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

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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 the resultant technology disruptions in the workplace. Disruptive technologies are changing the rules of competition in organisations. Most chief information officers agree that there could be significant value in utilising new technology to create a competitive advantage in an agile world; however, in practice, the adoption and implementation of newer technology occur relatively slowly. There is very little research on factors influencing strategic IT decisions from a perspective of disruptive technologies. The objective of this study was to investigate critical factors that guide strategic IT decision-making in an agile business context. Using a literature review, various factors that had an influence on strategic IT decision-making in organisations were identified. The factors were extended and confirmed with data from semi-structured interviews resulting in the Framework for IT decision-making and a model for the classification of IT systems, which provide CIOs with comprehensive guidelines to make strategic IT decisions in the midst of disruptive technologies.

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1 INTRODUCTION

The past few decades have witnessed a significant increase in disruptive technologies and the resultant radical upheaval of established work practices, products and markets. The objective of this research was to understand changes in the IT landscape from a disruptive technology perspective and to formulate a framework for strategic IT decision-making in an agile business environment. CIOs are recruited into organisations and expected to play a strategic role. However, in many instances they end up very frustrated, spending most of their time addressing operational issues (Bongiorno et al., 2018; Chen et al., 2021; Heller, 2013; Rizzo, 2018;

Varanini, 2018). Organisations have different strategies, core competencies and value propositions to the market and their customers. CIOs with different experience, qualifications, skills and abilities 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 (Narayan, 2015; Rizzo, 2018). 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 (Barlow, 2013; Schmidt & Cohen, 2013; Schwab, 2016). Except for the work done by Selkälä (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 to decide on what technologies to adopt that will maximise business value and allow them to compete in agile business conditions.

Decision-making in a disruptive technology environment seems to be a relatively new concept in research owing to the limited availability of studies on this topic. This seems rather surprising given the massive impact of disruptive technologies across all organisations in every industry. This research argues that if there is a 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 compete in disruptive market conditions. Strategic IT decision-making in a disruptive environment is influenced by various internal and external factors.

Although several studies on topics such as disruptive technologies, IT governance, role of the CIO, decision theory, IT and EA value creation were found, little research on strategic IT decision-making in agile business conditions from a disruptive technology perspective could be found. The gap in the current literature is that most research on decision-making focuses on processes (Petrick & Martinelli, 2012; Selkälä, 2016; Tamm et al., 2014) without considering disruptive technologies that have a direct impact on strategic IT decision-making in an organisation. Existing studies taking disruptive technologies into account focus on how to promote the strategic role of the CIO but not on factors influencing their IT decision-making (Chen et al., 2021; George & Howard, 2020).

This research intends to understand factors influencing strategic IT decision-making and to suggest a framework (referred to as the FIT 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.

In this paper, we first provide a background to the study including the existing frameworks that were scrutinised in the first round of data analysis to get related factors. This is followed

by a description of the research methodology that was followed to derive the framework. The results from both the existing frameworks and the qualitative data collection are presented in Section 4, with a discussion on the decision-making framework that is complemented by the BIDD model that can assist the CIO or other decision-makers as a guide in making technology investment decisions and identifying areas of focus. The paper concludes with a discussion on the use of the FIT framework.

2   BACKGROUND

2.1   Changes in the technology landscape

The disruption caused by the internet revolution has resulted in an exponential increase in the growth of new technologies and the resultant technology disruptions in the workplace (Chambers, 2015; Schwab, 2016; Tilson et al., 2021). Many firms do not grasp new technology trends early enough to improve business processes and capitalise on these emerging technologies (Christensen et al., 2015; Christensen & Christensen, 2003; Ebert & Tavernier, 2021).

With the rapid changes in the technology landscape, CIOs and key decision-makers need to learn to manoeuvre through 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 (Heller, 2013; Rizzo, 2018).

Traditional technology adoption life cycles are no longer relevant for companies operating in a hyper-competitive environment (Rogers, 2016). 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 & Christensen, 2003; O'Reilly & 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 and digital business (Schwab, 2016). CIOs' decisions to adopt or ignore any of these trends could have a significant impact on any business if due process is not followed (O'Reilly & Tushman, 2016; Rizzo, 2018; Roberts & Watson, 2014). 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.

2.2   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

& Christensen, 2003; McNish & Silcoff, 2016; O'Reilly & Tushman, 2016). Consumer-driven technologies such as mobile, social and cloud increase customers' service delivery expectations, which force organisations to adopt digital business strategies (Rizzo, 2018; Schmidt & Cohen, 2013; Schwab, 2016). Companies that do not adapt to changing market conditions could find themselves going down the same path as Kodak, Nokia, Blackberry, Blockbuster and many other organisations that obstinately focused on the source of competitive advantage that made them successful initially; their inability to adapt to new technology trends in time caused their downfall (Chambers, 2015; Christensen et al., 2015; Christensen & Christensen, 2003).

2.3 Changing expectations and demands on CIOs

The expectations for CIOs are changing. They are now expected to focus more strongly on business enablement and adding business value as opposed to being IT specialists focused on operational issues (Barlow, 2013; Bongiorno et al., 2018; Chen et al., 2021; Heller, 2013; Rizzo, 2018). Technology is now part of mainstream business, as it requires significant capital investment and operational expenditure that, in turn, attract the attention of most business executives, to realise a return on investment (Heller, 2013; Rizzo, 2018). Technology also permeates every aspect of business which implies that IT is no longer peripheral; it dictates how business is conducted. CIOs are now faced with the 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 (Adner & Kapoor, 2016; Sinek, 2011; Sutherland & 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 & 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 (Heller, 2013; Raskino & Waller, 2015; Rizzo, 2018). 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 (Barlow, 2013; Heller, 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 roles and expectations of CIOs are changing (Bongiorno et al., 2018; Chen et al., 2021; George & Howard, 2020; Rizzo, 2018; Varanini, 2018). CIOs across a broad range of industries all seem to be faced with similar challenges, yet little research that guides CIOs on how to address the changing expectations of them has been done. CIOs with varying skills and experience synthesise information from various sources to formulate IT strategies that they believe are the best for the company (Capitani, 2018; Demuru & Katinis, 2018; Varanini, 2018). The absence of frameworks or guidelines for strategic IT decision-making could result in inconsistent decisions on

technology choices since 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 with understanding the practical implications of these technologies in legacy business applications and business processes (Raskino & Waller, 2015). The uncertainty created by the pace of technology changes slows the adoption of new technologies in business (Brinker, 2013; Hope et al., 2011; Peters, 2014). The reactive responses of CIOs result in business leaders making a significant percentage of IT and IT budget expenditure decisions outside the control of the CIO (Heller, 2013; Roberts & 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 (Bongiorno et al., 2018; Evans, 2003; Peters, 2014).

Many organisations currently have technical CIOs that have been promoted through the ranks due to their years of experience (Heller, 2013; Maffè, 2018; Varanini, 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 the changes brought about by new technology, to create business value (Barlow, 2013; Demuru & Katinis, 2018; Heller, 2013; Hope et al., 2011; Rizzo, 2018; Roberts & Watson, 2014).

2.4   Impact of COVID-19 on business strategies

The COVID-19 pandemic at the start of 2020 was a catalyst for accelerating digital transformation across businesses in all industries globally. Lockdowns moved the world online resulting in many employees working from home and numerous businesses pivoting to hybrid digital business models to maintain operations and preserve cash flows. A McKinsey online Global survey of executives between July 7 to July 21, 2020 (McKinsey, 2020), found that companies accelerated the digitization of customer and supply chain interactions and internal operations by three to four years as a result of COVID-19. The global pandemic forced CIO's and company executives to make technology decisions that resulted in business model innovations which enabled them to adapt and survive during a crisis. Decision making on technologies in existence, not new technologies, was critical for the digital transformation of businesses to survive in the new normal. CIO's will need to continuously assesses changes in the technology landscape and fast track IT decision making to remain competitive in any disruptive conditions (McKinsey, 2020).

3   EXISTING STRATEGIC IT DECISION-MAKING FRAMEWORKS

In information systems (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 that addressed how strategic IT decisions should be made within a disruptive technology environment were found in the literature consulted.

Nevertheless, the literature review revealed four studies that addressed strategic IT decision-making. These will be briefly analysed below.

3.1 CIO decision-making – Issues and a process view

Selkälä (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. Selkälä (2016) could find little research on the CIO decision-making process, as most CIO-related research focused on IT governance, IT and business alignment, and IT investments describing the concerns of CIOs. CIOs across organisations perform similar activities, e.g., determining key issues, IT governance and IT value creation, all of which require decision-making. No research could be found to guide decision-making processes for CIOs.
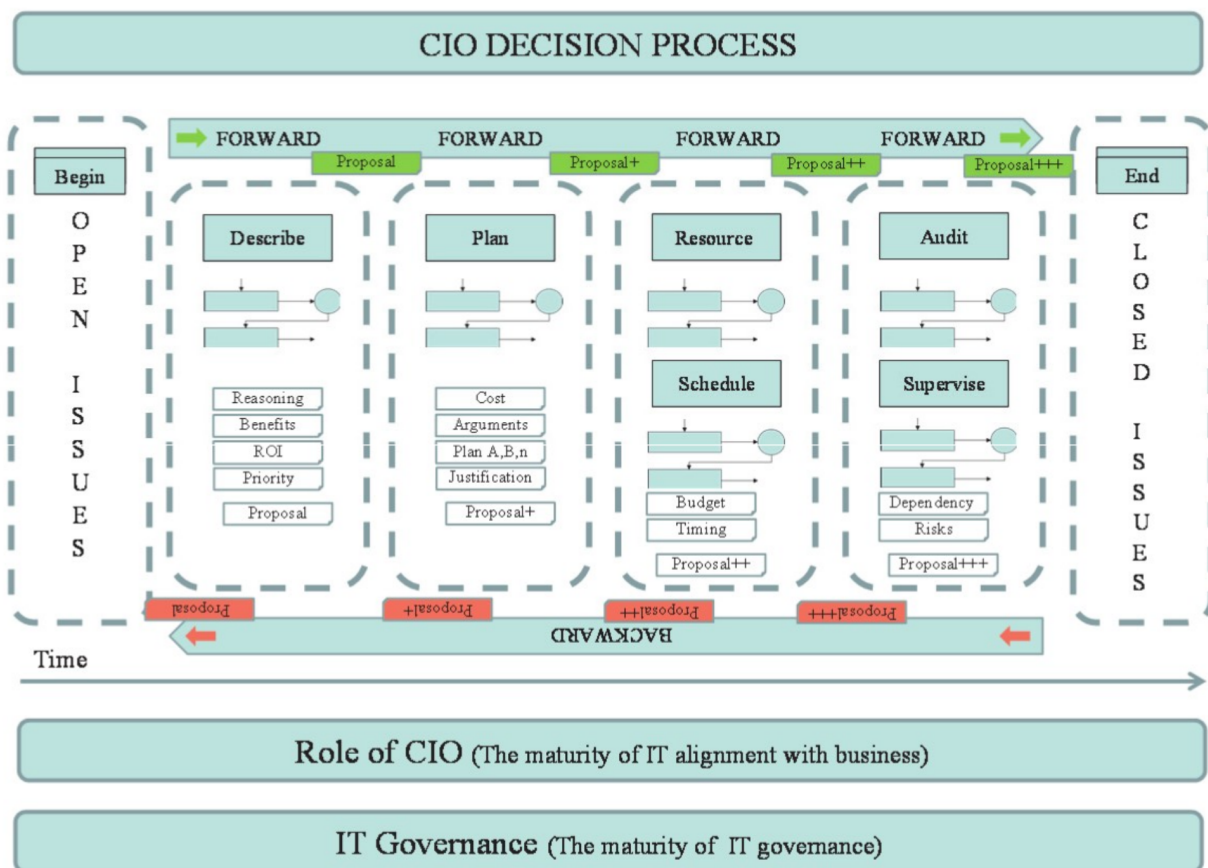

Figure 1: The CIO decision-making process [a]

[a]Selkälä (2016)

Selkälä (2016) focuses on CIO decision-making processes and suggests that key IT manage-

ment issues should be "managed with a good and solid process that takes into consideration the organisational benefits". The key issues being addressed by CIOs are mainly related to cost reductions and change management. Ongoing tasks include IT platform development and the alignment of IT with business (Selkälä, 2016).

The IT decision-making model proposed by Selkälä (2016) is shown in Figure 1. 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 how issues will be addressed by the CIO (Selkälä, 2016). The process description also defines what action will be taken and what information is needed for making decisions.

Figure 1 focuses on the decision-making process that CIOs follow in entities, to address identified issues in a context of conflicting values. This study focuses on guiding CIOs on "how" to arrive at a decision that could be implemented in an organisational context by following a structured process. Table 1 displays the detail of each step in the decision-making process.

Table 1: CIO decision-making process elements [a]

Stage	Factor
Begin	Issue
Describe	Return on Investment IT compatibility Priority Estimation Proposal text
Plan	Plan A, B, C, … Cost estimates Justification Summary
Resource and Schedule	Budget Resourcing plan Financial planning and timetable
Audit and supervise	Dependency check Privacy and data protection Laws and regulation Information security and risks Key human resource allocation
Decide	Conditions fulfilled

[a]Selkälä (2016)

3.2 Model of strategic IT decision-making process

Senior executives in most organisations need to make strategic IT decisions that are often important, though infrequent (Tamm et al., 2014). These decisions are challenging because of uncertainty about aspects under consideration, as well as costs and expected benefits. Tamm et al. 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 is that if the decision-making process is better understood, 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". Figure 2 shows the strategic IT decision-making model (SITDM Model) by Tamm et al.
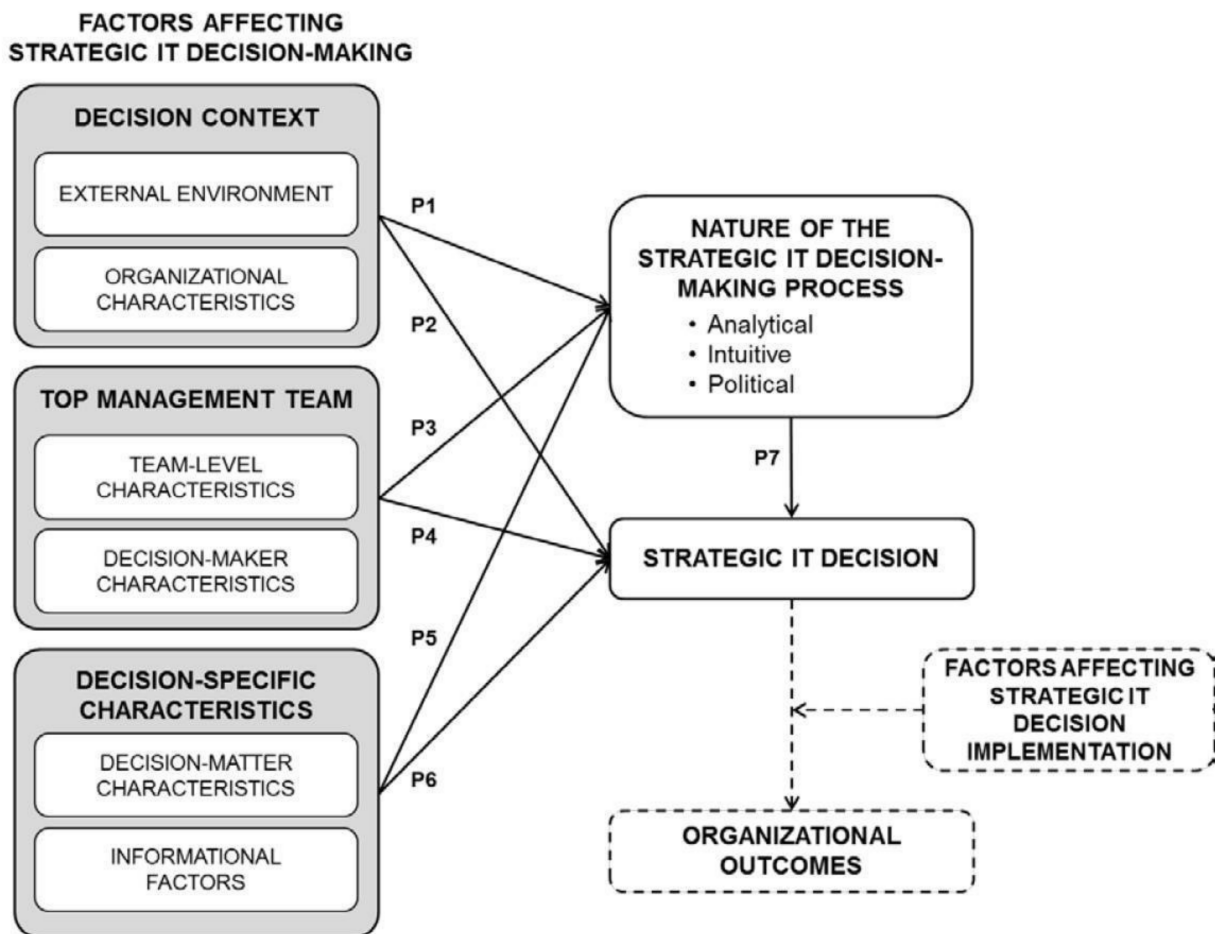

Figure 2: A Strategic IT Decision-Making Model (SITDM) [a]

[a]Tamm et al. (2014)

3.3   Driving disruptive innovation: Problem–finding and strategy–setting in an uncertain world

Petrick and Martinelli (2012) developed a ten-step strategic road-mapping method to help companies develop an external view of the future that 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 3 provides an overview of the strategic road-mapping framework proposed to develop an external view that will drive strategy setting and execution in a disruptive innovation environment.
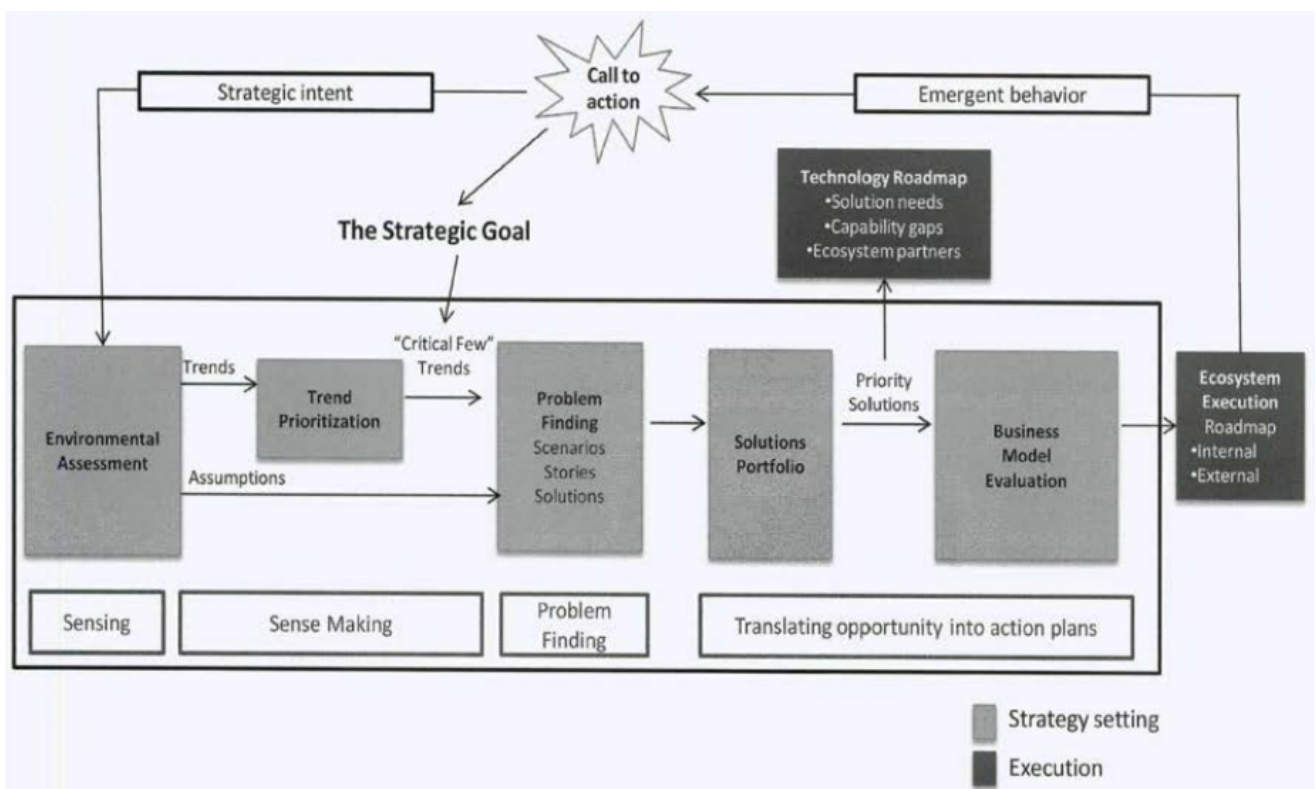

Figure 3: Strategic road-mapping to translate strategy into action [a]

[a]Petrick and Martinelli (2012)

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 & Martinelli, 2012):

- 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.

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. Thereafter, the method recommends a series of steps that consider environmental factors, technology road maps, business model evaluation and execution in an ecosystem.

The proposed method 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 & Martinelli, 2012). The framework is more process-focused; however, some of the factors mentioned can be useful for CIOs to consider when making strategic IT decisions.

4   RESEARCH METHODOLOGY

Since 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 and therefore, an interpretive philosophical paradigm was selected.

The research approach adopted in this study was to ensure that the knowledge created advanced theoretical understanding of the phenomena under study and at the same time addressed practical business or managerial issues. The aim was to address the "research-practice gap" (Rousseau, 2006) managers and CIOs rely on previous experience and not on available theoretical knowledge. This study intended 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.

The design science research (DSR) framework selected for this research was based on the model proposed by Vaishnavi and Kuechler (2004). The DSR approach was used in exploring a range of business and managerial issues and focused on theory-building through a combination of inductive and deductive approaches, owing to the nature of the problem being researched (Saunders et al., 2009). The existing frameworks discussed in Section 3 were used to suggest guiding questions for the literature study as discussed in Section 5.

An inductive research approach was then used to create a framework, using secondary data confirmed by primary data. 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. Since 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. Secondary data sources used in this research were mainly from books, articles, research papers and journals.
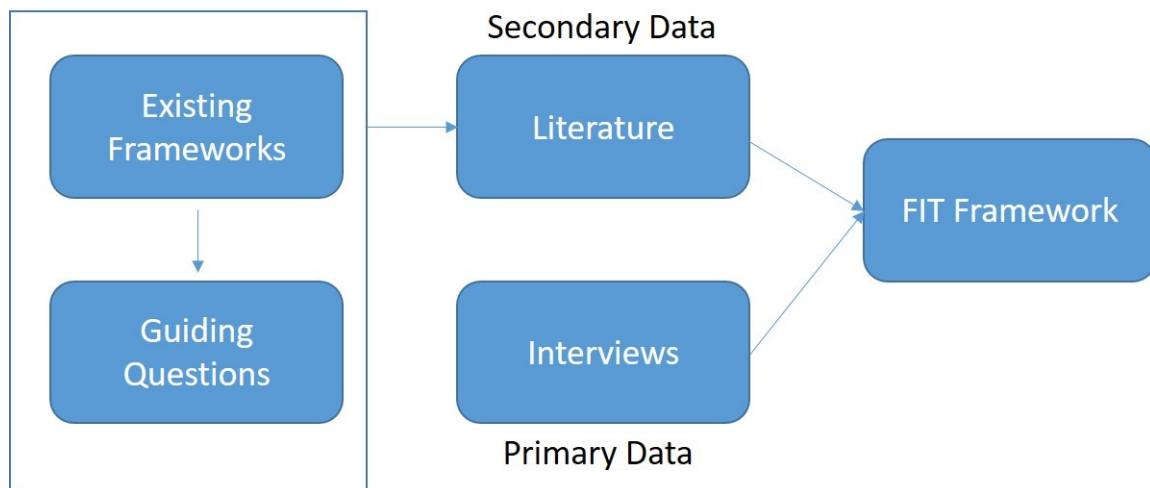

Figure 4: Research process

For primary data, 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 in an agile environment. This population represented a cross-section of organisations in industries that have been or may be affected by disruptive technologies. The selected participants 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, South Africa and the Netherlands who had significant IT consulting experience in global organisations. Although the focus of this study is on CIOs' decision-making, participants from other groups were also included such as enterprise architects and business executives who influence IT decisions.

Data from interview transcripts were analysed using thematic coding analysis. The collected data was analysed qualitatively using ATLAS.ti to reach conclusions and extract theoretical insights that form the basis of the proposed framework. 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 data collection and coding analysis process ended when theoretical saturation was reached and no further themes or concepts emerged (Bryman & Bell, 2011). The emerging themes and concepts were used to confirm and enrich the factors identified from the secondary data as is explained in the next section.

5   DEVELOPMENT OF THE FRAMEWORK

Several studies on topics such as disruptive technologies, IT governance, the role of the CIO, decision theory, IT and EA value creation were found, 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 focuses on a topic, process or technology without considering contextual factors or disruptive technologies that have a direct impact or that influence strategic IT decision-making in an organisation.

That said, the different strategic IT decision-making models presented in Section 3 served as a useful starting point in the development of a strategic IT decision framework. The CIO decision-making process model of Selkälä (2016) – apart from listing the steps on how decisions are made by CIOs – also highlights the importance of providing justifications for why the decisions are made (see Table 1).In the strategic IT decision-making model by Tamm et al. (2014), the focus is on the context, the decision-making team and the decision-specific characteristics, i.e., more on how decisions are being made and by whom. Petrick and Martinelli (2012) provide a road map to help companies develop an external view of the future that can assist in justifying and driving change. The models under discussion, therefore, consider the reasons for making IT decisions (why), the decision-makers (who) and the way in which decisions are made (how) as important factors influencing IT decision-making. As pointed out before, none of the models considers disruptive technologies that have an impact on such decision-making. To address this shortcoming, the suggested framework will also address the influence that different categories of technologies have on the strategic IT decision-making process (what).

Four guiding questions were thus formulated to guide the analysis of the secondary and primary data. The literature review focused on identifying factors emanating from IS and management theory that influence strategic IT decision-making in agile business conditions. The four questions are provided below:

Why – Why should organisations consider or react to disruptive threats or innovation? What is the rationale for IT decisions in a disruptive environment?

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 made and fast-tracked within organisations in an environment faced with a continuous stream of disruptive technologies?

Key topics were thereafter consolidated into strategic decision factors which form the basis of the strategic IT decision framework. 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 research and are discussed in Section 6.

The framework verification process compared the output of the thematic coding analysis of interview transcripts to the DMF's identified from existing literature. The approach followed was to determine if each of the codes could be logically mapped to the DMFs. During the mapping process, certain codes were found to be linked to multiple factors. Interview transcripts were analysed in greater detail to understand the context, intent and relationships between defined codes. During this process, the identified codes were analysed in the context of the proposed decision framework to determine if codes 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 that influenced strategic IT decision-making were identified, as shown in Table 2. This table also provides a selection of the literature from which the DMFs were derived.

6   THE FACTORS INFLUENCING DECISION-MAKING

The following section gives a brief description of the decision-making factors (DMFs) with references to responses from CIOs and identifies key criteria that influence activities and decisions made by CIOs in carrying out their mandate in an organisation.

Strategic fit and value contribution: This factor focuses on whether the CIOs consider the strategic nature of IT systems and how this contributes to business value when motivating strategic IT decisions.

In this part of the research, questions focused on the 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 (Ebert & Duarte, 2018). Organisations like Facebook, Twitter, WhatsApp and Amazon may not have existed if traditional financial investment models had been used during the early stages of their development, because revenue generation was a secondary consideration and the source of revenue was uncertain.

The outcome of the discussions with CIOs indicated that in a disruptive technology environment, it is key to understand how a disruptive technology or innovation influences or aligns with 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.

External analysis: This factor focuses on the understanding of the impact of disruptive technologies and external factors on strategic IT decision-making in an organisation. The literature review done for this study highlighted the influence of timing and external

Table 2: DMFs as identified from literature

Guiding questions	Decision-making factors	Sources
Why	Strategic fit and value contribution	Bongiorno et al., 2018; Capitani, 2018; Castello et al., 2018; Chambers, 2015; Christensen et al., 2015; Gans, 2016; George and Howard, 2020; Lapalme, 2011; Maffè, 2018; Messina, 2018; Rizzo, 2018; Selkälä, 2016; Varanini, 2018
	External analysis	Bongiorno et al., 2018; Capitani, 2018; Castello et al., 2018; Chambers, 2015; Christensen et al., 2015; Gans, 2016; Lapalme, 2011; Maffè, 2018; Messina, 2018; Petrick and Martinelli, 2012; Rizzo, 2018; Selkälä, 2016; Tamm et al., 2014; Varanini, 2018
How	Organisational decision process	Capitani, 2018; Chambers, 2015; Christensen et al., 2015; Gans, 2016; Messina, 2018; Rizzo, 2018; Tamm et al., 2014; Varanini, 2018
	Organisational classification	Castello et al., 2018; Gans, 2016; Messina, 2018; Rizzo, 2018; Tamm et al., 2014
	Governance, risk and compliance	Dittmar and Kobel, 2008; Li et al., 2021; Selkälä, 2016; Weill and Woerner, 2013
Who	Expectation of the CIO	Bongiorno et al., 2018; Capitani, 2018; Castello et al., 2018; George and Howard, 2020; Maffè, 2018; Messina, 2018; Rizzo, 2018; Varanini, 2018
	EA approach and maturity	Bongiorno et al., 2018; Capitani, 2018; Castello et al., 2018; Gans, 2016; Lapalme, 2011; Maffè, 2018; Messina, 2018; Rizzo, 2018
What	Classification of IT systems	Bongiorno et al., 2018; Capitani, 2018; Castello et al., 2018; Gans, 2016; Maffè, 2018; Messina, 2018; Rizzo, 2018; Varanini, 2018
	Decision criteria for IT system	Bongiorno et al., 2018; Capitani, 2018; Gans, 2016; Maffè, 2018; Messina, 2018; Tamm et al., 2014; Varanini, 2018

analysis on strategic IT decision-making in fast-paced, agile market conditions (Maffè, 2018; Rizzo, 2018). 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.

During the interviews, 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 include disruptive technology misconceptions, the impact of disruptive technologies on business, industry analysis, timing, ecosystems, risk and complexity, current investments, and sunk costs and enablers.

For example, for the theme "impact of disruptive technologies on business", participants could explain its 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 (sic) 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.

Organisational expectations of CIO: This factor focuses on understanding the role of the CIO in an organisational context and the expectations of the organisation's multiple stakeholders about contributing to business value. 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.

Enterprise Architecture approach: This factor focuses on the understanding of IT enterprise architecture and its relevance for and influence on strategic IT decision-making. In the current disruptive business context, IT can play a critical role in influencing business strategy; however, investment decisions must also align with prevailing business objectives.

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; yet this methodology can lead to frustration, as it seems to be effective in documenting and describing artefacts, products, services and architecture which may not be applicable in a disruptive technology environment faced with rapid changes.

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 although its contribution to strategic decision-making is limited. In most cases, they are involved in consulting, designing and planning related to classic IT systems in organisations. Once decisions about the systems to implement have been made, EA plays a vital role in ensuring successful planning and implementation in organisations.

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.

Organisational decision process: This factor focuses on the understanding of key decision criteria, the decision processes in an organisation and the influence of stakeholders in decision-making. The two most prominent decision criteria that featured in almost every discussion were the 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. The key decision criteria for CIOs in the organisation decision process is given in Table 3 with some of the comments received by interviewees.

This factor also focuses on the understanding of the nature and characteristics of an organisation and how these influence strategic IT decision-making. An interesting observation

Table 3: Key decision criteria for CIOs

Decision criteria	Comment from interviewees
Costs	*Of course, wherever else you could automate, where you save people you would reduce – you would improve your costs situation on(sic) the long run. So those were the business drivers.*
Customer Focus	*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.*
Revenue	*They talk about three things and two of them were finance; making money, save[ing] money and then compliance.*
Business strategy 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 …*
Productivity improvement	*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.*
Other evaluation criteria	*Decision criterion(sic) that seem to be gaining prominence in South Africa following recent media articles relating to state capture are the following:* • *GRC (Governance, Risk and Compliance)* • *Legislation* • *Audits* • *Reputation impact*

made during interviews 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 the 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. 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.

All the participants interviewed generally agreed 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.

Organisational classification: During the literature review, the influence of organisational classification on strategic IT decision-making was highlighted based on characteristics, operating model, design, governance and nature of business (Castello et al., 2018). As indicated above, IT generally supports and enables business strategies, therefore the focus should first be on business before focusing 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. Discussions with participants in this section of the interviews focused on understanding organisational characteristics and their influence on decision-making in a disruptive environment. A typical large enterprise may have many companies or operations/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, more agile companies.

Participants indicated that for CIOs to be successful, it is imperative that they understand the characteristics of an organisation before focusing on the detailed merits of systems features and functionalities. The top five considerations that need to be considered by the CIO during decision-making include: *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 the 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 and licensing 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.

Governance, risk and compliance: Although this may not seem to be a factor that influences strategic decision-making, it is a critical factor that must be considered in the implementation of any IT system in an organisation. It was also observed that participants who spent most of their time on internal IT systems, or in operational and tactical IT strategy execution, focused more strongly on risk as a key factor to guide or influence decision-making.

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 digitisation 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.

Risk: Some of the participants expressed the view 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, it may be relevant to highlight business impact, loss of revenue, risk etc. to speed up decision process.

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 to 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.

Classification of IT systems and decision criteria for IT systems: These factors focus on the understanding of whether all IT systems used in an organisation are to be treated equally when strategic IT decisions are made. 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. 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.

The findings from the analysis revealed that most CIOs acknowledge that although they spend a significant amount of time focusing on maintaining internal IT systems, their focus should move towards enabling digital business using technology for their organisations. The analysis also revealed that most CIOs do not spend time on business IT, since 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 (Messina, 2018).

The BIDD model

During the literature review, it was clear that in creating a strategic IT decision framework, IT systems should be classified based on their primary function in organisations. Because IT

permeates all functional areas in businesses 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 and business have merged, resulting in no clear distinction between them (Heller, 2013). Technology has become the cornerstone of business and a 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.

IT systems deployed in organisations enable businesses and their 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, creating challenges for decision-making in an environment where IT becomes commoditised and permeates organisational boundaries and ecosystems.

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 a blurring of the lines between CIOs and business unit executives that can sometimes lead to confusion about who makes the decisions 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.

To differentiate IT systems and their characteristics in organisations, the researcher proposed the BIDD model shown in Figure 5. In using the FIT framework defined in Figure 6 the different decision factors identified should be aligned to the BIDD model. In an environment faced with the 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.

The BIDD model classifies all IT systems used in an organisation into four distinct categories. Each of these has 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 that CIOs are accountable for everything IT-related. This can result in CIOs being perceived as not adding value to the business or not using IT to create a 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.

Classifications of systems also help in determining the CIO's focus areas that will add the
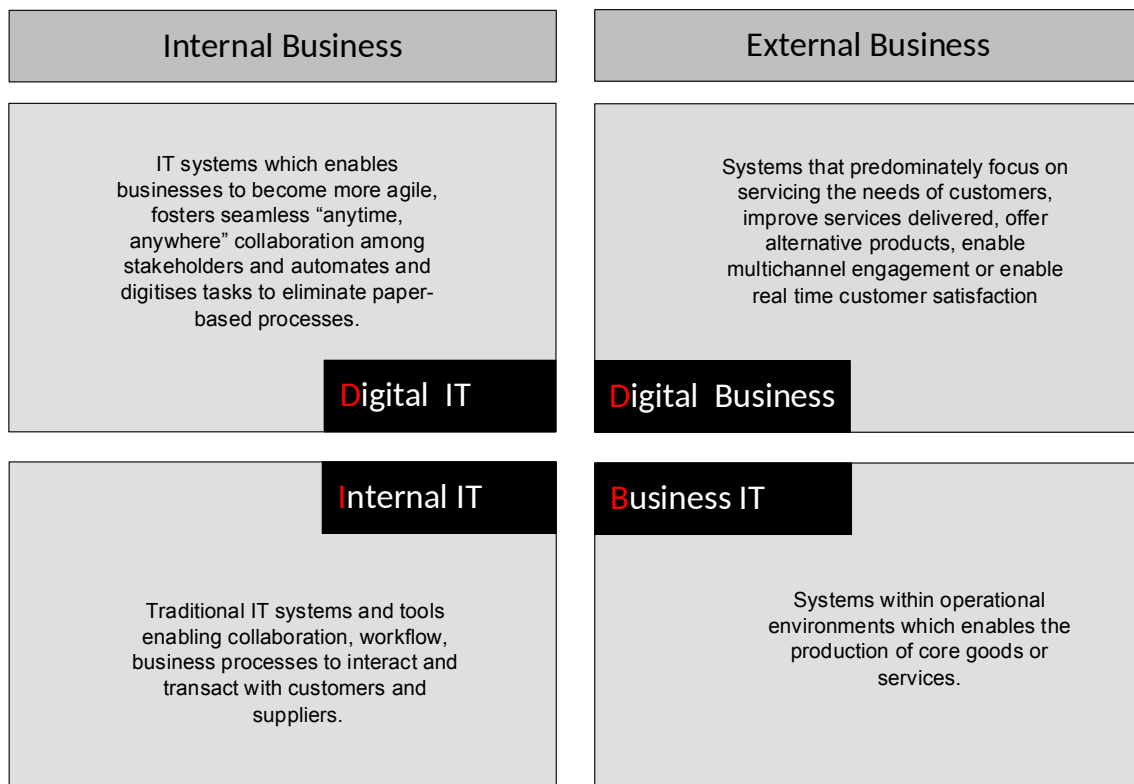
Figure 5: BIDD model

most value to the organisation and their peers. This approach will assist in creating aware-ness among stakeholders on IT ownership and where most of the time and budget are spent. Company executives will need to decide whether current investments support organisations' strategic intent in an agile business environment.

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.

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.

7   THE FIT FRAMEWORK

The output of this research is the FIT Framework (framework for IT decision-making) as shown in Figure 6. The FIT framework highlights nine factors that would provide CIOs with a com-prehensive overview of "why" a technology is required, "who" should be accountable for

the technology, "how" can decisions be made and fast-tracked within organisations in an environment faced with a continuous stream of disruptive technologies and "what" should be considered when making technology decisions in a disruptive environment These factors were identified during the literature review and the interviews with CIOs (and was discussed in more detail in Section 4).

Disruptive Technologies

External Analysis

People

Organisational
Expectations of the CIO

EA Approach

Technology

Classification of IT
Systems

Decision Criteria for IT
Systems

Organisation

Strategic FIT and Value
Contribution

Organisational
Classification

Organisational Decision
Process

Supply side disruption

Demand side disruption

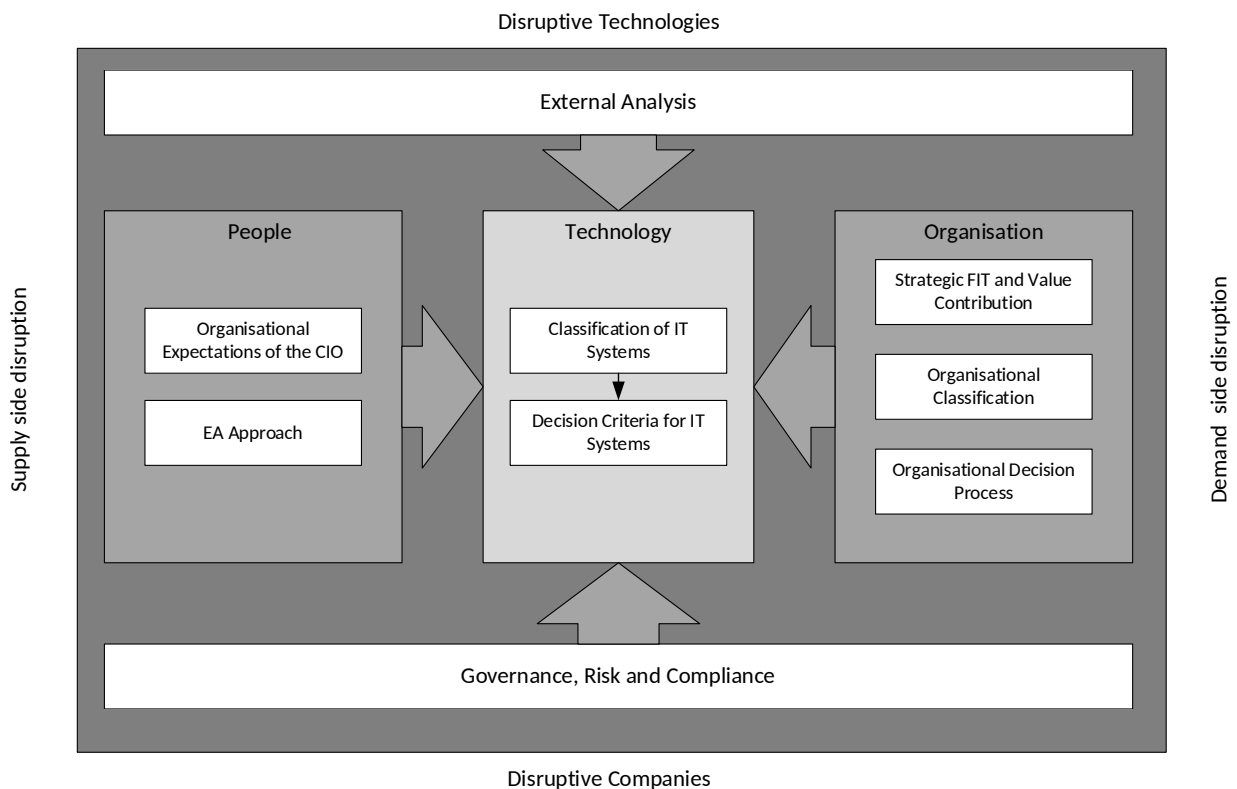Governance, Risk and Compliance

Disruptive Companies

Figure 6: FIT 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 continually 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 6.

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.

A critical component in the framework is to understand the technology landscape and to classify systems based on their purpose in an organisation. 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 (Business IT, Internal IT, Digital IT, Digital Business) model developed in this research.

8   GUIDELINES FOR THE IMPLEMENTATION OF THE FIT FRAMEWORK

The FIT 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 or not a factor applies. 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 much time focusing on technology specifications and functionality. The framework guides CIOs to consider other factors since they are all equally important when a decision has to be made on new technology investment.

There are nine steps recommended for CIOs in applying the FIT framework:

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 of IT systems 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).

9   DISCUSSION AND 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 they fear making the wrong decision in a complex technology environment. When considering the numerous available technology options that are continuously evolving, in many cases, the easiest decision is to make no decision and maintain the status quo.

The 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.

The FIT framework addresses the potential research gap that arises in research studies and makes a valuable contribution to management, businesses and institutions by providing practical guidelines to organisations that depend on IT to create a strategic advantage in agile market conditions. This research intended to address the "research–practice gap" (Rousseau, 2006) where managers and CIOs rely on previous experience and not on available theoretical knowledge. Aspects relating to basic and applied research that apply 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 the understanding of a business or management problem when faced with disruptive threats. Understanding challenges allows for deliberate decision-making on strategic approaches to follow.

The findings provide a solution to or guidelines for 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.

The FIT 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, clarifying the ownership of systems, understanding the organisational context and offering guidelines to fast-track strategic IT decision-making in organisations.

In summary, this study 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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