT contribution to business value enables quicker decision-making on upgrading or implementing new systems and technologies. The mapping of IT systems according to Figure 97 provides a structured approach to show how different technologies support organisational processes, add value and link to strategy.

Figure 97 and Figure 98 provide a high-level guideline for CIOs on how to apply the decision factor "strategic fit and value contribution" of the FIT framework practically in an organisational context. Figure 98 shows CIOs "why" this factor should be considered, provides guidance on "how" to use the framework and "what" to do with the information obtained from the analysis.

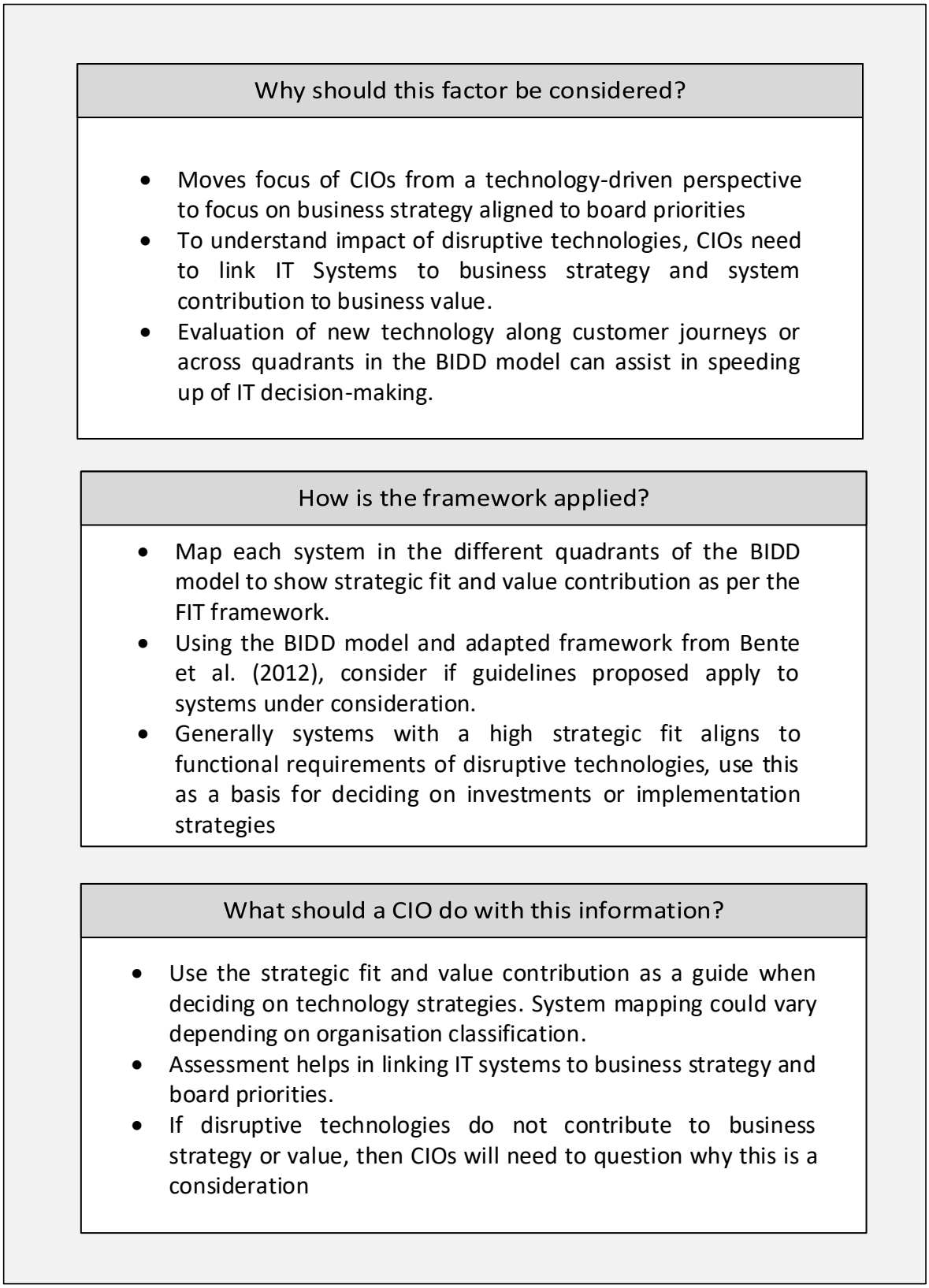


Figure 98 - FIT Framework Application Guideline – Strategic Fit and Value Contribution

6.3.3.8 Step 8 – Organisational decision process

Often least time and attention are spent on understanding organisational dynamics, governance, formal and informal decision processes, etc. that have been entrenched in an organisation's culture. Decision complexity increases exponentially as IT permeates the core of most businesses. Owners of key business processes insist on deciding or influencing IT decisions that can have a potential impact on their deliverables or disrupt entrenched processes in organisations.

Step 8 considers the decision approaches entrenched in organisations, which will enable CIOs to tailor motivations for disruptive technologies. Findings in this research, based on decision theories, illustrate that dominant factors that determine the success or failure of IT decisions is based on people, experience and self-interests (political, multiple perspective, individual differences perspective, recognition primed decision). However, research in this thesis indicates that in motiving disruptive technologies, decision approaches that align to incrementalist, bounded rationality and satisficing, and garbage can theories will be more appropriate, as indicated in Figure 99.

CIOs and enterprise architects may find the best technology that can transform organisations; however, if they misunderstand organisational dynamics, they may fail to obtain a decision to start with the implementation. Organisations' expectations of CIOs are changing from having a deep understanding of technology to focussing on leveraging technology to add value to business. Although there is an abundance of technical solutions currently in the market that can perform various functions, adoption, implementation and acceptance generally remain a challenge.

When motivating new technology investments, it is important to understand the organisational decision process. In many organisations, decision processes are complex, and because of IT's universal application, the exponential rate of change of technology and unclear accountabilities, decisions are often delayed or postponed. Long decision lead times often frustrate CIOs and IT departments, as they are expected to add value, but cannot invest in the required technology to transform the organisation. Approaches to fast-track decisions are not consistent across organisations and are not always successful owing to organisational culture or resistance to change.

Organisations subscribe or gravitate towards a default process or approach to motivate investment decisions that have been entrenched in the organisational culture. Generally, the approach followed seems logical in most situations, irrespective of criteria applicable to the topic under discussion, but if quick decisions must be made, alternative decision processes may have to be introduced.

CIOs will need to understand the decision process in an organisation and align motivations accordingly to fast-track decisions from idea to implementation. Proposed organisational decision approaches to assist in strategic IT decision-making are shown in Figure 99. Dominant approaches in organisations focus on technical matters, people and processes, despite these not generally being suited to agile business conditions. It is important to understand current entrenched decision processes and determine whether typical agile decision approaches identified in Figure 99 can assist in fast-tracking decisions on disruptive technologies.

Figure 99 and Figure 100 provide a high-level guideline for CIOs on how to apply the decision factor “organisational decision process” of the FIT framework practically in an organisational context. Figure 100 shows CIOs “why” this factor should be considered, provides guidance on “how” to use the framework and “what” to do with the information obtained from the analysis.

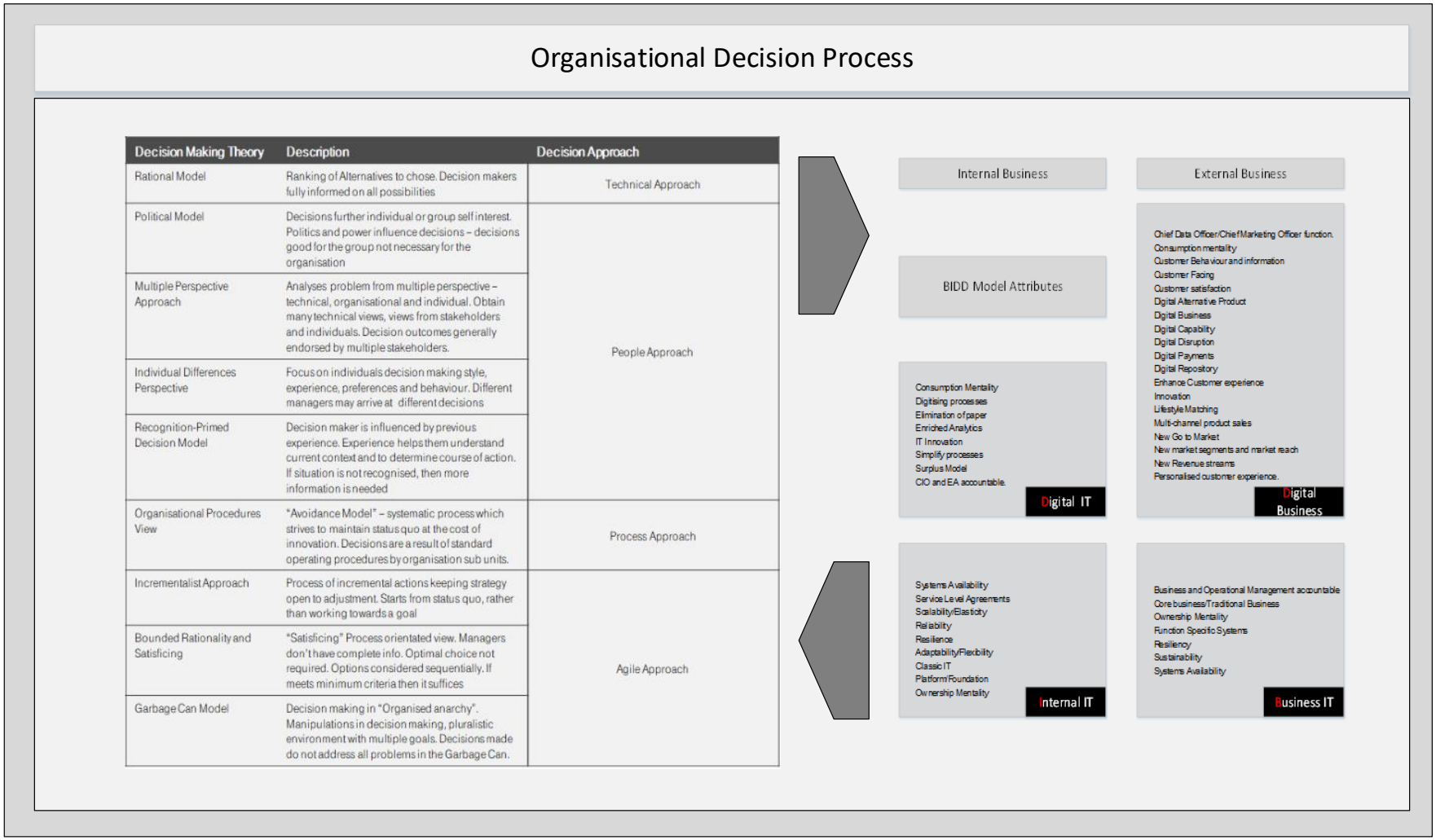


Figure 99 - Proposed Organisational Decision Approaches in a Disruptive Environment

Why should this factor be considered?
• To fast track IT decisions, CIOs need to consider organisation dynamics, culture and formal and informal decision processes. • The pervasive impact of disruptive technologies, implies business process owners and technology owners can influence IT decisions – the best technology will not result in a successful outcome. • Helps CIOs understand how to motivate IT decisions in a complex organisation structure

How is the framework applied?
• For different systems as per the BIDD model classification, understand the customer journey and RACI as defined as per step 1. • Consider the importance of speed, timing, technical specification, organisational culture and business process impact when deciding which might be the most appropriate decision approach shown in the framework within the organisation. • For systems in the digital quadrants of the BIDD model, consider decision criteria used as per step 6 and use agile decision making approaches or a combination when motivating new technologies.

What should a CIO do with this information?
• Linking different systems to appropriate decision approaches within organisations, avoids the use of only one approach to motivate all decisions • In most organisations, the rational approach is the default process, however consider the use of agile decision making approaches to fast-track IT decisions. • Avoids “analysis paralysis” to get to the best technology decision.

Figure 100 - FIT Framework Application Guideline – Organisational Decision Process

6.3.3.9 Step 9 – Decision success (compliance with GRC)

A positive IT decision must comply with prevailing GRC frameworks. Dealing with GRC was not described as a separate step; however, it is a factor to be considered in steps 6, 7 and 8 in the application of the FIT framework.

The elements of GRC were not part of the original proposed decision framework, as these generally do not contribute directly to IT value creation for business users or customers. Although this may not be a factor that influences strategic IT decision-making, it is a critical factor that must be considered in any IT system implementation in an organisation. CIOs who spend most of their time on internal IT systems as defined in the BIDD model, or in operational and tactical IT strategy execution, will generally focus more strongly on risk as a key factor to guide or influence decision-making. Business executives who are driving digital transformation strategies may, on the other hand, view GRC as a hindrance to organisational transformation in disruptive environments.

For any technology deployed (sustaining or disruptive) within an organisation, the respective owners need to understand the importance of implementing proper governance and operational processes in line with the ITIL framework or other industry best practices.

Figure 101 illustrates the application of the decision framework from a GRC perspective. Applications classified according to the BIDD model need to be assessed against organisational or industry GRC perspectives prior to motivating or investing in upgrades or purchase of new technology.

Generally, GRC may not be a business strategic imperative, but it may be critical in deciding if a chosen technology can be implemented or not in the context of an organisation, industry or country. It is therefore important to ensure that systems being investigated will comply with GRC requirements early in the life cycle of a project to prevent any delays in decision-making or implementation later in the project.

Figure 101 – Assessment of Impact of GRC on BIDD Model

In an environment that adheres to a multiple-perspective approach to decision-making, some of the basic generic considerations for any IT investment decisions may be the following:

- Governance: Will IT services consumed (cloud or other) be implemented according to proper governance and operational processes in line with the ITIL framework or similar frameworks?
- Compliance: Can it be ensured that IT and systems implemented comply with company policy and procedures, laws and regulations of the country or the industry in which they operate?
- Risks: Have IT risks been identified and sufficiently mitigated in case of failure?
- Risks: What are the implications of an IT system failure and can this be financially quantified?
- Risks: Will any health and safety risks be associated with the implementation or failure to implement an IT system?

GRC may not necessarily be a strategic factor to influence a decision in a disruptive environment, but could have the potential to delay or stop necessary investments.

Decision-making in an environment exposed to continuous disruptive technologies and disruptive business models is challenging and complex. The FIT framework proposes a logical approach to get to step 9 – decision success. Execution and the subsequent phases of an IT project life cycle will continuously experience decision challenges. Components of this framework can be used to support decision-making in other phases of an IT project and life cycle, but that is outside the scope of this research.

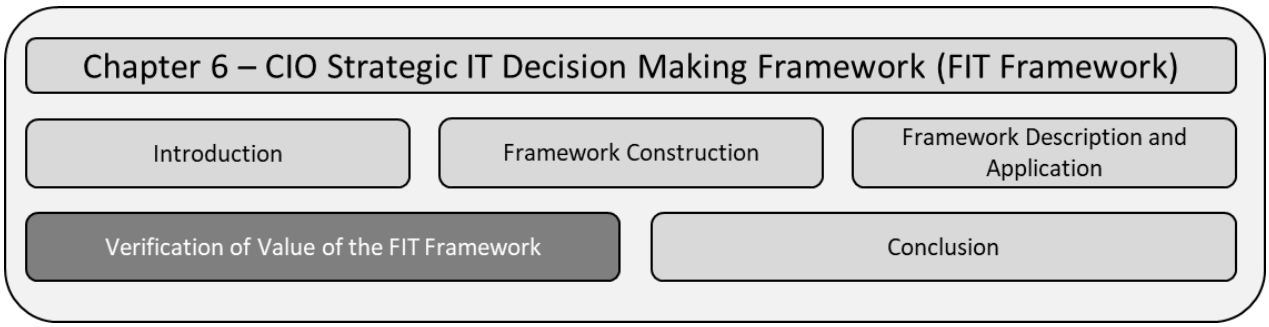
Figure 101 and Figure 102 provide a high-level guideline for CIOs on how to apply the decision factor “GRC” of the FIT framework practically in an organisational context. Figure 102 shows CIOs “why” this factor should be considered, provides guidance on “how” to use the framework and “what” to do with the information obtained from the analysis.

Why should this factor be considered?
• Compliance to GRC should form the basis of any IT decision to ensure organisational sustainability. • Can be used as a filter to prevent waste of valuable time on evaluating disruptive technologies, e.g. organisational data sovereignty requirements may prevent moving data to public clouds hosted offshore. • ISO or ISAE standards as an example, may prevent the use of certain systems or technologies within an organisation.

How is the framework applied?
• Consider the impact of governance, risk and compliance on systems in the different quadrants of the BIDD model. • Use the framework to consider if the items listed under GRC should be a consideration for disruptive or sustaining technology decisions. • In certain situations, if the implementation of disruptive technology is a business imperative, consider if GRC requirements can be changed before focusing on technology

What should a CIO do with this information?
• Use this factor as a consideration to determine areas of focus to enable successful IT decision-making. • Can be used a reason to fast-track decisions, e.g. POPI act – legislative changes may force technology changes. • Consider some of the basic requirements before focusing on technology.

Figure 102 - FIT Framework Application Guideline – Decision Success - Compliance to GRC



6.4 VERIFICATION OF THE VALUE OF THE FRAMEWORK

The cross-sectional nature of this study limits the evaluation of the applicability of the framework in an organisation. Nevertheless, a two-step verification process was undertaken to verify the relevance of this framework to strategic IT decision-making in a practical work environment.

Step One entailed further data analysis of interview transcripts to identify challenges that emerged during the research process and determine if these could be addressed by the proposed framework.

Step Two comprised a presentation of the FIT decision-making framework and the BIDD model to a multidisciplinary group of executives to solicit their views on the value and application of this framework in guiding strategic IT decision-making in a disruptive technology environment.

6.4.1 Step One - Challenges in decision-making and guidelines to address

During the interview process, various challenges were identified by participants regarding decision-making in their work environment. Data analysis was conducted on interview transcripts to identify challenges highlighted by participants. These are shown in Tables 6, 7 and 8 below. Challenges identified were categorised according to people, process and technology-related matters and references to sections in this study where these challenges were addressed by the framework are shown in the tables below.

6.4.1.1 People

Table 6 - Decision Challenges – People

Challenges Identified	Framework Reference
The CIO wants to control everything, they want to have the control, she wants to have the control and she calls us naughty and then it's not letting the business grow.	Section 6.3.3.1; Section 6.3.3.2. Roles and accountabilities for systems categorised according to the BIDD model and expectations of CIO must be defined.
If you not an engineer and you not focusing on manufacturing, so you in the surrounding areas, you are selling or the IT department. Supporting business from the one end to the other, they can get rid of you at any point in time, you seen as you know, you seen as an expense.	Section 6.3.3.1; Section 6.3.3.2. Roles and accountabilities for systems categorised according to the BIDD model and expectations of CIO must be defined. Section 6.3.3.7 maps IT to strategic fit to value contribution. Understanding of value contribution can help change behaviour and focus.
So, you must identify who are the stakeholders and how do you deal with them on an individual basis	Section 6.3.3.8. Understanding of decision process, especially multiple-perspective approach.
I call it lobbying, right, I feel like a politician, it's lobbying, you have to win them over	Section 6.3.3.8. Understanding of decision process – multiple-perspective approach and political approach.
Then vendors get upset about it and they might go and influence the board, and then often they are added because, that was just a gap, or fairness, you know, then instruction comes from the top. Then they go through the process with everyone else.	Decision process, political. Section 6.3.3.8.
You do that kind of decision; people find fault from day 1 with whatever you are trying to do – simply because they didn't agree with that, and that is the price of politics. So, you will never have a satisfied customer until you – unless you can really wow them, and that is not so simple if you talk about traditional IT and transactional systems	Section 6.3.3.8. Understanding of decision process, multiple-perspective approach and political approach. Section 6.3.3.1 Classification of IT systems.
The thing is as well, you have your traditional IT right. The guy's been doing it for the past ten, 15 years that way. You need to now, you want them to change. The first thing you need to show them, is what is the benefit to them?	Classification of IT systems Section 6.3.3.1. Strategic fit and value contribution Section 6.3.3.7.
The other extreme in this problem, you go, and you push these things in front of the business, down the business's throat. They look at it and first of all they're reluctant to use it. When they do eventually, after lot of evangelism and all of that, decide to use this here, it's very short lived. Prematurely retired, no ROI.	Understanding the customer and classification of IT systems Section 6.3.3.1. Strategic fit and value contribution Section 6.3.3.7.
I remember when I proposed our SAP and renewal of all our IT, because we were still running main frames and so forth – The first guy that shot it down in public when we made the decision was one of our production guys. He just said well you can go and sink	Understanding the customer and classification of IT systems Section 6.3.3.1 Strategic fit and value contribution Section 6.3.3.7.

an incline shaft with that amount of money, so why would you bother to buy a SAP vehicle?	Decision criteria for IT systems Section 6.3.3.6.
For those kind of decisions, we had a steering committee comprising of strategic directors, financial directors, you know, and IT steerco. That was really the body that made decisions around any IT systems. But the business, the production guys, engineering guys, they weren't really involved in those forums, they didn't want to attend those kinds of things. To them the IT is just a, a cost centre, you know.	Classification of IT systems – Section 6.3.3.1. Organisational decision process – Section 6.3.3.8.
The other thing is we are also moving towards consolidation of applications which is very key and that hasn't been done before. If you look at our landscape of applications, there's many that we have. Over time, it is who felt they wanted something and who shouted the loudest that got what they wanted. You end up with an estate that is of quite expansive. Remember the more applications you have, the more support structures you need.	Classification of IT systems – Section 6.3.3.1. EA approach – Section 6.3.3.3. Organisational decision process – Section 6.3.3.8.

6.4.1.2 Process

Table 7 - Decision Challenges - Process

Challenges Identified	Framework Reference
I *must* be honest with you. It's, it's a very, very difficult process right, especially when you have multiple stakeholders from multiple business units.	Organisational decision process – Section 6.3.3.8. Multiple Perspective Approach.
Our decision process is partially defined, it's not clearly defined as I'd like to see it. So, there's a lot of room for improvement	Organisational decision process – Section 6.3.3.8.
But don't get me wrong, the problem is not that IT can't change. The problem is not that the CIO doesn't know how to be disruptive. We are, we have been restricted by the red tape here.	Expectations of the CIO - Section 6.3.3.2. Classification of IT systems and understanding of the customer - Section 6.3.3.1. Organisational decision process Section 6.3.3.8.
Your procurement has got to be streamlined and you are saying, listen these are the partners I have identified, and I want to do business with, to help me through this transformation. Once you contracted you go.	External Analysis – Section 6.3.3.4. Organisational decision process Section 6.3.3.8. Decision criteria – Section 6.3.3.6.
Your budget committees and all the other stuff, the entire ecosystems got to work like that, no matter how much you try to turn this thing around but if you have to go through these processes, you fail.	Organisational decision process – Section 6.3.3.8.
There's always frustration in approval processes, because you have to struggle to get by. You have to show value for money.	Organisational decision process – Section 6.3.3.8. Strategic fit and value contribution – Section 6.3.3.7.
From a procurement side, as much as you put partners in place, strategic partners that you say you want to partner with to get things done, and you don't go through the whole contractual process, it still means your procurement process is long. It is a short RFI, RFP rather than a long one. It goes along that.	Organisational decision process – Section 6.3.3.8. Decision criteria for IT systems – Section 6.3.3.6.
Like I say, as much as we will try agile in IT you should agile the ecosystem supporting you. If you look at it in terms of agile for us is, it is about speed of delivery as opposed to delivering to the outer world.	Organisational decision process – Section 6.3.3.8. Decision criteria for IT systems – Section 6.3.3.6. External analysis – section 6.3.3.4.
In one of the state-owned organisations, once a decision is made, you execute the project irrespective of any changes in technology because it takes so long to get a decision. Then even though you may finish it, and the technology implemented is now obsolete	Organisational decision process – Section 6.3.3.8. Decision criteria for IT systems – Section 6.3.3.6.
Regarding IT decisions, it would be easiest for me to be honest with you, the easiest way for me to get, to get EXCO to approve something is if I link it back to, to legislation.	Organisational decision process – Section 6.3.3.8. Governance risk and compliance – Section 6.3.3.9.

6.4.1.3 Technology

Table 8 - Decision Challenges - Technology

Challenges Identified	Framework Reference
A lot of this is about emotions and politics, but, there's little about technology nowadays.	Expectation of the CIO – Section 6.3.3.2. Classification of IT systems – Section 6.3.3.1. Organisational decision process – Section 6.3.3.8.
Reaction to disruptive technologies depends on whether a board or a group executive is biased towards action; or whether it is a simple case of – not understanding or just simply being arrogant in thinking that the position is secure. You may have those decisions deferred indefinitely.	Classification of IT systems – Section 6.3.3.1. Organisational decision process – Section 6.3.3.8. External analysis – Section 6.3.3.4.
It's somewhat difficult due to the fact that IT often second guesses business requirements without fully understanding.	Expectations of the CIO – Section 6.3.3.2. Classification of IT systems – Section 6.3.3.1.
The more and more technology you have, the more complex the decision-making is. And it is trying to figure out okay how do you now make a call? Because the easiest and safest way is not to make any decision. Then you are in your comfort zone.	External analysis – Section 6.3.3.4. Organisational decision process – Section 6.3.3.8.
But by the way I do think, if you talk from a decision-making perspective, architecture was never really a key determinant, key factor for us.	EA approach – Section 6.3.3.3. Decision criteria for IT systems – Section 6.3.3.6.
When it comes to these operational things you get decisions, but when it comes to the standard IT stuff, really, you don't get decisions, but it is all about you having to try and improve cost and the guys, they see IT as a cost centre in that area.	Classification of IT systems – Section 6.3.3.1. Decision criteria for IT systems – Section 6.3.3.6.
So, we, we're trying to maintain the reputational, the reputation of the organisation at the cost of what? We're suppressing innovation, we're suppressing digitalisation. We're not, we're not being disruptive. We say we are disruptive, but we're not disruptive.	Classification of IT systems – Section 6.3.3.1. Decision criteria for IT systems – Section 6.3.3.6.
Then there is somebody that is so engrossed with a certain technology that they try and motivate it and why you need to invest in it. Then you got your vendors. They put pressure on you. So, that's what's happening, right, the vendors are now saying move into the cloud. In the next five years, we're not going to be supporting on premise. You are getting that type of pressure that's going to hit you. You got to make those decisions and say okay, at the end how do I manage to hold these balls in the air?	Decision criteria for IT systems – Section 6.3.3.6. External analysis – Section 6.3.3.4. Organisational decision process – Section 6.3.3.8.
You got all these forces that's hitting you. You got internal pressure, right. Some people read about technology in a magazine and they want it.	Classification of IT systems – Section 6.3.3.1. External analysis – Section 6.3.3.4.
Managing disruptive technologies - It is going to have to be a different approach, it is going to have to be a change because you are going to have the entire ecosystem support you. Firstly, you would have start with your people. You need different thinkers. You can't take people that are in a waterfall approach and ask them to now become agile. It is a huge change management	Expectations of the CIO – Section 6.3.3.2. EA approach – Section 6.3.3.4.
If you look at your digitisation technologies, it is actually sitting in the business. Why? Because that is basically where they need to change it, and this is where they have their money. All that happens in the back end is to make sure that you have a plan, to put it within the entire, the broader architecture	Classification of IT systems – Section 6.3.3.1. Organisation's expectations of the CIO – Section 6.3.3.2. EA approach – Section 6.3.3.3.
If something is so disruptive, it could be something that need to go to a AGM, you know. To get shareholder approval.	Decision criteria for IT systems – Section 6.3.3.6. External analysis – Section 6.3.3.4. Organisational decision process – Section 6.3.3.8.
This is where I think the role of the CIO is so key to your point about how do guide this decision-making. Because you are going to get this hype, everybody is IT literate. They'll (business) go out and have discussions, they go to dinners, briefing sessions,	Expectations of the CIO – Section 6.3.3.2. EA approach – Section 6.3.3.3. External analysis – Section 6.3.3.4.

someone is going to turn around and say listen what do you know about cloud? What are you doing about cloud? At the end of the day now it is sitting at the back of their mind. Then they come back to the CIO and say, what are we doing about cloud and when are we going to cloud?	
At the end of the day it depends on the business and how the organisation wants to operate, does it make sense for me to put it in? If it makes sense to put it in, make sure you have done all the checks and balances because of organisational culture - it is very important.	Organisational classification – Section 6.3.3.5. Organisational decision process – Section 6.3.3.8.
Everybody will tell you how much value it adds. So, from a prioritisation perspective, it makes it very difficult. It makes it difficult unless you actually can pin it down and say look, you know what, tie it down to which KPI, which KPI is this going to contribute to and motivate it.	Decision criteria for IT systems – Section 6.3.3.6. Strategic fit and value contribution – Section 6.3.3.7.
A lot of it would be rational, in terms of looking at alternatives; choosing the right technology; making sure all the information. It is a long-term decision. It is not something you do in an agile approach	Organisational decision process – Section 6.3.3.8.
From a procurement side, as much as you put partners in place, strategic partners that you say you want to partner with to get things done, and you don't go through the whole contractual process, it still means your procurement process is stable. It is a short RFI, RFP rather than a long one. It goes along that.	Organisational decision process – Section 6.3.3.8.
The thing is as well, you have your traditional IT right. The guy's been doing it for the past ten, 15 years that way. You need to now, you want them to change. The first thing you need to show them, is what is the benefit to them?	Classification of IT systems – Section 6.3.3.1. Decision criteria for IT systems – Section 6.3.3.6. Strategic fit and value contribution – Section 6.3.3.7.
Maybe one can high risk a small piece of your business and take the risk, but the number we play with our clients and stuff like that, we just, we just can't be paying a high-risk game in that space.	Classification of IT systems – Section 6.3.3.1. Decision criteria for IT systems – Section 6.3.3.6. GRC – Section 6.3.3.9.

6.4.2 Step Two – Group verification of FIT decision framework

To determine if the decision framework can be applied in practice, it was decided to present the FIT framework to a group of industry professionals and solicit their views on its value and use in decision-making.

The FIT decision framework and the BIDD model were presented to a small group of five participants, consisting of a CIO, an enterprise architect, a technology architect and two business consultants, to get their views on the framework and to determine if any other factors are considered when making strategic IT decisions in a disruptive technology environment. A copy of the presentation can be found in Appendix B.

None of the participants in the focus group was part of the original list of research participants or had prior insight into the contents of the framework. During the focus group discussion, the problem statement and CIO decision challenges in the context of disruptive technologies were discussed. The proposed framework was presented to the group as a solution to the challenges identified and thereafter the researcher initiated a general discussion on the applicability of the

framework in real world situations. Care was taken to obtain an unbiased view of the framework without asking leading questions to justify the outcome of this research.

The following five questions were discussed in the focus group discussion:

- What are your views on the framework for strategic IT decision-making? (FIT decision-making framework)
- Will the framework help CIOs in deciding how to approach disruption and fast-track strategic IT decisions?
- Are there any other factors that should have been considered in the framework?
- Are there any factors that should be removed from the framework?
- Are you aware of any other frameworks that can enhance the CIO decision process?

Table 9 summarises the discussions and suggestions from the focus group discussions.

Table 9 - Framework Verification - Summary of Discussions

Question	Responses
1. What are your views on the FIT decision-making framework?	• All participants agreed with the problem statement defined in this research. • Participants expressed frustration in their current work context in obtaining approval for IT decisions and indicated that a decision framework can assist in doing this. • The technology and enterprise architect in the group was frustrated with the “Everyone is an IT expert” attitude that is prevalent in their organisation. They voiced their frustration that best technology was not always implemented in the organisation and sometimes decisions were “forced on them and they had to make them work”. Existing processes and guidelines did not help them in carrying out their responsibilities. • There was agreement that all key factors that affect organisational decision-making had been addressed in the framework. • Many of the participants appreciated the fact that the framework makes factors that influence decision-making

	visible.
	• One of the participants wanted more detail on how to apply this framework practically, using an example.
	  o *Section 6.3.3.1, Figure 84 and Figure 86 were discussed using Bitcoin as disruptive technology example.*
	  o *The nine steps were discussed as considerations to make a decision, although not all may be applicable to the decision or technology being considered.*
	  o *Consensus was reached after this explanation that the process is logical and can be used in practice.*
	• A suggestion from one of the participants was that illustrating the FIT decision-making model in a "house" gives the impression of a customer being "constrained" and other ways of showing the factors should be considered.
	  o *The initial framework was illustrated by a picture of a house, as it was a metaphor to show how a framework is constructed – the layout of the factors in the house model had no real meaning.*
	  o *The FIT framework was thereafter changed to show the relationship between factors and provide guidelines on how this can be applied in practice as shown Figure 81 and section 6.2*

2. Will the framework help CIOs in deciding how to approach disruption and fast-track strategic IT decisions?	• Overall agreement was reached that the FIT decision-making framework is practical and will help CIOs in deciding on which technologies to deploy in their environment. • One of the business consultants in the group discussed his frustrations working with a CIO of a financial services organisation on a big data call centre analytics project. The CIO and his team acknowledged that huge

	value could be realised from his project, although after eight months of trying, the CIOs had still not been able to secure funding to implement this project in business. The comment from the business consultant was that the FIT decision-making framework could assist the CIO in fast-tracking organisational decision-making. • The EA in the group mentioned that many CIOs focus on technology – this model shows that there are other factors that influence decision-making, which will help CIOs be successful.
3. Are there any other factors that should have been considered in the framework?	• The technology architect in the group wanted to understand the detailed process guideline explaining how to deal with each of the factors in the FIT decision-making framework in practice. o *It was explained that this phase of the research did not go to the next level of detail showing processes, procedures, check-lists etc. and this will be a consideration in the next phase of this research.* o *No action will be taken in this phase.* • The CIO in the group mentioned that based on experience, focussing on the customer, business value and external analysis were key to obtaining business approval. He mentioned that he could not think of any other factors that needed to be included. • The EA in the group highlighted that the Protection of Personal Information Act and General Data Protection Regulation will have a major impact on CIOs' decision-making. o *These factors were addressed under GRC in the FIT decision framework.* • No other factors were proposed, as overall agreement was that each factor was relevant and should be a consideration.

4. Are there any factors that should be removed from the framework?	• No factor was identified to be removed. • Participants indicated that they generally considered most factors when they made decisions. The FIT framework makes factors visible and forces those using it to be deliberate when making decisions. • One of the comments offered was that the framework is comprehensive and will help in strategic IT decision-making.
5. Are you aware of any other frameworks that can enhance the CIO decision process?	• Participants were not aware or did not use any framework to help with strategic IT decision-making. • Participants mentioned that they all relied on their prior experience to assess and motivate new technologies. • Many participants mentioned that they were often guided by organisations' policies, procedures, templates etc., which determine what approach to follow in motivating IT investments. • The technology architect in the group mentioned that he had seen a "game plan" in his organisation that could help with decision-making. This will be assessed in the section below. • One of the focus group participants mentioned that he was aware of a paper on CIO decision-making, which was forwarded to the researcher after the discussion. This is discussed in the section below.

6.4.3 Suggestions from the focus group discussions

6.4.3.1 Considering the game plan framework

The game plan framework (Heiligensetzer, 2016) suggested by a participant in the focus group discussion is illustrated in Figure 103. This was briefly analysed to determine if aspects of the game plan can be used to enhance the FIT framework. Key characteristics of the game plan are indicated below:

- The focus is on customer IT governance and business influence of IT.
- The game plan describes two approaches to transition and transformation, as shown in Figure 103.
    - In a technically orientated game plan, business has a low influence on IT.

- A business-orientated game plan implies weak IT governance with distributed decision-making.

- The focus is on implementation and the transition and transformation phase of a project and not on how a decision is made during the conceptual phase of IT system selection and investment decisions.
- Stakeholder analysis and power maps determine communication and the game plan can be used to ensure successful delivery of a project.

Implication for the FIT framework

The game plan framework focusses on helping IT managers in the implementation phase of a project and assesses aspects to be considered, thus ensuring the successful execution of an IT initiative. As the focus of the FIT framework is on assisting CIOs in decision-making prior to the implementation phase, the concepts outlined in the game plan will not be considered.

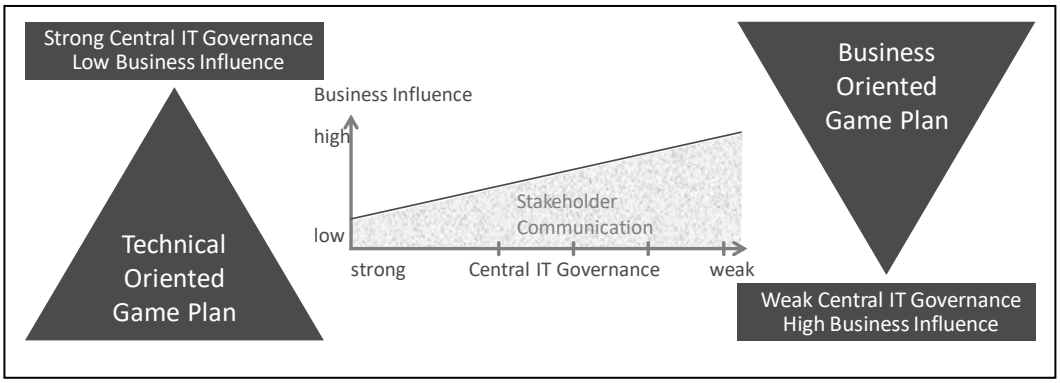


Figure 103 - Transition and Transformation Game Plan (Heiligensetzer, 2016)

6.4.3.2 Considering the "CIO decision-making – Issues and process view framework" (Selkala, 2016)

During the focus group discussion, one of the participants indicated that he was aware of a decision-making framework for CIOs (Selkala, 2016), which was subsequently shared with the researcher. This framework was discussed in section 2.5.5, where Selkala (2016) is quoted acknowledging similar challenges to those indicated in this thesis. Organisations are increasingly becoming dependent on ICT and it is a key factor for a company's value creation. Selkala (2016) mentions that previous CIO research mainly focussed on IT governance, IT and business alignment, IT investments, CIO challenges etc. Very little research is available on CIO decision-making.

The research by Selkala focusses on the CIO decision process based on issues that have become evident. Figure 104 illustrates the approach taken by Selkala in addressing open issues that may arise in an organisation.

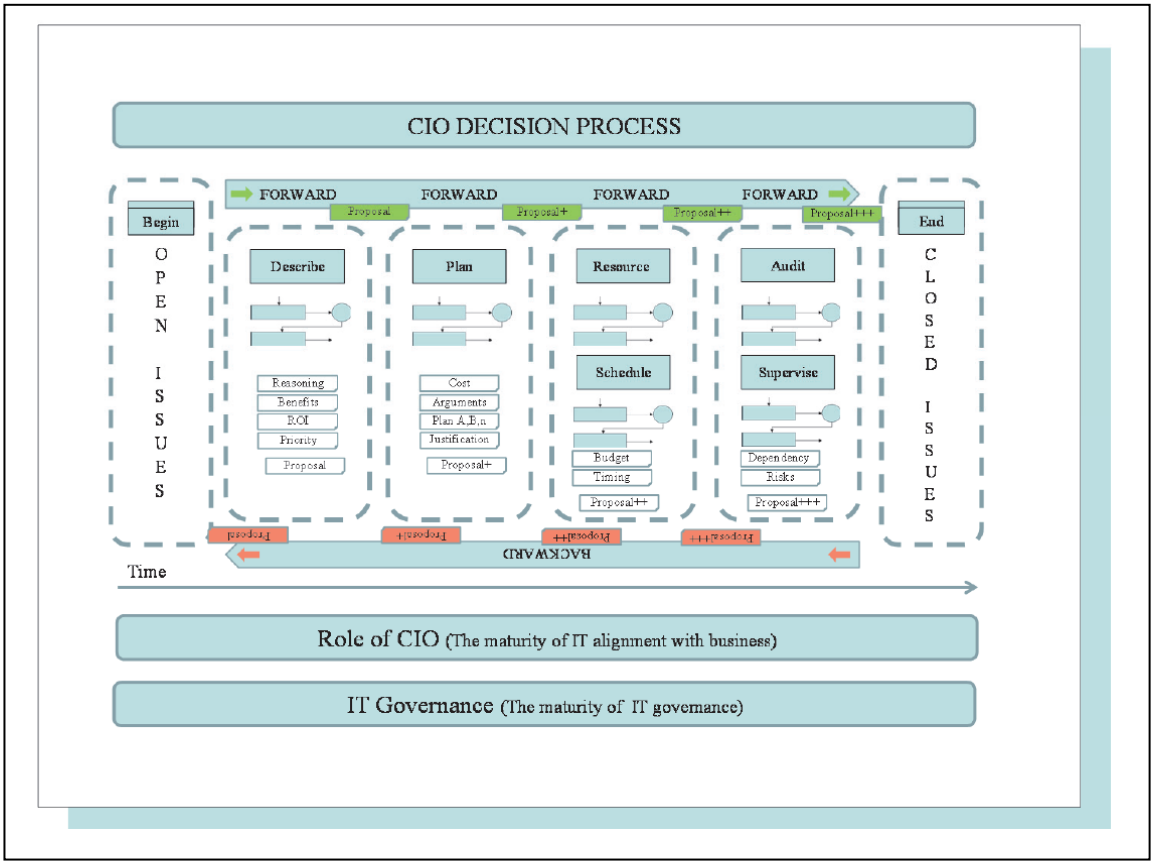


Figure 104- The CIO Decision Process (Selkala, 2016)

The model proposed by Selkala adopted a different perspective to CIO decision-making and rather focussed on processes to address identified issues. This framework confirms that some of the factors considered in this research are key decision factors. No additional factors were introduced.

6.4.3.3 Summary of FIT framework verification exercise

The framework verification exercise entailed reviewing all challenges that emerged during the primary research phase of this study. All challenges highlighted can be sufficiently addressed by the FIT framework, as indicated in Section 6.4.1. CIO challenges identified in this research were related to IT strategic decision-making in agile business conditions from a perspective of

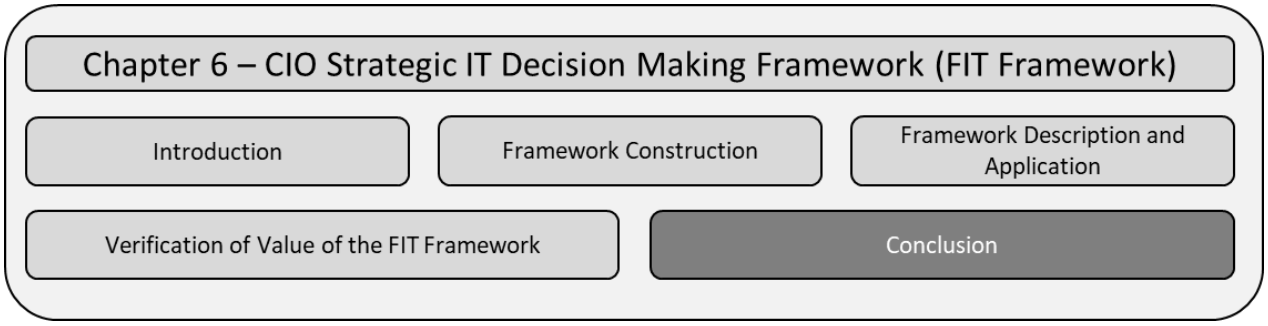
disruptive technologies. The FIT framework provides guidelines for strategic IT decision-making in agile business conditions.

The second step in the verification of the FIT framework entailed a discussion with IT experts in a focus group. None of the experts in the focus group had any prior insight into the framework before the discussion and had to provide comments based on the information presented to them during the discussion. All participants in the focus group discussion agreed with the problem identified in this research, found the framework insightful and believed that it could be applied in practice. All members of the focus group had over 15 years of experience in the IT industry and all previous IT decisions they had undertaken were based on their personal knowledge and experience in the field. None of the experts used any IT decision framework to guide their decision process and therefore found the FIT framework useful.

The framework application and verification exercise in Sections 6.3 and 6.4 answer SRQ3:

How can the decision framework be used in practice to guide strategic IT decision-making in agile business conditions?"

Based on the verification process followed and the feedback from field experts, the FIT decision-making framework can be used as a guideline for strategic IT decision-making when considered from a disruptive technology perspective.



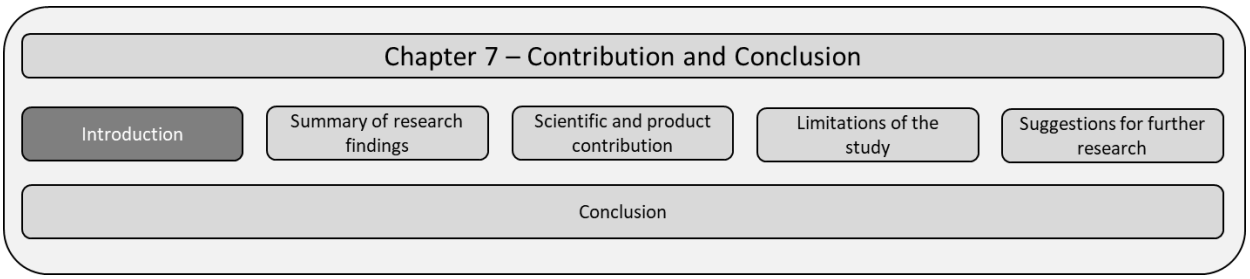
6.5 CONCLUSION

In Chapter 6, the final FIT framework was presented that can assist CIOs with strategic IT decision-making in a disruptive technology environment. The framework identified nine factors that influence IT decision-making in an organisational context.

A secondary contribution of the research was the BIDD model, which was also discussed in detail. The purpose of the BIDD model is to classify IT systems deployed in an organisation based on their functional purpose.

A step-by-step guideline was also discussed to demonstrate how to use the FIT framework and the BIDD model to arrive at a strategic IT decision.

The FIT framework was presented to a focus group consisting of industry experts and found to be useful. The general feedback from the focus group participants was that the FIT framework is comprehensive, and all factors identified had an influence on strategic IT decision-making.



7 CONTRIBUTION AND CONCLUSION

7.1 INTRODUCTION

The intent of this study was to create a framework that CIOs can use to make strategic IT decisions in an environment faced with a continuous stream of disruptive technologies. CIOs are recruited into organisations and are expected to play a strategic role, but in many instances they end up being very frustrated, spending most of their time addressing operational issues (Heller. M, 2012). CIOs with different experience, qualifications, skills, abilities etc. are expected to step into a strategic role and make decisions about IT and IT strategy that could have a significant impact on the future sustainability of a business in a hyper-competitive environment. Disruptive technologies, consumerisation, cloud, IoT, big data and various other technologies and service provisioning models all make the decision-making process of a CIO more challenging. Little guidance is provided to CIOs on strategic IT decision-making in an agile environment.

As IT permeates the core of all businesses, ownership and accountability become diluted, which poses a challenge in terms of decision-making. Business value creation is highly dependent on an organisation's ability to implement technology timeously and leverage the full potential of IT investments. Because of the pervasive nature of IT systems, multiple stakeholder interests should be factored into business cases to fast-track decisions on sustaining, incremental or disruptive technologies.

Traditional technology adoption life cycles no longer apply regarding disruptive technologies. The risks and the reward proposition of disruptive technologies are different from traditional sustaining technologies (Christensen, 2015). Companies that adopt new technologies at the appropriate time could gain considerable advantage over the early and late majority, but also expose themselves to a significant amount of risk. Timing is essential when it relates to decisions on disruptive and emerging technologies, especially when the life cycles of these technologies are continuously reducing.

IT is a disruptive force that has the potential to affect all organisations across all industries. Disruption has changed the orientation of decision-making, as organisations find newer ways to make profits (Kaner and Karni, 2004). Technology selection approaches are moving away from focussing on technologies to focussing on service, product or process design, which enables an organisation's strategic intent.

Interviews with seasoned IT industry experts who had experience in companies across mature industries such as manufacturing, mining, high-tech telecommunication, media and banking revealed that most IT decisions were based on personal experience. However, disruption and the impact of disruptive technologies on business are based on future events. Unless CIOs follow a structured approach to decision-making, their experience alone may not help them with technology decision-making in a fast-paced environment.

No framework could be found in existing literature that addressed the problem statement identified in this thesis. Various research projects were found that focussed on different facets of disruptive technologies, business and IT alignment, decision-making, IT risk etc. On the other hand, no comprehensive framework could be identified in theory or in practice to guide strategic IT decision-making in a disruptive environment.

As the intent of the study was to create a strategic IT decision-making framework that could be used in practice by CIOs, a design science research approach was selected. In this research, the most important consideration was to choose a research methodology that best addressed the research question and to create an artefact that CIOs could use in making decisions about disruptive technologies. Figure 105 provides a view of the layout of this thesis aligned to the DSR approach.

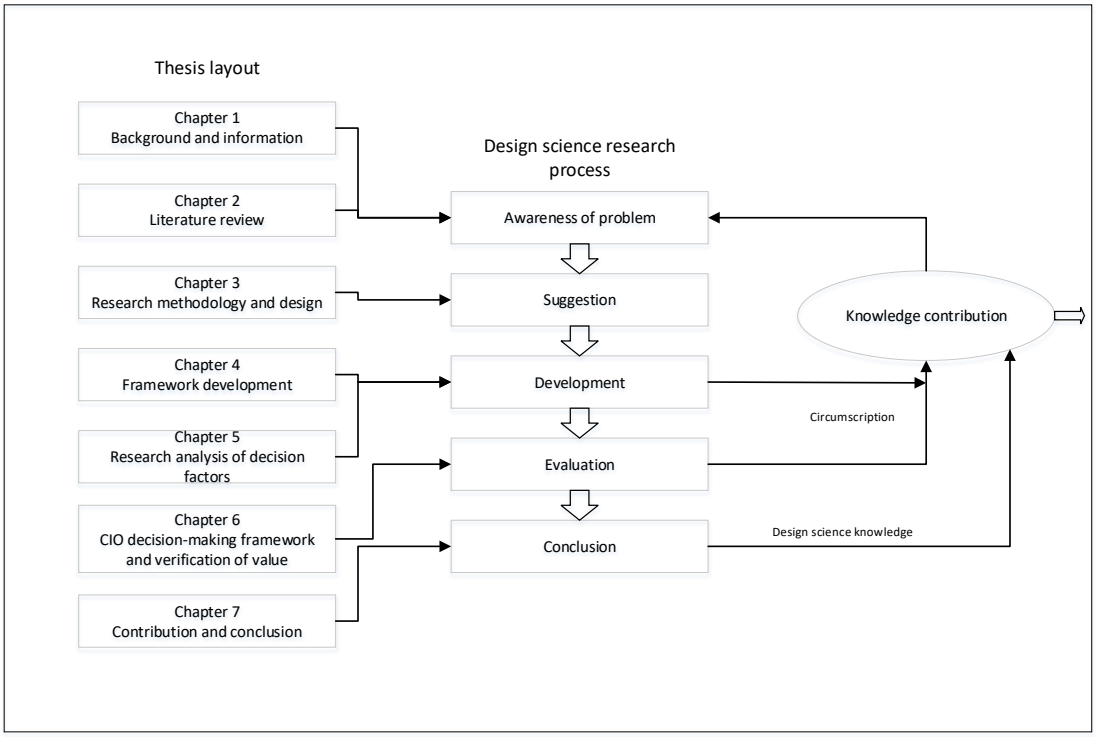
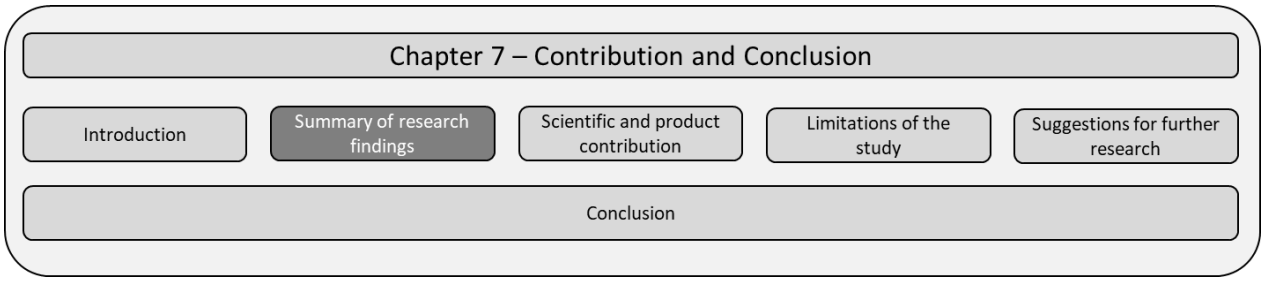


Figure 105 - Design Science Research - Layout of Thesis



7.2 SUMMARY OF RESEARCH FINDINGS

7.2.1 Contribution 1: Framework for IT decision-making (FIT decision-making framework)

The objective of this research was to create a framework to guide strategic IT decision-making in an agile business environment faced with a continuous stream of disruptive technology. The problem statement identified in section 1.2 defined the challenge for most CIOs in agile business conditions. There is a great deal of available technology, which can create distractions that significantly slow down the decision process. CIOs need to learn to prioritise which technology and which business problem to address in a rapidly changing technology environment (Evans, 2003). In many cases making no decision is safest, resulting in business sticking to traditional

ways of doing business. This approach significantly increases the risk to any enterprise of disruption by new entrants who are not handicapped by legacy IT systems.

To answer the main research question as defined below, the researcher assessed available literature to determine how strategic IT decisions were made and to determine if a generic framework could be constructed to aid in decision-making:

MRQ

"How can a CIO decision-making framework be constructed that can be used to guide CIOs in making strategic IT decisions in a disruptive technology environment?"

To answer the main research question in this thesis, SRQs 1, 2 and 3 had to be answered. This entailed a detailed analysis of literature relating to the following topics:

- Disruptive technologies – Understanding the nature of disruptive technologies and their impact on IT and business. Identify factors considered by successful organisations and CIOs who have embraced disruptive technologies in their business.
- Strategic decision-making: How managers make decisions in a complex environment when faced with uncertainty.
- CIO role – Understanding the role of the CIO in strategic IT decision-making related to disruptive technologies in an environment where IT is a key enabler of business success.
- EA – Generally EA has been a key function in organisations to ensure IT and business alignment. This section explores the role of enterprise architects in influencing decision-making from a disruptive technology perspective.

Chapter 6 presents the final strategic IT decision-making framework, which answers the MRQ and addresses the problem statement defined in Chapter 1.

To answer SRQ1, a comprehensive analysis of literature was conducted to identify factors that influenced technology decision-making in disruptive environments.

SRQ1

"What are the key factors in a framework that CIOs should consider when making strategic IT decisions in an organisation in agile business conditions?"

Section 4.1 describes the process followed to identify key factors that should be included in a decision framework based on literature reviews. To create a framework that could be used in practice, the factors identified in the literature review were tested with IT industry professionals

across industries who had experience in multiple local and global organisations to determine if the framework and factors identified were considered in practice. An additional factor that most participants recommended to be included in the framework was GRC. This factor was not identified as strategic during the literature review phase of the study. Although most participants did not view this as a factor that influenced strategic IT decision-making, the view was that all systems deployed in an organisation must comply with prevailing legislation that governs organisations, industries and the country. Section 4.3 shows the process followed and the results of the verification process to determine the key factors that were included in the FIT framework.

In Chapter 5, the FIT framework was refined by detailed data analysis of interview transcripts from interviews with field experts to answer SRQ2:

SRQ2

"How can the decision framework be refined with input from field experts based on their current experience in making decisions in a disruptive environment?"

In Chapter 5, each of the factors in the FIT framework was analysed in detail to determine how it influenced decision-making and key considerations when making strategic IT decisions.

In Chapter 6, a nine-step implementation guideline was proposed to implement the FIT framework in an organisational context. This was discussed with a focus group consisting of five IT professionals to understand whether the framework added value and could be implemented in practice. The outcome of this exercise answered SRQ3 as defined below:

SRQ3

How can the decision framework be used in practice to guide strategic IT decision-making in agile business conditions?"

The outcome of the literature review and primary research resulted in the development of the FIT framework (Figure 106), which contains key factors that must be considered when making strategic IT decisions on technologies and systems to deploy in organisations that support people, processes and customers. The view of CIOs and industry experts was that this is a comprehensive framework that could guide strategic IT decision-making in most organisations.

A detailed explanation of each of the factors and its role in IT decision-making is covered in Chapters 4, 5 and 6 in this thesis.

7.2.2 Contribution 2: Classification of IT systems: BIDD model

A secondary contribution of this research was an IT classification model referred to as the BIDD model. “Classification of IT systems” is one of the factors in the FIT framework that was identified as a key factor to be considered with all other factors in the FIT framework. During this study it became evident that, as IT permeates all areas of business, the functional purpose of IT must be considered when making strategic IT decisions.

IT systems deployed in organisations enable businesses and their employees to function and to deliver products and services to end customers. There are distinctions between IT systems used to service internal business processes and IT systems that enable external business processes. In many organisations ownership and accountability for internal and external IT systems are different, which creates challenges for decision-making in an environment where IT becomes commoditised and permeates organisational boundaries and ecosystems.

Organisations need to understand the classification of IT systems within organisations and their role in creating value and servicing end customers. They need to define the accountability of IT departments and business executives regarding implementation, support and use of these systems. To classify IT in organisations, this study proposes the BIDD model shown in Figure 107. Different systems according to the BIDD model classification may have different decision criteria and characteristics, which must be considered when making strategic IT decisions.

In using the FIT defined in Figure 106, the different factors defined in the model should be compared to the BIDD model defined in Figure 107. The detailed description of the application of decision frameworks is addressed in Chapter 6. Based on literature reviews and primary research findings, in an environment faced with continuous introduction of disruptive technologies, the choice of technology is dependent on understanding “how” technology creates value for customers, as opposed to understanding “what” the technology does.

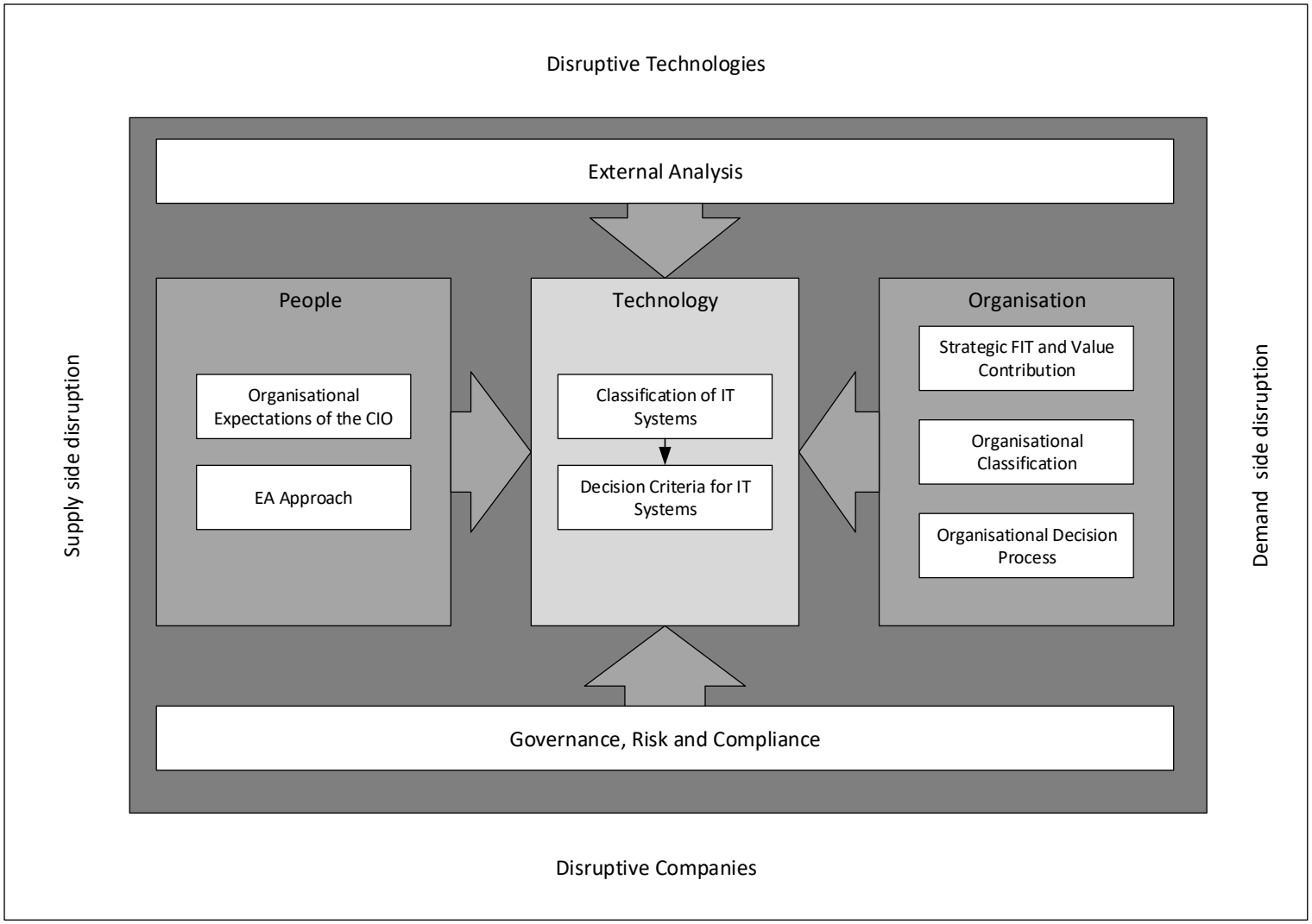


Figure 106 – Contribution 1: Framework for IT Decision-making (FIT Framework)

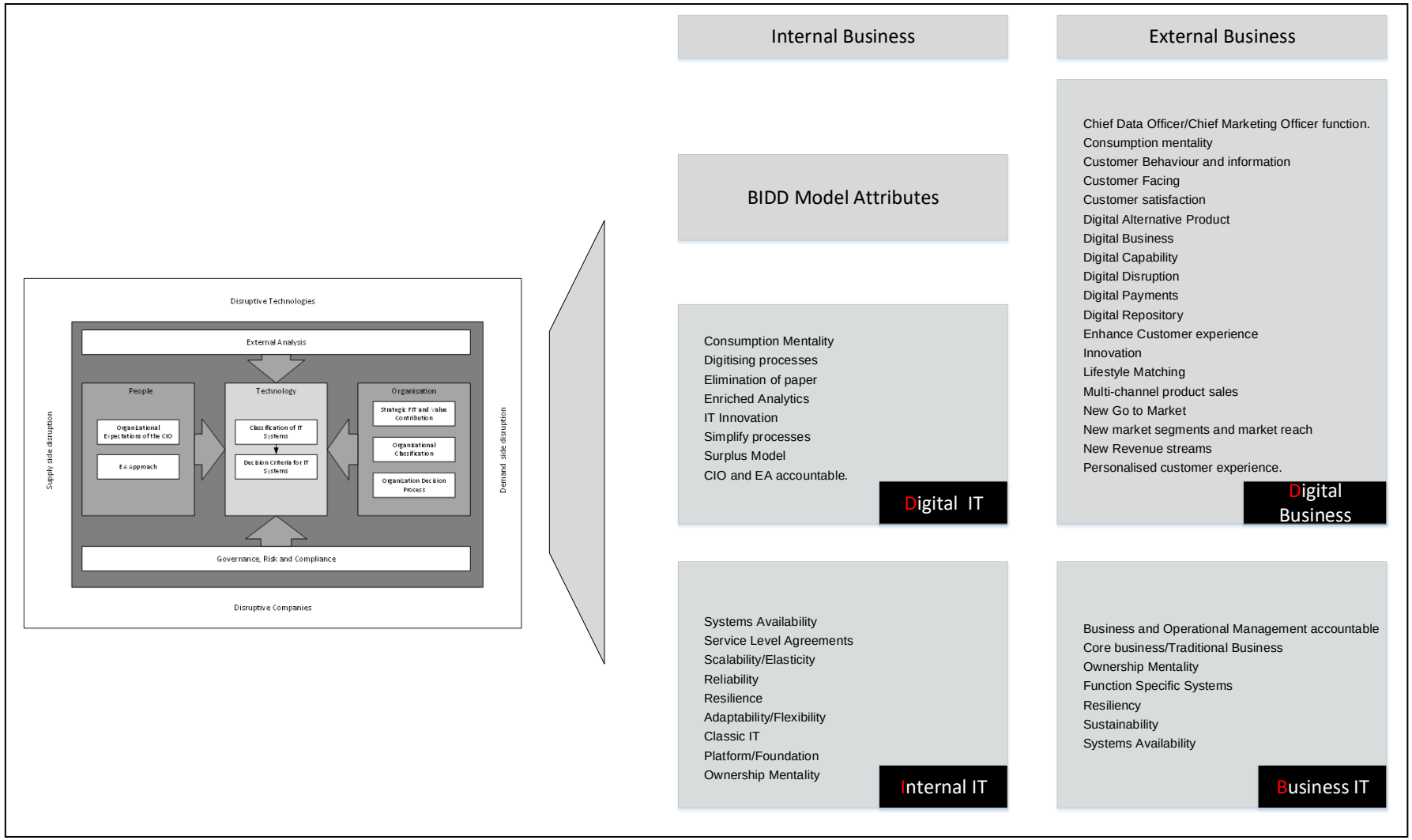


Figure 107 – Contribution 2: IT Classification Model (BIDD Model)

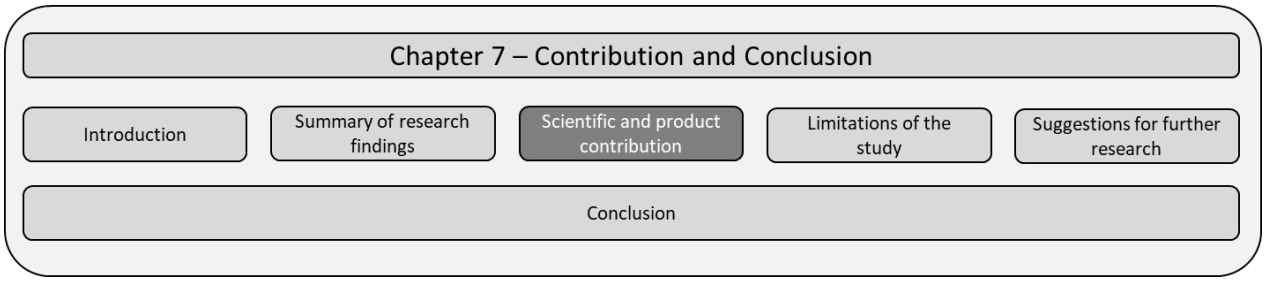
7.2.3 Guidelines for the implementation of the FIT decision-making framework

The FIT framework highlights nine factors that would provide CIOs with a comprehensive overview of “why” a technology is required, “who” should be accountable for the technology, “how” to motivate the technology and “what” process to follow to speed up the decision to invest in and implement the chosen technology.

The framework is a guideline on factors to consider; it is not prescriptive and all steps may not be applicable in all scenarios, yet it is important to understand the different facets influencing decisions and to make an informed decision on whether a factor is applicable or not. The steps in the guideline do not need to be executed sequentially; analysis can be executed in parallel, though sufficient consideration must be given to the factors identified to ensure that the CIO can justify a decision to different stakeholders in an organisation. Generally, CIOs and enterprise architects spend a huge amount of time focussing on technology specifications and functionality. The framework guides CIOs to consider other factors, as they are all equally important when a decision has to be made on a new technology investment.
The nine steps proposed in the FIT framework are:

- Step 1 – Use the “classification of IT systems” model (BIDD model) to understand the functional use of IT systems in the organisation.
- Step 2 – Understand the “organisation’s expectations of the CIO”. Who is the functional owner and what are the expectations of the CIO?
- Step 3 – Determine the “EA approach” suitable for a disruptive technology environment. What are the expectations of enterprise architects in deciding on a technology?
- Step 4 – Perform an “external analysis”. Understand external competing technologies and technology strategies and how these could affect current IT strategies.
- Step 5 – Consider the “organisational classification”. What is the organisation’s operating model and what systems, people, processes and customers are shared?
- Step 6 – Identify “decision criteria” for systems classified according to the BIDD model. What are key criteria that will determine if a technology is selected to be implemented?
- Step 7 – Understand the technology contribution to “strategic fit and value”. How does the chosen technology fit into an organisation’s strategy and how does it add value to customers identified in step 1?
- Step 8 – Consider the “organisational decision process”. What is the process to follow when motivating a decision and how does the organisation decide?
- Step 9 – Ensure decision success (compliance with GRC)

A more detailed description of the application of the framework and the execution of the steps is contained in Chapter 6.



7.3 SCIENTIFIC AND PRODUCT CONTRIBUTION

This section assesses the contribution of this thesis using the DSR framework and reflects on the process followed to ensure relevance and rigour in answering the research questions. To demonstrate relevance, the contributions of this study must show its ability to have a significant impact on business practices and organisational capabilities (Gregor and Hevner, 2013). Rigour is demonstrated using existing theory, methodologies and frameworks to extend the content of the existing knowledge base, which can be used for future research and practice. Figure 108 illustrates the process followed in this thesis using the DSR approach to ensure relevance and rigour in the research process.

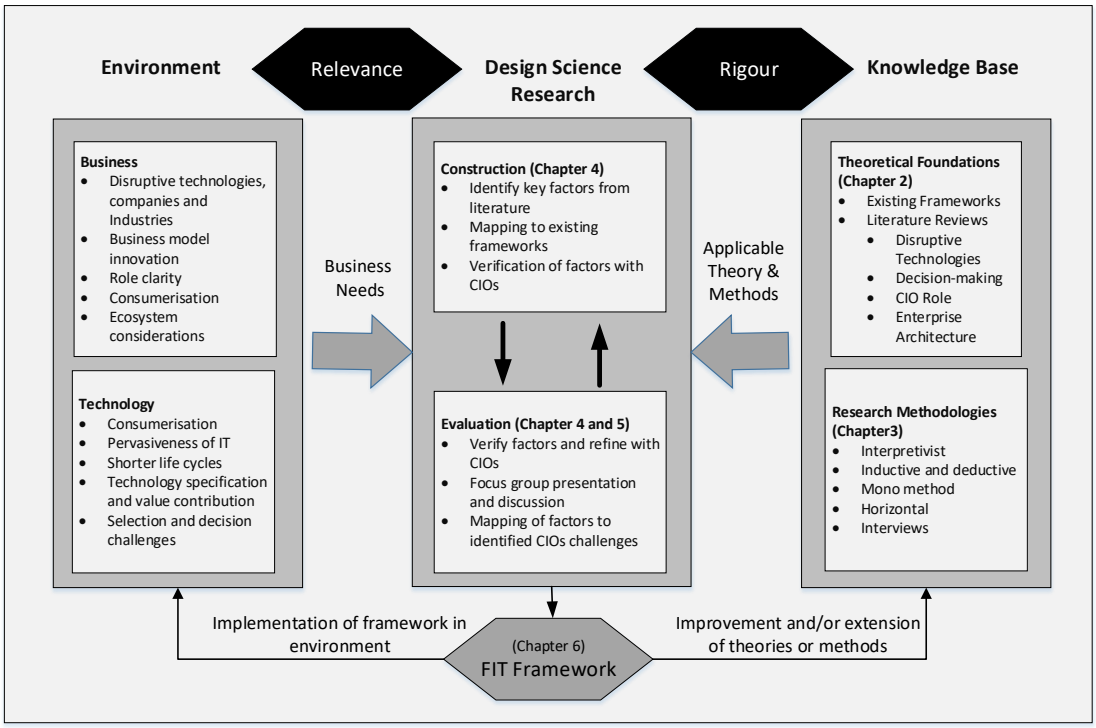


Figure 108 - Design Science Research Framework (Adapted from Gregor and Hevner, 2013)

Research indicates that there is a gap between basic or pure research (Shapiro et al., 2007) and practical application of research. For management and business research to be effective, the "lost in translation" impact must be considered in the entire research process. The FIT decision framework addresses the potential research gap that arises in research studies and makes a valuable contribution to management, business and institutions by providing practical guidelines to organisations that depend on IT to create a strategic advantage in agile market conditions.

The approach adopted in this study was to ensure that the knowledge that was created would advance theoretical understanding of the phenomena under study and simultaneously address practical business or managerial issues. The intent of this research was to address the "research-practice gap" (Rousseau, 2006), where managers and CIOs rely on previous experience and not on available theoretical knowledge. The research gap is caused by most theoretical knowledge in social research being unknown to technology-driven disciplines and generally in a form that cannot be applied in practice.

The output of this research was to create a practical guideline that CIOs can use in the execution of their accountabilities. Aspects relating to basic and applied research that are applicable to this study are the following (Saunders et al., 2009):

- The research expands the knowledge base on how disruptive technologies affect organisational decision-making. It provides practical guidelines on processes to follow and managerial considerations when making decisions about disruptive technologies.
- It has resulted in universal principles relating to a strategic IT decision-making process and its relationship to outcomes.
- Findings in this research are of significance and value to society and business in general, Failure to respond to disruptive threats could result in failure of established organisations and loss of employment, which would affect society.
- The research improves understanding of the business or management problem when faced with disruptive threats. Understanding of challenges allows for deliberate decision-making on strategic approaches to follow.
- The findings provide a solution to or guideline on a problem experienced by CIOs when making strategic IT decisions.
- Findings of practical relevance and value to managers in organisations have been reached. Interviews with CIOs and focus group discussions verified that all factors identified in the FIT framework are definite considerations when making strategic IT decisions in organisations.

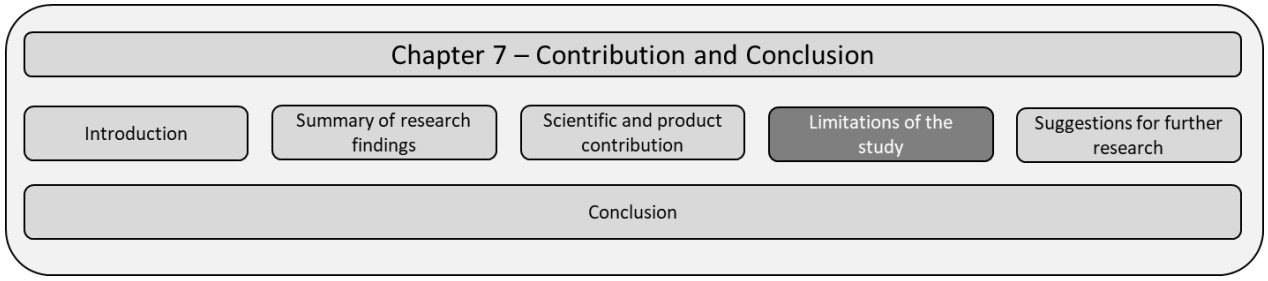
Gregor and Hevner (2013) proposed a seven-step process for effective research, positioning and presentation of a design science thesis. The approach followed in this thesis was compared to the process suggested by Gregor and Hevner (2013) and the results of this analysis are shown in Table 10.

Table 10 - Verification of Research Process against Guidelines Proposed by Gregor and Hevner, (2013)

Section	Contents	Reference in this Thesis
1. Introduction	Problem definition, problem significance/motivation, introduction to key concepts, research questions, scope of study, overview of methods, structure of the remainder of the paper.	Chapter 1 and Chapter 3
2. Literature Review	Prior work that is relevant to the study, including theories, empirical research studies and findings.	Chapter 2
3. Method	The research approach that was employed	Chapter 3
4. Artefact Description	A concise description of the artefact at an appropriate level of abstraction to make a new contribution to the knowledge base. Should include the description and the research process followed.	Chapter 3, Chapter 4 and Chapter 5
5. Evaluation	Evidence that the artefact was useful. Artefact is evaluated to demonstrate its worth with evidence.	Chapter 5 and Chapter 6
6. Discussion	Interpretation of the results: What the results mean and how they relate to the objectives. Includes summary of what was learned, practical significance and area requiring further work. Broad implications of the paper's result related to research and practice are discussed.	Chapter 5 and Chapter 6
7. Conclusion	Concluding paragraphs that restate the important findings of the work, restate the main ideas in the contribution and why they are important	Chapter 7

In comparing the approach followed in this thesis to the seven-step guideline proposed by Gregor and Hevner (2013), it can be concluded that this research complied with best practice design science approaches.

In summary, the FIT decision-making framework provides a concise description of the artefact at an appropriate level of abstraction to make a new contribution to the knowledge base (Gregor and Hevner, 2013). The framework provides CIOs with a practical guide on how to assess the impact of disruptive technologies on existing IT systems, define focus areas and optimise approaches to fast-track strategic IT decisions in the midst of disruptive technologies.



7.4 LIMITATIONS OF THE STUDY

In any research, it is valuable to understand limitations in terms of theory, methods and findings. Identified limitations help in identifying future areas of research or opportunities for future knowledge contribution (Selkala, 2016).

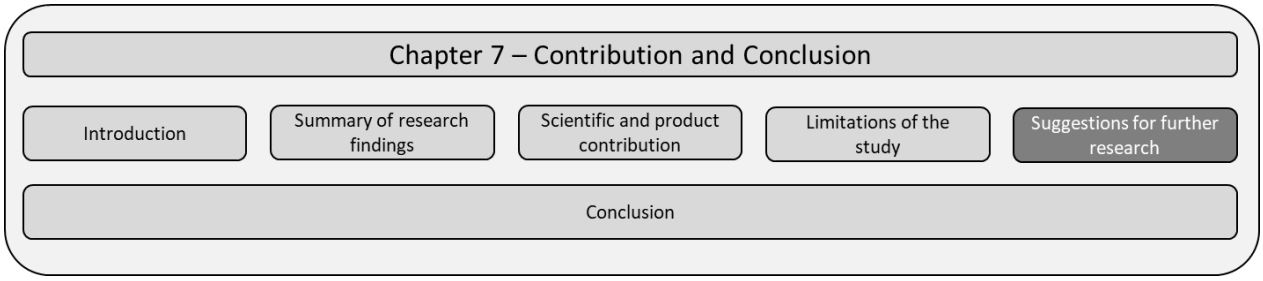
The following limitations may be relevant to this study in creating a strategic IT decision-making framework for organisations:

- The study predominantly focussed on strategic IT decision-making from the perspective of incumbent organisations that operated in a fast-changing technology environment. Participants selected for interviews had 15 to 20 years of industry experience. They provided feedback on how they made IT-related decisions or experienced decision processes in organisations. In future studies it may be interesting to interview participants from disruptive organisations such as Google, Amazon, Airbnb etc. to solicit their views on IT decision-making.
- Another limitation of this study is that it assumes organisations want to fast-track IT decisions and use IT as a source of competitive advantage. Although all participants interviewed agreed that they had to change and expressed frustration with the pace of IT decision-making and implementation in organisations, this may not represent the strategic intent of all organisations in the industry. Some organisations may have a strategy to

exploit a market segment for as long as possible based on a prior competitive advantage that made them successful.

- The evaluation of this study was based on a two-step verification process, which assessed its ability to address identified CIO challenges emanating from research, and in a focus group discussion with IT experts. The empirical value was not tested in an organisation to assess its value over an extended timeline. This may not constitute a limitation, but an area to be investigated in future research.

The limitations discussed identify areas for future research considerations and should not reduce the value of the proposed FIT decision-making framework.



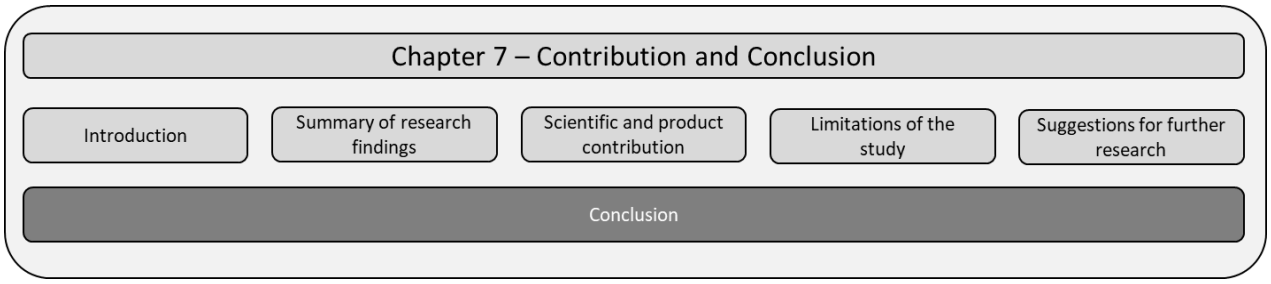
7.5 SUGGESTIONS FOR FURTHER RESEARCH

A horizontal research process was followed in this thesis to understand IT decision-making in a cross-section of the industry. The FIT decision-making framework was not practically applied in an organisation and tested over a period to observe results. Suggestion for future research are as follows:

- In future research it is proposed that research be conducted in an organisation over an extended period to evaluate the framework in practice. The value of most frameworks and models is derived from their execution. As the intent of this study is to create a framework to guide strategic IT decision-making, it would be valuable to determine if this framework has become an institutionalised artefact to guide strategic IT decision-making over the longer term.
- As this framework considers a holistic view of the organisation, different stakeholders may have varying perspectives of ownership of IT systems deployed in organisations. The concepts in this framework can be extended to consider the impact of ownership and accountability of business processes on IT decision-making.
- The BIDD model defined in this thesis assists in classifying IT based on its functional use in organisations. A future research consideration may be to enhance the BIDD model based on a design thinking perspective, i.e. focusing on customers' journeys from the

external environment to the core of an organisation, evaluating the role of customers in influencing IT decision-making.

Decision-making in a disruptive technology environment seems to be a relatively new concept in research owing to limited availability of studies on this topic. This seems rather surprising in view of the massive impact of disruptive technologies across all organisations in every industry. Further research on each of the factors in the FIT decision-making framework will complement the findings in this thesis and enhance the body of knowledge in the IS field.



7.6 CONCLUSION

CIOs and business executives have now come to the realisation that the next source of competitive advantage and growth will be emerging and disruptive technologies. CIOs who are generally the custodians of IT in organisations become paranoid because of the fear of making the wrong decision in a complex technology environment. When considering the numerous available technology options that are continuously evolving, the easiest decision in many cases is to make no decision and maintain the status quo.

The intent of this research was to understand factors influencing strategic IT decisions and to create a framework to guide strategic IT decision-making in an agile business environment, from the perspective of disruptive technologies. Lack of guidelines on IT decision-making approaches or best practices in an organisation is one of the factors contributing to the slow uptake of technology in the enterprise space in comparison to the rate of change in the consumer space.

Following a design science methodology, this study answered the MRQ and SRQs by delivering the following:

- Created a FIT decision-making framework that can be used as a practical guide for IT decision makers when considering technology investments in organisations.
- Identified key factors that form part of the decision framework that defines accountability and areas of focus and assists in speeding up decision processes in organisations.

- Verified the FIT framework by using it to address key challenges identified by industry experts and consulting with a focus group of industry experts.
- Created a step-by-step practical guide for implementation of the FIT decision-making framework in organisations.
- Contributed to the IS body of knowledge by creating a framework to assist with managerial decision-making in a disruptive technology environment.

The FIT decision-making framework in conjunction with the BIDD model contributes to the IS body of knowledge by providing a logical approach to assess the current state of the IT landscape, clarify ownership of systems, understand the organisational context and offer guidelines to fast-track decision-making in organisations.

In summary, this thesis provides a new perspective on how CIOs deal with strategic IT decision-making in a disruptive technology environment and provides an interesting perspective to all CIOs, enabling them to evaluate this approach against their own approaches, which can increase the value they add to their organisations.

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APPENDICES

APPENDIX A – RESEARCH QUESTIONNAIRE

Research Questionnaire

Towards a framework to guide IT decision making in an agile business environment, from the perspective of disruptive technologies

by

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Submitted in partial fulfilment of the requirements for the degree

PhD Informatics

in the

FACULTY OF ECONOMIC AND MANAGEMENT SCIENCES

at the

UNIVERSITY OF PRETORIA

Participant Name: _____

Date : _____

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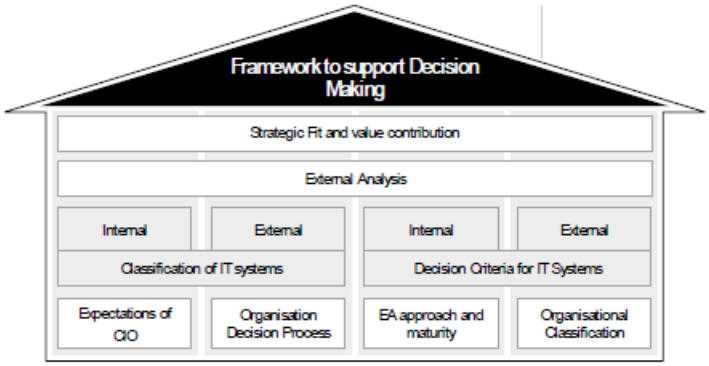
3 INTRODUCTION

Most organisations realise that they need to leverage IT to create sustainable competitive advantage to survive and grow their business in a disruptive environment, however often do not believe that they are leveraging IT to its full potential or in the capabilities of their IT teams. The objective of this study is to understand how CIO's and IT specialists decide on appropriate IT Systems, Solutions and technologies that can add value to their organisation in a disruptive technology environment.

To formulate a guideline to help IT Specialists with IT decision making, various criteria must be considered from different facets to better understand how decisions are currently made within organisations. Figure 1 provides a high-level overview of key factors that may be considered when making IT decisions. The intent of this questionnaire is to obtain insight from CIO's, Enterprise Architects and IT Specialists on important factors to consider in each of the core building blocks of the decision framework proposed.

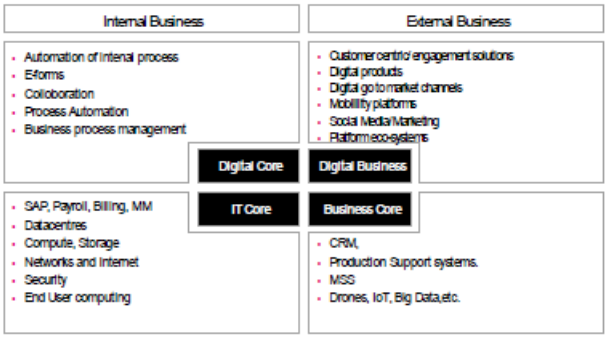
Figure 1 – Proposed Decision Framework



The model proposed in this research as indicated in Figure 2, can be used to identify IT systems under the control of the CIO and business executives and categorize all IT systems within the context of an integrated business model. The model also differentiates foundational or core IT systems and IT systems that are predominantly deployed to enable digital business models in a disruptive environment. The BIDC (Business, IT, Digital, Core) model will form the core of the

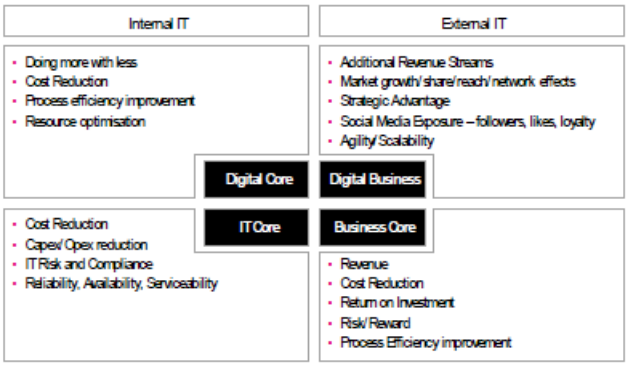
CIO decision framework which will enable CIO's to determine priority focus areas in agile business conditions. The model categorizes all IT systems used in an organization into four distinct categories, each of these would have different decision criteria and in many cases, follow a different approval process.

Figure 2 – BIDC Model – Example: Classification of IT Systems



After the classification of different IT systems into the four quadrants defined in the BIDC model, it is essential to understand if different decision criteria are used in selecting technologies in the different areas of an organization. Figure 3 gives a view of typical decision criteria that may be considered in each of the quadrants in the BIDC model however the list will be expanded during the next phase of this study.

Figure 3 – Example: Decision Criteria for IT Systems



3.1 GENERAL QUESTIONS

1. What approach have you followed in the past to determine "why" IT need to focus on identified priorities, "What" systems to deploy and "How" to implement these solutions.?

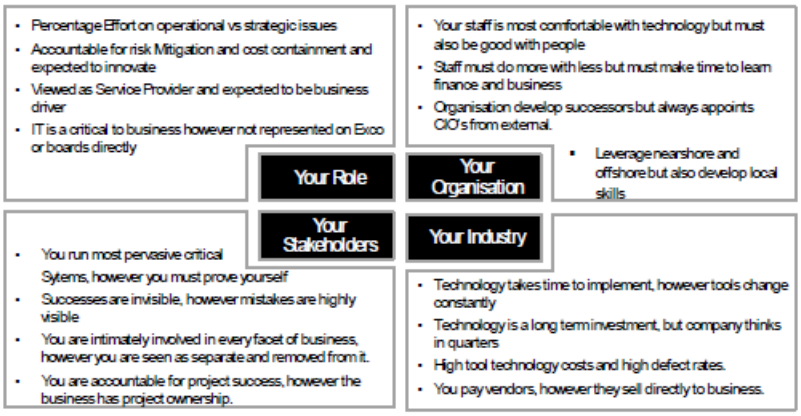
2. In the life cycle of a project - from Idea to Implementation - decisions need to be made by various stakeholders - what was your experience of the decision process in your organisations?

3. Do you think that a decision framework would be useful for CIO's and IT specialists in a disruptive technology environment and why?

3.2 EXPECTATIONS OF THE CIO

The intent of this section is to assess if IT Specialist or CIO's clearly understand the expectations of them from the stakeholders they interact with in the context of the industry that the company operates in. Questions will also assess if respondents current time allocation allows them to address stakeholder's expectations. Figure 4 below providers a view of typical expectations of CIO's from different perspectives.

Figure 4 – Expectations of a CIO (Heller, 2013)



3.2.1 Questions:

Expectations of the CIO (Scale 1=low 10=High)	
	Your Role
1	On a scale of 1 – 10, how strategic do you believe your role is to the organisation? ☐
2	What percentage of your time is spent on the following activities? Operational ☐ Tactical ☐ Strategic ☐
3	Are you happy with your current time allocation?
4	What type of skills do your organisation expect you to have for you to be successful in your role?
5	What are your top 3 priorities currently?
6	What is your role in aligning to business strategy or in influencing business strategy?
7	In your role - what is your measure of success?
	Your Stakeholders
1	How critical is IT to business operations i.e. producing products or delivering services to end customers?
2	How critical is IT with regard to enabling or influencing business strategy?
3	On a scale of 1-10 what is your rating of key stakeholder's perception of value of IT to business? ☐
4	Are you given sufficient recognition for the successes in the IT environment?
5	Are the services you deliver directly linked to business KPI's?
	Your Organisation
1	How important is it for your staff to have excellent technical, business or consulting skills?
2	Does your organisation expect you to constantly do more with less - cost savings with less people?
3	How replaceable are IT staff in your organisation - easily outsourced, nearshored or contracted externally?
4	Do stakeholders see the IT department and internal IT expertise as a core competence and a source of competitive advantage in a competitive industry?
	Your Industry
1	What impact does changes in technology in the external environment have on current IT projects in your organisation?
2	How do you currently manage your technology strategy in a disruptive technology environment?
3	How do disruptive competitors influence your technology strategy and how do you identify them?
	General
1	Analysing the BIDC model in Figure 2 - where do you believe most CIO's should focus to add the most value to an organisation?

3.3 ORGANISATION DECISION PROCESS

The intent of the following question is to understand how decisions are made in organisations. In many cases IT specialist and CIO's focus on the best technology and spend most of their time conducting in depth vendor analysis and functional analysis only to be frustrated when decisions are delayed due to poor understanding of their stakeholders who make the actual decisions.

Figure 5 – Decision Theory (Turpin and Marais, 2006)

Decision Making Theory	
Rational Model	Ranking of Alternatives to chose. Decision makers fully informed on all possibilities
Bounded Rationality and Satisficing	"Satisficing" Process orientated view. Managers don't have complete info. Optimal choice not required. Options considered sequentially. If meets minimum criteria then it suffices
Incrementalist Approach	Process of incremental actions keeping strategy open to adjustment. Starts from status quo, rather than working towards a goal
Organisational Procedures View	"Avoidance Model" – systematic process which strives to maintain status quo at the cost of innovation. Decisions are a result of standard operating procedures by organisation sub units.
Political Model	Decisions further individual or group self interest. Politics and power influence decisions – decisions good for the group not necessary for the organisation
Garbage Can Model	Decision making in "Organised anarchy". Manipulations in decision making, pluralistic environment with multiple goals. Decisions made do not address all problems in the Garbage Can.
Individual Differences Perspective	Focus on individuals decision making style, experience, preferences and behaviour. Different managers may arrive at different decisions
Recognition-Primed Decision Model	Decision maker is influenced by previous experience. Experience helps them understand current context and to determine course of action. If situation is not recognised, then more information is needed
Multiple Perspective Approach	Analyses problem from multiple perspective – technical, organisational and individual. Obtain many technical views, views from stakeholders and individuals. Decision outcomes generally endorsed by multiple stakeholders.

3.3.1 Questions:

Organisation Decision Process	
	Applicable decision theory
1	In your current organisation or typical organisation - who are the key individuals that ***influence*** major IT decisions?
2	In your current organisation or typical organisations, who are the **key decision makers** for major IT decisions?
3	Is the decision process in your organisation clearly defined and effective?
4	Based on the information in Figure 5 - which theory best reflects the approach in your organisation?
5	In your view, which approach described in Figure 5, would be most suitable in an environment which is faced with continuous disruption?
6	In motivating for IT projects how import is it to understand the different stakeholders in your organisation and ensuring that your motivation is tailored to address individual preferences?
7	Considering the BIDC model in Figure 2, which theory is best suited for the different quadrants in the model?
8	Do you think it would be beneficial to understand the decision-making style in your organisation when motivation for IT projects?

3.4 EA APPROACH AND MATURITY

Most CIO's rely on EA's to provide guidance and recommendations on technology decisions within an enterprise, however there has been lots of frustration on the relevance of this function during times of disruptive change. Many EA practitioners still subscribe to the Zachman Framework; however, this methodology can lead to frustration as this seems effective in documenting and describing artefacts, products, services and architecture. In disruptive technology environments, traditional EA approaches may not be applicable. These questions seek to establish the current thinking and expectation from EA in a disruptive environment. Figure 6 below provides a high-level overview of emerging schools of thought regarding EA in agile business conditions.

Figure 6 – Enterprise Architecture Schools of Thought (Lapalme, 2012)

	Enterprise IT Architecting	Enterprise Integrating	Enterprise Ecological Adaptation
Motto	Enterprise architecture is the glue between business and IT	Enterprise architecture is the link between strategy and execution	Enterprise architecture is the means for organizational innovation and sustainability
Objectives and concerns	Effectively enable the enterprise strategy	Effectively implement the enterprise strategy	Innovate and adapt
	Support IT planning and reduce costs	Support organizational coherence	Support organizational coherence
	Enable business		Encourage system-in-environment coevolution
Principles and assumptions	Apply a reductionist (mechanistic) stance	Apply a holist (systemic) stance	Apply a holist (systemic) stance
	Don't question business strategies	Don't question business strategies and objectives	System-in-environment coevolution
	Design organizational dimensions independently	Manage the environment	Environment can be changed
	Don't worry about non-IT dimensions; they're not your concerns	Jointly design all organizational dimensions	Jointly design all organizational dimensions
Skills	Have technical competence and engineering knowledge	Facilitate small-group collaboration	Foster dialogue
		Apply systems thinking	Apply system and system-in-environment thinking
			Facilitate larger-group collaboration
Challenges	Convince the organization to accept the designed plans	Understand organizational systemic dynamics	Foster sensemaking
		Collaborate across the organization	Encourage systems thinking and system-in-environment paradigm shifts
		Encourage systems thinking and paradigm shifts	Collaborate across the organization
Insights	Permits the design of robust and complex technological solutions	Permits the design of comprehensive solutions	Fosters system-in-environment coevolution and enterprise coherency
	Fosters the creation of high-quality models and planning scenarios	Enables significant organizational efficiency by eliminating unnecessary contradictions and paradoxes	Fosters organizational innovation and sustainability
Limitations	Can produce inadequate or unfeasible solutions for the larger organizational context	Susceptible to "perfect" designs that support unsustainable strategies	Requires many organizational preconditions for management and strategy creation
	Struggles with solution acceptance and implementation barriers	Requires a paradigm shift from reductionism to holism	
	Susceptible to "perfect" designs that support unsustainable strategies		

3.4.1 Questions:

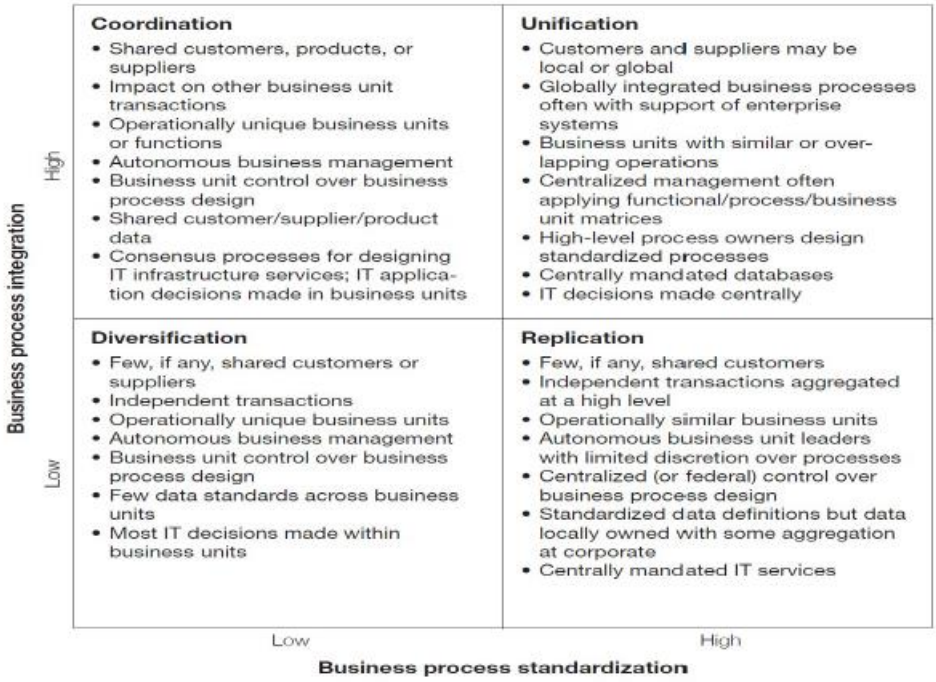
EA Approach and Maturity	
(Scale 1=low 10=High)	
1	Does current EA frameworks and approaches used within organisations provide sufficient guidance for CIO's to make optimal technology decisions?
2	Based on your experience, how effective were the enterprise architecture team in the following strategic objectives (Scale 1 – 10): a) Influencing Organisations Business strategy b) Shaping Operating Models c) Determining technology strategy or roadmap in a disruptive technology environment d) Choosing disruptive technologies such as cloud, big data, mobility, IoT etc. which creates competitive advantage for a company
3	EA is a mature discipline and most companies follow approaches generally aligned to Zachman, TOGAF, FEA or Gartner. In your experience, which framework do you believe helps companies on activities described in Question 2?
4	Based on the BIDC model in Figure 2, in which quadrant to you believe EA's spend most of their time currently and do you think their focus is aligned to the organisations expectation of them?
5	Do you think that classification of IT systems according the BIDC model could be useful in helping EA's in prioritizing initiatives or where they spend their time to add the most value to an organisation?

3.5 ORGANISATIONAL CLASSIFICATION

The intent of these questions is to establish the extent to which the operating model of an organisation influences business decisions. Understanding the characteristics of a business or the mandates of IT specialists and CIO's in different parts of a business will provide an overview of key KPI's that create business value. IT decisions and implementation plans will generally be supported if it results in business value creation for the organisation as whole and for parts of the organisation that may be impacted.

Figure 7 – Characteristics of Operating Models (Ross et al., 2006)

Characteristics of four operating models

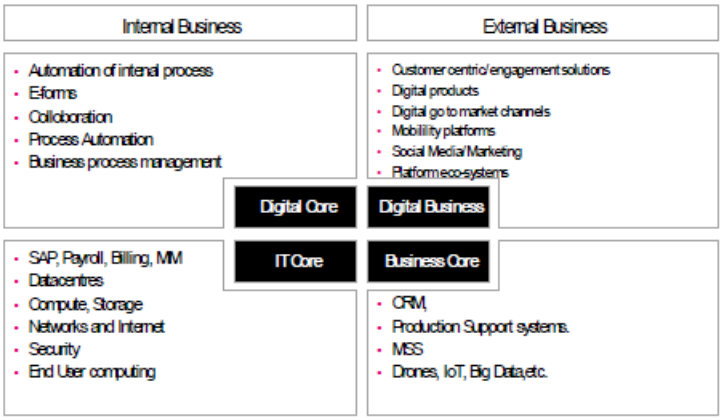


3.5.1 Questions:

Organisational Classification	
	Impact of Organisational Characteristics on Decision making
1	Based on your experience, have you considered your organisation's operating model in deciding on technology strategies or choices for your organisation?
2	In your opinion, do you believe it is important to consider the operating models as defined above when making technology choices for an organisation?
3	In a disruptive technology and business environment should CIO's pay any attention to business operating models?

3.6 CLASSIFICATION OF IT SYSTEMS

In traditional organisations, CIO's generally are generally accountable for the provision of IT systems for internal IT users and for business support systems such as SharePoint, ERP, CRM, payroll etc. Operational IT systems are generally managed by Business executives who are accountable for delivering products and services to the end customer. However, with the rapid changes in the IT environment over the last decade, there is no longer a clear distinction between internal business IT and operational IT systems. Disruptive technologies such as cloud, IoT, mobility, social, Big data etc. are driving digital business strategies which should be leveraged across an organisation to create competitive advantage.

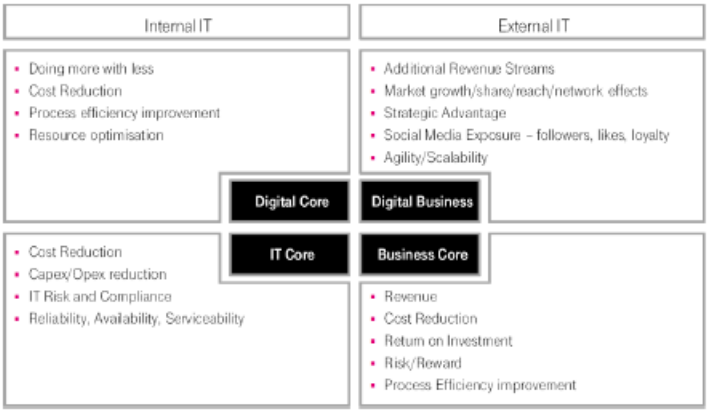


3.6.1 Questions:

Classification of IT Systems (Scale 1=low 10=High)	
1	In organisations that you have worked in, has there been a clear distinction between Business and Operational IT systems? Y ☐ N ☐
2	Gartner Predicts that through 2017, 38% of IT spend will be defined, managed and controlled by Business Leaders - is this something you have experienced and how did you manage this?
3	Do you believe the BIDC model above can be used as a model to classify Core and Digital offerings for Business and IT? Y ☐ N ☐
4	Rate the above quadrants in the BIDC model on a scale of 1-10 in terms of value contribution to business to compete in disruptive environments IT Core ☐ Digital Core ☐ Business Core ☐ Digital Core ☐
5	What percentage of your or IT teams time is spent on the different quadrants in the BIDC Model? IT Core ☐ Digital Core ☐ Business Core ☐ Digital Core ☐

3.7 DECISION CRITERIA FOR IT SYSTEMS

In traditional organisations, CIO's generally are generally accountable for the provision of IT systems for internal IT users and for business support systems such as SharePoint, ERP, CRM, payroll etc. Operational IT systems are generally managed by Business executives who are accountable for delivering products and services to the end customer. However, with the rapid changes in the IT environment over the last decade, there is no longer a clear distinction between internal business IT and operational IT systems. Disruptive technologies such as cloud, IoT, mobility, social, Big data etc. are driving digital business strategies which should be leveraged across an organisation to create competitive advantage. These questions try to establish typical KPI's that must be considered in each quadrant of the BIDC model that will aid decision making on key IT initiatives.



3.7.1 Questions:

Decision Criteria for IT Systems (Scale 1=low 10=High)	
1	Do the KPI's reflected in the BIDC model above provide a view of typical KPI's that would be considered in the different quadrants of the model? Y ☐ N ☐
2	In your experience are there additional KPI's that must be considered in obtaining approval for IT projects or the introduction of new technologies in your workplace?
3	In a Digital Disruptive environment, certain KPI's may be qualitative in nature - what in your opinion would be the best approach to convince senior decision makers to approve implementation of such disruptive technologies?
4	CFO's/Finance ultimately make the final decision on the adoption of new disruptive technologies. Finance as a discipline has not changed fundamentally over the last 40 or more years. To avoid long decision processes or delays in transforming the organisation to compete in a digital world - what approach would you suggest to align traditional ROI models with digital business expectations and KPI's?

3.8 EXTERNAL ANALYSIS

CIO's and IT Specialists who are expected to perform a strategic role in an organisation must continuously scan the external market to identify disruptive technologies and technology trends which can impact current business models. Most CIO's and enterprise architects currently spend most of their time analysing newer technology without consideration of timing, the impact of eco-

systems and impact on business models. Failure to get the timing of decisions right could have negative financial implications for the organisation and its sustainability in a disruptive technology environment. Over the last few years' consumerism trends has resulted in the emergence of disruptive organisations that have led to the failure of established organisations. Trends such as Social, cloud, mobility, e-commerce, big data analytics etc. have created digital company giants such as Google, Amazon, Ali Baba, Uber, Airbnb etc. which has resulted in many organisations scrambling to become more digital.

Figure 8 – External Analysis (Adner and Kapoor, 2016)

3.8.1 Questions:

External Analysis (Scale 1=low 10=High)	
1	Do you believe that CIO's or IT specialists should pay attention to emerging technologies and why?
2	What is your view on why newer technologies such as cloud, Big Data, IoT, Mobility, In Memory Computing etc. in general take extremely long to be included in IT architecture plans and implemented in many organisations ?
3	Rate the level of importance (Scale 1 – 10) and the percentage of time is spent by IT on the following factors when evaluating the implementation of new technologies.
	<table><tr><th></th><th>Importance</th><th>% Time</th></tr><tr><td>Specifications and functionality of the new technology or Solution</td><td></td><td></td></tr><tr><td>Timing of implementation of new technology or Solution</td><td></td><td></td></tr><tr><td>Eco-Systems of the new technology or Solution</td><td></td><td></td></tr></table>
4	Do you believe that the framework in Figure 8 could add value to CIO's and IT specialists in technology selection and investment decisions for their enterprise IT systems?
5	Do you think the framework for analysing the pace of technology subsititution is applicable for the different quadrants of the BIDC model?

3.9 STRATEGIC FIT AND VALUE CONTRIBUTION

Traditional Return on investment models may not be applicable in technology driven industries as it may difficult to accurately predict future revenue streams. Organisations such as Facebook, twitter, WhatsApp, amazon may not have existed if traditional financial investment models were used during their early stages of development as revenue generation was a secondary consideration and the source of revenue was uncertain. Enterprise Architects role therefore is to ensure that they provide a holistic view of a system from different perspectives depending on stakeholder group. EA role is also to map relationships between enterprise strategic goals, IT investments, products and services and key performance indicators. Technology in an enterprise should be classified in different categories and be treated differently from an enterprise decision making perspective (Bente et al., 2012). The classification of IT

systems and new technologies into the different quadrants can provide guidance to CIO's on strategic fit and derived value contribution, which will influence approach to decision making, system develop and implementation.

Figure 9 – Strategic Fit and Value Contribution (Bente et al., 2012)

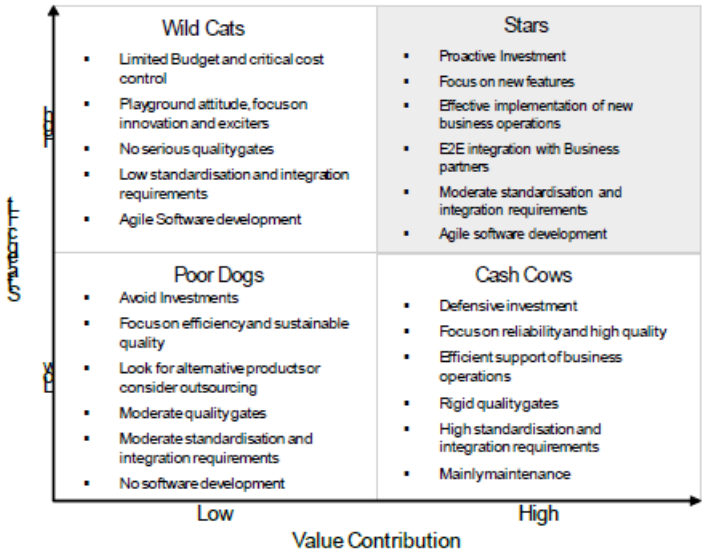
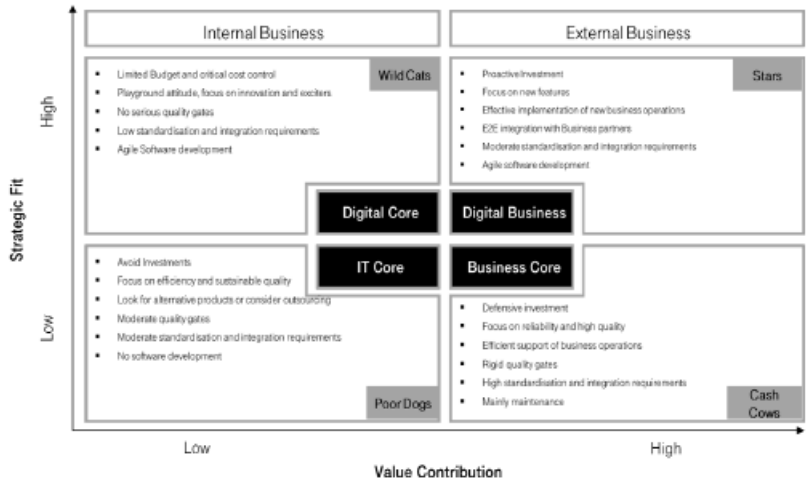


Figure 10 - BIDC Model – Strategic Fit and Value Contribution



3.9.1 Questions:

Classification of IT Systems (Scale 1=low 10=High)	
1	The model by (Bente et al., 2012) as indicated in Figure 9 shows mapping of enterprise IT systems to strategic fit and value contribution. What is your view on the mapping of the quadrants of the BIDC model to strategic fit and value contribution as indicated in Figure 10?
2	Based on your experience, have you classified IT systems and investments based on Organisational strategic fit or value contribution or have you used a different approach to determine focus areas for IT?
3	Do you believe that classifying IT Systems according to Strategic FIT and Value contribution would help in speeding up investment decisions for enterprise IT systems?
4	In a disruptive technology environment - do you believe the above classification can be useful to CIO's or IT specialists?
5	Are the any other frameworks that you have used to help with Strategic IT decision making that should be considered in this research?

THANK YOU – THE END!

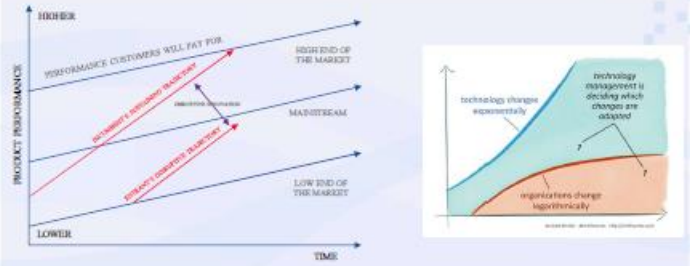
APPENDIX B – FRAMEWORK VERIFICATION PRESENTATION

Background

- Internet disruption resulted in exponential increase in new technologies
- Consumerisation is driving technology changes within Organisations
- Disruptive technologies are changing the rules of competition
- Increasing spend in Shadow IT within organisations
- Organisations drive to become "Bimodal" and "Digital"
- Technology is an enabler for Business Model Innovation
- Which technology should be selected and when?
- CIO role changing from an Integrator to an orchestrator
- Traditional Technology Adoption Life-cycles may need to change
- What drives CIO's decisions in agile business conditions?

3

Background – Disruptive Technologies & Decision Challenge

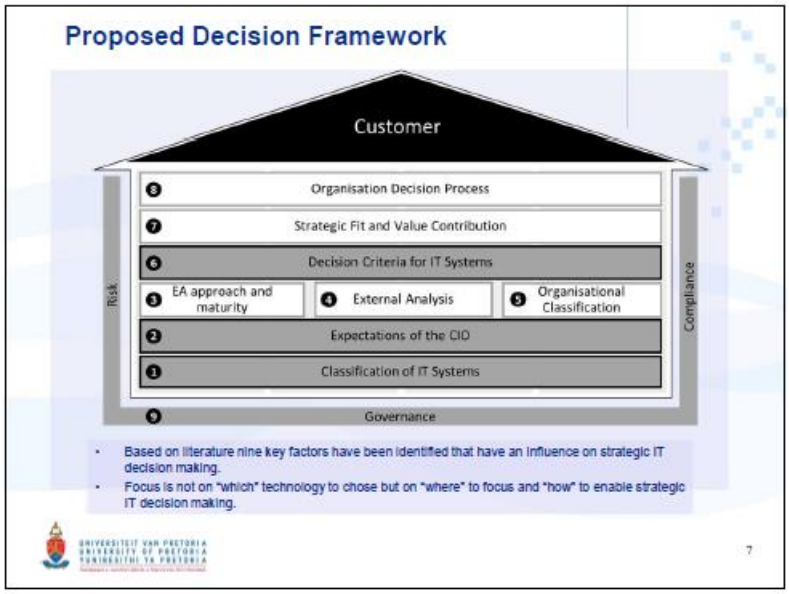


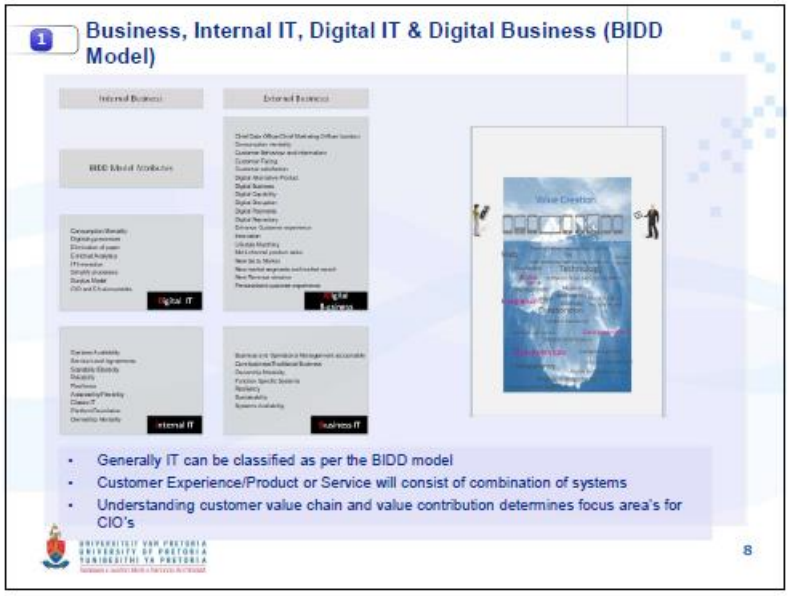
"Disruptive Innovation is a Strategy, not just the Technology" Clayton Christensen

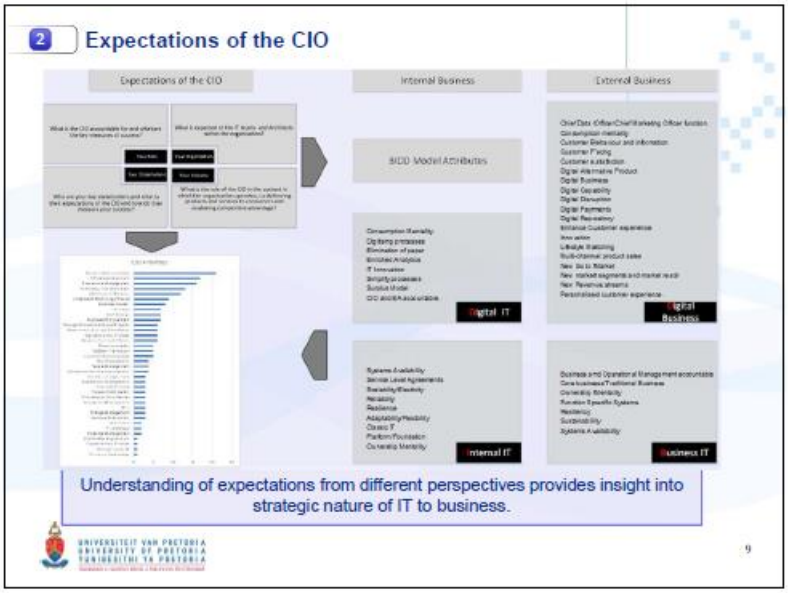
4


Purpose of this Research
• Understand expectations of IT in agile business conditions
• Understand factors that influence strategic IT decision making in the context of disruptive technologies
• Identify common decision characteristics across individuals, organizations and industries in agile business conditions
• Propose a decision framework for CIO's and IT specialists to optimize strategic IT decision making.
5


Research Approach
• Literature Review to understand what drives strategic technology related decisions in organizations
• Experiential learning – engaging with CIO's across industries.
• Review of IT Analyst reports (Gartner, F&S, Ovum etc.)
• Design Science approach – Problem Identification, Solution Objectives, Design and Development, Demonstration, Evaluation and Communication.
6


Proposed Decision Framework
Customer
8 Organisation Decision Process
7 Strategic Fit and Value Contribution
6 Decision Criteria for IT Systems
3 EA approach and maturity
4 External Analysis
5 Organisational Classification
2 Expectations of the CIO
1 Classification of IT Systems
9 Governance
Risk
Compliance
• Based on literature nine key factors have been identified that have an influence on strategic IT decision making.
• Focus is not on "which" technology to chose but on "where" to focus and "how" to enable strategic IT decision making.
7


1 Business, Internal IT, Digital IT & Digital Business (BIDD Model)
• Generally IT can be classified as per the BIDD model
• Customer Experience/Product or Service will consist of combination of systems
• Understanding customer value chain and value contribution determines focus area's for CIO's
8


2
Expectations of the CIO
Expectations of the CIO
Internal Business
External Business
BIDD Model Activities
Digital IT
Digital Business
Internal IT
Business IT
Understanding of expectations from different perspectives provides insight into strategic nature of IT to business.
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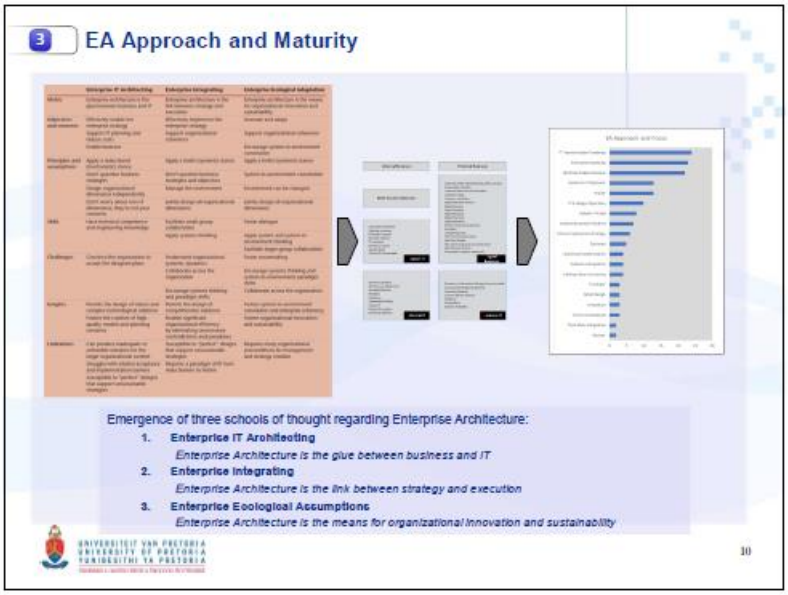
3
EA Approach and Maturity
Emergence of three schools of thought regarding Enterprise Architecture:
1. Enterprise IT Architecting
Enterprise Architecture is the glue between business and IT
2. Enterprise Integrating
Enterprise Architecture is the link between strategy and execution
3. Enterprise Ecological Assumptions
Enterprise Architecture is the means for organizational innovation and sustainability
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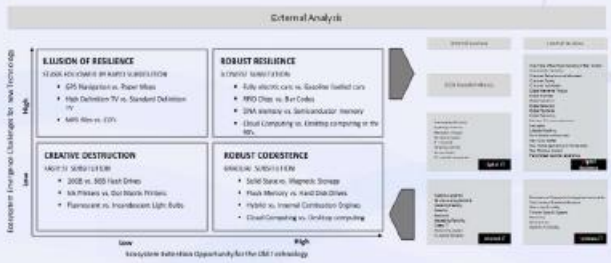
10

4 EXTERNAL ANALYSIS – PACE OF TECHNOLOGY SUBSTITION



CIO's should spend time on evaluating technology specifications, timing and eco-systems before making decisions to invest.

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11

5 Characteristics of Organization Design

- Relevant to global business, multiple companies/operating units, etc.
- Building strong IT core or platforms help companies become more agile in times of disruption.

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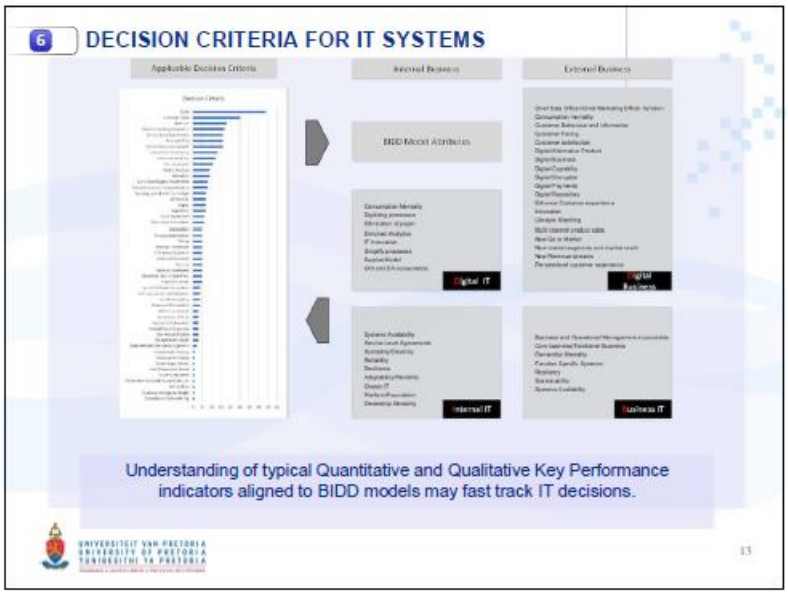
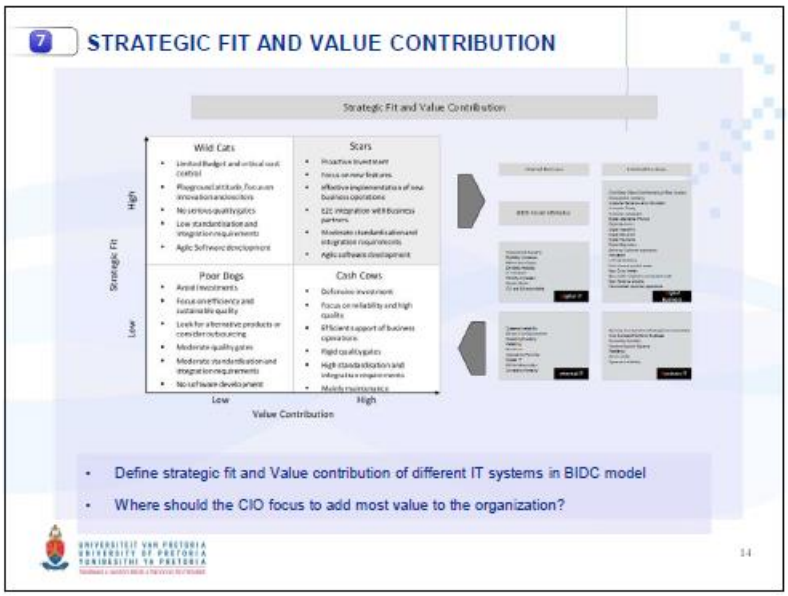
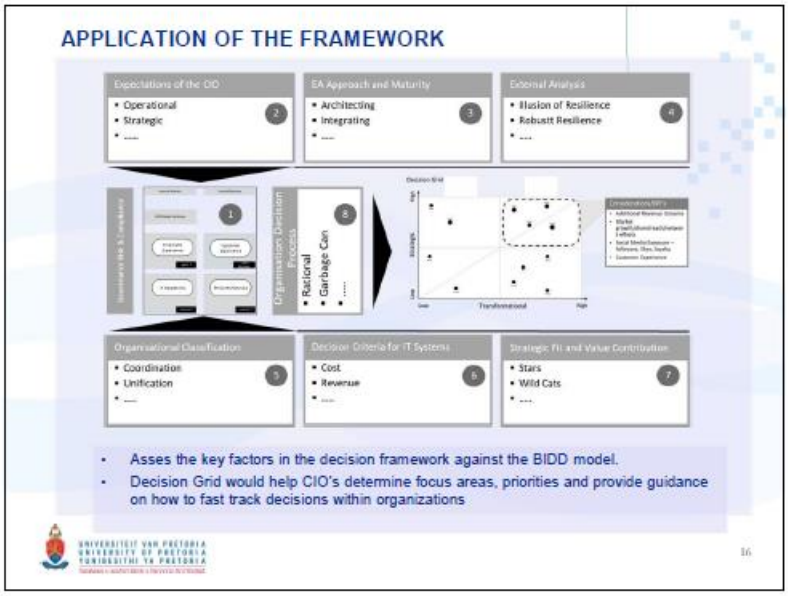
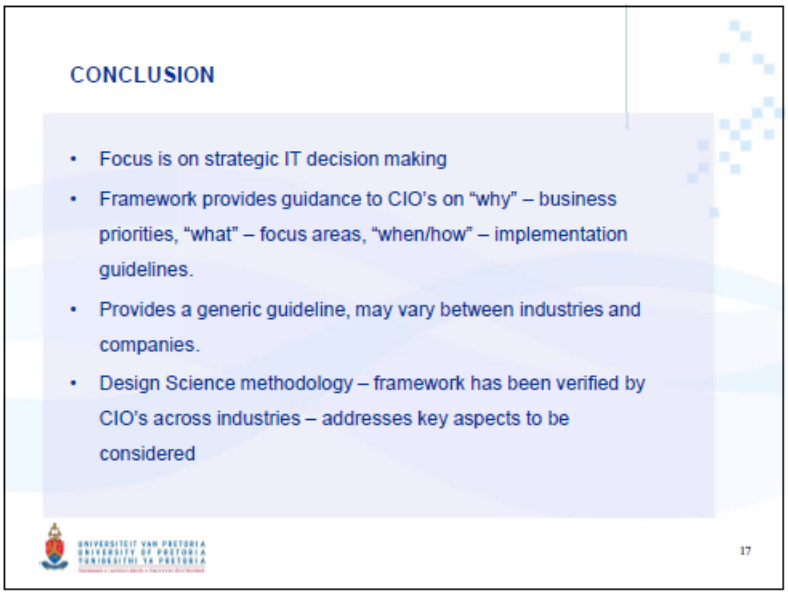
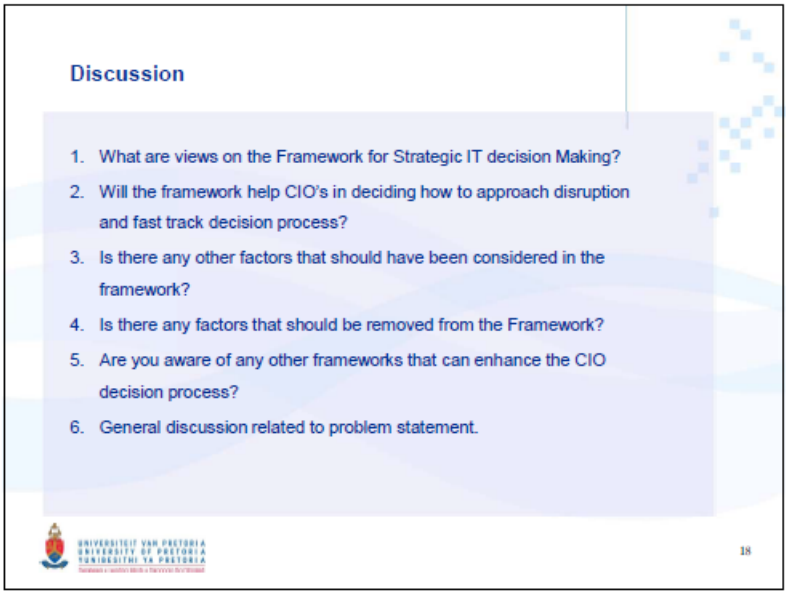

6
DECISION CRITERIA FOR IT SYSTEMS
Applicable Decision Criteria
Internal Business
External Business
BIDD Model Attributes
Digital IT
Digital Business
Internal IT
Business IT
Understanding of typical Quantitative and Qualitative Key Performance indicators aligned to BIDD models may fast track IT decisions.
13


7
STRATEGIC FIT AND VALUE CONTRIBUTION
Strategic Fit and Value Contribution
Wild Cats
Stars
Poor Dogs
Cash Cows
Strategic Fit
High
Low
Low
High
Value Contribution
Define strategic fit and Value contribution of different IT systems in BIDC model
Where should the CIO focus to add most value to the organization?
14

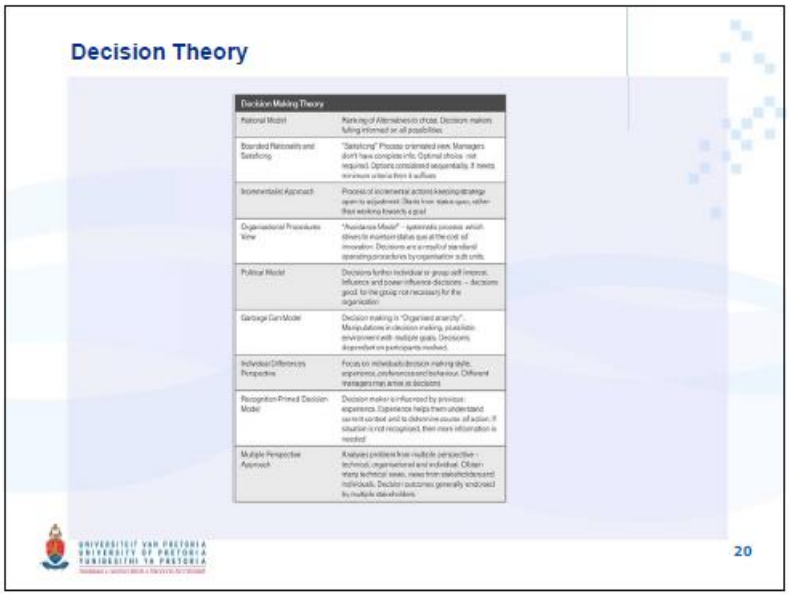

8
Organizational Decision Process
Revised Organisation Decision Approach
Technical & Process Approach
People Approach
Process Approach
Agile Decision Making Approaches
Rational Model
Political Model
Multiple Perspective
Organizational Procedures View
Incrementalist Approach
Bounded Rationality and Satisficing
Garbage Can
Understand current approach to decision making in an organization.
Determine ideal approach to decision making in disruptive conditions
Tailor business cases accordingly to optimize decision processes.
15


APPLICATION OF THE FRAMEWORK
Expectations of the CIO
Operational
Strategic
EA Approach and Maturity
Architecting
Integrating
External Analysis
Illusion of Resilience
Robust Resilience
Organisational Decision Process
Rational
Garbage Can
Organisational Classification
Coordination
Unification
Decision Criteria for IT Systems
Cost
Revenue
Strategic Fit and Value Contribution
Stars
Wild Cats
Asses the key factors in the decision framework against the BIDD model.
Decision Grid would help CIO's determine focus areas, priorities and provide guidance on how to fast track decisions within organizations
16

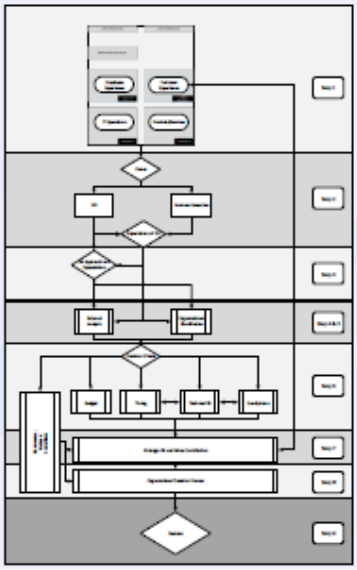

CONCLUSION
• Focus is on strategic IT decision making
• Framework provides guidance to CIO's on "why" – business priorities, "what" – focus areas, "when/how" – implementation guidelines.
• Provides a generic guideline, may vary between industries and companies.
• Design Science methodology – framework has been verified by CIO's across industries – addresses key aspects to be considered
17


Discussion
1. What are views on the Framework for Strategic IT decision Making?
2. Will the framework help CIO's in deciding how to approach disruption and fast track decision process?
3. Is there any other factors that should have been considered in the framework?
4. Is there any factors that should be removed from the Framework?
5. Are you aware of any other frameworks that can enhance the CIO decision process?
6. General discussion related to problem statement.
18


Back-Up
19


Decision Theory
Decision Making Theory
Rational Model
Bounded Rationality and Satisficing
Incremental(ist) Approach
Organizational Procedures View
Political Model
Garbage Can Model
Individual Differences Perspective
Recognition-Primed Decision Model
Multiple Perspective Approach
20

APPLICATION OF THE FRAMEWORK



APPENDIX C – AFRICON SUBMISSION

IEEE Africon 2017 Proceedings

Disruptive Technologies and IT decision making in an agile business environment

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Abstract **- The Internet disruption has resulted in an exponential increase in the growth of new technologies [1] and resultant technology disruptions within the workplace [2]. With the rapid changes in the technology landscape, Chief Information Officers (CIO's) and key decision makers need to learn to maneuver though the plethora of emerging technologies that can result in business model innovation [3] and give companies the ability to compete in a digital world. Disruptive technologies are changing the rules of competition [4], however the rate of change in technology in the traditional enterprise space has been slow. Most CIO's agree that there could be significant value in utilizing new technologies in creating competitive advantage in an agile world [5, 6], however in practice the adoption and implementation of newer technology is relatively slow. Various interpretive studies on IT decision making focused predominately on user acceptance of technology in a stable technology and business context [7]; however, this paper investigates critical success factors which guides technology decision making in an agile business environment. The focus of this paper is to provide a preliminary framework for CIO's to help them decide on technology strategies to support business transformation that will enable their organizations to compete in a disruptive technology environment.**

Keywords: Disruptive Technologies, Enterprise Architecture, Technology Life Cycle, Business Value creation, Decision Making, Adoption of Technology, Consumer technology, Digital Business

I. Introduction

The objective of this study is to understand changes in the IT landscape from a disruptive technology perspective and formulate a framework for IT decision making in an agile business environment. CIO's are recruited into organizations and are expected to play a strategic role, however in many instances they end up very frustrated, spending most of their time addressing operational issues [3]. Every organization is unique with different strategies, core competencies and value proposition to the market and their customers. CIO's with different experience, cultures, qualifications, skills, abilities etc. are expected to step into a strategic role and make decisions about IT and IT strategy that could have a significant impact on the future sustainability of a business in a hyper competitive environment [8]. Disruptive technologies, consumerization, cloud, IoT, Big Data and various other technologies and service provisioning models all make the decision-making process of a CIO more challenging. Culture, Priority, Legacy and Resourcing are the greatest barriers facing CIO's in their drive to become digital organizations [9].

While various studies exist on selection, implementation and acceptance of specific technologies, there seems to be a lack of research guiding IT decision making in fast changing disruptive market conditions [10]. Continuous evolution or the emergence of new technologies requires CIO's to make fast decisions on technology strategy and ensure quick implementation to realize business value.

The objective of this paper is to work towards understanding strategic factors that impact decision making within organizations. In a disruptive business environment, CIO's need to react quickly to changes in business strategy or changes in technology, this is only possible if decision processes are optimized within organizations.

The proposed framework helps CIO's to assess strategic characteristics of an organization that influence IT decisions. The framework also provides guidance on how to identify organizational IT priorities, address stakeholder expectations and enable quick decisions to shorten the time between planning and execution of IT initiatives.

II. Background

The objective of any IT decision is to support business strategy by enabling the organization to become cheaper, better or faster [11]. Although this is rather simplistic, it provides a valuable guideline for decision making [12].The role of the CIO is changing from an Integrator to an Orchestrator [3]. From a paradigm of managing all the pieces of IT supporting business processes to orchestrating different pieces of solutions from both internal and external to an organization to make business processes work. In the CIO's role as an orchestrator, they need to learn how to deliver services in a cloud, consumer and consumption based computing world.

One of the key success factors in surviving in the new paradigm is to have a very disciplined architecture and belief system [3]. A belief system refers to general rules and guidelines for decision making in an organization e.g. no capex expenditure. IT Governance results in creating a very

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disciplined environment where organization beliefs or rules are implemented [13].

The challenge for many CIO's is that they have limited time and need to prioritize where they need to focus to get the most value for their organization. While most CIO's are expected to spend more time on enabling business strategy or business model innovation, the reality is that most CIO's spend most of their time on operational issues [3].

Traditional technology adoption lifecycles are no longer relevant for companies operating in a hyper competitive environment [10]. Previously pioneers were the first to adopt emerging technologies into their business while mainstream business waited and observed before taking the plunge. With the current pace of technology change, failure to react to changing technology landscape could result in business disruption with disastrous consequences for businesses [4].

Disruptive and emerging technologies have the potential to lower the barriers of entry into an industry and cause the blurring of boundaries between industries. Digital technologies enable agile fast paced competitors to compete with traditional industry players [5]. Consumer driven technologies such as mobile, social and cloud increases customer's service delivery expectations which forces organizations to adopt Digital business strategies. Companies that do not adapt to changing market conditions could find themselves going down the path of Kodak, Nokia, Blackberry, Blockbuster and many other organizations that obstinately focused on their source of competitive advantage which made them successful, however their inability to timeously adapt to new technology trends caused their downfall [4].

Expectations of CIO's are changing and they are now expected to focus more on business enablement and add business value as opposed to being IT specialists focused on operational issues [5]. Technology forms part of the core of any business as it attracts a significant financial investment with business executives expecting increased revenue, greater customer satisfaction or increasing competitiveness because of IT investments. Technology also permeates every aspect of business which implies that IT is no longer at the periphery - it dictates how business is done. CIO's are now faced with a challenge of motivating "why" they need to invest in IT, decide on "what" they need to invest in, make a strategic bet on "when" is the right time to invest and to decide "how" they will execute the project [14]. The decision-making complexity [15] has increased exponentially over the past few years, the wrong decision could result in the failure of an organization.

The challenge for most CIO's is that there is so much technology available which can create distractions that significantly slows down the decision process. CIO's need to learn to prioritize which technology and which business problem to address in a rapidly changing technology environment [2]. In many cases making no decision is the safest resulting in business sticking to traditional ways of doing business. However, not making decisions increases the risk to any enterprise by new entrants who are not handicapped by legacy IT systems. For most organizations, the stakes are now much higher - in the past significant investments were made in implementing large scale core IT systems, ERP, mainframes, email etc. which improved the robustness and predictability of organizations. At present the value derived from IT systems resides at the periphery, at the point of customer demand. IT investments are under more intense scrutiny as it impacts the agility of organizations and could have a direct impact on customer satisfaction and loyalty which could have a significant impact on future sustainability of organizations [11].

CIO's and business executives have now come to the realization that the next source of competitive advantage and growth will come from emerging and disruptive technologies. The implication is that CIO's become paranoid when deciding on the myriad of available emerging technologies that in many cases don't decide at all. As per Gartner, more than 40% of IT spend happens outside the control of IT - this is driven by the consumerization of IT trend. Business executives are now more IT literate than ever and in many cases, would not hesitate to procure services via readily available cloud providers or bring consumer technology into a business environment without considering internal IT risk and governance processes. The result of this is that CIO's in many organizations end up playing catch up trying bring compliance and governance back into an enterprise. Newer technologies that evolve from a consumerization perspective will need to be secured by internal IT departments to reduce significant risk to businesses.

III. Proposed Decision Framework

A subjectivist ontological perspective [16] and a Design Science epistemological approach was chosen for this study aligned to the six-step model proposed by Peffers, et al., [17] which consists of the following steps; Problem identification and motivation, Solution Objectives; Design and Development; Demonstration; Evaluation and Communication. This research explores pragmatic problems influencing IT decision making and conceptualizes a decision framework that could be used in addressing challenges faced by IT practitioners.

The decision framework proposed in Fig. 1 is based on a preliminary study of existing literature and experiential knowledge on disruptive technologies, disruptive organizations, IT decision making and enterprise architecture. The framework explores various characteristics of individuals, organizations and its ecosystem that may influence IT decision making and the timing of these decisions. In a highly disruptive environment, it is essential that IT decisions are not taken in isolation based on features and functionality and that contextual and external factors are considered.

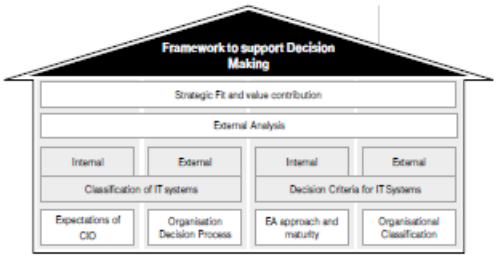

Figure 1 –Proposed Decision Framework

Each of the core building blocks of the decision framework is described in greater detail to provide a comprehensive overview of decision criteria and contextual factors that need to be considered in making decisions in a highly volatile environment. Even though solution and product technical functionality, specifications, integration etc. are important considerations, it is generally assumed that product quality is similar across technologies and vendors and they subscribe to prevailing dominant designs in the industry. Functional and technical specification rarely provide a source of competitive advantage when considered in isolation, in most cases adoption of newer technologies is highly dependent on product eco-systems [18], which implies that for CIO's to be successful they need to focus less on technical specification and focus more on business, contextual and external trends [5].

1) Expectations of the CIO

The proposed framework starts with a high-level analysis of the organization's expectations of the CIO in the context of the industry and enterprise. This analysis will provide insight into the fundamental reason "why" a CIO was employed in an organization and "what" they need to focus on to add value to business [14]. IT is a strategic asset and a source of competitive advantage to most organizations, CIO's are expected to perform a more strategic role rather than just maintain IT. The intent of this analysis is to understand the expectations of the CIO in the context of role, organization, stakeholders and industry [3].

In a disruptive environment, most CIO's are confronted with similar challenges across industries. There are numerous examples of organizations that have been disrupted by technologies or competition from unrelated industries, therefore it is imperative that CIO's in their role first adopt a macro overview of technology trends before making the final technology selection decision for their organization.

The new dimension of IT value contribution is moving to business model innovation. Business Model innovation implies a complete review of skills and capabilities of IT resources to deliver on the new paradigm. As per the CIO of Boeing " People believe IT is about technology, but it is a behavioral science - understanding the behaviors of your company's staff, leaders, and customers - and facilitating the adoption of a new vision." If CIO's change their mind-set from technology innovation to business model innovation, their focus would move away from project delivery, business change management and process reengineering. In the paradigm of business model innovation, CIO's need to understand how the introduction of new technology can drive or support new business models and revenue streams. CIO mind-set must move from how to secure, govern, standardize and introduce new technologies such as iPhones, iPads, IOT etc. to finding ways on how these technologies can change business models and to drive technology acceptance amongst business execs and users.

2) Decision Making Theory

This aspect analyses the default decision process followed within an organization for IT related decisions. Different theoretical models for senior management decision making in organizations were investigated and research found significant variation in decision-making styles, however common themes were found, such as intuition, sensitivity to context and presentation of information [19].

Failure to understand the dominant decision style in an organization, can result in the best technology roadmaps and implementation plans failing from the start due to organizational bureaucracy and failure to obtain timely approval on key initiatives [10].

Organization culture influences which decision theory will be the most commonly used in an organization. Research across multiple industries [19] have identified nine theories with distinctive characteristics that determine how decisions are made in organizations. In many organizations, CIO's can influence technology decisions, however need final approval from Executive committees, business stakeholders and governance boards, depending on the value of technology investments or delegation of authority [13]. In cases where CIO's don't have authority to make final decisions, it is imperative that they understand how decisions are made in their organization and which model the organization subscribes to [15]. Neglecting to understand the organization approach to decision making or the company culture could result in extended delays and frustration for CIO's who are expected to add strategic value to business in a disruptive technology environment. Extended decision making could render technology becoming obsolete or considered legacy by the time new technology is implemented and adopted by users in an organization. Decision speed is critical in high velocity environments [20].

3) Enterprise Architecture (EA) Schools of Thought

Enterprise Architecture is generally a function within most organizations whose primary objective is to create a technology strategy aligned to business [21]. This function generally falls under the leadership of CIO's and is expected to provide a description of interrelated components to guide their evolution as newer technologies and business strategies are introduced [19] .

Three distinct schools of thought have started to emerge which organizations tend to gravitate to. Understanding the prevailing school of thought within an organization will assist CIO's in understanding current mind-set within organizations and help CIO's develop transformation plans to optimize decision processes in a disruptive environment. A brief description of the three schools of thought are as follows [22]:

Enterprise IT Architecting: This approach aligns to traditional EA approaches such as Zachman, TOGAF, FEA etc. This school of thought does not question business strategies and focus on the creation of robust and complex technical solutions.

Enterprise Integrating: This approach views EA as the link between business strategy and execution.

Enterprise Ecological Adaptation: This is a strategic approach to Enterprise Architecture and influences organizational innovation and sustainability.

CIO's who are expected to perform a more strategic role in an organization will gravitate towards an Enterprise Ecological

Adaption approach to EA as this focuses on the organization in the context of the external environment.

4) Characteristics of Organization Design

The purpose of this section is to understand the organizational design, governance and synergies across business units. Organizations that need to focus efforts on a higher level than current EA approaches, i.e. at an enterprise level – should understand the enterprise logic for its core processes with the related IT architecture reflecting standardization and integration of its operating model [23]. The findings in this study shows that a stable foundation makes companies more efficient and agile than competitors. Companies decide what makes them great and then create a high quality, low cost core which provides consistency in a turbulent environment. Successful companies first define their operating model and then define processes and infrastructure that would be critical to support their current and future business strategy. Successful companies have made IT an asset and not a liability. Customers that have digitized their core processes have higher profitability and faster times to market. Many companies studied are spending time on smaller projects that don't support enterprise wide objectives, focused on cutting IT costs without figuring out how to increase value [23].

The four operating models described require a fundamentally different approach to IT strategy, implementation and decision making in any organization. Understanding the characteristics of an organization's operating model provides guidelines on the appropriate technology strategy to deploy within an organization [11].

5) Classification of IT Systems

The purpose of this analysis is to understand the role of various IT systems deployed in an organization and its role in value creation for different stakeholders. There is a misconception amongst many CIO's who believe that their role is to ensure the alignment of IT and business [3]. IT and business have merged resulting in no clear distinction between IT and business. Technology has become the cornerstone of business and failure to embrace technology in the core of a business could result in business disruption or obsolescence. Classic or traditional business models must be critically reviewed to avoid disruption from competition emanating from unrelated industries enabled by disruptive technologies. As IT permeates the core of most businesses, CIO's and Company executives should try to find ways of using technology to digitize products and services, to leverage online channels and achieve global reach.

In the traditional CIO paradigm, CIO's were employed to cater for the IT needs of the internal organization. With convergence, there is a dilution of accountability and blurring of the lines between CIO's and business unit executives that can sometimes lead to confusion on who makes the decision on common technologies. In most instances, separate infrastructure and systems are not required to service the needs of the internal organization and for the provision of services to customers.

The model proposed in this research as indicated in Fig. 2, can be used to identify IT systems under the control of the CIO and business executives and categorize all IT systems within the context of an integrated business model. The model also differentiates foundational or core IT systems and IT systems that are predominantly deployed to enable digital business models in a disruptive environment. The BIDC (Business, IT, Digital, Core) model will form the core of the CIO decision framework which will enable CIO's to determine priority focus areas in agile business conditions.

The model categorizes all IT systems used in an organization into four distinct categories, each of these would have different decision criteria and in many cases, follow a different approval process. In many organizations CEO's do not differentiate between business and Internal IT and assume CIO's are accountable for everything IT related [3]. This can result in CIO's perceived as not adding value to business or not using IT to create sustainable competitive advantage for a business. Business Unit executives who are accountable for business IT systems, sometimes continue to maintain the status quo and focus on cost reduction can often miss digitizing opportunities to transform business models by leveraging disruptive technologies.

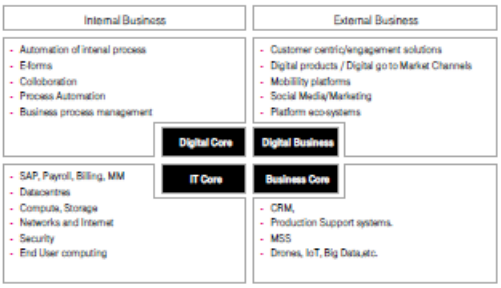

Figure 2 – BIDC Model – Classification of IT systems

6) Decision Criteria for IT Systems

The purpose of this section is to understand the requirements or perception of value from the perspective of the different stakeholders within an organization. After the classification of different IT systems into the four quadrants defined in the BIDC model, it is essential to understand if different decision criteria are used in selecting technologies in the different quadrants[24].

Certain financial KPI's would be common in each of the quadrants, however it would be essential to understand the ranking of KPI's in terms of importance of the different criteria used [25]. Fig. 3 gives a view of typical decision criteria that may be considered in each of the quadrants in the BIDC model however the list will be expanded during the next phase of this study.

CIO's will need an understanding of the categorization of IT systems deployed within an organization and the key decision criteria that will be considered in any investment decision. This enables CIO's to understand the different value proposition of technologies in the different quadrants and position business cases accordingly to fast track IT decision making within an organization.

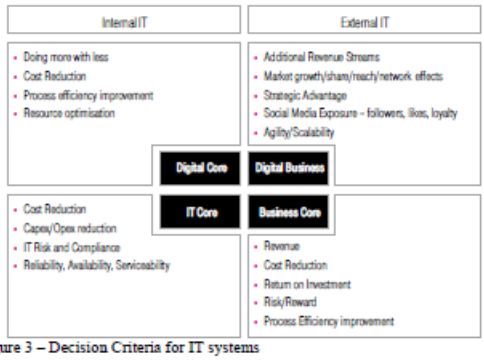

Figure 3 – Decision Criteria for IT systems

7) External Analysis

Technology disruption generally originates external to an organization and the purpose of this section is to proactively identify and formulate a response to external technology trends. Over the past 20 years there have been numerous technology shifts in the industry that have significantly disrupted businesses. The challenge for most businesses is the timeous identification of these shifts and understanding what dangers they may pose to incumbent organizations [18]. The biggest challenge facing most businesses is timing. There have been organizations that have adopted disruptive technologies and changed the industry overnight, e.g. Uber, Airbnb, twitter etc., however some disruptive technologies such as cloud, HD TV's, MP3's, have taken decades to unfold.

For CIO's, the identification of disruptive technologies and trends may be relatively easy, however determining when the technology transition will impact industries remains unknown. The foremost fear [18] of most organizations is being ready too late and missing the technology shift. Examples of organizations that have been disrupted by being ready too late are Blockbuster and Blackberry who failed to recognize the technology shift to video streaming and touchscreen technologies in their industries. The second fear is getting ready too early and depleting resources before the technology shift occurs. There are numerous examples from the dot-com crash in 2001, where organizations crashed because they migrated to the internet and online business models too early, however there were many organizations that later surfaced leveraging the same technologies renamed Web 2.0 revolution.

To understand disruptive technology shifts in the industry, there are two distinct considerations for CIO's and businesses, i.e. the technology itself and the broader eco-system that supports it [18]. The second consideration is the competition between old and new eco-systems that may exist which impacts the rate of adoption of new technologies. The maturity and strength of the components of the eco-systems play a significant role in the adoption of disruptive technologies.

Most CIO's and enterprise architects currently spend most of their time analyzing newer technology without consideration of timing, the impact of eco-systems and impact on business models. Failure to get the timing of decisions right could have negative financial implications for the organization and its sustainability in a disruptive technology environment.

8) Strategic Fit and Value Contribution

The purpose of this section is to understand how IT systems in an organization creates value for customers and is an assessment of technology in the context of the business strategy [11]. In current disruptive environments, IT can play a critical role in influencing business strategy, however investment decisions must also align to prevailing business objectives. Financial accounting standards and methodologies is a mature discipline which has not evolved to cater for investments in disruptive market conditions. Traditional return on investment models may not be applicable in technology driven industries as it may be difficult to accurately predict future revenue streams.

The challenge however is that if traditional accounting principles cannot be used as a measure of future success for future technology investments, CIO's will need to find other ways of justifying business value. The impact of technology investments on non-financial KPI's becomes increasingly important in a disruptive environment. However, this becomes a challenge due to the number of stakeholders involved and difficulty in quantifying qualitative value that may be derived from using pervasive IT systems.

IT is generally viewed through different frames depending on the stakeholder and his or her interest in IT. Enterprise Architects role therefore is to ensure that they provide a holistic view of a system from the different perspectives depending on stakeholder group. EA role is also to map relationships between enterprise strategic goals, IT investments, products and services and key performance indicators.

Technology in an enterprise should be classified into different categories reflecting strategic fit and value contribution and should be treated differently from an enterprise decision making perspective [11]. CIO's need to understand the classification of systems within an organization as spending too much time and investments on low strategic value topics could be disastrous for the CIO and the organization in agile market conditions.

IV. Conclusion High Level Application of the BIDC Framework

The objective of the CIO decision framework is to provide an overview of key elements to be considered when strategic technology decisions are required to transform organizations in disruptive market conditions. The framework does not provide an absolute answer on which technology to choose, however can be used to help structure arguments, thoughts and stimulate thinking on aspects to be considered for quicker decisions to be made within organizations [26]. In fast paced technology environments, organizations can succeed or fail if the timing of the technology decision is incorrect. In many cases, too much time may be spent on choosing the right or the most superior technology which may be considered obsolete once the technology is eventually deployed and used in organizations due to extended decision and implementation cycles within organizations [3] [20].

The Decision framework proposed analyses the six key dimensions against the quadrants in the BIDC framework to determine current against intended organization approach to decision making. Depending on the maturity of the organization and the industry in which the organization resides, it may not be necessary to assess all six building blocks in the decision framework, however it is highly recommended to establish a baseline of the current organizational belief system regarding rules, guidelines for decision making, governance, approach to EA etc.

The results of the BIDC assessment will be transposed onto a decision grid which will highlight the dominant approach to decision making within organizations.

Although CIO's are expected to simultaneously focus on operational, transformational and strategic initiatives, they need to continuously assess which area consumes most of their time. Once the dominant characteristics of the organization is determined, CIO's can use this information as a guideline to priorities key initiatives that could help transform the organization to the desired state in support of current business strategies.

The results of the analysis will also provide a high-level overview of key KPI's and decision considerations in each quadrant of the decision grid in the BIDC framework. The role of the CIO in disruptive environments is not about finding the best technology, but about harnessing technology to create platforms and eco-systems which enables business to remain competitive in a technology driven world.

Once a high-level analysis of contextual and environmental factors is obtained from the framework, it is recommended that CIO's have conversations on where they are as an organization and what are the technology implications, resource allocations and strategic choices available to their organization [18]. Responses to questions and determination of where one resides in the different quadrants of the proposed framework is a matter of judgement and would differ between organizations and individuals however these can be useful to stimulate executive level conversations that could result in more informed decision making.

The next step in this research entails a thorough literature study to refine the framework followed by structured interviews with key decision makers in organizations to test the applicability and relevance of this model in disruptive market conditions. The research will compare current decision making processes employed in organizations against the proposed decision framework. The outcome of the primary research will improve the value of the BIDC framework in becoming a valuable guideline for CIO's to guide decision making in a disruptive technology environment.

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APPENDIX D – DECISION CHALLENGES PEOPLE

The CIO wants to control everything, they want to have the control, she wants to have the control and she calls us naughty and then it's not letting the business grow.
If you not an engineer and you not focusing on manufacturing, so you in the surrounding areas, you are selling or the IT department. Supporting business from the one end to the other, they can get rid of you at any point in time, you seen as you know, you seen as an expense.
So, you must identify who are the stakeholders and how do you deal with them on an individual basis
I call it lobbying, right, I feel like a politician, it's lobbying, you have to win them over
Then vendors get upset about it and they might go an influence the Board, and then often they are added because, that was just a gap, or fairness, you know, then instruction comes from the top. Then they go through the process with everyone else.
You do that kind of decision; people find fault from day 1 with whatever you are trying to do – simply because they didn't agree with that, and that is the price of politics. So, you will never have a satisfied customer until you – unless you can really wow them, and that is not so simple if you talk about traditional IT and transactional systems
The thing is as well, you have your traditional IT right. The guy's been doing it for the past ten, fifteen years that way. You need to now, you want them to change. The first thing you need to show them, is what is the benefit to them?
The other extreme in this problem, you go and you push these things in front of the business, down the business's throat. They look at it and first of all they're reluctant to use it. When they do eventually, after lot of evangelism and all of that, decide to use this here, it's very short lived. Prematurely retired, no ROI
I remember when I proposed our SAP and renewal of all our IT, because we were still running main frames and so forth – The first guy that shot it down in public when we made the decision was one of our production guys. He just said well you can go and sink an incline shaft with that amount of money, so why would you bother to buy a SAP vehicle?
For those kind of decisions, we had a steering committee comprising of strategic directors, financial directors, you know, and IT steerco. That was really the body that made decisions around any IT systems. But the business, the production guys, engineering guys, they weren't really involved in those forums, they didn't want to attend those kinds of things. To them the IT is just a, a cost centre, you know.
The other thing is we are also moving towards consolidation of applications which is very key and that hasn't been done before. If you look at our landscape of applications, there's many that we have. Over time, it is who felt they wanted something and who shouted the loudest that got what they wanted. You end up with an estate that is quite expansive. Remember the more applications you have, the more support structures you need.

APPENDIX E – DECISION CHALLENGES PROCESS

I must be honest with you. It's, it's a very, very difficult process right, especially when you have multiple stakeholders from multiple business units.
Our decision process is partially defined, it's not clearly defined as I'd like to see it. So, there's a lot of room for improvement
But don't get me wrong, the problem is not that IT can't change. The problem is not that the CIO doesn't know how to be disruptive. We are, we have been restricted by the red tape here.
Your procurement has got to be streamlined and you are saying, listen these are the partners I have identified, and I want to do business with, to help me through this transformation. Once you contracted you go.
Your budget committees and all the other stuff, the entire ecosystems got to work like that, NO matter how much you try to turn this thing around but if you have to go through these processes, you fail.
There's always frustration in approval processes, because you have to struggle to get by. You have to show value for money.
From a procurement side, as much as you put partners in place, strategic partners that you say you want to partner with to get things done, and you don't go through the whole contractual process, it still means your procurement process is long. It is a short RFI, RFP rather than a long one. It goes along that.
Like I say, as much as we will try agile in IT you should agile the ecosystem supporting you. If you look at it in terms of agile for us is, it is about speed of delivery as oppose to delivering to the outer world.
In one of the state-owned organisations, once a decision is made, you execute the project irrespective of any changes in technology because it takes so long to get a decision. Then even though you may finish it, and the technology implemented is now obsolete
Regarding IT Decisions, it would be easiest for me to be honest with you, the easiest way for me to get, to get EXCO to approve something is if I link it back to, to legislation.

APPENDIX F – DECISION CHALLENGES TECHNOLOGY

A lot of this is about emotions and politics, but, there's little about technology nowadays
Reaction to disruptive technologies depends on whether a board or a group executive is biased towards action; or whether it is a simple case of – not understanding or just simply being arrogant in thinking that the position is secure. You may have those decisions deferred indefinitely.
It's somewhat difficult due to the fact that IT often second guesses business requirements without fully understanding
The more and more technology you have, the more complex the decision-making is. And it is trying to figure out okay how do you now make a call? Because the easiest and safest way is not to make any decision. Then you are in your comfort zone.
But by the way I do think, if you talk from a decision-making perspective, architecture was never really a key determinant, key factor for us.
When it comes to these operational things you get decisions, but when it comes to the standard IT stuff, really, you don't get decisions, but it is all about you having to try and improve cost and the guys, they see IT as a cost centre in that area.
So, we, we're trying to maintain the reputational, the reputation of the organisation at the cost of what? We're suppressing innovation, we're suppressing digitalisation. We're not, we're not being disruptive. We say we are disruptive, but we're not disruptive.
Then there is somebody that is so engrossed with a certain technology that they try and motivate it and why you need to invest in it. Then you got your vendors. They put pressure on you. So, that's what's happening, right, the vendors are now saying move into the Cloud. In the next 5 years, we're not going to be supporting on premise. You are getting that type of pressure that's going to hit you. You got to make those decisions and say okay, at the end how do I manage to hold these balls in the air?
You got all these forces that's hitting you. You got internal pressure, right. Some people read about technology in a magazine and they want it.
Managing disruptive technologies - It is going to have to be a different approach, it is going to have to be a change because you are going to have the entire ecosystem support you. Firstly, you would have start with your people. You need different thinkers. You can't take people that are in a waterfall approach and ask them to now become agile. It is a huge change management
If you look at your digitisation technologies, it is actually sitting in the business. Why? Because that is basically where they need to change it and this is where they have their money. All that happens in the back end is to make sure that you have a plan, to put it within the entire, the broader architecture

If something is so disruptive, it could be something that need to go to a AGM, you know. To get shareholder approval.
This is where I think the role of the CIO is so key to your point about how do guide this decision making. Because you are going to get this hype, everybody is IT literate. They'll (business) go out and have discussions, they go to dinners, briefing sessions, someone is going to turn around and say listen what do you know about Cloud? What are you doing about Cloud? At the end of the day now it is sitting at the back of their mind. Then they come back to the CIO and say, what are we doing about Cloud and when are we going to cloud?
At the end of the day it depends on the business and how the organisation wants to operate, does it make sense for me to put it in? If it makes sense to put it in, make sure you have done all the checks and balances because of organisational culture - it is very important.
Everybody will tell you how much value it adds. So, from a prioritisation perspective, it makes it very difficult. It makes it difficult unless you actually can pin it down and say look, you know what, tie it down to which KPI, which KPI is this going to contribute to and motivate it.
A lot of it would be rational, in terms of looking at alternatives; choosing the right technology; making sure all the information. It is a long-term decision. It is not something you do in an agile approach
From a procurement side, as much as you put partners in place, strategic partners that you say you want to partner with to get things done, and you don't go through the whole contractual process, it still means your procurement process is long. It is a short RFI, RFP rather than a long one. It goes along that.
The thing is as well, you have your traditional IT right. The guy's been doing it for the past ten, fifteen years that way. You need to now, you want them to change. The first thing you need to show them, is what is the benefit to them?
Maybe one can high risk a small piece of your business and take the risk, but the number we play with. with our clients and stuff like that, we just, we just can't be paying a high-risk game in that space.

APPENDIX F – POLITICAL MODEL QUOTATIONS

Often, in my opinion, if there is senior executive pressure on making it happen then it, it obviously gets the traction.
Your formal approach might be rational, but you might have some political players in there that will influence it.
I call it lobbying, right, I feel like a politician, it's lobbying, you have to win them over
A lot of this is about emotions and politics, but, there's little about technology nowadays
If it is done out of the C suite at the behest of the CEO, who would deem for example cloud to be a strategic play – then you might get that decision made literally before lunch.
So, a lot of it is so dependent on who are the people leading your organisation at the time.
The only way to get those kinds of decisions through, is to have some clout, which is exactly the way I did it in the mining side
Over time, it is who wanted something and who shouted the loudest that got what they wanted. You end up with an estate that is of quite expansive. Remember the more applications you have, the more support structures you need.
Everybody will tell you how much value their systems add. From a prioritisation perspective, it makes it very difficult. It makes it difficult unless you actually can pin it down and say look, you know what, tie it down to which KPI, which KPI is this going to contribute to and motivate it.
There is a lot of in fighting if you'd like – the Group CIO wants to control everything… there are two Organisational Units that want to do their own thing.
She actually called them naughty in the meeting, she used the word naughty. She wants to run them because the thing is she feels that at an ICT layer foundation, she should manage that.
I think she is not getting their buy in to centralise it at a group level. They want to control, this comes back to organisational classification in the operational divisional approach, where they empower the organisation, I mean they are a business on their own, they have got their own customers, Sasol's and stuff like that. They all independent, she can't run them in, she is holding them back.
The point that I'm trying to bring across is, that approach that you take in terms of getting your non-IT stakeholders to buy into the strategy, to buy into the initiatives that you're doing, is you have to add value.
So, you must identify who are the stakeholders and how do you deal with them on an individual basis

CEO always, he mentors me, so he tells me the first thing you need to do is stakeholder engagement and you need to lobby, so that's what I do. You need to get buy-in from, from all key stakeholders, otherwise it's just definitely not going to work
If you want your projects to succeed, a CIO must be able to effectively do stakeholder engagement
There absolutely are outside influences. So, I'll be frank with you after the visits the business recommended one party and the Group Technology said no, they don't support that one because that party didn't have a tier one bank implementation that they could refer to. So, there was rationale to the decision, but it wasn't quite balanced, you know, everybody wants in on it.
The other side of it where it does get influenced is the vendors. They start to influence the decision in process. So, they say if you take this we'll give you discount on this capability and those type of things.
I have seen decisions being completely influenced at a high level where they say, listen this is a strategic direction that we're going with this party, it's influenced by this strategic decision, this is why it's a good solution
The political one can come through. So, something like, again example, like an IBM, you know they can have heavy political sway over some of the decisions because of how deeply invested we are in them
Then they get upset about it and they might go an influence the Board, and then often they are added because, that was just a gap or fairness, you know, the instruction comes. Then they go through the process with everyone else.
When you do that kind of decision; people find fault from day 1 with whatever you are trying to do – simply because they didn't agree with that, and that is the price of politics. So, you will never have a satisfied customer until you can really wow them, and that is not so simple if you talk about additional IT and transactional systems.
The Group who had the final decision because they were Virgin's partner chose the 4-year solution. We later found out that the CIO who had made that decision had 4 years to go until retirement.

APPENDIX G – CIO QUOTES – DECISION MAKING IN DISRUPTIVE ENVIRONMENTS

The thing is if you say agile and you want to stay relevant - your **turn around time must be quick** then you need a **slimmer governance process**.
But hopefully our strategy, our technology strategy in order to implement, **allows it to be modular** and, you know, the ability that we're saying it should be an agile environment.
We have got a couple of things. We have got – To speed up the rational process we have got **discretionary allocations** and **thresholds for group executive members**
More **bigger delegation of authority**. So probably the CIO is going to be given a **pot of money** and told motivate for us upfront but then that is what you run with. It is within your power to make sure that you spend it properly to turn things around as oppose to go through other governance channels.
Your **procurement has to be streaming** and you are saying, listen these are the partners I have identified, and I want to do business with to help me through this transformation. Once you contracted you go
Your budget committees and all the governance processes - other stuff. The **entire ecosystems got to work in Agile** NO matter how much you try and try to turn this thing around but if you have to go through these processes, you fail. So, you can deal some of those disruptive trends without going through the formal process
In the beginning, we almost like **funnelled all ideas into a bucket** and we said, okay cool, lets quickly find out which are the quick ones and we did it literally through a **proof of concept**, we did 18 cases, we did a POC for each, it was a three months exercise and through it we realised which ones is going to have the **highest impact in the shortest space of time at the least cost**
If you follow a traditional approach, then even though you may finish it, and the technology implemented is now obsolete
It is going to have to be a different, it is going to have to be a change because you are going to have the entire ecosystem support you. Firstly, you would have start with your people. **You need different thinkers**. You can't take people that are in a waterfall approach and ask them to now become agile. **It is a huge change management**
But the size of the investment is very different hey, for those ones. So that's why it's, **it's not such a high-risk decision** at the end of the day
So, we have got a couple of things. We have got – To speed up the rational process we have got **discretionary allocations** and thresholds for group executive members
A lot of our decisions would be rational, in terms of looking at alternatives; choosing the right technology; making sure you have all the information. It is a long-term decision. It is not something you do in an agile approach

Like I say, as much as we will try agile you cannot have an agile ecosystem not supporting you. If you look at it in terms of agile for us is about speed of delivery as oppose to delivering to the outer world. Like in the commercial bank. They need to put certain products out there that means their whole ecosystem works differently.
We can motivate to get significant amounts of money – let us call it – accessible, in between the milestone dates. We have also got a slight change in terms of how much money we throw at, almost like the business case or discovery side. We want the guys to **cycle through the idea** and – let us call it – the **economics of an idea**, materially quicker. So, we release smaller amounts of money.
Have the guys do a really focussed dive and say is it worth the effort from a value or from whatever the various aspects are and come back with a rapid decision. What that then means is that you **get into execution quicker**, because a lot of the depends on these processes – the guys tend to think about it in the infinite detail. The other side of it is that we **shorten the architecture process to get good enough**, so that we can **get into the build side and we learn as we go**.
It is **not trying to do a detail design in its entirety**, answering all questions. It is almost a **fit for purpose** with **knowing enough to get the exercise going**.
The other is **testing**. We actually **take some bets**. We know that these are the 2 – 3 disruptive things; go into the industry, **go and play**. Go and figure out what we don't know. Figure out an application that will actually work; find out who is doing it. So, there is **definitely the path finding**, and that is a very quick approach where the guys have partitioned off some of the money into almost a bucket which is available– Listen guys **go and explore**
Technically does it, can it, **can it do the job**, yes, functionally can it do the job, yes it can, we're going. So, I've seen that as well, that's very much how the Flex keep solution was selected for our rest of Africa and divisions and stuff like that.
When we look at all of that, it's got nothing to do with those classic layers, they're completely obstructed now, so why are you even bothering with those layers or now, any cell of my mind that's focusing on those layers is playing out the game completely wrong. You're getting fixated on the one specific technology, it's not about that anymore. It's about **simply driving forward and it's about systemic engineering**, you see you're taking **Lego blocks** and putting them together and you could map it in there.
However, there have been other projects that where, I mean, there was one very recently, it was about to go live a week before. The bank had a look at it and said there was some issues with the customer interface and they pulled it. They made certain other decisions as a result. So, it's not common
I think garbage can could be **disruptive to the decision-making process** if you need to make it quick.
What I'm trying to tell you there is, put something in now that does X, but then it's sometime later and we're going to do X plus Y, and we can easily then **adapt and scale and do something**. Even it means change it for something else, it will be quicker then and agile.

APPENDIX H – CIO COMMENTS – USE OF BCG MATRIX

This model here, we use it in our strategy as well, when we're presenting to OPCO…however some people don't like the term dogs or cash cows as well.
I think it is aligned, but you hit the nail on the head. Digital core and digital business could end up being cash cows, right. Because if you look at the disruption in terms of new start-ups and the companies that are starting up, like Uber and Air BnB and all of those things, right. Or even if you look at, WeChat, if you look at WhatsApp and all of those things. How that disrupts your traditional Telco in terms of, nobody makes phone calls anymore, everybody sends WhatsApp messages. Or it's the thing called OTT over the top services where you can call from within WhatsApp, you don't buy, we don't have to have airtime. So, your digital business and your digital core could end up being a cash cow, right.
My view is that disruptive tech could be a wildcat in terms of optimising your business, but it could be something that becomes a cash cow later on.
Exactly, so you look at programmatic now, it's like, there is focus, not high focus, and it's still in its infancy stage but, I mean, give it another year, two years' time, that would be a standard for advertising. Now it's not a cash cow, it's not even a wildcat or a star, it could be now, for instance, poor dog, because it's not generating much revenue, but give it two years' time. Once the adoption takes up, you know, gains momentum, then it would end up being a cash cow.
It could add value, we do pockets of classifications, if it has a direct impact to the business, but generally we don't.
Say for instance it's an ERP system, right, that drives the business. For me, I would say that is basically, I wouldn't like to call it a cash cow because it doesn't sound like it's generating cash, but basically if that system had to stop, then the business comes to a standstill. Does this application directly contribute to that, yes it does?
We haven't formally gone and looked at the different applications or the different platforms and mapped it according to the model, but it's actually something that I'm thinking that I must do.
This structure may help - it's more trying to also create direction for the teams to say, this one in this business is critical...I think, yes it can help speed up investment decisions
We use it more for our OPCO reporting in terms of our strategy, based on each business unit. We take the fourteen businesses and we map them, is this a cash cow, is that a poor dog, shining stars, wildcats, and then we map them out. Then what we do is we put little rings or big rings in terms of the revenue. If it's like a massive, if you're like, three hundred million, it's a big ring, but you'll be on the top or at the bottom.
Focusing on the right systems helps us in terms of how do we go about changing that perception and basically adding value to the business
Typically, a mainframe system will be considered in IT core, but if I can get agreements in place that someone's going

to provide a data processing, you know, in the Cloud capability, which is available today. The, the example of Amazon farms, and it's going to drop our unit cost of processing down by 50%, that could very easily become a star. But over time it's probably going to shift back to a dog.
That is quite an interesting thing. You should be doing this analysis every couple of years on the systems anyway, just to uncover duplication
Yes, it can add value. You need to do the study every so often. Then you also need to ask business, there is x y system, do you use it? No, no. I wonder why we are running it. Or AB system, does it add any value? No, it is a grind. We were just told to use it, not sure why. Then you should be going to the board and say why do we use it? Switch it off

APPENDIX I – DISRUPTIVE TECHNOLOGY MYTHS

We have high Barriers to entry, so we will not be disrupted
Most innovation is incremental so probability of being disrupted is low.
Some of our competitors use newer technology, however it is not relevant in South Africa.
Nothing that they have we haven't got.
What is so funny? If you look at Uber and Airbnb. Oh, it is so dramatic. It is nothing new. They took technologies that has been available for 10 years, and just put them together in a different way.
They won't be able to manage it here. Our market conditions won't allow that. It's, we're in a particularly difficult time at the moment in terms of our ratio to demand and capacity, and all of that, okay
We've got too much of capacity, demand slow, competition's high, there's too many other entrants coming in, they'll battle. Logistics and that will prevent them I think
However, in the Uber example, it is type of commodity there, okay. Your demand to supply ratio there, capacity, is very high compared to cement. Cement's not there. It's not as commoditised as Uber rides are. It is a commodity, but it's not as commoditised as say, margarine is.
There are certain customer driven businesses, and certain businesses like mining where they don't rely on technology.
Strategic never comes from IT in my experience. Strategic initiatives come from marketing, from operations officers' office, occasionally from the accounting people; quite frequently from the CEO. But never from IT.

APPENDIX J – IMPACT OF DISRUPTIVE TECHNOLOGIES ON BUSINESS

For us technology now is a playing a big, big role in the way we do business. I mean, disruption is coming right, whether it's disruption to our radio stations or whether it's disruption to the other parts of the business on the education side, but disruption is coming.
I mean if you don't want to be disrupted, be out of business, you have to know what's happening out there
At the moment, it is not about if you are going to be disrupted. It is when you are going to be disrupted. So almost every organisation is going to be disrupted, it is just a matter of time.
Look at most of the billion-dollar organisations that have been created, they're trading organisations. They're bringing two parties together, Airbnb, they're platforms, they're collaborations. Amazon and them, they're platforms.
When we look at all of that, it's got nothing to do with those bottom technology layers, they're completely obstructed now, so why are you even bothering with those layers now, any cell of my brain that's focusing on those layers is playing out the game completely wrong. You're getting fixated on the one specific technology, it's not about that anymore.
It's about simply driving forward and it's about systemic engineering, you see you're taking Lego blocks and putting them together and you could map it in there. What is your factory's influence on strategic decision making? At the ops layer simple, you just want it faster, better, smarter, day earlier, dollar cheaper, you're good to go. At the tactical level, it's about flexibility, sufficient base for extraction and the like. And you have the entire ecosystem for itself to come, to an extent. But it's used for public enterprises, architectures, etcetera.
Think about, why is Office 365 taken off so much, because it gives you that flexibility. Our world has changed, you see it's busy changing from a constrained model to a surplus model and you've got to think surplus. Constraint says, I better squeeze you to only what you want, a surplus model says have as much as you want. Look at even the way data plans are growing and the like, it's a surplus response, un-capped, etc. People have a finite capacity, people will say they were trying to download every movie. Then they realise, why must I keep it on my media server, when I want it I will get it and that suddenly changes us from a hoarding mentality through to a

more consumption orientated mentality which, you want the flexibility on your platform to be able to do all of those things. So, it's not matching your likes but lifestyle matching not at the organisation level, but more important that human level.

Those are people that are trying to suck each other in, you're either in the Google world or you're in the Apple world or whatever, to all your devices now start talking and interacting to each other. But when you're looking at building the architecture, you want resiliency, what you don't want to do is have to forklift every three, four years. You want the flexibility, adaptability, scalability, there are many elements. You don't want to constrain users there suddenly, you want the ability to burst when required, you want this unlimited, you want this elastic, this elasticity, then you can stretch in any domain or dimension you want.

Big companies had the power in the past and they hired their own five engineers, their own RF engineers, their own telephony engineers, where are they now, they don't exist. Our contracts have become functional and service in nature. I'm buying a pipe, it's got a price tag associated with it and on the other hand you're selling them a valuable IT service level and a MTTR level. That is how all our functional contracts actually are. So, my point is, it's obstructed, no one thinks about the undersea fibre cable anymore, no one thinks about the terrestrial fibre cable, no one thinks about the local loop. It's completely opaque

Think about how things that come in there, you're watching movies and the like, it's changed how you view, in the olden days people collected VHS tapes, CD's etc., look at the way the future has evolved to the new technology. Nobody's selling CD stands anymore. This concept of CD shuttle has disappeared as well, so media, people no longer bother, they see no value to keep media anymore, when you want it, it will appear because you assume the bandwidth is generally available. Next, the application layer is of no use either. Your email is appearing on seven different types of, different makes of applications, different providers, etcetera, but it's appearing wherever you want it to. Data in its own right is the true magic and when you look at data, as far as looking at the major innovation that's happened over the last while, it's mostly collaboration, it's market place.

This is where we need to now focus, where do we make the investment on technology to stay ahead of the game, and to not be disrupted, you know. So that's where I feel that my role is important. Not claiming to know everything or understand everything, but I can give advice, I can learn new stuff and I can keep ahead of what's happening as well, you know. I can also help the business to make those decisions.

That's your core, your core IT infrastructure, that's where I'm saying that, you know, the decisions can be made not to go to Cloud, because you're not going to get disrupted on the nature of your business.
Disruptive technologies, that was high on our list. I mean you, you heard me talk about migrating to the Cloud or Cloud adoption. Digital first step speaks to mobility and internet of things. Big Data around the data we create and understanding your consumer. So that is what's very big for us in terms of enterprising value.
And anyway, personally I don't have a problem with it. It's for me, like I feel if they're going to install Slack, like the IT team would go and install Slack, it gives me a clear view of what disruptive technologies is out there. I could be focusing so much on Skype for business, where there could be something else out there that can do much more. I don't say no, I'd say okay let's install it, let's evaluate it in a, in a sandbox environment, and let's see what are the benefits and compare it to this, you know. Then make an informed decision
Typically, where you had organisations that were reluctant to move to Cloud based on regulation, based on band width constraints et cetera, et cetera, that will no longer be the case. Come next year, Microsoft will have a data centre in Cape Town and in Johannesburg in Midrand, and that changes the playing field. So, for me, I think that's key for, not only businesses but for CIO' to, you know, to take note of how that would then change your business operating model in terms of IT operations.
You know, the other thing, and we were talking about this very recent as well, is the Cloud adoption, right. So, if you look at Microsoft Play into, moving into Africa, are opening two new data centres, this changes the entire ball game, if you want to call it that, right. In terms of Cloud adoption, in terms of disruptive technologies
Publics clouds, in terms of disruption, for the likes of DD, BXC, T-Systems and all the other local players, this is a huge disruption
We've got what we call transform, that's related to, you know, so how do we take the bank forward completely in terms of transforming our environment. Then another one is to, we then support, we called it concept initially and the bank has sort of now coined the phrase that it's

digital fast lane. Where both the transform and those ones are agile capabilities where, depending on what you want to do.
Now, your transform is big heavy lifting, rebuilding and transforming your core capabilities and those, and your legacy. Your digital fast lane tends to be contained, focussed pieces of work that you can go and learn from there. In terms of selecting solutions, we do stay quite close to some of our lenders and things like that. So, for example, in the payments world, you know, we stay very close to who paid, providing payment capabilities out there, you know, so we have an understanding of the market.
That's not to say that, you know, we're sticking our head in the sand and saying nothing's going to come and disrupt us, we're just saying we've also got as much as we need to innovate.
If something new comes in, like cryptocurrency investment, it's an innovation topic…
I do think that where we are being disrupted is in the payments world. Not so much on your traditional payments but the e-commerce scene.
The big disruption is, you know, the different payment types in the payment world. If you look at QR codes versus near field capabilities, I mean, there's a very good example of how some things have progressed
I think it's more of a qualitative discussion rather than a quantitative one in that space, because when are you the one that tips over and tips the whole lot over and as a result
I think in pure disruption and new mobile capabilities there are regions that are better and there are things we are better on. So, mobile, you know, if you talk to Americans, mobile banking, South Africa's held up as one of the poster child's. If you look at what, you know, in terms of inter-operable wallet capabilities and some of the Scandinavian countries, in Belgium, they're miles ahead, you know. I mean, they hardly even use credit cards anymore at some of those places, those countries, because it's tap and go, or whatever the case may be
To our earlier discussion, if someone comes up with a disruptive capability to provide a Cloud mainframe example. Well they might become the star because, all of a sudden, your level of investment, you know, you've got a very strong business case and those sorts of things.

That's what I like about us, you know, we never say never. We don't say this won't happen. Obviously, you get some things wrong and right and we then to dabble and push and those sort of things, so. I think banking, we're a little bit luckier. If Apple now had to get something slightly wrong on their new future phone, on their smart phone, it wouldn't kill them, because that's now the standard. If there was a total disruptive capability, then they may. There are a lot of things that we're doing, but there's that one thing that could blind side anyone.
She has this Bee in her bonnet about everything must be digitalised and all the stuff you need and Big Data and IOT everything, to her it's all just one big, you know, it's just like a kid in this whole big cage of building blocks, but don't know what to do with it, and that is the problem. Some people are considering all of these things for the sake of considering all of these things.
Steve Jobs kind of used that when they built the iPod and all of that, but those are the kind of radical innovations and developments and all of that. People wouldn't know what they want. If all of a sudden if you came to me and you talked about something about holographic presentation, of somebody at this table even though he's sitting in Mumbai, all of that. If I never heard of this before, I would never know about it, so we'll talk about it.
We are conservative, particularly more right now, okay. You have CIO that is pushing us, but she is very mad. There's no point going and trying and split the axe up now if when we don't know what's going to happen, especially now
Like WhatsApp, I mean, SMSs are dead, because this has killed it, it's like only machines use SMSs now
But Capitec what they did do is, they built a very elegant, reusable customer lead process in terms of the way in which you open a transactional account, and the way in which you make it really easy for the customer to access a personal loan. That was the guts of their proposition.
So, a couple of things we are doing in the corporate banking side, on the treasury side – we are experimenting with block chain. But, putting it into the business and seeing how the capability works
The other side in terms of the response to Discovery is the acknowledgment of the power of data

to, I think, enriched decision making. It is the intersection of how we bring in non-bank specific data; how we get beyond our current card-based reward to actually get a far – let us call it – wider and more inclusive rewards programme to start thinking about what behaviour you want to reward, irrespective of whether they have a banking product with you or not.

Disruptive millennial market places, eCommerce sites; block chain. All of those we are looking at how digital fast lane, actually in a path finder test and learn process, identifies, bring some of those in, if it means potentially private equity or some stakes in some of them. Or just simply this is a capability that we need to bring into main stream. We purposely set those guys up to run. If you need to do something completely different around block chain or crypto currency, they will advise the board.

Like I say, as much as we will try agile you can agile the ecosystem is just as supporting. If you look at it in terms of agile for us, is about speed of delivery as oppose to delivering to the outer world. Like in the commercial bank. They need to put certain products out there that means their whole ecosystem works differently. It is very contained. Unfortunately, in many organisations, as much as you try agile, right, you need to make sure that your procurement processes are agile. Your investment is agile. You've been given a bucket of money and what happens in an agile side, sometimes you don't know what the ultimate solution is going to be. As you go along you build and you need funding. It doesn't work with us. Very much from a governance perspective, how much are you going to invest? What is the outcome going to be, etc. From a procurement side, as much as you put partners in place, strategic partners that you say you want to partner with to get, and you don't go through the whole contractual process, it still means your procurement process is stable. It is a short RFI, RFP or long one

Where cloud is disrupting is speed – Let us take an example - when you have a server under your desk and stuff like that. If you took the fastest team – it is still 2 – 3 weeks of buying, implementing, whatever. Cloud is instantaneous. The speed is what gaining disruption and the fact that when you bought a server and stuff like that, you couldn’t give it back tomorrow.

But life is now about data and data manipulation and the like, they define our lives. I think when you take philosophies like that into account you need to annex, it sounds bad but you need to, in my opinion you de-humanise the environment because you will destroy incredible numbers of jobs but the numbers of jobs that you will create are even more than you can articulate it.

They are using technology to improve their business advantage because they want to dynamically change the price of a can of baked beans from X, from R7.00 to R8.00 and then do it for three days and they just want that flexibility. Then they want to attract customer get them to like stuff and in the olden days they made customers fill in service forms and the like. These days you've got an app that can, that tries to dynamically track a lot of things.
For example, I got told by other bosses, no we must launch this product and I would bolt from them, sir, we will launch it and it will be a launch, how about a launch identical to that of Twitter or Google, it will be that big and they will like yeah and they will go away - launches are outdated, training is outdated, if you cannot assimilate it and understand it intuitively, you've done it wrong. Things should take off virally, if it's going to be successful it will be a viral expansion. If you've done it wrong, that's when you need to have user education and they stand in the queue and they show the people how to press the buttons and you know why, if something's meant to be, it must take off naturally and you must let them tell you that adds significant value to my life, they're naturally going to use it, they should not have to be sold on it as a concept
So much of energy and effort is going into business and business analytics, once you have that data, the problem with data at the moment, it's like having a huge engine but you can't couple it to reality. It's like giving you a thousand-six-hundred horsepower engine. Even if you touch the accelerator slightly the wheels are just spinning and that's part of the problem. Business doesn't know how to deal with this.
When you come back to individuals, they don't care, so mobility's a critical avenue for us. If I want a phone, I want a phone now, if I want a bank, I want a bank now and now could 2:00 in the morning, 3:00 in the morning. It doesn't matter when, it is soonest, so it's best to follow me.
If I was a banker right now, my plans would be not having a single data centre, if I was CIO. It is not going to happen. I guarantee you of the big five banks, no data centre. Capitec, probably. Capitec is going to beat all the banks. We know that. Why? Because they are an IT driven organisation. If they already don't have a data centre, I wouldn't be surprised. But I guarantee you, in their planning is to not to have a data centre. I guarantee if you went and spoke to that COO he is going to put his whole shop in reverse next year. That is what he should be doing.

APPENDIX K – PARTICIPANTS VIEWS ON INDUSTRY ANALYSIS

Our CIO definitely does have a very strong responsibility in understanding what is considered best of breed, what is leading in the technology space and those sort of things, to be able to help and guide the organisation.
I would be speaking to all the top vendors right. I would be speaking to Microsoft, I'll be speaking to AWS, I'll be speaking to all the local vendors. Whether it's T-Systems, Datacentrix et cetera, that play in that space. They'll be able to advise me what's coming down the road. So, I could make an informed decision.
We constantly keep abreast of what's happening globally. Through our innovation teams, so we have an innovation team that sits within the organisation, and they keep abreast of a lot of these technologies, disruptions that happening - we're well informed
We have a business partner in France and in Europe - across Europe. They also collaborate quite closely with us and keep an eye out as to what's happening out there in the industries. Even if it's outside of media, I mean if you look at the “XXX” play, it's something that's not just for South Africa, it's global, right. Not many people or many industries that are actually doing it.
I find myself focusing more on external business. This is where the most disruption actually comes from, that's my personal opinion, right. As much as I would focus internally, but I don’t let that, like take up too much of my focus. I will focus internally to ensure that the business is running optimally, smooth, everything is efficient, but my majority of my focus is external.
In terms of selecting solutions, we do stay quite close to some of our lenders and things like that. For example, in the payments world, you know, we stay very close to whose providing payment capabilities out there, you know, so we have an understanding of the market.
It is determined on what the overall need is. We then build up basically a request for information or a request for proposal, and that covered detailed technology, capabilities, business strategic items, functionality, product capabilities et cetera, et cetera. What the client needs are, also again, scanning the market, what are the trends, what do we need to understand, what do we know is coming down the line. You know, what are the regulatory changes coming that we need to take into account, so we built up a set of requirements looking at all those categories.

We then used the likes of research houses like Gartner, Frost and Sullivan and the like. If they look at their four-quadrant model, who would be in the top space that are, are considered best of breed payment providers, but also can handle scale.
If something new comes in, cryptocurrency investment etc., it's an innovation topic…
I wouldn't say it's anyone's particular job, you know, we've all got our roles in making sure we understand what our competitors are doing et cetera, if somebody spots something they would take it probably take it to architecture in Group Technology, my guess – they're future looking.
They used a very clever approach, so I'm not going to argue whether it's disruptive or not, but at the end of the day, are they eating into our market share, absolutely.
So, I mean, so we obviously try and stay abreast with what everybody's trying to do. So, it's just understanding your competitors, and that's part of our day to day function in the product side. Making sure we know what our competitors are doing. Banks and non-banks, it's not always has to be in the bank vertical, it can be other guys as well.
We use the research houses to understand what's out there. We go to international conferences to understand trends, other banks are quite happy to talk to you, we're not competing, they will talk to you quite happily.
You know, I think nowadays we're probably getting a little bit more value out of Gartner, in terms of the rapidly changing technology environments. The views we get from there are most current, in terms of trends and what's happening.
The only thing that you can say that perhaps was handed to them in a manner which is something that we do not enjoy and I see that in terms of the entire encumbrance of the industry, is a cleaner sheet to do things the way the client would like.
If you look at their app in terms of client experience, it ranks very poorly in terms of design. But it is simple, it is seamless, it is logical, it works. It is a function of underlying functionality and fit for purpose design without it being a gold standard. But it works for the target market, and it works in a completely seamless fashion to an on boarding experience in the branch

External analysis is always important, that is what we need to keep us relevant. That is fundamental. I think this is important where you have your Foresters and your Gartner's and all the other guys but we also talk very much to the other central banks. In terms of what they are doing.
But Capitec what they did do is, they built a very elegant, reusable customer lead process in terms of the way in which you open a transactional account, and the way in which you make it really easy for the customer to access a personal loan. That was the guts of their proposition.

APPENDIX L – PARTICIPANTS' VIEWS ON VALUE OF EA WITHIN ORGANISATIONS.

The EA framework, it is about sufficient guidance - the classical EA Frameworks don't fully address business strategies in this modern age.
You know, I think nowadays we're probably getting a little bit more value out of Gartner, in terms of the rapidly changing environments. The reason I said Gartner is because, the views we get from them are most current, in terms of trends and what's happening.
So, they're still sitting in that whole Legacy mindset, the Legacy systems, they haven't evolved with the technology. They haven't evolved appropriately.
I implemented TOGAF components. I still don't think it added any value, but yes that is what we did at the time. I can't really see all the value that was coming from it. I think things are a bit more agile now.
I mean SAB is massive, the enterprise architecture team and solution design team is huge, but they're not proactive. Like I say, it depends on organisation, they don't have room to be proactive. They're given the business requirement and they operate within that business requirement. They don't have the luxury to create or think about disruptive technologies. I think EAs are more flexible in an IT sector, where they have exposure to different customers, and they have insight to different customer architectures.
I do think as well though, those architects need to, there needs take some level of ownership of the success at the end of the day with delivery. If I take an architect in the sense of building a home, they become your, I'm not expecting them to become the project manager, but they are very closely involved with the end result as well. Take responsibility for that. So, yes, it's nice to be future focussed, but are you taking responsibility for what you've delivered.
I believe EAs spend most of their time on the IT core, and I don't believe the focus is aligned to organisation's expectations. There is some bias, but that's from my experience.
The other side of it is that we shorten the architecture process to get good enough, so that we can get into the build side and we learn as we go.

I think we over clubbed it in the past, and we went too much down to them being the high priest of everything design.
Architecture - that is really (a) takes too long; (b) very theoretical.
CIO's come in with an EA; then they talk about Zachman, TOGAF and whatever, and that is where they focus on a certain area. But it doesn't really help them in terms of adding value to business.
I think this world has moved on and they haven't.
But current approach is the old Zachman, TOGAF, it needs to change. It does need to evolve into something far more – let us call it – usable in an agile way.
In my time, as well we changed from old maintenance systems and AS400 systems which were still running applications in Cobol. We moved those kind of payrolls and financial systems to SAP. It was quite a traumatic change that we have done. But architecture side was never really a top priority or key part decision.
It is clear when you make this decision what infrastructure you require and how you manage it. But architecture has never been a driver.
Look at Enterprise Architecture I think is an important function. I know there's many organisations that have enterprise architecture but it firstly they don't have teeth. They are not agile or pro-active. They can be seen as sitting in a glass house. Are you with me?
Because typically what happens, and I know with my experience, even Eskom, they have an EA team there. Those guys who kept there but everybody walked passed them. At the end of the day what value do they add?
They don't have an influence, but they have a technical skill, they're more from a consulting perspective. So, the business owner will drive your CIO.
Enterprise Architecture is a bit of a difficult one that the whole organisation struggle with. Even the exec's because if you sell the case for enterprise architecture it goes over the head. Don't

understand this thing.
You see it is becoming less relevant now in the decision making. I will tell you why. Because if you look at Cloud. Before you invested huge amounts in tin and technologies. Now with SaaS and Cloud and all of that, you are buying output. Right? Now you need just to know how your clouds are going to talk to each other and where you are going to get the information. At one stage, you did a lot of that in-house. You had a lot of spaghetti.
No, I don't think EA plays a role influencing business

APPENDIX M – EA APPROACH IN AGILE BUSINESS CONDITIONS

If I look at it, it is my expectations are more aligned to this enterprise ecological adaptation. All the strategic outside in type of view.
EA is important. It helps with strategic decision making but I think and if I look at these 3 schools of thought, I think it is applicable. If I listen to you, it is important in all 3 categories.
Well column 3 the ecological adaption. The one here is the only way to go in my opinion. I have never met anybody doing that. Ever. In fact, I am only seeing people starting with column 1 (IT Architecting) type things and they are doing it wrong. Because they are only starting at level 3 or 4.
The one is in terms of setting standards and rationalising type of environments. In terms of the alignment between business, in terms of setting standards, I think that is important. When it comes to like Cloud, that's where you are looking external in, I assume they also quite important. Most probably they are important in all 3 categories.
I think where the sentiment that EA's don't add value, living in the glass house on the side. Is because maybe the expectations are not clear in terms of do you want them to play here (IT Architecting), do you want them to play here (Enterprise Architecting) or do you want them to play there (Ecological Adaptation)? Because if you are a strategic guy and you want them to assess which Cloud is the right thing and they spend their time looking at Zachman or TOGAF or whatever it is. Then you are going to say but these are not adding value. Maybe, that is one of the problems.
I think the way things are going in terms of EA and probably this is where the model of EA comes into question as well as time goes by. I don't think you can say it is one of these. It's got to be a mixture. It is got to be a hybrid model
It is important in all three depending on where you fit. You've got a component of keeping the lights on and there's an EA requirement there. There's a component of transformational and there's an EA requirement but the expectations in both are slightly different. It is just a matter of making sure that they understand the role they need to play as well.

Enterprise architecture in general is important because architecture should be focussing on strategic rather than actual. They are looking at longer terms, just your pure point in solution and ethical decisions. I think… should be looking longer term sustainability.
But they can't be seen in isolation in any one of these, they very much interlinked.
If you only focus on for instance enterprise ecological adaption, innovation sustainability, you do get EA's who are architects who only focus only innovation.
You get the IT people who say, well we are going to do TOGAF. They get the TOGAF architect in and he says can I speak to the business planner. You can't have any of that nonsense, but he has to make the business work. Unfortunately, column 1 is for old school. It is never going to bring you closer to business – This is making sure that your resources are properly deployed to support the traditional business model.

APPENDIX N – EA CONTRIBUTION TO IT STRATEGIC DECISION-MAKING

EA should give you a great end state. But without really the building blocks or the path to get there. I think, if you wanted my preference, it is very much to be in line with where the industry is; to be playing in that strategic space; but being able then to in fact bring that knowledge to bear in terms of the broad domains that we have in our architecture
I've always seen enterprise architecture as folk leaders in consulting services. Not there to make decisions, they are there to help decisions be made. They're there to explore options but that could be anything from your operations side to strategic side.
An Enterprise Architecture should typically have a low technical knowledge and a high level of business understanding. Where a technical Architect should high technical knowledge but for EA, their focus is on the business side. Their focus is on technical abilities. The business enterprise architect really needs to focus on the outcome. They should be relying on engineers and technical architects, but their focus is on helping the business achieve outcome. I think enterprise architecture is important.
Speaking to my experience and you speak to other organisations is that you need to make sure that when it comes to the demand and the solution building that they play a key role. Firstly, in terms of setting those standards but also being able to craft it with you.
The current reality is that a lot of things have, especially with legacy organisations, most organisations would pretty much be screaming about basic issues like stability. And everyone is saying, before you reach for the stars just make sure the foundation is safe. And a lot of people are not safe at that level. Why, because there has been disparity, architecture of different views, there's so many bolt-on, problems with data cleanliness. Archaic concepts like Data Warehouse that no one's implemented properly. So, the right continuous common centre vision and that should answer your question on enterprise architecture, I think it's incredibly important.
A legacy organisation is never going to do anything disruptive. It is good to have a company that is in chaos. It is a great way to fix it. And a company that is starting, it is a great way to structure it. But if you want to do something dramatic, it is too slow. IT, that is a CIO and Enterprise Architect can play a strategic role here.

This is what we do. Look at how it is going to affect us. How do we get involved? Okay CIO go and tell me how we can look at a finance solution or do something crypto currencies. Okay get the EA team, but the traditional EA team – if it has got nothing to with them – the EA team now only says no we can't do this, we can't do that. But sometimes you want a new approach. Okay we will go with cloud because we want high levels of computing power. We want to use it. The EA can actually limit you, so you don't bring the EA in until you have made your decision. Then you tell the EA okay make it happen. Their mindset needs to change, so they can help us.
I think the hallmark of success – if you are going into an agile construct and the ability to do a self-organising team with software being built in a continuous mode – You need very strong solution architecture and integration in the room to drive the build effort. A lot of thinking is then around how do we build something in an intelligent quick fashion, that in a sense is as close to target as it needs to be; is reusable; and something that does justice to the enterprise architecture at strategic level.

APPENDIX O – INFLUENCE OF ORGANISATIONAL CHARACTERISTICS ON DECISION-MAKING

I have to be honest with you. Regarding Decisions, it's a very, very difficult process right, especially when you have multiple stakeholders from multiple business units
I think the most fundamental is that, from a CIO's perspective, where we tend to miss the boat is understanding the organisation. That is the first thing, what is your organisation's business model? What is your organisation's culture? I pick up those as two fundamentals topics.
These business units, it's something new the way we operate now. In the past, we had a business unit, as long as they met their targets in terms of financial revenue - they were fine.
It's based on the nature of our business, it's so many different business units and the way they actually operate and the technology that they have. You have to analyse the problem, multiple perspective, technical, organisational and individual. Obtain many technical views because it's affecting many different platforms as well.
You don’t want to disrupt the operating model of the entity, especially when the entity is different compared to the other entities as well.
It's a diverse company with 14 different business units, each one doing something totally different from the other. My challenge is - how do you come up with an effective IT strategy that would align across the entire group.
The first step, I needed to understand what is the eco system within the group, and the only way to do that is to do an enterprise architecture. Evaluate or audit the current information that's in there, what is the infrastructure looking like, and then how do we then build from there. What are the goals, business goals, IT goals, and how then do we move forward? So, the first phase for me was to do an enterprise architecture.
Now that you're trying to bring everything together from a technology point of view, getting the adoption across the group is not easy
The way it works is, we give everybody a fair opportunity as well. Any project that we target, we

get representation from each of the business units involved.
That's where you consider the type of organisation you're going to have and whether you look at how do you create maybe a platform business. Amazon is a platform business at the moment.
It talks about the nature of the business. We have subsidiaries that are manufacturing. You can't centralise that. Your architecture cannot be the same, yes, your back-office staff can be common, but you can't bring a factory in and adopt the same standards for a factory environment. Let them run with it.
Because you're talking about disruptive technology in an IT environment. I wasn't in an IT environment. Different sectors play an important part. If you're a CIO in the medical industry, that's a different sector, the requirement is different. You need to comply to medical standards. Ensure that you're IT systems comply to medical standards. How do you create that standardisation? What systems do you implement?
I decided to get an independent consultant to do this for me, because I didn’t want to have a biased opinion, if I got somebody internally, they'll obviously favour a certain application over the other. Because you know how it is with key stakeholders, right, it's all about what makes their lives easier. I got an independent consultant to do an enterprise architecture for me across the group, looking at everything. Which is now a living document that we can build on year on year. So that became the foundation of my IT strategy.
If you'd look at my previous companies that I come from, the IT infrastructures were all dependent on what does the holding company dictate? I worked for international companies, what did they dictate? What did they want to see? How do we align to what international standards are? That was the mandate.
Look I have been in two different companies which were totally different in the way we approached the stuff. Because I think a lot depends on the organisation itself.
It's something that influences. I would assume the only system that you may not integrate, if it's something specific to that organisation itself

APPENDIX P – ORGANISATIONAL CLASSIFICATION – CONTRIBUTION TO DECISION-MAKING

This will create some sort of uniformity across the group, especially in a diverse group like this, you can have multiple companies doing different things. To govern that and to create some sort of structure, this document guides the different entities on what to implement should they decide to implement internally.
We can have more of a strategy where we say, how can I provide a generic platform that everybody can use so we can get the efficiency and the cost benefit from that and re-use opportunity
It's something that influences. I would assume the only system that you may not integrate, if it's something specific to that organisation itself.
That's where you consider the type of organisation you're going to have and whether you look at how do you create maybe a platform business. Amazon is a platform business at the moment
I think she will get their buy in to centralise it at a group level. This comes back to organisational classification, control in the operational divisional approach, the BU where they all empower the organisation. They are business on their own, they have got their own customers, they all independent, she can stop holding them back.
It's important to diversify because technology adds unique value to the OD, but sometimes it's important to unify, not only because you want it under control but because there is common value in it for the organisation to run centrally.
If you have a group CIO or a divisional CIO, it is basically just to look at the type of organisation you are running. If there is no shared customers or shared products or shared supply chain, then don't really consolidate – You can set the standards and guidelines, but you let each of these units run their different systems. Because what you do find is that certain people are so hung up on implementing a shared system, that there is just so much politics that is takes 4 – 5 years before a consolidation of SAP systems, for example.
We need to understand and look at standardisation, integration, the governance. Who decides on

what? When you come in as a CIO, understand the business. Who makes what decisions?
I think the most fundamental is that, from a CIO's perspective, where we tend to miss the boat is understanding the organisation. That is the first thing, what is your organisation's business model? What is your organisation's culture? I pick up those are two fundamentals topics.

APPENDIX Q – CIO STRATEGIC DECISION-MAKING IN AN AGILE BUSINESS ENVIRONMENT

CIO Strategic IT decision making in an agile business environment

- Background
- Changes in technology landscape
- Impact of disruptive technologies
- Changing expectations and demands on CIOs
- Key factors for making strategic IT decisions in agile business conditions

Background Information

- Work done in collaboration with Rajan Padayachee *(t-systems)*, Machdel Matthee (Professor at University of Pretoria)
- The objective of the study is to understand changes in the IT landscape from a disruptive technology perspective and formulate a framework for strategic IT decision making in an agile business environment.

Background Information

- Changes in technology landscape
- Impact of disruptive technologies on business strategies
- Changing expectations and demands on CIO's

Changes in technology landscape

- The Internet disruption has resulted in an exponential increase in the growth of new technologies and resultant technology disruptions within the workplace
- CIO's and key decision makers need to learn to maneuver though the plethora of emerging technologies and make quick technology decisions that can result in business model innovation and give companies the ability to compete in a digital world

Changes in technology landscape

- Over the past two decades, there has been various trends in IT from an industry perspective:
  - Open Source, Service Orientated Architecture (SOA), Web 2.0, Mobility, Social, Big Data, Cloud, internet of things (IoT), wearable devices, digital business etc.
- As the market evolves, supply and demand side economics within industries are changing.
- The supply of software and hardware is moving from a product centric perspective to a service-centric approach.

Changes in technology landscape

- The industry is moving away from a one-time purchase and install mode to a pay per use model where customers can buy what they need, when they need it and in a variety of payment models
- In the absence of any framework or guideline for CIO's, the implication is that these technology decisions are based on individual or team experience and inherent knowledge.

Impact of disruptive technologies on business strategies

- Disruptive and emerging technologies have the potential to lower the barriers to entry into an industry, result in the blurring of boundaries between industries which enable agile fast paced competitors to compete with traditional industry players.
- Consumer driven technologies such as mobile, social and cloud increases customer's service delivery expectations, which forces organisations to adopt Digital business strategies

Impact of disruptive technologies on business strategies

- Companies that do not adapt to changing market conditions could find themselves going down the path of Kodak, Nokia, Blackberry, blockbuster and many other organisations that obstinately focussed on their source of competitive advantage which made them successfully, however their inability to adapt to new technology trends in time caused their downfall

Changing expectations and demands on CIO's

- Expectations of CIO's are changing, and they are now expected to focus more on business enablement and adding business value as opposed to being IT specialists focussed on operational issues.
- Technology is now part of mainstream business as it attracts significant capital investment and operational expenditures which attracts attention from most business executives, to realize a return on investment.

Changing expectations and demands on CIO's

- CIO's are now faced with a challenge of motivating
  - "why" they need to invest in IT,
  - decide on "what" they need to invest in,
  - make a strategic bet on "when" is the right time to invest and
  - to decide "how" they will execute the project

Changing expectations and demands on CIO's

- IT has traditionally been viewed as a business enabler, with the blurring of the lines between business and IT, traditional roles of IT departments and CIO's are being re-evaluated
- IT Transformational plans have been shifting focus from technology selection and implementation to the application of technology to create business value

Changing expectations and demands on CIO's

- CEO's and CFO's expect more value for their IT spend and expect CIO's to do more with less resources
- Business expects IT Systems to be always available and have the ability to rapidly adapt to changing business conditions and market dynamics.
- CIO's generally focus on technology management and governance, while the role and expectation from CIO's is changing.
- CIO's across a broad range of industries all seem to be faced with similar challenges, however little research exists that guides CIO's on how to address the changing expectations of CIO's.

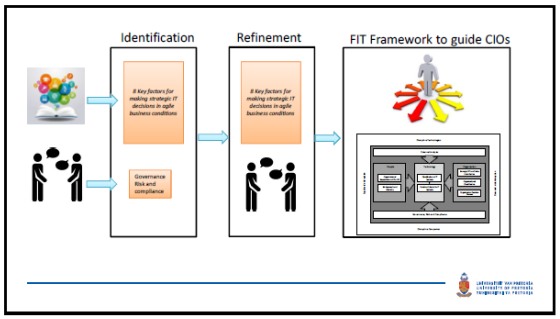
Objective of our work

- Development of an CIO decision making framework that can be used to guide CIO's in making strategic IT decisions in a disruptive technology environment

Some of the questions that we asked as part of the research

- Is the expectation of the CIO in the organisation clearly defined?
- Based on organisational characteristics, are some factors more import than others?
- How does the decision process within organisations impact decision making?
- Do organisations have a way of differentiating the many IT systems used within an organisation which may have different metrics that guide decision making?
- Are there different criteria used for the different IT systems deployed within an organisation?
- Is there an established process to identify emerging or disruptive technologies that could impact the organisation?
- What factors are considered when deciding on which emerging or disruptive technology to adopt?
- Does current EA frameworks and approaches used within organisations provide sufficient guidance for CIO's to make optimal decisions.
- Do CIO's deliberately consider the impact of an IT investment to the strategic fit or value contribution of an organisations products or services?

"What are the key factors in a framework that CIO's should consider when making strategic IT decisions within an organisation in agile business conditions?"



Key factors for making strategic IT decisions in agile business conditions

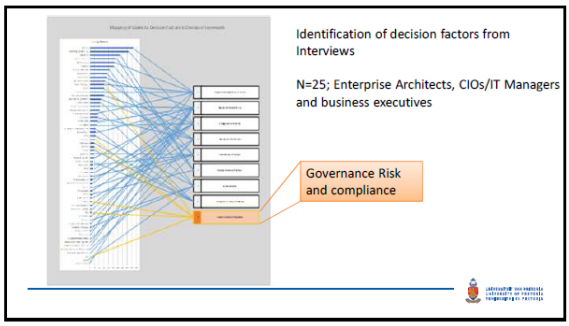
- **DMF1: Organisational Expectations of CIO** – What is the role and expectations of the CIO within an organisational context and from its multiple stakeholders.
- **DMF2: Organisation Decision Process** – What is the decision process within an organisation and the influence of stakeholders in decision making.
- **DMF3: EA Approach and Maturity** – Understanding of IT enterprise architecture and its relevance and influence on strategic IT decision making.

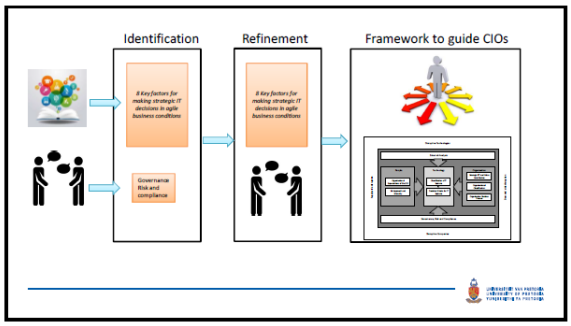
Key factors for making strategic IT decisions in agile business conditions

- **DMF4: Organisational Classification** – How does the nature and characteristics of an organisation influence strategic IT decision making.
- **DMF5: Classification of IT Systems** – understanding if all IT systems used in an organisation are treated equally when strategic IT decisions need to be made.
- **DMF6: Decision Criteria for IT Systems** – understanding what decision criteria will be applicable if IT systems are classified differently within an organisation.

Key factors for making strategic IT decisions in agile business conditions

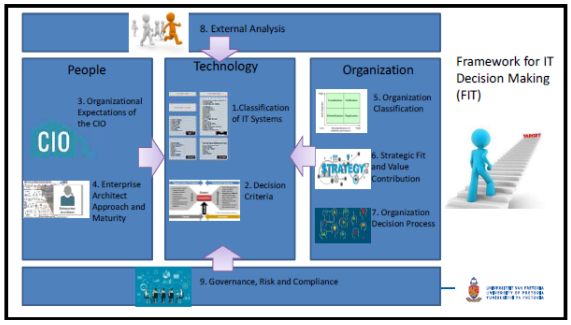
- **DMF7: External Analysis** – Understanding the impact of disruptive technologies an external factor on strategic IT decision making within an organisation.
- **DMF8: Strategic Fit and Value Contribution** – Understanding if CIO's consider the strategic nature of IT systems to business processes when motivating for strategic IT decisio





Framework for IT decision making (FIT Framework)

The FIT framework highlights 9 steps which would provide CIO's a comprehensive overview of "Why" a technology is required, "Who" should be accountable for the technology, "How" to motivate for the technology, "What" process to follow to speed up decision process to invest and implement the chosen technology.



Implementation method for using FIT

1. Consideration 1 – Using the Classification of IT Systems (BIDD Model) – understand the use of IT Systems (Internal and/or External).
2. Consideration 2 – Identify Decision Criteria – What are key criteria that will determine if a technology is selected to be implemented?
3. Consideration 3 – Understand the organization expectations of the CIO - Who is the functional Owner and what is the expectations of the CIO?
4. Consideration 4 – Determine the Enterprise Architect approach and maturity expectations - What is the expectations of the Enterprise Architect in deciding on a technology?
5. Consideration 5 – Consider the Organisational Classification – What is the organisations operating model and what systems, people, process and customers are shared?

Implementation method for using FIT

6. Consideration 6 – Match the Technology to determine Strategic Fit and Value contribution – How does chosen technology fit with organisations strategy and how does it add value to customers identified in Consideration 1?
7. Consideration 7 – Consider the Organisation Decision Process – What is the process to follow when motivating a decision and how does the organisation decide?
8. Consideration 8 – Do an External Analysis – What are competitors doing and what technologies could have an impact on current IT strategies?
9. Consideration 9 – Ensure Decision Success (Compliance to Governance, Risk and Compliance)

Consideration 1: Understand use of IT systems

Consideration 1: Understand use of IT systems

Internal IT: Focus is mainly on systems availability and adherence to service level agreements
Systems need to be scalable in line with business consumption demands.
IT systems must be reliable
Systems should be resilient with appropriate disaster recovery procedures in place
Systems should be adaptable and flexible to cater for changing business models or priorities.
Predominantly consists of classic IT systems, i.e. Enterprise resource planning (ERP), end user computing, collaboration, networking, Data centre services and application support services.
Systems in this quadrant form the underlying platform or foundation to support the operations of the business.

Consideration 1: Understand use of IT

Digital IT: Systems owners must move from a mindset of owning all aspects of systems deployed to provisioning services as needed based on consumption requirements.
Systems enable the digitising of business processes.
Systems deployed can result in the elimination of paper-based systems and processes.
Provides enriched analytics of available data to enable better decision making.
Focus on IT Innovation around internal IT systems
Systems deployed focus on simplifying processes e.g. by enabling mobile user interfaces to traditional systems.
Moving away from a mindset of IT system resources are limited or constrained to a mindset of unlimited cloud-based system provisioning.
Generally, fall under the accountability of CIO's and Enterprise Architects.

Consideration 1: Understand use of IT

Business IT: Technology within this quadrant mainly relates to systems deployed within an operational or production environment that enable the production of goods and services.

Traditional manufacturing execution systems are merging and integrating with IT systems, enterprise networks, cloud computing, IoT technologies etc., however rarely fall under the accountability and control of CIO's within an organisation.

CIO's need to identify and acknowledged its existence within an organisation and define their role in influencing decisions in this quadrant and define a roadmap to migrate ownership of these systems to the CIO.

Consideration 1: Understand use of IT systems

Digital Business: Generally owned by the Chief Data Officer/Chief Marketing Officer function.
Preference to pay for services consumed as and when required (Consumption mentality).
Focus on understanding customer behaviour and gathering customer information.
Comprises of predominately customer facing/interaction systems.
Focus on improving customer satisfaction.
Enables creation of digital alternative products, services and digital business capability.
Systems to enhance customer experience.
Drives products, services and business model innovation.
Multichannel engagement to match lifestyle of customers.
Enables access to new market segments and market reach.
Creates new Revenue streams
Offers personalised customer experience.

Consideration 1: Understand use of IT systems

Consideration 1 analysis should determine what part of the business is being impacted or can be impacted by new technologies.

- Customer Environment – Is technology driving changing customer needs, expectations, experience, fulfilment methods, reach etc (e.g Uber – immediate satisfaction).
- External Business Environment – How does technology impact an organisations products and services to customers, e.g. customer interaction, changing products and services expectations, changing business processes, online and offline requirements, etc (from organization perspective how do you react to customer needs).
- Disruptive Technologies – What are the trends and which part of the businesses sustaining technologies or current business models can be impacted. Can the organisation's business model be impacted by technology driven platform organisations or market disruptors?

Consideration 1: Understand use of IT systems

Disruptive Technologies identified should be mapped to the BIDD model to determine mapping to internal and external IT requirements. It is critical that the initial IT decision process starts with a customer need which may be overtly visible or expressed by the customer or an opportunity to create value for customers.

Consideration 2: Decision Criteria

Consideration 2 – Decision Criteria – What are key criteria that will determine if a technology is selected to be implemented?

- In traditional pipeline businesses Models, financials are a key factor in measuring the success of a business or investment. The results of research conducted in this study indicate that finances (Costs, Revenue, Financial KPI's) feature predominantly as a critical decision criterion for all IT systems amongst CIO, however it may not be the most important when selecting disruptive technologies which may impact current business models and value proposition to staff and customers.

Consideration 2: Decision Criteria

- Some of the most valuable technology driven companies in the world (Apple, Amazon, Uber, Airbnb, Google, Bookings.com etc.) have adopted platform business models and are disrupting companies across all industries.
- The measure of success in the start-up phase of these companies were not financially driven – typical decision criteria to measure success were network effects, number of participants on platforms, value unit, quality of interactions, conversion of consumers to producers, etc.

Consideration 2: Decision Criteria

- CIO's will need to define criteria which is important for systems classified in the different quadrants of the BIDD model. .
- When motivating for the implementation of new technologies, there are basic questions that need to be answered to obtain support for investments:
  - How will this investment reduce the costs of doing business?
  - Will this investment improve the revenue for the organisation?
  - What value will this add to customers or improve market share?
  - Will this investment improve productivity for the organisation?
  - What will the impact be on the overall financial KPI's of the business?

Consideration 3 – Expectations of the CIO

Consideration 3 – Expectations of the CIO - Who is the functional Owner and what is the expectations of the CIO?

If ownership and accountability is vague within organisations, the convergence of independent and disparate systems, due to commoditisation and the pervasive nature of disruptive technologies, will result in a decrease in the ability of organisations to leverage IT as a strategic resource to compete in agile business conditions.

Consideration 3 – Expectations of the CIO

- CIO's in any organisation need to review and understand expectations of them in agile business environments faced with disruptive technologies.
- CEO's in many organisations assume CIO's are accountable for all IT systems within organisations, however this is generally not the case.
- Once the expectations and accountability of CIO's are defined, they can then focus on their area of accountability to add value to organisations.
- From a CIO perspective, they should not assume accountability for all IT systems within organisations without creating visibility of ownership as this could impact their ability to influence decisions or their effectiveness as the CIO.

Consideration 4: Expectations of the Enterprise Architect

- CIO's and business stakeholders would need to clarify what the expectation is of Enterprise Architect regarding disruptive technologies under consideration.
- Many organisations have established Enterprise Architect practices which perform an advisory function to the CIO in ensuring business and IT alignment.
- As most organisations generally have the Enterprise Architect functions reporting into the CIO, it follows that the expectations of the CIO will drive activities and the focus areas for EA's.

Consideration 4: Expectations of Enterprise Architect

- In disruptive technology environments, traditional EA approaches may not be applicable as organisations move from an ownership and constrained mentality to a consumption and surplus mentality.
- Applications classified as per the BIDD model, must be linked to the different schools of thought and this should be used as a guide to determine EA approach and focus in a disruptive technology environment.

Consideration 4: Expectations of Enterprise Architect

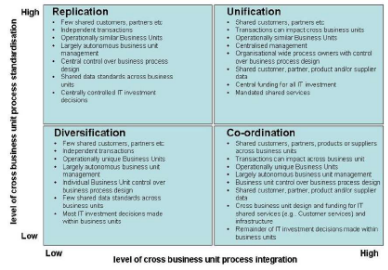
Enterprise Architects is key in ensuring that any IT system selection and implementation is successful, therefore they would need to be guided on where to focus to add the most value to an organisation. Main considerations in this Consideration are as follows:

- What are the changing expectations of the customer and how will the organisation transform to changes in the customer environment?
- What are the technology implications for the business in meeting customer expectations?
- What is the technology implication on the different quadrants of the BIDD model and are the system owners defined?
- What is the expectation of Enterprise Architects from IT Systems owners in assessing the different factors identified in the decision Framework?

Consideration 5: Organisational Classification

Consideration 5 – Organisational Classification – What is the organisations operating model and what systems, people, process and customers are shared?

Courtesy "Enterprise Architecture as strategy – creating a foundation for Business Execution" by Peter Weill, Jeanne W. Ross and David C. Robertson



Consideration 5: Organisational Classification

Consideration 5 – Organisational Classification – What is the organisations operating model and what systems, people, process and customers are shared?

Consideration 5 assesses the classification of an organisation and the extent to which it can impact decision making in organisations.

- Larger organisations may have multiple business units or companies working independently or have a high degree of sharing customers, processes, services etc.
- Different governance processes may result in differing decision processes across organisations, for example, individuals may be mandated to make decisions, or this may be delegated to committees.

Consideration 5: Organisational Classification

- Technology focussed CIO's and Enterprise Architect's may become frustrated due to complicated process or "red tape" in organisations resulting in failure to execute on their mandates which prevents them from adding value to their organisation.
- Some organisations with multiple divisional CIO's who are accountable for IT within their respective divisions, may have a federated governance model. In these types of organisations, the role of the group CIO may be one of providing overall IT standards, policies, shared IT services etc., however business unit specific systems selection and implementation is left to the decision of divisional CIO's.
- In this scenario, decision making on disruptive technologies may be a challenge due to multiple stakeholder interests, it is key that roles and accountabilities are clearly defined in advance to prevent unnecessary delays in the overall organisation adapting to changes in the market.

Consideration 6: Strategic Fit and Value Contribution

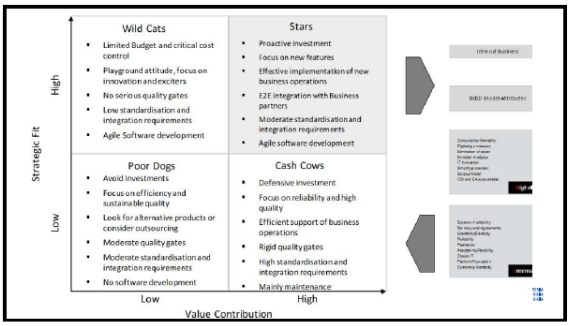
Consideration 6 – Strategic Fit and Value contribution – How does chosen technology fit with organisations strategy and how does it add value to customers identified in Consideration 1?

- Often business strategies and priorities are set by the board, these are then filtered down to IT to evaluate and implement technology that enables business to execute on its strategy.
- Linking IT systems to business strategy and linking IT contribution to business value enables quicker decision making on implementing IT strategies.

Consideration 6: Strategic Fit and Value Contribution

Use - IT Systems Strategic Fit and Value Contribution Matrix

- to classify organisation's IT systems according to Strategic fit and Value to an organisation.



Consideration 6: Strategic Fit and Value Contribution

Use - IT Systems Strategic Fit and Value Contribution Matrix

- To classify organisation's IT systems according to Strategic fit and Value to an organisation.
- A caution in using the BCG matrix is that systems that fall into the different categories may vary based on the maturity of the system and organisation at a point in time.
- Systems could be classified as a cash cow in one organisation may be a dog in another, however the value of this framework is the dialogue that this approach could stimulate within an organisation in a typical multiple perspective decision approach.

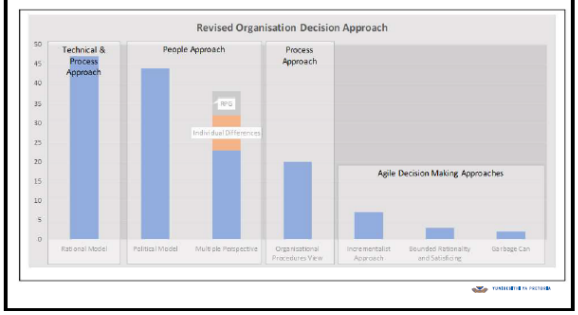
Consideration 7: Organisation Decision Process

Consideration 7 – Organisation decision Process – What is the process to follow when motivating a decision and how does the organisation decide?

- CIO's and Enterprise Architects may find the best technology that can transform organisations, however if they misunderstand organisational dynamics, they may fail in obtaining a decision to start with the implementation.
- Organisations expectations of CIO's are changing from having a deep understanding of technology to focusing on leveraging technology to add value to business.
- There is an abundance of technical solutions currently in the market that can perform various functions, however adoption, implementation and acceptance is generally a challenge.

Consideration 7: Organisation Decision Process

- When motivating for new technology investments, it is important to understand the organisation decision process.
- In many organisations, decision processes are complex, and due to IT's universal application, exponential rate of change of technology and unclear accountabilities, decisions are often delayed or postponed.
- Long decision lead times often frustrates CIO's and IT departments as they are expected to add value however cannot invest in required technology to transform the organisation. Approaches to fast track decisions are not consistent across organisations and are not always successful due to organisational culture or resistance to change.



Consideration 8: External analysis

Consideration 8 –What are competitors doing and what technologies could have an impact on current IT strategies?

- Consumerisation trends have had disastrous consequences for established organisations due to their failure to identify shifts in the industry and respond timeously.
- Disruptive technology trends such as mobility, social networking, cloud, big data and analytics etc., has resulted in the creation of global organisations such as Google, Amazon, Ali Baba, Uber, Airbnb, etc. using platform business models and leveraging network effects to globally disrupt all industries.

Consideration 8: External Analysis

- The importance of timing in order to stay competitive (E-commerce where there was a dot com bubble)
- The emergence of dominant design (Apple / Samsung / Nokia / Blackberry)
- Understanding the eco-systems (High-definition TV did not disrupt since the eco-system was not ready)

Consideration 9: Decision Success

Decision Success (Compliance to Governance, Risk and Compliance)

- A positive IT decision must comply with prevailing governance, risk and compliance frameworks that exists.
- Governance, Risk and Compliance (GRC) was not described as a separate Consideration, however is a factor to be considered in Consideration 6, 7 and 8 in the application of the FIT framework.

Consideration 9: Decision Success

Within an environment that adheres to a multiple perspective approach to decision making, some of the basic generic considerations for any IT investment decisions may be follows:

- Governance: Will IT services consumed (Cloud or Other) be implemented according proper governance and operational processes in line with the Information Technology Infrastructure Library (ITIL) framework or similar frameworks?
- Compliance: Ensure that IT and systems implemented comply to company policy and procedures, laws and regulations of the country or the industry that they operate in.

Consideration 9: Decision Success

- Risks: Have IT risks been identified and sufficiently mitigated in case of failure?
- Risks: What are consequential implications of an IT system failure and can this be financially quantified?
- Risks: Will there be any health and safety risks related to the implementation or failure to implement an IT system?

Thank You