Big Data Analytics Strategy Formulation: A Case Study of Big Data Analytics Organizations in South Africa

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Abstract

Storing data as big data in isolation lacks inherent value until it undergoes analysis to yield valuable insights. The main goal for organizations investing in big data analytics (BDA) for digital transformation is to enhance decision-making and generate organizational value. However, most organizations struggle to improve performance or gain a competitive advantage from BDA insights. This is primarily due to a failure to formulate and articulate BDA strategies to digitally transform business outcomes by making better insightful business decisions. As a result, top management continues to grapple with pervasive BDA issues that they find difficult to comprehend.

This research explores the foundational underpinning components that inform the formulation of a BDA strategy for organizations in South Africa. The importance of the South African context is that South Africa is classified as a leading emerging economy in Africa, with the potential to bridge the digital divide between developed and developing countries on the global market. Introducing BDA technologies can benefit South African organizations across multiple industries by enabling equitable digital economy participation in order to compete with global organizations and develop much needed future data analytics skills on the African continent. The research followed a general inductive approach, through a multiple case study of two prominent BDA organizations in South Africa. The research was conducted as a cross-sectional study and followed an inductive approach to formulate theory based on gathered evidence. In addition, a conceptual framework guided research concepts and principles to be explored through the inductive experience.

The empirical findings unveiled twelve key themes that inform the formulation of a BDA strategy in South African organizations, categorized into internal and external organizational components. Internally: Organizations require well-articulated BDA *business goals and objectives* that are aligned with the required, *BDA techniques* to be utilised and executed, by the *competent people* possessing essential *skills* to manage BDA complexities brought about by the various *big data characteristics*. The organizations have to utilize, *technologically* advanced tools from suppliers to further enhance, their competitive advantage in the market they operate, as outlined by the determinants of *Porter's 5 Forces model*, in a *cost-efficient manner*. Simultaneously, organizations must consider external components such as, the *legal and regulatory* climate, *social trends, economic factors*, *customer behaviour* and *competition outlook*. The amalgamation of the BDA strategy components is crucial for delivering valuable business outcomes that surpass BDA investment costs.

The research contributes to the field of Information Systems by providing a novel model that enriches extant literature and helps South African organizations with guidelines to follow when

formulating a BDA strategy, by identifying and outlining the key foundational components that should inform a BDA strategy.

Keywords: Big Data, Big Data Analytics, Strategy, BDA Strategy.

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My supervisor Professor Maureen Tanner of the University of Cape Town, for her invaluable guidance, patience, presence and providing feedback throughout the research process. You also enabled me to challenge and critically think about my work. My employer, for allowing me the time to learn and opportunity to grow. Candice Jacobs and Samantha Rhodes-Minnies for driving participation from their work colleagues within their respective organizations. Most importantly, all the research participants for showing their unselfish support towards the study and without your input this study would not have been possible.

Dedication

Lastly, I would like to dedicate this dissertation to my dearest wife, Shingirai Alanna Kondo, for encouraging, walking the journey with me and my two boys, Seán & Liam Kondo, for allowing me to trade their play time for my study hours knowing that “Papa” will always make-up time to play with them later.

Table of Contents

Table of Figures

Table of Tables

1 Introduction

The digital era has necessitated the need for organizations to have effective strategies to manage their operations (Choi, Wallace & Wang, 2018). Thus, identifying suitable strategies to implement technologies and processes becomes pivotal in achieving desired business outcomes (Aneato, 2020). According to Hunger and Wheelen (2021), strategy is defined as a master plan on how an organization will meet its mission and ambitions. A well-crafted strategy is important for an organization to sustain a competitive advantage (Nwachukwu, Chladkova & Fadeyi, 2018). Big Data Analytics (BDA) has been heralded to be one of the crucial pillars of the fourth industrial revolution (4IR) that has enhanced data-driven performance, leading to competitive advantages for organizations (Ramadan et al., 2020). Meanwhile Dong and Yang (2020), define BDA as special applications that manage, prioritise, and analyse big data for a specific business objective, such as discovering knowledge, predicting business outcomes, aiding decision-making, and establishing industry competitiveness.

This leads to the definition of a BDA strategy. A BDA strategy is a master plan that consists of fundamental components such as Porter's 5 competitive forces, emerging technologies, BDA techniques and big data characteristics that help organizations create value and establish a long-term competitive advantage through big data analytics (Amiri & Engelen, 2022; Corte-Real et al., 2019; Williams, 2016). For instance, emerging technologies such as cloud computing, machine learning, sensor networks and the ubiquity of the Internet of Things (IoT) influence the BDA strategy by offering new solutions that help organizations create business opportunities by revolutionising their operations and mitigate existing business challenges (Pedro et al., 2019). A coherent BDA strategy enables organizations to make better data-driven decisions that can augment their chances of achieving better business outcomes (Popovič et al., 2018). South African organizations are increasingly realising the value of BDA technologies and how BDA has the potential to enhance decision making, improve operational efficiency and establish industry competitiveness (Lufti et al., 2022). To help establish competitiveness, South African organizations can incorporate Porter's 5 Forces model into an organizations BDA strategy. This allows the organization to focus its analytics resources on key areas driving meaningful data driven insights that enhance business performance.

The next section discuses BDA background and introduction, problem statement, research questions, objectives, and research contributions.

1.1 Background

While the digital era has necessitated the need for organizations to have effective strategies to manage their operations (Choi et al., 2018), organizational leaders must leverage valuable

business insights from large amounts of available heterogeneous data to make better data-driven decisions that can improve business performance (Maritz, Eybers & Hattingh, 2020a). However, in this volatile business environment, characterised by rapid technology advancements, not all organizations have successfully managed to translate the potential of BDA capabilities into business value or realise improved business performance (Maritz et al.,2020a; Mikalef et al., 2019; Müller, Fay & Brocke, 2018).Therefore, the formulation of suitable BDA strategies that are aligned with adopted technologies and processes within the organization, becomes pivotal in achieving desired business outcomes (Aneato, 2020). To formulate a BDA strategy, it is crucial to understand BDA, hence BDA is defined as a business intelligence practice that applies innovative analytical techniques to big datasets (Sabharwal & Miah (2021).

BDA is considered a critical strategic driver with the capability of enabling technological business solutions that can improve operational competences, create new revenue opportunities, identify threats and lead to competitive advantage among rival companies operating in the same market (Aryal et al., 2018; Martins et al., 2022). South African organizations have to understand how BDA capabilities will add value to their organization by first formulating a practical BDA strategy before pursuing BDA investments, (Amiri & Engelen, 2022). The value is being portrayed by big technology giants such as Apple, Facebook, Microsoft, Google and Amazon that have managed to latch onto this opportunity to harness BDA value that can be used for indivisible strategic decision making (Talaoui et al., 2023).

According to the World Bank Group (2019), South Africa has shown that it has potential to continue expanding its digital economy. Therefore, the rapid digital economic expansion and focus on digitalization makes the South African context crucial for this study as BDA enables organizations drive dynamic digital growth in an emerging economy like South Africa (Bag et al., 2020).

1.2 Problem Statement

As established in the previous section, there is a need for a BDA strategy to help enhance business performance and create organizational value. Not enough research is being done to support this as most of the research encompassing BDA has primarily focused on predicting future BDA impact on specific sectors or describing BDA key characteristics (Al-Jaroodi et al., 2017), BDA capabilities (Grady et al., 2017), future BDA adoption challenges and technological innovation aspects of BDA (Shabharwal & Miah, 2021). However, few studies have focused on exploring suitable real-world BDA strategies that South African organizations can follow to increase competitive advantage, improve organizational performance, and achieve desired business goals (Adrian et al., 2017; Aneato, 2020). Furthermore, the gap between

technological capabilities and the organizational needs still exists even though current data-driven trends in managerial decision-making have led to competitive advantages and improved business outcomes (Parra et al., 2023). In particular, the technological solutions on the market are not completely adapted to the needs of South African organisations that have not fully understood what to do with their data (Parra et al., 2023). Consequently, South African organisations that do not understand the capabilities, business needs and challenges of BDA end up struggling to reach their desired business objectives and do not realize the expected benefits from their BDA investments (Tabesh, Mousavidin & Hasani, 2019). This can have dire consequences for a business which might fail to realise the value generated from BDA (Maritz et al., 2020b). For this reason, a well formulated BDA strategy can help resolve some of the challenges mentioned above, hence there is a need to research the main components that should inform the formulation of a big data analytics strategy to benefit South African organizations, researchers, and technology providers.

While the case for a BDA strategy has been established, another challenge facing organizations when it comes to BDA is that, according to Choi et al. (2018), the few empirical studies on BDA strategies within organizations have disregarded answering the fundamental question of how to determine which components inform a BDA strategy. Indeed, while formulating a BDA strategy that acts as a guide and roadmap before embarking on a journey to implement and adopt BDA within organizations is important, most organizations do not know the components that should inform such a strategy. For this reason, which ties into the research question and objectives, there is a need to research the main components informing the formulation of a BDA strategy for organizations in developing countries such as South Africa. A South African emerging economy context is relevant for this study as the country is undergoing rapid digital transformation and growth across multiple industries that are willing to supplement their existing services with BDA offerings (Bag et al., 2020). Several organizations in most of the developing countries such as South Africa, are not exempted when it comes to struggling to understand and identify the main components that should inform their BDA strategy (Aghimien et al., 2021).

1.3 Research Questions and Objectives

To address the above-mentioned research problem, this study will attempt to answer the following primary research question:

1. ***What are the main components that inform the formulation of a big data analytics strategy for organizations in South Africa?***

The secondary research questions will aim to understand the detailed ways in which the various identified main components influence or impact the formulation of a BDA strategy for South African organizations.

The secondary research questions are:

1. ***In what ways does Technology inform the formulation of a big data analytics strategy for organizations in South Africa?***
2. ***In what ways do Big Data Characteristics inform the formulation of a big data analytics strategy for organizations in South Africa?***
3. ***In what ways do Porter's Five Forces inform the formulation of a big data analytics strategy for organizations in South Africa?***
4. ***In what ways do Big Data Analytics Techniques inform the formulation of a big data analytics strategy for organizations in South Africa?***

The main objective of this research study is:

1. ***To identify the main components informing the formulation of a big data analytics strategy for organizations in South Africa.***

The sub-objectives of this research study are:

1. ***To understand the ways Technology informs the formulation of a big data analytics strategy for organizations in South Africa.***
2. ***To understand the ways Big Data Characteristics inform the formulation of a big data analytics strategy for organizations in South Africa.***
3. ***To understand the ways Porter's Five Forces, inform the formulation of a big data analytics strategy for organizations in South Africa.***
4. ***To understand the ways Big Data Analytics Techniques inform the formulation of a big data analytics strategy for organizations in South Africa.***

1.4 Research Contributions

Firstly, the research contributes to the body of knowledge by practically establishing the main components that inform the formulation of a BDA strategy for organizations in South Africa. Secondly, the research contributes at a theoretical level by providing a model that shows the main components that should inform a BDA strategy as guidelines for organizations in South Africa to consider when formulating a BDA strategy. The empirical findings from the study provide insights that help understand the linkage between the main components that should inform the formulation of a BDA strategy. In addition, the case studies revealed that there are

twelve (12) main components that interplay with one another showing relationships between the various components.

1.5 Dissertation Overview

The structure of this research proposal is as follows; Chapter two focuses on the literature review which covers a review of the BDA and BDA strategy related literature; Chapter three contains the research design and methodology adopted to guide the research; Chapter four describes the two case organizations selected for the purpose of this study; Chapter five details the findings and data analysis; Chapter six presents the discussion of the results; Chapter seven is the conclusion. The approach is shown in Figure 1 below.

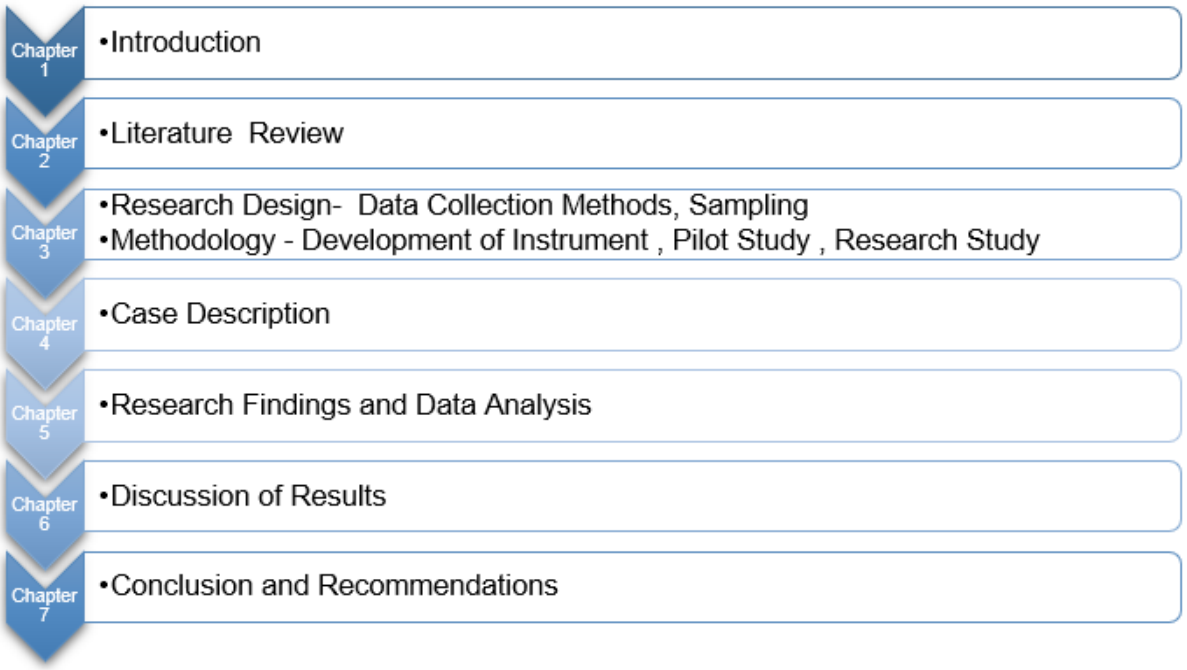

Figure 1:Research Structure

2 Literature Review

This section presents the literature review conducted on BDA related work, key big data characteristics, theoretical insights on strategies and how they can be formulated, challenges of BDA, and concludes by considering potential underpinning components that will help guide the research in terms of identifying components that should inform a BDA strategy for South African organizations.

2.1 Introduction

The “Data Age” characterised by globalization has seen unprecedented data volumes and high velocity of new data being generated. Organization have been scrambling not to miss out on the data boom and explore how they can realise value from available data (Mikalef et al., 2019). Traditional data mining techniques have been displaced by the development of BDA, which can reveal hidden patterns and presenting real-time information for effective decision-making by leveraging machine learning, cloud computing, and business intelligence (Mathrani & Lai, 2021). Additionally, the fourth industrial revolution (4IR) has ushered considerable advancements in technologies such as Big Data Analytics (BDA), cloud computing (CC), machine learning, Internet of Things (IoT), and Artificial intelligence (AI). Although BDA has been heralded as the cornerstone driving competitive advantage through data-driven decision making and enabling innovation in organizations (Jensen, Nielsen, & Persson, 2019; Vassakis et al., 2018), the business value created is yet to be understood and empirically validated across different industries (Dong and Yang, 2020). However, these nexus technologies have also been accompanied by several value realization determinants in developing countries such as South Africa exemplified by, lack of specialist skills, business support, poor infrastructure, and limited financial resources (Mathrani & Lai, 2021). This leads to the next section, covering developing countries in Africa and in particular South Africa.

2.2 Big Data Analytics Organizations in Africa

According to Ogunbukola (2024), the current landscape of BDA for organizations on the African continent present both opportunities and challenges. Some of the highlighted opportunities mentioned include, driving business growth and contributing towards economic development on the continent. On the contrary, the main challenges highlighted by African organizations include, a shortage of skills, lack of technological infrastructure and concerns over data privacy and security (Ogbuke et al., 2022). While some African organizations in industries such as mining (Bag et al., 2020), agriculture and healthcare are increasingly benefiting from leveraging this transformative BDA technology, the progression rate at which digital transformation is happening is not fast enough in African developing countries for other

industries to benefit and to compete with developed countries in America and Europe. This then results in African organizations lagging behind when it comes to realising value out of BDA. Despite significant investment efforts, organizations in African countries have faced challenges in realizing the anticipated economic benefits of BDA, largely due to the enduring digital divide between developed and developing countries. This divide is marked by a shortage of BDA skills, deficiencies in Information and Communication Technology (ICT) infrastructure, and high-cost structures, which hinder the full potential of digital transformation (Solomon & van Klyton, 2020). While literature in the African context clearly explores the existing opportunities and highlights BDA technology challenges for African organizations, there are limited academic guidelines documented to help organizations in Africa realise value out of BDA technology and this starts by identifying the key BDA strategic components that should inform a BDA strategy.

2.2.1 Big Data Analytics Organizations in South Africa

South African organizations have managed to transform their operations using BDA insights and making data driven decisions to elevate their organizations by regularly spending millions of Rands to upskill their workforce skills (Bag et al., 2021). The focus of this study on South Africa is suitable for this study because, South Africa is an emerging economy that is undergoing rapid digital transformation and there are a lot of BDA technology applications across multiple industries (Bag et al., 2020). According to the World Bank Group (2019), South Africa has shown that it has potential to continue expanding its digital economy. Although there have been positives strides to drive digital transformation by the South African government, organizations in South Africa still face challenges and struggle to identify the main components that should inform their BDA strategy (Aghimien et al., 2021). Some of the challenges are attributed to skill shortages and harsh economic conditions that are significantly different in developing countries compared to developed parts of the world (Bag et al., 2021). In its attempt to bridge the skills gap, the South African government introduced the Skills Development Act 97 of 1998 as a law to try and enhance employee skills in the workplace (Bag et al., 2021).

2.3 The Five Big Data Characteristics

The sources of data generated across multiple industries are rapidly increasing, which means, not only is the volume of data increasing astronomically but also complexity is presented by the heterogenous forms of captured data across these multiple industries (Arena & Pau, 2020). According to Van Rijmenam (2014), a well-articulated BDA strategy will focus on the characteristics of big data as they impact the organization's performance. There are five main characteristics of big data: volume, velocity, variety, veracity, and value (Hariri, Fredericks, &

Bowers, 2019). These five big data characteristics, known as the 5Vs, sometimes present evolving challenges for organizations related to data processing, analysis, storage, and visualisation that organizations must consider when formulating a BDA strategy (Jensen et al., 2019; Mathrani & Lai, 2021; Vergilio, Kor, & Mullier, 2022).

If organizations neglect big data characteristics when developing their BDA strategy, they might fail to achieve set BDA strategic goals due to the previously mentioned evolving challenges introduced by complexities around data processing of large volumes of datasets, increased need to store more data and making sure insights are properly visualized for easier decision making. As a result, to mitigate against the elevated processing and storage challenges introduced by the characteristics of big data, organizations must align their BDA strategic goals with suitable strategic technical tools (Berisha, Mëziu, & Shabani, 2022; Ghasemaghaei et al., 2017). To elaborate on this point further as an example, based on the prevailing big data characteristics, organizations should take into consideration the need to upgrade some of their existing infrastructure to accommodate the high paced generated volume of data by upgrading to high-speed broadband Internet and employing hyper scalable cloud computing storage platforms when developing their BDA strategy (Lv et al., 2017). However, low to medium developing economies, including South Africa face inadequate network infrastructure and technology challenges (Walker & Brown, 2019). A crucial element of effective BDA strategy formulation is the proactive planning for the interplay between the 5V's data characteristics and the inherent cost structures (Mathrani & Lai, 2021). Failure to proactively budget and plan might adversely impact the organizations profitability, as unanticipated implementation costs can easily erode profits (Mathrani & Lai, 2021). Each of the 5V's has the potential to pose logistical challenges if they are not reviewed as part of the BDA strategy components as they can bring about embedded uncertainty down the line in the entire analytics process. If strategic decisions are not made up front around how to extract the large volumes of different variety of data structures, coming from different data sources before transforming and loading it into meaningful insights. The five common big data Vs are explained and defined below:

2.3.1 Volume

Volume refers to the exponential growth of data in recent years, data has been collected and measured in Terabytes in 2005, Petabytes in 2010, Exabytes in 2015 and Zettabytes in 2020 (Zhang et al., 2018). When planning for a BDA project, the quantity and size of the datasets, referred to as the volume, will inform how organizations will ensure that the existing infrastructure is scalable and supports increased volumes of data (Maritz et al., 2020b). The

ability to process and analyse large volumes of diverse data is the core benefit of BDA, enabling organizations to make informed decisions, and gain a competitive edge.

2.3.2 Velocity

Velocity refers to the rapid rate at which new data is created and analysed (Dubey et al., 2019). Organizations will usually attempt to analyse the created data in real time or near real time to generate value, for instance sales transactions and sentiment data for breaking news is beneficial to the end users and targeted audience when processed in real time or near real time (Mikalef et al., 2018).

2.3.3 Variety

Variety refers to the data generated from several data sources and encompasses the three main data type categories, starting with structured data such as spreadsheets, and relational databases, secondly, semi-structured in the form of Extensible Markup Language-XML and lastly, non-structured data such as audio files, images and social media posts which makes up about 80% of the data today (de Camargo et al., 2018). Literature also mentions a fourth type of data referred to as meta-data, which is data about data (Berisha et al., 2022).

2.3.4 Veracity

Veracity speaks to the quality of the data, in terms of how secure and trusted the data is (Dubey et al., 2019). In other words, the data must be clean, authentic, reliable, and protected from unauthorized access or modification. Top management and decision makers depend on reliable and high-quality data to derive meaningful insights that can be used to generate business value (Akter et al., 2016). For example, social media data posted as individual sentiments is usually not reliable for organizations to make isolated decisions using that data.

2.3.5 Value

Value characteristics represent the valuable insights generated after data is extracted and transformed (de Camargo et al., 2018). The value proposition of big data resides in social or economic benefits for organizations and is closely related to the knowledge and skills of individuals that analyse and put it into application (Berisha et al., 2022).

2.4 Big Data Analytics Techniques

Vanani and Majidian (2019) define BDA as advanced methods used to manage data from different sources and formats. Meanwhile, Dong and Yang (2020) define BDA as special applications that manage, prioritize, and analyse big data for a specific business objective, such as discovering knowledge, predicting outcomes, aiding decision-making, and establishing industry competitiveness. The above definitions demonstrate that BDA is a multi-dimensional phenomenon that requires amalgamation of technologies, systems, techniques,

methodologies, practices, and applications that are designed to extract value from data with the aim of enabling organizations to get invaluable insights from critical business data and information for better decision making (Rahman, 2020).

There are three main advanced analytics dimensions of BDA techniques: descriptive, predictive, and prescriptive analytics (Aneato, 2020). The linkage between the BDA techniques and the BDA strategy is that the relevant BDA techniques have to inform which BDA technologies, new or existing will be used to give the expected insights required for enhanced decision making (Davenport, 2018).

2.4.1 Descriptive Analytics

Descriptive analytics is the most common technique used to summarize big data into simplified information using reporting tools (Davenport, 2012). The technique summarizes past data to create insightful reports that the organization can use to aid decision making. Organizations use this technique to answer what is happening in their business.

2.4.2 Predictive Analytics

Predictive analytics uses historical data to answer future predictive questions like what will or is likely to happen and make automated decisions using past data (Aneato, 2020). Organizations use this technique to answer what is likely to happen based on applying algorithms on historical patterns.

2.4.3 Prescriptive Analytics

Prescriptive analytics prescribes an action to be taken by a decision maker after analysing existing data (Tabesh et al, 2019). Organizations use this technique to know what they need to do by applying advanced analytical techniques to make specific recommendations (Grover et al., 2018).

2.5 Technologies Supporting BDA

Over the last two decades The International Data Corporation (IDC) estimated that the BDA market would surpass $203 billion in revenue by 2020 (The International Data Corporation [IDC], 2017). The IDC further anticipates that global BDA spending will recover from the COVID-19 pandemic over the next five years as global economies start to recover (Rydning & Shirer, 2021). Figure 2 shows that it has been more than a decade since big data and big data analytics first appeared on the Gartner hype cycle as an emerging technology in 2011 (Fenn & LeHong, 2011). Since then, BDA has become embedded in emerging technologies like cloud computing, machine learning and the Internet of Things (Burke, Davies & Dawson, 2021).

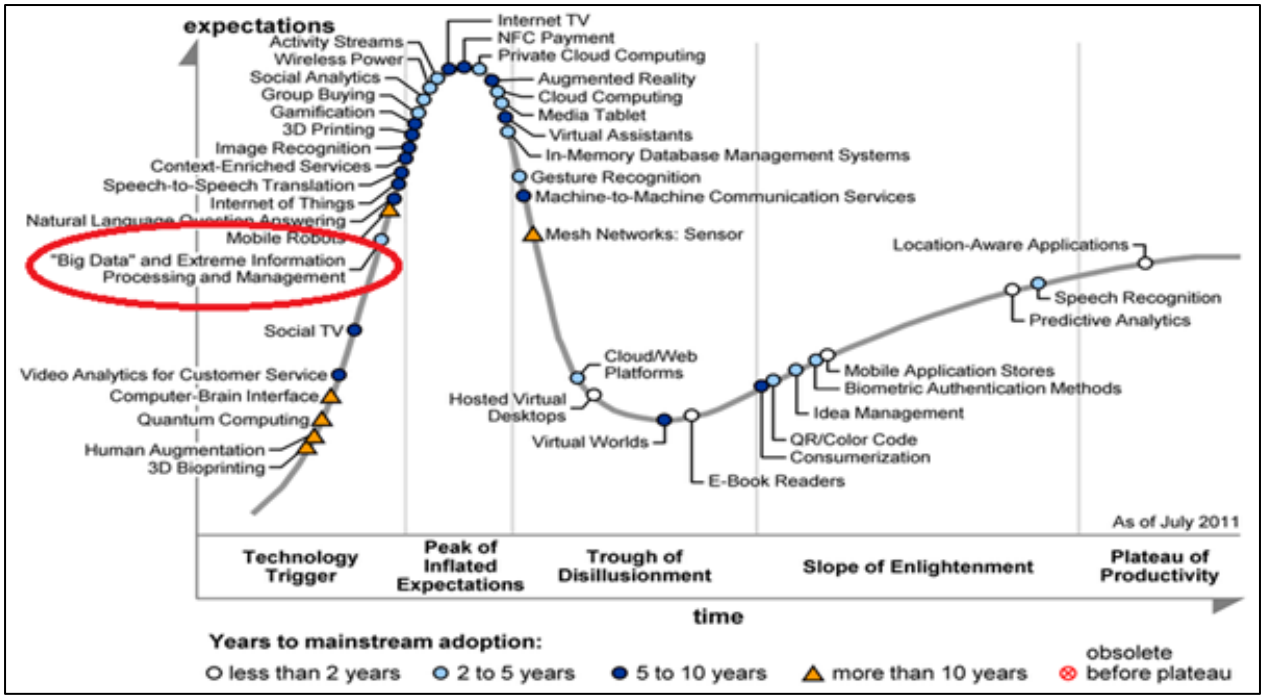

Figure 2:Gartner Hype Cycle for 2011 (Source: www.gartner.com)

Figure 3 shows the 2021 Gartner Hype Cycle for emerging technologies (Burke et al., 2021). It shows that BDA has fallen away as it is now embedded in a myriad of fourth-industrial revolution technologies such as the Internet of things (IoT), artificial intelligence (AI), cloud computing and extended reality (Burke et al., 2021). The positive implication of these is that the trends have revolutionised the way organizations use BDA by creating opportunities to holistically integrate emerging technologies into analytical decision-making (Konanahalli et al., 2020). However, while the embedded new trends highlight the new multiple analytics use cases, at the same time they also present significant problems for an organization, such as the quality of data generated, skill gaps, technological barriers, inadequate readiness, data management and governance issues (Konanahalli et al., 2020). The above-highlighted opportunities and challenges resulting from emerging technologies may influence how organizations review BDA informing components when formulating their BDA strategy.

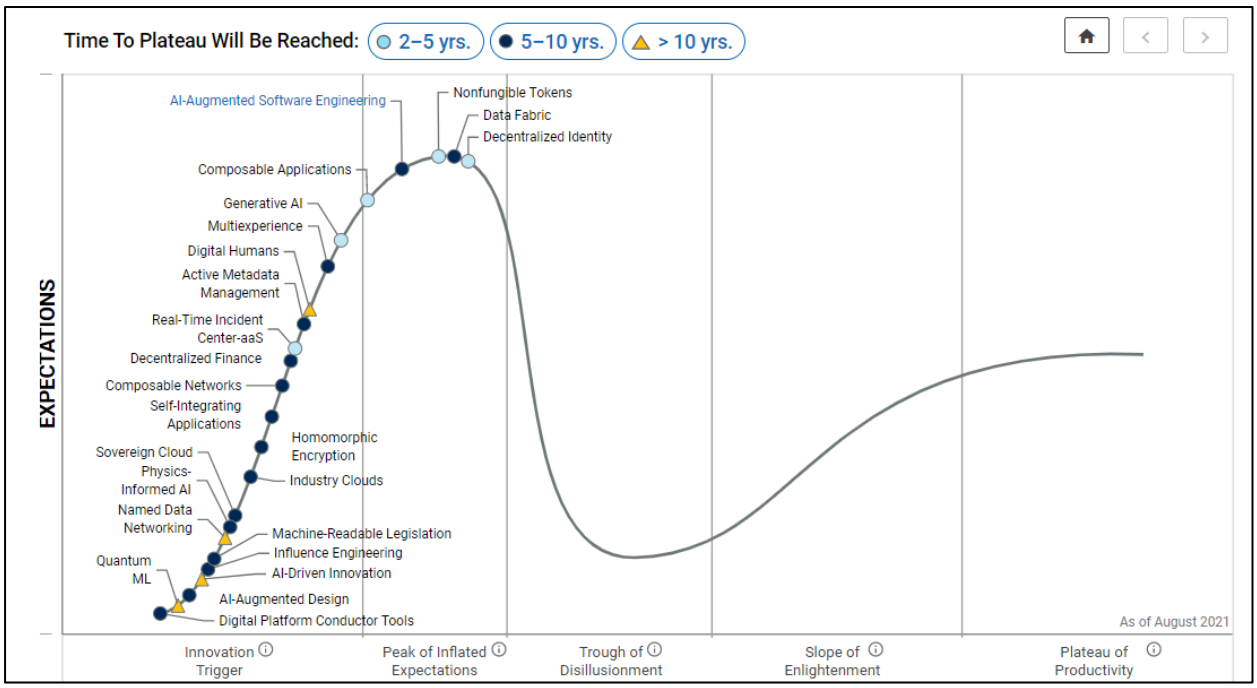

Figure 3:BDA embedded into emerging technologies (Source: www.gartner.com)

The emerging technologies for the Gartner Hype Cycle for 2023 shown in Figure 4 highlights the continued embedding of BDA into popular emerging technologies such as of AI. Therefore, organizations are encouraged to strategize on how they can exploit these new technologies into their BDA strategy in order to enhance their business offering while also determining the possible impact of new technologies being introduced into the industries they operate (Chandrasekaran & Davis, 2023).

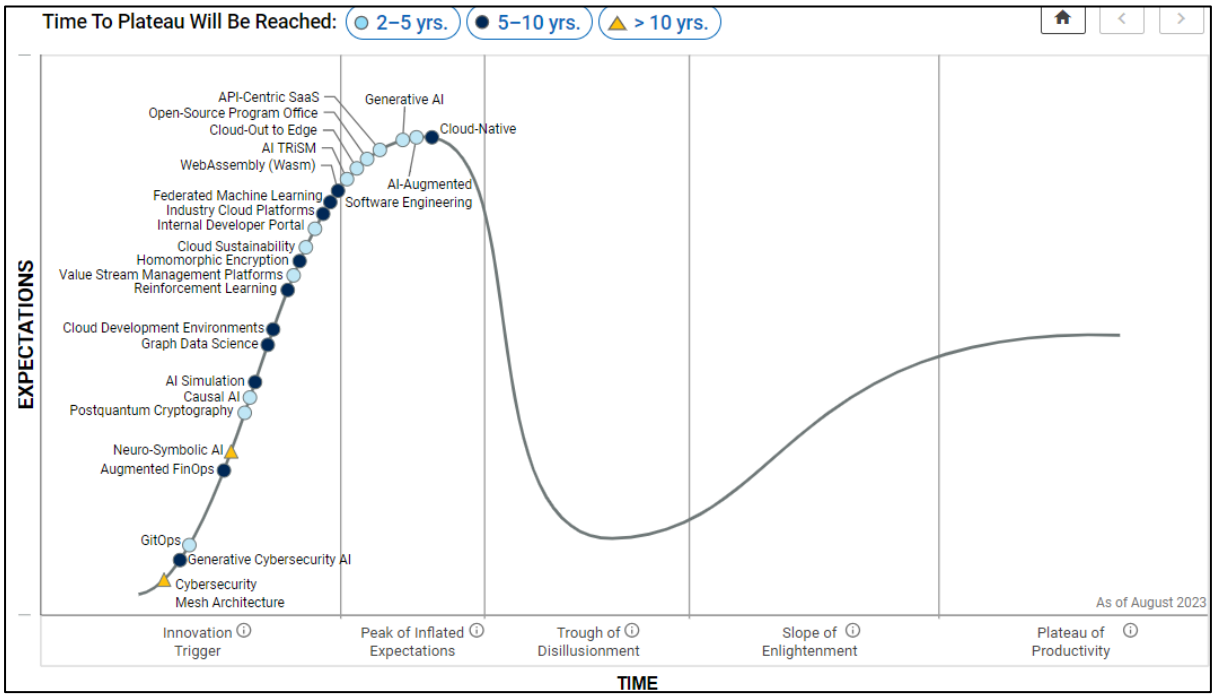

Figure 4:BDA embedded into emerging technologies (Source: www.gartner.com)

2.6 Strategy

The word strategy, originated from the military and according to Chandler (1969), strategy is defined as the articulation of long-term goals and objectives of an organization, employing a combination of tactics and necessary resources to strategically achieve the established objectives. Porter explains strategy as a position taken by organizations that have managed to formulate strategies that give them a competitive advantage and enable them to make profits within their industry (Porter, 2012). A business strategy provides a coherent multidimensional roadmap leading to common objectives that are followed by strategic planners and implementors (Porter, 1997).

2.7 Porter's 5 Forces

Since a BDA strategy usually lays the foundation for implementing BDA within an organization, it is imperative to discuss strategy formulation in this sub-section. According to Hunger and Wheelen (2021), strategy formulation involves developing long-term plans to effectively manage external opportunities and threats while considering organization strengths and weaknesses. This process interlinks with other defined components, such as the organization's vision, mission, and objectives. Despite the known benefits resulting from selecting a suitable strategy to achieve organizational objectives (Nwachukwu et al., 2018), most of the studies have focused on processes that purely inform organizations on strategy formulation, but few have gone on to further present a basic sustainable strategic model with components that are adaptable to varying environments (Satyro et al., 2017).

Professor Michael E. Porter is one of the seminal contributors to the field of strategy and competition. His five (5) forces model assists organizations in decision-making by analysing the level of forces acting in a particular industry instead of solely focusing on their own internal factors (Porter, 1997; Saadatmand et al., 2018). Significantly, the model acts as a framework for organizations to analyse the level of competition in their industry using five basic forces that are explained below and illustrated in Figure 5. The combined impact of these forces influences the organizations' ability to generate profits and strengthen its overall appeal in the market (Gupta & Nanda, 2015; Maxim, 2021).

2.7.1 The Bargaining Power of Buyers

Bargaining power of buyers refers to the power of buyers applying pressure on suppliers to reduce prices or demand better quality of products or services at the same price (Porter, 2008). In the context of the study, the buyers are defined as the consumers of BDA products or services that can be acquired by a supplier organization. Buyers that possess substantial

bargaining power are likely to experience higher financial performance compared to buyers with lower bargaining power because they can leverage their influence in negotiations with suppliers by compelling suppliers to accept lower prices and granting extended trade credit Chang et al., 2021). At the same time, if the cost of switching is lower or substitute products are readily available then buyers will try to subscribe to cheaper BDA products.

2.7.2 The Bargaining Power of the Suppliers in the Industry

Bargaining power of suppliers refers to the power of suppliers applying pressure on buyers by lowering product quality, availability or increasing prices (Porter, 2008). The suppliers are defined as the distributors of BDA related products or services to organizations. BDA suppliers have the power to change delivery terms and conditions, quality of products or services, payment terms and to increase prices for products or services which then impacts buyers profit margins. A monopolistic market situation means suppliers have the greatest power to increase prices since there are no substitutes to what the supplier is offering (Porter, 2008). At the same time, organizations that supply BDA products or services have to strategize on how to retain customers and avoid customers moving to competitors by rather shifting the buyer's purchasing decision from a price point focus to a product or brand loyalty approach (Goyal, 2020).

2.7.3 The Threat of New Entrants in the Market

The threat of new entrants in the market refers to the extent to which it is difficult for new entrants to enter an industry and start competing with well-established organizations (Porter, 2008). Ideally organizations want to make sure the barrier to entry is high in order to lower the threat of new entrants. Whilst the threat of new entrants exists in any industry, the extent of the threat depends on the existing barriers to entry such as government policies, capital requirements and the ability of the new entrants to scale sustainably (Hunger & Wheelen, 2021). The BDA new entrants are usually disruptive newcomers to an industry that often bring new innovative ideas to gain market share. Therefore, they are a threat to established organizations as they can erode existing profits (Porter, 2008). A critical exercise for organizations to mitigate against new entrant threat is to forge future plans on how to analyse entry barriers and continuously seek quality products or services enhancement in order to guard against existing customers dropping their products or services. This proactive anticipation approach of new entry threats is essential to maintain long term business success (Bruijl, 2022).

2.7.4 The Threat of Substitute Products

This threat is introduced when other products or services that can fulfil the same function as existing products or services are introduced into the market and have the potential to attract

customers away from existing offerings (Porter, 2008). For instance, videoconferencing was introduced as a possible substitute to physical travel. The threat of substitute products is high when the substitute product offers an appealing balance between price and performance in comparison to existing offerings within the industry (Porter, 2008). To avoid customers switching to these introduced other products, organizations should develop strategies to mitigate related risks and be confident about their trading prices they are charging buyers and be able to show value of their BDA product or service (Tulchinskaya, 2019).

2.7.5 The Rivalry between Companies Operating in the Same Market

Product prices and profitability are usually affected when more organizations compete in a market (Porter & Magretta, 2014). According to Bruijl (2022), organizations are encouraged to differentiate their products on the market, continuously drive technology innovation as part of their BDA strategic goals to make sure they stay ahead of competitors.

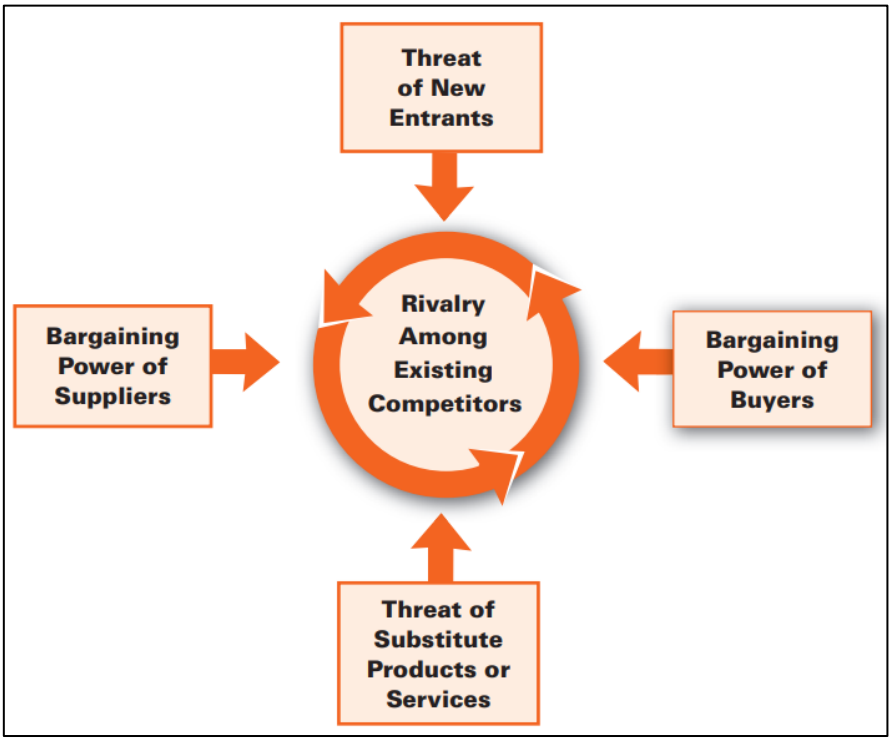

Figure 5: Porter's Five Forces Model (Source: Porter & Magretta, 2014)

Porter goes on to highlight the importance of attaining higher profitability within a specific industry by providing goods or services at a higher price or lower costs than competitors. This can be a result of operational effectiveness and unique strategic positioning within the value chain such as logistics, product design, training, and order processing (Porter & Magretta, 2014). This leads to most of the competitive strategy work to be attributed to Porter's low-cost differentiation-focus framework. Therefore, according to Porter, there are two ways an organization can maximize performance; they can either lower production costs in a particular

industry or they can differentiate their line of products or services from those of rival organizations (Parnell, 2006).

To deliver unquestionable value to its customers each organization requires a strategy that gets everyone within the organization to align on common purpose and direction (Porter & Magretta, 2014). Strategy formulation is challenging for managers since several components must be considered, such as social trends, upcoming new technologies, customer behaviour, competition outlook, legal and regulatory climate (Kudryavtsev, Menshikova & Gavrilova, 2016). According to Porter (1996), organizations must avoid the mistake of thinking that business strategies alone will result in improved business performance; rather, organizations should complement their existing business strategies with other core organizational factors. Some of these factors that influence successful BDA projects include organizational capability, technological capability, analytical capability, human capability, and the quality of the information (Adrian et al., 2017). This demonstrates that incorporating Porter's 5 Forces model into an organizations BDA strategy allows the organization to focus its analytics resources on key areas driving meaningful data driven insights that enhance business performance.

2.8 Big Data Analytics Strategy Formulation

Most business leaders are familiar with BDA and its benefits but are unsure how to leverage BDA to create business value (Dong & Yang, 2020). This emanates from a lack of available frameworks and roadmaps to guide organizations with a suitable approach of how organizations can use BDA to improve business performance (Williams, 2016). Therefore, organizations are encouraged to formulate a BDA strategy before implementing BDA to help align their business strategy with big data initiatives (Lakoju & Serrano, 2017). However, while tools like Strength, Weakness, Opportunities and Threats (SWOT) analysis and balanced scorecard have been formulated to assist organizations in making information technology decisions (Maritz et al., 2020a), these tools only assist in evaluating and aligning planned technological investments with business strategy. Although it might not be straight forward to differentiate between a BDA strategy and a business strategy, a business strategy encompasses foundational strategic initiatives pursued by an organization in order to create value for itself and its stakeholders (Boyles, 2022).

In summary a business strategy takes a holistic strategic view across the entire organization to ensure business success and competitive advantage (Boyles, 2022). In contrast, a BDA strategy is a long-term master plan that consists of fundamental components that empower organizations to generate value, and establish competitive advantage through utilizing big data analytics, while aligning with the overall business strategy to enhance organizational performance (Akter et al., 2016; Amiri & Engelen, 2022). Furthermore, tools like SWOT lack

comprehensive guidelines for them to be used individually for formulating a BDA strategy. Moreover, previous research points to the value of big data as an important strategic tool, but very few empirical studies have explored how it should be incorporated into business strategy (Mikalef et al., 2016). Consequently, this leaves organizations grappling with their BDA deployments.

2.9 Big Data Analytics Strategy Challenges

Research on BDA technical methods and value propositions is abundant, however there is still a relative shortage of experience-based information about BDA strategy (Williams, 2016). In addition, one of the challenges facing organizations when it comes to BDA is that, according to Choi et al., (2018), empirical organization studies on BDA strategies have disregarded answering the fundamental question of how to determine the optimal components that should inform a BDA strategy. According to Amiri and Engelen (2022), the core BDA challenge when it comes to components that should inform a BDA strategy is the inability to select comprehensive main components that consists of strategic components that coherently fit one another to the point that they enable value creation for organizations. Again, the challenge facing business leaders when formulating BDA strategy in the twenty-first century is that there is a multitude of constantly changing factors that must be taken into consideration such as the rapid emergence of new technologies, the influence of social trends, the changing legal and legislation landscape, the rise of innovative competitors, the changes in customer behaviour and the fluctuations in the global economic climate (Gavrilova et al., 2018).

Furthermore, Ferraris et al., (2019), mentioned additional challenges contributing towards BDA complexities inherent in data integration, ensuring availability of qualified employees, the importance of data security and privacy compliance and the inadequacy of existing information technology infrastructure. As a result, to avoid falling into the same documented challenges faced by other organizations implementing BDA solutions, South African organizations are encouraged to proactively assess and understand relevant BDA challenges applicable to their landscape before forging ahead to integrate mitigating strategies within the BDA strategic plan.

2.10 Summary of Literature Review

The recent literature on BDA focuses on technical solutions for analysing Big Data (BD) and lacks integration with other constructs within the BDA ecosystem (Dong & Yang, 2020; Strang & Sun, 2020). The emergence of the Internet led to high volumes of BD being generated from platforms like social media (Khan, 2019). According to an International Data Corporation (IDC) forecast done in 2021, the data created will fast outgrow available storage capacity (Rydning & Shirer, 2021). In addition, an unusual spike in data growth was experienced in 2020 when most people were working, learning, and entertaining themselves from home due to the

COVID-19 pandemic (Rydning & Shirer, 2021). Organizations invest in data analytics hoping to gain competitive advantage or favourable business outcomes but sometimes these BDA initiatives fail to yield tangible desired outcomes (Pour, Abbasi & Sohrabi, 2023). In summary, BDA phenomenon introduces significant challenges for organizations, as it necessitates continuous learning to master new technologies, techniques, skillsets, and methodologies to unlock the full potential of BDA (Côrte-Real et al., 2019).

In addressing the gaps identified in the literature review and problem statement, it becomes evident that the integration of appropriate BDA techniques, coupled with an understanding of big data characteristics, is essential for informing the selection of relevant BDA technologies, whether new or existing, required to generate the insights necessary for enhanced organizational decision-making (Davenport, 2018). This research underscores the practical significance of main BDA components employed by South African organizations, which should serve as a foundation for developing robust BDA strategies in developing countries. Moreover, the application of Porter's 5 Forces model enables South African organizations to strategically refine their BDA approaches, optimize resource allocation, and improve overall profitability (Maxim, 2021).

Potential interventions for organizations in South Africa involve identifying key informing BDA components and the adoption of a structured approach BDA strategy implementing prior to initiating BDA projects. South African organizations that manage to understand and effectively identify the main BDA components that will add value to their business by initially formulating a well-defined BDA strategy before pursuing BDA investments, have a greater likelihood of realizing business value from BDA technologies (Amiri & Engelen, 2022).

Figure 6 below, is a conceptual model that highlights the potential BDA strategy components emanating from literature and shows the relationship between explored components that have been discussed in this chapter and will be used to further guide this study.

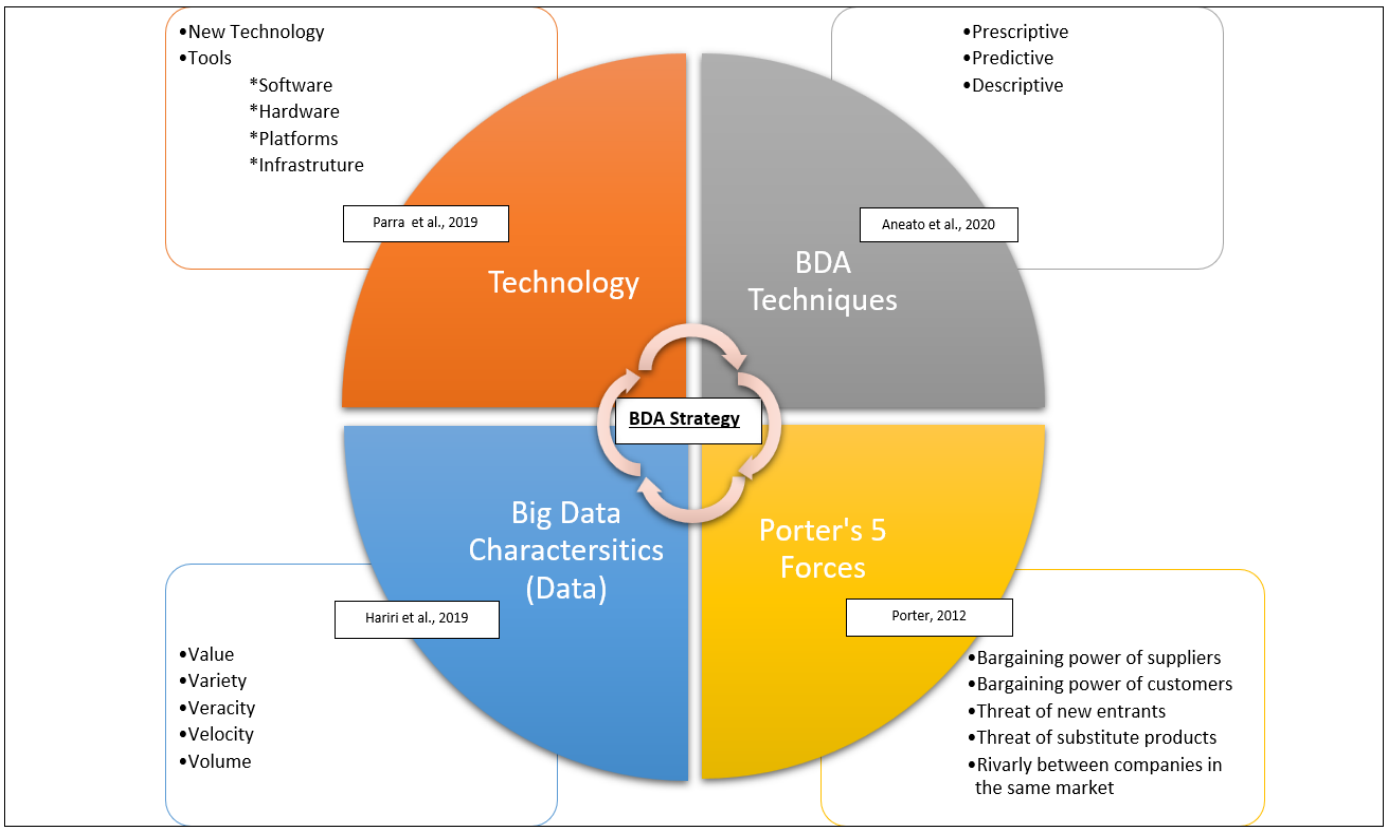

Figure 6:Adapted conceptual framework showing BDA strategy components (source: Authors own construct)

3 Research Methodology

This section addresses the research purpose, philosophy, approach, strategy, data collection and analysis techniques that was followed to guide this research.

3.1 Research Philosophy

The researcher's beliefs inform the research process, the nature of reality and how they acquire knowledge (Saunders et al., 2019). A research philosophy guides how the research will be conducted. There are two main research philosophical assumptions: ontology, which looks at theories about the nature of the reality being investigated, and the second one is epistemology, which looks at how knowledge of the reality is formed and justified (Mauthner, 2020).

3.1.1 Ontology

According to Saunders et al., (2019), there are two extreme ontological stances: objectivism and subjectivism. Objectivism denotes those realities exist independent of the human mind and that humans do not construct realities but instead live to notice them because they already exist (Chinweuba, 2021). On the other hand, subjectivism opposes objectivism by presenting a viewpoint dependent on humans, in that knowledge is constructed from the views and actions of humans (Saunders et al., 2019). This research aimed to get an in-depth empirical understanding of the main components informing the formulation of a BDA strategy employed by organizations; therefore, it took a subjectivism stance to effectively allow for exploration of the phenomena through interactions with different actors to produce realities.

3.1.2 Epistemology

Epistemology is the study of knowledge that speaks to how knowledge can be created, acquired, and communicated (Couper, 2020; Don-Solomon & Eke, 2018). Epistemology posits questions like "What do you know "and "How do you know it "(Don-Solomon & Eke, 2018). There are three main epistemological assumptions: positivist, interpretive and critical. This research adopted an interpretive epistemology to examine how South African organizations perceive and utilize Big Data Analytics. It focused on the meaning-making processes within these organizations, with the aim to understand how they interpret and contextualize BDA main components that inform the formulation of a BDA strategy, considering factors such as industry specifics, past experiences with technology, and challenges unique to the South African context (Bell et al., 2019). This stance was chosen for the study to ensure that new South African understandings, participants views and beliefs were accurately represented (Saunders et al., 2019).

3.2 Research Purpose

This research was an exploratory study that explored the main components informing the formulation of a BDA strategy using case studies as a research strategy since there is limited knowledge regarding identifying informing BDA strategy components. In addition, an exploratory study was used because it aims to provide more insights by investigating a phenomenon that has not been fully covered by existing literature and help clarify a phenomenon with scarce information available (Saunders et al., 2019).

3.3 Research Method

There are two distinct research methods: quantitative and qualitative research methods. According to Myers (2019), quantitative research involves using statistical tools and packages to analyse and interpret numbers considered as scientific evidence of a phenomenon. On the contrary, qualitative methods use words and images to derive meaning and establish associated relationships from collected data (Saunders et al., 2019). A qualitative method was adopted for this research study as it is aligned with the research topic which aims to explore and understand the main components informing a BDA strategy in South African organizations were partial information about the informing BDA main components is known (Islam & Aldaihani, 2022). A qualitative method is also commonly associated with general inductive research and interpretive philosophy (Denzin & Lincoln, 2018). In addition, a qualitative method allowed the researcher to inductively incorporate their own knowledge, experience and beliefs related to the environment and research topic. The adopted method is appropriate in this context as the goal of the research is to allow theory to emerge inductively and build new theory using a conceptual model showing the components informing the formulation of a BDA strategy (Bell, Bryman & Harley, 2019).

3.4 Research Approach

There are several reasoning approaches to research that follow different logic and play separate roles in knowledge advancements: deductive, inductive, and abductive. Abductive reasoning combines deductive and inductive research that involves developing new explanatory hypotheses and theories from evidence based on existing knowledge's context (Folger & Stein, 2017; Shani & Coghlan, 2020). Deduction mostly begins with a theoretical base, deriving and testing hypotheses and then revising the theory (Saunders et al., 2019). Conversely, induction starts with empirical observations about a specific phenomenon and then constructing concepts and theories (Woiceshyn & Daellenbach, 2018).

Early-day philosophers of science debated the dominance of one philosophical approach over the other, leading to inductive philosophers asking where the theories come from if they are

not induced from empirical observations in the first place (Woiceshyn & Daellenbach, 2018). Induction research has been argued to be pivotal in advancing knowledge and developing valid theories that capture how people think. According to Edmondson and McManus (2007), the inductive approach was more suitable for this research since little or no previous theory existed on identifying components informing the formulation of a BDA strategy. In addition, the other approaches such as deductive approach are not appropriate as they relate more to the positivist philosophy and focus on developing theory or hypotheses and formulating research strategies to test hypotheses (Saunders et al., 2019).

Thomas (2006) explained how both the researchers' outlined objectives, together with the analysis of the raw data in an inductive approach led to the findings without the restrictions usually faced by deductive analysis. An inductive approach relates more to the interpretivist philosophy (Saunders et al., 2019) and allows for the development of dominant themes and categories from the coding to emerge directly from the raw data resulting in the formulation of a model, framework, or theory (Thomas, 2006). This research followed an inductive approach to formulate theory after concluding the evidence gathered (Folger & Stein, 2017, p. 307). In addition, a conceptual model was used to guide research concepts and principles through inductive experience (Kant, 2002). As evidenced by Garvey and Jones (2021), who utilized a conceptual framework to guide their inductive qualitative analyses by suggesting research components and relationships to explore further. The benefit of following an inductive approach while using a conceptual framework is that initial components can be revised, eliminated or new components can be included as they emerge from the empirical findings without distorting the data to fit a preconceived framework (Garvey & Jones, 2021).

3.5 Data Collection

3.5.1 Target Population

The target population of interest was identified as South African organizations implementing BDA solutions within their work environment or offering BDA solutions as a service to other organizations.

3.5.2 Research Strategy

The research strategy was coherent with the research philosophy, approach, and purpose. The research followed an interpretive multiple case study strategy of two organizations (Myers, 2019). The rationale for selecting a multiple case study was that it allows for an in-depth examination of research phenomena in their natural environment, at the same time, it enables literal and theoretical replication of the findings to be combined across each selected multiple case (Yin, 2018). In addition, case study research is mostly used to build new theories (Myers,

2019). According to Saunders et al., (2019), a multiple case study provided more evidence compared to a single study and was appropriate for this research to allow for replication of research study in another environment. Considering this study is on identifying the main components informing the formulation of a BDA strategy, an interpretive case study was coherent with previous studies by Walsh and Waema, (1994) on information systems strategy development.

The choice of the research strategy was important as it informed how the researcher answered the research questions and objectives (Saunders et al., 2019). The unit of analysis was on an organizational level as strategy is traditionally formulated at the organizational level, by top management aiming to align resources and capabilities with organizational goals (Mayende & Joseph, 2020). The selected respondents included Chief Operations Officers (COO), Chief Technology Officers (CTO) and top management leaders working in South African organizations because the notion was that it is their duty to formulate strategy (Mayende & Joseph, 2020; Ukko et al., 2019).

The data collected from the first case study was analysed first by the researcher to confirm preliminary findings before interviewing and analysing data from the second case study. Thereafter the second case study findings were used by the researcher to confirm insights gathered from the first case study.

3.5.1 Sample Size

The sample size for case study research usually involves selecting one or two case studies to explore a specific phenomenon (Saunders et al., 2019). This study drew data from a sample of two case study organizations, making it a multiple-case study that answers the research question and objectives. The rationale for selecting a multiple case study was that theory created from multiple case studies is more convincing and reliable because it is grounded in several empirical pieces of evidence (Gustafsson, 2017). In addition, the multiple case study allowed the researcher to confirm or reject the emerging conceptual themes based on comparison of the cross-case findings (Myers, 2019).

The two case organizations were selected because they each present relevant characteristics regarding organizational size, level of BDA experience for each case organization (see Figure 10, 12), business processes and BDA strategy formulation methods. Therefore, it provided valuable responses from each study participant. As part of the sample size, respondents included support staff and BDA project leaders as they get involved in implementing and supporting a BDA strategy. For this reason, they formed part of the study cohort because they make operational decisions that impact the success or failure of the overall BDA strategy

(Wheelen et al., 2017). Further details about the respondents are provided in chapter 4 - Case Description.

3.5.2 Sampling Technique

The suitable sampling technique for this study that aligned with qualitative research was a non-probability technique in the form of purposive sampling since the sample size only covered two deliberately selected case organizations with experience and knowledge in the BDA phenomena under investigation (Saunders et al.,2019). The already established selection criteria of the case organizations was chosen because, the case organizations are BDA service providers based in South Africa, utilizing BDA models and techniques to provide services for other organizations in other industries and have enough BDA work experience to guarantee data collection of rich information (Renjith et al., 2021). The case organizations have also recently shown their competitive nature, competencies and exploits within the industry by utilising BDA related technologies to win several regional and African awards - see Appendix F, G. Respondents that fulfil the BDA knowledge criteria in each case organization were identified in a manner that represented all the organizational employee hierarchical and functional levels, which included personnel from technical, administration, management and executive to get a holistic view of potential components informing a BDA strategy. The sampling criteria used to select the respondents adopted a heterogeneous purposive sampling approach. The heterogeneous approach focuses on ensuring organizational inclusiveness and diversity among the selected respondents (Saunders et al., 2019). In addition, in order to capture a wide range of perspectives and experiences, the respondents represented: firstly, different senior and junior employment roles in the organization; secondly, different levels of BDA experience; thirdly, different views on BDA strategy formulation (Chiarelli et al., 2019).

3.5.3 Data Collection Method

Data collection commenced after approval from UCT Ethics Committee. Data was collected from case A organization from the 06th - 15th of March 2023 and for case B organization from the 29th - 31st of March 2023 using semi-structured interview questions as the research instrument, which was conducted mostly face-to-face with the participants allowing the interviewer to pick on body language and facial expressions that provided invaluable observational data. According to Myers (2019), the benefit of conducting semi-structured interviews is that it allows for some improvisation when new questions emerge during the interview process without being restricted to adhere to pre-formulated questions. Hence the researcher will not miss out on new insights that might emerge.

The interview was piloted with a purposive sample to test the reliability and rigour of the interview questions and to measure the accuracy of the estimated time needed to complete

the interview (Neuman, 2014). After the pilot interviews, a few changes were made to the research instrument such as, the estimated interview time needed to complete the interview was adjusted from the initial 45 minutes to 60 minutes, instead of an initial long list of questions, the research instrument questions were categorised into labelled descriptive sections that related to the conceptual framework themes (see Appendix C). In addition, some demographics and interview questions were revised to eliminate ambiguity. The captured pilot interview data was used to gauge the reliability and rigour of the interview questions and was not used in the analysis.

The study additionally explored several data sources for triangulation, including researchers field notes, organizational documents (see Appendix I,F,G,K), such as files which included information on vision statements, core values, company resource allocations, goals and objectives used by the case organization and their clients to validate themes from the interviews and to enrich the understanding of components informing BDA strategy formulation (Jonsen & Jehn, 2009). The researcher's observed experience from both case environments was captured using field notes (see Appendix I), during or soon after each interview for triangulation purposes (Tenzek, 2018). Triangulation is defined as a process that involves using two or more data collection techniques to explore a phenomenon that enhances the credibility and validity of the findings (Flick, 2022).

The researcher achieved triangulation by combining different sources on data such as field notes recorded from interviews, observations and shared documents to enrich the findings and offer a comprehensive overview of the main BDA components that should be informing the formulation of a BDA strategy (see Appendix F, G, I, K). To protect some of the case organizations intellectual property, the researcher had to sign a confidentiality and non-disclosure agreement in order for case A to be able to share confidential BDA related secondary files with the researcher (see Appendix J, K).

Videoconferencing tools such as Microsoft Teams was used when face-to-face interviews were not feasible especially for remote participants in other regions. Interviews were recorded after participants voluntarily gave consent and lasted approximately sixty (60) minutes. Open-ended discussions without time limits were facilitated to help build the study's credibility. The targeted profiles of the interview participants are listed as a summary in Table 1 below with further information per case organization such as each respondent's pseudonym is provided in chapter 4 - case descriptions. Eleven (11) case A interviews were initially conducted, with an additional three (3) interviews conducted before theoretical saturation was reached and ten (10) case B interviews were initially conducted, with one (1) additional interview conducted before theoretical saturation was reached.

Table 1:Target list of participants

Role	Expertise	Company
Data Scientist	Data, technology and architecture mapping	Case A, B
Delivery Lead	BDA service delivery management	Case A, B
Support Staff	Technology delivery and configuration	Case A, B
Business analysts	BDA process mapping to technology	Case A, B
Chief Technology Officer- CEO	BDA strategy and business governance	Case A, B
Chief Operations Officer- COO	Operational integration	Case A, B
Chief Automation Officer- CAO	Automation delivery and governance	Case A, B

The next section details the data analysis process to be followed before the dominant themes are identified, and the final informing main components are presented as guidelines for BDA strategy formulation.

3.5.4 Interview Questions Formulation

The interview questions in the research instrument were formulated using a simple approach that directly asks questions linked to the specific research questions and objectives for a general inductive approach study (Thomas, 2006). See the interview guide - Appendix 9.3 for a sample of the interview questions. The questions raised in the interview guide were formulated using the conceptual framework generated from literature and helped to answer the main research question of identifying the main components that should inform the formulation of a BDA strategy.

3.6 Data Analysis

3.6.1 Data Analysis Tool

Once the data was collected and transcribed, coding was performed using NVivo version 12 to analyse the qualitative data collected and develop themes from the transcribed text generated from the recorded interviews.

3.6.2 General Inductive Analysis

A general inductive approach was used to analyse the primary and secondary data through reviewing qualitative data transcripts, case company websites, secondary data supplied by the case organizations and checking interview field notes (Appendix I), to draw out themes and categories. Figure 7 shows an overview of the general inductive process of data analysis that was used for this study.

A general inductive approach can be referred to as an informal grounded theory provides a simple and non-technical approach that comes up with findings linked to the specific research questions and objectives (Thomas, 2006). The approach was chosen because it allows for

massive amounts of qualitative data to be categorised in a methodical and concise manner (Thomas, 2006). In addition, the inductive approach allows for the development of dominant themes and categories from the coding to emerge directly from the raw data resulting in the formulation of a model, framework, or theory (Thomas, 2006).

A summarised view of the coding process using NVivo version 12 to analyse the qualitative data collected and develop themes from the transcribed text is shown in Appendix M. The data analysis for the multi-case study was conducted in a manner that allowed case A participants to be interviewed first and data analysed for insights before the insights from case A were used to help inform the data collection and analysis for case B. This iterative research strategy allowed data collection and analysis to take place for case A with the initial insights used to refine subsequent phases of data collection and analysis for case B (Bell et al., 2019).

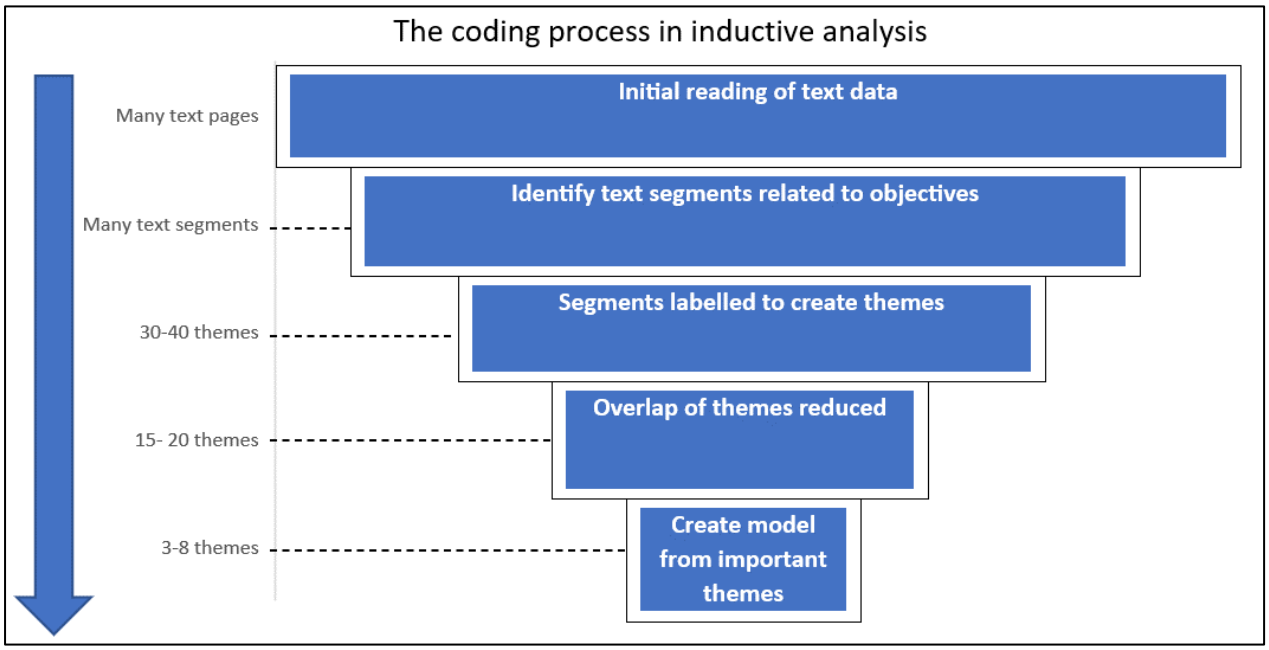

Figure 7:Inductive analysis coding process adapted from Thomas (2006)

3.6.3 First and Second Order Coding Cycles

To complement the general inductive analysis coding process illustrated in Figure 6, the study incorporated Corley and Gioia (2004), data structure model to further demonstrate qualitative research rigour (Gioia et al., 2013). The benefit of using the data structure is that it visually shows representation of how raw data was converted to overarching themes by linking first-order codes, which are directly derived from the raw data to second-order concepts, which are more abstract and theoretical. The researcher was able to link the codes and concepts to develop overarching themes that emerged from the data. Figure 8 shows an example of the data structure used by the researcher to analyse and interpret qualitative data following the

Gioia et al., (2013), method. See more constructed data structure models as examples in Appendix L.

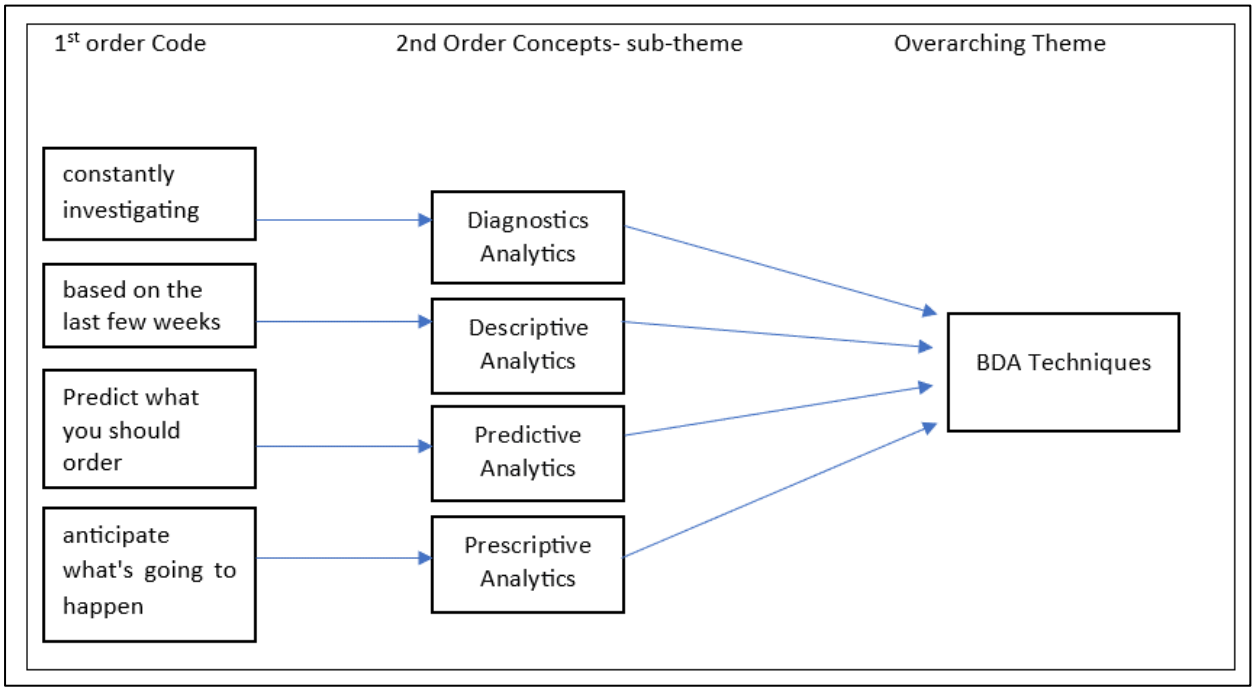

Figure 8:Gioia method data structure showing 1st order codes, 2nd order concepts and overarching theme

3.7 Summary of Research Design

A summary of the research design is shown in Table 2.

Table 2:Design summary

Philosophical Perspective	Ontology: Subjectivism Epistemology: Interpretivism
Research Method	Qualitative Research
Research Strategy	Case Study Approach- Multiple case study
Research Approach	Inductive
Research purpose	Exploratory
Research Instrument	Semi-structured Interviews
Data Analysis	Thematic analysis

3.8 Research Timeframe

The research timeframe for this study blends well with a cross-sectional study due to the time constraints posed by the required completion dates of the master's programme.

3.9 Project Risks

The researcher experienced project risk related to delays in obtaining research approval from the UCT ethics committee. In addition, a similar risk of lead times in obtaining organizational consent was experienced before the researcher could start approaching consenting participants to schedule interviews for data collection.

3.10 Project Budget

There was no specific budget initially allocated to this research as the researcher did not pay the case organizations or the respondents during data collection, although cost was later incurred to transcribe recorded interviews and edit final research paper. Furthermore, there was no software license fees as the software and research tools used to analyse and collect data are already licensed to the University of Cape Town (UCT). The next section describes the ethical considerations.

3.11 Research Ethics and Confidentiality

3.11.1 Informed Consent

Organizational-level permission to conduct research was obtained from the appropriate leader. A participation consent form that clearly states the study's aim was emailed to participants to cover consent matters. Participants were notified that participation is voluntary and were allowed to withdraw from the study at any time.

3.11.2 Privacy and Confidentiality

To protect the identities of the organizations and participants, no personal details was requested, and the respondent's identity will remain anonymous (Saunders et al., 2019). Therefore, the information provided by the respondents was treated as private and confidential. Furthermore, as part of the data management strategy, collected data and files were securely stored in a safe and trustworthy UCT repository.

The respondents were informed that the study is part of a UCT dissertation, and were guaranteed privacy, confidentiality, and anonymity. In addition, the participants were granted the right not to answer specific questions should they choose to exercise this right. In summary, according to Oates (2012), participant rights are summarised below:

- No personal details were requested, and the respondent's identity remained anonymous.
- Participation in the research was voluntary with no expected obligations.
- The right to withdraw their participation from the research at any time.

- The information provided by the respondents was treated as private and confidential information.
- The right to give informed consent.

3.11.3 Avoidance of Harm

The researcher avoided any harm to the participants by safeguarding their emotional wellness, not causing them stress, or causing conflict during the interview process (Saunders et al., 2019).

3.11.4 Institute Protection

This research complied with UCTs research ethics policies and ethical code. Approval to conduct research was granted by UCT Faculty of Commerce ethics committee.

3.12 Limitations

An experienced limitation was that some participants were a bit intimidated to interact academically in a social setting during the interview process (Myers, 2019), which impacted the depth of their responses and the quality of the data collected.

3.13 Research Validity and Reliability

Reliability and validity are key to measuring the quality of the research. Reliability refers to replication and consistency resulting from other researchers replicating a research design and coming to the same findings (Saunders et al., 2019). To elaborate on the reliability and replication, the multiple case study of organization A and organization B allowed the researcher to replicate case A research study in a different case B environment. Pilot testing was conducted with a “case A” pilot interview participant using a draft of interview questions so that the captured initial data could be analysed to ensure alignment with the expected data gathered from the rest of the interviews. The pilot testing ensured a baseline of how to manage participant expectations, gave focus on the relevant questions and expected output before refining the interview questions to remove ambiguity for future participants (Bell et al., 2019).

Validity refers to appropriateness of the procedures used, accuracy of how data was analysed and the point to which the study findings can be applied to other studies (Saunders et al., 2019). This process ensures legitimacy of the research results. Case study research is more popular in qualitative research due to its advantage of "face validity," which is the use of real-life empirical cases of organizations that researchers can relate with. Another advantage of qualitative interviews is that, reporting direct quotations from interview participants also provides credibility to the study and face validity to the findings (Myers, 2019).

To ensure validity of the research and methodological rigour the selected participants represented different roles within the case organizations. The interview participants fulfilling the sample criteria were selected without any bias by a representative from each case organization that had been assigned to assist with the participant selection process. The active engagement with each individual participant from real world organisations tells a genuine story that supports a rigorous approach to general inductive qualitative research (Myers, 2019). Although saturation was reached after 10 interviews, an additional 4 more interviews were conducted for Case A organization and 1 additional interview after reaching 10 interviews for Case B organization.

3.14 The Rigour of the Study

The inductive approach allowed the researcher to discover underlying patterns from the raw data and develop additional unexpected themes during coding, consequently enriching the overall data analysis (Roberts, Dowell & Nie, 2019). According to Phillippi and Lauderdale (2018), the qualitative field notes (see Appendix I), utilised by the researcher during the interview process is an essential component of rigorous qualitative research that offers a complementary lens that captures contextual details that enhance the interpretation of research findings.

Credibility in qualitative research points to the ability of the researcher to demonstrate that their interpretation of reality resonates and is congruent with the viewpoint of the data provided by the interviewed participants (Daniel, 2019). Throughout the research journey, part of the stakeholder or member checking process applied by the researcher to achieve credibility after interview completion included, the researcher sharing the transcripts and recordings with the participants for verification and also allowing other later participants to verify interpretations and data gathered from earlier interviews (Loh, 2013; Thomas, 2006).

Moreover, credibility was achieved by including participants verbatim quotes that are incorporated into the research findings in chapter 5, and triangulation of the gathered secondary data (see Appendix F, G, H, I J, K), to provide further validation. Credibility was further achieved by the researcher describing his experience as a researcher and verifying the preliminary research findings from case A organization with the participants before interviewing case B organization (Cope, 2014). Transferability relates to applying the findings from one study to other group of people (Daniel, 2019). As a result, the researcher applied the valuable lessons and findings from case A organization onto case B organization. To demonstrate further transferability, the researcher ensured that all the selected sample participants were knowledgeable about the BDA phenomenon (Ferero et al., 2018).

4 Case Description

This section describes the two cases selected for the purpose of this study. The multiple-case companies are all based in South Africa and operate independently. However, they both have a keen interest in working with BDA solutions within their organizations while also providing BDA solutions for other client organizations. Interviews were conducted with the volunteering participants within the two case companies. In the following sections the researcher aims to share insights into the various participant demographics within the multiple-case study companies. The participants were interviewed across different organizational roles, varying experience levels and qualification levels.

4.1 Demographic Overview of Study Participants

Interviews were conducted with the volunteering participants within the two case companies. The researcher aims to show the reader insights into the participants demographics within the two multi-case study organizations as well as an overview illustrating that participants were interviewed across different roles, with difference experience levels and varying qualification levels. Table 4 and Table 6 respectively illustrates case A and case B participants demographics. The following interview ID format was adopted, “CA/CB_Interview Number_INT”, where CA/CB represents Case A or Case B as the organization and INT is an acronym for the Interview. Interview Number is the number of the interview for that organization. For example, CA_01_INT refers to interview number 1 for Case A organization.

4.1.1 Interviewee Role Classification

Participants were asked questions to clarify their roles within the company. The participants demographics shown in Table 4 and 6 highlight the various roles in which the participants are operating under. The roles range from senior executive roles such as, Chief Executive Officer (CEO) to specialist roles such as data scientists, automation engineer, senior data analyst and all the way to junior software developers.

4.1.2 Interviewee Years of Experience

According to Schmidt and Hunter (1993), the years of experience are important to understand the extent of people’s knowledge. In relation to this study, the years of experience will inform the interviewee’s level of bias or knowledge in terms of identifying the main components informing the formulation of a BDA strategy. 10 out of the 25 participants across both case A and case B organizations have less than 5 years of experience within BDA. Figure 9 shows a wide range of participants experience ranging from a few months of experience such as four (4) months, to participants that have acquired BDA experience over a period of 23 years. It can be noted that, the junior participants are either recent graduates coming straight out of university or are just starting their careers while the more experienced participants are the

most senior leaders within the two case companies. For example, the CEO of case B has 23 years of experience working with big data and data analytics. The Chief Automation Officer of case A organization has about 14 years of BDA related experience. Case A also shows that the company has the least amount of average experience and has not been in existence for a long time (established in 2018) compared to case B (established in 1999) that shows it has been operational for quite some time considering the average years of experience of each participant.

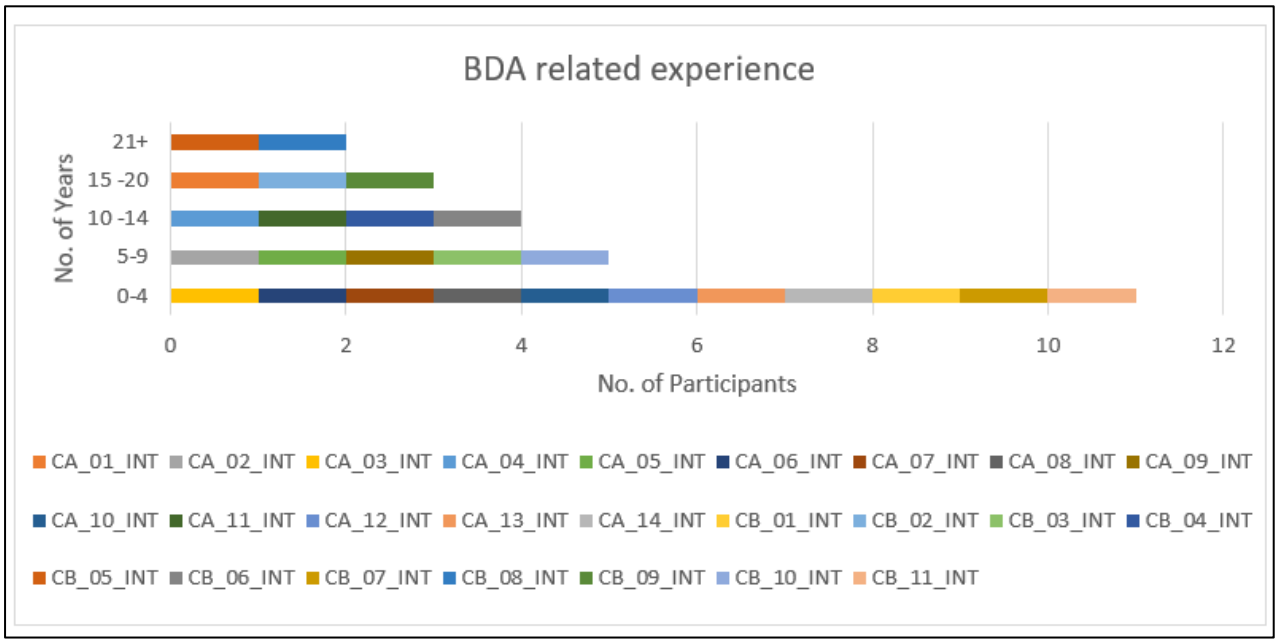

Figure 9:Case A & B participants combined BDA related experience

4.1.3 Interviewee Qualifications

A total of 22 out of the 25 participants from both case A and case B hold tertiary level qualifications. The breakdown of the tertiary qualifications is summarised in Figure 10. 16 hold degree level qualifications, 6 participants hold diploma level qualifications, 3 participants were educated at master's level. 3 participants held professional certifications and 2 participants held matriculation certificates which are conferred to individuals who successfully complete grade 12 in South Africa. The Chief Technology Officer (CTO) for case A showed great academic and industry understanding of the phenomena since he has about 8 years of experience, holds a master's degree in big data science and is currently a Doctor of Philosophy (PhD) student in the same field.

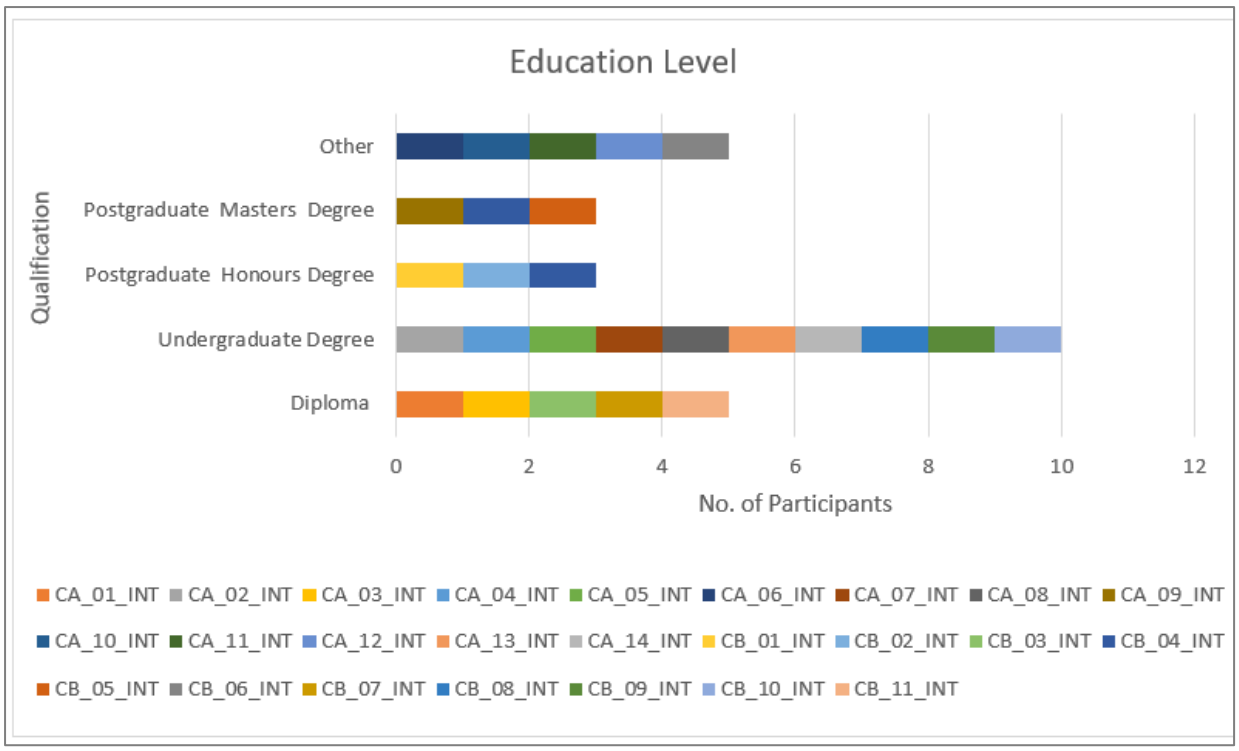

Figure 10:Case A & B participants combined education level

4.1.4 Case A (CA) - South Africa

Established in 2018 and with a turnover estimated at ±105 million South African Rands, case A is an Information Technology (IT) services and IT consulting company based in Stellenbosch, South Africa, specialising in disruptive hyper-automation global solutions. Case A delivers BDA solutions that empower clients to make data-driven decision making with features like process optimization, data analytics and intelligent automation. The company has won numerous newcomer awards, such as AI and Innovation Solutions awards and client business impact awards - see Appendix F. Their annual turnover is similar to that of case B.

The company employs between 25-35 employees, and they leverage emerging technologies integrated with BDA to provide intelligent automation client solutions. Case A strategically partners with leading vendors to ensure they continuously deliver relevant BDA related emerging technology to customers. Some of their existing customers operate in the agriculture, logistics, insurance, banking, and retail industry (see Table 4 for a detailed overview of serviced sectors). Case A mainly utilizes descriptive and prescriptive modelling data techniques coupled with Robotic Process Automation (RPA) tools to help customers make informed data driven decisions and enhance performance.

The case study focused on interviewing a pool of expert employees from their Stellenbosch office with powerful BDA skills and experience across multi-industries. The

employee profiles in Table 3 below were interviewed independently to answer research questions related to the study. Eleven (11) interviews were initially conducted, with an additional three (3) interviews conducted before theoretical saturation was reached and with no new themes emerging before the researcher deemed the sample size sufficient.

Table 3:Depicts Case A Interviewee Personas

Interview No.	Interview ID= CA	Position /Expertise
Pilot	Pilot	Hyper Automation Engineer
1	CA_01_INT	Operations Technical Lead & Dev Ops
2	CA_02_INT	Advanced Hyper Automation Engineer
3	CA_03_INT	Advanced Hyper Automation Analyst
4	CA_04_INT	Principle Data & Analytics
5	CA_05_INT	Data Specialist
6	CA_06_INT	Advanced Hyper Automation Engineer
7	CA_07_INT	Automation Engineer
8	CA_08_INT	RPA Developer
9	CA_09_INT	Chief Technology Officer
10	CA_10_INT	Hyper Automation Engineer
11	CA_11_INT	Chief Automation Officer
12	CA_12_INT	Automation Software Engineer
13	CA_13_INT	Junior Software Developer
14	CA_14_INT	Hyper Automation Engineer

Figure 11 highlights the interviewed employees BDA qualification level for case A organization that is discussed in section 4.1.3.

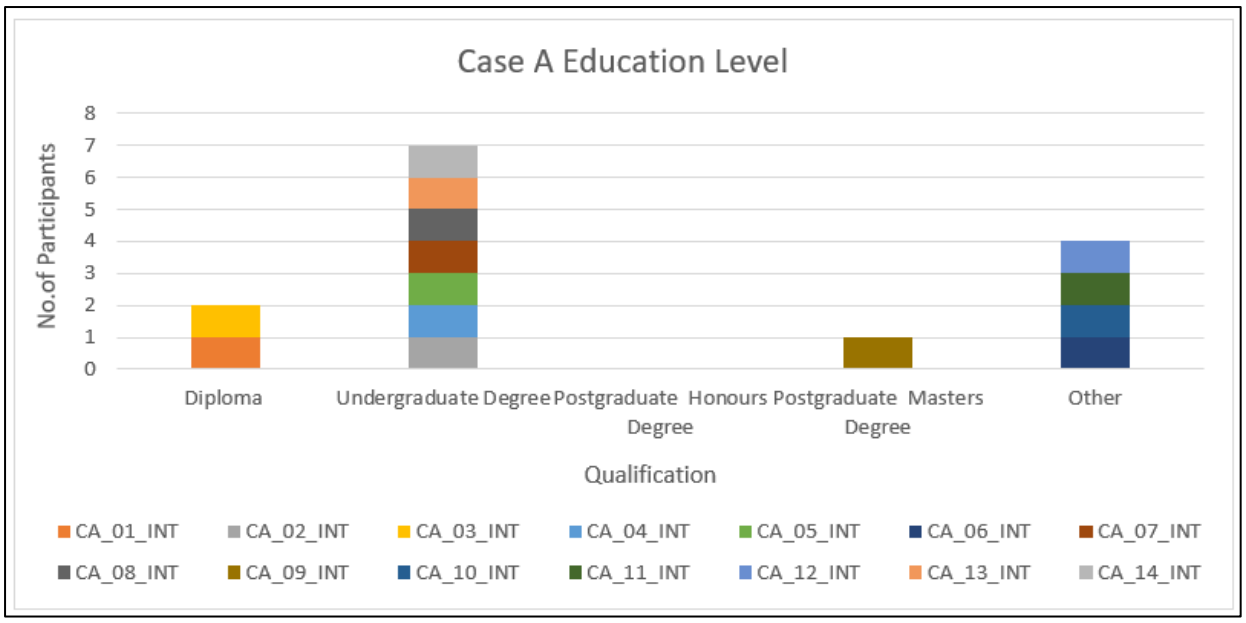

Figure 11:Case A participants education level

Figure 12 below is an illustration of the breakdown of case A BDA related experience that is discussed in section 4.1.2, showing that most of the employees have less than 5 years of experience. However, most of them are skilled up to tertiary level except for the most junior participant, CA_10_INT with 4 months of experience and educated up to South African matriculation level (Grade 12).

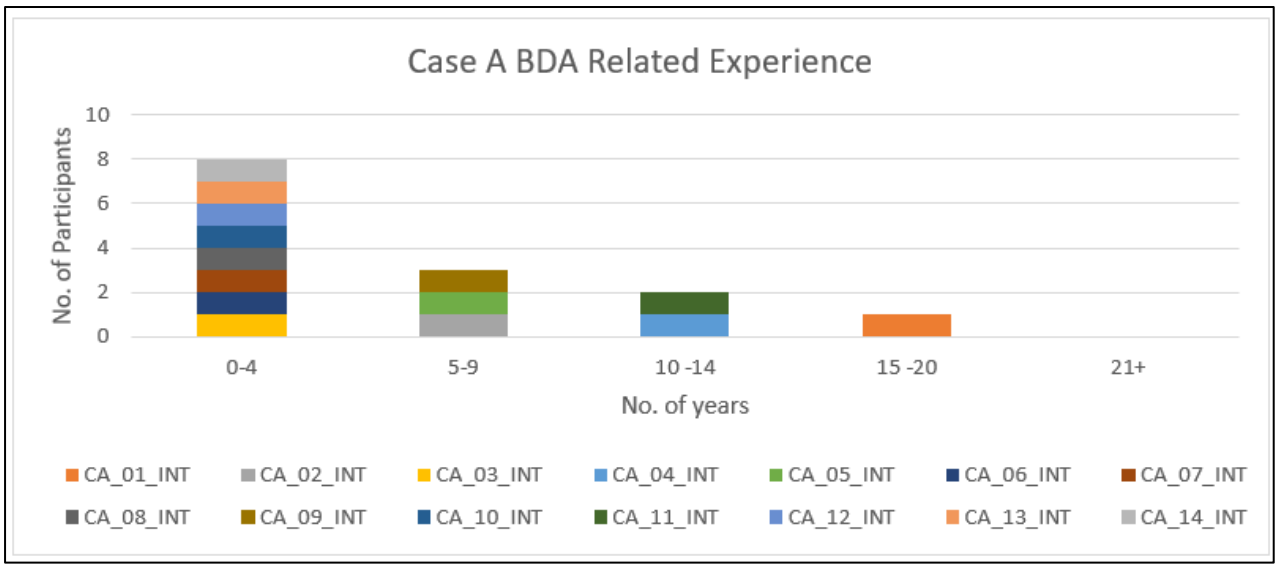

Figure 12:Case A participants BDA related experience

Table 4 is a detailed demographics summary of case A participants that took part in the research study.

Table 4:Case A Participants Demographics

Interview ID	Title	Org.Size	Client Industry	Qualification	Experience (Years)	Interview Length (MM: SS)
Case A:						
Pilot Interview	*Hyper automation engineer*	*25-35*	*Education, Logistics Credit risk, Retail, Finance*	*Diploma in network systems*	*0.6*	*50:35*
CA_01_INT	*Operations technical lead and DevOps*	*25-35*	*Retail, Insurance, Transport, Banking*	*National diploma in Information Technology*	*20*	*54:17*
CA_02_INT	*Advanced hyper automation engineer*	*25-35*	*Finance, banks, retail*	*Bachelor's degree in mechatronic engineering*	*5*	*57:14*
CA_03_INT	*Advanced hyper automation analyst*	*25-35*	*Finance, food & beverage*	*National diploma in Childcare*	*1*	*35:26*
CA_04_INT	*Principle- data & analytics*	*25-35*	*Finance, retail, healthcare*	*BSc in Computer Science*	*10*	*55:35*
CA_05_INT	*Data specialist*	*25-35*	*Healthcare, insurance*	*Degree in Information Technology*	*5*	*31:07*
CA_06_INT	*Advanced hyper automation engineer*	*25-35*	*Insurance, retail, banking*	*Certified Blue Prism developer*	*4*	*51:30*
CA_07_INT	*Automation engineer*	*25-35*	*Finance, banking, healthcare*	*BSc in Civil engineering*	*2*	*46:31*
CA_08_INT	*RPA developer*	*25-35*	*Finance*	*Qualified civil engineer*	*1.5*	*38:01*
CA_09_INT	*Chief technology officer*	*25-35*	*Healthcare, banking & finance, logistics*	*Master's Degree in big data science, PhD in progress*	*8*	*30:44*

CA_10_INT	*Hyper automation engineer*	*25-35*	*Retail, logistics, banks*	*Matriculation certificate*	*0.4*	*43:41*
CA_11_INT	*Chief automation officer*	*25-35*	*Financial, banking medical, insurance, logistics, agriculture, retail*	Lean Six Sigma, certified black belt.	*14*	*36:37, 16:14, 41:03*
CA_12_INT	*Automation software engineer*	*25-35*	*Agriculture, logistics, retail*	*NQF 4, System Information qualification*	*4*	*54:27*
CA_13_INT	*Junior software developer*	*25-35*	*Insurance, logistics, banking*	*Bachelor business science in Information Systems*	*1*	*63*
CA_14_INT	*Hyper automation engineer*	*25-35*	*Banking, Finance, logistics, education*	*BTech in Marketing*	*3*	*43:38, 46:21*

4.1.5 Case B (CB) – South Africa

Case B was founded in 1999 and is a leading data analytics and software consulting company based in Cape Town, South Africa. Their organizational aim is illustrated in Figure 13, their aim reads as, “to turn data into wisdom that enables companies to work wonders”. Their data analytics skills, industry experience, technology and products assist companies to realize value out of their BDA investments by taking data, organizing it into information, interpreting the data and drawing valuable insights for decision making.

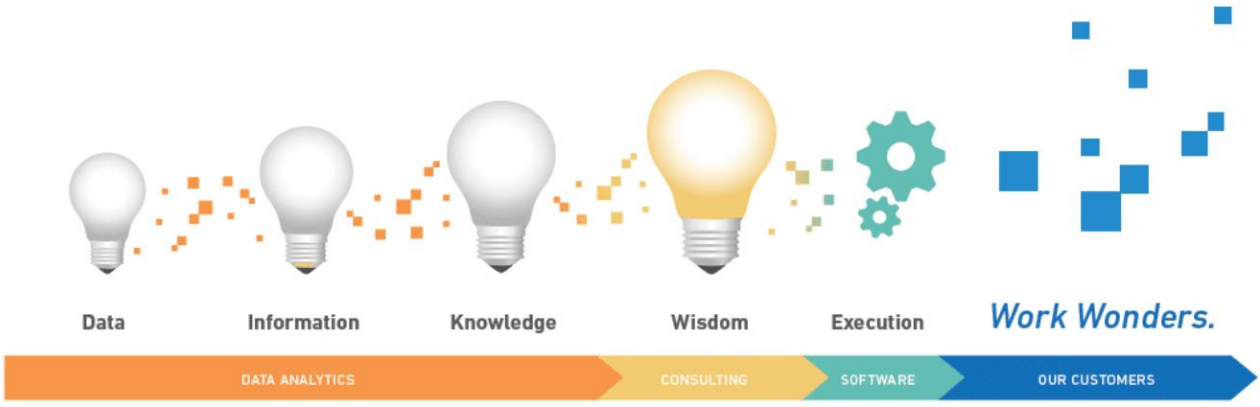

Figure 13:Case B “Aim” captured as secondary data for triangulation

Part of its BDA solutions to other organizations, utilizes machine learning models, credit risk scorecards, psychometric risk assessments, business intelligence dashboards and

predictive models that help create value for organizations in other industries such as, debt agencies - see appendix G. Over the years, the company has managed to deploy innovative machine learning solutions across the largest debt collection agencies in Africa. Apart from serving companies within South Africa, it has a global digital footprint in more than 150 blue-chip companies across 30 countries in Africa, Middle East, and Europe.

The organization has acquired vast knowledge and experience servicing companies encompassing a wide industry spectrum that includes sectors such as retail, banking and finance, education, ICT, credit risk and healthcare. In addition, the company leverages its data analytics skills, industry experience and technology to help companies generate data insights that enable them to make profitable business decisions. They employ about ±60 employees and have a turnover of more than 100 million South African Rands. Case B organization employs data scientist, developers and consultants that work together to develop data analytics products and solutions from large complex data sets. Furthermore, their experts apply their knowledge and experience to help other organizations make decisions and develop BDA strategies that improves organizational performance. The organization has managed to win numerous achievement awards over the years including the artificial intelligence (AI) award at the Africa Tech Week Awards in 2021, see Appendix G.

The unit of observation within case B organization includes respondents with personas shown in Table 5 below. Ten (10) case B interviews were initially conducted, with a further one (1) additional interview conducted before theoretical saturation was reached.

Table 5:Case B Interviewee Personas

Interview No.	Interview ID= CB	Position /Expertise
1	CB_01_INT	Data Analytics Consultant
2	CB_02_INT	Senior Consultant
3	CB_03_INT	Decision Analytics Consultant
4	CB_04_INT	Data Scientist
5	CB_05_INT	Portfolio Management
6	CB_06_INT	Head of Delivery
7	CB_07_INT	Head of Product Delivery
8	CB_08_INT	Chief Executive Officer
9	CB_09_INT	Senior Consultant
10	CB_10_INT	Associate Consultant
11	CB_11_INT	Senior Data Analyst

Figure 14 highlights the education level of case B organization participants that is discussed in section 4.1.3

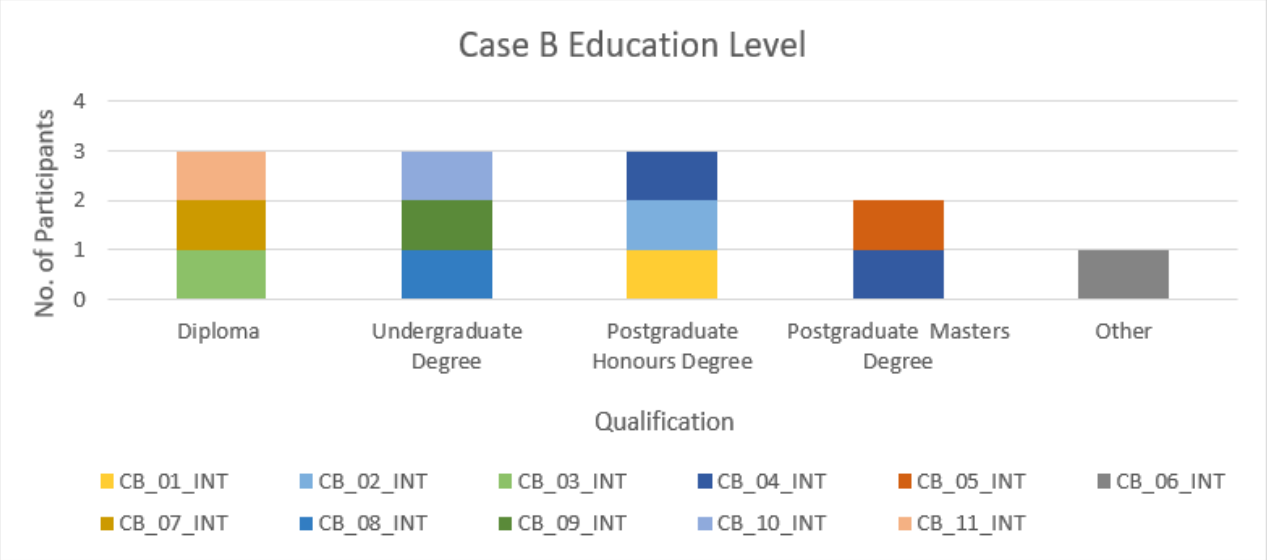

Figure 14:Case B participants education level

Figure 15 illustrates the interviewed employees BDA related experience for case organization B that is discussed in section 4.1.2.

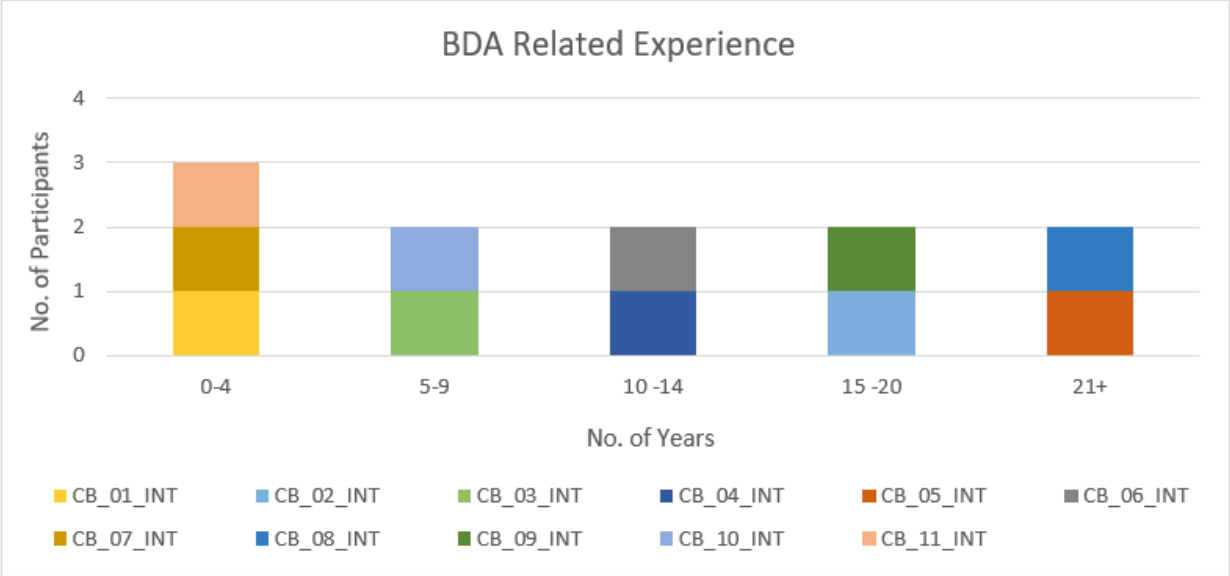

Figure 15:Case B participants BDA related experience

Table 6 shows a detailed summary of case B participants demographics.

Table 6:Case B Participants Demographics

Interview ID	Title	Org.Size	Client Industry	Qualification	Experience (Years)	Interview Length (MM: SS)
Case B:						
CB_01_INT	*Associate consultant in data analytics*	*50-60*	*Credit risk, retail*	*Postgraduate Hons degree in Statistics*	*4*	*57:51*
CB_02_INT	*Senior consultant*	*50-60*	*Finance, banking, retail*	*BCom Hons in mathematics & computer science*	*18*	*32:29, 12:30*
CB_03_INT	*Decision analytics associate consultant*	*50-60*	*Credit risk*	*Diploma in computer engineering*	*6*	*45:09*
CB_04_INT	*Senior data science specialist*	*50-60*	*Retail, medical aid*	*Masters in econometrics, Postgraduate Hons degree in statistics,*	*11*	*75:06*

				Postgraduate Hons degree in economics		
CB_05_INT	*Head of portfolio management*	*50-60*	*Credit providers, retail, finance, banking*	*Master's degree Psychometrics*	*23*	*80:50 18:17*
CB_06_INT	*Head of delivery*	*50-60*	*Retail, Financial services*	*Agile certifications, project management certification*	*10*	*42:25*
CB_07_INT	*Head of product delivery*	*50-60*	*Credit*	*Diploma in software development, Postgraduate Hons degree in business economics*	*1*	*34:21*
CB_08_INT	*Chief executive officer- CEO*	*50-60*	*Financial services, retail credit providers, vehicle finance, micro loans, education*	*BSc degree in computer science and mathematics*	*22*	*44:27*
CB_09_INT	*Senior consultant*	*50-60*	*Retail, banking, ICT, healthcare, credit*	*Bachelor's degree in social science*	*15*	*50:27*
CB_10_INT	*Associate consultant*	*50-60*	*Retail*	*BSc in actuarial and financial mathematics*	*7*	*51:52, 97:43*
CB_11_INT	*Senior data analyst*	*50-60*	*Credit*	*Diploma in mathematics technology*	*4*	*50:52*

5 Research Findings and Analysis

The following chapter provides a detailed overview of the various themes that were identified during the interviews with the respective participants using a general inductive approach. The participants were asked to answer questions linked to identifying the main components that informed the formulation a BDA strategy for an organization. The research instrument questions were formulated to gather empirical evidence to the following research questions. The primary research question:

- ***What are the main components that inform the formulation of a big data analytics strategy for organizations in South Africa?***

The secondary research questions were formulated as follows:

- ***In what ways does Technology inform the formulation of a big data analytics strategy for organizations in South Africa?***
- ***In what ways do Big Data Characteristics inform the formulation of a big data analytics strategy for organizations in South Africa?***
- ***In what ways do Porter's Five Forces inform the formulation of a big data analytics strategy for organizations in South Africa?***
- ***In what ways do Big Data Analytics Techniques inform the formulation of a big data analytics strategy for organizations in South Africa?***

The first section relates to the empirical findings that depict the main BDA components that inform the formulation of a BDA strategy for organisations in South Africa, with the subsequent sections delving into how the identified main components inform a BDA strategy for organization in South Africa. The chapter concludes by exploring how technology, big data characteristics, big data techniques and Porter's five forces inform the formulation of a BDA strategy. The analysis process looked at the codes that emerged inductively from the multi-case interviews.

5.1 Empirical Findings

This chapter answers the main research question - ***What are the main components that inform the formulation of a big data analytics strategy for organizations in South Africa?*** To help answer the research question, preliminary data from organization A was analysed first before interviewing and analysing organization B. This allowed the researcher to explore potential correlations or variations in the emerging themes. The findings are covered in the following subsection, showing the main components informing the formulation of a BDA strategy for organizations in South Africa.

5.2 Main Components Informing a BDA Strategy

The study found that both case organizations agreed that data is the foundation of any BDA strategy. However, they also stressed that having the right access to data is just as important as having the data itself. This is because data needs to be accessible to the right people to be turned into insights that can be used for decision-making.

"The main thing is, how can you get the data." (CA_01)

The components that emerged can be categorise into internal and external organizational components. The internal components relate to the components that are within the organizations internal control like business objectives and the external components are components outside the organizations control such as economic factors. The main themes and sub themes from both case organizations that emerged inductively from the data analysis are depicted in Figure 16. Subsequently, the themes and sub themes will be discussed in more detail in the following subsections.

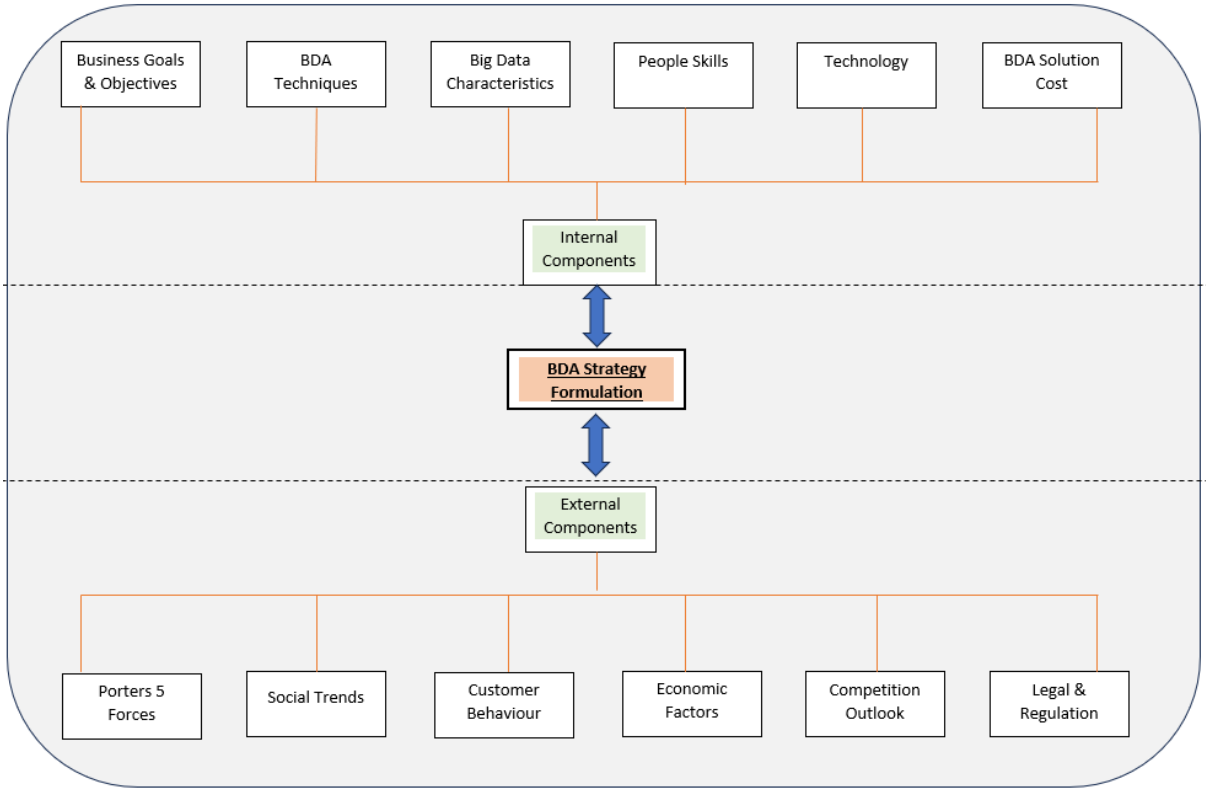

Figure 16:Representation of the main BDA overarching themes

5.2.1 Internal Component 1 - BDA Business Goals and Objectives

As highlighted in Table 7 case references, both case organizations equally emphasized the importance of setting clear BDA goals and objectives from inception when formulating a BDA strategy in order to derive business value. However, they both explained that sometimes, the

objectives and goals are not clearly outlined and there is often a tendency to straight away focus on a solution without pausing to understand the initial purpose. In addition, participants mentioned the adverse effect of failing to derive desired business value from BDA due to goals and objectives that are not well articulated. See secondary data collected in Appendix F used by case A to map out a BDA solution regardless of understanding existing BDA strategy. As a result, they fail to take an organizational-wide view of how the BDA components align with the organizations goals and objectives. Therefore, this challenge necessitates the need for organizations to include the setting up of goals and objectives in their BDA strategy to achieve desired outcomes (such as, enhanced decision making, problem solving, competitive advantage over rivals and profit making).

Table 7:Business goals and objectives component

Theme /Sub-theme	Sources	References	Case A references	Case B references
Business Goals & Objectives				
Business needs	22	**105**	69	36
Initial purpose	25	**130**	78	52
Clear vision	19	68	49	19
Business plan	23	**126**	94	32
Decision making	15	70	15	55
Business opportunity	14	30	11	19
Problem solving	9	41	31	10
Profit making	7	39	0	39

Table 7 shows the sub themes deemed to be the most important when identifying BDA related goals and objectives. As illustrated in Table 7, there must be a clear vision for the BDA initiative, purpose of the BDA initiative must be well articulated and well known, there must be an outlined plan that shows the roadmap of how this will be implemented and the needs of all stakeholders, including the customers and the business, must be taken into consideration. The theme was mainly echoed by the most experienced participants from the two case organisations. CA_11, the chief automation officer with 14 years of experience and CB_05, the head portfolio manager with more than 23 years of BDA related experience.

"…probably you need to tie up your BDA strategy to the goals or the values of the company. So, at every end the CEO comes and says, we're going to focus for the next three years on the following strategy. You're going to tie up your BDA strategy to that strategy…You need to have that alignment of vision and goals against the bigger organization… You have to have a strategy; the strategy now must have the foundation of certain pillars in order for you to be successful. So, it's almost like understanding the why before you actually give the answer…there are certain themes or categories

that we want to work on to give us the effective outcome that we're looking for... And based on this category, we're going to focus on it." (CA_11)

"The foundation of what we're trying to do is to understand what's the purpose, what do we want to do when we are done and then there's clearly a history of analytics of some sort. And that's what we will be migrating for and solving for the pain points…we want to not just understand the objectives and visions but also understanding the pain points and how to solve for key objectives and vision…it is the candidates with a clear understanding of what is the organizational objectives, what is the divisional objectives, strategic intention, what's the purpose of those departments divisions in the industry so that it is highly aligned. You have to understand objectives, strategy purpose to align rather than to drive a strategy on its own." (CB_05)

5.2.2 Internal Component 2 - BDA Techniques

The findings reveal that organizations should consider the BDA analytics techniques when formulating a BDA strategy. Firstly, this is because the selected appropriate BDA analytics techniques should align with the identified BDA use case(s) and expected BDA outcome(s). BDA techniques sources and references can be seen in Table 8.

Table 8:BDA techniques theme & sub-themes by source and references

Theme /Sub-theme	Sources	References	Case A references	Case B references
Big Data Analytics Techniques				
Diagnostic analytics (new)	1	3	0	3
Descriptive analytics	22	66	40	26
Predictive analytics	24	**85**	45	40
Prescriptive analytics	17	28	17	11

Descriptive analytics is a data analysis technique that uses past data to create reports that summarize what has already occurred. The participants considered this analytics technique as the first step in data analysis, as it provides a foundation for understanding trends and patterns in the data, which can then be used to inform decision-making.

"When you start off with BDA… you will always start off with a reactive approach, which is what happened? The past? How did it happen, you will always start off with that." (CA_11)

The second technique is diagnostics analytics technique which looks at understanding the root cause of an incident to provide insights into why a particular problem happened. Once you have understood your past trends the third progressive technique would be the predictive technique, which tries to predict future trends based on historic data.

The importance of knowing the right BDA techniques to apply was mentioned by participant CA _11 and how this can be used to drive sales figures, which raises the need for organizations to include the selection of appropriate BDA techniques in their BDA strategy. The importance of the analytics techniques is closely linked to the understanding of social and customer

behaviour components mentioned in section 5.2.8 and 5.2.9. respectively, as information about predicted future trends relies on organizations understanding existing social and customer patterns that are revealed after applying the appropriate analytics technique.

"A good example of that is Valentine's Day... with enough information and good amount of certainty, irrespective of whether we are in a high inflation environment or low inflation environment. People will always go and buy red roses always, right it's because there's a significant value attached to it. It's got nothing to do with the monetary value. It's got the significance, because it's your significant other hence people will make sure they go buy red flowers or a teddy bear or chocolate or this or that, but that's where the prescriptive becomes powerful is that almost you, you can 90% of the time you can say to the store, if you have "n" amount of flowers, we can guarantee you that 90% of it is going to be sold." (CA_11)

Lastly, would be to start anticipating future patterns and trends after mastering the descriptive and predictive techniques. However, this maturity model approach is not always followed in chronological order as it depends on the use cases, business goals, industry and nature of business the organisation is into. Sometimes organizations start with the predictive techniques or prescriptive techniques. Depending on the specific industry or the business context the organisation operates, the different techniques will apply to different use case(s) for example an airline industry might need to consider how to include datasets based on weather conditions, holiday seasons and customer demand to support the use of a predictive or prescriptive technique model to adjust air fares.

While a descriptive technique might inform them of past trends the future insights will be more beneficial to plan for future bookings revenue. As part of BDA strategy formulation, the relevant BDA techniques have to then inform which BDA technologies, new or existing will be used to give the expected insights, which relevant BD characteristics will be encountered (data variety, data volumes, value, etc) and the required people skills to be integrated into the BDA strategy. The participants emphasized the importance of considering all of the BDA components together when developing a BDA strategy, as they are all interconnected, which brings the following subsection about big data characteristics that will have to be explored in conjunction with the BDA techniques.

5.2.3 Internal Component 3 - Big Data Characteristics

The link between big data characteristics and BDA techniques is crucial since the big data characteristics will determine which BDA technique(s) should be used to achieve the intended business objectives and vice versa. For instance, if you are working with large volumes of dynamic data, you will need to consider utilising BDA techniques that can deal with real-time data streaming requirements.

The relationship between the BDA techniques and the big data characteristics is described by exploring the initial 5Vs; volume, velocity, veracity, variety, value, and visualization as one of the new 6th V emerging from the participants findings. These characteristics of big data form part of the overarching BD characteristics component that informs the formulation of a BDA strategy. Each of the 5V's pose logistical challenges and can bring about embedded uncertainty in the entire analytics process when it comes to making strategic decisions around how to extract the different forms of data, coming from different data sources before transforming and loading it into meaningful insights. Further details of some of the challenges include dealing with varying data sources that range from internally created operational data systems such as customer relationship management (CRM) systems and databases to externally created data from websites and social media platforms. Data quality and validation, storage capacity of high volumes of frequently flowing data. While it becomes difficult to consolidate all the data into one place, it becomes important to plan and formulate a strategy on how all these big data characteristics can be harnessed.

The participants revealed that it is essential to first understand the business value that the user or client wants to achieve out of the BDA initiative. The business value can be derived from the set goals and objectives mentioned in section 5.2.1.Secondly, the user or the client must understand the business value propositions offered by the BDA solution. Thirdly, there is need to conduct a cost benefit analysis to weigh the costs of the BDA solution versus the value propositions. This is important because it can be challenging to derive the desired benefit from big data analytics that is worth the capital outlay, human effort and the time spent. In summary the value metric generated out of BDA must be well defined and measurable.

Table 9:Data characteristics theme & sub- themes by source and references

Theme /Sub-theme	Sources	References	Case A references	Case B references
Big Data Characteristics				
Value	24	125	73	52
Volume	20	70	37	33
Velocity	14	22	14	8
Veracity	20	53	32	21
Variety	17	39	27	12
Visualisation (new)	14	23	14	9

The big data components discussed with the participants relate to the 5 Vs: volume, velocity, veracity, variety, and value. Under the big data characteristic theme, value was the main sub theme noted by the 24 out of the 25 participants from both case organizations as shown in

Table 9. The importance of generating business value out of BDA was highlighted by a few participants who summarised the value characteristic as below.

"You need to show buyers the value BDA system(s) adds to their bottom line. (CA_01)"

"… so, you need to make sure that your project or your BDA build provides value for the client……....you need to check for value" …. If you don't identify them then basically you won`t have a proper solution and your solution would be faulted and you may not have created value for your clients." (CA- 06)

The findings also reveal the strategic importance of collecting large volumes of data to provide strategic advantage in terms of forecasting and predicting future trends. In addition, the large volumes of data should be well managed, as the right technology and people skills will be required to process it. The advent of the Internet meant that the volume of data that is being generated per second is exponentially increasing as new technologies are introduced and the population grows. The reality presented by this organic growth is that at some point one must consider scalable cloud computing solutions as part of ones,' BDA strategy that will cover cloud storage and optimise the costs associated with high volumes of data.

Participants went on to mention how velocity, which speaks to the speed at which the data is generated by sensor technology and all the other different data sources must be considered in your BDA strategy. The need to include the velocity big data characteristic in your BDA strategy is because it will help inform the required technological tools such as software, hardware and infrastructure that will be required to design a BDA solution that accommodates the capturing and analysis of data at high velocity. CA_02, stressed the importance of all 5 Vs informing a BDA strategy but also linked the people skills, tools selection process and the data velocity characteristic to enable organizations to appropriately select the right solution to implement that supports the data frequency.

"I definitely think that you have to consider all 5 of them because otherwise you don't really know what solution you are trying to build, so you need to look at them so that you know the tools, the solution, the people, everything that you need and also whatever you're using your data for… how frequently are we getting data, how often is this process going to run. So, I think those are definitely key items to consider with any strategy, and definitely also with big data analysis strategy." (CA_02)

Furthermore, when it comes to velocity, a qualified civil engineer, CA_08 who is a robotic process automation (RPA) developer for case A organisation went on to reveal the available value-added opportunity of strategically using automation and robots (bots) as a solution to help accurately and reliably capture high speed data streams.

"So, in total, it will be about 3000 billing cycles, which would generally take a day or two if a person has to do it. And I mean, there's a possibility of missing a few items when dealing with large data. So yes, by using automation and bots to solve the problem, we can bring that down to literally an hour.

So, we can turn 3000 accounts within an hour and the risk of missing accounts is very, very minimal." (CA_08)

When asked about big data veracity characteristics, the participants revealed that at a BDA strategic level, more time must be spent defining measures that will be implemented on how an organization plans to check the quality and reliability of the data before it is transformed into meaningful insights and information. If the data quality, data completeness and data accuracy is questionable it will impact the quality of the output and degrades the possible value of the insights generated for the top management and decision makers. CB_11, a senior data analyst for case B organization, working with retail credit clients mentioned the importance of veracity in delivering accurate business results and staying ethical when data is initially captured.

"...when customers applying to open accounts are filling out forms or when we are collecting data, it's more for customers to be honest about who they are, where they live. The data that they give us is ultimately what we use. So, I think it complements big data strategies in the very core of it …So if the customers can just be honest and no fraudulent information is provided in who they are and we collect honest data, our strategy will give honest results and more accurate results?" (CB_11)

Variety is the most challenging big data characteristics that deals with the different types of structured, semi-structured and unstructured data in different data formats pulling from different datasets (sources). A standardized data collection method must be strategically defined beforehand to ensure interoperability between diverse data types. This was mentioned by CA_12 a software engineer.

"Variety is important…, if you know that you're just going to work with PDFs, then it will be easy to build a strategy that's based just on PDFs. But if you know, beforehand, you need to work with text files, PDFs, HTML files, or whatever else they might be, there are millions of different things, music, then you need to build a strategy that will be able to analyse all of these different types of data." (CA_12)

In addition to the existing 5Vs, visualisation was highlighted as an emerging big data characteristic that must equally be included as a component that informs your BDA strategy. Furthermore, there is correlation between the people skills and the visualization big data characteristic, because visualisation experts are required to present the information in a meaningful way. As one of the final steps in the big data analysis lifecycle, one participant mentioned the importance of producing graphical visualizations of the analysis to end users using the right tools to make the data easy to understand and use.

"I love Qlik®, but it`s not always the right tool for the right situation. Sometimes it might be Microsoft Power BI, or if they`re just going to do reports, it will be Excel or something like that." (CA_04)

Adversely, participants mentioned that if there is a lack of understanding of any of the applicable big data characteristics and in addition they are not considered as part of the

underpinning components informing the formulation of a BDA strategy, organizations might later face implementation challenges due to inadequately designed solution architecture and using poorly scoped technology tools. As a result, organizations might struggle to realise targeted BDA value.

5.2.4 Internal Component 4 - People Skills

All participants acknowledged and agreed that while formulating a BDA strategy there is a need to ensure that people with the right skillsets are available to enable successful BDA initiated business outcomes.

Table 10:People skills sources and references

Theme /Sub-theme	Sources	References	Case A references	Case B references
People Skills				
Upskilling cost	6	8	0	8
BDA experience	23	85	52	33
Skilled workforce	25	**182**	109	73
BDA use case understanding	24	123	67	56

As indicated in Table 10, the need for a skilled workforce was the main sub theme component to inform the formulation of a BDA strategy for organizations in South Africa. Furthermore, a data analytics skilled workforce is essential for the successful planning and implementation of any BDA initiative. Employees with the necessary skills, experience and domain knowledge can champion and coordinate BDA initiatives across all business levels, ensuring that the objectives set out are well planned, executed and monitored. This was summarized by one of the operational level participants with more than 20 years BDA related experience;

"I think the biggest thing is human skill. At the end of the day, you need someone that can work with BDA, but not only at the technical level. You need management level; you need operational level." (CA_01)

Both case participants indicated that organizations must have an experienced workforce that understands and has knowledge on BDA to be able to implement the identified use case solutions based on the available data. One of the challenges mentioned by case B head of delivery, is that organizations are quick to "*jump onto every emerging trend"* without fully understanding the use case scenarios that are applicable to their organization or industry. The value of having people with the skills to understand the typical use cases was mentioned by head of product delivery for case B organization.

"The BDA strategy for me is sort of to understand what the typical use cases are, business cases that our software and people can solve for our clients or prospective clients." CB_07

Case B participants were the only ones to mention that the cost of upskilling employees is a key component to consider when developing a BDA strategy. This becomes crucial when new technologies and tools, such as software or platforms are constantly introduced, and the existing workforce is forced to learn new programming languages or how to use the new tools in order to continue supporting BDA operations effectively.

"You need good people. You need good analyst skills and you do need, I guess an organization that's supportive of that and willing to spend any money… you need to train up your own internal staff members, and broaden their skills…" (CB_02)

5.2.5 Internal Component 5 - Technology

The technology theme was a primary component across both case organizations and was indicated as an essential theme to be considered when formulating a BDA strategy especially for a skilled workforce that is going to work with BDA technologies. The technology component was the most referenced theme in both case organizations in this study, it was referenced ***228*** times as shown in Table 11.

Table 11:Technology theme by reference and source

Theme /Sub-theme	Sources	References	Case A references	Case B references
Technology				
Tools - (hardware, software, platforms, infrastructure)	25	***228***	142	86
New technology	24	111	48	63
Technology assessment	22	76	37	39
Autonomous technology	16	48	35	13

According to the findings, case A participants spoke more about the technological tools like the software and hardware, while case B participants centred most of their technology conversations around new technologies such as AI and machine learning, this could be attributed to the notion that case B drives BDA innovation and has won a few innovative African awards, see Appendix G. In addition, the findings suggested that assessing the right tools to use for one's BDA initiatives is as important as using the tool itself. For instance, a principal data analyst for case A organization with a BSc. in Computer Science and more than 10 years' experience highlighted the value of being able to identify the suitable software, hardware, platforms, and infrastructure as part of the BDA technology assessment process. This challenge raises the need for organizations to include suitable technology in their BDA strategy.

"You play around with different tools to know which tool will work for what." (CA_04)

CB _11, a senior data analyst further highlighted the correlation between choosing the suitable technology and factoring the bargaining power of suppliers according to Porter's 5 Forces. The suppliers high bargaining power can negatively impact an organization's operations if they choose to discontinue offering their service or product that organizations critically require for their BDA endeavours.

"…the big data analytics strategy obviously comes down to the profitability of the company. Is it worth it to go into the cloud? Is it worth it to get a bigger server to be onsite-prem? Obviously, taking all legal and those things into account, they do influence us in our strategies because if we suddenly want to move from a specific access database to a SQL based one, then we need to learn SQL and all this time we have been coding data in SAS, for instance. So, tools do impact strategy when deciding which tool is more profitable and do we have the resources to execute strategies given the suppliers willingness to provide us with what we need." (CB_11)

Furthermore, the above participant quotes provided an empirical example of the need to think system wide and holistically when scoping components that inform a BDA strategy. The technology component for instance, was bundled with other complementary BDA components which are discussed in detail in other sections of this chapter, such as legal and regulation, being mindful of the bargaining power of suppliers (Porter's 5 Forces) and the willingness by organizations to upskill employees to expand their capabilities (people skills). These related BDA components must be reviewed as underpinning components that inform the formulation of a BDA strategy as they have the potential to holistically impact an organizations value proposition and profitability.

The other significant finding across the two case organizations was the impact of new technologies on existing BDA strategies. While most participants mentioned the positive aspects brought about by new technologies in aiding their BDA initiatives, some also indicated how new technologies brings about new challenges and uncertainty. For instance, the artificial intelligence (AI) technology and platforms that have recently been launched have brought about uncertainty and challenges for organizations, in terms of whether to adopt or to ignore incorporating such technology within the business.

> *"…like this ChatGPT that just came out. How can we use it in big data analytics? How can we use that to make big data cleaner and you can actually ask it for certain type of coding." (CB_11)*

> *"...products like ChatGPT are not necessarily a full BDA solution so you don't have to dump your current service offerings but maybe start using it as part of your existing BDA strategy. So, you kind of find a nice little middle ground." (CA_02)*

Considering the main five (5) big data characteristics, volume, velocity, value, variety and veracity, organizations must now rethink how they manage these data characteristics. The importance of new technology and its impact on strategy BDA was revealed by CA_02, an advanced hyper-automation engineer who is qualified in mechatronic engineering.

"New technology, I think is very important so that you kind of keep up with it because as an example people used to take notes on paper before and now you've got the little portable scanning systems and if people are immediately putting data into tablets or whatever in real time, the volumes and the frequency that you starting to record data is going to increase quite rapidly, so it's definitely something that you want to keep in mind when considering your BDA Strategy…There are different kinds of technologies to consider when it comes to BDA. So, you need to know how you are going to gather your data to begin with and that I think is the key part that technology plays." (CA_02)

The importance of thinking about autonomous technology as part of one's technology component that informs one's BDA strategy was mostly mentioned by the case A participants (35 references - see table 11) who highlighted the use of robotic automation processes (RPA), cloud computing, machine learning, AI to save time, help clean the high volumes of data while maintaining decent data quality and minimising errors (data veracity). On the other hand, case B participants only referenced autonomous technology 13 times out of the 48 times and mainly spoke about leveraging autonomous functions within AI and machine learning in order to gain competitive advantage. An additional point that necessitates the need to include technology in a BDA strategy was mentioned by CB_04, who pointed out the educational challenge faced in a South African context which then forces organisations to only utilise autonomous technologies at a basic level due to the lack of adequate education and skills required to fully utilise the capabilities offered by these kinds of technologies. This further highlights the importance of educating people to a level that they have the knowledge and skill to fully utilise autonomous technology.

Lastly, understanding BDA components such as big data characteristics, people skills, business goals and BDA techniques will help organizations make informed decisions when assessing which technological tools, new technologies and autonomous technologies are best suited for their specific BDA initiatives.

5.2.6 Internal Component 6 - BDA Solution Cost

The cost of the BDA solution plays a crucial role in formulating a BDA strategy as the organization has to initially understand available investment budget to fund the acquisition of the required BDA resources such as technologies and analytics people skills. For instance, technology decisions such as choosing between cloud hosting versus on-premises or open-source software versus proprietary have cost implications on overall profit margins. According to the findings, 22 participants from both case organisation made 111 references based on the cost of the BDA solution as a main underpinning component that must be considered when formulating your BDA strategy (Table 12).

Table 12:BDA cost theme by reference and source

Theme /Sub-theme	Sources	References	Case A references	Case B references
Cost of BDA Solution	22	111	56	55

One of the main objectives of most organizations embarking on BDA initiatives is to enhance their value proposition while remaining profitable.

"Then there's also the idea of clearly understanding your costs around the various solutions and clearly, what's also quite hard in our times, is to build our business case, as part of your strategic plan, as that will have what is your use cases or purposes that will deliver the value?" (CB_05)

The CEO of case B organisation, CB_08 further elaborated the cost impact of technology in an African context compared to the other regions in the world, like America where technological resources that enable BDA initiatives are cheaper and easily accessible. This then informs how one structures one's BDA strategy when it comes to factors like deciding to utilise physical hardware on premises versus subscribing to a cloud first strategic approach.

"I think in the African context we have not reached the point yet where cloud computing is cost effective, right? There's very few businesses that run at the scale where cloud computing makes your commercial sense. So I think that's still a bit of an impediment actually; in terms of a BDA strategy so even though they are trying, it`s very different with American businesses, and as a smaller business ourselves, you know, we struggled with the same still cheaper to buy hardware than to do it on all our analytical servers in the cloud, even though we are moving very slowly." (CB_08)

According to the findings, there are overall strategic costs that should not be overlooked when formulating a BDA strategy. These costs are associated with how one sources, stores, processes and presents the data as information and insights (visualization).

"If you are talking about prices, it would be a similar thing to any kind of business, because the cost of making that strategy and processing all of that data, there's obviously a cost to that." (CA_10)

A senior data analyst for case B organisation revealed a critical link between the choice of technology, and the associated cost to implement the technology and how the value proportion has to be justified to end users (consumers). With regards to organizations offering BDA services to other industries, one participant made the connection between accounting for overall BDA associated costs versus the selling price point and how that impacts the bargaining power of clients that are being offered BDA services (Porter's 5 Forces).

5.2.7 External Component 1 - Porter's 5 Forces

Most of the participants in the two case organisations indicated the value of including Porter's 5 Forces model when focusing on underpinning components that should inform the formulation of a BDA strategy. The participants emphasised the value of comprehending the 5 forces and how that empowers an organization to strategically optimize its BDA strategy, effectively plan resources and enhance profitability. The common theme identified in the study under Porter's

model was the rivalry among existing competitors operating in the same industry (see Table 13). The findings showed that the rest of the forces centred around the rivalry among existing competitors which is aligned with the visual presentation of Porter's 5 forces model depicted in Figure 4 under the literature review section. Each force is discussed in detail in the following subsection in relation to how it informs the formulation of a BDA strategy.

Table 13:Porter's 5 forces by source and reference

Theme /Sub-theme	Sources	References	Case A references	Case B references
Porter's 5 Forces				
Supplier bargaining power	23	45	25	20
Customer bargaining power	23	44	25	19
Rivalry between companies operating in same market	23	67	41	26
Threat of substitute products	22	39	25	14
Threat of new entrants	19	43	23	20

5.2.7.1 Bargaining Power of Buyers

The findings indicated that as part of one's BDA strategy formulation, one must plan for the price point at which one intends to provide BDA services or products, to accommodate for changes in the business environment, technology, and business conditions. A data specialist, CA_05 highlighted the importance of strategically having a larger number of consumers to have the upper hand when it comes to charging higher BDA product or service prices to increase profitability. In summary an organization that plans to have more customers will be better positioned to bargain with customers on price due to increase in demand compared to an organization with a smaller client base.

"The more buyers you have, will result in an increase in demand. Which in turn will allow you to offer a better price." (CA_05)

In addition, one participant CB_10 further elaborated the above finding and emphasised how consumers compare price points for BDA offerings on the market and how it affects their bottom line. Customer bargaining power negatively or positively impacts net profits after all costs have been deducted hence the importance of reviewing customer bargaining power when formulating a BDA strategy to plan and to gain competitive advantage.

"The bargaining power becomes a little bit interesting, because now, once everyone that currently sits in the market is able to collect as much data as they can, then what they'll do is, they would want to understand how their current product compares with their competitors, they would want to understand that now, because you're now doing a comparison, therefore, now you want to understand what if you

were to reduce your price to be the same as your competitor? Or how am I going to sell more? And will I be able to achieve the profits that are required? That's the first question." (CB_10)

Lastly, the findings revealed that the prevailing South African economic climate can influence the buying power of customers since buyers tend to spend on the bare minimum to sustain their own operations. This was highlighted by a decision analytics associate consultant for case B organization, who linked the customer buying power to the currently under pressure South African economic climate and how that influences consumer behaviour when consuming BDA technologies using a bread and milk analogy. Customers will only spend money on the bare minimum BDA services if the general economy is not thriving.

"Depends on your economy as well. I mean, you know, if your economy is not doing very well, then you're not going to sell luxury type of items... You have to sell like bread and milk and all those other things. So yeah, I don't know, the usual bargaining power won't be very good. I mean, people just going to revert to buying your products that they only need." (CB_03)

5.2.7.2 Bargaining Power of Suppliers

The findings showed that, similar to the buying power of customers, the suppliers will also use the same bargaining tactics to justify their BDA products or services when it comes to the price point that they offer to South African organizations. This situation results in the need to set up strategic vendor partnerships as part of a BDA strategy to lower key input costs and to help sustain South African organizations BDA operations that are reliant on services or products from leading suppliers. Participant CA_01, with more than 20 years of experience went on to highlight how critical it is to conduct some form of due diligence when selecting technology vendors and having a reliable supplier as it will not force you to switch to a more expensive supplier which might result in lowering your profits.

"*The strategy is to ensure you partner with suppliers to sustain your BDA strategy. In our case we partner with reputable vendors that provide platforms that we mainly use to run our BDA service offerings. We try to stay away from smaller companies and technologies that are dependent on humans. We carefully analyse before we invest in any technology or supplier. It's very important to know that the supplier will be there for the next 20 years." (CA_01)*

5.2.7.3 Threat of New Entrants

The findings reveal the need to be mindful of who the new entrants are as well as their product offering. If they can easily enter the market, based on cost and time, one needs to have a plan in one's BDA strategy to mitigate that threat and strengthen one's relationship with existing customers to remain competitive.

"Looking at startups. I mean, you always get a band or a group of guys, which you know, incorporate the latest tools, and they can cut your time by so many days or whatever, you know, so it seems very promising but then obviously, they need to deliver and you need to do some investigation into your competitors by checking if it's something that is viable, will they be a threat to what you are actually doing and …will your customers jump ship? and then also your relationship with your customers." *(CB_03)*

5.2.7.4 Threat of Substitute Products

According to the findings, some of the participants mentioned that organizations should be aware of BDA related substitute products because of the possible negative impact of losing customers and market share due to customers preferring to buy a cheaper alternative product or service, which in turn affects the organizations profitability.

"There is big influence because if it is a cheaper substitute, someone's not going to use your product anymore. So, you need to also be aware what the possible substitute is, because it could influence price." (CA_05)

The importance of how this threat should guide the formulation of a BDA strategy was emphasized by CA_14, a case A participant who highlighted the strategic questions decision-makers need to address when determining how to respond to the introduction of substitute products. Some of the corresponding answers shared by the case participants included developing unique value propositions, building stronger customer relationships, and investing in new innovative BDA solutions.

"This is probably the biggest threat in the environment, there`s always a threat that a new product will come around and provide better value than what we have. So, the question is at that moment do you adapt, adjust, do you pivot, do you move to the new product or do we evaluate the cost or either option." (CA_14)

5.2.7.5 Rivalry between Companies Operating in the same Market

According to the findings, the case participants revealed that organisations will try to undercut each other in one way or another to increase their market share and profits. Some competitors operating in the same market will even employ unscrupulous tactics just to gain an advantage over other competitors, as mentioned by the chief executive officer (CEO) of case B organisation, who highlighted the dirty tactics used by competitors just to get ahead.

"Sometimes you think you`re in partnership with people and then at the end of the day they just want to find out what your goals and aspirations are so that they can use it against you. Obviously, that depends on what type of partnership it is that you have and sometimes you think they want to be partners when they actually want to get close to you to see what you have. So, you have to be weary, be cautious of what you say, what you do and what you reveal out there basically." (CB_08)

Considering the above statement, most participants emphasized the importance of driving your own organization's strategic BDA goals and objectives rather than getting distracted by the competition and focusing on what they are doing. Some of the participants mentioned that one possible way of dealing with the unfair competitor tactics mentioned above is to focus on your own strengths, such as exceptional customer experience and highlighting your unique value proposition. At the same time, the reminder is not to be oblivious but to strategically make sure organizations stay informed about their competitor BDA activities;

"Focus on what you're doing, but don't be ignorant and think that there isn't competition out there. Always be aware of things that are happenings around you, but don't concentrate or focus too much on your competition that you forget about your own goal..." (CA_03)

Lastly, as part of your BDA strategy components, participant CA_07 suggested that it is important to match your rivals pricing models and price points to ensure that you stay informed of the pricing of your rivals so that you continue satisfying your clients and providing them with unquestionable value;

"It`s important to keep them happy and you would want to match your rivals in terms of costing and if they`re going to come down at a lower price you need to see what I am giving the client, what is the competitor offering." (CA_07)

5.2.8 External Component 2 - BDA Social Trends

According to the findings (Table 14), South African organizations must stay up to date and be on the lookout for evolving lifestyle changes and be able to respond to social trends such as accelerated remote work and shift towards online shopping after COVID-19 pandemic in order to maintain a competitive edge in a volatile market. By leveraging big data, organizations must identify what is socially trending before finding a suitable approach that integrates these trends with their BDA strategy to make informed decisions that will enable them to attract new customers and ensure they also stay relevant within the market space.

"*Social trends should complement a BDA strategy because you always need to be aware of what's out there… social trends are very important to always keep up to date, what is out there in the world and how you can apply it and make your big data analytics strategies more current." (CB_11)*

Table 14:BDA social trends by source and reference

Theme /Sub-theme	Sources	References	Case A references	Case B references
Social Trends	23	37	20	17

5.2.9 External Component 3 - BDA Customer Behaviour

The findings revealed that, customer behaviour helps inform one's BDA strategy by allowing decision makers to identify customer trends that will enable them to maximum their profits as mentioned by CB_10, a qualified actuary and financial mathematician (Table 15).

"You will always be able to identify trends within your data… understand how exactly your clients are behaving, and you can ensure that based on that behaviour, you are able to make more profitable strategic decisions as a result of that." (CB_10)

CB_10 went on to make the interlink between social trends and customer behaviour by giving an example of how social trend aspects brought about by the COVID-19 pandemic such as a reluctant to shop in person led to the growth of e-commerce and avoidance in handling cash by people led to the accelerated adoption of contactless payments. According to the findings

these changes in trends and behaviours meant organizations had to plan on how to capture and process increased data capacity from these datapoints at a strategic level to sustain BDA initiatives.

In summary understanding customer behaviour is crucial in the formulation of a BDA strategy as it will enable organizations to gain invaluable insights about customer purchasing patterns and preferences. Organizations can then implement targeted marketing strategies to ensure the provide personalised customer experiences that enhance customer satisfaction.

Table 15:BDA customer behaviour by source and reference

Theme /Sub-theme	Sources	References	Case A references	Case B references
Customer Behaviour	22	63	28	35

5.2.10 External Component 4 - BDA Economic Factors

Economic factors are variables external to the organization that can influence a business financial state such as interest rates and inflation rate. Organizations should closely monitor economic factors and make adjustments when economic conditions change. This necessitates the need for organizations to include economic factors in their BDA strategy as these volatile factors can impact profits generated from BDA assets. Most of the references were made by case B participants, 52 compared to the 10 references from case A (Table 16). This could be attributed to the fact that case B organization has more experience and considering that most of their work is with BDA clients in the retail credit provision, microloans, vehicle finance and insurance credit risk industry. According to the findings, case B participants mentioned how economic factors in South Africa like high inflation, interest rates and exchange rates can impact your spending power, by making certain BDA resources like technological tools and BDA skilled individuals less affordable. This potentially then forces organizations to look for alternatives or substitute products.

"I think it largely depends on your economy as well... are you going to replace your product with a less unknown product? … that's all driven by the economy and there are risks in that as well. Sometimes you can't afford the same product that you used to have, and you have to move on to something else." (CB_03)

"I think the major challenges is budget, right? So, in the current economic climate is it's difficult to find budget right and justify spend while revenues is under pressure. I think especially in a South African context, with the repo rate going up. It's globally tough going but in a South African context specifically, it's even tougher." (CB_05)

Table 16:BDA economic factors by source and reference

Theme /Sub-theme	Sources	References	Case A references	Case B references
Economic Factors	19	62	10	52

5.2.11 External Component 5 - BDA Competition Outlook

According to the findings, South African organizations must first understand their competition landscape before developing a plan of action which specifies how they intend to compete with their rivals (Table 17). The plan of action should be part of the BDA strategy that will help differentiate an organizations service from competitors (product differentiation) and allow them to maintain a competitive advantage. Most of case B participants mentioned that when formulating a BDA strategy organization should consider planning for having a competition performance monitoring mechanisms to enable better decision making based on information gathered on how rivals are using BDA.

> *"Competition outlook should always be taken in terms of what can you do differently to your competitors… How can you build your data, present your data, or process your data better than your competitor and give you a competitive advantage…* also being aware of what your competition is doing, so that you can employ it in your overall BDA strategy." *(CB_11)*

In contrast to the competition outlook approach mentioned above (competitor analysis), other participants like CB_06 (head of delivery), raised the point that while organizations should still monitor their competitors, they should not let their BDA strategy be solely driven by what their competitors are doing. Instead, organizations are encouraged to be confident enough to trust their own unique abilities and strive to formulate their own BDA strategy that aligns with their goals and capabilities.

> *"… you need to be aware of what these guys are doing but it shouldn't be your driving force... if you really trust your market and what you're doing, just make sure that you do it to your best ability and what you feel is your north star and follow your path, especially with your BDA strategy…" (CB_06)*

Based on the two competition outlook approaches, the recommendation for organizations is to find the balance between being overly confident to only focus on their own BDA strategy and being aware of what competitors are doing before incorporating a few significant BDA aspects from competitors into their own BDA strategy.

Table 17:BDA competition outlook by source and reference

Theme /Sub-theme	Sources	References	Case A references	Case B references
Competition Outlook	24	106	22	84

5.2.12 External Component 6 - BDA Legal and Regulatory Climate

The findings indicated that there is a big concern around organization not being mindful of the legal and regulatory aspects of BDA in a South Africa context hence the need to include this component when formulating a BDA strategy (Table 18). The importance of having the right skilled people who can advise on such matters was also identified as crucial. The strategic interlink between having the right people skills and the legal and regulation theme is also mentioned as a critical aspect that will benefit the organization when it comes to related BDA data compliance issues. Failure to comply with data laws and regulations might have dire consequences that will jeopardize BDA operations and lead to lawsuits or heavy monetary penalties that can easily erode the BDA value.

"*We also have an IT and security officer. So, all these roles play a part in the strategy formulation and advises alongside their expertise. So, an example would be, the security officer will make sure that we are in bounds of the POPI act and all the safety and security measures as per our policies…" (CA_11)*

"it`s important to align your strategies to the law of whatever country or whatever your solution is needed, you have to make sure that it`s compliant to everything and you have to make sure that your client`s privacy is met also, you can`t leak information." (CA_07)

Table 18:BDA legal & regulatory climate by source and reference

Theme /Sub-theme	Sources	References	Case A references	Case B references
Legal and Regulation				
Laws & acts	23	51	26	25
Data security & privacy	19	45	28	17
Data residency	12	14	6	8

Another relevant finding mentioned by the participants when formulating BDA strategy was centred around ensuring organizations comply with, data residency, privacy, and security laws, especially for organizations handling customer data. The importance of setting robust data protection measures to safeguard customers data was stressed by participants to avoid jeopardizing future business and eroding customer trust. On the other hand, with the rise of cloud computing, both case participants revealed concerns around data security and the growing complexity of navigating data residency laws governing data stored across different geographical legal borders such as the General Data Protection Regulation (GDPR) in Europe and POPIA in South Africa.

5.3 Overview

In summary this study collected qualitative data on the main underpinning components that inform the formulation of a BDA strategy for organizations in South Africa. The collected data was inductively analysed using NVivo and although there were slight deviations in how the underpinning components informed the formulation a BDA strategy for case A and case B organizations, the identified 12 main themes discussed under the findings section were common in both case organizations. Most importantly, it is worth mentioning that technology, and in particular tools, had the most significant references - **228**, followed by people skills - **182** references, and lastly business goals and objectives BDA (Initial purpose) - **130**, are the top three crucial components from the findings that should inform a BDA strategy formulation. In addition, the value characteristic of big data was also significantly referenced by participants - **125** references.

5.4 Emerging BDA Strategy Formulation Model

The emerging model was produced from real world empirical interviews data and is fundamentally connected to the empirical findings from the multiple case study participants. The inductive approach allowed for the development of dominant themes and categories from the coding to emerge directly from the raw data resulting in the formulation of a model (Thomas, 2006). The formulated empirical to conceptual model helps answer the research questions, contributes towards minimising the knowledge gap in literature, and help guide organizations.

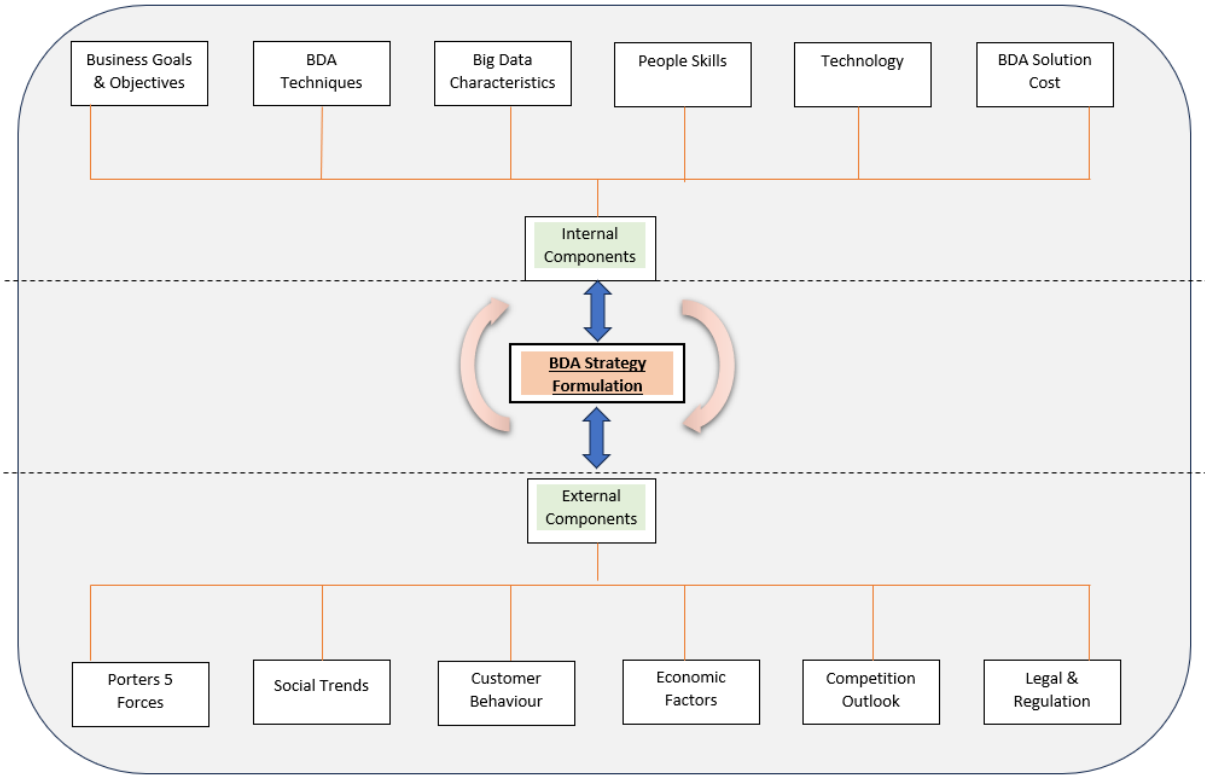

Figure 17: Proposed BDA strategy formulation model

Figure 17, is an illustration of the model, separated into six internal and six external organizational components. The internal components cover aspects that are internal to the organization and can be controlled within the organization, such as people skills and business objectives. The external components encompass components that are outside of the organization and are not in the organizations control, for example economic factors and legislation landscape.

6 Discussion

The aim of this chapter is to expand on the main BDA components research findings presented in section 5 and to compare the research findings with existing literature and provide answers to both primary and secondary research questions. The primary research question was:

- **What are the main components that inform the formulation of a big data analytics strategy for organizations in South Africa?**

The secondary research questions were:

- ***In what ways does Technology inform the formulation of a big data analytics strategy for organizations in South Africa?***
- ***In what ways do Big Data Characteristics inform the formulation of a big data analytics strategy for organizations in South Africa?***
- ***In what ways do Porter's Five Forces inform the formulation of a big data analytics strategy for organizations in South Africa?***
- ***In what ways do Big Data Analytics Techniques inform the formulation of a big data analytics strategy for organizations in South Africa?***

The rest of the chapter is structured as follows; Section 6.1 and 6.2 will answer the research questions by discussing the identified main components, how these components then inform the formulation of a BDA strategy and the ways in which components like technology, big data characteristics, Porter's 5 forces and big data techniques inform the formulation of a BDA strategy for South African organizations. According to the perspectives of the formulated model, the discussion of the findings is organised into six internal and six external components that should inform the formulation of a BDA strategy. In addition to the integration between the findings and the academic knowledge from literature on the components, the discussion will proceed to demonstrate how the findings fit or differ with current knowledge regarding the components that should inform a BDA strategy for South African organizations and which new knowledge is contributed.

6.1 Internal BDA Components

The findings revealed a grouping of internal and external components which are shown in Figure 7 as the main overarching themes. This section will focus on discussing the 6 internal components illustrated in Table 19 in relation to relevant literature as well as covering the primary and secondary questions of this research study.

Table 19:Internal BDA components and supporting literature

Internal BDA Components	Empirical Evidence	Supporting Literature
Business goals & objectives	Section 5.2.1	(Grover et al., 2018; Tabesh et al., 2019)
BDA techniques	Section 5.2.2	(Amiri & Engelen, 2022; Aneato, 2020; Davenport, 2018)
Big data characteristics	Section 5.2.3	(Ghasemaghaei et al., 2017; Hariri et al., 2019; Mikalef et al., 2018)
People skills	Section 5.2.4	(Adrian et al., 2017; Mathrani & Lai, 2021; Wheelen et al., 2017)
Technology	Section 5.2.5	(Kudryavtsev et al., 2016; Mikalef et al., 2021; Walker & Brown, 2019)
Solution cost	Section 5.2.6	(Mathrani & Lai, 2021)

6.1.1 Business Goals and Objectives

Objectives are quantifiable outcomes of planned activities that stipulate what is to be accomplished within specific timelines and the achievement of set objectives should in turn result in realization of the organization's mission (Hunger & Wheelen, 2021). When formulating a BDA strategy, the findings highlighted the need for South African organizations having clearly articulated BDA business goals and objectives in their BDA strategy in order to be able to generate meaningful insights and enhance decision making (Grover et al., 2018). This was consistent with literature that states that, BDA business goals must be clearly stated and communicated to ensure successful transformation of data into insights (Tabesh et al., 2019).

There was further reference to the link between clear business objectives and the expected business benefits from BDA efforts. To realise the value of BDA, it is crucial to initially formulate clear BDA business objectives based on organizational needs. Subsequently, South African organizations should then strategically determine the appropriate BDA investments to pursue based on these organizational needs, rather than allowing a perceived need for BDA technologies dictate the strategic business goals and objectives (Maritz et al., 2020a). There is a gap in literature compared to what the findings revealed in relation to how South African organizations mentioned the need to also include the purpose, vision representing a future strategic path, business plan and business needs as part of the precise goals and objectives that should be informing a BDA strategy. Al-Sai et al., (2020), in their paper only generally discussed having clear goals and strategy that aligns with your vision and mission. Their paper did not include incorporating the purpose, mission and vision as part of the precise goals and objectives that should be informing a BDA strategy.

6.1.2 BDA Techniques

While Amiri and Engelen (2022), distinguished four main BDA techniques: descriptive, diagnostic, predictive and prescriptive. The South African organizations mainly distinguished three main data analytics techniques: descriptive, predictive, and prescriptive (Grover et al., 2018), as the BDA techniques that should be included by organizations for BDA strategy formulation.

According to Hariri et al., (2019), the aim of applying big data analytic techniques is to find hidden patterns and to extract information from massive datasets that is going to unlock valuable business opportunities. For this to happen South African organizations need to determine and decide on the appropriate BDA techniques to apply to bring about organizational success (Davenport, 2018). Consequently, the selected techniques should inform the relevant technological tools and required people skills to support BDA operations (Davenport, 2018). From this discussion in can be noted that, the interplay of the components revealed under South African case organization findings is in line with what literature is suggesting.

6.1.3 Big Data Characteristics

The findings revealed that South African organizations have to include the initial 5V's of big data characteristics: volume, velocity, variety, veracity, value, with the addition of visualization in their BDA strategy for BDA to be effective (Hariri et al., 2019). In line with literature, the inclusion of the 5Vs of big data characteristics in the BDA strategy is essential because it can significantly impact the overall cost of a BDA solution and also influence other components such as technology selection (Ghasemaghaei et al., 2017). It can be proposed that strategically planning how to mitigate challenges posed by the characteristics of big data becomes crucial for BDA organizations in South Africa. In their BDA strategy, South African organizations need to include mitigating strategies showing how they intend to harvest large volumes of rapidly generated data and manage diverse data formats (Berisha et al., 2022). This means that a well formulated BDA strategy will ensure that a scalable approach is selected to accommodate an increase in data: volume, usage, storage, and processing needs.

Value is the most important big data characteristic revealed by South African organizations in the empirical findings, hence the importance of creating or realising business value out of BDA was echoed in literature by Amiri and Engelen (2022), who highlighted that formulating a big data analytics strategy has the potential to help organizations derive economic or social value from BDA initiatives.

6.1.4 People Skills

The empirical findings demonstrated that BDA in a South African context, is not only synonymous with technology, but the right combination of people skills and tools should be applied to realise business value. According to literature, the success of BDA investments is dependent on the availability of qualified BDA people (Al-Sai et al., 2020). This goes in line with the case study findings that strategic business outcomes are highly dependent on technical and business knowledge. A lack of knowledge around these two areas has been noted in literature as constraints in deriving full potential of BDA technologies (Mikalef et al., 2019). In addition, organizations integrating their people skills with their BDA strategy will also consider having employees with the required leadership competencies to direct BDA initiatives in alignment with the set strategic business goals (Côrte-Real et al., 2019). Conversely, the shortage of people with the required BDA related skills poses a challenge for South African organization as they fail to recruit the skilled workforce that is required to enhance business decision making. This skills shortage challenge is more apparent is developing countries like South Africa (Mathrani & Lai, 2021). In summary the people skills component plays a critical role in informing the formulation of a BDA strategy for South African organizations because people with the right skillsets must be available to successfully drive BDA initiatives.

6.1.5 Technology

It has been demonstrated that technology is a crucial component when it comes to big data analytics and has to be carefully selected (Aneato, 2020). This is in alignment with the study findings that revealed that South African organizations mentioned technology as the most crucial component of a BDA strategy as highlighted by the empirical findings from both case participants. Technology is related to data collection, storage, processing, analysis, application, and visualisation (Al-Sai et al., 2020). According to the results, South African organizations BDA strategies should utilize technological tools that are compatible with the various characteristics of big data like volume, variety, and velocity in order to scale sustainably. Otherwise, as stated in literature, the misfit between the data processing and the technology applied can cause challenges that can result in technical people failing to achieve the set objectives of BDA initiatives (Amiri & Engelen, 2022).

According to Isabelle et al., (2020), organizations have to be more strategic in their approach when integrating emerging technologies into their service offerings, which means South African organizations must also be strategic when it comes to BDA technology selection criteria. This is further extended to the BDA solution cost and economic factor component discussed in sections 6.1.6 and 6.2.4 respectively. Furthermore, this has been previously discussed by other authors as the global price of most BDA tools and software is usually

quoted in United States Dollars (USD), which influences the operating model in developing countries like South Africa (Isabelle et al., 2020).

According to the findings, the rapid evolution of technology such as IoT, generative artificial intelligence, cloud computing and machine learning, ushered by the digital era has introduced BDA strategy dilemma for South African organizations that now have to contemplate implications of these emerging technologies regarding whether they will present business opportunities or threats for them and the industry (Union, 2020). Furthermore, South African organizations must strategically predict and plan if they are going to hold off adoption or integrate these emerging new technologies into their daily operations with the hope of enhancing their business performance (Union, 2020).

Literature goes on to mention that a BDA strategy should also define how the technology will be integrated into the organization and used organizational wide, including clearly communicating anticipated business value (Mikalef, Watering, & Krogstie, 2021). Based on the above discussion, including technology becomes a crucial component of a BDA strategy for South African organizations looking to utilize BDA to enhance business performance.

6.1.6 BDA Solution Cost

Despite the continuous growth and integration of BDA in emerging technologies like artificial intelligence and machine learning, there remains uncertainty regarding the conducive conditions under which BDA can consistently deliver tangible business value as only a small percentage of organizations have managed to harness the full potential of their BDA investments (Mikalef et al., 2019). Based on the findings it can be deduced that tools and in particular new technology is critical in advancing BDA initiatives for South African organizations but at the same time, it can be noted that the cost of BDA investments is not cheap (Mathrani & Lai, 2021). Hence, technology costs often act as a barrier to entry for South African organizations that usually have limited resources to invest in BDA to enhance their business performance (Mathrani & Lai, 2021).

Therefore, organizations must initially base their BDA initiatives on a cost-benefit analysis when assessing total cost of ownership to justify BDA investments. This is true especially for organizations operating in developing countries such as South Africa, where unlike organizations operating in Europe, costs associated with the big data characteristics such as data storage, processing power, memory and bandwidth are not becoming more economical or decreasing with time (Ferraris et al., 2019). An additional challenge that contributes towards the BDA costs in developing countries is that most of the well-developed infrastructure and BDA qualified skilled people reside in developed countries (Mathrani & Lai, 2021). This means that South African organizations operating in a globalized market from emerging economies

have to fiercely contest with similar organizations operating in developed countries. In order for South African organization to effectively compete, they need to plan for all BDA cost implications in their BDA strategy as this might impact their profitability.

6.2 External BDA Components

This section will focus on discussing the 6 external components illustrated in Table 20 in relation to relevant literature, at the same time cover the primary and secondary questions of this study. According to Grover et al., (2018), to ensure BDA strategy success, South African organizations are encouraged to go beyond the internal components already discussed in section 6.1. For instance, the summarised internal components discussed thus far include integrating datasets, BDA techniques, knowledge and implementation experience of analytics, methods, and tool. South African organizations should rather consider a more holistic integration approach which includes adding external components within the environment that they operate. These external components will be discussed in this section. This external component approach is in line with sentiments echoed in literature as a core challenge faced by business leaders when formulating BDA strategy in the twenty-first era. Literature highlights that there is a barrage of dynamic components that must be taken into consideration, such as the rapid emergence of disruptive new technologies, the endless influence of social trends, the evolving legal landscape of data privacy, the disruptive rise of innovative competitors, the unpredictable changes in customer behaviour as witnessed during the COVID-19 global pandemic and the volatile global political or economic climate (Gavrilova et al., 2018; Isabelle et al., 2020).

Table 20:External BDA components and supporting literature.

External BDA Components	Empirical Evidence	Supporting Literature
Porter 5 Forces	Section 5.2.7	(Maxim, 2021)
Social trends	Section 5.2.8	(Hunger & Wheelen, 2021; Kudryavtsev et al., 2016)
Customer behaviour	Section 5.2.9	(Tabesh et al., 2019)
Economic factor	Section 5.2.10	(Gavrilova et al., 2018; Isabelle et al., 2020)
Competition Outlook	Section 5.2.11	(Grover et al., 2018)
Legal and regulatory climate	Section 5.2.12	(Grover et al., 2018; Isabelle et al., 2020; Konanahalli et al., 2020; Union, 2020)

6.2.1 Porter's 5 Forces

Despite persistent adoption challenges faced by emerging economies such as South Africa, South African organizations recognize the potential transformative power of BDA and thrive to integrate the phenomenon into their business strategies (Lufti et al., 2022). The findings showed that the rest of the forces centred around the rivalry among existing competitors which is aligned with literature (Porter, 1996).

Porter (1996) argues that to sustain competitive advantage, organizations need the capability to create, market and deliver products or services more efficiently or with fewer resources than their rivals. An increasing number of authors have argued that Porter's 5 forces model is too static and additional forces such as, globalization, digitization and deregulation should be added to make it relevant to the complex needs of the 21st century era (Isabelle et al., 2020). From this discussion, it can be concluded that, the BDA components results from this study resonate deeply with the argument from other authors mentioned above, who advocate for integrating the 5 forces with additional forces to make it more impactful (Isabelle et al., 2020). In this case, there is need for South African organizations to integrate Porter's 5 forces with the other BDA main components from the findings such as the legal and regulatory climate to inform the BDA strategy and make it more impactful. See the illustrated interplay of components from the emerging model in Figure 15.

In addition to the interlinking of Porter's 5 forces and other components, the findings show corroboration with past literature in that South African organisations in their BDA strategy must analyse the level of competition within their industry in order to establish business objectives that drive competitiveness in the market they are operating in (Maxim, 2021).

6.2.2 Social Trends

Social trends are prevailing patterns of behaviour and preferences that become widespread within a society over time (Morris et al., 2015). The trends can be influenced by various technological, cultural, political, or demographic aspects. The findings reveal that South African organizations have to monitor social trends as part of their BDA strategy since social dynamics in different geographical areas may be important to their overall BDA strategy or might be beneficial in other business trading relationships with other trading organizations in the industry (Hunger & Wheelen, 2021). According to Oesterreich et al., (2022), the social trend component should be treated with the same importance as the crucial technology component considering how BDA is being integrated into emerging digital technologies to assist organizations create business value.

Much of the available literature on social trends and BDA interconnects with tracking social media trends or social networks and how BDA can be strategically leveraged by organizations

to improve social engagements by detecting rich trends and relations that offer personalised experience to consumers (Misra et al., 2020). What this study failed to comprehensively connect to literature was the dichotomy around the perceived potential risk brought about by the new digital emerging technologies that have been embedded with big data analytics and how this can be incorporated into a BDA strategy before the prevailing fears of emerging technologies become crippling social trends. Strangely, in a South African context where societies are still impacted by historical social inequality and most of the workforce occupies low and semi-skilled jobs such as elementary work and operating basic machinery (Khuluvhe et al, 2022). As a result, a multitude of detrimental social issues arise for South African organizations to consider around the fear of potential mass unemployment and the unclear ethical considerations around automation (AI) impacting individuals and societies as the fear of emerging technologies like, AI, BDA and automation replacing low to semi-skilled human jobs grows exponentially with time (Lyu & Liu, 2021; Rapanyane & Sethole, 2020).

6.2.3 Customer Behaviour

Customer behaviour plays an important role in customer-oriented businesses such as the retail, credit risk, insurance and banking industries (Ebner et al., 2014). Since one of the key purposes of BDA from the empirical findings is to increase organizational efficiencies and gain valuable customer insights. It is important for South African organizations to include how they intend to track customer behaviour in their BDA strategy since they need to understand customer habits and behaviour for decision makers to be able to prescribe suitable action to be taken after analysing existing data (Tabesh et al., 2019). Consequently, South African organizations should be able to apply advanced analytical techniques to strategically enable them to know what they need to do and by when to maximize their profits, for instance identifying potential consumer demands way in advance (Grover et al., 2018).

In addition, the study reveals that South African organizations that proactively pick up on customer trends by leveraging captured enormous amounts of data about customer behaviour can also improve customer experience by recommending insightful solutions (Adepoju, 2020). Furthermore, in line with the findings regarding the benefits of picking up customer trends, utilizing BDA to analyse customer patterns or behaviours unveils emerging market trends that help South African organizations with insights that shape the implementation of targeted marketing efforts, personalised offers, and contribute towards establishing a much stronger market brand (Mathrani & Lai, 2021). In summary, prioritising customer experience means South African organizations have to include in their BDA strategy customer behaviour plans on how they intend to monitor customer behaviour in order to generate customer insights that will enable them to maximize profits.

6.2.4 Economic Factors

Economic trends in any given country can have an obvious impact on business activities (Hunger & Wheelen, 2021). The findings of this study slightly differ from existing literature in that, most studies have not explored BDA strategy related factors in developing countries, and South Africa is classified as a low to medium income country (LMIC). The reliance on BDA products such as tools from suppliers exposes South African organizations to inherent economic vulnerabilities associated with American economic trends and United States dollars (USD) instabilities. This means that, changes in the American economy, as well as fluctuations in USD value relative to South African currency (ZAR), directly impacts procurement costs for South African BDA consumers and service providers, which results in foreign exchange risk (Isabelle et al., 2020).

Consequently, organizations operating in a third world economy like South Africa will experience and be affected by unique economic factors such as high interest rates and inflation, compared to other European and American organizations operating in the same industry. Therefore, this suggests that strategic understanding of such economic factors becomes crucial and must be included when formulating an effective BDA strategy as failure to plan for such anomalies can easily erode anticipated future revenue. Furthermore, South African organizations are expanding their operational footprint on a global scale, meaning that economies and BDA dependency industries around the world are becoming highly integrated and interdependent (Isabelle et al., 2020). As depicted by case B organization that has a digital footprint in more than 150 blue-chip companies across 30 countries around the world.

6.2.5 Competition Outlook

The advent of BDA has brought about a new level of competition among South African organizations as they try to anticipate the impact of emerging technologies to prepare for a volatile competitive landscape. In addition, the findings reveal that South African organizations are being forced to speed up innovation to remain relevant on the global market or to defend competition threats (Grover et al., 2018). The findings mention the advantage of knowing what the competition is doing to stay ahead, this is aligned with literature which stipulates that the more an organization captures information about its rivals the more it knows about its competitor and the more it gains a strategic advantage (Ranjan & Forpon, 2021). On the contrary, other participants encouraged South African organizations to take a different approach by staying focused on their own BDA strategy and not to worry about what the competition is doing. Regardless of approach taken the recommendation is to find middle ground and for South African organizations to include competition outlook as a BDA strategy

component that will help look into exploiting new opportunities or neutralize future competition threats (Grover et al., 2018).

6.2.6 Legal and Regulatory Climate

The holistic integration of the rules and regulation component with other components such as the people skills component enables South African organizations to have qualified personnel with the suitable regulatory data governance skillset as highlighted by the advantages of having an IT and security compliance officer in the findings (Nakasholo & Iyamu, 2023). South African organizations should plan for how they intend to mitigate the risk of possible data security and privacy threats in their BDA strategy to avoid service disruptions or comprising performance of BDA systems (Ogbuke et al., 2022).

Consistent with the findings and academic literature, international governments are enacting new data governance rules and regulations for organizations to comply with data regulations. Some of the regulations implemented by the European Union (EU) to safeguard against unlawful processing and transferring of European citizens personal data includes GDPR (Isabelle et al., 2020). However, in a South African context, despite the implementation of a legal framework such as POPIA, to protect users and societies it has been challenging to enforce such legislation in South Africa due to lack of standard practices across different organizations in adhering to POPIA principles (Union, 2020). As mentioned in the findings, the implications of POPIA noncompliance may result in hefty penalties or reputational damage for South African organizations. For this reason, South African organizations must prioritize and include legal and regulatory compliance standard practice requirements in their BDA strategy formulation to avoid exposing the organization to potential damaging legal liabilities (Georgiadis & Peols, 2021).

Globalization has brought about substantial data security concerns for developing countries like South Africa, regarding the physical locations of storage servers and reliance on cloud-based computing as users start worrying about the risk of cyber-attacks and data theft (Konanahalli et al., 2020). A well thought through BDA strategy will consider planning for possible data breaches by designing secure data systems and taking measures that enables them to stay compliant (Grover et al., 2018).

7 Conclusion

This chapter concludes this research study and provides an overview of the research findings in relation to the research questions, as well as covering study limitations and providing recommendations for future research.

In conclusion, what is different about this research study from other studies is that the applied inductive empirical approach covering the two case organizations seamlessly connects well with the advent of the fifth industrial revolution (5IR) which accentuates the need for organizations to embrace a human centric approach to harmonise the seamless integration between technologies such as big data analytics and human proficiencies. For this reason, organizations that are going to allow their BDA strategy formulation process to be informed by technology components and human expertise together with the other explored main BDA components, will be able to unlock the full potential of BDA investments and help achieve desired business outcomes.

7.1 Research Summary

7.1.1 Research Problem and Questions

The research set out to answer the primary research question - ***What are the main components that inform the formulation of a big data analytics strategy for organizations in South Africa?***

Through rigorous exploration, the following questions were addressed and answered during the research;

- ***In what ways does Technology inform the formulation of a big data analytics strategy for organizations in South Africa?***
- ***In what ways do Big Data Characteristics inform the formulation of a big data analytics strategy for organizations in South Africa?***
- ***In what ways do Porter's Five Forces inform the formulation of a big data analytics strategy for organizations in South Africa?***
- ***In what ways do Big Data Analytics Techniques inform the formulation of a big data analytics strategy for organizations in South Africa?***

7.1.2 Overview of Findings

The research findings started by focusing on the participants demographics to provide an overview of the experience and educational qualification level of the various participants. The

second focus area encompassed the empirical findings that were considered by the participants as the main components that should inform the formulation of a BDA strategy for South African organizations. The revealed components were very relevant in answering the main research question in a South African context, as the study focused on identifying the main components informing the formulation of a BDA strategy for organizations in South Africa. Some of the identified components that should be part of a BDA strategy for South African organizations included the importance of advancing technological tools, the integration with new technologies, the critical aspect of employing a skilled analytical workforce to effectively support BDA investments, integrating Porter's 5 forces to stay competitive in the market, staying informed with customer behaviour, and social trends in order to stay relevant and finally ensuring there is a set plan on how to harness various big data characteristics in order to draw valuable insights to enhance business performance.

In addition, the findings unveiled twelve key components that inform the formulation of a BDA strategy for South African organizations, categorized into six internal and six external main components. The findings showed how the research study answered the secondary questions by, understanding the ways in which specific components identified from literature via a conceptual model i.e., *Technology, Big Data Characteristics, BDA Techniques and Porter's 5 Forces* inform the formulation of a BDA strategy for organizations in South Africa. Lastly, the study also found that for the BDA strategy to be more impactful, most of the participants emphasised the need for South African organizations to ensure that the main components co-exist in a complementary manner and how it is crucial to maintain a balanced integration of the components that inform a BDA strategy. As precaution, the participants warned South African organizations against neglecting the balance and interplay of components as a risk that could lead to an escalation of BDA related problems.

7.1.3 Limitations of the Study

The limited research conducted on BDA strategy formulation motivated for the qualitative approach taken. This study sample size might have limited the BDA focus only to the two case study organizations and might not be representative of the greater BDA business landscape. Therefore, findings cannot be generalized to other organizations in other industries. Finally the research timeline followed a cross sectional approach. This implies that the research and the collected data was captured over a short period of time, thus overlooking changes that might unfold over a longer period of time.

7.1.4 Recommendations for Future Research

The research findings are based on the intervention within the multiple - two case organizations in South Africa, hence lacks generalizability. As a result, considering the way BDA strategies are formulated by organizations operating in different industries varies, it would be worthwhile to conduct a study exploring and comparing the main components informing the BDA strategy formulation for organizations operating in similar industries versus organizations operating in different industries in other developing country while following a longitudinal approach. In contrast, it is also worth noting that although we cannot make empirical generalizations with a multiple case study research, the purpose of the qualitative findings is to make theoretical generalizations rather than statistical reasoning (Bell et al., 2019).

7.2 Research Conclusions

The implications of South African organizations implementing BDA initiatives without identifying the main components informing a BDA strategy and not establishing clear business goals have a higher probability of BDA failure. What was evident during the study was that most South African organizations typically start scoping and planning for BDA related work without taking the time to formulate a BDA strategy as revealed by most participants and supported by some of the secondary data collected from the empirical interviews.

A positive research outcome was that managers and executives in South African organizations utilizing BDA have now been made aware of the importance of identifying main components that should inform the formulation of a BDA strategy before rushing into implementation phase. The main components considered as guidelines include having clearly defined BDA business objectives, the alignment between selected BDA techniques, technology and big data characteristics, identifying the suitable people skills required to support the BDA investments, conducting cost-benefit analysis to justify cost of BDA solutions, incorporating Porter's 5 forces model to maintain a competitive advantage in the market, keeping an eye on customer behaviour and social trends, being aware of the impact on operations of economic factors, tracking competitors and understanding the global legal and regulatory landscape when it comes to data governance.

Undoubtedly, South African business leaders have been incited to make sure they set aside the required time to initially identify the main BDA components applicable to their organization by utilizing the formulated empirical research components as guidelines to reveal the main components that should be informing their BDA strategy to effectively enhance decision making and extract strategic business value from their BDA investments. In their paper, Mathrani and Lai (2021), warn organizations that fail to deploy the right BDA strategies in the

next few years could potentially lose market share and business growth, which makes this research even more important as it guides South African organizations on identifying which components should potentially be informing their BDA strategy.

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9 Appendices

9.1 Appendix A- Organization Consent Form

Management Consent

I, _____, give the researcher of this study consent to conduct their study in the following organization:

_____

_____

I am aware that participation is voluntary and that respondents may choose to withdraw from this study at any time, should they choose to do so.

_____ _____

Signature Date

9.2 Appendix B- Covering Letter and Individual Consent Form

Department of Information Systems
Leslie Commerce Building
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Private Bag X3 - Rondebosch – 7701
Tel: +27 (0) 21 650 2261 Fax: +27 (0) 21650 2280
Internet: http://www.commerce.uct.ac.za/informationsystems/

20 February 2023

Request to conduct research and interview participation consent form

Dear Sir/Madam,

In terms of the requirements for completing a Master's Degree in Information Systems at the University of Cape Town a research study is required.

The researcher, in this case **Never Kondo**, has chosen to conduct a qualitative case study interview focusing on "**Big Data Analytics Strategy Formulation: A Case Study for Big Data Analytics organizations in South Africa."** The objective of the research is to understand the main components underpinning the formulation of a big data analytics strategy for Organization in South Africa

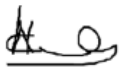
Your participation in this research is voluntary. All information will be treated in a confidential manner and used exclusively for the purpose of this study. No individual names will be recorded or published. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. You can choose to withdraw from the research at any time for whatever reason, in accordance with ethical research requirements.

The data collection method will be one-on-one interviews with specific staff members responsible for a given task related with my research. The semi -structured interview discussions will be conducted using Microsoft Teams for remote staff and at your premises in person for office staff. The interview will last 45 minutes. If you are willing to participate in this study, kindly sign the attached form and return to me at your earliest convenience.

Should you have any questions regarding this research, please feel free to contact me on **0720596262** or email: **kndnev001@myuct.ac.za**

Your participation in this study would be appreciated but is entirely voluntary.

Sincerely,



Never Kondo

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Research Participant Consent Form

I, _____, consent to participate in the research on "**Big Data Analytics Strategy Formulation: A Case Study for Big Data Analytics organizations in South Africa**."

I am aware that participation is voluntary and that I may choose to withdraw from this study at any time, should I choose to do so.

_____ _____

Signature Date

9.3 Appendix C- Qualitative Questionnaire Interview Guide

Semi – Structured Interview Guide

Date	**DD/MM/YYYY**

Introduction

A BDA strategy usually lays the foundation for implementing BDA within an organization. Hence it is important to know the main underpinning components of a BDA strategy before embarking on a journey to adopt BDA within organizations. BDA is special applications that manage, prioritise, and analyse big data for a specific business objective, such as discovering knowledge, predicting outcomes, aiding decision-making, and establishing industry competitiveness. A BDA strategy is a master plan that consists of fundamental components such as Porter's 5 forces, emerging technology, BDA techniques and big data characteristics that help organizations create value and establish a long-term competitive advantage through big data analytics

Steps	**Description**
Interview greetings Provide researchers' name Provide the research topic Provide the purpose of the interview	Thank you for taking the time to participate in this study, my name is Never Kondo, and this exploratory study is on "Big Data Analytics Strategy Formulation: A Case Study of Big Data Analytics organizations in South Africa."
Interview Duration	The interview will take 45- 60 minutes.
Allocate Interview ID: e.g. CA_00_INT /CB_00_INT	The adopted interview ID format will be CA/CB (Interview Number) INT, where INT is an acronym for the interview and CA/CB represents Case A or Case B as the Organization.
Rights of the participant	The researcher provides the following information: The participant may respond to any question The participants have the right to decline voice recording The participant may offer any information after the interview. The participant may ask for a copy of the research results

	The participant will be sent the summaries or recordings of the interview for validation.

- The researcher briefs the participant about the ethical procedures regarding the information from the interview.

- The researcher assures the participant that the data provided during the interview will be kept confidential.

- Provide the participant with the opportunity to ask questions based on informed presented above:
    - Question: “Do you have any questions about the procedures I have just explained?”

- The research has been approved by the **University of Cape Town’s Faculty of Commerce Ethics Committee,** and due to the qualitative nature of the study, “I would like to request your **permission to record this interview.** “

Demographics

- What is your position/title in the organization?
    - *CA/CB_00_INT:*
- How many employees are in the organization?
    - *CA/CB_00_INT:*
- Which industry sector do your organization operate in?
    - *CA/CB_00_INT:*
- Please provide industry information about your organization's clientele.
    - *CA/CB_00_INT:*
- Describe in terms of number of years your level of experience in BDA and related work.
    - *CA/CB_00_INT:*
- What professional certifications or qualification(s) do you hold?
    - *CA/CB_00_INT:*

Interview Questions

1. What is your understanding and perception of big data analytics?

CA/CB_00_INT:

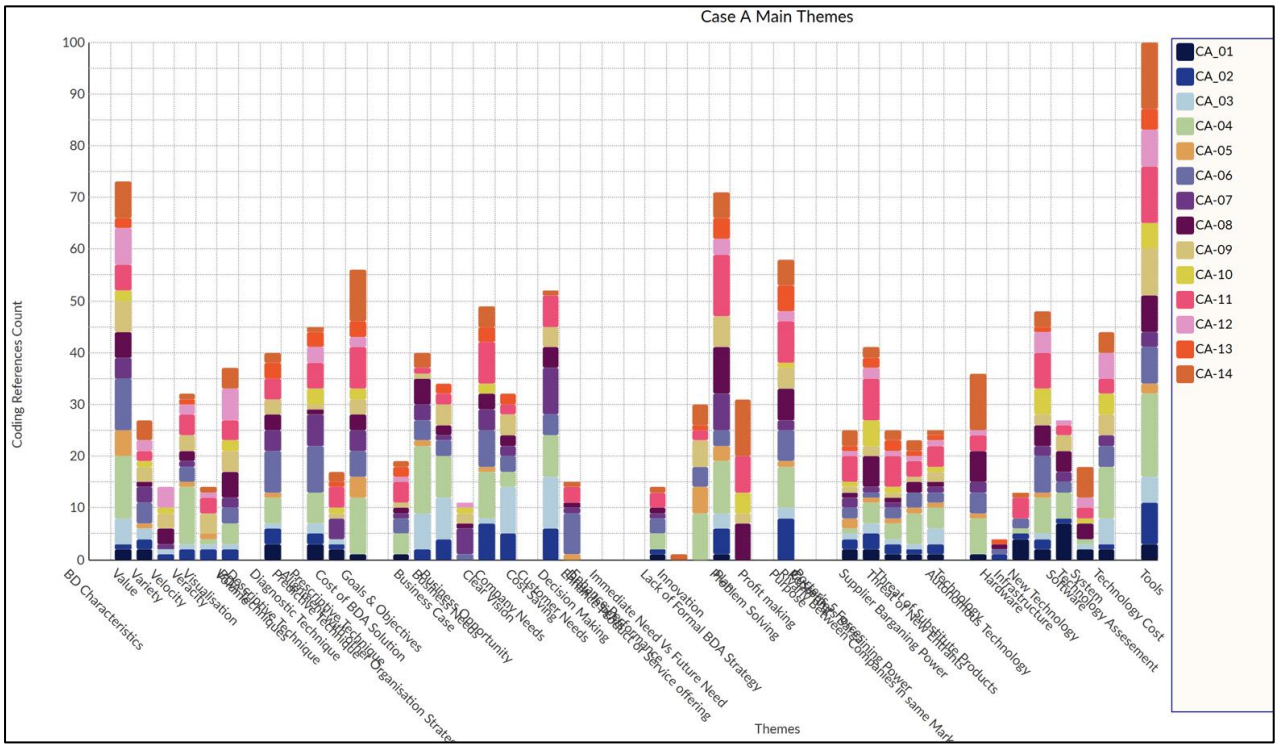
2. How is BDA used in your organization or client organizations (e.g. use case(s))?
CA/CB_00_INT:
3. Describe how managers, technical specialists and other users in your organization get involved in formulating a BDA strategy.
CA/CB_00_INT:
4. Explain the level of BDA experience or BDA technical skills an employee requires to contribute towards a BDA strategy.
CA/CB_00_INT:
5. What are your views of BDA strategy in your organization and (or) your client organizations?
CA/CB_00_INT:
Main Components informing a BDA strategy
6. What do you consider to be the main components informing the formulation of a big data analytics strategy for your organization? * [List all applicable components]
CA/CB_00_INT:
BDA Techniques component
7. Explain which of the listed BDA techniques your organization or client organizations use the most and how it informs a BDA strategy. ☐Descriptive (Already-happened) ☐Prescriptive (Future-recommendations) ☐Predictive (Future trends based on past data) ☐Other (Please specify)
CA/CB_00_INT:
Big Data Characteristics component
8. Discuss how the five big data characteristics, volume, velocity, variety, veracity, and value, informs the big data analytics strategy for your organizations.
CA/CB_00_INT:
9. Discuss/explain the process that your organization follows to formulate a BDA strategy.

CA/CB_00_INT:
Technology component
10. How does technology inform the formulation of BDA strategy in your organization?
CA/CB_00_INT:
Other complementary components
11. Describe how social trends should complement/inform a BDA strategy.
CA/CB_00_INT:
12. Describe how competition outlook should complement/inform a BDA strategy.
CA/CB_00_INT:
13. Describe how new technology should complement/inform a BDA strategy.
CA/CB_00_INT:
14. Describe how customer behaviour should complement/inform a BDA strategy.
CA/CB_00_INT:
15. Describe how legal and regulatory climate should complement/inform a BDA strategy.
CA/CB_00_INT:
Porter's 5 Forces component – Strategic competitiveness
16. Explain and comment on how the bargaining power of buyers informs a big data analytics strategy.
CA/CB_00_INT:
17. Explain and comment on how the bargaining power of suppliers in your industry informs a big data analytics strategy.
CA/CB_00_INT:
18. Explain and comment on how the threat of new entrants in the market informs a big data analytics strategy.

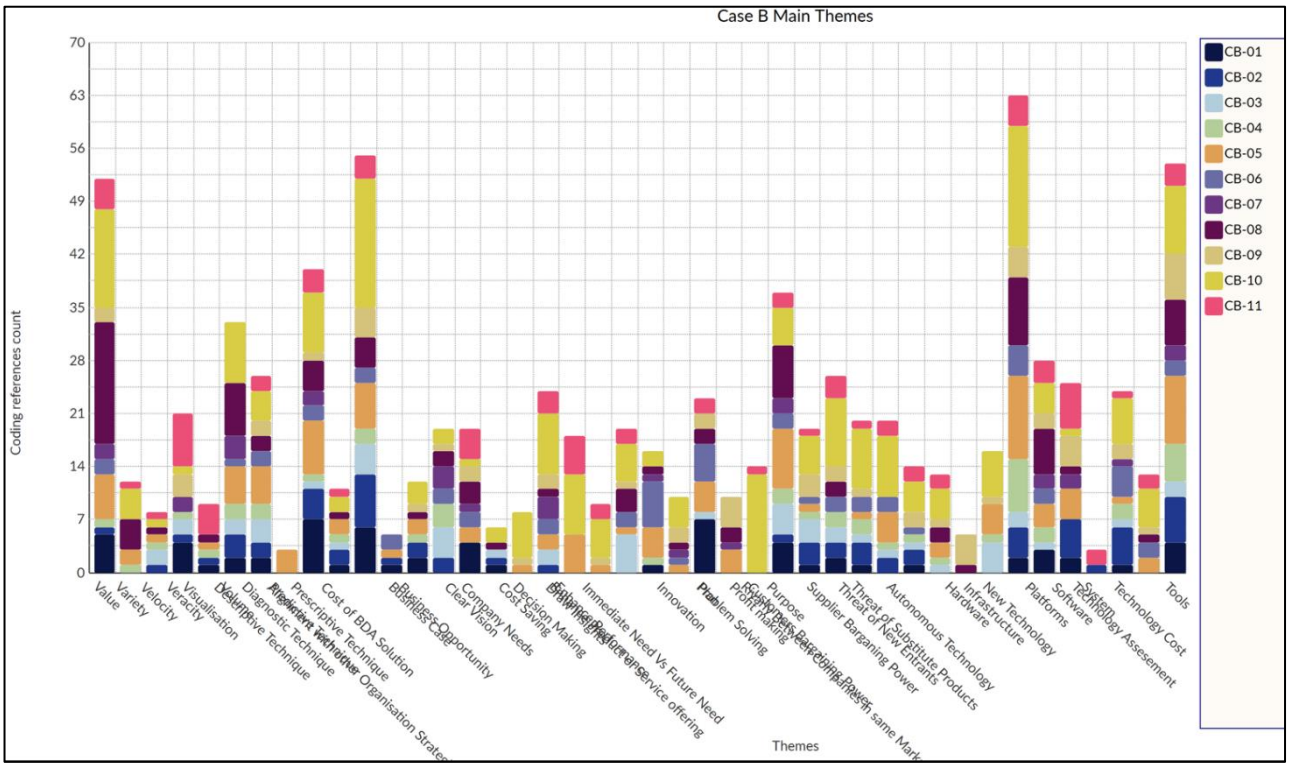
CA/CB_00_INT:
19. Explain and comment on how the threat of substitute products informs a big data analytics strategy.
CA/CB_00_INT:
20. Explain and comment on how the rivalry between companies operating in the same market informs a big data analytics strategy.
CA/CB_00_INT:
BDA Strategy Formulation challenges
21. Discuss some of the major challenges faced by your organization when formulating a BDA strategy.
CA/CB_00_INT:
22. In your view, what are the disadvantages of not identifying effective main components of a BDA strategy?
CA/CB_00_INT:
23. In your opinion, how can organizations overcome or mitigate some of the challenges and inhibitors faced when identifying main components informing a BDA strategy.
CA/CB_00_INT:
Conclusion
• Provide the participant with the opportunity to ask any additional questions: o Question: “Do you have any questions about the study or interview?” • Explain the next steps that will follow and thank the participant for their time and willingness to engage in the study o “I will complete the scheduled interviews and proceed to the data analysis of the research. The study will be completed around May, and if you are interested, I may share a copy of the report once completed.” o “Once again, I would like to thank you for your time and engagement in the study.”

9.4 Appendix D- NVivo Hierarchy Charts Showing Interview Study Themes

Case A organization



Case B organization



9.5 Appendix E- UCT Ethics Approval

Faculty of Commerce

Private Bag X3, Rondebosch, 7701
2.26 Leslie Commerce Building, Upper Campus
Tel: +27 (0) 21 650 4375/ 5748 Fax: +27 (0) 21 650 4369
E-mail: jacques.rousseau@uct.ac.za
Internet: www.uct.ac.za
@Commerce UCT UCT Commerce Faculty Office

25 01 2023

Never Kondo

Department of Information Systems

University of Cape Town

REF: REC 2023/01/011

Big Data Analytics Strategy Formulation:

A Case Study for Big Data Analytics Organisations in South Africa

We are pleased to inform you that your ethics application has been approved. Unless otherwise specified this ethical clearance is valid until 31-Jan-2024 .

Your clearance may be renewed upon application.

Please be aware that you need to notify the Ethics Committee immediately should any aspect of your study regarding the engagement with participants as approved in this application, change. This may include aspects such as changes to the research design, questionnaires, or choice of participants.

The ongoing ethical conduct throughout the duration of the study remains the responsibility of the principal investigator.

We wish you well for your research.

2023.01.25
07:49:25 +02'00'

Jacques Rousseau
Commerce Research Ethics Chair
University of Cape Town
Commerce Faculty Office
Room 2.26 | Leslie Commerce Building

Office Telephone: +27 (0)21 650 2695 / 4375
Office Fax: +27 (0)21 650 4369
E-mail: jacques.rousseau@uct.ac.za
Website: http://www.commerce.uct.ac.za/com/Ethics-in-Research

9.6 Appendix F- Case A Secondary Data

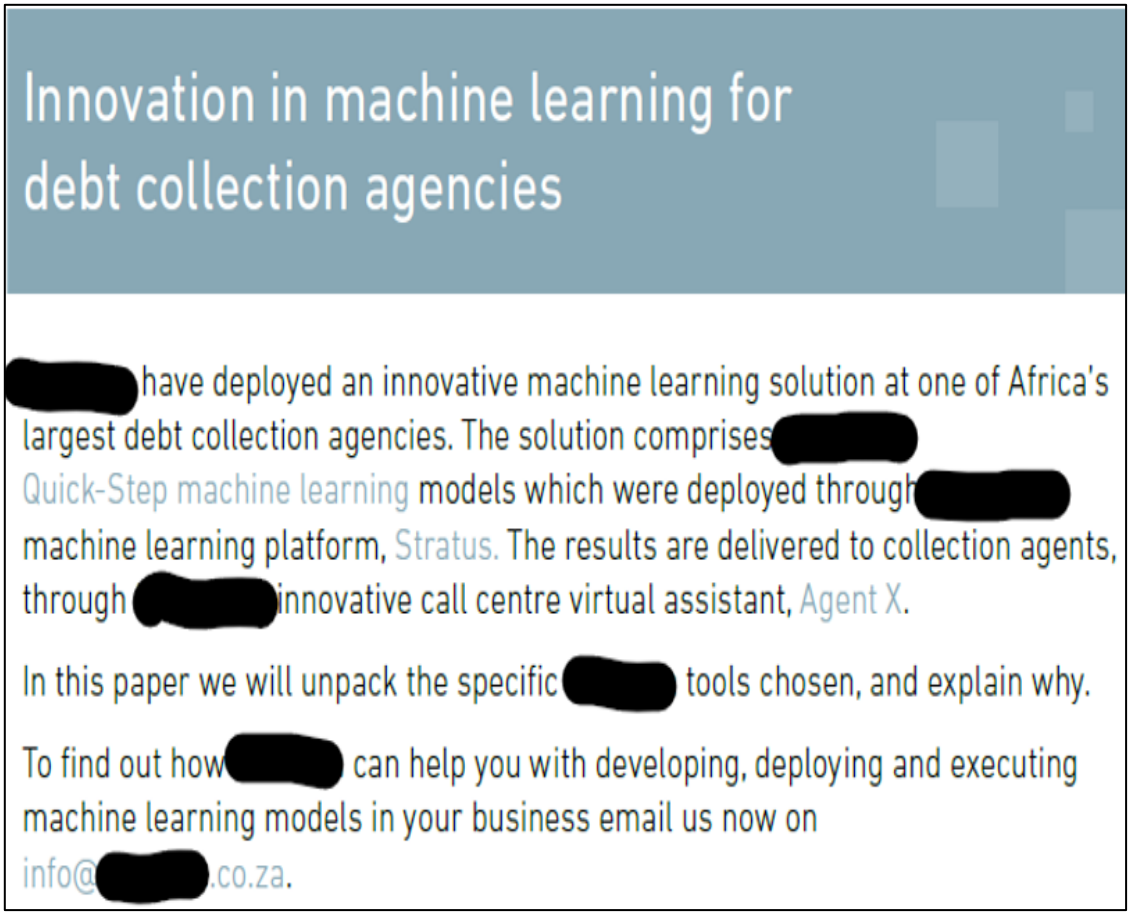
An example of a Process Definition Document (PDD) showing topics covered for strategic scoping and automation of BDA related tasks used by case A organization.

TABLE OF CONTENTS

An example of case A showcasing their technological advancements in integrating AI & cloud innovative solutions in the big data analytics industry highlighting the importance of integrating technology, in this case, new technology to inform your BDA strategy as one of the critical main components.

9.7 Appendix G- Case B Secondary Data

An example of case B organization driving big data analytics innovation and marketing their capabilities in line with their BDA strategy.



An example of case B showcasing their technical skills and innovative achievements in the big data analytics industry as part of their main people skills and technology BDA strategic components.

Case B organization core values that determine the path they take and the strategic BDA decisions they make.

Our Core Values

Client Value Creation

We are committed to creating value for our clients in a tangible and measurable way. We measure our success by our clients' success arising from our interventions.

Integrity

We will ensure absolute confidentiality of our clients' information. We will act ethically and responsibly; deliver work of the highest quality and accuracy; and "deliver on time, right first time".

Respect For The Individual

We respect the abilities and beliefs of people that we meet and work with and treat people with due consideration regardless of their position. Constructive criticism and feedback is encouraged. We will deal with people in an open, honest and empathetic way and will be transparent in decision making and communication.

Our People

We will attract and develop the best talent for our business. We believe that teamwork and collaboration result in better solutions and opportunities. We support the people that we hire to enable them to be successful. We recognise – and are committed as a South African company – to redress the imbalances of our past and still maintain our consistently high standards. We do not compete against each other and rather provide coaching and development. We recognise that we are in a demanding profession and will provide people with appropriate support.

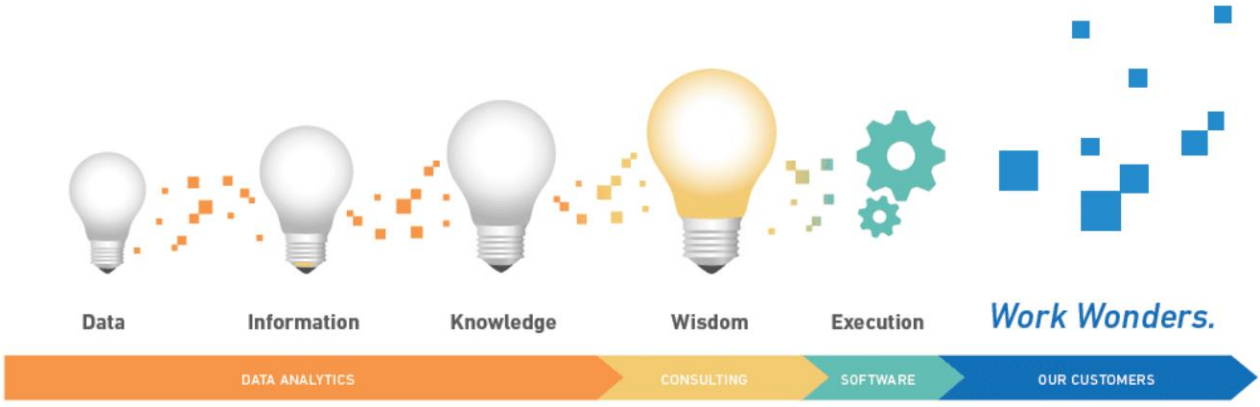
Innovation

We value new ideas and innovation and will maintain a constant awareness of trends and developments both locally and internationally. We recognise that diversity of experience, background, and expertise is essential to innovation.

Performance

We embrace accountability and strive to maintain a performance-based culture in which we will reward outstanding performance and contributions.

Case B organizational aim illustration showing the augmented important relationship between transformed data and customers:

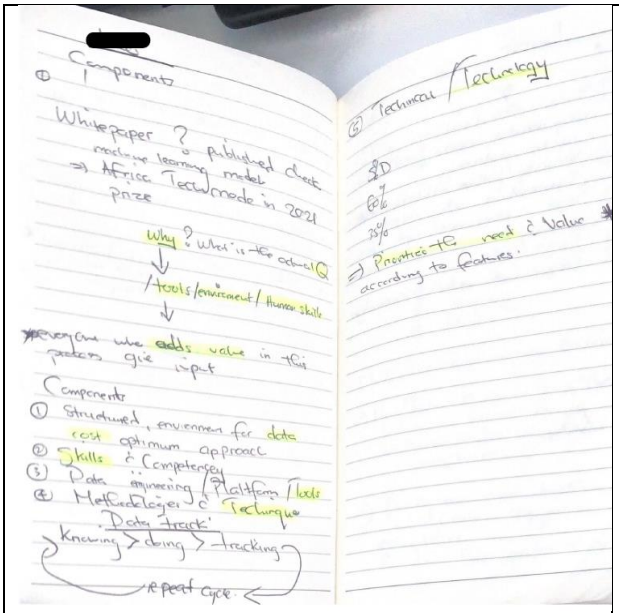


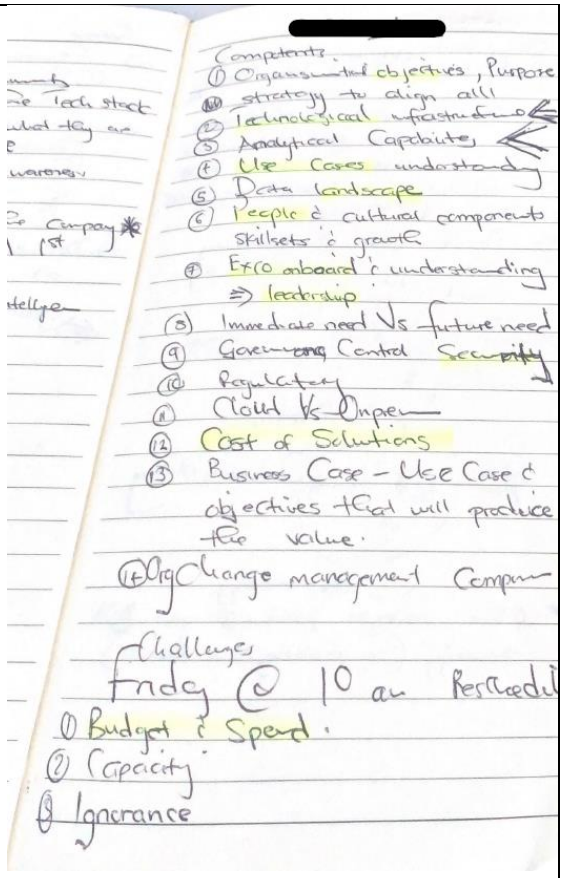
9.8 Appendix H- Main Themes- Subthemes from NVivo Coding

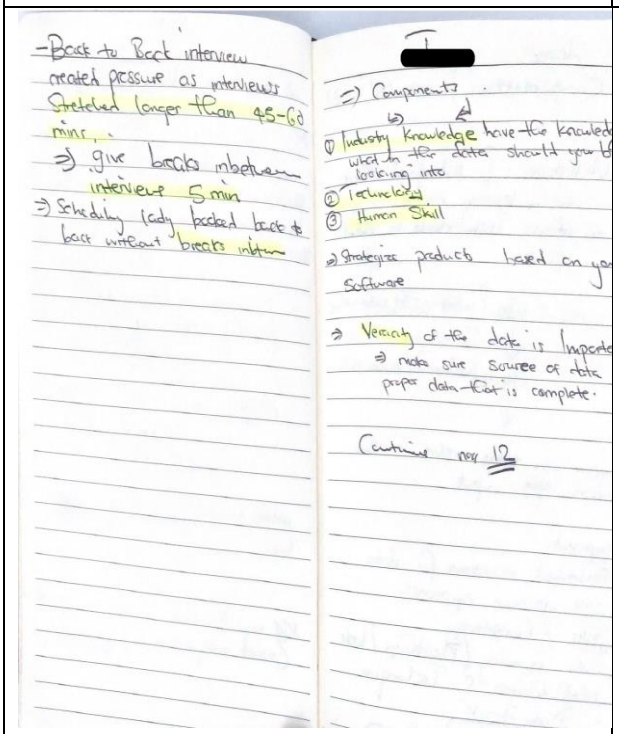
Theme /Sub-theme	Sources	References	Case A references	Case B references
Big Data Characteristics				
Value	24	**125**	73	52
Volume	20	70	37	33
Velocity	14	22	14	8
Veracity	20	53	32	21
Variety	17	39	27	12
Visualisation (new)	14	23	14	9
Big Data Analytics Techniques				
Diagnostic analytics (new)	1	3	0	3
Descriptive analytics	22	66	40	26
Predictive analytics	24	**85**	45	40
Prescriptive analytics	17	28	17	11
Porter's 5 Forces				
Supplier bargaining power	23	45	25	20
Customer bargaining power	23	44	25	19
Rivalry between companies operating in same market	23	**67**	41	26
Threat of substitute products	22	39	25	14
Threat of new entrants	19	43	23	20
Technology				
Tools	25	**228**	142	86
New technology	24	111	48	63
Technology assessment	22	76	37	39
Autonomous technology	16	48	35	13
People Skills (new)				
Upskilling cost	6	8	0	8
BDA experience	23	85	52	33
Skilled workforce	25	**182**	109	73
BDA use case understanding	24	123	67	56

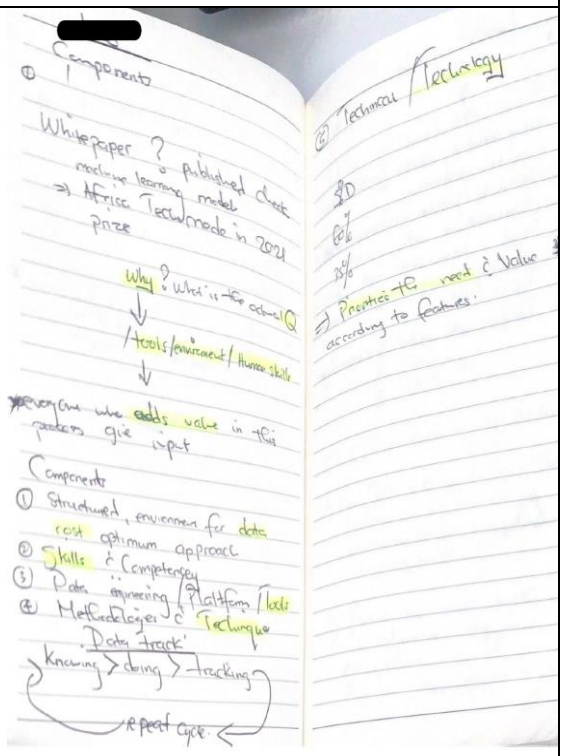
Business Goals & Objectives (new)				
Business needs	22	105	69	36
Initial purpose	25	**130**	78	52
Clear vision	19	68	49	19
Business plan	23	126	94	32
Decision making	15	70	15	55
Business opportunity	14	30	11	19
Problem solving	9	41	31	10
Profit making	7	39	0	39
Legal & Regulation				
Laws & acts	23	51	26	25
Data security & privacy	19	45	28	17
Data residency	12	14	6	8
Overall Cost of BDA Solution (new)	22	**111**	56	55
Economic factors	19	**62**	10	52
Customer behaviour	22	**63**	28	35
Competition outlook	24	**106**	22	84
Social trends	23	**37**	20	17

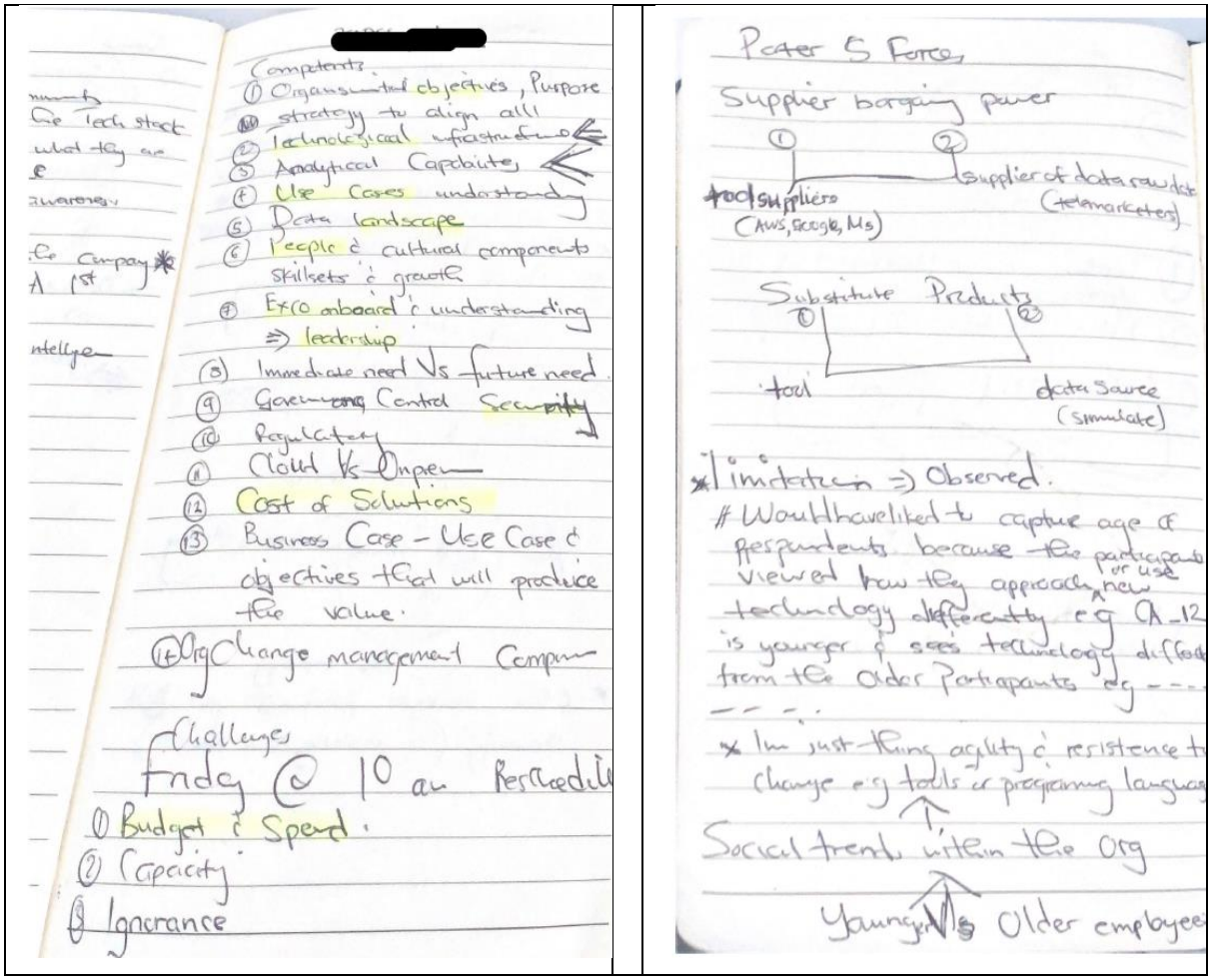
9.9 Appendix I - Researchers Sample Field Notes Captured from Case A & B Organizations

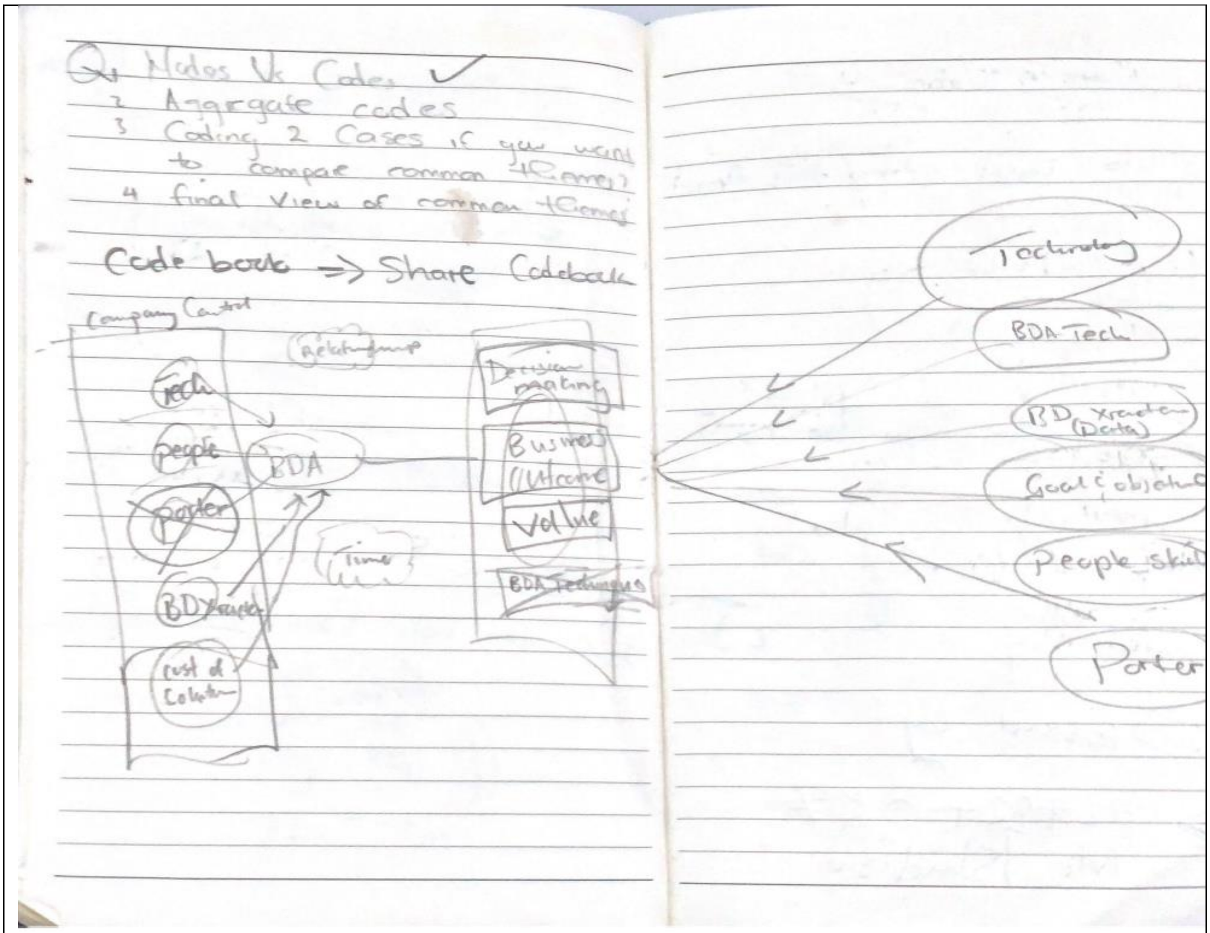


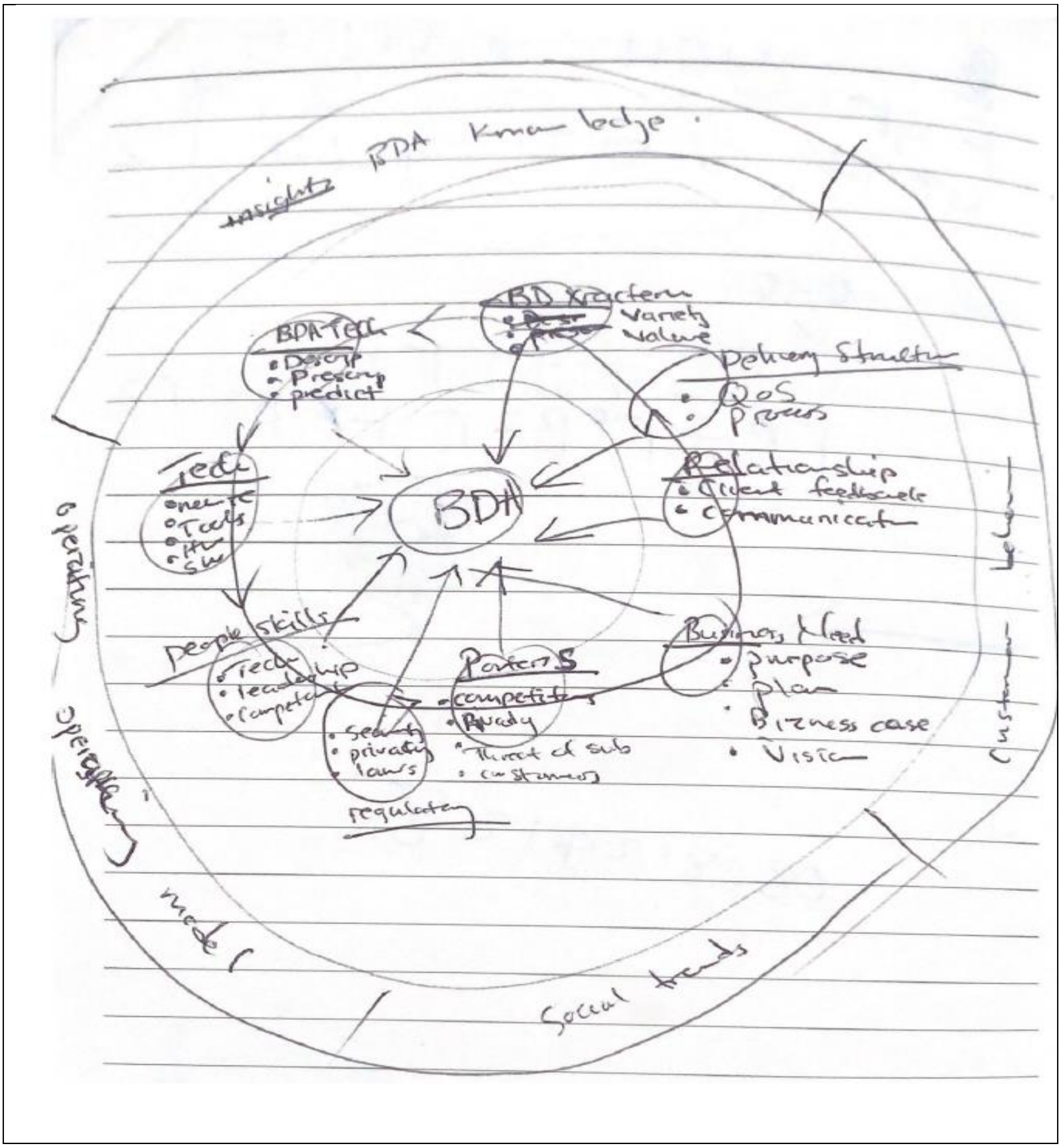




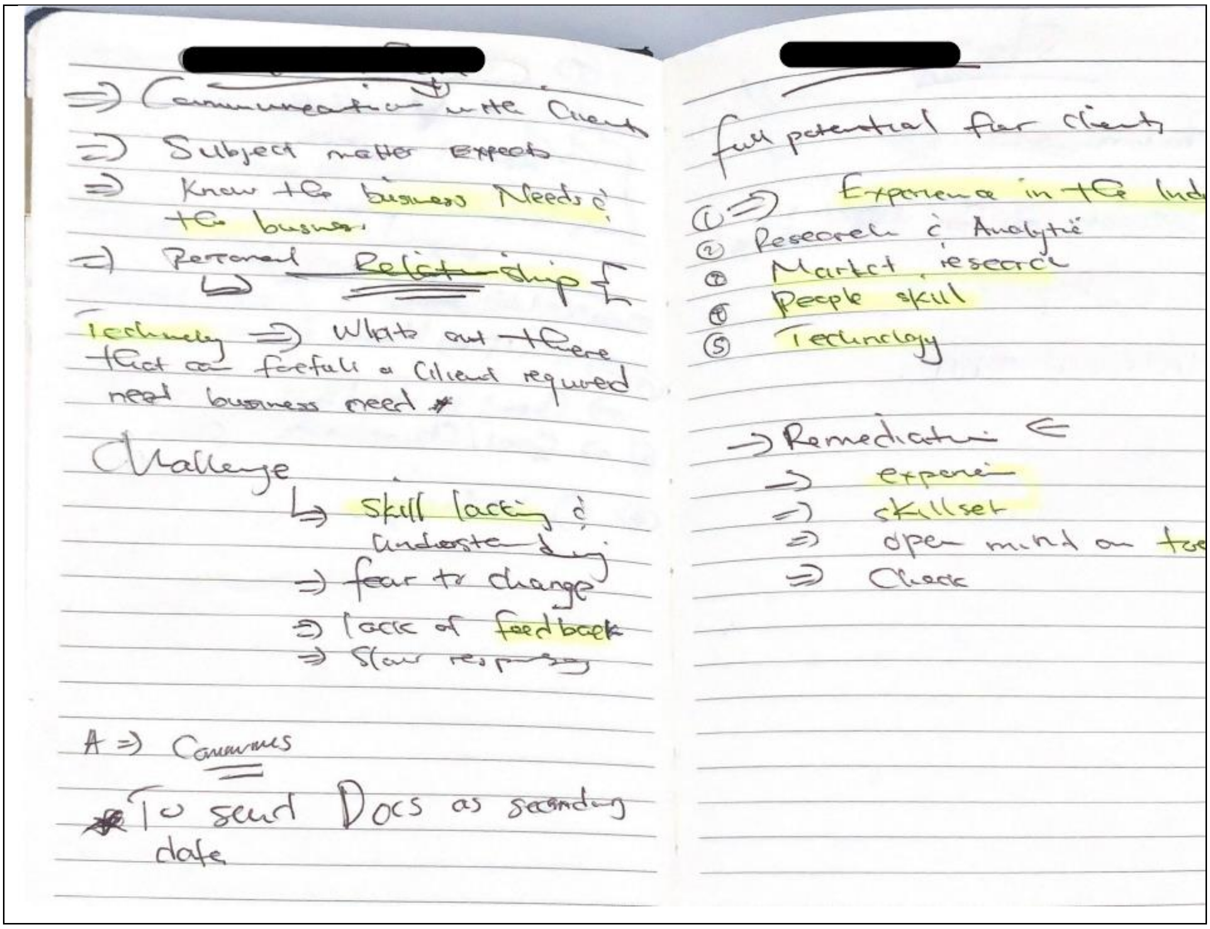



Competents
① Organisational objectives, Purpose
② strategy to align all
③ Technological infrastructure
④ Analytical Capabilities
⑤ Use Cases understanding
⑥ Data landscape
⑦ People & cultural components skillsets & growth
⑧ Exco onboard & understanding ⇒ leadership
⑨ Immediate need Vs future need
⑩ Governance Control Security
⑪ Regulatory
⑫ Cloud Vs Onprem
⑬ Cost of Solutions
⑭ Business Case - Use Case & objectives that will produce the value.
⑮ Org Change management Comm
Challenges
Friday @ 10 am Restricted
① Budget & Spend.
② Capacity
③ Ignorance
Porter 5 Forces
Supplier bargaining power
① ②
tool suppliers (AWS, Google, Ms)
Supplier of data raw data (telemarketers)
Substitute Products
① ②
tool
data source (simulate)
* interaction ⇒ Observed.
# Would have liked to capture age of respondents because the participants viewed how they approach new technology differently eg QA_12 is younger & sees technology differ from the older participants eg
* Im just thinking agility & resistence to change e.g tools or programming langua
Social trends within the Org
Younger Vs Older employee


Nodes Vs Codes
2 Aggregate codes
3 Coding 2 Cases if you want to compare common themes?
4 final view of common themes
Code book => Share Codebook
Company Context
Relationship
Tech
people
porter
BDA
BD Xracter
rest of Collection
Time
Decision making
Business Outcome
Value
BDA Techniques
Technology
BDA Tech
BD Xracter (Data)
Goal & objective
People skill
Porter



BDA Knowledge
insights
BD Xracteristics
Variety
Value
BDA Tech
Descrip
Prescrip
predict
Delivery Structure
QoS
Process
Tech
Tools
BDA
Relationship
Client feedback
Communication
people skills
Tech
leadership
competency
Business Need
purpose
plan
Bizness case
Vision
Porters 5
competitors
Rivalry
Threat of sub
customers
privacy
laws
regulatory
Social trends



[redacted]

⇒ Communication with Client
⇒ Subject matter Experts
⇒ Know the business Needs of the business
⇒ Personal Relationship {
↳

Technology ⇒ What's out there that can fulfill a Client required need business need *

Challenge
↳ Skill lacking & understanding
⇒ fear to change
⇒ lack of feedback
⇒ Slow responses

A ⇒ Communes

* To send Docs as secondary date

[redacted]

full potential for clients

① ⇒ Experience in the Ind
② Research & Analytic
③ Market research
④ People skill
⑤ Technology

→ Remediation ⇐
⇒ experience
⇒ skillset
⇒ open mind on tre
⇒ Check

10 Appendix J - Case A Confidentiality and Non- Disclosure Agreement

CONFIDENTIALITY AND NON-DISCLOSURE AGREEMENT

Entered into and between

[redacted]
(REGISTRATION NUMBER: 2018[redacted])
[redacted]
Stellenbosch
7600
Email[redacted]
(herein represented by [redacted] with identity number
COO [redacted] and duly authorised thereto)

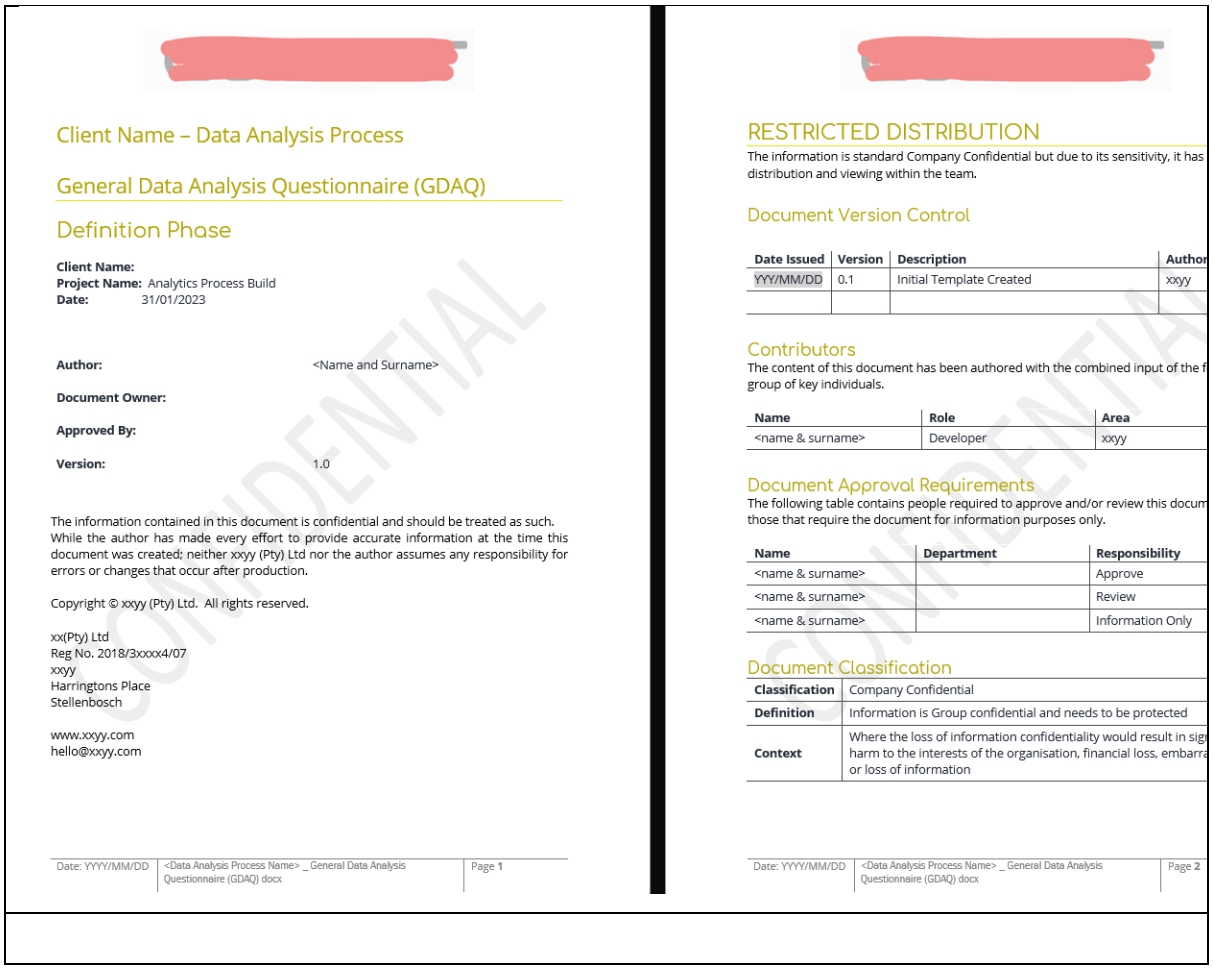
and

___Never Kondo ___
(REGISTRATION NUMBER: ___N/A_____)
[redacted]
Milnerton Rural, Sandown
7441, Cape Town
South Africa
(*physical address*)
Email: KNDNEV001@myuct.ac.za
(herein represented by **Never Kondo** with identity numbe[redacted] and duly authorised thereto)

NK

11 Appendix K - Case A General Data Analysis Questionnaire

The questionnaire is used by case A organization as a tool to gather basic information from clients before embarking on big data analytics related project.



Client Name – Data Analysis Process

General Data Analysis Questionnaire (GDAQ)

Definition Phase

Client Name:
Project Name: Analytics Process Build
Date: 31/01/2023

Author: <Name and Surname>

Document Owner:

Approved By:

Version: 1.0

The information contained in this document is confidential and should be treated as such. While the author has made every effort to provide accurate information at the time this document was created; neither xxyy (Pty) Ltd nor the author assumes any responsibility for errors or changes that occur after production.

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Harringtons Place
Stellenbosch

www.xxyy.com
hello@xxyy.com

Date: YYYY/MM/DD | <Data Analysis Process Name> _ General Data Analysis Questionnaire (GDAQ) docx | Page 1

RESTRICTED DISTRIBUTION

The information is standard Company Confidential but due to its sensitivity, it has distribution and viewing within the team.

Document Version Control

Date Issued	Version	Description	Author
YYY/MM/DD	0.1	Initial Template Created	xxyy

Contributors

The content of this document has been authored with the combined input of the f group of key individuals.

Name	Role	Area
<name & surname>	Developer	xxyy

Document Approval Requirements

The following table contains people required to approve and/or review this docum those that require the document for information purposes only.

Name	Department	Responsibility
<name & surname>		Approve
<name & surname>		Review
<name & surname>		Information Only

Document Classification

Classification	Company Confidential
Definition	Information is Group confidential and needs to be protected
Context	Where the loss of information confidentiality would result in sig harm to the interests of the organisation, financial loss, embarra or loss of information

Date: YYYY/MM/DD | <Data Analysis Process Name> _ General Data Analysis Questionnaire (GDAQ) docx | Page 2

[redacted]

TABLE OF CONTENTS

[redacted]

1. Introduction

The purpose of this document is to collect preliminary general data analytics info
<**client name**> in preparation for data analytics project work. Data infrastructure
matters are to be brought under our attention as part of the analysis process tha
the following stages of data analytics modeling and the various time frames f
Designing, Building , UAT and Production Deployment.

2. Data Analytics Process Related Questions

Data Analytics Process Name	xxyy
What are the key objectives to be achieved by the data analytics process ? • <Include high level examples>	
Departments the Data Analytics Process applies to	xxyy
Who is the SME (Subject Matter Expert) for the Data Analytics process ?	xxyy
Will the SME do the demo for the Data Analytics process	Yes/No
If No – Please advise	
Who are all the key stakeholders involved with this Data Analytics process?	xxyy
What are the stakeholders roles, expectations and data analytics needs	
Are the Stakeholders from the same department?	Yes/No
If No – Please elaborate	
How many Applications apply to this Data Analytics process?	
Please list the applications • Example : Avaya CCM (Contact Centre Management • ETC...	
Any changes to the Data Analytics process planned within the next 6 months?	Yes/No
If Yes, Please elaborate	
Will business require a MI (Management Information) report?	Yes/No
MI Report (Management Information) – Please list information required for the MI report • To be Confirmed	

Data collection: What are the primary sources of data for your analytics process (internal & external) ?	
How is the data collected, and what methods or tools are used?	
What data formats and data types are available ?	
Is there a defined ETL (Extract, Transform, Load) process?	
Are there data integration challenges	
Data Storage: Where and how is the data stored for analysis?	
What considerations are made for data security and compliance?	
How are variables engineered or modified to enhance analysis?	
Scalability: What is the current hardware infrastructure in place for data storage and processing ?	
How easily can the analytics infrastructure scale to accommodate increased data volumes?	
Tools: Which data analytics software tools and platforms are currently in use?	
Is the organization leveraging cloud services for data analytics?	Yes/No
If Yes, Please elaborate	
Data Security and Regulation: Do you have any data compliance regulations other than the statutory ones that you need to comply with ?	Yes/No
If Yes , Please elaborate	
What measures are currently in place to ensure data security and privacy?	

[redacted]

Risks: What potential risks associated to the data analytics process do you foresee ?	

3. Data Infrastructure

Will IT support be available for XXYY?	Yes/No
If Yes, Please supply contact details	
Are there any potential gaps in hardware , software and network capabilities that might impact data analytics process ?	Yes/No
If Yes , Please elaborate	
Is there Test environments available for the applicable Applications?	Yes/No
Is the Test environments an accurate replica of the live environment?	Yes/No
If No, Please elaborate	
Will business be able to provide / create the necessary test data?	Yes/No
Any planned updates on the applicable application in the next 6 months?	Yes/No
If Yes, Please elaborate	
Does business take preference to a specific data visualization tool?	Yes/No
If Yes, which one?	

[redacted]

4. Questions you as Business might have?

* Example: What criteria are considered in selecting a particular model?
* What policies and procedures are in place to ensure data quality and governance?
*
*
*
*

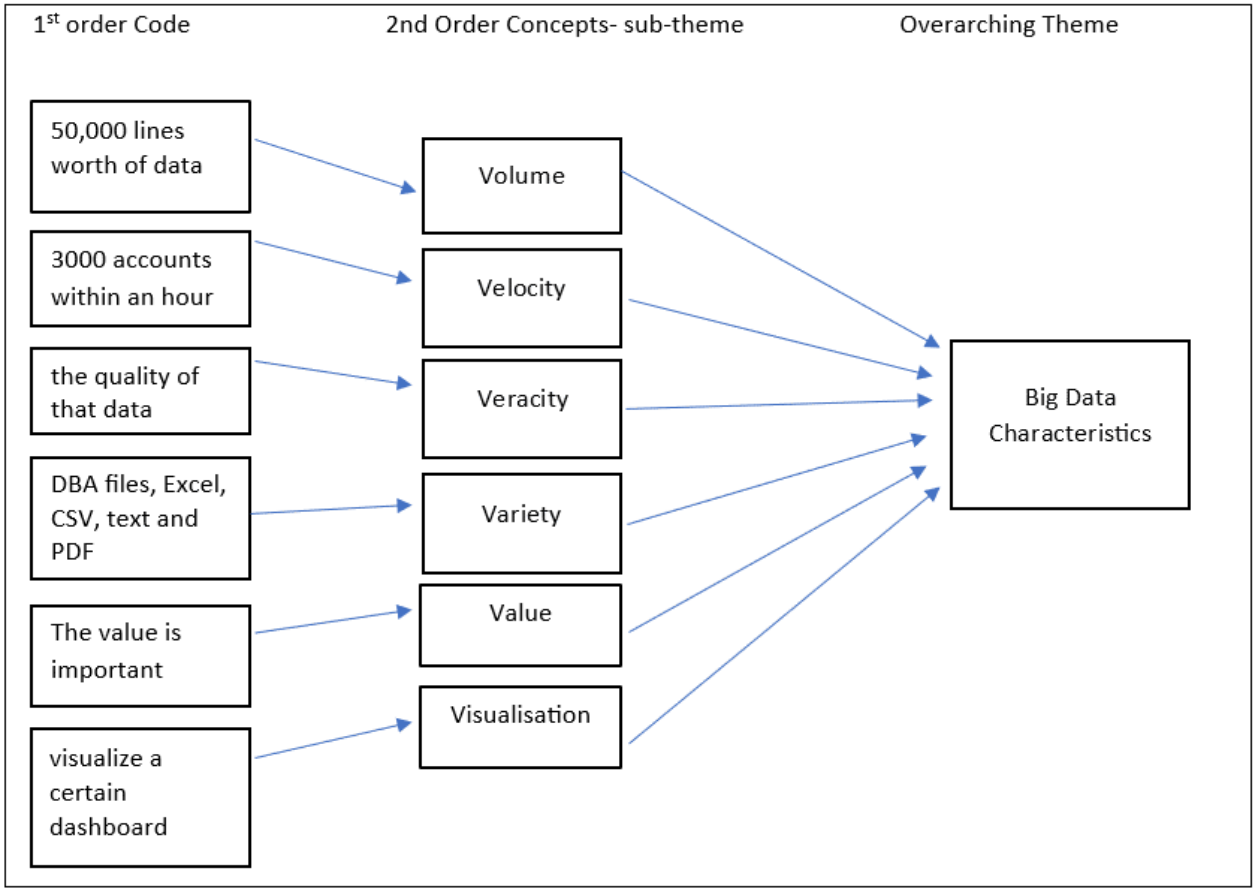
5. To be completed by XXYY: Project Planning Tool

Has the Project Planning Tool been completed	Yes / No
Based on the Project Planning Tool result, is this a Low, Medium, High or Very High Analytics process?	
Can this Data Analytics process be seen as one process or does it contain sub-proc	
If the process contains sub-processes – How many?	
*	
*	

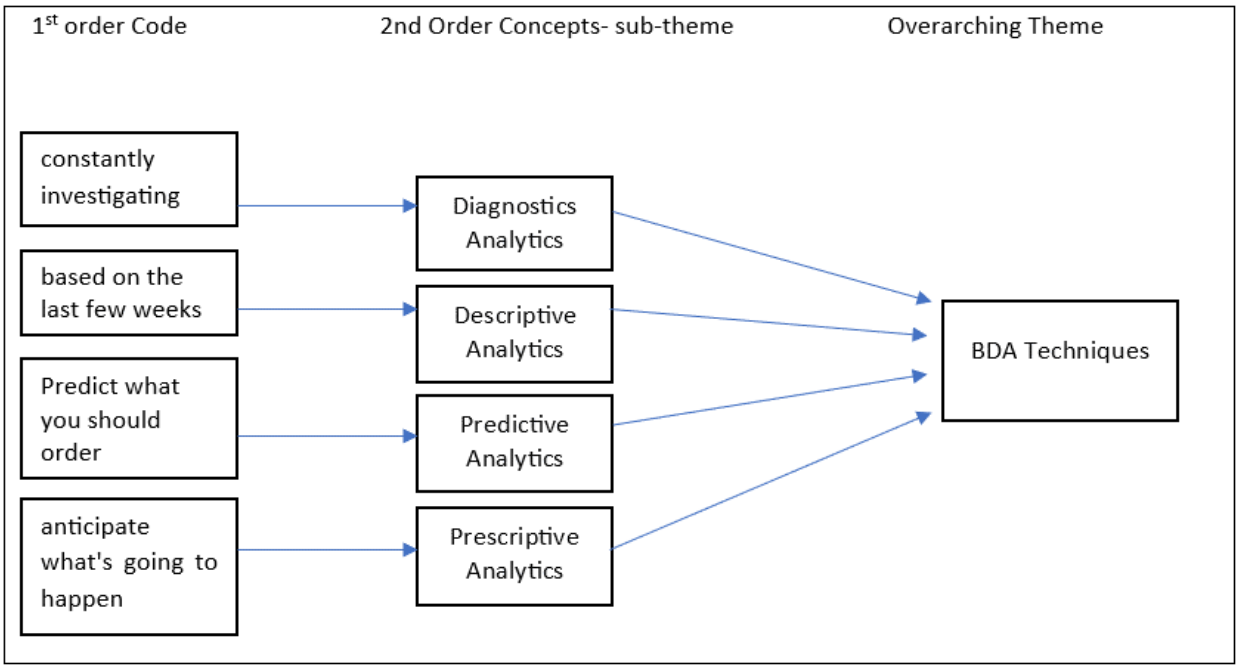
12 Appendix L- Data structure used for data analysis.

Examples of the complementary 1st order- 2nd order- theme, data structure model used for data analysis for both case A and B organizations showing how raw data was analysed and converted to overarching themes.

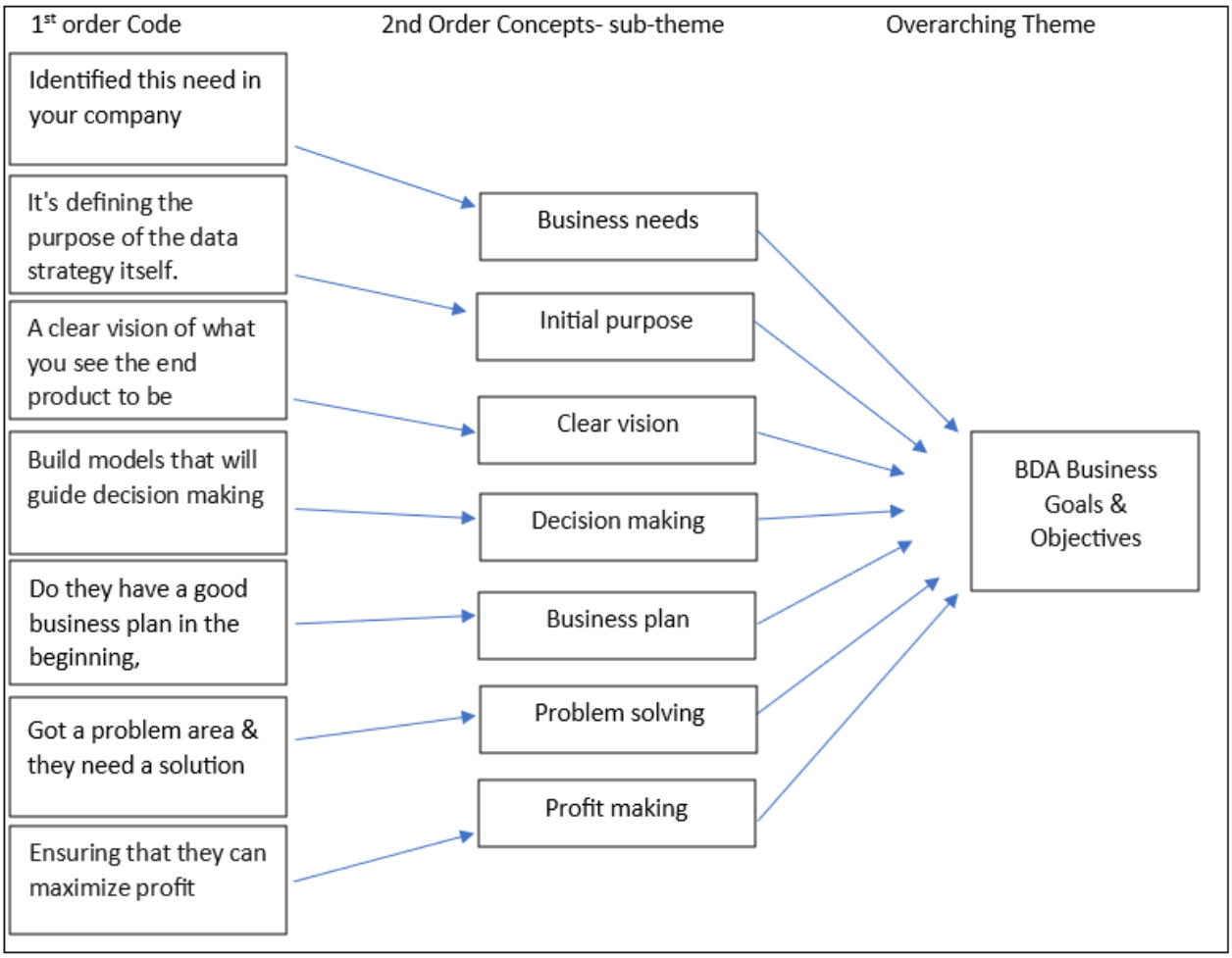
Big Data Characteristics Theme



BDA techniques Theme



Goals and Objectives Theme



13 Appendix M- Example of NVivo Interview Codes