



The role of human capital in leveraging predictive big data analytics for strategic value creation through culture

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ABSTRACT

This research investigated the pivotal role of human capital in leveraging predictive big data analytics for strategic value creation within public organisations, specifically focusing on tax and revenue administrations. Grounded in resource-based theory, the study explores how human capital—defined by knowledge, skills, abilities, and other characteristics (KSAOs)—interacts with organisational culture to optimise the use of big data analytics, thereby enhancing operational efficiency and creating competitive advantages.

The research aimed to address gaps in the literature regarding the integration of human capital with technological resources and the subsequent impact on organisational performance. Employing qualitative methodologies, including interviews, the study examined the development of human capital, the influence of organisational culture on attitudes towards big data, perceived benefits of predictive analytics for strategic value, and the challenges faced by public organisations in maximising big data capabilities. The findings contribute valuable insights into fostering a data-driven culture and enhancing the overall performance of public sector organisations amid rapid digital transformation.

Key words: Human capital; Predictive big data analytics; Strategic value; Culture

DECLARATION

I declare that this research project is my own work. It is submitted in partial fulfilment of the requirements for the degree of Master of Philosophy in Corporate Strategy at the Gordon Institute of Business Science, University of Pretoria. It has not been submitted before for any degree or examination in any other University. I further declare that I have obtained the necessary authorisation and consent to carry out this research.

Nozaba Sopeng

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Signature

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1 CHAPTER 1: INTRODUCTION TO THE RESEARCH PROBLEM

1.1 Introduction

This research focused on investigating the role of human capital in leveraging predictive big data analytics through culture in the public organisations that seek to achieve operational efficiency, create strategic value and ultimately achieve operational efficiency. Big data is massive sizes of information (volume), that is frequently processed and at a rapid pace (velocity), and that is analysed in various formats, structured and unstructured (variety) thereby making it complicated to process and analyse using the conventional ways of data management (Ghasemaghaei & Calic, 2020 ; Huynh et al., 2023). Big data has been widely acknowledged as one of the strategic resources, which means a resource that is valuable, rare, inimitable, and no substitutable (D’Oria et al., 2021a) and that affects the overall performance of a firm (Ghasemaghaei & Calic, 2020).

Acciarini et al. (2023) posit that the value of big data arises from specific resources and processes, thus contributing to value creation. Other researchers advance that big data will create strategic value if it is complemented with appropriate competitive human factors (Gupta et al.,2020) to interpret data in real-time (Ghasemaghaei & Calic, 2020) and timeously generate new insights to inform strategic decisions (Mikalef et al., 2020). Therefore, Gupta et al. (2020) advance the pivotal role of human capital in leveraging technology to achieve firm performance growth. In this sense, human capital is a combination of knowledge, ability, skill, and other characteristics that provide value to the firm (Wright, 2021) because according to Ployhart (2021) the interest of the firm is in the resources that contribute to performance and thereby creating strategic value.

While previous research has highlighted the growing recognition of the value of big data analytics firms frequently find themselves disconnected from harnessing its full potential value (Mazzei & Noble, 2017). This underscores the need for careful consideration and attention to the potential value of big data analytics. Furthermore, there is a narrow understanding of the mediating role of other constructs on the effects of big data analytics on firm performance (Ghasemaghaei & Calic, 2020). This research responds to a research call to explore how human capital working in public organisation would complement or create constraints in big data predictive analytics capabilities (S. Gupta et al., 2020a) .

1.2 Background

This chapter outlines the background to the research problem for this research.

The research setting for this study is the Tax and Revenue Administration X in one Southern African region responsible for collecting and assessing tax revenues for the government .

Bellon et al. (2022) point out that the phenomenon of digitisation has brought about a paradigm shift in how tax administrations operate. The past two decades have given rise to rapid modernisation of processes within the African tax and revenue administrations and the widespread adoption of Information and Communication Technologies (ICTs), as observed by (Mascagni et al., 2021). Mikalef et al., (2022) also express a notable utilisation of technologies in public organisations and the utilisation of big data by the public sector is viewed as a promising approach to addressing societal problems.

1.3 Research problem

Ghasemaghaei & Calic, (2020) suggest that big data is a key strategic resource for firms seeking to improve performance and ultimately, gain a competitive advantage. While Gupta et al. (2020) explain that performance is sometimes used interchangeably with operational efficiency, a state where actual performance exceeds expectations, in the realm of strategic management, the phenomenon of competitive advantage has been proposed as a substitute for performance (Barney et al., 2021). In this view, Barney et.al. (2021) reveal that for a firm to achieve superior performance, that firm must have the ability to develop and leverage its resources to create strategic value (Akter et al., 2020).

Digitalisation and the increasing value of big data have led to a global disruption of business models and strategic thinking. As big data-specific technologies continuously advance, scholars have discovered that, data as a resource has assumed a critical role in driving strategic unique value (Zhu & Li, 2023)). However, researchers argue that big data alone is not enough to influence operational efficiency instead firms need to orchestrate certain big data resources (Zhang et al., 2022a). Gupta et al. (2020) agree that firms often mistakenly make substantial investments to acquire data before investing in technology and do not acquire and retain the right human capital and therefore fail to leverage predictive big analytics capability to achieve operational efficiency. Hitt et al. (2001 as cited in Gupta et al.,2020) assert that merely adopting technology will make no

difference if it is not supported by the right human skills, managerial and technical skills set.

Zhu and Li (2023) advance that organisations must have the ability to extract meaningful insights from big data, to create strategic value and ultimately achieve operational efficiency (Cui et al., 2022). Mascagni et al. (2021) posit that ICTs improve tax revenue and enhance tax compliance and, in that sense, in the context of this research, strategic value that can be derived from leveraging big data is tax compliance which is necessary for operational efficiency.

1.4 Research question and research purpose

This the backdrop of this research problem, the primary research question that this study asks is, “How does human capital working in a public organisation leverage predictive big data analytics through culture to create strategic value?”

The primary research question aims to investigate the function of human capital in effectively leveraging predictive big data analytics to achieve organisational strategic value through culture. Gupta et al. (2020b) urge researchers to investigate how the human capital within a public sector organisation can enhance or hinder the capabilities of predictive big data analytics.

This question highlights the interplay between human capital which Moliterno and Nyberg (2019) describe as individual human capital as a collection of competencies referred to as KSAOs, which includes Knowledge, Skills, Abilities, and other traits and the strategic application of predictive big data analytics in the context of a public sector organisation.

Four secondary research questions have been established to explore this research question systematically. Each sub-question is designed to delve into distinct facets of the overarching question to also guide the data collection and analysis.

1.4.1 Research question 1

How is human capital (skills, knowledge, ability, and other characteristics) working in public organisations developed to leverage predictive big data analytics?

The researcher aims to gain an in-depth understanding of the essential competencies that human capital resources possess within public organisations and how these competencies contribute to the effective use of predictive big data analytics capability.

1.4.2 Research question 2

How does the culture influence the attitudes toward big data analytics?

The research question intends to address the role of culture in leveraging big data analytics in a public organisation for strategic value creation

1.4.3 Research question 3

What are the perceived benefits of big data capabilities specifically for strategic value creation in a public organisation?

To understand how human capital leverages big data analytics, it is important to critically examine the perceived benefits associated with developing predictive big data analytics capabilities specifically for strategic value creation.

1.4.4 Research question 4

How can the public firm overcome obstacles to create strategic value from predictive big data analytics?

For successful adoption of big data analytics and improved operational efficiency, the researcher aims to identify the possible challenges that could inhibit public organisations from realising the benefit from investment in the predictive big data analytics technology.

In conclusion, this chapter has systematically addressed the intricate relationship between human capital, data-driven culture and the strategic use of predictive big data analytics within public organisations. By formulating a targeted central research question and clearly outlined the secondary research questions, it has established a framework for evaluating the competencies of human capital that facilitate the effective implementation of predictive big data analytics.

1.5 Research scope

The scope of this research investigated the phenomenon of this research revolves around the intersection of human capital, culture, and predictive big data analytics within

public organisations, focused tax and revenue administration. It explored the competencies and skills that human capital must possess to engage with predictive big data analytics technologies and how these elements are influenced by the prevailing culture.

The study targeted public organisations in a Southern African region, examining their current practices, experiences, and challenges in adopting big data analytics to enhance operational efficiency and strategic outcomes. By employing qualitative research strategy, including interviews and case studies, the research aimed to provide valuable insights into how human capital can be optimally developed and aligned with organisational culture to foster a data-driven environment, ultimately contributing to improved performance in tax revenue collection and compliance.

1.6 Research aim

The research takes a case study approach. While big data use is researched in corporate firms, there remains a need to better understand how it may be used in a public firm.

The public organisations are the largest and the primary generators and collectors of data globally and they are actively exploring methods to use big data technology. Nevertheless, the practical application of big data within the public sector is currently quite restricted. Despite numerous research efforts aimed at explaining the concept of predictive big data analytics, many public organisations still lack clarity regarding the capabilities and limitations of this technology for them (Guenduez et al., 2020).

Studies show that firms employing data-driven decision-making strategies are typically five percent more efficient on average and achieve a six percent greater profit margin compared to their competitors. However, similar evidence is lacking in the public sector. Certainly, the ability to utilise big data effectively for instigating changes within the public sector has not yet been established as a common practice (Di Vaio et al., 2022). According to Guenduez et al. (2020) cognizant of the evolving nature of big data in terms of its definition regarding scope and characteristics, there exists some uncertainty with its adoption in the public sector. Despite these uncertainties, big data can enhance government-citizen understanding, inform policymaking, and improve public service delivery (Guenduez et al., 2020).

Tax administrations as public sector firms are “the lifeblood of any economy and critical to the success of government digital agenda” (Basseley et al., 2022, p.2). Tax administrations are transforming the way they conduct their mandate of tax collection through digitalisation (Bellon et al., 2022) of registration for tax purposes, filing, reporting, and payment processes to improve tax compliance.

Governments invest in technology intending to gain benefits and theoretically, Mascagni et al. (2021) point out that there is an expectation that technology shall improve tax revenue. In Peru, Bellon et al. (2020) investigated the effect of technology on firm performance and tax compliance and found that technology had a stronger impact on collections, specifically on value-added tax (VAT).

1.7 Research contribution

This research contributes to the existing body of knowledge by exploring the integral role that human capital plays in enhancing the effectiveness of predictive big data analytics in public organisations, particularly tax and revenue administrations. By employing the resource-based view of the firm as a theoretical lens, the study highlights how the combination of knowledge, skills, and capabilities in human capital can create a competitive advantage that enables organisations to meaningfully leverage predictive big data analytics for operational efficiency and strategic value creation.

Furthermore, this study contributed to the existing literature by providing a nuanced understanding of how human capital and culture interact to influence the effective use of predictive big data analytics in public sector organisations. Specifically, it:

- a) Fills a gap in understanding the role of KSAOs within the context of big data analytics in a public organisation, thus enriching human capital theory.
- b) Illustrates how a data-driven culture can enhance organisational performance, providing empirical evidence that supports the broader strategic management discourse predictive big data adoption.
- c) Highlights the unique challenges public sector organisations face when integrating advanced big data analytics within traditional structures, thereby adding a layer of contextual awareness to the existing knowledge base.

The findings are intended to inform other tax and revenue administrations, policymakers and organisational leaders on best practices for fostering an organisational culture conducive to big data-driven decision-making, ultimately enhancing the performance and accountability of public organisation in an era marked by rapid digital transformation.

1.8 Conclusion to Chapter 1

In conclusion, this research distinctively addressed the intertwined roles of human capital and culture in harnessing predictive big data analytics within public organisations, particularly in the context of tax and revenue administrations. By acknowledging the significance of big data as a strategic resource and identifying the need for a comprehensive understanding of how human capital can either enhance or limit predictive big data analytical capabilities, this study has advanced the discourse on operational efficiency and strategic value creation. Through a robust theoretical framework rooted in the resource-based theory, the study has established the essential competencies required for effective data use and how organisational cultural influences that shape attitudes toward predictive big data analytics initiatives. Ultimately, this research endeavored to bridge the existing gaps in literature, providing actionable insights for public organisations navigating the complexities of digitalisation and big data-driven decision-making.

1.9 Structure of the Research Report

The research report has been structured as follows:

Chapter 2 is a literature review that contextualizes the theoretical framework of resource-based theory the field of predictive big data analytics and human capital and substantiates this study in the academic literature.

Chapter 3 explains why the study is being conducted and defines the research questions that this study will address.

Chapter 4 outlines the research methodology adopted in conducting this research.

Chapter 5 presents the research findings.

Chapter 6 analyses and discusses the findings in relation to the literature reviewed in Chapter 2.

Chapter 7 concludes with actionable recommendations and future research directions.

2 CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

This literature review investigates human capital's role in leveraging predictive big data analytics to create strategic value in a public organisation. The researcher's argument is built on the work of Gupta et al. (2020b) who identified a gap in the literature. These authors called for a better understanding of the effect of leveraging big data and predictive analytics to improve organisational performance in the context of human capital.

The literature will begin by discussing resource-based theory, the theoretical lens of this study. The researcher will then conceptualise the key phenomena relevant to the research: 'human capital', 'predictive big data analytics', 'culture', and 'strategic value creation'.

A growing focus on human capital signifies a substantial shift in perspective, aiming to understand human capital as a unit-level concept among strategy and strategic management scholars in human resource (Nyberg et al. 2014) and the role it plays in competitive advantage. This is a view rooted in resource-based theory (Barney, 1991 as cited in Nyberg et al.,2014). The researcher will explore how human capital uses predictive big data analytics in the organisation to create strategic value, influenced by culture. This investigation will be framed within the theoretical context of resource-based theory.

2.2 Theoretical Framework: Resource-based theory

Embedded within strategic management literature, the resource-based theory asserts that firms vie for competitive advantage primarily through their resources, which can improve performance (Mikalef and Gupta, 2021). The theory serves as an appropriate theoretical framework for this study. Firstly, this theory is a commonly used theoretical framework that is particularly relevant when exploring how organisations create strategic value from their investments in information technology (Mikalef & Gupta, 2021). Additionally, previous research indicates that this theory effectively illustrates the relationship between organisational resources and firm performance. Lastly, Davis and DeWitt (2021) suggest that resource-based theory is one of the most impactful approaches in strategic management, achieving an exceptional level of prominence that

is rare in academic disciplines. This theory emphasises the importance of internal resources and capabilities in achieving competitive advantage, highlighting how effective utilisation of information technology assets can lead to enhanced organisational performance.

At the core of the resource-based theory are resources and capabilities. Scholars contend that resource-based theory views an organisation as a collection of resources and capabilities that can provide a sustainable competitive advantage (Khanra et al., 2022; Zhang et al., 2022b). This theory focuses on how an organisation's different types of resources and capabilities are distributed and used to generate strategic value (Akter et al., 2016). Most research acknowledges that the process of leveraging IT resources in combination with other organisational resources is a source of competitive advantage and value creation (Van De Wetering et al., 2019a).

Resources encompass both tangible and intangible assets, including technology, human skills, and organisational structures Akter et al. (2016) that organisations possess (Ameen et al., 2024). These resources serve as the foundational assets, whereas capabilities represent the organisation's ability to effectively use, bundle, manage, and exploit these resources to create strategic value (Ameen et al., 2024). Moreover, capabilities can be understood as specific subsets of an organisation's resources, specifically designed to enhance the efficiency of other resources (Akter et al., 2016). In essence, capabilities form a distinct category of resources aimed at elevating the effectiveness of the firm's other resources (Akter et al., 2016) for competitive advantage. The significance of resources for a firm is intrinsically linked to their potential to enhance the organisation's performance (Ployhart, 2021). Therefore, a better understanding of predictive big data analytics in the context of resource-based theory gives further insight into how organisations can use this capability for value creation, aligning fully to the purpose of this study.

2.2.1 Bundling of resources and capabilities

The study aims to investigate how a public organisation manages its resources and capabilities to create operational efficiency and achieve competitive advantage.

“It is vital to leverage resources and capabilities to generate superior firm performance.”
(Mishra et al., 2019, p.1737)

The idea of a bundle, which refers to the interconnected resources and capabilities that form the foundation of a company was introduced by Barney et al. (2021). They assert that, from a managerial perspective, the organisation, which comprises authority structures, policies, practices, and organisational culture, plays a crucial role in combining these resources together. As Feldman (2004) noted, the concept of resourcing refers to how management allocates and uses resources to their outcomes, consequently influencing their strategic planning and goals. Additionally, they highlight that the strength of an organisation in maintaining this bundle relies on the willingness of those who manage these resources and capabilities to collaborate and remain committed to the collective effort. Thus, the effective integration of resources depends on their nature and the collaborative relationships among those who oversee them. For employees to exchange and transfer knowledge amongst themselves, for improved operational efficiency, trust is a key component that should not be ignored (Mention & Bontis, 2012).

Resource-based theory suggests that different assets are part of a broader category of resources, and by combining these resources, organisations can create valuable capabilities (Bag et al., 2021). They argue that within the context of resource-based theory, organisational management should focus on rearranging resources to develop relevant capabilities to maintain a sustainable competitive advantage. This study accordingly will focus on how the public organisations generate strategic value from harnessing the predictive big data analytics through its human capital and culture.

Akter et al. (2020) suggest that the core idea of the resource-based view is that organisations with their various resources and the ability to manage these resources can achieve a competitive edge. However, Ployhart (2021) points out that for these resources to offer competitive advantage, they have to be valuable and rare while those that are difficult to imitate and not easily substituted provide a sustainable competitive advantage.

2.2.2 Critiques of Resource-based theory

Resource-based theory is limited in that its focus is more on the organisation's internal resources and capabilities and overlooks the specific mechanisms that connect these various elements (Barney et al., 2021). Some scholars feel that this perspective does not consider that organisations operate within an eco-system, and they are often affected by the environment they operate in. As noted by (Zhang et al. 2022a), it is the actions taken with resources—rather than the resources themselves—that influence

organisational performance and contribute to a competitive advantage. Additionally, this theory does not account for how resource management impacts performance.

More scholars advance that having strategic resources and capabilities is perceived as not enough to achieve a competitive advantage, especially in fast-changing business environments. In their review, Kraaijenbrink et al. (2010) point out that the effective use of these resources and capabilities is essential for maintaining a competitive edge. Consistent with and in support of this, Barney (2001 as cited in Ameen et al.2024), emphasises that just possessing resources and capabilities does not allow organisations to create strategic value, particularly in a rapidly changing context.

Yang and Konrad (2011), as referenced by (Ameen et al. 2024), criticise the resource-based theory for not paying enough attention to contextual factors. Similarly, Oliver (1997 also cited in Ameen et al.2024), contends that both the acquisition and deployment of resources are influenced by the institutional context in which they occur. However, some scholars disagree that organisations should spend their valuable time building their resources and creating capabilities(Feldman, 2004).

2.3 Human capital as a strategic resource

Understanding what human capital and why it is a strategic resource will provide a deeper understanding to the researcher on what features of this central construct are necessary in creating value for an organisation through leveraging big data analytics.

in this study. Human capital is a construct that began in the field of Economics (Becker, 1964, as mentioned in Ployhart (2021). When resource-based theory was introduced (Barney, 1991 as mentioned in Ployhart (2021), human capital was recognised as a resource that can enhance a firm's competitive advantage. This resource-based theory created a link between human capital theory to strategic management. Since the 1990s, resource-based theory has significantly shaped strategic human resource management and, later, strategic human capital (Gerhart & Feng, 2021)

“HC construct has traversed” (Nyberg et al., 2014)

Becker (2002 as cited in Wright,2021) define human capital as “...the knowledge, information, ideas, skills and health of individuals.” But recent scholars, Nyberg et al. (2019) suggest that human capital should be viewed as a resource that operates at multiple levels. They define human capital at the individual level as a set of competencies

called KSAOs, which stands for Knowledge, Skills, Abilities, and other characteristics. They emphasise that individual human capital plays a significant role in enhancing a team's performance since it provides a foundation for developing distinct resources and abilities (Elsharnouby and Elbanna, 2021).

In this research report, following Wright (2021), the researcher will use the abbreviation HC to refer to human capital. HC should be understood to mean an individual's knowledge, skills, abilities, and other characteristics (KSAOs).

There are also more complicated resources, like knowledge gained through experience (Bag et al., 2021). These resources are regarded as intricate because they depend on a collaborative team of employees alongside several specialists who possess a comprehensive knowledge of the whole procedure. Human capital has these qualities, and therefore, it is considered strategic (D'Oria et al. ,2021) and has the potential to impact a firm's overall performance (Ghasemaghæi and Calic, 2020).

Davis and DeWitt (2021) explain that the VRIO model, which stands for valuable, rare, inimitable, and organised to exploit, helps identify the essential qualities of strategic resources (D'Oria et al., 2021) that a company must obtain from strategic markets to achieve a competitive advantage. Competitors can easily copy some resources, so organisations need to be careful and select resources that are hard for others to imitate. There are also more complicated resources, like knowledge gained through experience (Bag et al., 2021). These resources are regarded as intricate because they depend on a collaborative team of employees alongside several specialists who possess a comprehensive knowledge of the whole procedure. Human capital has these qualities, and therefore, it is considered strategic (D'Oria et al. ,2021) and has the potential to impact a firm's overall performance (Ghasemaghæi and Calic, 2020).

From a management literature view, human capital is described as a unique asset that can be obtained but cannot be easily duplicated Gupta et al. (2020c), making it a suitable strategic resource within the strategic management context, the value of human capital mainly depends on its ability to improve competitive advantage (Elsharnouby and Elbanna ,2021).This is based on their employees' skills, knowledge, expertise, and abilities.

2.3.1 KSAO – Resource-based theory perspective

The purpose of this study is to establish how the human capital use their knowledge and how the organisational knowledge is exploited to create strategic value through predictive big data analytics.

2.3.1.1 Knowledge

The element of knowledge in the KSAOs is important for this study because knowledge as defined within the framework of Elsharnouby and Elbanna (2021) resides in human capital. It is in this context that, Mention & Bontis (2013) define human capital as a concept based on the employee competencies including their knowledge, skills expertise, and capabilities. Knowledge is an essential factual or procedural information required to carry out specific tasks (Nyberg et al. 2014). If human capital as described by Elsharnouby and Elbanna (2021) is an important aspect of intellectual capital that reflects the knowledge held by an organisation, then knowledge is a key concept in this study.

“Central to HC is knowledge.” (Elsharnouby and Elbanna, 2021)

Hsu and Wang (2012 as cited in Elsharnouby and Elbanna,2021) highlight that knowledge encompasses both explicit and tacit knowledge, which arises from networking relationships, and the individual knowledge of employees. Tacit knowledge is often understood to encompass values informed by organisational culture, as well as personal experiences and attitudes that are typically implicit (van der Voort et al., 2021a).

Human capital is a valuable resource that can be cultivated through effective recruitment management; however, its development and long-term viability are contingent upon an organisation's knowledge culture. The literature characterises this distinct resource as something that can be acquired but cannot be replicated. Shamim et al. (2020) point out that the knowledge-based view suggests knowledge is a key strategic resource for organisations and the main aim of a firm is to turn that knowledge into results. Organisations invest in human capital with the expectation of harnessing their skills and intellectual capabilities, ultimately leading to its evolution into a core competency, thereby creating knowlesge (S. Gupta et al., 2020b).

To improve their efficiency and create strategic value, Barney (1990) posits that organisations must own and bundle their strategic resources that are valuable, rare, difficult to imitate, and organisable (Barney et al., 2021) and capabilities. Human capital is a strategic resource that can be used by organisations to effectively make use of other resources and/or capabilities, specifically predictive big data analytics, to generate strategic value. In this study, the resource-based theory acts as a conceptual link between key ideas from human capital theory and the strategic management of organisations (Ployhart, 2021).

2.3.1.2 Skills and abilities

The researcher is interested in identifying and gaining an in-depth understanding of the skills and abilities that human capital in a public organisation should possess to leverage predictive big data analytics and ultimately create value for the organisation.

Skills and ability are developed based on the individual knowledge (Nyberg et al., 2014). Skills refer to an individual level of proficiency and capabilities while ability is a lasting capacity, usually cognitive, that is necessary to perform a specific task. Skills of the workforce are seen as hidden resources; they are not obvious and come from learning and practice (Bag et al., 2021). In their study, Nyberg et al. (2014) recognised just two subcategories within the unit-level human capital resource classification that stem from the definitions of KSAOs: 'Knowledge' and 'skills and abilities'.

Human skills are divided into two main categories: technical skills and managerial skills. Technical skills involve the practical knowledge needed to use new technologies effectively and to analyse different types of data to gain insights from large datasets. Managerial skills are abilities that help employees understand and make sense of the insights drawn from big data analysis. They focus on the ability of employees to comprehend and interpret the information derived from data analysis. These skills are important because it is not enough just to gather data; teams need to make sense of it and apply their findings in ways that impact the organisation. Effective managers must be able to translate technical data into actionable strategies (Van De Wetering et al., 2019a).

In the context of resource-based theory, an organisation's ability to control and manage its resources is influenced by its policies, authority structures, practices, and culture (Barney et al., 2021). This framework enables the organisation to hold a bundle of

resources and capabilities together effectively. However, the cohesion of these resources is dependent on the other characteristics of individuals, upon the voluntary willingness of individuals to remain connected to the organisation. Their motivation to share their experiences, skills, and knowledge for the purpose of strategic value creation is inherently voluntary (Barney et al., 2021).

2.3.1.3 Other characteristics

The study aims at understanding how the other characteristics in human capital would be instrumental in how human capital leverages predictive big data analytics as an emerging technology.

The human element present in human capital makes this resource particularly susceptible to individual biases and heuristics (Sarma & Sharma, 2014) and influences exerted at both managerial and unit levels (Wright, 2021). This is what defines the other characteristics that constitute a human capital. Coff's (1997 observation as cited in Nyberg et al. 2014) highlights that human capital resources, like other valuable assets, can leave a company. Consequently, it is regarded as a unique strategic resource that necessitates distinct management approaches. This makes human capital a super-class of resources at the firm level. Thus, the dynamics of resource management not only rely on structural aspects but also on the voluntary contributions of individuals within the organisation, which are influenced by the other characteristics of individuals (Nyberg et al., 2014).

Denison (1984 as cited in Shamim et al. 2020), describe culture within organisations as a collection of norms, values, attitudes, and behavioural patterns that shape the fundamental identity of organisations and how it conducts its operations. Organisational culture feeds on the other characteristics of human capital.

2.3.2 Development of human capital

This study aims to understand how integrating diverse expertise within teams would help public organisations to capitalise on the available data resources. By fostering a collaborative environment, businesses can cultivate unique competencies that enhance performance and establish a sustainable competitive advantage in the marketplace.

The skills element of human capital is dependent on learning (Bag et al., 2021). More specifically, the technical skills are instilled in human capital through training and

development. It is for this reason that for organisations that consider exploiting their human capital to create strategic value through leveraging big data analytics, the human capital should have the required and appropriate skills.

Organisations upskill and develop specific capabilities to harness the power of extensive structured and unstructured datasets (Akhtar et al., 2019). To effectively leverage big data and analytics investments, a strong human talent infrastructure is essential. Skilled professionals, such as data scientists, developers, and analysts, are crucial for creating and executing successful analytics strategies. This expertise is necessary, especially in managing and interpreting vast amounts of unstructured data, highlighting their importance in both the initial design and final analysis stages of big data projects (Grover et al., 2018).

While knowledge itself does not diminish, it can become obsolete as new technologies and inventions emerge thereby necessitating organisations to use their current knowledge while also seeking out new insights to navigate (Gupta & George, 2016) disruptive and emerging technologies. Organisations must invest in interdisciplinary education in Business Intelligence and Analytics, which should encompass analytical and IT skills, domain expertise, and communication abilities. By fostering such educational approaches, organisations can develop data scientists—hybrid professionals skilled in both technology and academia (De Mauro et al., 2016).

According to (Akhtar et al., 2019) the big data analytical capabilities should be tied not only a skilled workforce but also critical competencies and advanced technologies, supplemented by mathematical, statistical, and machine-learning techniques. This integrative approach shall create competency in analysing large datasets, yielding insightful reports that can significantly enhance organisational performance.

“Analytics is a technical function and requires expertise on various technologies” Shet et al. (2021, p. 317) and, therefore, requires continuous training for employees on new tools, techniques, methods and technologies. Shet et al. (2021) established that organisations generally do not invest much in support functions such as human resources, which implies a need for capabilities across multiple technologies and adequate support.

Organisations need to design an effective and contextual training programs , Shet et al. (2021) note that while it may be easier to learn the analytics techniques understanding

its practical implementation can be challenging, hence on-the-job training and hands-on experience provision to the human resource personnel, other decision-makers Shet et al. (2021) and the rest of employees is recommended.

Big data analytics demands substantial resources, particularly sophisticated technologies, and proficient teams, to extract insights that improve organisational outcomes (Akhtar et al., 2019). Effective analysis relies on interdisciplinary expertise, drawing from fields such as operations management, computing, and statistics. Therefore, it is essential to establish and train personnel with diverse skill sets, enabling organisations to generate substantial-value insights (Akhtar et al., 2019).

Akhtar et al. (2019) established that MegaTelCo employed a diverse group to leverage big data to identify key customers eligible for incentive programs, ultimately improving retention rates and customer satisfaction. Similarly, in clinical informatics, Aridhia demonstrated the potency of a multidisciplinary team by integrating technologies such as Hadoop and SQL to develop a centralised data system that enabled personalised treatment options (Akhtar et al., 2019).

Furthermore, research into multi-disciplinary teams in the film industry underscores the significant correlation between competitive advantage and the collaborative use of diverse skill sets (Akhtar et al., 2019). The findings suggest that the synergy generated through collaborative efforts—rather than reliance on individual talents—is a key driver of organisational success. This collaborative culture, characterised by effectively coordinating diverse resources, is notably challenging for competitors to replicate.

Consequently, organisations that adeptly manage diverse teams can achieve enhanced performance by promoting collective learning and developing context-specific competencies, such as big data management, that are difficult to imitate. Multi-skilled teams that leverage these capabilities can extract valuable insights from complex datasets, leading to more informed business development strategies and superior performance outcomes (Akhtar et al., 2019).

In conclusion, integrating diverse expertise within teams is essential for organisations seeking to capitalise on the available data resources. By fostering a collaborative environment, businesses can cultivate unique competencies that enhance performance and establish a sustainable competitive advantage in the marketplace.

2.4 Predictive big data analytics

Predictive big data analytics is a key construct that the researcher seeks to gain an understanding of what it is and how it can be bundled with human capital to create strategic value in a public organisation.

Due to digital advancements, a vast amount of digital information, often labelled 'big data', is now available to public administration and private companies at relatively low costs. The Tax and Revenue administration under study is a public organisation that has embarked on the digitalisation journey. From the public sector perspective, tax administrations have embraced digitalisation by applying technology to various tax-related activities Bassey et al. (2022) to enhance strategic value.

This access can help improve their operations (Huynh et al., 2023). However, big data is only valuable if it is effectively managed, processed, and analysed. Some researchers have pointed out that simply obtaining big data does not automatically lead to valuable insights for businesses and society; it requires careful handling to uncover its full potential (Zhang et al., 2022a). Therefore, while big data presents opportunities, its benefits are realised only through proper management and evaluation, leveraging specific resources and processes to generate value (Acciarini et al., 2023).

2.4.1 Big data

Big data relates to the emergence of new data sources, innovative technologies, and enhanced user expertise (Bag et al., 2021). In the 21st century, organisations have experienced the proliferation of digital processes and systems, resulting in business disruptions caused by big data and big data analytics.

Big data is integral to the field of data science, which encompasses a collection of core principles that facilitate the systematic extraction of information and knowledge from data. Data science is employed to inform various types of decisions and involves a diverse range of activities, such as data generation, processing, and application. It is often referred to as the "black box" of decision-making (van der Voort et al., 2021b). Furthermore, big data consists of technology-generated information that is voluminous (volume); collected from various sources generated in real-time, in different formats, and it is generated at high speeds to process (velocity) and originating from multiple sources in different formats (variety). This complexity makes it challenging to process and

analyse using conventional data management tools, skills Ghasemaghaei and Calic (2020) and software in a reasonable timeframe (Sahut et al., 2022)

As technologies advance, big data attracted more academic attention, and some scholars introduced two more properties namely veracity, which is concerned with the quality associated with big data derived from user-generated content and value, which implies that big data allows firms to boost their revenue and improve the customer experience while reducing the cost of production. The 5V Framework of big data suggests that big data is a valuable source of information necessary for decision-making and value creation (Acciarini et al., 2023).

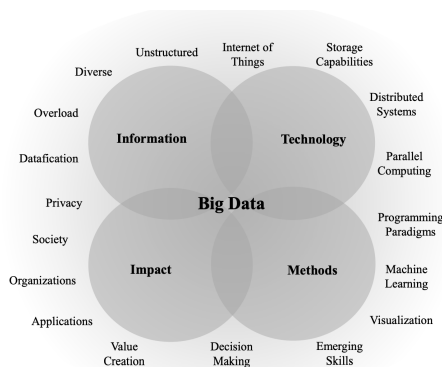
This research will adopt big data using the 5V framework (Volume, Velocity, Variety, Veracity, and Value). The definition that will be used throughout this report is:

“Big Data is the information asset characterised by such a high volume, velocity, and variety that it requires specific technology and analytical methods for its transformation into value.” (De Mauro et al., 2016, p. 122-135).

This definition explains the features of information, the technology needed to use it effectively, and the methodologies of turning that information into insights that can affect businesses, governments, and communities. It also highlights the importance of terms like ‘big data technology’ and ‘big data method’ when discussing the specific technologies and methods mentioned in the original definition (De Mauro et al., 2016). This definition is illustrated in Fig.1

Figure 1:

Big data themes and related topics



Source 1: (De Mauro et al., 2016)

Table 1:

The 5Vs of Big Data Framework

The attributes of Big Data	Description	Author
Volume	“Large amounts of data”	Acciarini et al., 2023, p.2
Variety	“Different types of data that it is possible to use.”	Elia et al., 2020, p.618
Velocity	“The speed at which data are generated and transmitted”	Elia et al., 2020, p.618
Veracity	The accuracy of the data	Tonidandel et al., 2018
Value	“Data translated into learning, knowledge creation and /or economic gain”	Mazzei and Noble, 2017, p.

Source 2: Researcher's compilation

This research explores how public organisations exploit their human capital to harness predictive big data analytics for strategic value creation, emphasising the value of big data. The value of big data lies in how it can be used to help organisations, like improving their efficiency in operations (Mazzei and Noble, 2017). According to Elia et al. (2020), the actual value of big data lies in its capacity to generate valuable insights through data analysis, which enables organisations to gain competitive advantages. Additionally, value encompasses the strategic benefits linked to investments in technology. In the realm of big data, the aim of applying advanced technologies to large datasets is to uncover hidden information, allowing for informed decision-making in both strategic and operational contexts (Elia et al., 2020).

The value of big data has positioned big data as a valuable, rare, inimitable, and non-substitutable (D’Oria et al., 2021b) resource in strategic management literature. As big data-specific technologies continuously advance, scholars have discovered that big data as a resource has assumed a critical role in driving strategic unique value (Zhu & Li, 2023). However, researchers argue that big data alone is not enough to influence

operational efficiency instead firms need to orchestrate certain big data resources (Zhang et al., 2022a).

Similarly, other researchers advance that big data will create strategic value if it is complemented with appropriate competitive human factors Gupta et al. (2020a) to interpret data in real-time (Ghasemaghaei & Calic, 2020) and timeously generate new insights to inform strategic decisions (Mikalef et al., 2020). This aligns closely with the human resource-based view of a company, which suggests that a company's resources and abilities are linked and work together in some way (Barney et al., 2021). Cappa et al.(2021 as cited in Acciarini et al.2023) contend that businesses must possess a comprehensive overview of the various applications of big data to fully realize its specific potential across different sectors. This approach enables companies to pinpoint possible connections between various business domains and view big data as a "valuable asset" for enhancing their business models.

2.4.1.1 Big data in public organisations

This study aims to understand what big data in public organisations is and how it is used to improve operational efficiency for strategic value within the resource-based theory context.

In public administration, big data refers to large amounts of information that often integrate well-organised data collected by government agencies with real-time data that is continuously and automatically gathered. This real-time data can be structured and unstructured, often generated passively through online activities by public and private organisations (Guenduez et al., 2020). Over the last twenty years, African tax administrations have undergone significant modernization. A vital aspect of this transformation has been the digitisation of tax records and the widespread use of information and communication technologies (Mascagni et al., 2021b).

However, some scholars believe that for a tax administration that depends heavily on its ecosystem, more than technology is needed to achieve the desired operational efficiency Kochanova et al. (2020) and ultimately realise the strategic value of big data.

The literature affirms that organisations shall only realise strategic value from big data by adopting technology if this resource is complemented by the necessary human skills to effectively transform big data into a capability (S. Gupta et al., 2020). As stated by

Gupta and George (2016), achieving the desired outcomes for an organisation relies not just on technology but also on other necessary skills.

Resource-based theory serves as a crucial framework for understanding how investments in information technology create value and assist organisations in achieving operational efficiency Mikalef and Gupta (2021) As noted by Mazzei and Noble (2017), a significant aspect of this theory is that firms can enhance their success by combining data resources with strong analytical skills.

The value of data increases substantially when coupled with an organisation's ability to adapt and make the most of the insights gained from that data (Mazzei and Noble, 2017). Big data offers detailed insights into how public organisations operate and perform Klievink et al.(2017) supports informed decision-making Desouza and Jacob (2017), and facilitates evidence-based policymaking in public administration (Guenduez et al., 2020). This synergy enables organisations to refine their business models and enhance overall performance, ultimately resulting in greater competitiveness (Mazzei and Noble, 2017).

2.4.2 Big data analytics

The focus of this study is to gain an understanding of what big data analytics is, how it fits within the theoretical framework of resource-based theory and lastly how it can be of use to public organisations that seek to create strategic value from its use.

Analytics encompasses the techniques that enable the examination of large datasets maintained by organisations (Nocker & Sena, 2019).Big data analytics involves specifying, capturing, storing, accessing, and analyzing large datasets to understand their significance and leverage their value for decision-making (Zhang et al., 2022b). According to Xu et al. (2023), it involves using advanced analytical methods to uncover valuable insights that help inform decisions through forecasting (Spanaki et al. (2018). Essentially, big data analytics is focused on processing and examining substantial amounts of data to extract useful insights to create value (Wamba et al., 2017). Lastly, Choi et al. (2018) refers to big data analytics as handling information from various places and in different types. For instance, data can be gathered from the internet, social media, business systems, and cloud services, and it can be in forms like text, images, sound, or videos (Choi et al., 2018)

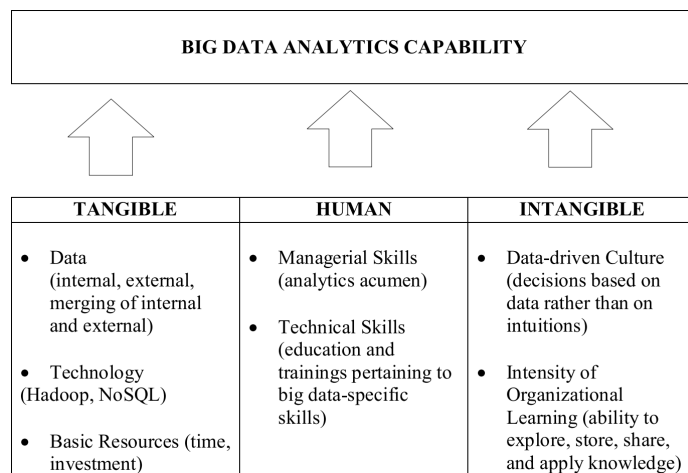
Big data analytics refers to a new set of technologies and systems created to efficiently extract useful information from large amounts of different data types by allowing quick collection, exploration, and analysis. Big data frequently compels organisations to invest in cutting-edge technology for tech-driven operations. However, organisations often fail to use it optimally due to a deficiency in the necessary human skill set resources and this research shall add on Gupta et al. (2020a) research findings that illustrate the pivotal role of human skills in establishing a robust big data analytics capability.

The previous research outlines various resources that organisations need to harness the benefits of big data; however, it falls short in providing insights into how companies can develop a big data analytics capability. Building on the original resource-based theory and further contributions from multiple researchers along with recent studies that address big data challenges Gupta and George (2016) suggest seven key resources that will enable organisations to establish a big data analytics capability.

Based on this classification by Gupta and George (2016) , and in the context of resource-based theory, organisation’s ability to bundle these resources will enable such organisations to gain sustainable competitive advantage.

Figure 2:

Classification of big data resources



Source 3: Gupta and George, 2016, p.1051

Business data can be categorised into internal and external data. Internal data is generated from the organisation’s operations, such as inventory and sales, but relying solely on it can limit competitive advantage. In contrast, external data—from sources like

the internet and mobile devices—provides broader insights, including customer preferences for products like movies and music. For organisations seeking to enhance their big data analytics capabilities, integrating both internal and external data is crucial. This combination enriches the analytical process and enables companies to better understand market dynamics, ultimately fostering a sustainable competitive edge (Gupta & George, 2016).

Research has been conducted to categorise the various forms of analytics available to businesses and three pertinent types were identified: descriptive, predictive, and prescriptive analytics (Nocker & Sena, 2019). Descriptive analytics is concerned with examining historical data to explain what has happened. In contrast, predictive analytics aims to anticipate future outcomes by using both historical and current data, thereby addressing the question, "What is likely to happen?" Finally, prescriptive analytics guides decision-making processes by responding to the inquiry, "What actions should be taken?" (Zhang et al., 2022; Xu et al., 2023). This study specifically focuses on predictive big data analytics, which will be further discussed in the subsequent section.

In their research, Gupta et al. (2020) argued that there needed to be a narrow understanding of the significance of human skills in developing capabilities and their role in operational efficiency. This view is also shared by Mikalef et al. (2021) who argue that the definition of big data analytics overlooks the organisational resources needed to make the most of these technologies and data to achieve better performance compared to competitors. Mikalef et al. (2019) found that the abilities to analyse big data, including physical assets, non-physical assets, and skilled personnel, are positively linked to benefit, even though it is "the humans who interpret outcomes and make decisions" (Mikalef et al., 2020, p.3).

Human capital play a crucial role in the use of big data because the data generation, processing, dashboard creation, and the design of all artifacts are primarily conducted by individuals. Consequently, the personal knowledge and skills of these individuals are inevitably incorporated into the data, subtly influence the use of big data (van der Voort et al., 2021b).

2.4.2.1 Data analytics maturity

When an organisation understands the significance of big data analytics, it impacts the design of its analytic processes. Consequently, organisations that promote data-sharing

and advanced analytics tend to exhibit a higher level of sophistication in their big data analytics efforts.

In the tax and revenue administration context, the WCO has designed the Analytics Maturity Model (AMM) that serves as a framework for assessing the analytical maturity of organisations, illustrating the progression through various stages toward enhanced process maturity. The WCO recommends that each level must be successfully navigated before progressing to the next.

- a) Level 1: Organisations operate primarily using spreadsheets and informal analysis, lacking a cohesive analytical strategy.
- b) Level 2: Data is used minimally and not strategically, with insights confined to a select few individuals, limiting overall organisational understanding.
- c) Level 3: Acknowledgment of the necessity for improved data governance emerges, as organisations begin to leverage analytics more effectively.
- d) Level 4: Characterised by a data-driven culture, this level entails skilled personnel conducting advanced analytics, including artificial intelligence, and fostering analytics adoption throughout the organisation.
- e) Level 5: Organisations at this stage have fully integrated a data-driven decision-making process, establishing clear roles like the Chief Analytics Officer and promoting collaboration among teams for sharing analytical insights, with ongoing improvements through self-learning methodologies (WCO Capacity Building Framework On Data Analytics Executive Summary, n.d.).

In the academic context, Grossman identifies five levels of analytical maturity within organisations, which are: 1) the ability to generate reports; 2) the capability to build and implement models; 3) having repeatable processes for analytics development and deployment; 4) maintaining consistent enterprise-wide analytics processes; and 5) having analytics driven by strategy (Bratasanu, 2018).

2.4.3 Predictive analytics

Predictive analytics encompasses a range of techniques that forecast future outcomes by identifying patterns and predicting relationships based on current and historical data (Fan et al., 2014). Predictive big data analytics (PBDA) involves applying sophisticated analytical techniques to large datasets to extract valuable insights (Xu et al., 2023). This process enables organisations to forecast or predict potential future outcomes based on both historical and current data. By leveraging vast amounts of information, big data predictive analytics helps organisations improve their predictions, make accurate decisions, and enhance their efficiency (Chatterjee et al., 2023).

Predictive analytics is a technique that organisations can use to improve their operational efficiency and achieve a competitive edge. As noted by Gupta et al. (2020b), capabilities are regarded mainly as a set of strong, repeated abilities partly derived from tacit knowledge. Ameen et al. (2024) describe capabilities as an organisation's ability to exploit or use resources in a way that creates value. This involves transforming primary resources into dynamic capabilities (S. Gupta et al., 2020b).

Predictive analytics capability plays a crucial role in structuring vast datasets to enhance decision-making processes in organisations. The integration of specific human skills is of paramount importance for effectively managing the critical components of predictive data analytics. These skills encompass a range of tasks, including the collection, storage, transfer, and sharing of data (system architecture), in addition to the searching, analysis, and visualization of data (data analytics). Collectively, these competencies ensure that organisations can leverage data-driven insights to optimize business processes and drive strategic initiatives (S. Gupta et al., 2020b).

Moreover, Akhtar et al. (2019) suggest that analysing big data requires expertise from a variety of fields, the core elements of big data analytics which include mathematics, statistics, engineering, user interface design, computer science, and information technology (Sun et al., 2018). It is therefore imperative to form big data-savvy teams that possess a diverse skill set from multiple disciplines, allowing for better insights that lead to improved business performance (Akhtar et al., 2019).

Human capital provides the foundation for creating unique resources and abilities (Elsharnouby & Elbanna, 2021b). Based on that, many research studies recognise that leveraging information and technology resources alongside other organisational assets

contributes to generating value (Van De Wetering et al., 2019b) organisations must also acquire and develop the necessary skills over time.

By building PBDA skills, organisations can achieve a uniqueness that is hard to copy, as this fosters a data-driven culture that makes decisions based on evidence and data Yasmin et al. (2020) and improved forecasting ability.

Van der Voort et al. (2021) argue that domain experts have valuable knowledge that should be considered when analysing data and the input of these professionals is necessary to overcome resistance. They posit that professionals should be seen not only as recipients of information but as independent decision-makers. They further assert that domain experts are important in questioning data intelligence, as these experts may not be the final say in a chain led by data analysts (van der Voort et al., 2021b).

Akhtar et al. (2019) reported that research has shown that integrating knowledge from multi-disciplinary teams improves innovation performance. An example of a study within the film industry demonstrated the connection between competitive advantage and the use of such teams, arguing that it is the complementary skills from various domains that provide organisations with an edge (Miller and Shamsie, 1996).

Fostering a collaborative culture and establishing routines around multi-disciplinary teams is a capability that competitors struggle to replicate. Thus, organisations skilled in coordinating diverse talent are likely to gain a competitive advantage. These organisations achieve superior performance by enhancing collective learning in complex tasks and fostering specific competencies related to knowledge sharing, such as managing big data. Multi-skilled big data teams that leverage these skills can derive insights from complex data and make more effective decisions, leading to improved outcomes (Akhtar et al., 2019).

2.4.3.1 Benefits and challenges of predictive big data analytics

The focus of this study is to examine the resulting benefits organisations can realise by leveraging predictive big data analytics. Additionally, also understanding the challenges organisations face when implementing predictive big data analytics is important in this study.

2.4.3.1.1 Benefits of predictive big data analytics

Organisations can leverage predictive big data analytics solutions to spend less time looking for potential issues and more time taking action to maximise the value of every resource. Several recent studies have documented the key benefits of incorporating predictive analytics into an organisation's business intelligence strategies (Attaran & Attaran, 2018).

In their study, Rajpurohit, (2014 as cited in Attaran & Attaran, 2018) revealed that 68 percent of organisations utilising predictive analytics have experienced a competitive edge as a result. In addition. Additionally, in one other research, predictive analytics tools convert raw data into straightforward and actionable insights. enabled a plant personnel to leverage vast amounts of data, allowing them to make real-time decisions that greatly enhance equipment maintenance and reliability (Attaran & Attaran, 2018).

Other notable insights, such as identifying new revenue streams, enhanced profitability and customer service, and improved operational efficiencies were also found by the study (Attaran & Attaran, 2018).

Traditional analytics generally require significant development time and are often confined to a separate analytics environment that must be accessed independently. Conventional business intelligence (BI) tools focus on quantifying and analysing historical data to reveal what has occurred in the past. Conversely, predictive analytics utilises that same information to enable rapid and accurate forecasting. The benefits of predictive analytics are especially relevant to business applications where analytics is integrated seamlessly. Organisations of all sizes are increasingly employing predictive analytics to support core business functions such as marketing, merchandising, sales, and risk management (Attaran & Attaran, 2018).

Historically, governments have gathered information about their citizens to assist in governance and policy development. Data-driven decision-making has become essential for modern economic policies, encompassing everything from population statistics to household income and commodity prices. To move beyond traditional methods of data storage and analysis, it is vital for governments to adopt new technologies such as Hadoop or NoSQL and establish advanced frameworks for decision-making (Moorthy et al., 2015).

For a public organisation like the tax and revenue administration, the focus should not only be on collecting data from various available sources but also on organising and analysing unstructured information from diverse formats, including physical documents, scattered databases, legacy systems, social media posts, videos, mobile signals, emails, and GPS data (Moorthy et al., 2015).

2.4.3.1.2 Challenges of predictive big data analytics

Predictive analytics faces a number of challenges during implementation. A benchmark study conducted by Ventana Research on behalf of IBM identified various difficulties organisations encounter while using predictive analytics. The research also highlighted a key business barrier to the effective deployment and utilisation of predictive analytics (Attaran & Attaran, 2018).

These challenges can be divided into technical and organisational issues, which are summarised as follows:

1. Difficulty in integrating predictive analytics into the organisation's information architecture;
2. Challenges in accessing source data;
3. Issues with applying the results;
4. Lack of resources, including budget limitations and skill shortages;
5. Insufficient awareness of how to apply predictive analytics to business problems;
6. Absence of in-house experts to implement the findings;
7. An overemphasis on past patterns;
8. High costs associated with measuring data;
9. Low accuracy of results.

McGuirt et al. (2015 as cited in Attaran et al., 2018) reported that their survey highlighted the key challenges institutions face in effectively using data from different departments for decision-making. They shared that these challenges include ensuring data quality, addressing new types of data, and adopting more advanced analytics techniques .

Singling out universities where the survey was conducted, the report indicated that many universities struggle with analytics capabilities and often lack the internal resources needed to make the most of the extensive data insights available to them. As a result, they tend to either outsource their analytics needs or, more frequently, fail to utilise the

information at their disposal (McGuirt et al. (2015 as cited in Attaran et al., 2018) and this can be so for organisations.

The other challenge is finding the right analytics solution and caution that there is no one-size-fits-all solution or simple device that is universally applicable. A range of new tools tailored for specific analytics purposes is emerging, and independent standards are being rapidly developed by various vendors Attaran et al., 2018).

2.5 Culture

This study aims to critically review the concept and influence of culture in leveraging big data analytics in a public organisation for strategic value creation. Martínez-Caro et al. (2020) contend that an organisation can leverage its current culture to drive the necessary changes and embrace a new digital strategy, thereby fostering the development of a digital culture (Martínez-Caro et al., 2020a). Culture is reflected in the strategic direction, market orientation, human resource policies and practices, as well as internal networks and information sharing within an organisation serving as a source of competitive advantage (Mention & Bontis, 2012). An organisational culture that effectively uses resources and prioritises data-based decisions tends to achieve competitive advantage (Yasmin et al., 2020). Organisational culture encompasses individuals' mindsets, which directly impact their behaviour (Martínez-Caro et al., 2020).

To effectively generate value within organisations, it is imperative to prioritise the acquisition of new knowledge. The integration of big data stands as a pivotal strategy in this pursuit. Moreover, the role of digital technologies must be balanced. These technologies represent information in various forms and facilitate ongoing reinterpretation, which is essential for extracting valuable insights. The ability to organise, process, and rearrange internal knowledge fosters a culture of collaboration that transcends departmental boundaries. Such collaboration is crucial for transforming and commercialising newly acquired external knowledge, as highlighted by (Martínez-Caro et al., 2020).

However, technology on its own is insufficient; what is required is an organisational culture conducive to the effective utilisation of these digital tools. A digital culture that promotes openness and knowledge sharing among employees is fundamental. Employees' willingness to use and disseminate their knowledge is critical for generating innovative ideas and discovering new methodologies. Martinez (2015) assert that this

openness enhances creativity and allows organisations to harness the full potential of digital technologies.

Recent researchers have identified four key aspects of organisational culture: (1) it tends to be established and resistant to change; (2) it is often assumed and not questioned; (3) its significance comes from the members of the organisation; and (4) it includes a common understanding among the members (Martínez-Caro et al., 2020b). The capability for big data analytics will not enhance decision-making performance unless the culture supports data-driven decision-making. Culture is a more significant factor in the failure of big data initiatives compared to data characteristics and technological issues (Shamim et al., 2019).

Resistance to change can stem from external influences as well as internal personal factors. However, researchers such as Lewin, as referenced by (Van Eeden et al., 2016) perceive resistance as a challenge that needs to be addressed and defeated. Oreg (2006 as cited in van Eeden et al. 2016) highlights that an individual's tendency to resist change is influenced by their self-esteem, need for achievement, and sense of control over their surroundings. Conversely, changes that modify the core values and visions of the current system tend to provoke greater resistance (van Eeden et al., 2016).

The transformation of organisational culture within Saudi Arabian higher education, particularly regarding the integration of big data analytics has been extensively documented. Similar to institutions globally, Saudi Arabia's higher education system has embraced big data analytics to enhance decision-making and performance, in line with the Saudi 2030 Vision (Aseeri & Kang, 2023).

2.5.1 Data-driven culture

The study focus is on the big data analytics and therefore it is important to critically review the role of data-driven culture in leveraging big data analytics. Organisations must cultivate a data-driven culture to minimise reliance on intuition and gut feelings. A data-driven culture is essential for promoting decision-making based on data (M. Gupta & George, 2016). In the absence of a data-driven culture, managers and decision-makers in data-centric organisations may still rely on their instincts and intuition to make decisions, but they tend to use data to support decisions that have already been made (Shamim et al., 2019). Furthermore, previous research highlights the significance of organisational culture in fostering capabilities related to big data (Shamim et al., 2020).

Shamim et al. (2020) discuss big data-driven decision-making in relation to its effectiveness and efficiency, emphasising that decisions should be made solely on data rather than intuition. According to other scholars, decision-making that relies on data has a positive impact on organisation performance, indicating that organisations that use data-driven approaches tend to be more efficient (Shamim et al., 2020). The adoption of data-driven decision-making is closely associated with the behavior of executives. A critical step in implementing advanced analytics is fostering a data-driven culture, which serves as a vital element in converting data resources into a significant competitive advantage (Bratasanu, 2018).

Data-driven decisions tend to yield superior outcomes across all industries, as companies that successfully integrate sector expertise with data science gain a significant competitive edge. To effectively manage change in a data-driven business environment, five key areas are particularly crucial: (1) a vision, (2) talent management, which can be challenging to achieve, (3) technology that aligns with a big data strategy, (4) decision-making processes that enhance cross-functional collaboration, and (5) a corporate culture that fosters a shift from relying on intuition and gut feeling (Bratasanu, 2018). De Mauro et al. (2016) argue that a cultural shift is equally important, encouraging all employees to manage and integrate data into decision-making effectively (Buhl et al., 2013).

2.5.2 Leadership and culture

In today's digital environment, adopting a data-focused approach is important for organisations that seek sustained competitive advantage. At the core of this transformation is the pivotal role of top management support. As substantiated by El-Haddadeh et al. (2021) the engagement of top management in initiatives like big data analytics is crucial for establishing an organisational data-driven culture that values predictive big data analytics. When leaders prioritise data-driven initiatives, they create a fertile ground for new ideas and methodologies to succeed.

Moreover, Shet et al. (2021) reinforce this argument by demonstrating that the involvement of top management significantly enhances human resource effectiveness. Effective analytics are inherently collaborative, necessitating a cohesive approach across various departments. Without the backing of strong leadership, efforts to integrate analytics within an organisation can falter, leading to suboptimal utilisation of resources.

Therefore, top management must transcend their hesitations and actively invest in human resources, as their commitment can catalyse the profound changes needed for successful implementation of data-driven initiatives (Shet et al., 2021).

In their work, Kouzes and Posner (2002 as cited in Meng,2014) highlighted that leaders play a critical role in conveying the core values and culture of an organisation to their subordinates. They argued that leadership not only affects the culture but is also pivotal in creating and sustaining that culture at a consistent level. Overall, research on organisational culture has primarily centered on its effects on corporate outcomes, demonstrating that executive leadership plays a crucial role in shaping and developing culture (Meng, 2014).

However, a notable barrier surfaces when top management hesitates to allocate resources towards human capital due to an uncertain perception of the benefits. However, Kletzer (2018 as cited in Bratanu,2018) posits that when it comes to organisational cultures, managers often have varying views on the benefits of data analytics, which influences their adoption of data-driven tools. This can hinder the organisation's ability to adapt and leverage big data analytics effectively. It is imperative that leaders recognise the long-term benefits of investing in human resources, as their support is essential for fostering an environment conducive to change (Shet et al., 2021a).

Furthermore, as organisations delve deeper into big data analytics, the necessity for a robust information and technology infrastructure becomes crucial. Organisations must pay attention to the technical underpinnings necessary for successful big data analytics. A well-designed information and technology setup and a skilled analytics team are integral to effective data capture and transformation. They pave the way for automation and the advancement of data-science initiatives. Regrettably, many organisations underestimate these requirements during the initial stages of IT system configuration, setting the stage for substantial obstacles down the line (Shet et al., 2021a).

2.6 Strategic Value Creation

Because this study looks at the value of big data analytics in strategic value creation, it is important to critically review the concept and relevance of strategic value creation. Corbett and Webster (2015) discussed three key perspectives—opportunity, control, and data limitations—that influence how organisations view big data. These perspectives significantly impact decision-making regarding big data initiatives. For this research, the

focus will be on the opportunity frame, which highlights the innovative possibilities that organisations recognise within big data.

Organisations invest in big data to gain a competitive edge and improve performance, but the realisation of these benefits depends on effectively integrating complementary resources (Chatterjee et al., 2021; Ghasemaghahi and Calic, 2020). Competitive advantage is achieved when a firm possesses and leverages valuable resources and capabilities (Barney et al., 2021). To extract value from big data analytics, organisations must possess the capacity to efficiently collect, integrate, coordinate, and use big data as a resource for the development of their big data analytics capabilities (Zhang et al., 2022b). The value realised from resources how effectively and thoughtfully they are used by individuals (Günther et al., 2022).

Ghasemaghahi and Calic (2020) posit that firms invest in big data to gain a competitive advantage within their industries and enhance their firm performance. However, firms must cultivate complementary resources to effectively use their investment in artificial intelligence (Chatterjee et al., 2021). Barney et al. (2021) draw attention to the ambiguity of the term competitive advantage. Nevertheless, they provide a basic definition of competitive advantage by explaining that a firm is considered to have a competitive advantage when that firm possesses certain resources and capabilities.

2.6.1 Value and value creation

Before one can understand strategic value creation, it is important to delve into the concept of value itself. The concept of value has been defined in various ways across literature, with some definitions aiming to encompass a broad range of interpretations. One such definition, as cited by (Haksever et al., 2004), is offered by Baier (1969, p. 40), who characterises value as “the capacity of a good or a service or activity to satisfy a need or provide a benefit to a person or legal entity”. From the perspective of strategy and marketing literature, value is intricately linked to the customer's willingness to pay, representing a demand-side view. This approach emphasises the economic aspect of value.

A complementary definition provided by MacDonald et al. (2016, p. 69) further refines the understanding of value by asserting that it encompasses “all customer perceived consequences arising from a solution that facilitates or hinders the achievement of the customer's goals.” This points to a more comprehensive interpretation that considers the

broader implications of value on customer experience and goal attainment. Together, these definitions illustrate the multifaceted nature of value and its importance in both theoretical and practical contexts.

Regarding this research and the research question, "How does the human capital in a public organisation leverage predictive big data analytics for strategic value creation?" "Leveraging a new technology requires that value is created in the first place" (Björkdahl and Holmén, 2019). Baier's definition appears to be fitting. The value-in-use perspective defines value as the result of a process that uses resources, highlighting that this value is linked to human capital or an organisation employing those resources to pursue a desired objective Chesbrough et al. (2018), and this process is value creation. Value creation consists of various activities that allow both providers and customers to achieve greater value gradually Chesbrough et al. (2018) and value creation involves organizing activities into a process (Freudenreich et al., 2020).

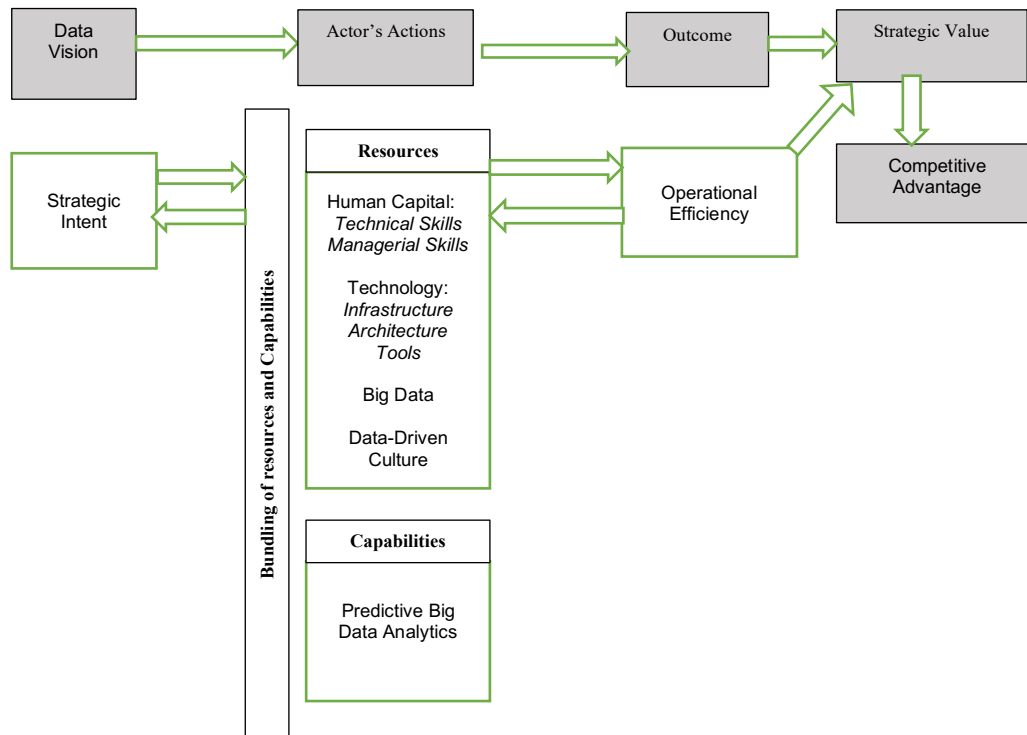
In the context of big data, value refers to the main aim of using advanced technologies on large amounts of data. This is done to uncover hidden information that can be used wisely for strategic and operational purposes. A precise definition of big data that highlights its key features, technological issues, and expected effects is big data being defined as an information asset with very high volume, speed, and variety, requiring specific technologies and analytical techniques to turn it into useful value (De Mauro et al., 2016).

2.6.1.1 Creating strategic value: resource-based theory perspective

Organisations derive strategic value from their resources and capabilities by ensuring that the integration and bundling of these assets are closely aligned with their overarching strategic objectives. This alignment is crucial for enhancing operational efficiency and securing a competitive advantage. By thoughtfully coordinating resources and capabilities, creating a data-driven culture, organisations can better position themselves to derive value from their data and big data technologies investments, Fig 3.

Figure 3:

Conceptual model for creating strategic value -Resource based theory perspective.



Source 4: Researcher's own compilation

2.6.1.1.1 Data vision

A strategic approach to implementing analytics is vital for achieving the desired outcomes from data-driven insights (Bratanu, 2018). Big data analytics capability refers to the strategic competence to harness data for deriving actionable business insights facilitated by robust data management practices, advanced technological infrastructure, and a skilled workforce. This capability positions firms to enhance their competitive advantage (Akter et al., 2016).

Developing advanced data-driven solutions entails addressing challenges like identifying analytical requirements, designing machine learning solutions, and ensuring that analytics initiatives align with business strategies. Additionally, it requires fostering new skills and mindsets across a large segment of the workforce (Bratanu, 2018).

Research has highlighted the role of strategy-led big data analytics in generating strategic (Wixom et al., 2013). Some scholars argue that applying big data in decision-making is intrinsically linked to the organisation's strategic objectives. Furthermore, Akter

et al. (2016) emphasise the potential of big data analytics to provide competitive differentiation and real-time insights. They advocate for establishing an analytics-driven culture, ensuring that strategic aims are cohesively integrated with the essential capabilities of data management, technology, and talent to attain lasting competitive advantages.

2.6.1.1.2 Actor's actions

Each actor in the data science process contributes their unique value to the process from data generation to use of data by bringing their individual skills and knowledge (van der Voort et al., 2021b).

In the organisational context, the process from data generation to data utilisation typically involves various individuals and organisations, referred to as 'actors,' each with their own knowledge, specialisations and interests thereby placing human actors and their characters at the center of data science. It therefore becomes clear that the data science process heavily depends on human intervention. Data is generated for specific purposes identified by humans, and the systems used to process the data are also designed by them. Humans interpret the data and convey those interpretations to users, who then make their own interpretations (van der Voort et al., 2021b).

“Resources allow actors to enact schemas.” (Feldman, 2004)

In his research, Feldman demonstrated that for schemas to be implemented, individuals must use specific assets and capabilities. Resources are formed and reformed through actions, meaning they cannot be understood separately from their context. When organisations undergo a change that alters actions, it also impacts the resources available to the individuals within the organisation (Feldman, 2004). Manteen et al. (2024) suggest that big data has transformed how organisations function, handle information, and make strategic decisions and it presents significant opportunities for enhancing human resource management practices (Mateen et al., 2024).

The hospitality sector is one of the highly data-driven sector that generates wealth of big data with mass and social media extensively disseminating information that influences customer preferences. This is one sector that stands to gain by investing in big data to enhance their human resource practices and analytics has become a resource for human resource strategies. Manteen, et al., (2024) established that big-data-driven human resource practices can lead to accurate and strategically sound decision-making,

leading to human resource effectiveness. Predictive analytics can be applied to the data to gain insights into identifying potential risks of turnover and forecasting trends in workforce employability in different economic sectors (Mateen, et al, 2024).

Value creation lies in the ability of organisations to bundle their resources and capabilities Van De Wetering et al. (2019) to extract insights from big data to inform decision-making, and this ability has an impact on the advanced data analytics methods that organisations apply (Wamba et al., 2017). M. Gupta and George (2016) suggest that organisations should create an Organisational-wide capability to realise value from leveraging big data analytics.

Recent research indicates that the ability to derive actionable insights from data is closely tied to a developed resource base (Côte-Real et al., 2019; Van De Wetering et al., 2019). This encompasses a robust technological infrastructure capable of storing and processing large volumes of data, along with the requisite human skills and knowledge (M. Gupta & George, 2016). Such competencies are crucial for interpreting valuable insights that inform strategic decision-making, enhancing competitiveness (Mikalef et al., 2020).

Human capital, which encompasses employees' skills and knowledge, is vital in value creation across various domains. It is the pivotal resource that converts information into actionable insights. It facilitates the interpretation of outcomes and enables data-driven decision-making (Mikalef et al., 2020).

2.6.1.1.3 Outcomes

Organisations strive for sustainable performance by effectively integrating their capabilities and resources and balancing operational and performance outcomes to achieve competitive advantage (Gupta et al., 2020b). Research shows a positive relationship between big data analytics and improved organisational performance, which can have both positive and negative effects. Quality management practices, such as just-in-time and lean manufacturing, alongside accurate data predictions, enhance market responsiveness and promote sustainable competitive advantage. Ultimately, an organisation's long-term success depends on key performance dimensions: market, financial, and operational, emphasising the need for business leaders to develop capabilities while utilising strategic resources (Gupta et al., 2020b). Akter et al. (2016)

noted that big data analytics significantly contributes to business and firm performance through informed decision-making and operational efficiencies.

Martínez-Caro et al. (2020), notes that culture is viewed as a significant source of lasting competitive advantage and is crucial for the effectiveness of an organisation. According to the competitive advantage theory, organisations must develop and leverage their resources to obtain a competitive edge, Porter (2008 as cited in Akter et al., 2020).

2.7 Conclusion to chapter 2

In conclusion, chapter 2 has provided a comprehensive examination of the role of human capital in leveraging predictive big data analytics for strategic value creation through culture, within public organisations. Through the lens of resource-based theory, the study underscores the importance of human capital as a strategic resource that can be developed and harnessed to optimise the use of advanced big data analytics technologies. It highlighted the significance of skills, knowledge, abilities, culture, and leadership in fostering an environment that supports data-driven decision-making.

Culture plays a critical role in shaping how human capital is applied and how new technologies are embraced. A culture that promotes openness and knowledge sharing facilitates the effective integration of predictive analytics. Leadership is pivotal in this process, as leaders are responsible for setting a strategic data vision, embodying a commitment to data-driven strategies, and nurturing a supportive culture that aligns with organisational goals.

The insights into predictive big data analytics reveal the necessity for organisations to invest in technology while cultivating leadership that champions and models digitalisation. Leaders are instrumental in aligning organisational objectives with the capabilities of big data analytics, ensuring that resources are efficiently exploited and that there is a cohesive effort across different departments to make informed decisions.

Overall, this chapter has highlighted the gaps in the current understanding, suggesting that future research should focus on developing frameworks and methodologies that facilitate the alignment of human capital, culture, technological resources, and leadership in public sector contexts. Such an alignment is crucial for maximising the strategic benefits derived from big data analytics, ultimately reinforcing the competitive edge and operational efficiency of public organisations in an ever increasingly data-driven world.

3 CHAPTER 3: RESEARCH QUESTION AND RESEARCH OBJECTIVES

3.1 Primary research question

The primary research question, 'How does human capital working in a public organisation leverage predictive big data analytics through data-driven culture to create strategic value?' aims to investigate the function of human capital in effectively leveraging predictive big data analytics to achieve organisational strategic value. Gupta et al. (2020b) urge researchers to investigate how the human capital within a public sector organisation can enhance or hinder the capabilities of predictive big data analytics.

This question highlights the interplay between human capital which Moliterno and Nyberg (2019) describe as individual human capital as a collection of competencies referred to as KSAOs, which includes Knowledge, Skills, Abilities, and other traits - and the strategic application of predictive big data analytics in the context of a public sector organisation.

Four specific research objectives have been established to explore this research question systematically. Each objective is designed to delve into distinct facets of the overarching question through focused sub-questions that guided data collection and analysis.

3.2 Research question 1

How is human capital (skills, knowledge, ability, and other characteristics) working in public organisations developed to leverage predictive big data analytics?

This research question seeks to identify the essential competencies that human capital resources possess within public organisations and how these competencies contribute to the effective use of predictive big data analytics capability.

Guiding questions

- a) The skills of the human capital in an organisation should include the employee proficiency in comprehending and interpreting the information from the big data, because just gathering data will not be enough unless that data is converted to

meaningful insights to inform organisational decision-making (Van De Wetering et al., 2019a) hence this sub-question aimed to identify the core skills and expertise necessary for successfully implementing predictive big data analytics capabilities in a public organisation.

- b) Organisations are focusing on cultivating the necessary skills and abilities to ensure that their staff can consistently achieve strategic outcomes for sustainable competitiveness (Shet et al., 2021b). This sub-question investigates how the organisation cultivates and develops human capital, shedding light on training and development practices employed to enhance adoption of big data analytics.
- c) It can be reasonably concluded that organisations that prioritise organisational learning tend to possess significant organisational knowledge, which can be leveraged to develop a big data analytics capability (M. Gupta & George, 2016). The researcher sought to collect instances from participants regarding the impact of employee expertise on the effectiveness of predictive big data analytics projects, highlighting the practical advantages of knowledge in this context.
- d) Organisations that incorporate big data analytics into their decision-making processes tend to achieve greater productivity and improved operational efficiency (Akhtar et al., 2019). This sub-question sought to illustrate the effectiveness of human resource management in enhancing the implementation of predictive big data analytics.

3.3 Research question 2

How does culture influence attitudes towards predictive big data analytics?

The research question intends to address the role of organisational culture in leveraging big data analytics in a public organisation for strategic value creation.

Guiding questions

- a) A data-driven culture is crucial for fostering data-based decision-making (Gupta & George, 2016), without it, managers in data-centric organisations may rely on intuition and typically use data to justify decisions already made (Shamim et al., 2019). The researcher sought to assess the overall organisational culture regarding

data-driven decision-making, aiming to gather insight into prevailing attitudes within the organisation.

- b) Resistance to change has been established as key aspect of organisational culture (van Eeden et al., 2016) and it can either promote or hinder acceptance of predictive big data analytics in organisations.
- c) This sub-question enabled the researcher to investigate how different departments view and use predictive big data analytics, highlighting variations in cultural attitudes across functional areas.
- d) The behavior of executives plays a crucial role in the adoption of data-driven decision-making. To implement advanced analytics effectively, it is essential to cultivate a data-driven culture, which is key to transforming data resources into a competitive advantage (Bratasanu, 2018).

3.4 Research question 3

What are the perceived benefits of big data capabilities specifically for strategic value creation in a public organisation?

To understand how human capital leverages big data analytics, it is important to critically examine the perceived benefits associated with developing predictive big data analytics capabilities specifically for strategic value creation.

Guiding questions

- a) This sub-question identifies specific strategic benefits the organisation has derived from utilising predictive big data analytics, establishing a direct link between analytics and organisational success. Several recent studies have documented the key benefits of incorporating predictive analytics into an organisation's business intelligence strategies (Attaran & Attaran, 2018).
- b) This sub-question assessed stakeholder perceptions regarding the impact of predictive big data analytics on strategic outcomes, capturing insights on its significance in strategic planning and execution.

- a) Participants were invited to share success stories related to strategic value creation that stemmed from predictive big data analytics, reinforcing the narrative of its importance for achieving organisational goals.

3.5 Research question 4

How can the public firm overcome obstacles to create strategic value from predictive big data analytics?

For successful adoption of big data analytics and improved operational efficiency, it is important for the study to identify the possible challenges that could inhibit public organisations from realising the benefit from investment in the predictive big data analytics technology.

Guiding questions

- a) The enormous volume of big data poses significant challenges to conventional computing systems (Fan et al., 2014). The guiding question aimed to identify the challenges faced in implementing predictive big data analytics within public sector organisations, providing context to the unique barriers affecting big data analytics implementation.
- b) The researcher established the solutions or approaches that have proven effective in overcoming the challenges identified, offering insights into best practices that other organisations can adopt.
- c) By answering guiding question the respondents would enable the researcher to explore how public sector organisations can leverage their existing resources to facilitate the adoption of predictive big data analytics, emphasising how public organisations can optimise their resources in overcoming constraints.

In conclusion, this chapter has systematically addressed the intricate relationship between human capital, data-driven culture and the strategic use of predictive big data analytics within public organisations. By formulating a targeted central research question and clearly outlined the secondary research questions, it has established a framework for evaluating the competencies of human capital that facilitate the effective implementation of predictive big data analytics.

Furthermore, exploring organisational culture's influence on attitudes towards data-driven decision-making underscores the contextual factors that shape the adoption of these technologies. By investigating the perceived benefits arising from the development of big data capabilities, this research aims to strengthen the understanding of how predictive big data analytics can drive strategic value creation.

3.2 Conclusion to chapter 3

In conclusion, Chapter 3 has critically examined the research question and objectives that underpin the study of human capital's role in leveraging predictive big data analytics through organisational culture for strategic value creation within public organisations. By articulating four specific research questions, this chapter has explained the essential competencies required for effective implementation of predictive big data analytics, the influence of organisational culture on technology adoption, and the perceived benefits and challenges associated with these initiatives. These research questions not only guide the investigation but also frame the discourse around how human capital and organisational culture interact to drive successful big data analytics practices in a public sector context.

4 RESEARCH METHODOLOGY

4.1 Introduction

In this chapter, the researcher outlines the research methodology that underpins the exploration of how human capital leverages predictive big data analytics within the Tax and Revenue Administration X to create strategic value. The researcher begins by discussing the philosophical principles that guide this study, setting a theoretical foundation for the research. Following this, the research design and approach adopted are discussed, and the direction of the investigation is critically shaped.

An essential aspect of conducting research is defining the population, unit of analysis, and sampling methods. These components are not merely procedural; they significantly impact data collection and analysis. In this chapter, the researcher delves into these elements individually, providing a comprehensive overview of the methodological choices.

Additionally, the limitations of this study, acknowledging the constraints that may affect the findings, are discussed. Ethical considerations are also paramount in research; thus, these are outlined, and the measures implemented by the researcher are detailed to ensure the integrity of the study.

4.2 Philosophical underpinnings

This study aims to explore how the human capital that works in a public organisation leverages predictive big data analytics through a data-driven culture to create strategic value for their organisation. The researcher adopted the interpretivism paradigm, allowing an in-depth understanding of the phenomenon from the point of view of the participants within their natural settings (Patnaik & Pandey, 2019). As noted by Bell et al. (2019), interpretivism focuses on gaining insights into human behaviour, particularly emphasising the mechanisms and motivations underlying social actions.

This research philosophy is suitable for this investigation as it fosters a strong relationship between the researcher and the participants, allowing the latter to share their narratives (Baxter & Jack, 2008) and also benefitting the researcher to gain an in-depth understanding of the phenomenon. This in-depth understanding of the phenomenon

from the participants' perspectives is largely influenced by their knowledge or interpretation and/or experience while interacting with the phenomenon and the extent of such interactions (Bell et al., 2019).

4.3 Research Strategy

A research strategy refers to an overall approach to conducting a study or research (Bell et al., 2019). The interpretivism paradigm adopted in this study already directs the researcher towards a specific research approach that will enable an in-depth understanding of the phenomenon (Bell et al., 2019). This research aims to understand how an individual's skills, knowledge, abilities, and other characteristics, data-driven culture contribute to creating strategic value using predictive big data analytics in a public organisation. Based on the underlying interpretivism paradigm, the paradigm To achieve the aim of the study qualitative research is found and adopted as the befitting research strategy for this research.

Qualitative research employs an interpretive and naturalistic methodology, examining phenomena within their real-life contexts. This approach aims to understand and interpret the meanings that individuals ascribe to these phenomena (Patnaik & Pandey, 2019). This study sought to investigate the interplay between predictive big data analytics, strategic value and the pivotal role of human capital (S. Gupta et al., 2020b). It was conducted within the context of a public organisation.

4.4 Research design

The research design directs the researcher on how to implement the research methodology and the analysis of the resulting data (Bell et al., 2019). The research design is about what data to collect, how to collect that data and how to analyse the resulting data collected. The research question for this study is 'How does human capital working in a public organisation leverage predictive big data analytics through data-driven culture to create strategic value'? Bell et al. (2019) emphasise that the design of research and the data collection methods should be closely aligned with the specific research questions that stem from theoretical frameworks.

This study follows an inductive approach, which is well-suited for qualitative research conducted within a cross-sectional design. Given that qualitative strategy is the primary focus of this study, the Case study design adopted in this study adopts an inductive strategy to explore the connections between theory and research effectively.

A case study design was selected to explore how human capital is exploited in harnessing predictive big data analytics. However, it was necessary to consider the broader context, including the public organisation and, more specifically, its employees (Baxter & Jack, 2008) and consider their viewpoints on the interpretation of the phenomenon under study.

Therefore, the researcher used a qualitative case study design, particularly a single case study which enables a thorough methodological exploration (Patnaik & Pandey, 2019) of the intricate relationships within the context. Additionally, predictive big data analytics is a new phenomenon, and this research seeks to study it within its natural setting (Yin, 2009).

A single case study is useful in clarifying complex theoretical concepts, human capital and predictive big data analytics within a specific context, which is the public organisation. The key reason for using this design is its relevance in examining an extreme or notable example of a phenomenon that is rare allowing for its in-depth and documentation. For instance, Galunic and Eisenhardt (1996) analysed the organisational adaptation of an exemplary firm that consistently ranked as the top-performing technology company globally for several years (Patnaik & Pandey, 2019).

4.5 Population

The population targeted in this study was individual employees within the public Tax and Revenue Administration X in Southern Africa, explicitly focusing on employees involved in data analytics and decision-making processes.

In the unique context of this low-income and least-developed Southern African country, coupled with the absence of existing research on predictive big data analytics, a single case study approach is deemed necessary and appropriate. Understanding how strategic value can be created in this resource-constraint environment can inform the development of strategies for technological innovation in similar contexts around the world and beyond the scope of private organisations.

4.6 Unit of analysis

In this study, the unit of analysis is guided by the research question, which aims to explore the role of human capital in leveraging predictive big data analytics capability

within a public organisation. This approach aligns with the recommendation that the unit of analysis should be related to how the research question is framed (Yin, 2009).

The unit of analysis was defined as individual employees whose perspectives contributed significantly to understanding the integration of human capital in leveraging big data analytics.

According to (Kumar, 2018) the researchers should clarify the unit of analysis regarding what they are investigating. The researcher's focus in this study was on individual employees' perspectives, attitudes, and insights on how they leverage predictive big data analytics capability to create strategic value for the organisation they work for. That is, the study has an organisation as the sub-unit analysis.

Yin (2018 as cited in Kumar,2018) suggests that a single case study may encompass units of analysis at multiple levels. Accordingly, the individual employees are the first level unit of analysis (Kumar, 2018).

4.7 Sampling method and size

The sampling method employed purposive and snowball sampling techniques to select participants with relevant expertise, resulting in a diverse pool of insights from various organisational levels, including senior management and technical staff.

A sampling method as informed by the research question the researcher seeks to address with the investigation (Tongco, 2007).

The researcher gained access to the Tax and Revenue Administration X employees who enhanced the theoretical understanding of how human capital leverages predictive big data analytics in creating strategic value, thereby forming the basis for the sample (Bell et al., 2019). The interview guide (Appendix I) was used to guide the interview.

The researcher adopted recommendations of Bakkalbasioglu (2020) and coupled purposive sampling with an access strategy such as an interviewee-as-a-fixer strategy to increase access. The researcher followed a generic purposive sampling, which Bell et al. (2019, p.115) describe as "... often used to gain insights into a wide range of roles within an organisation",

The researcher purposefully sampled participants involved in the data management end-to-end process from the three leadership levels—strategic, managerial, and technical — to enhance the chances of capturing diverse experiences and identifying any shared core patterns beyond a homogeneous sample (Bell et al., 2019).

4.8 Measurement instrument

The measurement instrument used was a semi-structured interview guide designed to extract rich qualitative data while maintaining flexibility to adapt to the flow of conversation. Accordingly, the study employed semi-structured in-depth interviews as the primary measurement instrument. This approach was important for exploring diverse perspectives and experiences related to the research focus.

4.9 Data collection

The researcher used her networks to compile a list of potential respondents. She contacted them telephonically to schedule interview dates and used WhatsApp to confirm or reschedule the schedules. In addition, the organisation's contact person sent an e-mail to the potential respondents informing them of the study and the interviews and inviting them to make time for the researcher when she comes. This e-mail by the organisation confirmed to all participants that the researcher had consent from the organisation.

Twenty-five individuals were invited to participate; seventeen accepted, and four proposed an online meeting on Microsoft Teams, which the researcher accepted. Three potential respondents were removed from the interview list as they indicated that they would no longer be able to attend the interview due to unforeseeable circumstances, this left the potential respondents at fourteen. The researcher provided the purpose of the study prior to the interview, and in some instances, the researcher provided definition of the concepts under investigation.

The four respondents who had proposed an online interview were not interviewed due to technological challenges, specifically, the researcher's inability to record the interviews via Teams or Zoom, an alternative format. The interviews were conducted between 10 September 2024 to 27 September 2024. Thirteen interviews were conducted and recorded via Microsoft 365 Dictate App using the researcher's phone.

While conducting the qualitative research case study, the flexibility inherent in this approach played a crucial role in the process (Gaya & Smith E E, 2016). During this interview process, the researcher alternated the sequence of questions and pursued leads where they arose to create a conversational qualitative interview and not a quantitative interview (Bell et al., 2019). As the researcher, being aware of how my presence would create bias highlighted the dynamic relationship between the researcher and the subjects involved (Nassaji, 2020).

4.10 Analysis approach

Thematic analysis refers to a technique used to recognize, examine, and interpret recurring patterns of meaning, known as ‘themes,’ within qualitative data. The researcher applied the thematic analysis approach and according to bell et al., (2019). This method does not follow any defined steps (Bell at al., 2019) but Clarke and Braun (2015) have designed a phased approach to this analysis, Table 1. The thematic analysis is flexible in that the researcher often moves back and forth between the different phases.

The researcher used thematic analysis to generate codes and themes from the qualitative data collected through interviews, codes are the smallest units that highlight key features of the data related to the research question. These codes formed the basis for categories, which are broader patterns of meaning centred around themes helping to organize and present the researcher’s insights (Clarke & Braun, 2017).

Table 2
Thematic Analysis Phases

Analysis Phase	Description of the Process
1. Familiarising oneself with the data	Transcribing data (if necessary) reading and re-reading the data noting down initial ideas
2. Generating initial codes	Coding interesting features of the data in a systematic fashion cross the entire data set, collating data relevant to each code
3. Searching for the themes	Collating codes into potential themes, gathering all data relevant to each potential theme
4. Reviewing themes	Checking if the themes work in relation to the codes extracts (level 1) and the entire dataset (level 2) , generating a thematic map of the analysis
5. Defining and naming themes	Ongoing analysis to refirn the specifics of each theme, and the overall story the analysis tells, generating clear definitions and names for each theme

Source 5: Clarke and Braun (2015)

4.10.1 Familiarising oneself with the data

The starting phase in conducting thematic analysis which the researcher followed was to transcribe in verbatim the recorded interviews. The researcher used manual technique and documented in Microsoft Word to guarantee that participants' contributions were accurately represented in verbatim, in accordance with the best practices proposed by Nassaji (2020).

This procedure included an in-depth engagement with the data through repeated readings of the transcriptions to identify preliminary ideas and insights. Additionally, the transcriptions were anonymised to uphold ethical standards by protecting the identities of the respondents.

4.10.2 Generating initial codes

In this phase, the researcher re-read the transcripts and labelled with brief descriptors that summarised the content of individual sentences or paragraphs that are relevant to the research question, what is referred to as coding. Clarke and Braun (2015) describe this process as the identification of pertinent segments and their categorisation to enable a thorough analysis. The transcription excerpts from each participant were methodologically decoded and re-encoded to extract relevant codes for each passage. Additionally, significant quotations from these passages were also selected during this phase.

4.10.3 Searching for the themes

In this phase, the researcher organised, summarised and categorised the codes and constructs themes based on the emerging common patterns from the codes. This process involved compiling all relevant data associated with each theme, allowing for a comprehensive examination of the dataset. By doing so, the researcher was able to identify patterns and overarching concepts that emerged from the data, providing deeper insights into the nuances and relationships within the information.

The researcher used qualitative data management software called Atlas.ti, which was timebound. As it was set to expire on October 25, 2024, the researcher opted for a manual analysis.

4.10.4 Reviewing themes

The researcher thoroughly reviewed the themes to confirm that they represented the richness of the data. This examination involved cross-referencing the themes with initial coded data extracts as well as the entire dataset, aligning with the methodological recommendations put forth by Clarke and Braun (2015). This led to some initially identified themes being dropped of and new ones defined.

4.10.5 Defining and naming themes

The researcher examined to enhance the particularities of each theme and construct a cohesive narrative based on the data collected. In accordance with the guidelines established by Clarke and Braun (2015), this phase involved the formulation of precise definitions and titles for each theme.

4.11 Limitations

The researcher acknowledges few limitations while conducting this study, including potential researcher bias, a small sample size, and the specificity of the case, which may affect generalisability.

The qualitative research approach offers a level of flexibility, enabling the researcher to recognize how their presence might introduce bias during data collection(Nassaji, 2020). The researcher acknowledges that sampling bias could be present due to the researcher being the ex-employee of the population being investigated and their relationship with participants could affect either the responses given by participants or the researcher's interpretation of those responses. The researcher mitigated this bias by employing a purposive sampling strategy.

Qualitative research strategies face limitations such as time and participant availability, which can hinder comprehensive data collection and analysis. To address these challenges, the researcher relied on theoretical saturation, which indicates that no new properties or dimensions emerge from the collected data. However, despite efforts to achieve saturation, the researcher acknowledges that gaps may still exist, indicating that deciding when to stop data gathering a delicate balance between thoroughness and practical constraints(Chandra Mandal, 2018).

4.12 Ethical considerations

Ethical considerations were rigorously addressed by obtaining ethical clearance from the University of Pretoria's Research Ethics Committee. This ensured informed consent, confidentiality, and voluntary participation in accordance with established ethical guidelines throughout the research process.

As this research involves human participants, the researcher applied for ethical clearance from the University of Pretoria's Research Ethics Committee before collecting data and was granted approval. The application included the research proposal, the interview guide, the informed consent form, and the data management plan. The researcher maintained the ethical principles and guidelines of the University of Pretoria such as ensuring voluntary participation, confidentiality, anonymity, and data protection. Despite the researcher gaining consent from the organisation to access and use their documents and data for this research, the researcher still had to protect participants as well as the organisation's confidentiality and anonymity (Bell and Bryman, 2007). The names of the respondents have been concealed. The researcher informed the participants of the aim and objectives of the study, the expected duration of the interview, and their right to withdraw at any time without any consequences.

The researcher upheld the privacy and confidentiality of the recordings by securely storing them and ensuring that access to the data was restricted solely to the researcher. Additionally, during the data analysis process, the researcher remained cognizant of ethical considerations and actively worked to preserve the research's objectivity.

4.13 Conclusion to chapter 4

This chapter has outlined the research methodology underpinning this study on how human capital leverages predictive big data analytics through culture within the Tax and Revenue Administration X to create strategic value. By adopting an interpretivist paradigm and qualitative research design, the study allows for a rich, in-depth understanding of the experiences and perspectives of individual employees within the organisation.

The use of purposive and snowball sampling techniques further enhances the diversity of insights collected, ensuring a comprehensive exploration of the interplay between human capital, culture, and data analytics capabilities. The thematic analysis

methodology employed facilitates the identification of recurring patterns and themes within the data, aligning with the overarching research questions and objectives.

Moreover, ethical considerations have been rigorously addressed to uphold the integrity of the research, ensuring participants' confidentiality and voluntary participation throughout the data collection process.

While the chapter acknowledges certain limitations, such as potential researcher bias and the small sample size, it reinforces the commitment to achieving theoretical saturation to provide meaningful findings. These methodological choices are essential in drawing informed conclusions about the strategic value creation potential of leveraging human capital in combination with predictive big data analytics and culture, setting the stage for the detailed analysis and findings presented in Chapters 5 and 6.

5 CHAPTER 5: RESULTS

5.1 Introduction to findings

This chapter presents the research findings derived from the data collected through semi-structured interviews, as detailed in Chapter 4 on Methodology. The data is systematically interpreted and presented in accordance with the research question and objectives outlined in the chapter.

5.2 Sample description

The researcher undertook semi-structured interviews with employees at a public organisation in Southern Africa. The interview participants comprised individuals at various levels, including Commissioners, Deputy Commissioners, Managers, and one Supervisor. All interviews were conducted in person at the respondents' offices, with two exceptions, where the interviews took place at a restaurant due to the interviewees working from home at the time. The fieldwork occurred in September, and the interviews varied, ranging from 36 to 75 minutes.

Each respondent expressed a willingness to participate in the interviews; however, scheduling required rescheduling with most due to prior commitments at the office. Upon the commencement of the interviews, all participants exhibited a commendable level of engagement and enthusiasm in their responses. Notably, of the 12 interviewees, only one was female, which may be attributed to the technological context of the research, suggesting a potential influence on gender diversity within the organisation.

The organisation under study operates within the capital city of a southern African nation and is tasked with collecting tax revenues for the national government. The leadership structure features a Commissioner General (CG), overseeing various departmental functions. Reporting directly to the CG are several Commissioners, who, in turn, supervise Deputy Commissioners. Below this tier, Managers oversee their respective teams, including Supervisors who report to them. This hierarchical framework facilitates the state's effective management of tax collection processes and revenue generation.

Table 2 below provides a list of respondents and their functional roles. The organisation and respondents' names are anonymised by the approved research methodology, associated ethical considerations, and the organisation's consent.

Table 4

Respondents List and Roles

Respondent	Role
R1	Business Solution Specialist
R2	Deputy Commissioner -Priority Client
R3	Manager Records Management
R4	Manager Data Analytics
R5	Supervisor Records Management
R6	Data Engineer -IT
R7	Deputy Commissioner -Policy Advisory
R8	Deputy Commissioner -Compliance Risk Analysis and Intelligence
R9	Project Manager
R10	Priority Account Manager
R11	Priority Account Manager
R12	Commissioner -Client Services

Source 6: Researcher's compilation

Table 7 below tabulates the themes, categories and sub-categories that resulted from the thematic analysis.

Table 5

List of Themes, Categories and Sub-Categories

Research QuestionsRQ	Theme	Categories	Sub-Categories
RQ 1	Developing knowledge, skills and abilities (KSA)	Investment in human capital-training and skills development	Creating awareness on data science
			Training in data and data analytics
			Training in the use of data tools-power BI
		Focus on the effectiveness of human resource management	knowledge distribution
			Inter-departmental collaboration
		harnessing employee knowledge	Willingness to share knowledge
	using existing knowledge		
RQ 2	Culture and predictive big data analytics	Adopting a data-driven culture	Strategic objective on data-driven organisation
			Big data-driven decision-making ranking
			entrepreneurial mindset
		Attitudes towards predictive big data analytics	barriers to acceptance of predictive big data analytics technology
			promoters of acceptance of predictive big data analytics
RQ 3	Strategic value creation through predictive big data analytics and human capital	strategic benefits from predictive big data analytics	data science solution
			data-driven reporting
			data-driven decisions
		perceived strategic value of big data and	structured training programs

		predictive analytics	
RQ 4	Navigating challenges and leveraging resources for predictive analytics	Factors that limit implementation of predictive analytics for public organisations	inadequate investment in technological infrastructure
			inadequate architectural framework
			Insufficient Big Data Storage Capacity
			Uncertainty in Leadership Direction and Ambitious Data Vision
			Cultural Resistance to Data Adoption
		Practical solutions for enhancing big data analytics capabilities	Cost-Effective Investment Tactics
			Enhancing Digital Literacy and Facilitating Trade
			Integration of Data Detection and Improved Data Movement
			Self-Service Data Querying and Diverse Data Storage
			Institutionalising Data-Driven Leadership
			Sustainability of Data Vision Across Leadership Changes

Source 7: Researcher's compilation

This research examines the role played by human capital working in a public organisation to optimise organisational performance by leveraging big data predictive analytics capabilities.

5.3 Research question

What is the role of human capital working in a public organisation in leveraging predictive big data analytics? The four research objectives addressed the research question and guided the interview.

5.4 Theme 1: Developing Knowledge, Skills, and Ability (KSA)

Research Question 1: Understand how human capital (skills, knowledge, ability, and other characteristics) working in a public organisation is developed towards leveraging predictive big data analytics.

Theme 1 discusses the results from respondents' opinions and experiences on how public organisations develop human capital to leverage predictive big data analytics in a public organisation.

5.4.1 Investment in human capital - Training and skills development

Human capital combines individual knowledge, skills, ability to perform tasks and other characteristics that create value for the organisation. In responding to the skills that respondents thought would be contribute to leveraging predictive big data analytics, one respondent highlighted the data management competency without necessarily specifying the skill:

“I would say people who are able to appreciate and handle data, people who can analyse such data and maybe draw insights from it.”(R10)

Most respondents mentioned skills in Mathematics , Statistics, Data Analytics and IT, “I think we need skills related to Statistics...or data analytics. (R3) More respondents shared their opinion:

“We need data scientist, data analysts, we definitely need IT professionals in their different specialities, and we need Domain experts.”(R6)

Most respondents reported that the ability to use Power BI, SQL and Python would be necessary abilities to leverage predictive big data analytics, “We got other skills like Python, we have Power BI skills (R9) and:

I would say SQL skill is the one such skill required to enable interaction with data, the usage of data or let me say, extraction , transformation and coding tools also known as ETL tools or data transformation tools. (R6)

Some of the respondents also expressed the importance of having diverse skills for data analytics capability and central to that being the domain experts:

“I think different skills can work together there to complement big data....IT can help you with analytical tools, but the level of analytics still needs background of business.”(R11)

And Respondent 8 also expressed that :

You have to have somebody who understands IT, you also have to have somebody who has the business domain knowledge...and for analysis, you can have a combination of somebody who has done statistics and mathematics, those skills that will help you to navigate around data science. (R8)

About two respondents mentioned strategic thinking and project management as useful competencies:

“I think if you are talking about skills, we are talking about strategy, you need to have strategic thinking...We also got Project Management, we have Dev Ops; Dev Ops is one of the skills that can help us today.”(R9)

The other respondent “I also think about management or strategists...”(R6)

One respondent who is a Commissioner mentioned that the concept of data science was new in the organisation, “The field is data science and that field because it is pretty much very new concept to the corporates even to the public service where they are making use of it”. (R8) , so they started by creating awareness of the subject. “So, for us...the way we went about it, firstly, it was to create the awareness around the subject of data science”. (R8)

The other Commissioner also presented his perspective regarding the importance of understanding data and big data:

...instead of understanding the science behind data analytics or big data, we jumped into, say, what are the tools...we tried that, and it frustrated us because everyone was saying, you should understand Power BI, learn Power BI, but we didn't understand, why am I learning Power BI? What for? (R2)

The organisation designed a structured data and data analytics training program mandatory for all employees; "...what we did was to develop a capacity development framework for data science and data analytics." (R8)

One respondent working in the Centre of Excellence shared his experience that:

"There was also a Power BI course for the entire staff, WCO data analytics awareness kind of training for the entire staff as well as those self-driven courses that were online (R1) "

Respondent 3 described his observation of how the training was structured, "the people who do not work directly with data were given the basics only...the ones working with data were given intermediate". (R3)

Respondent 8 supported Respondent 3's observation by quantifying the training: "I think about 80 per cent of the entire organisation actually went to some basic training on Data Analytics". He further indicated that the same number was also trained to use basic Microsoft Excel to understand these tools.

The organisation's commitment extended to creating a supportive environment for those employees who desired to advance their knowledge in data analytics through certification.

We also have certification programme which is financed by the organisation where people who want to be certified in the area of data analytics or any area whether descriptive...are given a chance to get certified and that is paid for by the organisation (R4)

Respondent 4 who further reported that the organisation granted those employees under the certification program time off to pursue their study requirements: "...is going to write soon and is given Mondays and Fridays off".(R4)

5.4.2 Focus on the effectiveness of human resource management

Most respondents see the Department of Human Resource (HR) as playing a critical role in terms of prioritising data-related training, as one Respondent 6 explained:

HR has been very key in that they have now dedicated a program; capacitation program that is called data practitioners program and that data practitioners' program is so prioritised that I have realised no other training activities are on top of that one.(R6)

This respondent commended the HR Department in that they are fully engaged in capacitating the human capital to “making sure that we get value out of data”.(R6)

The organisation introduced a new stream within its organisation called the Centre of Excellence assigned to implement predictive big data analytic initiatives. New roles like the Chief Data Officer and Data Practitioners that had not been in existence before were created to manage the new data-driven vision:

“Actually, I also think that the fact that there is a [department] that is dedicated to data is already an initiative that is trying to leverage the issue of analytics.”(R6)

One other respondent who shared the similar perspective mentioned that :

...let's look at the structure of the organisation, does it support this dream that we have that we want to be a data-led organisation, then we realised that we are not, we do not have the right structure. What we did was to have a new business function that we call Business Drivers. In the Business Drivers, we have [people] who are responsible for data analytics, we have people who are responsible for data quality. That function is headed by Chief Data Officer.(R8)

The other respondent shared that this Business drivers function is actually called the Centre of Excellence :

“The Centre of Excellence is a department on its own but they do not work alone. We have designated a governance model; to say how we govern data because quality is important when you make decisions based on data.”(R12)

Two Commissioners had a perspective that the HR department focused only on the data analytics team while other departments were lagging. He also emphasised the importance of reviewing job profiles:

“Even with just drawing up job profiles...But I think the majority of operations, the job profiles they would want to have that as a requisite skill.”(R7)

In as much as the job done by HR Department in capacity building is commendable by most respondents, the issue of job-profile design seemed to be common as one other respondent shared his experience that:

“It is just not a matter of capacity-building, it’s also about designing the job profiles themselves so that they know to hire for the right purpose.”(R12)

Respondent 2 labelled HR department as being “overwhelmed”. He described HR’s role as larger than what it currently does:

I don’t think they have had time to actually think about their role specifically, to step up and say, we want our human resource to be ready by 2025, to be prepared to swim into the big dam of big data. (R2)

Additionally, Respondent 12 seemed concerned about the HR department's ability to design job profiles that will enable them to hire the right people for a data-driven organisation. He believed that the HR department is still traditional and not transformational enough to identify the competencies that would be necessary to drive a data-driven culture:

I don’t think our Human Capital Department understands that because you then should be able to help the rest of the organisation by hiring, to make assessment of skills we have and closing gaps by hiring from outside and so your method of hiring has to be different. (R12)

Talent management is important for organisations that aspire to be data-driven and the role of HR departments in that regard is key:

“We need to firm up on our succession and talent management so that it will force us to have this structured training development. “(R2)

Respondent 12 also shared his opinion on the importance of talent management:

“In terms of talent management, what kind of new competencies and skills do we have to build.” (R12)

Respondents were concerned about the traditional HR department that should be transformational to support the organisation in becoming a data-driven organisation, “They need to be transformational themselves. The first step is to help them to be the transformations champions.” (R12)

Respondent 4 emphasised the importance of knowledge distribution within the organisation:

“We have a program or a course...where we basically deal with data literacy, where we have sessions at our training centre where we teach people about data and data analytics.” (R4)

Through the collaboration of departments and coordination by HR, the Training Academy is used to facilitate knowledge transfer.

“We do also have in our academy, an instructor in analytics, there is another Data Analyst who is hired in the...academy who will be dealing with in-house trainings.”(R4)

5.4.3 Harnessing employee knowledge

Knowledge is the core of human capital, it refers to . Employees also use prior knowledge from their previous roles to implement the data-driven initiatives. Respondent 10 illustrated his understanding:

“Currently, people in the M&E are from Research. They have been working with data previously, so they were able to transfer such skills into the M&E space and therefore are able to provide insights.”(R10)

Three respondents alluded to the benefit of employee capacitation in basic data analytics:

As a data engineer, previously, we would find ourselves having to deal with requests or even issues that are from technical side and all the way up to the consumer level, but now we tend to focus on on the area of making pipelines,

which is more like to feed data into the people who are going to use it to do presentations , being data analysis.(R6)

The other respondent shared that :

“...instead of always relying on IT to extract reports and dashboards, people in different areas are now able to request data that they need to perform analysis themselves.” (R4)

The last respondent also commented that :

Instead of always relying on IT to extract reports and dashboards, people in different areas are now able to request data that they need to perform analysis themselves,so it's true that we are not at the level of predictive data analysis yet but I think we are just at the level of analysing data that we have.(R1)

The benefit of knowledge in big data analytics should be improved efficiency as one of respondents indicated that:

“I do not have an example but... based on the data that we had already gathered, we use data to say, you see we have different categories of clients.”(R5)

Only one respondent felt that:

“knowledge is limited. That is why I said there is an office that has been established with the knowledge that they already have maybe from school.”(R3)

Data Engineers have been offloaded and now focus on creating a pipeline “which is more like just feeding the data into the people who are going to use it...” (R6) also shared his experience that the organisation has invested by paying for licenses.

The organisation created awareness to amongst others, instill a sense of the importance of collecting quality data, as one respondent said:

So if they are aware, they know why it is important for us to be capturing this information, some other guy somewhere in another function will be using the same data to run certain data analytics models to solve certain business

problems and to make sure the integrity of the data when it sits in our database is in an a manner that we want. (R8)

Infrastructure plays a crucial role in organisations seeking to leverage technology. Some respondents shared their concerns about the infrastructure capability to handle big data, and the storage issue.

For us to even say we are ready for big data, it also implies that we need the infrastructure to be able to process big data and we may not have that now. I don't think that our infrastructure is capable of processing big data now. (R6)

To add to this sentiment, Respondent 4 explained, "In terms of big data, we are still dealing with our architecture, so we can't say much about big data ..."

5.5 Theme 2: Culture and predictive big data analytics

Research Question 2: Explore how organisational culture influences attitudes towards predictive big data analytics.

Theme 2 presents the results per their opinions on how organisational culture influences attitudes towards predictive big data analytics.

5.5.1 Adopting a data-driven culture

The organisational strategy has a pillar on 'Data-Driven Organisation'; Respondent 1 acknowledges this but is uncertain on whether the organisation is there yet:

The strategy, for instance, includes four pillars to implement our current strategy. One of them being to be a data-driven organisation so this is trying to work towards a culture of being data-driven and then making the efforts I have already mentioned, but I am not sure if the culture is there yet. (R1)

The organisation has a clear data vision, embedded in its strategies, where data is at the centre of what the organisation aspires to achieve. This respondent shared that they use the data from the clients to build the systems.

We have already begun collecting a lot of data even from our clients by way of surveys so that when we build our systems, we have the right data. The data

from our clients is what will inform how we curate the systems based on how they consume the systems. We are constantly looking for data to help us improve even our services such as the tax clearance forms. (R1)

In addition to gathering data from the clients, the organisation has considered integrating its systems with certain institutions for the purposes of information sharing to reduce the burden of document issuance on their clients. At the same time, they can get them from these other institutions.

For example, with Home Affairs, because they are the ones who provide identity documents, we want to integrate our systems so that we have access to identity data to avoid having to require that people produce their identity cards when they come for our services. (R1)

On the other hand, Respondent 4 observes that there is a slight change towards a data-driven culture within the organisation:

...we can see that even our strategy is now based on key results, meaning everyone has to now report in terms of numbers and using data to report, meaning in most cases, you now see departments requesting access to data, they now want to report for their key result areas. (R4)

Regarding organisational culture and data-driven decision-making, on a scale of 4, the World Customs Organisation (WCO) ranked the organisation at level 2, going to 3 “ in terms of how we use data to make decisions” (R2). He agrees with Respondent 4 that the organisation has “...adopted OKR System. The key results are clear and can be quantifiable.”

One Commissioner expressed his opinion that the current leadership does not seem to be in support of this data-driven decision-making:

“But with the current leadership you don’t see that much. I think it is going back to saying, yes, we want to do that but, in the meantime, let’s see where we can collect.”(R7)

Adopting an entrepreneurial mindset is essential for public organisations to make certain business decisions, as illustrated by Respondent 2:

We lacked business acumen, so that we grow, we have to think like a business, like entrepreneurs. Businessmen know what affects the bottom line, they cannot afford to miss the target, and they cannot afford to be corrupt, so you need to say, the mindset of this is a business. (R2)

In terms of making data-driven decisions, this is what Respondent 2 had to say:

So, we said, let's focus on the things that matter. As we did that, we started to talk figures now, how do we meet targets. So, when the assessment was done, even when we were not being deliberate before, all the things you are doing, you are already focusing on data things, so now you have to be deliberate. Build that culture. (R2)

One respondent from the Project Management Department believed that the organisation is data-driven, "...it is not driven by anything else." (R9). She described that the organisation had adopted a system thinking using the vehicle analogy which has different all-important parts to make the vehicle functional.

Creating awareness around any change, or any being introduced is a starting point. The Deputy Commissioner explained that awareness sessions on data and data analytics were convened with all staff, including personal assistants (PAs). "We started with awareness, in that awareness each and every single employee..." was included. (R8)

A sense of uncertainty was expressed by Respondent 6 who said despite him being aware of visualizing data in reporting, what he is not certain of is whether the reports are used in decision-making:

What I am not privy to is that are they really influencing decision-making process because I am not sure whether whatever decisions that are being taken, I don't know their linkage to maybe an insight that was made from our data. (R6)

5.5.2 Attitudes towards predictive big data analytics

The researcher wanted respondents' perspectives on the cultural factors that either promote or hinder the acceptance of predictive big data analytics within their organisation.

5.5.2.1 Barriers to acceptance of predictive big data analytics

5.5.2.1.1 Age structure of the workforce

The ageing workforce has an attitude towards technology. It is unwilling to accept any cultural change, and this, coupled with generational attitudes towards technology, creates constraints in the acceptance of technology.

I'd say maybe the ageing of the organisation; I'd say that. We are tilted towards older people than younger people in the organisation so the level of appreciation of data is, it's hard for people to conceive and understand the importance of data in decision-making. (R10)

This view was also raised by one of the Commissioners who shared that:

I think a lot of people who work here are old. Technology is very fast-paced and requires people who think differently... Majority of our workforce is made up of people who have worked here for a long time and are used to doing things in a certain way. Unlearning that is difficult. (R12)

"So when it comes to big data, there is still that thinking that data is for certain people" (R3), and the resistance to traditional practices also hinders the acceptance of any technology:

"People are used to what they have been doing for many years and that kind of becomes an obstacle for adoption and cultural change."(R1)

One Deputy Commissioner shared a similar view:

You can imagine all those old ladies and gentlemen who were here as Customs Departments and Income Tax Departments, 30 years down the line, they are still doing this, and you come with these brilliant young IT guys teaching them how to press a computer when they used to carry a file. (R2)

Emphasis on the workforce generational challenges and perception around their willingness to adapt to the technology seemed to be amongst almost all of the respondents, " most of our staff were born before technology and they do not really like new things especially the technological things."(R11)

5.5.2.1.2 Resistance to change

It is Human nature for people, especially when disengaged, to resist change, whether positive or not, and their attitude is sometimes driven by incentives that could come with the change initiative. This is according to Respondent 9:

There are disgruntled people who will always be questioning in the corridors like, why are we learning these things; why do we have to read; why do we have to go to all these trainings, especially those that are in-house. You know that most people like external training because they carry a financial benefit. (R9)

For change to be appreciated, proper planning and a more stable environment are necessary; when it happens along with other competing priorities, people get overwhelmed and could develop a resistant attitude towards that change. Furthermore, the systems and processes are also impacted by competing priorities and therefore compromising the resulting data quality. Here's how this was described by another respondent:

We move too fast, and we do a lot of different things at the same time and as a consequence, we realise that while we are ahead on other things, others suffer, that's when we then said, let's identify projects and prioritise them chronologically based on where we want to go. (R5)

This view is supported by Respondent 2: "But the pace was too high because we were doing lots and lots of changes, so people are still not healed from the pressure of the marathon." (R2)

Still emphasising the importance of impact of lack of planning on the systems, one respondent explained that "We would find our systems required a lot of hard work for integration because data was not good quality data...". (R5)

One of the Deputy Commissioners expressed that the organisation is hesitant in making data-driven decisions because of too much reliance on historical data, fear of unknown outcomes, and difficulties in making accurate projections, leading to outdated strategies and a lack of confidence in predicting future tax changes impact:

We are not able to do that so that is why we are so hesitant because the question is always that what if we get less revenue? Because you have got to be able to say if you do this, this is going to be the impact. We have to be making medium and short-term projections reasonably accurate, but we are not able to do that because we are still struggling with the now. I think the fear of the unknown even just doing prediction. (R7)

5.5.2.1.3 data quality

Being a data-driven organisation requires accurate and credible data. Respondent 4 perceives data quality could present doubt about the insights derived from that data and, therefore could be a barrier to the acceptance of the data-driven culture, “it’s hard to work with data which is not of good integrity.” (R4)

Lack of data literacy could be a barrier to acceptance, as has been expressed by a few respondents, “I was talking about literacy levels or knowledge.” (R6). He went further to emphasise the importance of effective change management, “...which I think is a showstopper in a lot of things that are cultural.” (R6)

One of the respondents raised a concern about the ineffective and blanket approach to data and data analytics training that did not consider individual needs or roles, leading to employee resistance and dissatisfaction:

So, I think the approach was the reason that the adoption was not good because we never gave ourselves some time to categorise them on the only courses that they need based on what their line of work is. I think that created a bit of resistance. (R6)

This observation, however, differs from what other respondents reported regarding the training approach. They mentioned that the data and data analytics training program was structured and categorised into primary, intermediary, and certification, “The people who do not work directly with data were given the basics only...the ones working with data were given intermediate.” (R3)

5.5.2.1.4 Inadequate investment in infrastructure

One respondent shared his view that the inadequacy and misalignment of infrastructure needed to support big data initiatives, such as data warehouses, especially when

considering cost-effective equipment options pose a challenge in supporting the data-driven culture:

So, I think, perhaps maybe even when we look at our approach towards even the equipment itself because you need infrastructure to be able to that. The question will be, if now you are saying bring your own device, it is partly subsidized. The question is, are you going to be able to put into place infrastructure that requires big data. So, the message is, it's probably because we are following that because we might not be that much prepared for the necessary infrastructure because we need big data warehouses. So, if you are looking at cheaper options for infrastructure, are you going to be able to do that? I am not sure if there is alignment. (R7)

The respondent doubts whether the organisation's infrastructure has the capacity for big data. The difference in the data appreciation between the core and the support staff was rather surprising as observed by one respondent who had been tracking performance of the organisation in terms of using Power BI:

Surprisingly, even in areas where data is dealt with, not all people appreciated it...the support was the one ahead because offices like R&D and IT were the ones ahead but the core like audit were behind but they are the ones who deal with client data, they are the frontline of our operation.

This respondent made an interesting observation that these core departments have the younger generation staff, yet they are the ones showing less appreciation for the big data analytics technology being introduced, "The core business has almost new people, I think they are the ones with younger people more than any office." (R11)

5.5.2.2 Promoters of acceptance of predictive big data analytics

Raising awareness around the type of data and cultivating a mindset shift toward recognising the value of data in achieving organisational goals and improving performance is key in supporting the data-driven culture as noted by this respondent:

It was awareness. If you look at our strategy before 'Lesokoana' (relay), we had 'Rea aha' (We are building) so in the 'rea aha' one of the pillars in the strategy we said, when we assessed our environment, we lacked business acumen so

then we were going to grow that so that we think like business, like entrepreneurs.
(R2)

Respondent 2 further emphasised the importance of automating processes and adopting systems like OKR to quantify results and track performance which he was of the view that this practice fosters a data-driven mindset within the organisation:

“As it is, we want to measure what matters. We have this model, the OKR system. The key results are clear and can be quantified.” (R2)

Collective responsibility for data quality was also found to influence the acceptance of predictive big data analytics, “now everyone is using data to see how dirty it is, so everyone is coming on board to clean data.” (R4)

5.5.2.2.1 Leadership commitment to data-driven culture

Using big data enables managers to decide based on evidence rather than intuition. Organisations enhance their data management capabilities by prioritising budgets for data initiatives, “they prioritise their budgets for initiatives that are related to that mandate”. (R3). This is the view that was also shared by Respondent 4, “and like I said, they even have approved the stand-alone budget for capacitating staff on issues of predictive data analytics and big data.” (R4)

In addition, allocating resources such as dedicated staff for data governance:

“After the establishment of the Center of Excellence, it was realised that there was a shortage of resources for gathering data and information, so they resourced that office with temporary staff.” (R3)

Leadership has empowered senior management in data-driven decision-making “I am aware that even the enforcement that every senior manager in their own area have to be the one reporting their issues not relying on anyone” (R6) by fostering accountability through data interaction:

“Whatever interests they may have wanting to interact with the data, they should be able to because the expectation is that everyone should be accountable for their areas in terms of reporting.” (R6)

The organisation has adopted KPI-driven performance management to measure the performance of the strategy:

“Even the corporate plan itself is now measured by KPIs, and that’s a clear indication that now the management is no longer interested in people talking; they want to see numbers.” (R4)

In support of this perspective is Respondent 2 says, “as it is, we want to measure what matters. We have this model that we adopted, the OKR system. The key results are clear and can be quantified.” (R3)

In addition, the strategic plan has a strategic objective, “become a data-driven organisation” (R4), related to digitalisation and data analytics.

Integrating data analytics and digitalisation as a specific strategic objective within the corporate strategy, which is continuously measured, to be exact, every week to monitor performance, marks a commitment to driving the culture. “The regular monitoring and measurement of progress underscore a commitment to data-driven initiatives.” (R4)

As a sign of leadership commitment, the organisation has also defined empathy as one of the corporate values, “One of our values is empathy”, and they live this by creating an empathetic environment; leadership supports individuals in their journey towards adopting data-driven practices:

We have fortnightly feedback sessions. These are not meant to determine where we are in terms of performance but to understand the human being and where they are. They give people an opportunity to open up and seek support. So, we listen to people so that they are ready for the journey. (R2)

One of the respondents expressed uncertainty about the emphasis individual leaders place on predictive data analytics across business areas. He noted that discussions around predictive big data analytics primarily occur informally and are initiated by the Chief Data Officer in his section:

I am not sure, in terms of individual leaders in terms of all business areas, I think in terms of those who are in IT and the business drivers, the conversations that we have are at an informal level regarding the predictive data analysis. (R1)

The organisation has entrusted HR department with the responsibility of initiating and facilitating training programs to ensure that employees acquire necessary skills and certifications in data analytics:

Perhaps because we have that office which is led by HR for data practitioners so they anticipate that HR is taking initiatives to make sure that people are taking courses and certified in data courses. So maybe they entrusted HR to ensure that people are given relevant training. (R10)

One respondent emphasised the importance of Executive Committee (EXCO) support and efforts to promote acceptance and integration of analytics within the organisation when change initiatives face mixed attitudes.

There is always the positive and negative attitude so there are those who bring the personal elements to it, sometimes it exposes other people that they are not working in their own so they'll fight it, but there are those who'll accommodate, but another thing is the issue of change because some people still don't absorb this issue of using data, so, but generally I think the model that we have done now, I think some tried to fight it but at least until now we have a lot of support from the EXCO so it is up and running. (R4)

Adopting technology requires a continuous learning culture. One Commissioner raised a concern that there is limitation in the leadership in terms of interrogating the data. He emphasised the need for leadership to be part of the data literacy learning programs:

It requires leaders who think differently because they can drive this change in their departments by asking the right questions and that is where the big concern is because most of the time when [we] ask people to train in data literacy courses, the leadership does not take time to learn. (R12)

As a result of this concern, more leaders are not able to interrogate data and therefore their ability to use the data to make data-based decisions becomes limited:

“Very few leaders at Tax and Revenue Administration are like me and able to interrogate the data, make sense out of it and use it to make decisions.” (R12)

One of the Managers echoed the same view:

“If our leadership could maybe be taken to a course in data literacy. Appreciation of data in decision-making of some sort.” (R10)

5.6 Theme 3: Strategic value creation through predictive big data analytics and human capital

Research Question 3: Examine the perceived benefits of developing big data and predictive analytics capabilities specifically for strategic value creation.

The researcher sought to gather in-depth insights from respondents regarding the perceived benefits derived from effectively leveraging human capital within the public organisation. This approach aims to clarify the advantages experienced by the organisation through the strategic exploitation of its human capital in the context of predictive big data analytics.

5.6.1 Benefits and perceived strategic value of leveraging predictive big data analytics

The standard process that seemed to have benefitted from the establishment of the Data Analytics Function is the refund process:

“We have tools that have been developed currently for data matching, on the processing, of the returns, filing, at the borders trying to match the import VAT and VAT declarations.”(R10)

Mandated by the legal framework, the organisation found processing business refund applications after thirty days to be detrimental to business growth, “the law says we will refund you after ninety days which is three months.” (R8). To address this, they explored ways to accelerate the refund process while remaining compliant with legal requirements, hence the development of the refund solution.

Then we looked at how can we be able to actually balance out this need for business to make sure that it is not a constraint by our own laws and processes. Then we thought that maybe we can actually build a data science product that will help to do the analysis, the verification quite quickly and will have that ability

not to even wait for the three months to lapse so that we can process and pay but do it when it comes . So now we have such solution, we are able to refund. It is still at the development stage but it has been deployed, it is working. We are able to refund people as quickly as possible, we don't have to take the three months. (R8)

This respondent shared that using the tools developed by their teams improved the reconciliation of collected import VAT against the corresponding returns for refunding, and this has enhanced efficiency in the refund process, "it takes less time to process refunds currently as was the case initially." (R10)

Respondent 4 agrees that there has been improved efficiency in processing refunds, which likely adds strategic value by reducing potential revenue losses. This improvement addresses the concern that "we might be financing some businesses through refunds without proper verification:"

Initially we couldn't verify them because didn't have time, we have to just refund so the risk was that we might be financing some businesses, so now at least we know when we refund a certain client it's because that particular client will deserve the refund, so we've started realising that benefit. (R4)

Most respondents expressed an observable benefit of data-driven reporting that uses tools like Power BI. This could not have been possible if the employees had not been empowered through training in Power BI and basic data analysis. The shift towards data visualization reporting from traditional reporting has brought significant benefits to data, data analysis, and the use of analytical tools.

I believe since I have heard that the reports that management use to EXCO, there is an emphasis on them being based on what the data says and also that everyone has been capacitated with Power BI and so the expectation is that, instead of writing those long reports, they now expect to see the use of data analysis. (R1)

Respondent 2 supported this view, "our reporting has improved a lot, and we are starting to measure what matters." (R2)

In addition, Respondent 1 highlighted that using data in executive committee forums is a step towards improved data-driven decisions:

Since EXCO proceedings are now based on analysed data, “I would say it enhances decision making. Just based on that we already are at the point where we have data enhancing our decision making.” (R1)

One respondent was unsure whether any decisions were taken based on the data or insights from the data, “this one is kind of tricky because it goes back to what decisions were based on the insights.” (R6). The other one, Respondent 7 was not aware of any benefit or success, “I don’t think I do, but colleagues in compliance might have something”. (R9)

A transformative shift in mindset towards data tools like PowerBI must be balanced so organisations can derive strategic value from adopting big data and predictive big data analytics. The organisation is known for its reputation for efficiency and strategic excellence.

“Another thing is that our organisation is taken as the number one in terms of efficiency and maybe strategy as well.” (R3)

The perceived efficiency has increased confidence from both regional and national entities and recognition as a leading example in records management practices:

...so that kind of things make other people trust us; so, the records management, if I can make an example, some people came from Botswana specifically knowing that in Country X there is a Revenue Services that is responsible for successful record management solution, so they came to learn from us. Even the ones from DCEO came and said they have heard that we have good systems so that makes other people to consider us as the best.

Most respondents acknowledge that the organisation is in the early stages of adopting predictive analytics, but what is already happening is the growing appreciation of data science solutions. There is observable appreciation of the importance of predictive analytics in in client interaction.

When you look at the chat-bots that we use, which are not built in-house, there’s basically a predictive analysis where our systems will chat with clients and

questions they might ask so I think they do appreciate a lot and even now they want to improve it. (R4)

5.7 Theme 4: Navigating challenges and leveraging resources for predictive analytics

Research Question 4: Explore how a public organisation can overcome obstacles to create strategic value from predictive big data analytics

Under this theme, the researcher is interested in exploring the obstacles faced by non-high-tech public organisations in implementing predictive big data analytics, practical strategies for overcoming these challenges, and how existing resources can be used to facilitate successful adoption and create strategic value.

5.7.1 Factors that limit the implementation of predictive analytics in public organisations

This category explicitly addresses the obstacles and difficulties public organisations encounter when implementing predictive big data analytics. It sets the stage for understanding the unique context and factors influencing their strategic value creation.

5.7.1.1 Inadequate investment in technological infrastructure

Respondents are of the view that an organisation has to display willingness to invest in data-enhancing technology to harness the benefits of big data and predictive analytics, so one of the barriers that was reported by Respondent 1 was “the other one would be an investment in technologies that help us leverage on the use of data.” (R1)

In addition, the same respondent highlighted the challenge of insufficient access to advanced data tools:

There was something I picked up having interacted with some Eswatini Revenue Services employees who came here under WCO initiative where Eswatini being an IT connectivity champions in SACU. Some of their employees come here for capacitation of RSL staff. I picked up that their use of PowerBI is much more advanced than ours in the sense that even the kind of licences that they have, they are much more advanced, they have more licences for the power BI tools. (R1)

Public organisations are often funded by government and any capital budget is requested from the government. One of the reported challenges facing public organisation is that the government does not have funds to implement data-driven infrastructure:

“Unless it is funded by things such as World Bank. From the past, government does not find anything to upgrade infrastructure.” (R6)

The characteristics of big data include the volume and the veracity of data and these require adequate storage that is supported by the national legal and regulatory frameworks. The respondents feel that one of the significant challenges the organisation faces is the legislative constraints on data storage that restrict cloud utilisation:

“Yes, these are some of the challenges. We do have all this big data that we’re going to use but the question is that of storage because we know legislation does not allow us to store it on cloud.” (R5)

Respondent 4 also emphasises that insufficient data storage capacity shall limit the organisation from leveraging big data:

“Even if we want to have big data from maybe social media, there’s no storage where we can store such particular information because the issue is still our infrastructure.” (R4)

Respondent 7 shares his concerns around infrastructure and storage capacity:

So, I think, perhaps maybe even when we look at our approach towards even the equipment itself because you need infrastructure to be able to do that. The question will be, if now you are saying bring your own device, it is partly subsidized. The question is, are you going to be able to put into place infrastructure that requires big data. (R7)

He is of the view that there is likely a misalignment between the data vision and what is on happening the ground:

We might not be that much prepared for the necessary infrastructure because we need big data warehouses. So, if you are looking at cheaper options for infrastructure, are you going to be able to do that. I am not sure if there is alignment. (R7)

5.7.1.2 Inadequate architectural framework

One respondent highlighted that the architecture is not fit for purpose in a data-driven organisations. This is seen through the lack of sandboxes where designed models could be tested before going live. With the current infrastructure, system best practices do not allow predictive analysis to be conducted in a live environment:

The biggest challenge was our architecture. Our architecture was not coherent to what we want to achieve so I think that was the biggest challenge. For instance, we don't have sandboxes. Sandbox is where our data analytics can go test their works, test their models, and test all those things we don't have in our infrastructure. We still have live systems so best practice does not allow that the predictive analysis to work in that environment where you're working directly with live systems. (R4)

5.7.1.3 Uncertainty in leadership direction on the big data vision

Public organisations confront the challenge of ambiguity in leadership priorities during transitional periods, which creates uncertainty regarding strategic focus on data analytics:

“Our challenges are leadership priorities, it always depends on the coming CG, if the current CG prioritises digitalisation of data analytics, so the coming CG might have different strategy all together.” (R3)

The uncertainty is further compounded by pressures to achieve ambitious data deliverables, often resulting in a misalignment between organisational aspirations and the practical realities of data utilisation:

“We have challenges maybe of being too ambitious. The organisation being ambitious in delivering maybe more than what we can and also ensuring that what has been delivered as a data product actually works.” (R8)

5.7.1.4 Cultural resistance to big data analytics

Cultural resistance and perceptions surrounding data and data analytics are some of the challenges facing public organisations when implementing predictive big data analytics. One key issue is the perception that data initiatives are primarily the domain of the IT department. Employees, such as tax collectors and customs officers, often feel disconnected from these "data things," resulting in a reluctance to engage with analytics efforts. As one respondent noted:

“Despite the efforts that may still exist in the back of people’s minds, they may at times resist undertaking the efforts, reflecting a deep-rooted cultural inclination towards established practices.” (R1)

Additionally, the ageing workforce exacerbates this challenge. The organisation has a higher proportion of older employees, which can hinder the collective appreciation of the importance of data in decision-making. As articulated by a respondent, "it's hard for people to conceive and understand the importance of data in decision making" (R10), indicating a generational gap in the understanding of data analytics and its relevance to their roles. This is compounded by a persistent attachment to traditional methods, making it difficult to shift mindsets towards adopting big data and data analytics technology.

One respondent highlighted that "public enterprises or public sector environments tend to have most people who don't move about a lot", suggesting that this stagnation contributes to difficulties in fostering a data-driven culture.

5.7.2 Practical solutions for enhancing big data analytics capabilities

5.7.2.1 Cost-effective investment tactics

I think it is for people working directly in the data analytics space to resort to strategies that focus more on using OPEX rather than CAPEX because usually where money is involved, people are usually concerned with big amounts but if you look into strategies that have to do with subscribing and paying little amounts here and there instead of big amounts so that could be one of the strategies that is resorted to. (R1)

The respondent feels that to overcome inadequate investment in technological infrastructure, public organisations should shift focus from capital expenditure (CAPEX) to operational expenditure (OPEX). He suggests that public organisations can alleviate concerns associated with significant financial commitments by prioritising subscription-based models that require smaller, incremental payments.

Technology is only meaningful if used by those it is intended for. Enhancing the digital literacy levels of taxpayers is one tactic that public organisations must focus on. By implementing client-focused initiatives, organisations can train users to adopt digital channels more effectively than traditional methods:

“Let’s get to this one of the literacy levels of our taxpayers, we have client dedication through their initiatives, they can also be able to train people to practice to use our digital channels more than the traditional ones.” (R6)

“Additionally, promoting regional trade requires negotiating bilateral agreements that facilitate system integration with trade partners for seamless exchange of information. Remember that the issue of the integration of systems of your partners, partners being SARS”. (R6)

Furthermore, “this thing of bilateral agreements with our trade partners that will enable integration of systems will be very key.” (R6)

The respondents believe that while investment in technological infrastructure is a key challenge, public organisations could focus on cost-effective investment in data analytics tools and enhancing digital literacy and regional trade facilitation. This would aim to optimise the use of technological resources while overcoming obstacles to create strategic value.

5.7.2.2 Strengthening data architecture for predictive analytics

The respondents suggest that the inadequate architectural framework could be strengthened by integrating data detection processes, implementing self-service data querying, and establishing robust storage capabilities for diverse big data types.

5.7.2.2.1 Integration of Data Detection and Improved Data Movement

What we are doing now, we are working on the data detection. We are bringing data detection in our general enterprise architecture. We are dealing with movement of data now so we want to build that detection which will allow the streaming where we can have information moving from our systems to a certain storage and then be cleaned, all those things that are data management processes will be done there and then we can have the platform where our data science and analytics can do their models and those things and test and then implement. (R4)

Respondent 4, a Manager in Data Analytics, explained that their primary focus lies in the integration of data detection within the overarching enterprise architecture. They are currently in the process of developing a streamlined methodology that promotes the efficient transfer of information into specified storage systems, thereby optimising the overall movement of data. He contends that this innovative solution has the potential to address the existing limitations posed by an inadequate architectural framework. Through this approach, a more cohesive and functional data environment may emerge, enabling enhanced decision-making and operational efficacy within the organisation.

5.7.2.2.2 Self-Service data querying and diverse data storage

The Manager Data Analytics also proposes that an alternative and effective approach in addressing the architecture limitation is the introduction of a self-service data querying portal:

“So, we want to have a portal where people will just query the data for themselves, a codeless, where you’ll just drag and drop get what they want and do their jobs for different departments.” (R4)

By introducing the self-service portal, the data analytics team can then focus fully on the predictive analysis.

Have a big storage where they can store both structured and unstructured data as you know the information from social media is not structured and also the volumes are huge so now we have that place such as data league to store such data and information so that we start with some predictive analysis. (R4)

Additionally, developing significant storage capabilities to handle both structured and unstructured data—like information sourced from social media—will improve the organisation's ability to perform predictive analysis.

By implementing a thorough architectural framework that offers various data storage solutions and self-service options, the organisation can effectively overcome existing challenges and maximise the potential of predictive analytics.

5.7.2.3 Institutionalising big data-driven leadership

Public organisations can address the limitation of uncertainty in leadership direction and an ambitious data vision by promoting a commitment to data analytics within leadership roles and the organisation's culture. This approach aims to ensure ongoing support and prioritisation of predictive big data initiatives, no matter who is in charge.

5.7.2.3.1 Prioritising data as a core function

To address the uncertainty in leadership direction regarding data initiatives, it is crucial for public organisations to acknowledge the global landscape is increasingly focused on data, and solidify its commitment to data as a core function:

“ So, the world is now focusing on data, so if our organisation or the board can fix the fact that we are moving and data has become the core.” (R3)

Ensuring this priority is communicated to incoming leaders through their job descriptions will encourage them to take predictive big data seriously and align their strategies accordingly, thereby reducing ambiguity around leadership direction:

That can make the coming CG to take the predictive big data seriously. We know that the world is moving so I think if it is written in their job description so that whoever comes continues with that then it will help. (R3)

5.7.2.3.2 Sustainability of data vision across leadership changes

Another effective approach to reduce uncertainty in leadership direction is to embed the vision for predictive big data throughout leadership transitions. By clearly documenting

the role of predictive analytics in leadership, the organisation can maintain a consistent approach to its data vision, “whoever comes continues with that then it will help”. (R3) When new leaders take over, highlighting these responsibilities will encourage them to focus on and advocate for continuing data initiatives. This strategy helps build a strong organisational culture aligned with data-driven practices and sets clear expectations for future leaders about the value of predictive big data.

5.8 Conclusion to Chapter 5

In conclusion, Chapter 5 has explored the important findings from the interviews conducted with public organisation employees. The insights gathered highlight the crucial role that both human capital and technology play in adopting predictive big data analytics. Respondents emphasised that investing in training and fostering a data-driven culture is just as vital as improving technological infrastructure.

However, challenges such as cultural resistance and insufficient resources were also common themes, pointing to the complex landscape of implementing these analytics in a public sector environment. Despite these obstacles, the potential benefits of enhanced decision-making and service delivery are clear.

6 CHAPTER 6: FINDINGS AND DISCUSSION

6.1 Introduction

This chapter discusses the research findings outlined in Chapter 5, comparing them with the established literature presented in Chapter 2.

6.1.1 Research question discussions

The main research question aimed to explore how human capital uses predictive big data analytics to generate strategic value through data-driven culture within a public sector organisation. This question emphasises the role of human capital in the strategic use of predictive big data analytics and a data-driven culture in the context of a public sector organisation.

Each of the four research sub-questions were designed to delve into distinct aspects of the main research question through focused sub-questions that were used as a guide during the data collection and further helped in the data analysis.

6.2 Theme 1: Developing Knowledge, Skills and Abilities (KSA)

6.2.1 Investment in human capital _Training and skills development

Skills relate to a person's level of proficiency and their capabilities, whereas ability refers to an enduring capacity—often cognitive—that is required to carry out a particular task. Workforce skills are viewed as hidden assets; they are not immediately obvious and develop through learning and practice (Bag et al., 2021). Two respondents conceded that the concept of data science was novel in the context of public and private organisations. They reported that as an organisation, they created awareness of the concept of data science specifically big data analytics to instill knowledge among employees (Huynh et al., 2023b). This initiative was supported by the WCO.

For organisations to successfully develop data analytics strategies, Akhtar et al. (2019) suggest that skilled professionals, such as data scientists, developers, and analysts, are important. Additionally, Sun et al. (2018) highlight that the core elements of big data analytics include mathematics, statistics, engineering, user interface design, computer science, and information technology. Most respondents considered data analytics, information, and technology (IT) skills, mathematics, and statistics as the required skills

for an organisation to implement big data analytics. They further on suggested that skills in strategic thinking and project management are also critical effective data analytics capability. Respondents reported that diverse set of skills was necessary for an organisation to harness the value from predictive big data analytics. Consistent with this perspective is Akhtar et al. (2019) who expressed that analysing big data requires expertise from a variety of fields, including operations management, computing, mathematics, and statistics allowing for better insights that lead to improved operational efficiency. In support of this view is Bag et al. (2021) who recommend that these core skills be supported by key competencies and machine learning techniques.

Almost all respondents reported that the organisation designed a structured capacity development program that included data analytics awareness and use of tools such as Microsoft Excel and Power BI. This program was which was mandatory for all employees. Few respondents felt that the program was not structured adequately in line with specific department's needs. As a result, there was some observed level of resistance from other departments which felt that the training in data analytics was not relevant for them. This finding contradicts the recommendation that organisations should design effective and contextual training programs (Shet, et al., 2021) to improve performance.

This capacitation program was offered at the organisation training academy. The organisation also benefitted from the World Customs Organisation comprehensive Capacity Building Framework that guides Members towards the adoption and optimisation of the use of data analytics and the effective implementation of successful analytics initiatives (WCO Capacity Building Framework on Data Analytics Executive Summary, n.d.).

Despite about 80 percent of employees being capacitated in basic data analytics and reporting using Power BI as reported by almost all respondents, some respondents though aware that executive were not convinced that the top management decisions were data driven.

One respondent highlighted the support that the organisation extends for employees who desire to advance their knowledge through certification in data analytics. The organisation funds studies for such employees and afford them time-off for preparation of exams and/or exams. This perspective is consistent with what Shet et al. (2021) suggests regarding appreciation of leaders in the lasting advantages of investing in

human capital, as their backing is crucial for creating a supportive atmosphere for change.

6.2.2 Focus on the effectiveness of human resource management

Almost all respondents except for a few commended the work done by the Human Resource Department in prioritising capacitation of its human capital in data analytics and allocating financial resources towards this big data initiative. This approach is a concept of resourcing which refers to how management allocates and uses resources to achieve their strategic outcomes (Feldman, 2004). Within the context of resourcing, talent management is therefore one of the crucial elements to effectively manage change in a data-driven business environment (Bratanu, 2018). The human aspect in human capital makes this resource a 'super-class' resource that requires distinct management approaches (Nyberg et al., 2014). A common perspective among the respondents was that the human resource department is still traditional and lacks the capability to apply big data analytics to improve their practices including job-profiling, talent management and recruitment and this could lead to limited support of achieving the data-driven objective.

In the context of public organisations, big data refers to the voluminous information that is often collected by government agencies through online activities (Guenduez et al., 2020). Big data has transformed how organisations function, handle information, and make strategic decisions and it presents significant opportunities for enhancing human resource management practices (Manteen et al., 2024). Organisations can benefit from data-driven human resource practices. By applying predictive analytics can be applied to the data (Manteen et al., 2024) human resource departments can make accurate and strategically sound decisions leading to human resource effectiveness and therefore help in integrating big data analytics capability in the business operations. Shet et al. (2021) have established that organisations generally do not invest much in support functions such as human resources.

In the context of resource-based theory resources serve as the foundational assets of an organisation (Ameen et al., 2024) and the core of resource-based theory is the ability of an organisation to integrate resources with analytical capabilities and strategic decision-making (Akter et al., 2020). Most respondents revealed that the organisation had established a new department within the organisation that is responsible for data science specifically predictive big data analytics and data quality assurance. This is in

line with the recommendation that organisation leaders should concentrate on reorganising resources to build essential capabilities that are vital in the current business environment for maintaining a sustainable competitive edge (Bag et al., 2021).

Some respondents shared that the organisation through its training academy has hired a data analyst specifically to offer training on data analytics to continuously upskill employees and on-board new employees. This finding echoes the perspective of Shet et al. (2021) who caution that data analytics is a specialised discipline that demands different technologies and therefore this necessitates employees to engage in ongoing training on the latest tools, techniques, methods, and technologies.

6.2.3 Harnessing employee knowledge

Nyberg et al. (2014) argue that skills and ability are based on knowledge. Elsharnouby and Elbanna (2021) suggest that knowledge in an organisation is concentrated in human capital and Mention and Bontis (2013) define human capital as the personal competencies of employees, encompassing their skills, knowledge, expertise, and abilities. Knowledge is a key strategic resource for organisations and the main aim of any organisation is to turn that knowledge into results (Shamim et al.,2020).

Respondents were asked to share their perceived success stories of how the individual knowledge in the organisation impacted predictive big data analytics capability. Most respondents , specifically those working with data analytics uttered that they experienced reduced workload as more employees now had the ability to perform basic data manipulation following the training in basic data analytic.

Conclusion: Discussion of Research Question 1

Based on research question 1, the researcher sought to identify the essential competencies that human capital should poses for leveraging big data analytics. The discussions reveal that there is theoretical support of the essential diverse skills including data science, IT, statistics, strategic thinking, and project management are essential for human capital to leverage big data analytics. Secondly, the data analytics capacitation program that was developed was a double-edged sword in that it enhanced the knowledge of big data analytics but also created resistance amongst some employees because it was not adequately tailored for different departments which is in line with the literature.

Last but not least, the support functions such as human resource was not capacitated to harness the predictive big data analytics in the implementation of the human resources practices to integrate the data-driven approach in the organisation. The discussion adds to the literature on the extent to which human resource roles are developed to support big data-driven strategies.

6.3 Theme 2: Culture and predictive big data analytics

How does organisational culture influences attitudes towards predictive big data analytics? The research question intended to address the role of organisational culture in leveraging big data analytics in a public organisation for strategic value creation.

6.3.1 Adopting a data-driven culture

The organisation has adopted a data-driven data vision. Most respondents mentioned that the organisation had embedded within its strategy a data-driven culture under strategic objective “Become a data-driven organisation” (R4). For organisations to achieve the desired outcomes from data-driven insights, Bratasanu (2018) suggested a strategic approach to implementing analytics. Despite the organisation integrating data-based approach in their strategy, most respondents did not feel like the organisation had reached the stage where decisions were made based on the data- presented through data-based reporting. One of the respondents also indicated that in so far as data-driven decision-making is concerned, the World Customs Organisation rated at level 2 going to 3 as an organisation that uses data to make decision.

6.3.2 Attitudes towards predictive big data analytics

Organisational culture as defined by (Martínez-Caro et al., 2020b). encompasses individual’s mindsets which directly impact their behaviour, and this is influences and describes the element of ‘other characteristics’ in human capital.

6.3.2.1 Barriers to acceptance of predictive big data analytics technology

6.3.2.1.1 Age Structure of the workforce

The aging workforce has an attitude towards using big data analytics technology to create business value. It is unwilling to accept any cultural change, and this, coupled with generational attitudes towards technology, creates constraints in the acceptance of technology. Most respondents reported that the ageing workforce has attitude towards

adoption of big data analytics technology. Tsertsidis et al. (2019) highlight that the attitude among seniors in organisations is at times caused by the anxiety about using new technology; lack the tech skills that younger generations possess, leading to a fear of trying unfamiliar tools. Contrary to the view of Tsertsidis et al. (2019), one respondent mentioned that the senior employees often uttered that they did not find the training relevant for them as they were nearing their retirement age.

One respondent suggested that the organisation would benefit from big data analytics capability by hiring younger generations who they assumed are tech-savvy, one respondent shared that having been monitoring the adoption of the big data analytics technology within the organisation, acceptance of the technology was more in the support departments as opposed to core department. They however remarked that this was not expected as the core departments were populated with more younger employees. This insight is contrary to what Meyer (2011) argue that the younger employees tend to be more at ease with using information and communication technology while older employees bring valuable experience and a deeper understanding of the organisation's internal structures and operational procedures.

6.3.2.1.2 Resistance to change

Resistance to change is recognised as a crucial element of organisational culture (Van Eeden et al., 2016) and it can either facilitate or obstruct the adoption of predictive big data analytics within organisations.

Most respondents shared that there was observable resistance to the acceptance of big data and data analytics among employees from the core departments and the long-serving employees. This insight is consistent with Shahbaz et al. (2020) who define resistance to change as the actions of an employee who is unwilling to embrace current or upcoming change and posit that this resistance often stems from a desire to maintain the status quo. Additionally, Van Eeden et al. (2016) argument that changes that modify the core values and visions of the current system tend to provoke greater resistance as they get threatened if they feel that they are being removed from their comfort zone. One respondent shared their perspective that the resistance to the big data analytics initiatives was the implementation approach that encompassed all employees without paying attention on their specific jobs-needs for the data analytics.

One of the deputy commissioners raised the concern that there were a lot of changes happening and for change to be appreciated, proper planning and a more stable environment are necessary; when it happens along with other competing priorities, people get overwhelmed and are likely to develop a resistant attitude towards that change. Oreg (2006 as cited in van Eeden et al. 2016) highlight that an individual's tendency to resist change is influenced by their self-esteem, need for achievement, and sense of control over their surroundings.

6.3.2.2 Promoters of acceptance of predictive big data analytics

6.3.2.2.1 Leadership commitment to data-driven culture

Respondents explained that the leadership showed commitment towards data analytics initiatives by prioritising financial resources for capacity building; creating a dedicated department on data analytics and resourcing it with temporary data analysts but they were not convinced if these commitment translated into the desired data-driven decision-making culture. As substantiated by El-Haddadeh et al. (2021) the engagement of top management in initiatives like big data analytics is crucial for establishing an organisational data-driven culture that values predictive big data analytics.

One respondent indicated that the organisation has adopted and embodies a corporate value of empathy which is aimed at creating an environment that supports individuals in their journey towards data-driven practices. The top-management holds sessions every two weeks with their teams to establish their mental state during the transition. In their work, Kouzes and Posner (2002 as cited in Meng,2014) highlighted that leaders play a critical role in conveying the core values and culture of an organisation to their teams. They argued that leadership not only affects the organisational culture but is also pivotal in creating and sustaining that culture at a consistent level.

Conclusion: Discussion of Research Question 2

Based on Research Question 2, the researcher has established how organisational culture shapes attitudes towards predictive big data analytics in public organisations. Despite a leadership commitment to a data-driven vision, progress is hindered by generational resistance and a comfort with the status quo among senior employees and this resistance is often deepened by competing priorities and a lack of comprehensive leadership support for fostering a data-driven culture. Leadership commitment is limited to resource allocation but does not extend to communicating the benefit of big data

analytics amongst teams. Although top management has allocated resources and created dedicated analytics departments, there are few formal discussions around predictive analytics. Encouraging a culture that merges experience with technological adaptation and provides incentives for change could facilitate wider acceptance of big data analytics and enhance strategic value creation.

6.4 Theme 3: Strategic value creation through predictive big data analytics and human capital

To understand how human capital leverages big data analytics, it is important to critically examine the perceived benefits associated with developing predictive big data analytics capabilities specifically for strategic value creation.

6.4.1 Benefits and perceived strategic value of leveraging predictive big data analytics

All respondents acknowledged that the organisation was still at the initial maturity stages of implementing big data analytics. As alluded to by one of the respondents, with regards to the data-based decision-making maturity of the organisation, this organisation was ranked at level 2. According to the WCO, level 2 refers to a stage where data is used only to a slight extent and not in a strategic manner, with insights being restricted to a small group of individuals, which limits the overall understanding across the organisation (WCO Capacity Building Framework On Data Analytics Executive Summary, n.d.).

6.4.1.1 Enhanced operational efficiency _Refund processing

The organisation's internal processes should not be regarded as obstacles to business success but rather as mechanisms that promote operational efficiency and align with strategic objectives. Most respondents mentioned that the newly developed data-science tool of refund processing as an observable benefit from the predictive big data analytics capability. They reported that this tool has reduced the time taken to process a tax refund. This insight is consistent with Bassier et al. (2022) who posit that in the context of a public sector, tax and revenue administrations have adopted digitalisation by using technology for various tax-related functions (Bassegy et al., 2022) to improve strategic benefits.

Respondents indicated that according to the legislation, a tax refund is processed within 90 days, but as the administration, they would find themselves refunding some

businesses, especially those that were on perpetual refund without thorough assessment and this led to possible revenue leakage. This benefit is consistent with some researchers' argument that for a tax authority that relies significantly on its ecosystem, achieving the needed operational efficiency requires more than just technology (Kochanova et al., 2020) and, in the end, realising the strategic advantages of big data.

Reporting

Furthermore, a perspective that was common among respondents was the improvement in the reporting resulting from using Power BI. They also mentioned that the organisation was not focused on reporting on outcomes under the outcome and key results (OKR) model. Developing big data analytics skills enables organisations to attain a distinctive edge that is challenging to replicate, as it promotes a culture focused on decision-making rooted in evidence (Yasmin et al., 2020).

6.4.1.2 Confidence in the organisation brand

The organisation has realised perceived increased confidence from the stakeholders. This is according to one respondent who mentioned that there was perceived trust in the organisation from external stakeholders including the ministers. These stakeholders perceived this organisation as exemplary in strategic excellence and operational efficiency. This respondent highlighted that both domestic and regional institutions have recognized this organisation as a model in records management for bench-marking.

Conclusion: Discussion of Research Question 3

Research Question 3 sought to examine the perceived benefits associated with developing predictive big data analytics capabilities within a public organisation. The researcher has established that the organisation is still at the initial stages of maturity with implementation of big data analytics. Nevertheless, the researcher has established that the organisation is slowly starting to benefit from the knowledge within the data analytics departments which has developed the refund processing tool and thereby improving the process efficiency of refunds. The perceived strategic benefit is reduced revenue leakage. One other benefit has been with the organisation reporting framework which harnessed the Power BI tool. These benefits and improvements in operational efficiency have been perceived by the public as indication of an efficient organisation thereby increasing stakeholder confidence and strengthening the organisation's brand

image. These advancements underscore the essential role of human capital in effectively leveraging big data analytics for continuous improvement and strategic advantage.

6.5 Theme 4: Navigating challenges of implementing predictive big data analytics

For successful adoption of big data analytics and strategic value, it is important for the researcher to identify the possible challenges that could inhibit public organisations from realising the benefit from investment in the predictive big data analytics technology. It is equally important to understand the practical solutions that could be implemented to mitigate these challenges.

6.5.1 Factors that limit the implementation of predictive analytics in public organisations

6.5.1.1 Inadequate investment in technological infrastructure

While other research has focused on technology investment in technology, this study has established that government funded organisations have a financial limitation when it comes to investing in technological infrastructure. One respondent reported that because the organisation is funded from the government budget, this impacts on the extent that the organisation can invest in technological infrastructure. Shet et al. (2021) suggest that as organisations delve deeper into big data analytics, it is necessary that they pay attention to technical underpinnings necessary for successful big data analytics by investing in robust information and technology infrastructure. The well-designed information and technology setup and a skilled analytics team are integral to effective data capture and digitalisation (Shet et al., 2021a).

In their reporting, two respondents doubted the readiness of the organisation in investing in the technological infrastructure and referred to how the organisation implemented the bring your own device policy which the organisation partly subsidises. The respondent saw this approach as a form of misalignment between the data vision and what is practically happening in terms of investment in technology.

Respondents expressed different perspectives on the challenges of data storage. One respondent raised concerns about inadequate data storage capabilities to accommodate vast amount of data generated from multiple sources. Another respondent highlighted regulatory concerns, noting that even if data storage was available, the current legal and

regulatory framework does not permit cloud storage, thereby posing significant compliance issues.

6.5.1.2 Inadequate architectural framework

One respondent indicated that the existing architecture of the organisation is not adequate to support a data-driven organisation. They indicated that the lack of sandboxes-controlled testing environments where designed models can be evaluated prior implementation is the indication of an inadequate architecture.

6.5.1.3 Uncertainty in leadership direction on the big data vision

Change in leadership of organisations has an adverse impact on sustainability of big data-driven culture. One respondent revealed the data-driven vision misalignment issue between the incoming commissioner general and their predecessor. This finding aligns with the insights of Kouzes and Posner (2002 as cited in Meng, 2014) who highlighted that leaders play a critical role in communicating core values and culture of an organisation to their teams. This underscores the importance of ensuring that leadership transition is managed in a way that preserves and promotes data-driven culture.

6.5.1.4 Cultural resistance to big data analytics

Literature asserts that human capital is a strategic resource that can be nurtured through effective recruitment management Shamim et al. (2020). In the public organisation context this relationship is complex. Two respondents noted that the organisation's adherence to the public service code of conduct complicates efforts to recruit the data-savvy employees aligned to the culture and this creates challenges of changes in hiring practices. This complexity poses a challenge of navigating political obligations inherent in public service. As a result, the difficulty in adapting hiring practices to attract individuals with necessary analytical skills further hinders the organisation's ability to embrace big data analytics thereby impacting the capacity of human capital to leverage predictive big data analytics effectively. This is further exacerbated by the inadequate capability of the human resource department in terms of using predictive big data analytics.

6.5.2 Practical solutions for enhancing big data analytics capabilities

6.5.2.1 Cost-Effective Investment Tactics

One respondent identified practical approach for public organisations to address the challenges of inadequate investment in technological infrastructure by suggesting a mindset shift from capital expenditure to operational expenditure. They proposed that prioritising subscription-based models, organisations can apprehensions often associated with upfront payments. Embracing this cost-effective investment tactic not only provides a more manageable financial pathway but also encourages a more agile adoption of innovative solutions, fostering a culture of continuous improvement in data-driven capabilities.

Another respondent suggested development of a substantial storage capabilities designed to accommodate both structured and unstructured data, including voluminous data from various platforms. This facility would enhance the organisation's capacity to conduct predictive data analytics thereby improving decision-making and operational efficiency.

6.5.2.2 Strengthening data architecture for predictive analytics

The respondent revealed that a robust architectural framework is essential to enhance the organisation's data management capabilities. One key insight from Respondent 4 highlighted that they were implementing a multifaceted approach to remedying the limitations of the current architecture. They emphasised the integration of data detection processes into the overarching enterprise architecture which involves establishing streamlined methodology for the efficient movement of data into designated storage systems. This initiative is intended to create a more effective environment for data management where data can be cleaned and processed before being used by data science and analytics teams for modelling and testing.

Furthermore, the introduction of self-service data querying portal emerged as a practical approach. By enabling users to access and query data independently through codeless interface, the organisation can empower different departments to fulfil their data needs without delays. This approach allows data analytics teams to concentrate more on predictive analysis.

6.5.2.3 Institutionalising big data-driven leadership

One respondent highlighted the importance of instilling a commitment to big data analytics within leadership roles, suggesting that this approach would ensure continuous and sustainable support for predictive big data analytics irrespective of change in leadership. The respondent articulated that it is fundamental for public organisations to also align with the global trends toward data-centric operations stating that "...the world is now focusing on data". (R3). This observation highlights the necessity of public organisations to set their commitment to data as a core function of their operations.

To further this commitment, the respondent recommended that the importance of big data initiatives be explicitly communicated in the job descriptions of incoming leaders noting that this practice would urge anyone taking that role to take predictive data analytics and data initiatives seriously and align their data vision accordingly.

Conclusion: Discussion of Research Question 4

Research Question 4 examined the challenges public organisations face in leveraging predictive big data analytics. The discussions on this question have brought attention to the key challenges include insufficient investment in technological infrastructure due to budget constraints, inadequate data architecture for effective analytics, and uncertainty in leadership that disrupts the establishment of a data-driven culture. Additionally, cultural resistance and adherence to public service codes complicate the recruitment of skilled analytics professionals. To address these issues, solutions such as adopting subscription-based funding models, enhancing data architecture, and institutionalizing a commitment to data-driven leadership are crucial for if public organisations seek to enjoy the benefits of big data analytics and achieving strategic value.

6.6 Conclusions to Chapter 6

Chapter 6 has addressed the intricate relationship between human capital, predictive big data analytics, and organisational culture within the public sector. Each research question sought to explain specific aspects of this relationship, revealing that the development of relevant skills is paramount for maximising the benefits of data analytics in strategic decision-making.

In research question 1 in identifying the essential competencies that human capital should poses for leveraging big data analytics, the discussions identified diverse skills including data science, IT, statistics, strategic thinking, and project management, and this is consistent with the literature. Secondly, the data analytics capacitation program that was developed was also aligned to existing literature. The gap in literature was established on the extent to which human resource roles are developed to support big data-driven strategies.

In Research Question 2 on establishing how organisational culture shapes attitudes towards predictive big data analytics in public organisations. The discussions established that generational resistance and a comfort with the status quo among senior employees was consistent with literature. Leadership commitment as highlighted in the discussion is aligned with best practices. However, limitation has been found on the uncertainty in pursuing data vision during leadership transitions.

In Research Question 3, when examining the perceived benefits associated with developing predictive big data analytics capabilities within a public organisation, the discussion revealed that the operational efficiencies observed align with the literature. The organisation's perceived reputation for strategic excellence underpins the value.

In Research Question 4 that examined the challenges public organisations face in leveraging predictive big data analytics. Investment in technological infrastructure remained a recurring issue. Strategic investment in cost-effective technologies and subscription based models could provide a viable solution for public organisation. Ensuring leadership continuity regarding big data analytics priorities through embedding these objectives in leadership roles is consistent with the literature.

7 CHAPTER 7: CONCLUSION

7.1 Introduction

This chapter provides the conclusions of the key findings of the research on the role of human capital in leveraging predictive big data analytics for strategic value creation through organisational culture within a public sector organisation. It revisits the fundamental conclusions drawn from the study while providing insights into the theoretical contributions, practical implications, and recommendations for future research.

7.2 Principal theoretical findings

The research underpinned the importance of integrating human capital theory with resource-based theory and culture in effectively explaining how to leverage predictive big data analytics.

Furthermore, the study revealed that a supportive organisational culture plays a critical role in fostering a data-driven mindset, which is essential for the successful adoption of predictive big data analytics. An organisational culture supportive of data-driven practices is indicative of a more successful implementation and acceptance of predictive big data analytics initiatives. The study has highlighted how leadership commitment can significantly influence attitudes towards big data analytics acceptance.

Lastly, the study has identified the importance of capacitating the human resource roles within public organisations in the field of data science and predictive big data analytics to influence the human resource practices to align and respond to the data-driven environment.

7.3 Research contribution

In terms of research contributions, this study contributes to the existing literature by providing a nuanced understanding of how human capital and organisational culture interact to influence the effective use of predictive big data analytics in public sector organisations. Specifically, it:

- a) fills a gap in understanding the role of KSAOs within the context of big data analytics in a public organisation, thus enriching human capital theory.
- b) illustrates how a data-driven culture can enhance organisational performance, providing empirical evidence that supports the broader strategic management discourse predictive big data adoption.
- c) highlights the unique challenges public sector organisations face when integrating advanced big data analytics within traditional structures, thereby adding a layer of contextual awareness to the existing knowledge base.

7.4 Recommendations for management and/or other stakeholders

Considering these findings, the chapter presents the following tailored recommendations for management and relevant stakeholders:

7.4.1 Tailor made data analytics capacitation programmes

Public organisations need to design comprehensive big data analytics training programs that foster both technical and managerial skills among employees. These training programs focused on enhancing data literacy and analytical skills across all employee levels to maximize the potential benefits of predictive analytics effectively. Organisations need to design an effective and contextual training programs, Shet et al. (2021) note that while it may be easier to learn the analytics techniques understanding its practical implementation can be challenging, hence on-the-job training and hands-on experience provision to the human resource personnel, other decision-makers Shet et al. (2021) and the rest of employees is recommended. Additionally, the program should specifically address the varied needs of different departments within public organisations. This approach will minimise the undesired attitude toward big data analytics by ensuring that all employees feel supported and equipped to embrace data analytics. Furthermore, this approach will integrate a data-driven culture that encourages data literacy and collaborative problem-solving and knowledge sharing.

7.4.2 Enhance data-driven culture.

Culture is influenced by the other attitudes in human capital, it is therefore vital that organisations become aware of this and improve their recruitment systems to identify competencies that will adapt to the big data-driven culture within the organisations, in

that way, the human capital will be capable of leveraging predictive big data analytics. Human capital, which encompasses employees' skills and knowledge, is vital in value creation across various domains. It is the pivotal resource that converts information into actionable insights. It facilitates the interpretation of outcomes and enables data-driven decision-making (Mikalef et al., 2020).

It is therefore recommended that organisations could foster a culture that encourages and supports data-driven decision-making by creating a big-data knowledgeable human capital. The human capital should be encouraged, and an environment be created to enhance knowledge-sharing among individuals and collaboration between departments and involving employees in the development and implementation of big data analytics initiatives.

7.4.3 Institute a culture of data-driven leadership

El-Haddadeh et al. (2021) emphasise that the engagement of top management in initiatives like big data analytics is crucial for establishing an organisational data-driven culture that values predictive big data analytics. Public organisations are governed within the public service code of conduct and therefore influencing the appointment of the public organisation's leadership. It is therefore recommended that organisations should consider embedding big data-driven expectations in leadership roles to ensure continuous and sustainable big-data culture regardless of changes in the leadership. This could be done through specifying big-data analytics role in the performance contracts and the job profiles of the chief accounting officers in the public organisations. When leaders prioritise data-driven initiatives, they create a fertile ground for new ideas and methodologies to succeed.

7.4.4 Optimise technological infrastructure

Public organisations are recommended to invest big data storage infrastructure as this capability can ensure that organisations leverage data-driven insights to optimise business processes and drive strategic initiatives (S. Gupta et al., 2020b). Public organisations must seek to invest in adequate technological resources, including data architecture and storage solutions, to support the processing and predictive big data analytics. To move beyond traditional methods of data storage and analysis, it is vital for governments to adopt new technologies such as Hadoop or NoSQL and establish advanced frameworks for decision-making (Moorthy et al., 2015).

7.5 Suggestions for future research

While the study provides valuable insights, it acknowledges certain limitations including its focus on a single public organisation, which may not fully encapsulate the broader dynamics at play in diverse organisational contexts, thereby restricting the generalizability of its findings to broader contexts. Additionally, the potential biases inherent in respondents' perspectives and the researcher through application of the qualitative research approach cannot be ignored.

To address these limitations, future research should investigate the role of human capital in big data analytics across various sectors and geographical regions, examining both the challenges and best practices that emerge in different contexts to offer a more comprehensive understanding of how public organisations can leverage predictive big data analytics for effective operational efficiency and improved service delivery.

Future research could explore:

- a) Long term effects: the long-term effects of human capital investment in leveraging predictive big data analytics capabilities across various public sector departments and measuring the impact on strategic value creation over time. Such studies could make use of longitudinal designs.
- b) Impact of organisational change: Examining how transformations in leadership and culture affect the implementation and success of predictive analytics initiatives as organisations evolve in response to technological advancements.
- c) Qualitative studies on resistance: Delving deeper into employee attitudes and resistance to change regarding data-driven initiatives to design better training and change management strategies that accommodate diverse workforce demographics.
- d) Examine the implementation strategies that yield the most significant impact and assess how structured training and development contribute to enhanced organisational performance.

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APPENDIX 1 Consistency matrix

Title: Role of human capital in leveraging predictive big data analytics to create strategic value through culture

Research question	Literature review	Data collection tool	Data analysis
RQ 1: How is human capital (skills, knowledge, ability, and other characteristics) working in public organisations developed to leverage predictive big data analytics?	Van De Wetering et al., 2019a; Shet et al., 2021b; M. Gupta & George, 2016; Akhtar et al., 2019	Interviews- Interview guide	Thematic analysis to identify the essential competencies that human capital resources possess within public organisations
RQ 2: How does the culture influence the attitudes toward big data analytics?	Gupta & George, 2016 van Eeden et al., 2016 Bratasanu, 2018	Interviews- Interview guide	Thematic analysis to address the role of organisational culture in leveraging big data analytics
RQ 3: What are the perceived benefits of big data capabilities specifically for strategic value creation in a public organisation?	Attaran & Attaran, 2018	Interviews- Interview guide	Thematic analysis to examine the perceived benefits associated with developing predictive big data analytics capabilities
RQ 4: How can the public firm overcome obstacles to create strategic value from predictive big data analytics?	Fan et al., 2014 ; Attaran & Attaran, 2018)	Interviews- Interview guide	Thematic analysis to identify the possible challenges that could inhibit public organisations from realising the benefit from investment in the predictive big data analytics technology

APPENDIX 2: GIBS Ethical clearance form

APPENDIX 3: Copyright declaration form

(Uploaded separately in the provided folder)

Appendix 5: Certification of additional support

(Uploaded separately in the provided folder)

Appendix 6: Interview guide

Introducing statement	Thank you for agreeing to talk to me today. I have put together an interview guide to provide some structure to our conversation and ensure that relevant topics are covered, but feel free to take the conversation wherever it naturally leads. This is a flexible interview that allows for an open and engaging discussion between us.
Brief explanation of the process	The interview is intended to last for not more than 45 minutes. I would like to formally request your consent to audio-record our conversation for transcription purposes. Your input into this matter would be greatly appreciated.
Research questions	Guiding Questions
Explore how human capital (skills, knowledge, expertise, and capabilities) in public firms is used in leveraging predictive big data analytics	1. What core skills and expertise in your organisation contribute to implementing predictive big data analytics?
	2. How does your organisation cultivate and develop human capital to enhance its predictive big data analytics capabilities?
	3. Can you give examples of how employee knowledge has directly impacted the success of predictive big data analytics initiatives?
	4. In your experience, how do human resources support the integration of predictive big data analytics in decision-making processes?
Explore how organizational culture influences attitudes towards predictive big data analytics	1. How would you describe your organisation's culture regarding data-driven decision-making?
	2. What cultural factors promote or hinder the acceptance of predictive big data analytics within your organisation?
	3. How do different departments within your organisation view and utilize predictive big data analytics?
	4. In what ways does leadership emphasize the importance of predictive big data analytics in shaping organisational culture?
Examine the perceived benefits of the development of predictive big data analytics capabilities specifically for strategic value creation	1. What specific strategic benefits has your organisation experienced from utilising predictive big data analytics?

Introducing statement	Thank you for agreeing to talk to me today. I have put together an interview guide to provide some structure to our conversation and ensure that relevant topics are covered, but feel free to take the conversation wherever it naturally leads. This is a flexible interview that allows for an open and engaging discussion between us.
Brief explanation of the process	The interview is intended to last for not more than 45 minutes. I would like to formally request your consent to audio-record our conversation for transcription purposes. Your input into this matter would be greatly appreciated.
Research questions	Guiding Questions
	2. How do stakeholders within your organisation perceive the impact of predictive big data analytics on strategic outcomes?
	3. Can you share any success stories related to strategic value creation that stemmed from predictive big data analytics?
Explore how the non-high-tech public firm can overcome obstacles to create strategic value from predictive big data analytics	1. What challenges do you face in implementing predictive big data analytics in a non-tech-intensive public organisation?
	2. What strategies have proven effective in overcoming these challenges?