Investigating The Impact of Organisational Resources, Entrepreneurial Orientation Dimensions and Big Data Analytics on Business Performance of South African E-commerce SMMEs

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To my fellow classmates, I appreciate your positive contribution and all the knowledge you've shared.

Dedication

I dedicate this dissertation to my siblings, Nthuteng Mogale and Brian Mogale. I hope this inspires you to always reach for your dreams. To my mother, Mahlodi Mogale, thank you for always praying for me and supporting every single dream I've ever had.

Abstract

Small, Medium and Micro Enterprises (SMMEs) are key contributors to economic growth in South Africa. It is important to understand the essential organisational resources (IT Infrastructure, IT human resources and financial resources) and dimensions of entrepreneurial orientation (EO) (innovativeness, proactiveness and risk-taking) that influence the utilisation of big data analytic (BDA) capabilities. It is also important to understand the impact of big data analytic (BDA) capabilities on business performance (productivity and profitability). Leveraging insights from BDA capabilities is believed to create economic value, especially in e-commerce which generates large volumes of data.

This study investigated the combined impact of organisational resources and EO dimensions on BDA capabilities, and ultimately on the business performance of South African e-commerce SMMEs. The study uses both the resource-based view and dynamic capabilities view to build a theoretical framework. The study was guided by a conceptual model developed through a literature review and utilised quantitative methods to analyse data collected from SMME owners, partners and managers. A probability simple random sampling technique was used for this study. Data were collected from 288 responses to a questionnaire and were analysed using Partial Least Squares Structural Equation Modelling. The findings revealed that IT infrastructure, IT human resources and financial resources have a significant positive impact on BDA capabilities. Furthermore, innovativeness and risk-taking (EO dimensions) enhanced BDA capabilities positively and significantly while another EO dimension, proactiveness, had an insignificant impact on BDA capabilities. The mediation analyses revealed that BDA capabilities fully mediate the relationship between organisational resources and business performance, while the EO dimensions are partially mediated.

The study makes important theoretical and practical contributions and future research directions are discussed. A framework is provided that can be tested in future academic studies, specifically in the context of South Africa. Practically, the study indicates areas of investment for South African SMMEs engaged in e-commerce which may support their expansion and long-term sustainability, profitability and productivity. Both the resource-based view and dynamic capabilities view theories are context-sensitive, these findings should be considered limited in their generalizability and relevance to different contexts.

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Chapter 1: Introduction

1.1 Background Problem Statement

The increase in connectivity and data generation through platforms such as electronic commerce (e-commerce) sees businesses requiring strategies to turn their data into valuable insights. The world has progressed beyond the knowledge economy and is rapidly moving towards insight-driven business models built using big data as the foundation of future competitive advantage (Dinana, 2020). Among other advantages, the utilisation of big data and big data analytics (BDA) enables e-commerce organisations to generate insights that can be used for needs identification, market segmentation, decision making and performance improvement (Akter & Wamba, 2016). Big data is a critical organisational resource with substantial economic value. This value is created by enabling business process improvements and profitability driven by the usage of BDA capabilities (Santarsiero et al., 2021). While large organisations have unlocked the big data value (Akter et al., 2019), South African Small, Medium, and Micro Enterprises (SMMEs) still face challenges in fully exploiting big data's potential (Seseni & Mbohwa, 2021). SMMEs are pivotal to the growth of emerging economies; in South Africa, they contribute significantly to job creation, income generation, and overall economic growth (Ncube & Zondo, 2022).

In dynamic business environments like South Africa, it is imperative for e-commerce SMMEs to make maximum use of their resources and BDA capabilities to improve their business performance (Behl et al., 2019). Organisations enhance their performance by using capabilities built from their unique combination of financial, human and infrastructural resources and these undergo continual reconfiguration in dynamic business environments. The combination of these resources allows organisations to leverage BDA capabilities and improve their profitability and productivity (Santarsiero et al., 2021). The degree to which top management in SMMEs emulate the entrepreneurial orientation (EO) dimensions of innovativeness, proactiveness and risk-taking influences the allocation of adequate organisational resources and investment in technologies such as BDA capabilities (Dubey et al., 2020).

1.2 Problem Statement

According to literature, organisational resources such as IT infrastructure, IT human resources, and financial resources are enablers of BDA capabilities. Furthermore, the holistic effects of the EO dimensions have been recognised as enabling BDA capabilities. BDA capabilities have

been empirically found to positively impact business performance, enhancing its profitability and productivity (Ferrari et al., 2018; Shan et al.,2018; Behl et al., 2019; Dubey et al., 2020; Maroufkhani et al., 2020; Horng, 2022). However, in the context of South African e-commerce SMMEs, the fundamental issue of how these organisational resources, the individual EO dimensions and BDA capabilities interact and collectively influence business performance has not been investigated under one lens as previous studies have focused on the some elements (Mokhadinyana, 2021; Seseni & Mbohwa, 2021). At a time when SMMEs are critical to economic growth and e-commerce usage continues to rise (Goga, 2021; Seseni & Mbohwa, 2021; Ncube & Zondo, 2022), it is imperative to address this existing gap in literature. This research sought to address this by investigating the relationships between these organisational resources, EO dimensions, and BDA capabilities and their collective impact on business performance in the context of South African e-commerce SMMEs.

1.3 Purpose and Objectives

Despite empirical evidence from research that has separately investigated organisational resources, EO dimensions, BDA capabilities and their impact on business performance, a need exists to expand knowledge by looking at how they collectively impact business performance, especially in the South African e-commerce context. With this in mind, the purpose of this study was to investigate the combined impact of organisational resources and entrepreneurial orientation dimensions on BDA capabilities and the mediating effect of BDA capabilities on the business performance of South African e-commerce SMMEs.

Specifically, the objective was to:

- Investigate the impact of organisational resources (IT infrastructure, IT human resources and financial resources) on the BDA capabilities of South African e-commerce SMMEs.
- Investigate the impact of entrepreneurial orientation dimensions (risk-taking, proactiveness, innovativeness) on BDA capabilities of South African e-commerce SMMEs.
- Investigate the mediating effect of BDA capabilities on the relationship between organisational resources, entrepreneurial orientation dimensions and business performance of South African e-commerce SMMEs.
- Investigate the impact of BDA capabilities on the business performance of South African e-commerce SMMEs.

1.4 Research Questions

This study has attempted to answer the following questions:

- Primary question: What combined impact do organisational resources and the entrepreneurial orientation dimensions have on the business performance of South African e-commerce SMMEs under the mediating effect of BDA capabilities?
- Sub-questions:
    - What impact do organisational resources (IT infrastructure, IT human resources and financial resources) have on the BDA capabilities of South African e-commerce SMMEs?
    - What impact do entrepreneurial orientation dimensions (risk-taking, proactiveness, innovativeness) have on the BDA capabilities of South African e-commerce SMMEs?
    - What is the mediating effect of BDA capabilities on the relationship between organisational resources, entrepreneurial orientation dimensions and business performance of South African e-commerce SMMEs?
    - What is the impact of BDA capabilities on the business performance of South African e-commerce SMMEs?

1.5 Significance of Study

The limited amount of literature found on this topic indicates the importance of expanding a very small knowledge base. The uniqueness of the proposed context provides an additional perspective to the field of study. Hence, the study contributes to the existing body of knowledge and attempts to narrow the research gap by providing empirical evidence regarding organisational resources, EO dimensions and BDA capabilities and their influence on business performance.

Firstly, this study highlights the critical organisational resource allocation choice that impacts South African e-commerce SMMEs' data-driven capabilities by examining the effects of IT infrastructure, IT human resources, and financial resources on BDA capabilities. Understanding the impact of these resources is essential to academia and practice as it can lead to better resource management and indicate areas where investment is needed to support the expansion and long-term sustainability of South African e-commerce SMMEs. Secondly, by examining the EO dimensions in the context of BDA capabilities, this study expands knowledge on how individual and organisational characteristics affect the ability of this group of SMMEs to invest in BDA capabilities to improve their business performance.

Thirdly, by examining the mediating effect of BDA capabilities on the relationship between organisational resources, EO dimensions, and business performance of South African e-commerce SMMEs, this study adds depth to the field of study. The mediating analysis provides a holistic perspective of the way that these variables interact. This provides South African e-commerce SMMEs with practical insights which will assist them to develop strategies that leverage BDA capabilities as a critical driver of business performance.

Lastly, by investigating the direct impact of BDA capabilities on business performance, this study provides actionable insights on leveraging BDA capabilities to improve profitability and productivity for South African e-commerce SMMEs. These findings can contribute to the broader discussion about the role of BDA capabilities in e-commerce, highlighting its potential to increase competitive advantage and as a key driver of improved business performance in South Africa.

1.6 Structure of Study

In Chapter 1, the context of this study is introduced, the objectives and research questions are outlined, and the significance of the study is discussed. Chapter 2 presents an overview of the theoretical and empirical literature reviewed, including the conceptual framework that was developed and proposed hypotheses. Chapter 3 provides a description of the research methodology employed, including ethical considerations. Chapter 4 details the data analyses, provides findings, and discusses these findings. This research report is concluded with a summary of research findings, recommendations, limitations and directions for future work.

Chapter 2: Literature Review

2.1 Introduction

This chapter reviews existing literature with the objective of investigating the combined impact of organisational resources and entrepreneurial orientation dimensions on BDA capabilities and the mediating effect of BDA capabilities on the business performance of South African e-commerce SMMEs. The focus is on literature relevant to the research objectives, aiming to provide a comprehensive understanding of the current state of knowledge while identifying gaps. Furthermore, this chapter outlines the theoretical frameworks that underpin this study, develops a conceptual model and outlines the hypotheses on the relationships between the identified concepts.

2.2 SMMEs and E-commerce

SMMEs play a significant role in the economy of many countries, including South Africa, where they are one of the main boosters of economic growth and development. They contribute to job creation and hence reduce the unemployment rate by employing a significant portion of the workforce (Ncube & Zondo, 2022). In South Africa, the majority of businesses are SMMEs, which accounted for an average annual employment of 59% of the workforce by the second quarter of 2022 (SEDA, 2022). These businesses contribute over of 40% of the gross domestic product (GDP) of the country (OECD, 2022).

The COVID-19 pandemic changed global trends and presented severe challenges to businesses and industries across the world, such as the reduction in total revenue (Shen et al., 2020). In consumer trends, research found that 52% of consumers avoided physical stores and opted for delivery services, and this contributed to a surge in e-commerce activities in developed and developing countries, including South Africa (Bhatti et al.,2020). Throughout the COVID-19 pandemic, globally e-commerce sales grew exponentially, and this was also noted in the South African market. This growth was attributed to the increased consumer demand for alternative ways to access basic products needed during periods of restricted mobility. This created opportunities for SMMEs to enter the e-commerce market (Bhatti et al.,2020). E-commerce in South Africa generated $5.62 billion in revenue in 2020, $6.26 billion in 2021, and $6.12 billion in 2022 and this has been projected to reach US$7.22 billion by the end of 2023 (Statista, 2023).

2.2.1 South African SMME Landscape

According to the South African National Small Enterprise Act 102 of 1996, as amended by the National Small Business Amendment Acts of 2003 and 2004, an SMME is defined as a distinct business entity managed by one or more individuals and includes its branches or subsidiaries; it may be part of any sector or sub-sector in the economy. The size or class categorises these entities according to the standard industrial classification, taking into account the total number of full-time paid employees and the total annual turnover equivalent of paid employees. Macro enterprises have 0-10 employees, small enterprises have 11-50 employees, and medium enterprises have 51-250 employees; there are different turnover levels stated per industry (South African Government, 2019). According to OECD (2022), 67% of SMMEs in South Africa are run by the owner and do not have any employees.

While SMMEs are big contributors to economic growth (Ncube & Zondo, 2022), they face high failure rates due to their challenges (OECD, 2022). South Africa has one of the lowest success rates, with 70% to 80% of businesses failing in their first year and only half of the surviving businesses lasting five years (OECD, 2022). In South Africa 58% of businesses operate informally (OECD, 2022). This has been explained as being due to limited access to funding caused by financial exclusion or lack of information about funding opportunities (Seseni & Mbohwa, 2021; IOE, 2021; OECD, 2022). According to Seseni and Mbohwa (2021), the shortage of entrepreneurial networks is a challenge faced by SMMEs and restricts the ability of the managers to access essential information; opportunities to network are not widely available. Large enterprises have realised the importance of research and development (R&D) as a precursor and encouragement to be innovative and gain a competitive advantage. However, this is a challenge for SMMEs given the barriers to obtaining financing for R&D (Seseni & Mbohwa, 2021). A serious lack of entrepreneurial, business, and technical skills is also a challenge for the development of SMMEs, especially those who run digital businesses such as e-commerce (Seseni & Mbohwa, 2021).

Ayandibu and Houghton (2017) highlight the importance of the SMME sector as a contributor of technical and other innovations. Innovation in SMMEs occurs differently than in large enterprises due to the challenges that SMMEs face (Dossou-Yovo & Keen, 2021). In highly technological industries such as e-commerce, innovation is especially difficult but these SMMEs need to innovate to survive (Dossou-Yovo & Keen, 2021). Goldberg et al. (2014) suggest that the success of South African SMMEs depends on support for innovation and the

implementation of policy reforms that provide a favourable and conducive environment for their growth.

South African SMMEs face challenges that limit their growth, such as little finance and credit support, poor infrastructure, a lack of skills, inadequate access to information, undeveloped entrepreneurial networks and minimal research and development (R&D) (Goga et al., 2019; Seseni & Mbohwa, 2021; Fubah & Moos, 2022). However, over the years the South African government has indeed created some initiatives to increase the overall entrepreneurial opportunities for SMMEs, emphasising SMME development through assistance programmes. These initiatives include promoting the use of digital technology, through which SMMEs are assisted in creating e-commerce platforms which will give them access to local and international markets and in so doing create a foundation for the sustainability of their businesses (Ncube & Zondo, 2022; Goga et al., 2021; Fatoki, 2018).

2.2.2 E-Commerce and its South African Landscape

E-commerce began in the 1990s, along with the commercialisation of the Internet, and witnessed retailers selling directly to the consumer (Risberg, 2022). E-commerce has been defined differently by various authors based on its context (OECD,2019). For this study, e-commerce is defined as the process of buying and selling products or services using digital technologies. This includes the exchange of information such as transactional data, capital through online payment systems, business activities such as inventory management, and logistic flows for the movement of products from sellers to buyers (Mashalah et al., 2022; Risberg, 2022).

2.2.2.1 E-commerce Classifications

E-commerce is based on various commercial relationships pairing consumer, business, and/or government (OECD,2019).

Kang (2010) classifies e-commerce into three areas: (1) consumer-oriented, (2) business-oriented, and (3) the e-commerce technology infrastructure that consists of network infrastructure, software tools and applications. Consumer-oriented e-commerce is has as sub-classes: business-to-consumer (B2C), which involves selling of goods and services by a business to the consumer; consumer-to-consumer (C2C) involving the sale of products and services among consumers; and government-to-consumer (G2C) that involves services offered by government institutions to consumers (Kang, 2010; Mashalah et al., 2022). Finally, there is direct-to-consumer (D2C) consumer-oriented e-commerce that involves businesses selling

products or service directly to the consumer and bypassing traditional distribution channels (Lauri, 2021). Business-oriented e-commerce is business-to-business (B2B), where businesses sell products and services to each other and share the value chain (Hussein et al.,2019); business-to-government (B2G) that involves the selling of products and services from business to government institutions; and government-to-business (G2G) where services are offered by government institutes to businesses (Kang, 2010; Pham & Pham, 2021). This study is framed within commercial relationships between business and consumer and its various e-commerce business models.

2.2.2.2 South African E-commerce Landscape

In South Africa, various e-commerce business models can be distinguished based on features such as platform choice, payment types, delivery models, and customer service (Goga et al., 2019). The main e-commerce business model consists of online retailers that do not have physical stores and operate from warehouses that products are shipped from. These large enterprises, such as Takealot, are totally integrated from the platform through to logistics and payment systems. On the other hand, most SMMEs only have platform and payment system integration and logistics are processed separately. Large enterprises generally offer marketplaces and use custom-built platforms, unlike SMMEs, which often use prebuilt platforms such as Shopify (Goga et al.,2019). In contrast with the main e-commerce business model, omnichannel retailers combine physical stores and online channels, offering consumers a seamless experience. These stores often offer consumers hybrid delivery options, including "click and collect", where the consumer shops online and collects in-store (Goga et al.,2019; Risberg, 2022). Lastly, marketplace platforms offer a channel for multiple sellers to sell their goods to a wide customer base all using the same platform. Sellers leverage the platform's infrastructure and services at a fee (Goga et al.,2019). The South African e-commerce ecosystem is dominated by large enterprises by market value, revenue, and volumes. These enterprises also dominate in the share of website traffic (Goga et al.,2019).

The success rate of e-commerce SMMEs is relatively low, and this can be attributed to the challenges that they face (Behl et al., 2019). The threat emanating from large enterprises is due to their size, scope, and ever increasing dominance through the repeated acquisition of small enterprises; this is clearly a concern for SMMEs. For example, Takealot poses the risk of becoming a monopoly as it has acquired several of its online competitors. Large enterprises can also create customer loyalty schemes offering free subscriptions or delivery, leaving the consumer with less motivation to shop around (Goga et al.,2019). Due to the high fees faced

by SMMEs, such as platform fees, banking and payment transaction fees, logistic costs, and online advertising, they find themselves with very thin profit margins (Goga et al.,2019; Johnson & Iyamu, 2019). However, faced by the general challenges mentioned in Section 2.2.1, various studies have shown the positive impact of the adoption of e-commerce on the growth of the business of SMMEs. For example, a study by Ibrahim et al. (2018) investigated SMMEs and found that the adoption of e-commerce positively impacted the growth of the business. These findings are consistent with the studies by Abebe (2014) and Zhou and Chen (2014). Behl et al. (2019) stated that successful e-commerce SMMEs can increase their customer base and profit while sustaining their competitiveness.

In addition to finding a positive link between e-commerce adoption and the business growth of SMMEs, Abebe (2014) argues the need for entrepreneurial orientation (EO), noting the dimensions of innovativeness, risk-taking and proactiveness as important in exploiting new innovative technologies such as those used in e-commerce. Proactiveness by SMMEs in identifying marketing trends and consumer needs while taking risks, such as investing in e-commerce, sets them on a path to success (Abebe, 2014).

2.3 Big Data Analytics Capabilities

Interest in big data and big data analytics is growing as more organisations become aware that processing large volumes of data can create value and competitiveness for businesses. Studies have found that the predictive value (the value that comes from being able to predict trends) that comes from processing large volumes of data has the potential to transform business processes, create business capabilities, and increase productivity and profitability compared to competitors (Batistič & van der Laken, 2019).

2.3.1 Big Data, Big Data Analytics Capabilities and Technologies

The term ‘big data’ gained prominence in the late 1990s, and its definition has evolved since then (García & Álvarez-Fernández, 2022). Jaber and Abbad (2021) define big data as “*high-volume, high-velocity and/or high variety information assets that demand cost-effective, innovative forms of information processing that enable enhanced insight, decision-making, and process automation*” (p.1). ‘Big data analytics (BDA)’ is defined as the tools and procedures utilised to derive insights and value from big data to assist in decision making (Jaber & Abbad (2021). It involves the collection of big data followed by analysis, use and interpretations to gain actionable insights (Akter at el., 2019). ‘BDA capabilities’ refer to the organisation's

capacity and competency to effectively exploit the insights derived from BDA that support data-driven decision-making (Yasmin et al., 2020).

Big data includes both structured and unstructured data that needs to be analysed and visualised to create meaning and facilitate decision-making (Akter & Wamba, 2016; Ferraris et al.,2019).

García and Álvarez-Fernández (2022) reviewed literature to explain the characteristics of big data. They found that the number of characteristics proposed ranges from three to sixteen; however, these can be condensed to seven. It is generally agreed that big data's fundamental characteristics are the "three Vs" (volume, velocity and variety); however, the characteristics have evolved to the "seven Vs" (volume, velocity, variety, veracity, value, variability and visualisation) (García & Álvarez-Fernández, 2022) as described in Table 1.

Table 1: Big Data Characteristics

Characteristic	**Description**
Volume	The quantity of data stored which increases exponentially daily, increasing the need for IT infrastructure which can store and process this data (Akter & Wamba, 2016; Ferraris et al.,2019).
Velocity	The speed at which data is created, collected, and processed in real-time which enables fast decision-making and allows businesses to be agile (Akter & Wamba, 2016; Ferraris et al.,2019).
Variety	The types of data generated from different digital platforms; this can be structured or unstructured data (Akter & Wamba, 2016; Ferraris et al.,2019).
Veracity	The reliability and quality of the data, which should contain little noise, be complete and dated (Akter & Wamba, 2016; Ferraris et al.,2019).
Value	The potential strategic and informational benefit obtainable from the data which allows businesses to make decisions and create a competitive advantage (Akter & Wamba, 2016; Ferraris et al.,2019).
Variability	The changes to the data over time. This may be due to the change in the data structure or user interpretations (García & Álvarez-Fernández, 2022).
Visualisation	The presentation of data in a way that is readable and easily interpreted by users (García & Álvarez-Fernández, 2022)

This study takes into account the "seven Vs" of big data as it is necessary to consider the value derived from the usage of BDA, the variability that e-commerce data may present and the need for visualisation and interpretability all attained through BDA capabilities (the organisation's capacity and competency).

Big data plays three significant roles in business. The first is in business efficiency by facilitating an understanding of and predicting customer behaviour and buying patterns,

detecting fraud, and improving the supply chain. The second is that it encourages business innovation by stimulating the creation and introduction of new products and services. Thirdly, it assists business development by reducing barriers to entry and allowing new business owners to gain insights into areas of profitability in the market (Seseni & Mbohwa, 2021). BDA capability adds business value to an organisation of any size as it enables and even enforces data-driven decision-making capabilities based on evidence rather than intuition, limiting the introduction of human judgement errors due to its precision (Batistič & van der Laken, 2019).

BDA capabilities are enabled through various technologies that have emerged over the past years. These include, and are not limited to : (1) Apache Hadoop: this is an open-source framework that stores and processes big data across clusters of computers using simple programming models. It comprises of the core named the Hadoop Distributed File System (HDFS), the processing component that is the MapReduce programming model and resource scheduler called Hadoop YARN (Yet Another Resource Negotiator) (Balusamy et al., 2021; Syed et al., 2021). (2) Apache Spark: this is s an open-source cluster computing framework for analysing large scaled data with in-memory processing capabilities. Spark offers speed, supports complex computations and has many advantages over Hadoop MapReduce (Syed et al., 2021). (3) NoSQL Databases: NoSQL databases are efficient in handling big data, whether unstructured or semi-structured data. These allow for flexible data models, which are ideal for big data applications (Syed et al., 2021). (4) TensorFlow: this is an open-source machine learning framework that provides tools for developing and deploying deep learning models, often used in BDA for predictive modelling. This library and related tools enable efficient programming and training of neural network and other machine learning models (Pang et al., 2019).

2.3.2 BDA Capabilities and E-commerce

Big data capability is an important component of e-commerce as it provides businesses with ways to enhance their customer experience and offerings and optimising sales (Akter & Wamba, 2016; Goga et al.,2019). Through BDA, businesses can gain insights into customer preferences, and these can inform inventory management and manufacturing decisions. The customer data can be collected from orders, product reviews, search terms, loyalty cards (combining online and offline data), tracking cookies, trends on social media, etc, all of which provide insights into customer trends and preferences. Customers usually choose e-commerce stores with good reviews and a variety of sellers in the case of marketplace e-commerce platforms, reinforcing the need for better data regarding customer choices and behaviour.

Better customer data provides better insights, such as spending patterns, giving the business a competitive advantage against competitors (Goga et al., 2019). Business, in its nature, is dynamic which increases uncertainties and rapid changes, and a business' survival is dependent on its ability to sense environmental trends and respond to them proactively (Yu & Easterbrook, 2014).

According to Akter and Wamba (2016), the benefits of establishing BDA capabilities in e-commerce include:

a. Personalisation: Businesses can tailor their selection of the products they should present and messaging in real-time in the form of customised promotions on the platform to increases revenue and Return on Investment (ROI).
b. Dynamic pricing: The business has the ability to quickly change the price based on competitor pricing in order to win sales.
c. Customer services: Usually customers air their grievances online and a proactive customer management process rooted in sensors such as social listening can help the business to resolve queries quickly and to offer a tailored after sales service.
d. Supply chain visibility: Customers expect visible after sale processes including tracking of their parcel. BDA capabilities enables the collection of information from multiple systems including a third party delivery system to create a single view for the customer to access the real-time information about their parcel.
e. Security and fraud detection: This entails the analysis of data at an aggregated level (using the customer's purchase history, location, web logins etc.) and allows for the detection of fraudulent transactions relating to credit card data theft, returns and identity theft.
f. Predictive analytics: This is the analysis of historic big data to identify events before they happen through data mining processes. Predictive analytics assist businesses in preparing for the future in budgeting, seasonality sales trends, forecasting inventory requirements, and predicting customer behaviour and preferences.

SMMEs are among the organisations that should leverage BDA capabilities and the benefits of big data to inform strategy for business growth. However, most SMMEs have not unlocked its benefits, especially in developing countries such as South Africa (Seseni & Mbohwa, 2021). This may be due to challenges they face relating to big data storage, analysis, and usage. Mohd et al. (2018) categorise big data issues for SMMEs into three main areas of concern: resources, knowledge, and data management. The lack of resources includes a scarcity

of in-house data analytics experts due to the lack of skilled and experienced people available. Additionally, the rate of change and complexity of new technology and the financial limitations experiences by SMMEs for investing in these technologies make it difficult for existing in-house talent to keep abreast with innovations. The low levels of BDA capabilities limit SMMEs' chances to reap the benefits of BDA and curb interest in new management trends. This can also be attributed to a lack of studies describing successful business cases that SMMEs can refer to in order to gain new knowledge. Data management is another challenge that SMMEs are faced with, and includes data security, protection and privacy. The inability of SMMEs to scale up their IT security, given the associated costs, makes them vulnerable to cyber-attacks, raising concerns about their customer's data protection and privacy.

Despite the challenges outlined, the significance of BDA in e-commerce remains important. Alrumiah and Hadwan (2021) studied the impact of BDA capabilities on vendors' and customers' e-commerce experience. They found that BDA's capabilities improved the vendor's revenue and customer experience by offering personalised products and services. This study also highlights that acquiring BDA capabilities is challenging due to the rapid growth in data (Alrumiah & Hadwan, 2021). Li and Zhang (2021) studied the enterprise e-commerce marketing system in terms of big data collection and analysis and found that applying big data technology to enterprise e-commerce marketing improved business processes, reduced labour costs, and improved productivity. Both these studies highlight the importance of BDA capabilities to business processes and performance. Behl et al. (2019) state that more SMMEs are implementing BDA once they have seen positive results from their established competitors.

2.4 Organisational Resources and BDA Capabilities

2.4.1 BDA Capabilities

BDA capabilities have been identified as a critical resource in organisational value creation. Each organisation leverages a unique blend of financial, structural, and human resources to create BDA capabilities so as to enable business performance improvements and transform business processes by providing a toolkit for solving business problems and aiding decision-making (Batistič & der Laken, 2019; Santarsiero et al., 2021). BDA capabilities enable organisations to gain market insights by obtaining internal and external knowledge (Shan et al.,2018). Using the lens of the Resource-based View (RBV) theory, big data is identified as an essential resource; therefore, it is critical to understand the enabling resources influencing the development and utilisation of big data for value creation and development of BDA

capabilities, especially in the South African context (Walls & Barnard, 2020; Santarsiero et al., 2021).

2.4.2 Organisational Resources

Akter et al. (2016) recognised the need for organisations to leverage their IT capabilities, such as IT infrastructure, in enabling and enhancing both direct and indirect business performance, especially in the big data environment. Many studies reported in the literature have empirically shown a direct or indirect relationship between IT infrastructure and IT capability in influencing business performance (Akter et al., 2016). The IT infrastructure used to manage data sources and IT human resources needed to understand the tools have been identified as building blocks for creating BDA capabilities that impact business performance (Akter et al., 2016; Shan et al.,2018; Li & Chan, 2019). In South Africa, where SMMEs are faced with infrastructure and skills challenges (Seseni & Mbohwa, 2021), it is important to understand the extent to which these fundamental skills and resources enable BDA capabilities and influence business performance.

2.4.2.1 IT Infrastructure

IT infrastructure refers to the components that enable the business to perform its daily activities digitally (Li & Chan, 2019) and includes the e-commerce infrastructure. A sufficient and appropriate infrastructure is important in developing any IT capacity. This infrastructure must allow internal and external data sources to be integrated, store data, and enable the processing and visualisation of insights (Shan et al.,2018). Integration with external partners gives opportunities to mutually benefit from the insights found in the data. Due to the frequent changes in technology and data volumes, IT infrastructure must be sufficiently flexible to accommodate a dynamic environment so as to meet business objectives and technology requirements (Li & Chan, 2019).

2.4.2.2 IT Human Resources

IT human resources emphasises the need for employees to gain the knowledge and skills necessary to address problems associated with big data and to fully utilise it to achieve the best possible business performance. IT knowledge resources are considered to be key in any organisation, are unique in each business and change over time (Shan et al.,2018). The IT skills needed include managerial and technical skills relating to big data collection, analysis and presentation (Batistič & der Laken, 2019). Literature shows that staff with appropriate IT skills are difficult to find, compensate and retain, especially for SMMEs, due to the high demand for

these skills in the market - this is no different in the South African context. Available staff members may possess the theoretical knowledge of IT but lack practical experience; this is a challenge for SMMEs, given that their success is dependent on having access to the relevant technical and business knowledge (Behl et al., 2019).

2.4.2.3 Financial Resources

Despite Akter et al. (2016) highlighting the need for IT infrastructure and IT human resources, these authors fail to highlight the financial resources needed to build BDA capabilities (Gupta and George, 2016; Li & Chan, 2019). Adequate financial resources are often not allocated to building BDA capabilities, despite knowing that profitable results may be achieved in the long term (Gupta and George, 2016) and will give organisations the flexibility to adapt to market changes and customer needs (Shan et al.,2018). In South Africa, one of the main challenges for SMMEs is financial resources (Seseni & Mbohwa, 2021). Therefore, measuring the availability or lack of financial resources in enabling BDA capabilities is critical. To stay ahead of the competition and remain sustainable, SMMEs require enough financial investment to aid the process of innovation and continuous competitiveness. Financial resources are also key in ensuring adequate IT infrastructure is acquired, and IT human resources are found and retained (Shan et al.,2018).

2.5 Entrepreneurial Orientation

Entrepreneurial orientation (EO) refers to a readiness to take risks and be innovative and proactive (Lomberg et al., 2017; Dubey et al., 2020; Ciampi et al., 2021). There are three dimensions associated with EO. Innovation refers to a creative ideation process where new products or services are developed; proactivity refers to the organisation's ability to identify and capitalise on market opportunities ahead of competitors; and risk-taking is the extent to which management is willing to provide organisational resources in support of an idea whose outcome is uncertain (Ciampi et al., 2021). These dimensions affect processes, practices and decision-making capabilities that enable the organisation to gain competitive advantage. The three dimensions (risk-taking, innovativeness and proactiveness) are independent, and each contributes to business performance. When the dimensions are considered to be dependent on one another, the results tend to hide or inaccurately attribute effects from variation in one dimension (Lomberg et al., 2017; Dubey et al., 2020). EO theory is closely associated with studies about SMMEs, given its theoretical assumptions (Asad et al., 2021).

The nature of SMMEs is to take risks and to be proactive and innovative in order to grow the business. Innovation is a key factor for high-tech environments, with risk-taking and proactiveness as supporting factors. SMMEs must proactively create innovative strategies to stay ahead of the competition, especially in dynamic business environments such as e-commerce (Lomberg et al., 2017; Behl et al., 2019).

Innovatively oriented e-commerce SMMEs can reshape market structures to gain competitive advantage, through the adoption of BDA for processes such as personalisation and dynamic pricing (Akter & Wamba, 2016; Asad et al., 2021). Proactive e-commerce SMMEs are more likely to adopt BDA as a strategic tool for exploiting emerging market opportunities and maintaining competitive advantage (Asad et al., 2021). E-commerce SMMEs with a high-risk orientation often invest in innovation such as BDA despite the risks and cost. Despite this, SMMEs are able to they extract enough value from BDA to cover the high cost of innovation through the long-term benefits gained (Asad et al., 2021).

Asad et al. (2021) argue that entrepreneurially-oriented organisations influence the adoption of BDA compared to organisations where factors such as innovations are less important. An organisation's capability to innovate using insights gained through BDA leads toward a sustainable long-term competitive advantage and high performance (Akter & Wamba, 2016; Asad et al., 2021). Literature has detailed the positive relationship between EO and business performance (Lomberg et al., 2017; Dubey et al., 2020) and highlighted the importance of allocating sufficient organisational resources to EO driven initiatives (Asad et al., 2021).

2.6 Business Performance

The economic value of big data can be described through the business performance improvements that are realised (Santarsiero et al., 2021). Business performance is measured using dimensions such as productivity, profitability, and overall benefit to various business processes (Eniola & Ektebang, 2014; Santarsiero et al., 2021). Profitability refers to revenue growth, and productivity refers to improvements across various processes of business operations (Mangla et al., 2020; Ahmad, 2023).

A business is always judged by the market on its profitability as an indicator of growth. Hence, studies highlight the importance of productivity as a key indicator of business performance (Eniola & Ektebang, 2014). SMMEs need to assess their potential market share as they compete not only with other SMMEs but also with large enterprises. The business' ability to invest in valuable resources and capabilities gives it a market differentiator and

competitive advantage. Although some organisations have seen the positive impact of BDA capabilities on their business, some have still not achieved that result, and this could be attributed to the suitability of business processes to take advantage of BDA capabilities and to dispersed resources (Walls & Barnard, 2020).

E-commerce businesses face big challenges that affect business performance, such as the volatility of customer needs and changing profiles and numbers of existing competitors. While e-commerce SMMEs must be innovative, they must also have a competitive spirit to drive business performance (Behl,2020). Having the most suitable IT infrastructure, IT human resources, financial resources and BDA capabilities positively impacts business performance (Akter & Wamba,2016; Mazzoleni et al., 2019).

2.7 Theoretical Foundation and Frameworks

2.7.1 Resource-based View and Dynamic Capabilities View

Resource-based View (RBV) theory defines business resources and capabilities as the foundations for attaining competitive advantage and ensuring long-term sustainability. RBV focuses on inimitable, valuable, rare, incomparable internal resources. These can be tangible assets such as technologies or intangible assets such as employee and management skills used to increase performance and gain a competitive advantage. RBV proposes that organisations use both tangible and intangible resources to increase performance and gain a competitive advantage (Dubey et al., 2020; Horng et al., 2022). RBV also states that an organisation's performance depends on the availability of these resources (Eniola & Ektebang, 2014). RBV emphasises that it is easier for organisations to exploit external opportunities using their existing internal resources than for them to try to acquire new skills for every new opportunity that arises. The resources that SMMEs have, such as IT Infrastructure, IT human resources and financial resources, greatly affect future competitive advantage, leading to high business performance (Eniola & Ektebang, 2014). The EO dimensions (innovation, risk-taking, proactiveness) are also considered to be strategic resources that contribute to the development of a business' unique and valuable set of resources, and create a sustainable competitive advantage (Lomberg et al., 2017; Dubey et al., 2020; Ciampi et al., 2021).

Braganza et al. (2017) argue that assumptions based on RBV alone do not hold for big data because of the need to continuously build additional capabilities to respond to changes in the big data landscape. Hence, RBV is criticised for not sufficiently considering the external environment and failing to explain the lack of business performance during volatile times. In

response, Dynamic Capabilities View (DCV) was proposed as an extension of RBV to explain organisations' competitive advantage in volatile and dynamic environments. This extended theory is considered suitable for studying BDA capability (Braganza et al., 2017; Dubey et al., 2020; Horng et al., 2022). Almazmomi et al. (2021) agree that DCV is better than RBV at explaining high-tech SMMEs, such as those participating in e-commerce, given their dynamic nature.

DCV refers to the organisation's "*ability to integrate, build, and reconfigure internal and external resources/competencies to address, and possibly shape, rapidly changing business environments*" (Dubey et al., 2020, p.3). Capabilities are described as an inimitable intellectual capital (Shan et al., 2018). Resources and capabilities are seen as the foundation of DCV, with resources including technology, knowledge and human resources and capabilities indicating productivity and performance. DCV posits that the more quickly organisations can reconfigure their resources and adapt to changing marketing conditions, the more easily they can achieve competitive advantage and improve business performance (Walls & Barnard, 2020). DCV emphasises capabilities in sensing, seizing, and reconfiguring resources (Walls & Barnard, 2020), which is crucial for BDA in resource-constrained SMMEs. SMMEs can employ DCV to reconfigure resources in implementing BDA to uncover insights such as customer preferences, enabling them to detect new business opportunities to improve business performance (Wamba et al., 2017). DCV is often criticised for becoming less impactful in stable environments with fewer opportunities for reconfiguring of resources (Herold et al., 2022). The EO dimensions of risk-taking and proactiveness are linked to the business' ability to sense opportunities in a dynamic business environment and turn them into competitive advantages (Lomberg et al., 2017; Dubey et al., 2020; Ciampi et al., 2021). RBV and DCV are particularly relevant in the study of SMMEs because of the importance of scarce resources for SMMEs to sustain the business and to equip them to compete in rapidly changing marketing conditions and face dynamic challenges.

2.8 Conceptual Model and Research Hypotheses

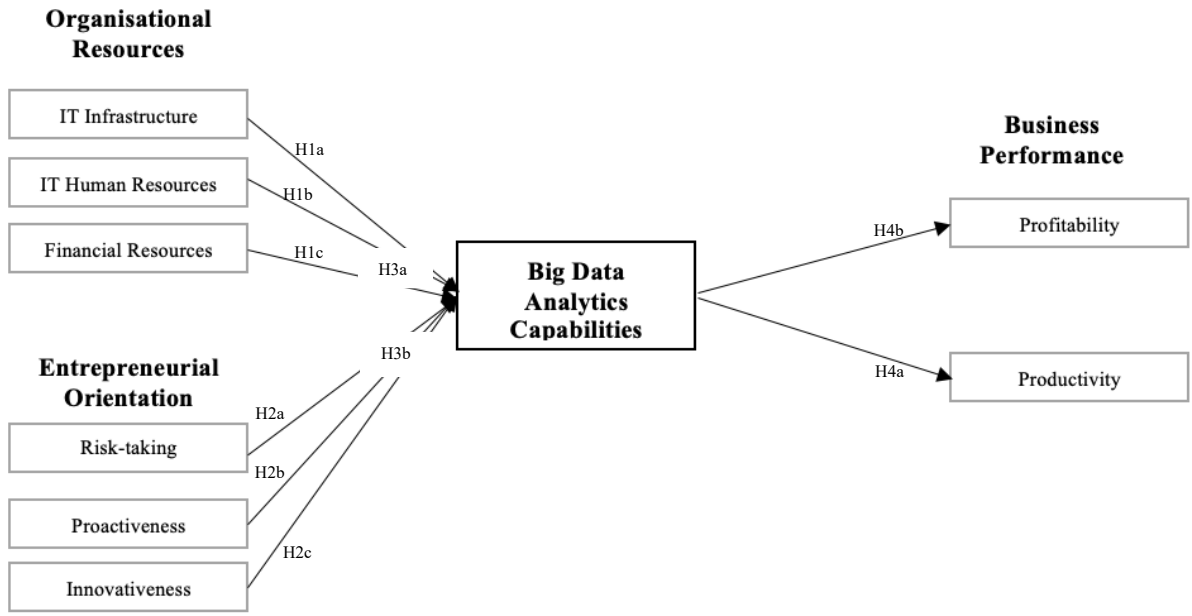

Figure 1: Conceptual Model

2.8.1 Organisational Resources

The study by Shan et al. (2018) found that IT technology resources, such as IT infrastructure, positively influence IT technology capabilities, such as BDA capabilities. The availability of BDA capabilities has been shown to create a competitive advantage for organisations, leading to improved business performance (Shan et al., 2018). Li and Chan (2019) emphasise the need for an IT infrastructure that can help an organisations exploit business opportunities effectively and build capabilities that will assist it to achieve ambitious strategic objectives. In South Africa, SMMEs face challenges such as the lack of access to the infrastructure needed for their businesses (Seseni & Mbohwa, 2021). Therefore, it is imperative to investigate the impact this has on the successful implementation and utilisation of BDA capabilities and business performance. With this understanding, this study hypothesises that:

H1a: IT Infrastructure has a positive impact on BDA Capabilities.

Shan et al. (2018) also emphasise the need for adequate financial resources and IT human resources in the innovative implementation of BDA. A shortage of these resources can negatively impact the organisation and their business performance (Shan et al., 2018). IT human resources are core to building BDA capabilities (Wamba et al., 2017), and enable

organisations to exploit those BDA capabilities and improve their business performance (Batistič & der Laken, 2019). In their studies, Wamba et al. (2017) and Shan et al. (2018) found that access to suitable IT human resources and financial resources positively impacts BDA capabilities. In South Africa, SMMEs are known to face financial barriers and challenges in gaining IT skills and retaining skilled IT professionals (Behl et al., 2019; Seseni & Mbohwa, 2021). Therefore, understanding the impact that the availability of financial resources and IT human resources has on enabling the exploitation of BDA capabilities is imperative. This study, therefore, hypothesises that:

H1b: IT Human Resources have a positive impact on BDA Capabilities.
H1c: Financial Resources have a positive impact on BDA Capabilities.

2.8.2 Entrepreneurial Orientation Dimensions

Asad et al., (2021) and Dubey at el. (2020) argue that EO activities such as innovativeness, proactiveness and risk-taking enable SMMEs to leverage BDA capabilities and improve their business performance. The risk SMMEs face is reduced when BDA capabilities are utilised as they provide insights and enable SMMEs to make good business decisions. The value extracted from BDA capabilities can be reinvested into further innovation initiatives, enabling SMMEs to continuously be innovative and improve their business performance (Asad et al., 2021). Innovation is a key indicator in understanding the success of SMMEs such as those in the e-commerce sector (Behl et al., 2019). The EO dimensions of innovativeness, proactiveness and risk-taking significantly impact the BDA capabilities of SMMEs, highlighting its importance in enabling BDA capabilities (Asad et al., 2021;, Behl et al., 2019; Dubey at el., 2020; Naz, Haq, & Nasir, 2022). As a result, this study hypothesises that:

H2a: EO's Risk-taking has a positive impact on BDA Capabilities.
H2b: EO's Proactiveness has a positive impact on BDA Capabilities.
H2c: EO's Innovativeness has a positive impact on BDA Capabilities.

2.8.3 BDA Capabilities

Through the RBV lens, big data is seen as a key value-creating organisational resource that can be leveraged to create the dynamic capabilities that allow an organisation to reconfigure internal and external competencies in a constantly changing business environment (Ciampi et al., 2021). Using the theoretical foundation of DCV as an extension of RBV, not only are BDA

capabilities seen as a resource, but the processes required to unleash their potential in creating new market opportunities and sustaining business performance for SMMEs are also considered important (Shan et al., 2018; Ciampi et al., 2021). BDA capabilities are essential in enhancing customer experience and value, especially on e-commerce platforms (Shan et al., 2018). The importance of organisational resources in creating BDA capabilities that directly impact business performance needs to be emphasized (Wamba et al., 2017 & Shan et al., 2018). BDA capabilities positively influence business performance and improve competitive advantage (Wamba et al., 2017; Maroufkhani et al., 2020). IT technology such as BDA positively mediates organisational resources and business performance (Shan et al., 2018). BDA capabilities have a strong mediating effect between EO dimensions and business performance, and BDA capabilities have a significant impact on the business performance of SMMEs (Asad et al., 2021). Mangla et al. (2020) found a significant mediating effect of BDA on the project performance of SMMEs. As a result, this study hypothesises that:

H3a: Organisational Resources (IT Infrastructure, IT Human Resources and Financial Resources) under the mediative effect of BDA capabilities positively impact Business Performance (Productivity, Profitability).
H3b: Entrepreneurial Orientation dimensions (Risk-taking, Proactiveness, Innovativeness) under the mediative effect of BDA Capabilities positively impact Business Performance (Productivity, Profitability).
H4a: BDA Capabilities have a positive impact on Productivity.
H4b: BDA Capabilities have a positive impact on Profitability.

2.9 Chapter Summary

Chapter 1 outlined the problem statement and objectives of this study. Based on this, Chapter 2 presented a literature review of related studies highlighting the current knowledge and how this study relates to and differs from current literature. This chapter drew insights into organisational resources, EO dimensions, and BDA capabilities and highlighted how they influence business performance in the context of South African e-commerce SMMEs. Literature established the importance of IT infrastructure, IT human resources, financial resources, risk-taking, proactiveness, and innovativeness in influencing BDA capabilities. The importance of BDA capabilities to business performance has also been highlighted. The chapter presents a conceptual model formulated through the literature review to guide this study and draws hypotheses to be empirically tested.

Chapter 3: Research Methodology

3.1 Introduction

This chapter details the methodology used to conduct this study to investigate the impact of organisational resources, entrepreneurial orientation dimensions, and big data analytics on the business performance of South African e-commerce SMMEs. This chapter outlines the ontological and epistemological stance of the study, research methods, approach, sampling strategies, data collection and analysis techniques employed, and ethical considerations.

3.2 Research Philosophy

The research philosophy reflects the researcher's assumptions about how they view the world. These assumptions inform the research strategy and methods employed. The chosen philosophy may be influenced by practical considerations; however, the main influence is the relationship between knowledge and the process in which it is formed (Saunders et al., 2007).

3.2.1 Ontology

Ontology is the study of being concerning what exists in the world and which humans can acquire knowledge; it asks how reality is constructed (Saunders et al., 2007; Scotland, 2012; Moon & Blackman, 2014). The two extremes of ontology are objectivism and subjectivism.

In objectivism, the phenomenon being studied is considered to be independent of the researcher. Hence, the only true meaning is seen as residing in the phenomenon, and the researcher aims to find that meaning. Objectivists believed that only one true reality exists, but its structures can change, leading to the nature of the reality changing. Hence, independent and dependent causal relationships exist, and knowledge can be measured and tested, having been broken down into variables, and this is used to observe the effect of these relationships. (Saunders et al., 2007; Moon & Blackman, 2014).

Subjectivism relates to the idea that meaning exists within the subject (observer or researcher) where that subject imposes a meaning on the object. Thus, meaning is socially constructed and reflects multiple realities. This viewpoint helps us in understanding how an object is constructed by social actors. This is a continuous process where the social phenomena are in a constant state of revision through social interactions (Saunders et al., 2007; Moon & Blackman, 2014).

For this study, the researcher attempted to measure the relationships between organisational resources, entrepreneurial orientation dimensions and big data analytics and its

impact on the business performance of South African e-commerce SMMEs. The researcher aimed to measure and test these constructs using statistical analysis to observe their relationships; the researcher took an objectivist ontological stance.

3.2.2 Epistemology

Epistemology explains what constitutes acceptable knowledge (Saunders et al., 2007). It focuses on how knowledge can be acquired or produced and how to establish the scope of its applicability (Moon & Blackman, 2014). According to Oates (2006), most information systems and computing studies adopt one of three philosophical stances: positivism, interpretivism, and critical research, which are reviewed in this study.

A positivist epistemological stance is associated with the objectivist ontology and hence takes the view that the truth is objective and has measurable properties that exist independently from the observer, thus is value-neutral (Scotland, 2012). The positivist researcher believes they are neither influenced by nor influencing the study participants. This researcher used existing theory to generate hypotheses, which were tested statistically using quantifiable observations to develop the theory further. The product of positivist research is a law-like generalisation which can be replicated due to the highly structured methodology followed by the researcher (Saunders et al., 2007). The quality of a positivist study can be judged by its objectivity (the degree to which the study is free of researcher bias), reliability (findings centred on repeatability), internal validity (findings are accurate, measured correctly and reflect reality) and external validity (findings are generalisable) (Oates, 2006).

An interpretivist epistemological stance, on the other hand, is associated with the subjectivist ontology and hence is based on a belief that the realities of the world are subjective and are individually constructed. This philosophy emphasises that knowledge is based on understanding people in their roles as social actors and how they give meaning to their roles and the roles of others. Interpretivist researchers argue that law-like generalisations cannot reflect rich insights into this complex world. Therefore, interpretivist researchers are of the view that generalisation is not important. The interpretivist researcher is challenged with understanding their subject's world through the subject's viewpoint, as they adopt an empathetic stance.

This researcher adopted qualitative methods for acquiring data to create contextual depth in their study (Saunders et al., 2007; Scotland, 2012). The quality of a positivist study can be judged by its trustworthiness (trust can be placed in the research), confirmability (findings are accountable and dependable, ensuring auditability), dependability (research process and data

are well documented), credibility (research subjects are accurately identified and described to ensure the credibility of findings) and transferability (findings can be transferred to a different context, allowing some level of generalisation in settings with the same features) (Oates, 2006).

Critical research aims to critique the status quo, identify power relations, conflicts, and contradictions, and create transformation through empowerment or emancipation (Oates, 2006; Myers & Klein, 2011). As in the case of the interpretivist, a critical researcher emphasises that reality is created and re-created by people. However, the critical researcher explains that reality also has objective characteristics that can shape our perceptions and perspectives of the world (Oates, 2006). The critical researcher faults the interpretivist researcher for failing to examine the structures of power and control that govern and validate specific worldviews (Oates, 2006). The quality of a critical study can be judged by its fairness, ontological authenticity, educational authenticity, catalytic authenticity, and tactical authenticity (Oates, 2006).

For this study, the researcher is not attempting to critique the phenomenon socially or understand people's subjective viewpoints of the phenomenon and their role as social actors. Therefore, interpretivism and critical research philosophical assumptions were not chosen. The researcher, however, sought to measure relationships and patterns to explain the impact of organisational resources, entrepreneurial orientation dimensions and big data analytics on the business performance of South African e-commerce SMMEs, Therefore, the most appropriate philosophical assumption for this study was that of positivism.

3.3 Research Method

Research can be conducted qualitatively, quantitively or using mixed methods. Quantitative research is associated with the objectivist ontology and positivist epistemology and utilises strategies to identify patterns in large samples of data representative of the population, focusing on the relationships between variables that can lead to a general conclusion (Moon & Blackman, 2014; Queirós et al., 2017). The data collected is numerical and requires numerical methods of data analysis to describe and understand behaviour (Moon & Blackman, 2014).

On the other hand, qualitative research explores the world of meanings, motives, beliefs, values, and attitudes. It delves into deep connections, processes, and phenomena that cannot be simply measured by isolating variables (Queirós et al., 2017). Qualitative research is subjective in nature and utilises strategies for an in-depth examination of a relatively small number of cases. Collected data is analysed with nonstatistical techniques, which aim to clarify concepts to gain deeper insights into the research problem (Moon & Blackman, 2014).

Mixed method research uses a combination of quantitative and qualitative data collection techniques and analysis processes that allow the researcher to benefit from the strengths of both methods and minimise the weaknesses of the two (Moon & Blackman, 2014).

A quantitative research method is objective and aligned with the positivist epistemology. It focusses on hypothesis testing and measurement using statistical techniques; therefore, it has been adopted for this study. This research method is well-suited to the objectives of this study as it allows for systematic investigation, statistical analysis, and precise quantification of relationships, effects and their strength and significance between organisational resources, entrepreneurial orientation dimensions, BDA capabilities, and business performance in South African e-commerce SMMEs.

3.4 Research Design and Methods

3.4.1 Research Approach

According to Osei-Bryson and Ngwenyama (2014), there are four inferential logics a researcher can use to theoretically explain the phenomena or phenomenal behaviour of interest. These inferential logics are deduction, induction, abduction and retroduction (Osei-Bryson & Ngwenyama, 2014).

A researcher who adopts deductive inferential logic develops a theory to be tested with empirical data to move from general propositions to generalised specific propositions (Saunders et al., 2007; Scotland, 2012). The deductive research process starts with deducing a hypothesis from theory, creating concepts or variables from the hypothesis and proposing their relationships, testing the hypothesis, examining the outcome to either confirm or modify the theory, and lastly, modifying the theory based on the outcomes (Saunders et al., 2007). The deductive approach to theory is characterised by explaining causal relationships between variables, controls to allow for hypothesis testing and enable replication, the independence of the researcher from the observations, and operationalisation to allow quantitative measurement and generalisation (Saunders et al., 2007).

An inductive inferential logic aims to build theory, using known propositions to generate untested conclusions. The researcher starts with specific propositions and then ends with general propositions (Saunders et al., 2007; Ngwenyama, 2014). The inductive researcher is concerned with the context in which events occur while seeking to understand how people interpret their social world before they try to establish cause-effect links between variables as is done in the deductive approach (Saunders et al., 2007).

An abductive inferential logic to theory combines features of both the deductive and inductive approaches but is distinct from both. Abduction is unique in that there is no intrinsic explanation for the observed phenomenon, and it does not present a new case for the general rule but combines both aspects (Vila-Henninger et al., 2022). Lastly, retroductive inferential logic helps researchers infer the cause behind social behaviour by identifying the underlying factors that contribute to it (Osei-Bryson & Ngwenyama, 2014).

The purpose of this study is to test the theory of organisational resources, entrepreneurial orientation dimensions and big data analytics and their impact on the business performance of South African e-commerce SMMEs. Therefore, the deductive approach to theory was adopted for this study. This approach allowed the testing of theory through the identified variables and their relationships to either confirm or modify established knowledge and to verify its applicability in the context of South African e-commerce SMMEs.

3.4.2 Research Purpose

Three research types were considered for the purpose of this study, namely exploratory, descriptive, and explanatory. Exploratory research is grounded in theory and helps the researcher better understand or gain new insights into the research problem (Oates, 2006; Saunders et al., 2007). The advantage of exploratory research is its flexibility and adaptability as new insights occur. However, this does not mean that there is an absence of direction for the research process. The focus is initially broad and progressively narrows as the research progresses (Saunders et al., 2007).

Descriptive research aims to tell a story about the phenomenon under investigation, including what occurred and how each person perceives it. It defines and describes the phenomenon's characteristics and the relationships between the variables. The data (quantitative or qualitative or both) collected is rich and captures the phenomenon's complexity and context (Oates, 2006; Saunders et al., 2007).

Explanatory studies extend descriptive studies by explaining the cause-and-effect relationships of the phenomenon or explain the phenomenon itself (Oates, 2006).

This study aims to describe the relationships between organisational resources, entrepreneurial orientation dimensions, big data analytics and business performance variables in the South African e-commerce context. As previous researchers have explored and created a theoretical foundation for these concepts, the researcher seeks to describe and measure the relationships of this phenomenon in a new context and complexity.

3.5 Data Collection

The following section contains details of the research strategy and research instrument used in this study.

3.5.1 Research Strategy

There are several data generation methods to consider that will allow the researcher to look at the phenomenon of interest in different ways. The researcher considered seven research strategies for this study, namely, experiment, survey, case study, action research, grounded theory, ethnography, and archival research.

Firstly, experiments aim to provide a causal link between two variables. These studies measure if changing one independent variable will result in changing a second dependent variable under controlled conditions. Due to the highly controlled conditions of experiments, internal validity is improved, but external validity is difficult to establish (Saunders et al., 2007). Survey studies allow the researcher to collect large amounts of data from a sample representative of a larger population. Quantitative data can be collected using a survey, which can be analysed using descriptive and inferential statistics (Saunders et al., 2007). A case study aims to understand the phenomenon in its real-life context. Unlike experiments with highly controlled contexts, case study boundaries are not precisely defined. A variety of data collection methods can be employed in a case study over a long period of time (Saunders et al., 2007). Action research is conducted within a specific context and clearly focuses on promoting change. This type of strategy is iterative and involves phases of diagnosis, planning, actioning, and evaluating (Saunders et al., 2007). Grounded theory research aims to build theory by predicting and explaining behaviour using a series of observations. This can take either an inductive or deductive approach but is always grounded in data (Saunders et al., 2007). In ethnographic research, the researcher immerses themselves in the social world of the phenomenon of interest often for an extended period with the purpose of gaining insights into, understanding, and interpreting the phenomenon from the perspective of the social world (Saunders et al., 2007). Lastly, archival research utilises documentation and records which may be historical or recent as the source data for the study. This strategy allows the researcher to answer research questions relating to the past and observed changes over time (Saunders et al., 2007).

The researcher did not aim to immerse themselves in the social world of the phenomenon of interest as required by ethnography research and did not aim to solve a real-life problem as required by action research. Additionally, the researcher did not aim to use controlled

laboratory settings as needed by experiments or to study any administrative documentation and records as utilised in the archival research strategy. The researcher did not aim to build theory as is the aim in grounded theory research but rather set out to test theory. Lastly, the researcher did not aim to gain a rich understanding of the phenomenon in its real-life context as done through a case study.

This study aimed to measure relationships and patterns to explain the impact of organisational resources, entrepreneurial orientation dimensions and big data analytics on the business performance of South African e-commerce SMMEs. Therefore, a large amount of data needed to be collected. As such, a survey research strategy was deemed the most appropriate method for this study.

3.5.2 Research Instrument

A questionnaire was used as the research instrument for the survey research carried out in this study. Questionnaires have pre-defined questions that provide an efficient way of collecting data from a large population. The questions provided need to be brief, relevant, unambiguous, specific, and objective (Oates, 2006). The questionnaire for this study was self-administered electronically, meaning that the respondents completed the questionnaire online without the researcher being present. This supports the philosophical stance taken as this research can be seen to have been carried out without the answers selected by the respondent being influenced by the research in any overt way (it was objective).

The questionnaire was designed based on the current literature, guided by the conceptual framework, and adapted from previous literature but was designed carefully to be appropriate in the context of this study. Since the original questions used as the basis for the questionnaire were not intended for use in South Africa and may have targeted large organisations, many questions needed to be amended to ensure their relevance and consistency for the South African e-commerce context.

The questionnaire included close-ended questions using a five-point Likert scale. Such questions are easy to construct and likely to produce reliable data, though they may be criticised for the lack of reproducibility, the likelihood of central tendency bias as participants avoid extreme answers, and social desirability bias as participants may portray themselves in a likeable manner (Taherdoost, 2019). The Likert scale may have any number of points (two to eleven) however various authors have found the reliability and validity of the data to be optimised when using a seven-point Likert scale (Taherdoost, 2019). Since the questions for this study were adapted from existing literature where a five-point Likert scale was used to

measure the degree of comfort and acceptance this study also adopted a five-point Likert scale. In the scale 1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree and 5=Strongly Agree. The questionnaire was divided into two sections. The first consisted of questions about the participant's demographic profile, and the second consisted of questions related to the main variables identified for this study. All the questions were made mandatory to ensure a complete data set.

The research instrument measured (i) IT infrastructure, (ii) IT human resources, (iii) financial resources, (iv) the entrepreneurial orientation dimensions of innovativeness, proactiveness, and risk-taking, (v) BDA capabilities were measured, and (vi) business performance's constructs of profitability and productivity. Table 2 outlines the constructs and studies from which they were adapted. The questionnaire can be viewed in Appendix A.

Responses from research questions are measured using either nominal, ordinal, interval, or ratio data. Nominal data can be classified into discrete categories by name and are often assigned a number as a code for that category, allowing for analyses. These categories should be exhaustive and mutually exclusive (Brace, 2018). Ordinal data makes use of ranking scales so that nominal categories can be ranked based on the criteria given in the questions but with no specific measurement of difference between the ranks. This creates an awareness that each rank is more or less than the other (Brace, 2018). Interval scaled data has a numerical ranking and there is a set equal distance between each point to make it possible to determine the relative strength of the relationships (Brace, 2018). Lastly, ratio scales give meaning to the zero point so that the distance between each point has a true meaning (Brace, 2018). This study collected nominal data in the form of the participants' demographic profiles and ordinal data from the identified variables of the conceptual model using the five-point Likert scale.

The questionnaire was distributed to the target population through electronic mail. A total of 392 questionnaires were distributed to increase the likelihood of achieving a high response rate. All responses were deemed for inclusion in the study, as control were implemented within the electronic questionnaire to ensure that only valid and complete responses were submitted for analysis.

Table 2: Construct Definitions and Reference

Reference	Definition	Number of questions	Sources
Descriptive Data	Basic information about the participants and their business, such as age, education level, position, and business age.	8	
IT Infrastructure (Predictor variable)	IT infrastructure components enable the business to perform daily activities digitally and enable BDA capabilities. IT infrastructure must be able to integrate internal and external data sources, store data, and allow the processing and visualisation of insights while being flexible to the increasing data volume.	4	Wamba et al. (2017) ; Shan et al. (2018); Li & Chan (2019)
IT Human Resources (Predictor variable)	IT skills and knowledge needed include managerial and technical skills relating to collecting, analysing and presenting Big Data Analytics. These are needed to address problems associated with Big Data Analytics and to fully utilise its capabilities to achieve high business performance.	4	Wamba et al. (2017) ; Shan et al. (2018); Behl et al. (2019)
Financial Resources (Predictor variable)	Financial resources are needed to aid the process of innovation and continuous adaptation to market change, stay ahead of the competition, and remain sustainable.	2	Shan et al. (2018)
EO dimensions (Innovativeness, Proactiveness, Risk-taking) (Predictor variables)	Entrepreneurial orientation (EO) defines the ability to take risks be innovative and proactive. These dimensions affect the organisations' processes, practices and decision-making capabilities that enable competitive advantage. The three dimensions (risk-taking, innovativeness and proactiveness) are independent and contribute to business performance.	8	Behl et al. (2019); Dubey at el. (2020); Asad et al., (2021)
BDA Capabilities (Predictor variable or Mediator)	Enable the creation of market insights by obtaining internal and external knowledge. These can influence strategy, processes, productivity, and profitability. This capability is dependent on tangible and intangible resources.	8	Behl et al. (2019) ; Shan et al. (2018); Ferrari et al. (2018); Maroufkhani et al. (2020)
Business Performance (Profitability, Productivity) (Outcome Variables)	The degree to which a company successfully accomplishes its goals and objectives. This comprises non-financial performance indicators like productivity in operations and financial performance indicators like profitability, revenue growth, and return on investment. These aim at increasing shareholder value.	9	Ferrari et al. (2018); Behl et al. (2019); Maroufkhani et al. (2020)

3.6 Time Frame

This study adopted a cross-sectional approach and hence collected data at a single point in time, rather than being a longitudinal study where the aim is to collect data over a prolonged period. A cross-sectional study is inexpensive and gives a good picture of the current state of the phenomenon. Cross-sectional surveys provide standardised data which can be easily coded and completed promptly (Bowling & Ebrahim, 2005). Given the time constraints of completing this study, a longitudinal study could not be adopted, though such a study is appropriate for understanding change over time and the consequences of a phenomenon.

3.7 Target Population and Sampling

The following section contains details of the target population, sampling techniques and sample size used in this study.

3.7.1 Target Population

The population selected for this study were formal South African e-commerce SMMEs. The roles selected within the e-commerce SMMEs were the business owners, business partners, and business managers who are likely to be in decision-making positions and be aware of the organisation's technological investments. These roles were also selected taking into consideration that two-thirds of SMME owners run their business without employees (OECD, 2022).

The South African e-commerce market has experienced high growth since 2019, especially in clothing and apparel, online entertainment, groceries, and fast foods ("South Africa - ECommerce," n.d.-b). The researcher decided not to define separate populations by product offering, type of e-commerce platform, e-commerce business model or channels in which they operate so as to obtain a wide representation of participants. Even though the experiences and success factors of each industry may differ, the researcher aimed to collect data that represents the South African e-commerce landscape as a whole.

This target population was selected because data is generated with every transaction, compared to other industries where data is not generated in large volumes. Data was collected from the number of participants recommended by the sample size calculation.

3.7.2 Sampling Technique and Sample Size

Sampling is a technique used by researchers to systematically select a subset of the target population to be participants in their research (Sharma, 2017). Probability sampling means that

all items in the population have an equal chance of being included in the sample. This increases the chance that the sample will be a true representation of the population and therefore this technique has good freedom from bias. However, it takes time and energy which are costly and there may be to the sampling errors (Taherdoost, 2016). Non-probability sampling cannot be generalised to a target population as the selected group of participants are not necessarily representative of the population or selected randomly; a rationale (often accessibility or convenience) is applied in their selection (Taherdoost, 2016).

This study aimed to generalise the results to the South African e-commerce SMME population in line with the philosophical stance. Therefore, a probability simple random sampling technique was appropriate for the study. This technique involves randomly selecting participants from a complete list of candidates thereby avoiding sampling bias. The researcher used business directories and online searches to create a reasonably complete list of candidates from which the desired sample was randomly selected.

According to SEDA (2022), there were 792 838 formal SMMEs in South Africa by quarter 3 of 2021 (see Figure 2). Of these 310 792 (39,2%) operate in trade and accommodation. E-commerce platforms facilitate trade therefore the trade and accommodation category was considered for this study. Although the official number of SMMEs in South Africa has been widely reported by the South African government and various other publications, the official number of SMMEs engaged in e-commerce is not well documented. However, Thenga (2020) estimates that there were about 5 000 e-commerce businesses in South Africa at the time of their study.

KEY INDICATORS	2021Q3	2022Q2	2022Q3	q-o-q change	y-o-y change
Number of SMMEs	2 404 564	2 535 238	2 683 602	5.9%	11.6%
Number of formal SMMEs	677 786	680 830	792 838	16.5%	17.0%
Number of informal SMMEs	1 641 859	1 777 887	1 791 317	0.8%	9.1%
Number jobs provided	9 758 313	9 310 816	n/a	n/a	n/a
% operating in trade & accommodation	38.1%	39.5%	39.2%	-0.4% pts	1% pts
% operating in community services	13.5%	13.5%	14.6%	1.2% pts	1.2% pts
% operating in construction	13.1%	14.4%	14.4%	0% pts	1.3% pts
% operating in fin. & business services	16.0%	13.8%	12.1%	-1.7% pts	-3.9% pts
% black-owned formal SMMEs	73.6%	75.5%	75.7%	0.2% pts	2.1% pts
% contribution of SMEs* to turnover of all enterprises#	-55.5%	38.3%	36.1%	-2.1% pts	91.7% pts

Figure 2: SMME Q3 of 2021 Key Indicators (SEDA, 2022)

The Raosoft sample size calculator (http://www.raosoft.com/samplesize.html), a free online tool, was used to determine the sample size considering the population size, the margin of error and the confidence level. The calculator uses the formula given below, where the sample size

is n and margin of error E, N is the population size, r is the fraction of responses, and $Z(c/100)$ is the critical value for the confidence level c (Raosoft,2014).

$$x = Z(^{c}/_{100})^{2} r(100-r)$$

$$n = {}^{N\,x}/_{((N-1)\,E^{2}+x)}$$

$$E = \text{Sqrt}\,[{}^{(N-n)\,x}/_{n(N-1)}]$$

Based on the Raosoft calculation, the sample required was 257 from a population of 5 000 e-commerce SMMEs, as estimated by Thenga (2020) and 271 from a population of 310 792 trade and accommodation SMMEs as reported by SEDA (2022). This is based on a 90% confidence level, 5% margin of error and 50% response distribution, which is recommended if the skewness is not predetermined. The research chose the lower sample size of 257 respondents due to the inclusion of accommodation businesses in the SEDA (2022) figures, which were not considered for this study; however, the sample sizes are not vastly different.

3.8 Pilot Study

A pilot study is a mini-version of a full-scale study conducted in preparation for the complete study (van Teijlingen & Hundley, 2002). It allows the researcher to pre-test the research instrument (questionnaire) with a sample of experts who resemble the targeted populations to understand where the participants experience difficulties in answering the questions, identify where the question may be vague, identify if participants had difficulty answering the different types of questions, understand if the pre-defined answers cover all possible answers and how long it takes to complete the survey (van Teijlingen & Hundley, 2002).

A pilot study was not conducted as this study adapted constructs and questions from existing literature as outlined in Table 2. This study builds upon well-established theories and uses previously validated instruments. The researcher deemed the robustness of prior research as a foundation, reducing the need for preliminary testing. The researcher also considered the time constraints of completing this study. This study adopted a cross-sectional approach to limit the collection of data over a prolonged period.

3.9 Data Analysis Methods

All quantitative data collected was exported from the online survey questionnaire in a CSV file format and thereafter loaded into SmartPLS 4 for statistical analyses. The researcher made sense of the data, checked for anomalies, and coded the questions to ensure ease of analysis.

Partial least squares structural equation modelling (PLS-SEM) was adopted for data analysis. Structural equation modelling is a multivariate statistical technique that enables researchers to model and estimate complex relationships between the dependent and independent variables. PLS-SEM is a non-parametric causal-predictive method which emphasises the explanation of the total variance in the dependent variables of the model, unlike covariance-based (CB)-SEM, which only considers the common variance (Shmueli et al., 2019; Buitrago et al., 2021; Hair et al., 2021).

PLS-SEM works efficiently with complex models, has no identification and convergence problem in reflective and formative models, and has high efficiency in parameter estimation, which makes it more statistically powerful than CB-SEM (Shmueli et al., 2019; Buitrago et al., 2021; Hair et al., 2021).

PLS-SEM consists of a structural or inner model which links the constructs, as well as a measurement or outer model that depicts the relationship between the constructs and its indicator (questionnaire items). As depicted in Figure 3, the measurement model consists of exogenous latent variables that explain other variables in the model and endogenous variables that are explained in the model (Hair et al., 2021). PLS-SEM uses a nonparametric bootstrapping procedure that does not rely on any data distributional assumptions; this procedure calculates standard errors of coefficients to assess their statistical significance (Hair et al., 2021). Despite recognising the statistical power of PLS-SEM described in statistical methods textbooks, the researcher also drew inspiration from the reported studies referenced in this paper (Wamba et al., 2017 ; Ferrari et al, 2018 ; Shan et al., 2018 ; Behl et al.; 2019 ; Dubey et al.,2020; Ciampi et al., 2021) which also employed the PLS-SEM procedure.

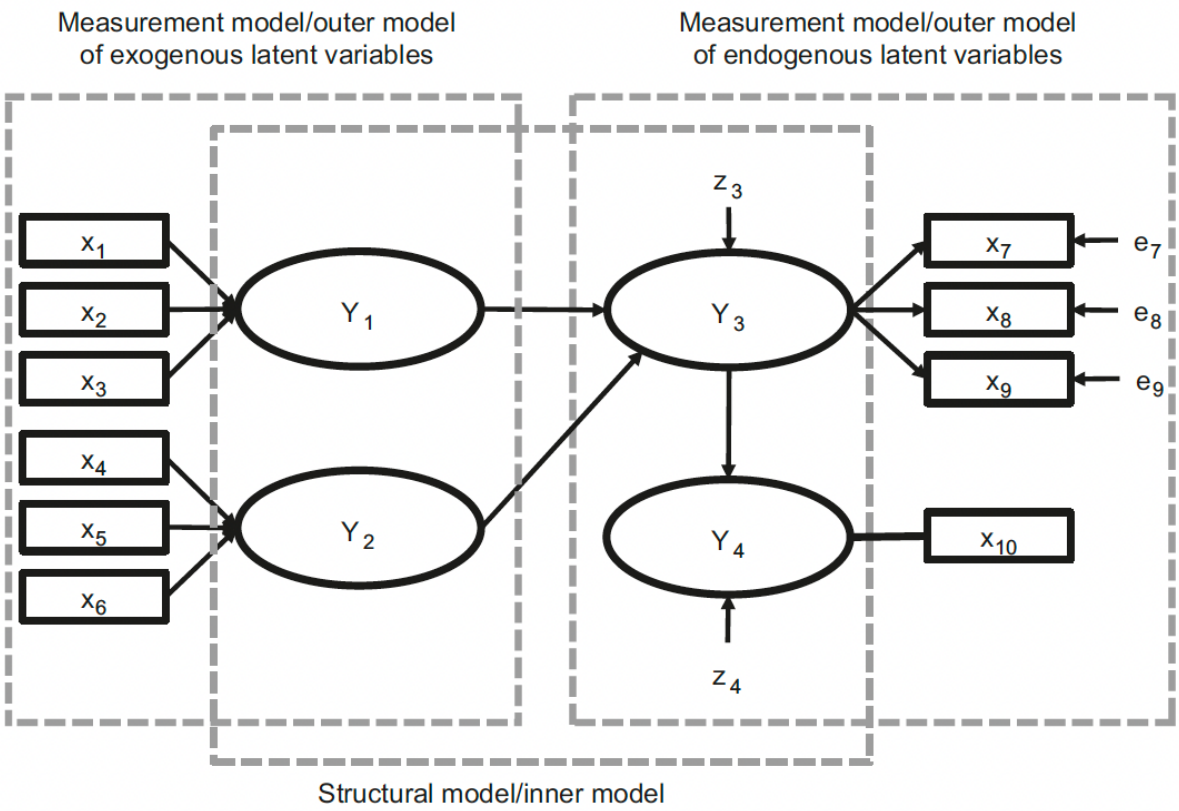

Figure 3: PLS path model (Hair et al., 2021)

The researcher applied the PLS algorithm and bootstrapping procedures in SmartPLS. The PLS algorithm estimates the scores of variables based on the available path model and indicator data and then estimates path model relationships (Hair et al., 2021). Bootstrapping is a resampling method that involves drawing a large number of subsamples, with replacement, from the initial data and estimates models for each subsample. This method is used to determine standard errors of coefficients, enabling the assessment of their statistical significance without making any distribution assumptions (Hair et al., 2021).

The researcher assessed the outer model by testing the internal consistency reliability, construct item reliability, discriminant validity and convergent validity. The outer model was then evaluated by assessing the indicator collinearity, coefficient of determination (R^2) and path coefficient (hypothesis testing). Lastly, path analysis was performed for hypothesis testing. The results are discussed in Chapter 4.

3.10 Ethics

Before commencing the data collection process, ethical clearance was sought and was received from the University of Cape Town Ethics Committee (Appendix B). As part of the application the research instrument, along with the application form were submitted for review. Respondents were informed about the purpose of the study, the anonymity of the responses, and that participants were entering the study voluntarily and could withdraw their participation at any stage. Participants had to indicate on the survey questionnaire if they consented to partake in the study before answering any questions. Confidentiality and anonymity of the respondents were strictly adhered to, as no personal or identifiable information was collected about the participants.

3.11 Chapter Summary

This chapter detailed the research design and methodology adopted for this study. It also highlighted the philosophical underpinnings of the research. An objective ontological stance and positivist epistemological stance were adopted for this study, which followed a deductive approach using a quantitative method. A survey research strategy was adopted for the data collection. A questionnaire research instrument using a five-point Likert scale with closed-ended questions was used for completion by owners or managers from targeted sample of 257 e-commerce SMMEs in South Africa. Given the time constraints for completing this study, a cross-sectional approach was employed. PLS-SEM was adopted as a suitable procedure for data analysis. This procedure was performed using SmartPLS 4 by applying the PLS algorithm and bootstrapping procedures.

Chapter 4: Data Analysis, Findings and Discussions

4.1 Introduction

The study intended to investigate the combined impact of organisational resources and entrepreneurial orientation dimensions on BDA capabilities and the mediating effect of BDA capabilities on the business performance of South African e-commerce SMMEs. This was achieved by examining the responses from e-commerce SMMEs in South Africa to address the research objectives.

This chapter presents the study's empirical analysis and findings, which form the foundation for the conclusion and recommendations. It begins with an overview of the demographic analysis of the sample. The measurement model was evaluated by assessing indicator reliability, internal consistency reliability, convergent validity, and discriminant validity, thereby testing the internal consistency and reliability of the model (Hair et al., 2021). The structural model was evaluated by calculating indicator collinearity and the coefficient of determination. Lastly, the hypotheses were tested, and the findings were discussed.

4.2 Demographic Analysis

The survey received 288 responses (see Table 3). The majority of respondents were in the age group of 31-40 years (46%), followed by 18-30 years (22%), with the more than 50 years age group receiving the lowest number of responses (14%). The majority of respondents indicated that they have a postgraduate degree (57%), followed by university degree holders; the group of higher certificate holders was the smallest (2%). The only two positions within the organisation of the respondents were business owners (80%), followed by business managers (20%) as the respondents were intentionally selected to be owners or managers in decision-making positions and most likely to be aware of technological investments and developments in the business environment. The majority of the SMMEs surveyed had been in business for 3-5 years (49%), followed by 6-9 years (27%) while 7% had been in business for less than one year. The largest group of the surveyed SMMEs had 2-5 employees (35%), with the smallest group indicating that they have 51 or more employees (3%). The majority of respondents indicated that they were in the beauty and personal care industry (46%), followed by the clothing industry (32%), with the fewest respondents in the home and kitchen industry (2%).

Table 3: Participants Demographics

Demography	Category	Frequency	Percentage
Age	18-30 years	63	22%
	31-40 years	133	46%
	41-50 years	52	18%
	More than 50 years	40	14%
Level of Education	Training Certificate	8	3%
	Higher Certificate	6	2%
	Diploma	29	10%
	University Degree	81	28%
	Postgraduate Degree	164	57%
Position	Business Owner	230	80%
	Business Manager	58	20%
Age of Business	<1 year	20	7%
	1-2 years	22	8%
	3-5 years	141	49%
	6-9 years	77	27%
	10+ years	28	10%
Number of Employees	Only 1	17	6%
	2-5 employees	101	35%
	6-10 employees	81	28%
	11-20 employees	55	19%
	21-50 employees	26	9%
	51 employees and above	8	3%
Product Offering	Arts, Crafts & Sewing (paints, ceramics, etc.)	9	3%
	Beauty & Personal Care (cosmetics, shaving kit, etc.)	132	46%
	Books (print or digital), Magazines & Newspapers	34	12%
	Clothing	92	32%
	Electronics (TVs, smart watches, etc.)	14	5%
	Home & Kitchen (furniture, coffee makers, etc.)	7	2%

4.3 Outer Model (Measurement model) Assessment Findings

The outer model assessed the relationship between the constructs and their indicators in the developed conceptual model. The outer model was assessed using the four-step assessment procedure proposed by Hair et al. (2021). Firstly, indicator reliability was assessed; secondly, internal consistency reliability was assessed; thirdly, convergent validity was assessed and finally, discriminant validity was assessed (Hair et al., 2021). The PLS Algorithm was executed in SmartPLS 4 to calculate the model's reliability and validity.

4.3.1 Indicator Reliability

Indicator reliability analyses the extent to which the indicator's variance is explained by its construct. The indicator's explained variance is computed by squaring the indicator's loading to create the bivariate correlation between the indicator and its construct. Therefore, indicator reliability denotes the commonality of an indicator. It is recommended that the indicator loadings be above 0,7 for the construct to explain more than 50% of the indicator's variance. Indicator loadings below 0,4 should be considered for removal to increase the internal consistency reliability or convergence validity (Hair et al., 2021).

The indicator reliability was assessed by observing the outer loadings of the analysed data. The observed outer loadings for each indicator, computed through PLS-SEM, loaded higher than 0,7 as Hair et al. (2021) recommended. Hence, no indicators were considered for removal. The results indicate that the variance in each of the indicators is attributable to its constructs and that the indicators are consistent and valid measurements of their respective constructs. The results are shown in Appendix D, with indicator coding in Appendix C.

4.3.2 Internal Consistency Reliability

Internal consistency reliability measures the degree to which indicators of the same construct are associated with each other (Hair et al., 2021). The primary PLS-SEM internal consistency reliability measures are Jöreskog's composite reliability, Cronbach's alpha and Dijkstra composite reliability.

Cronbach's alpha measures the interrelatedness among indicators (Ringle et al., 2014). It measures internal consistency reliability by assuming that all indicators have equal loadings, therefore producing fairly low reliability values (Hair et al., 2021). In contrast, composite reliability (rho_c) does not assume that all indicators have equal loadings. As a result, rho_c is more forgiving as it prioritises indicators according to their reliability, compared to Cronbach's alpha, which is sensitive to the number of indicators, making it rather conservative (Ringle et

al., 2014; Hair et al., 2021). It was for this reason that rho_c was introduced as an alternative to the very liberal composite reliability (rho_a) and the more conservative Cronbach's alpha; it lies in between the other two and is considered to be consistent (Hair et al., 2021).

Values between 0,6 and 0,7 are acceptable for all three methods (Rho_c, Cronbach's alpha and rho_a,), values above 0,7 are satisfactory to good, but values near 0,95 are considered problematic (Hair et al., 2021).

Table 4 provides the internal consistency reliability results of this study. The lowest Cronbach's alpha observed is 0,738 for EO Innovativeness, and the highest is 0,921 for BDA Capabilities. The lowest observed rho_c coefficient is 0,839 representing Business Performance Productivity, while the highest rho_c coefficient is 0,935 for BDA Capabilities. The rho_a's lowest coefficient is 0,744 representing Business Performance Productivity, and the highest observer coefficient is 0,928 for BDA Capabilities. The results of this study indicate an internal consistency reliability in the measurement model as assessed against the recommended thresholds.

Table 4: Measurement Mode Internal Consistency Reliability

	Cronbach's alpha	**Composite reliability (rho_a)**	**Composite reliability (rho_c)**
BDA Capabilities	0,921	0,928	0,935
Business Performance - Profitability	0,853	0,858	0,891
Business Performance - Productivity	0,744	0,744	0,839
EO - Innovativeness	0,738	0,765	0,851
EO - Proactiveness	0,841	0,842	0,926
EO - Risk-taking	0,834	0,917	0,898
Financial Resources	0,762	0,808	0,891
IT Human Resources	0,886	0,887	0,921
IT Infrastructure	0,811	0,834	0,874

4.3.3 Convergent Validity

Convergent validity measures the degree to which the constructs converge to explain the variation in the indicators. This is measured by the indicator's average variance extracted

(AVE) for each construct. AVE is computed as the sum of all squared loadings divided by the number of indicators, indicating the commonality of each construct (Ringle et al., 2014; Hair et al., 2021). The minimum acceptable AVE is 0,50, which indicates that a construct can, on average, explain more than half of the variance of its indicators that make up the construct (Hair et al., 2021).

The observed AVEs of this study (see Table 5), range between 0,565 and 0,862, demonstrating sufficient convergent validity of the measurement model compared to the recommended acceptable values.

Table 5: Measurement Model Convergent Validity

	AVE
BDA Capabilities	0,644
Business Performance - Profitability	0,577
Business Performance - Productivity	0,565
EO - Innovativeness	0,657
EO - Proactiveness	0,862
EO - Risk-taking	0,748
Financial Resources	0,804
IT Human Resources	0,746
IT Infrastructure	0,635

4.3.4 Discriminant Validity

The last step in evaluating the outer model is assessing the discriminant validity. Discriminant validity measures the degree to which each construct differs empirically from other measurement model constructs (Hair et al., 2021). In PLS-SEM, discriminant validity can be assessed using the Fornell-Larcker criterion, Heterotrait-monotrait ratio (HTMT) and cross-loadings.

The Fornell-Larcker criterion measures discriminant validity by ensuring that the square of AVE for the construct is greater than its correlation with all the other constructs (Ringle et al., 2014; Hair et al., 2021). Table 6 depicts the results of the Fornell-Larcker criterion for this study. The square root of AVE for all constructs was greater than their

Table 6: Fornell-Larcker criterion results

	BDA Capabilities	**Business Performance Profitability**	**Business Performance Productivity**	**EO Innovativeness**	**EO Proactiveness**	**EO Risk-taking**	**Financial Resources**	**IT Human Resources**	**IT Infrastructure**
BDA Capabilities	0,803								
Business Performance Profitability	0,580	0,760							
Business Performance Productivity	0,594	0,545	0,752						
EO Innovativeness	0,521	0,425	0,543	0,811					
EO Proactiveness	0,424	0,287	0,503	0,450	0,929				
EO Risk-taking	0,379	0,300	0,307	0,290	0,222	0,865			
Financial Resources	0,490	0,529	0,492	0,476	0,437	0,264	0,897		
IT Human Resources	0,578	0,487	0,636	0,689	0,616	0,327	0,485	0,864	
IT Infrastructure	0,472	0,494	0,541	0,387	0,339	0,316	0,450	0,430	0,797

correlation with other constructs in the measurement model, establishing a strong discriminant validity according to the Fornell-Larcker criterion.

The heterotrait-monotrait ratio (HTMT) was introduced as a measure that improves on a shortfall of the Fornell-Larcker criterion, where the indicator loadings on a construct differ slightly. HTMT measures the relationships across all constructs by comparing the correlations between different indicators (heterotrait–heteromethod correlations) relative to the correlations between the indicators of the same construct (monotrait–heteromethod correlation) (Ringle et al., 2014; Hair et al., 2021). HTMT values above 0,9 for conceptually similar constructs and values above 0,85 for conceptually different constructs point to problems with the measurement model and suggest that there is no discriminant validity (Hair et al., 2021). The observed HTMT values for this study (see Table 7) are below the 0,85 threshold and confirm the discriminant validity of the measurement model.

The cross-loading approach requires that the factor loading indicators of each construct must be higher than the factor loading of other constructs in the measurement model, with each indicator loading higher than 0,7 (Buitrago et al., 2021). The observed cross-loadings, as shown in Appendix E for all indicators, were higher on their constructs than other constructs, i.e. each factor loading was greater than the minimum value of 0,70.

4.4 Inner Model (Structural Model) Assessment Findings

4.4.1 Indicator Collinearity

Structural model coefficients for the relationships between constructs are determined by estimating a sequence of regression equations. The structural model regressions need to be assessed for potential collinearity issues due to the possibility of bias resulting from strong correlations among predictor constructs (Hair et al., 2021). This process is similar to that of the outer model measurement model. However, in this instance the construct scores of the predictor constructs in each regression in the structural model are employed to calculate the variance inflation factor (VIF) values (Buitrago et al., 2021; Hair et al., 2021). VIF values should be lower than 3; values higher than 3 indicate probable collinearity issues among the predictor constructs values (Buitrago et al., 2021; Hair et al., 2021).

Table 7: Heterotrait-monotrait ratio (HTMT) results

	BDA Capabilities	**Business Performance Profitability**	**Business Performance Productivity**	**EO Innovativeness**	**EO Proactiveness**	**EO Risk-taking**	**Financial Resources**	**IT Human Resources**	**IT Infrastructure**
BDA Capabilities									
Business Performance Profitability	0,633								
Business Performance Productivity	0,699	0,687							
EO Innovativeness	0,620	0,512	0,723						
EO Proactiveness	0,469	0,336	0,640	0,548					
EO Risk-taking	0,404	0,344	0,386	0,379	0,260				
Financial Resources	0,567	0,633	0,645	0,604	0,545	0,321			
IT Human Resources	0,623	0,557	0,785	0,829	0,713	0,388	0,578		
IT Infrastructure	0,514	0,581	0,675	0,477	0,403	0,366	0,553	0,494	

All observed VIF values for this study were less than 3 (see Table 8), indicating no probable collinearity issues among the predictor constructs.

Table 8: Variance inflation factor (VIF) Results

Item	VIF	Item	VIF	Item	VIF	Item	VIF
BDA1	2,337	EOI1	1,685	BPD1	1,526	FR1	1,608
BDA2	2,792	EOI2	1,671	BPD2	1,517	FR2	1,608
BDA3	2,738	EOI3	1,285	BPD3	1,377	IT1	2,247
BDA4	2,473	EOP1	2,108	BPD4	1,336	IT2	2,301
BDA5	2,215	EOP2	2,108	BPF1	1,836	IT3	1,737
BDA6	2,653	EOR1	2,495	BPF2	2,013	IT4	1,665
BDA7	2,515	EOR2	2,303	BPF3	1,774	ITH1	1,987
BDA8	2,184	EOR3	1,605	BPF4	1,630	ITH2	2,739
				BPF5	2,218	ITH3	2,335
				BPF6	2,157	ITH4	2,452

4.4.2 Coefficient of Determination (R^2)

The coefficient of determination is used to analyse the model's predictive power. The R^2 value indicates the variance accounted for in each latent construct. The R^2 value ranges from 0 to 1, with higher values indicating a greater predictive power of the model. R^2 values below 0,25 are considered very weak, above 0,25 are considered moderate and values above 0,75 can be considered substantial (Hair et al., 2021). A high R^2 value can indicate that the model overfits the data, which means that the model has the potential to not fit another sample drawn from the same population. R^2 values should be interpreted taking into account the study's context and the model's complexity (Shmueli et al., 2019; Hair et al., 2021).

The observed R^2 value was 0,456 for the relationship between the mediating variable BDA Capabilities and the independent variables (EO Innovativeness, EO Risk-taking, Financial Resources, IT Human Resources and IT Infrastructure), explaining 45,6% of the variance (Table 9). The observed R^2 value was 0,336 for the relationship between the dependent variable Business Performance Profitability and the mediating variable BDA Capabilities (see Table 8). Hence it explains 33,6% of the variance. The observed R^2 value was 0,353 for the relationship between the dependent variable Business Performance Productivity

and the mediating variable BDA Capabilities, explaining 35,3% of the variance. According to the R^2 guidelines (Hair et al., 2021), this study's R^2 values indicate that the included independent variable and mediating variable significantly impact the variance seen in the dependent variables, indicating the model's predictive power.

Table 9: Coefficient of Determination (R^2)

	Coefficient of Determination (R^2)
BDA Capabilities	0,456
Business Performance - Profitability	0,336
Business Performance - Productivity	0,353

4.5 Hypothesis Testing and Path Coefficients

An analysis of the path coefficients and their statistical significance and hypothesis testing were performed to answer the research question posed in this study. Path coefficient values fall between -1 and 1, with negative values indicating a negative relationship and positive values indicating a positive relationship (Buitrago et al., 2021; Hair et al., 2021). Each hypothesis was assessed based on the significance levels (p-value less than 0,05) at 95% confidence level, t-values greater than 1.96 at 95% confidence level and the explained variance of the dependent variables (R^2). The t-value indicates the strength and direction of the relationship between the independent and dependent variables concerning the variance in the data. High path coefficient values for each hypothesis indicate that the independent variable significantly affects the dependent variable (Buitrago et al., 2021; Hair et al., 2021). This assessment was performed through the SmartPLS bootstrapping approach.

4.5.1 Organisational Resource and BDA Capabilities

As stated previously, this study recognises the impact of organisational resources such as IT infrastructure, IT human resources and financial resources on BDA capabilities. Literature has shown the importance of IT infrastructure, having the right IT human resources and the availability of financial resources, all of which enable organisations to exploit these resources in the innovative implementation of BDA (Wamba et al., 2017; Shan et al., 2018; Li & Chan, 2019). Behl et al. (2019) also highlighted the positive impact of BDA capabilities on the business performance of technology SMMEs such as those in e-commerce.

The researcher sought to investigate the impact of organisational resources (IT infrastructure, IT human resources and financial resources) on the BDA capabilities of South African e-commerce SMMEs. Therefore, the following hypotheses were tested:

Hypothesis H1a: IT Infrastructure has a positive impact on BDA Capabilities.

IT infrastructural components enable the business to perform daily activities digitally and increase BDA capability. IT infrastructure must be able to integrate internal and external data sources, store data, and by enabling processing and visualisation assist the users to gain insights. IT infrastructure must also be flexible to be able to cope with the continually increasing data volume. It allows organisations to successfully navigate the data-driven landscape, gain competitive advantage and make well-informed decisions in the dynamic digital environment (Wamba et al., 2017; Shan et al., 2018; Li & Chan, 2019). This study hypothesised that IT infrastructure has a positive impact on BDA capabilities.

The results from PLS-SEM (see Table 10) show that IT Infrastructure had a statistically significant positive influence ($\beta = 0{,}175$, $p < 0{,}002$, $t = 2{,}856$) on BDA Capabilities. Therefore, H1a was supported. It was found that a one-unit increase in IT Infrastructure led to a 0,175 unit increase in BDA Capabilities. IT Infrastructure was identified as being the second strongest organisational resource that contributed to predictions of BDA Capabilities. These results align with studies by Shan et al. (2018) who found a significant impact of IT infrastructure on BDA capabilities, and Wamba et al.(2017) who found IT infrastructure to be a key component of BDA capabilities.

Obtaining a proper IT infrastructure is critical to the success of e-commerce SMMEs as it allows e-commerce SMMEs to handle large volumes of data, secure transactions, deliver personalised experiences, and streamline operations efficiently using BDA capabilities. These operations would be challenging, possibly resulting in missed opportunities and inefficiencies without a highly scalable, secure, and responsive IT infrastructure. Hence the critical role that IT infrastructure plays in e-commerce's ability to use BDA capabilities for profitability and productivity is clear (Zhu, 2004; Akter & Wamba, 2016; Yang et al., 2022).

The positive impact of IT infrastructure on BDA capabilities found in this study highlights the fact that South African e-commerce SMMEs believe that their existing IT infrastructure is reliable, scalable, flexible, and meets customer needs and that this has enabled them to build and use BDA capabilities to improve their business performance.

Hypothesis H1b: IT Human Resources have a positive impact on BDA Capabilities.

'IT human resources' refers specifically to employees' or consultants' IT skills and knowledge, including managerial and technical skills relating to collecting, analysing and presenting insights derived from BDA capabilities. These are the foundational knowledge and skills necessary for addressing problems associated with BDA and for unlocking its full potential to drive high business performance (Wamba et al., 2017; Shan et al., 2018; Behl et al., 2019). This study hypothesised that IT human resources positively impact BDA capabilities.

The results from PLS-SEM (see Table 10) show that IT Human Resources had a statistically significant positive influence ($\beta = 0{,}253$, $p < 0{,}000$, $t = 3{,}734$) on BDA Capabilities. Therefore, H1b was supported by this study's data. It was found that a one-unit increase in IT Human Resources led to a 0,253 unit increase in BDA Capabilities. IT Human Resources was the organisational resource that contributed most to a prediction of BDA Capabilities, though suggesting a moderate influence. This highlights the big need for IT skills and knowledge in improving BDA capabilities and concurs with the findings of Wamba et al. (2017) and Shan et al. (2018).

Seseni and Mbohwa (2021) noted that South African SMMEs are often faced with a shortage of IT skills. Behl et al. (2019) also argue that IT skills are difficult to find, compensate for, and retain, especially in the case of SMMEs as there is a high demand for these skills in the market.

This study has found that according to the respondents South African e-commerce SMMEs currently do have the necessary skills to use BDA capabilities, interpret insights from their data, learn new technologies and solve business problems using technology. A path coefficient of 0,253 indicates a moderate influence, which may suggest that some South African e-commerce SMMEs do not have the right IT skills to exploit BDA capabilities.

Hypothesis H1c: Financial Resources have a positive impact on BDA Capabilities.

Financial resources are needed to aid the process of innovation and continuous adaptation to the dynamic business environment and to stay ahead of the competition (Shan et al., 2018). Adequate financial resources are essential in building BDA capabilities and acquiring the right IT infrastructure (Gupta and George, 2016; Shan et al., 2018). This study hypothesised that financial resources have a positive impact on BDA capabilities.

The results from PLS-SEM (see Table 10) show that Financial Resources had a statistically significant positive influence (β = 0,166, p <0,006, t = 2,525) on BDA Capabilities. Therefore, H1c was supported by this study's data. It was found that a one-unit increase in Financial Resources leads to a 0,166 unit increase in BDA Capabilities. Wamba et al. (2017) and Shan et al. (2018) support the assertion that financial resources have a positive impact on BDA capabilities.

A sufficient investment in BDA capabilities enables SMMEs to improve their profitability, allowing them to reinvest the profit into innovative initiatives, gain and retain skilled workforce, and improve their BDA capabilities (Alrumiah and Hadwan, 2021; Li and Zhang, 2021; Seseni & Mbohwa, 2021).

Table 10: Organisational Resource Hypotheses Results

Hypothesis	Relationship	Path Coefficient (β)	STDEV	T-value	P-value	5.0% LCL	95.0% UCL	Decision
H1a	IT Infrastructure -> BDA Capabilities	0,175	0,061	2,856	0,002	0,078	0,280	Supported
H1b	IT Human Resources -> BDA Capabilities	0,253	0,068	3,734	0,000	0,139	0,361	Supported
H1c	Financial Resources -> BDA Capabilities	0,166	0,066	2,525	0,006	0,059	0,276	Supported

4.5.2 Entrepreneurial Orientation Dimensions and BDA Capabilities

SMMEs require EO abilities to operate in dynamic environments such as e-commerce. EO abilities enable SMMEs to create new opportunities for business growth by being innovative, proactive and taking risks. These qualities boost BDA capabilities, and hence lead to improved business performance (Asad et al., (2021). Since innovation has been found to be a key factor for e-commerce SMMEs (Behl et al., 2019), organisations need to commit resources to develop BDA capabilities, allowing them to take advantage of data-driven insights. These insights gained through BDA capabilities equip SMMEs with the tools to make decisions that significantly reduce their business risks and the confidence to initiate strategic business

endeavours proactively. This data-driven proactive approach has significantly improved overall business performance, highting the relationship between an EO dimension and the development and application of BDA capabilities (Asad et al., 2021; Behl et al., 2019; Dubey et al., 2020; Naz et al., 2022). The researcher sought to investigate the impact of the EO dimensions (Risk-taking, Proactiveness, Innovativeness) on the BDA capabilities of South African e-commerce SMMEs therefore, the following hypotheses were tested:

Hypothesis H2a: EO's Risk-taking has a positive impact on BDA Capabilities.

Risk-taking represents the degree to which SMMEs are willing to commit financial resources to pursuing initiatives with uncertain results and potential costs of failure. These can include the investment in BDA capabilities (Ciampi et al., 2021).

The results from PLS-SEM (see Table 11) indicate that EO's dimension of Risk-taking had a statistically significant positive influence (β = 0,148, p <0,002, t = 2,824) on BDA Capabilities. Therefore, H2a was supported by this study's data. It was found that a one-unit increase in Risk-taking led to a 0,148 unit increase in BDA Capabilities. This indicates the positive impact that risk-taking has on BDA capabilities. These findings support the findings reported from prior studies which found that the EO dimension of risk-taking had a significant impact on the BDA capabilities of SMMEs, indicating its importance in enabling BDA capabilities (Asad et al., 2021; Behl et al., 2019; Dubey et al.,2020; Naz et al., 2022).

Hypothesis H2b: EO's Proactiveness has a positive impact on BDA Capabilities.

Proactiveness is reflected in the SMMEs' approach to using BDA capabilities for strategic advantage. It implies that organisations actively seek to use BDA capabilities before issues arise or changes become necessary (Lomberg et al., 2017; Dubey et al., 2020; Ciampi et al., 2021).

The results from PLS-SEM (see Table 11) indicate that EO's Proactiveness dimension did not have a statistically significant influence (β = 0,042, p <0,151, t = 1,032) on BDA Capabilities. Hence, H2b was not supported empirically as it did not indicate a positive impact on BDA Capabilities. These findings do not support the findings of other researchers who found proactiveness to have a significant impact on BDA capabilities of SMMEs (Asad et al., 2021; Behl et al., 2019; Dubey et al.,2020; Naz et al., 2022).

The maturity level of the BDA capabilities studied in the research reported here may have influenced the level of proactiveness in using BDA capabilities. An organisation in the early stage of developing BDA capabilities may operate differently from those having a fairly high level of maturity (Król & Zdonek, 2020). BDA capabilities maturing can be described as the progression of an organisation in integrating, managing, and leveraging all relevant internal and external data sources for use at critical decision points, creating an ecosystem of data-driven insights (Król & Zdonek, 2020). Organisations in the initial stage of maturity are in a learning phase, where they are only starting to use BDA capabilities to gain insights based on their day-to-day business activities. However, they are not yet proactively using BDA capabilities to build strategies. Organisation at the highest level of maturity are in an advanced phase where they regularly use BDA capabilities to predict outcomes and build data driven strategies (Król & Zdonek, 2020). The findings of this study suggest that South African e-commerce SMMEs are mostly still in the learning maturity phase.

Hypothesis H2c: EO's Innovativeness has a positive impact on BDA Capabilities.

Innovativeness is the ability to identify and capitalise on market opportunities ahead of competitors; the resulting process is often associated with high risks and costs (Asad et al., 2021; Ciampi et al., 2021). E-commerce SMMEs exhibit a strong propensity for technological innovation, such as BDA capabilities (Lomberg et al., 2017; Behl et al., 2019). These organisations not only see the choice to make an investment in BDA capabilities as a strategic one but also that such an investment provides a means for mitigating the risks associated with business innovation and aids in making informed business decisions (Lomberg et al., 2017; Behl et al., 2019; Asad et al., 2021). Thus, this study hypothesised that EO's innovativeness positively impacts BDA capabilities.

The results from PLS-SEM (see Table 11) indicate that EO's dimension of Innovativeness had a statistically significant positive influence ($\beta = 0{,}138$, $p < 0{,}003$, $t = 2{,}797$) on BDA Capabilities. Therefore, H2c was empirically supported. It was found that a one-unit increase in Innovativeness leads to a 0,138 unit increase in BDA Capabilities. This indicates the extent of the positive impact that Innovativeness has on BDA Capabilities. These findings align with prior studies that found that EO dimensions of innovativeness has a significant impact on BDA capabilities of SMMEs, indicating its importance in enabling BDA capabilities (Asad et al., 2021; Behl et al., 2019; Dubey et al.,2020; Naz et al., 2022).

Table 11: Entrepreneurial Orientation Hypotheses Results

Hypothesis	Relationship	Path Coefficient (β)	STDEV	T-value	P-value	5.0% LCL	95.0% UCL	Decision
H2a	EO Risk-taking -> Big Data Analytics Capabilities	0,148	0,052	2,824	0,002	0,066	0,234	Supported
H2b	EO Proactiveness -> Big Data Analytics Capabilities	0,042	0,040	1,032	0,151	-0,024	0,109	Not Supported
H2c	EO Innovativeness -> Big Data Analytics Capabilities	0,138	0,050	2,797	0,003	0,061	0,223	Supported

4.5.3 Mediating Effects of BDA Capabilities

A mediating variable creates a link between the independent variable and the dependent variable to explain the process of the relationship and why and how a cause leads to an outcome (Abu-Bader & Jones, 2021). Grounded in RBV and DCV, BDA capabilities have been identified as a critical resource in organisational value creation, especially in the dynamic business environment of e-commerce SMMEs (Dubey et al., 2020; Horng et al., 2022).

Organisational resources such as IT infrastructure, IT human resources and financial resources have been found to influence the innovative implementation of BDA capabilities and improve business performance (Wamba et al., 2017; Shan et al., 2018; Batistič & der Laken, 2019; Li & Chan, 2019; Behl et al., 2019). In the SMME landscape, entrepreneurially-oriented organisations have shown a strong inclination to use BDA capabilities to improve their business performance compared with organisations where factors such as innovation are less pronounced (Lomberg et al., 2017; Dubey et al., 2020; Asad et al., 2021). Business performance in the context of this study refers to profitability, which is revenue growth, and productivity, which represents the improvement in business operations (Mangla et al., 2020; Ahmad, 2023). In light of this, this study sought to investigate the mediating effect of BDA capabilities on the relationship between organisational resources, entrepreneurial orientation

dimensions and the business performance of South African e-commerce SMMEs. Therefore, the following hypotheses were tested:

Hypothesis H3a: Organisational Resources (IT Infrastructure, IT Human Resources and Financial Resources) under the mediative effect of BDA Capabilities positively impact Business Performance (Productivity, Profitability).

Based on the results of from PLS-SEM (see Table 12) IT Infrastructure was found to have a statistically significant positive influence ($\beta = 0{,}104$, $p < 0{,}003$, $t = 2{,}740$) on Productivity and a statistically significant positive influence ($\beta = 0{,}101$, $p < 0{,}004$, $t = 2{,}683$) on Profitability under the mediating effect of BDA capabilities. IT Human Resources were found to have a statistically significant positive influence ($\beta = 0{,}150$, $p < 0{,}000$, $t = 3{,}489$) on Productivity and a statistically significant positive influence ($\beta = 0{,}146$, $p < 0{,}000$, $t = 3{,}438$) on Profitability under the mediating effect of BDA capabilities. Financial Resources were found to have a statistically significant positive influence ($\beta = 0{,}099$, $p < 0{,}009$, $t = 2{,}382$) on Productivity and a statistically significant positive influence ($\beta = 0{,}096$, $p < 0{,}011$, $t = 2{,}289$) on Profitability under the mediating effect of BDA capabilities. Therefore, H3a was empirically supported, indicating that BDA Capabilities significantly mediate the relationship between IT Infrastructure, IT Human Resources, Financial Resources, Productivity and Profitability.

These findings indicate the importance of the role BDA of capabilities in facilitating the usage of organisational resources namely, IT infrastructure, IT human resources and financial resources, and improving business profitability and productivity. This indicates that South African e-commerce SMMEs are aware of the business value that BDA capabilities create and the importance of the needed organisational resources in improving business performance. They consider IT human resources to be the most critical organisational resources, followed by IT infrastructure and financial resources. These results emphasise the need for knowledge and skills to address problems associated with BDA and to fully utilise its capabilities to achieve excellent business performance (Shan et al., 2018). This further reinforces the proposition that IT human resources are the key resources of any organisation (Shan et al., 2018).

H3b: Entrepreneurial Orientation dimensions (Risk-taking, Proactiveness, Innovativeness) under the mediative effect of BDA Capabilities positively impact business performance (Productivity, Profitability).

Based on the results of from PLS-SEM (see Table 12), Innovativeness had a statistically significant positive influence (β = 0,082, p <0,003, t = 2,785) on Productivity and a statistically significant positive influence (β = 0,080, p <0,002, t = 2,812) on Profitability under the mediating effect of BDA Capabilities. Proactiveness was found to have a statistically insignificant influence (β = 0,025, p <0,154, t = 1,022) on Productivity and a statistically insignificant influence (β = 0,024, p <0,151, t = 1,031) on Profitability under the mediating effect of BDA Capabilities. Risk-taking was found to have a statistically significant positive influence (β = 0,088, p <0,002, t = 2,854) on Productivity and a statistically significant positive influence (β = 0,086, p <0,003, t = 2,752) on Profitability under the mediating effect of BDA capabilities. Therefore, H3b was partially supported by the significance of Innovativeness and Risk-taking, with Proactiveness proving to be less important due to its empirical insignificance. These results partially concur with those of Asad et al. (2021), who found a strong mediating effect of BDA between EOs' and SMMEs' business performance.

These results suggest that South African e-commerce SMMEs believe that only innovativeness and risk-taking are major factors that influence BDA capabilities. Asad et al. (2021) state that the innovation process is risky, requiring the efficient implementation of BDA not only to reduce risk but also to help in decision-making. South African SMMEs often face financial constraints, and this may influence their proactiveness in actively seeking new market opportunities or new technologies to invest in (Seseni & Mbohwa, 2021). The environmental turbulence caused by the COVID-19 pandemic reduced the resources available (Shen et al., 2020), and may have caused SMMEs to perceive changes in the external environment as more of a threat than an opportunity (Bodlaj & Čater, 2019). However, such crises should make organisations particularly externally oriented, innovative, and proactive.

The observed R^2 value was 0,456 for the relationship between Organisational Resources (IT Infrastructure, IT Human Resources and Financial Resources), Entrepreneurial Orientation dimensions (Risk-taking, Proactiveness, Innovativeness) and the mediating variable BDA Capabilities, explaining 45,6% of the variance and the predictive power of the model.

Table 12: Mediating Effects Hypothesis Results

Hypothesis	Relationship	Path Coefficient (β)	STDEV	T-value	P-value	5.0% LCL	95.0% UCL	Decision
H3a	Financial Resources -> Big Data Analytics Capabilities -> Business Performance - Productivity	0,099	0,041	2,382	0,009	0,033	0,171	Supported
	Financial Resources -> Big Data Analytics Capabilities -> Business Performance Profitability	0,096	0,042	2,289	0,011	0,032	0,172	Supported
	IT Human Resources -> Big Data Analytics Capabilities -> Business Performance - Productivity	0,150	0,043	3,489	0,000	0,082	0,222	Supported
	IT Human Resources -> Big Data Analytics Capabilities -> Business Performance Profitability	0,146	0,043	3,438	0,000	0,079	0,218	Supported
	IT Infrastructure -> Big Data Analytics Capabilities -> Business Performance - Productivity	0,104	0,038	2,740	0,003	0,046	0,171	Supported
	IT Infrastructure -> Big Data Analytics Capabilities -> Business Performance Profitability	0,101	0,038	2,683	0,004	0,045	0,168	Supported

Hypothesis	Relationship	Path Coefficient (β)	STDEV	T-value	P-value	5.0% LCL	95.0% UCL	Decision
H3b	EO Innovativeness -> Big Data Analytics Capabilities -> Business Performance - Productivity	0,082	0,030	2,785	0,003	0,036	0,133	Supported
	EO Innovativeness -> Big Data Analytics Capabilities -> Business Performance Profitability	0,080	0,029	2,812	0,002	0,035	0,129	Supported
	EO Proactiveness -> Big Data Analytics Capabilities -> Business Performance - Productivity	0,025	0,024	1,022	0,154	-0,015	0,065	Not Supported
	EO Proactiveness -> Big Data Analytics Capabilities -> Business Performance Profitability	0,024	0,023	1,031	0,151	-0,015	0,063	Not Supported
	EO Risk-taking -> Big Data Analytics Capabilities -> Business Performance - Productivity	0,088	0,031	2,854	0,002	0,039	0,139	Supported
	EO Risk-taking -> Big Data Analytics Capabilities -> Business Performance Profitability	0,086	0,031	2,752	0,003	0,037	0,138	Supported

4.5.4 Big Data Analytics Capabilities and Business Performance

BDA capabilities are built by effectively exploiting valuable insights derived from BDA to support data-driven decision-making (Yasmin et al., 2020). These have equipped e-commerce SMMEs with insights into their customers' preferences and experiences, which improves their operations and increases their ability to generate profit (Akter & Wamba, 2016; Goga et al.,2019). The measurement of business performance through profitability refers to revenue growth, and the measurement through productivity refers to improvements across various processes of operations (Mangla et al., 2020; Ahmad, 2023). This research sought to investigate the impact of BDA capabilities on the business performance of South African e-commerce SMMEs therefore, the following hypotheses were tested:

Hypothesis H4a: BDA Capabilities have a positive impact on Productivity.

The results from PLS-SEM (see Table 13) show that BDA Capability had a statistically significant positive influence ($\beta = 0{,}594$, $p < 0{,}000$, $t = 15{,}914$) on the business performance Productivity. Therefore, H4a was supported. It was found that a one-unit increase in BDA Capabilities leads to a 0,594 unit increase in Productivity. The observed R^2 value was 0,353 for the relationship between the dependent variable Productivity and the mediating variable BDA Capabilities. This explains 35,3% of the variability in the dependent variable, which can be explained by the independent variable, thus depicting the prediction power of the model.

These results suggest that South African e-commerce SMMEs have experienced the positive impact of BDA capabilities on their productivity. BDA capabilities increase productivity by providing South African e-commerce SMMEs with the means to personalise their customer experience by analysing large volumes of customer data, including browsing history, purchase behaviours, and customer demographics. Additionally, they can optimise inventory and their supply chain. With the help of real-time analytics, these organisations can monitor operational inefficiencies such as website downtime and payment processing failures, giving them valuable insights, which assist them to make informed decisions (Wamba, 2016; Goga et al., 2019).

Previous studies have explored the positive impact of BDA capabilities on business performance, in line with this study's findings. In their study, Raguseo and Vitari (2018) found that investment in BDA capabilities improves the financial performance of a business. BDA

capabilities improved the revenue of e-commerce SMMEs and the customer experience by offering personalised products and services (Alrumiah & Hadwan, 2021).

Hypothesis H4b: BDA capabilities have a positive impact on Profitability.

The results from PLS-SEM (see Table 13) show that BDA Capabilities had a statistically significant positive influence ($\beta = 0{,}580$, $p < 0{,}000$, $t = 11{,}763$) on the Profitability of a business. Therefore, H4b was supported. Thus, a one-unit increase in BDA Capabilities leads to a 0,580 unit increase in Productivity. The observed R^2 value was 0,336 for the relationship between the dependent variable Profitability and the mediating variable BDA Capabilities. This explains 33,6% of the variability in the dependent variable, which can be explained by the independent variable, thus depicting the prediction power of the model.

These results suggest that South African e-commerce SMMEs have experienced the positive impact of BDA capabilities on their profitability. BDA capabilities increase profitability by providing South African e-commerce SMMEs with tools to segment their customer base and provide tailored product recommendations, increasing the likelihood of sales and ultimately boosting revenue and profitability (Wamba, 2016; Goga et al., 2019).

Previous studies have explored the positive impact of BDA capabilities on business performance and agree with this study's findings. Yasmin et al. (2020) found that BDA capabilities positively impact business performance, especially productivity, which affects business operations. Li and Zhang (2021) found that BDA capabilities improved business processes, reduced labour costs and improved productivity.

Table 13: BDA Capabilities and Business Performance Hypothesis Results

Hypothesis	Relationship	Path Coefficient (β)	STDEV	T-value	P-value	5.0% LCL	95.0% UCL	Decision
H4a	Big Data Analytics Capabilities -> Business Performance Productivity	0,594	0,037	15,914	0,000	0,537	0,660	Supported
H4b	Big Data Analytics Capabilities -> Business Performance Profitability	0,580	0,049	11,763	0,000	0,501	0,664	Supported

4.5.5 Hypothesis Results and Resulting Framework

Table 14 provides a summary of the hypothesis tests and test results. These findings contributed to the development of the resulting framework depicted in Figure 4.

Table 14: Hypothesis Results

Hypothesis	Definition	Results
H1a	IT Infrastructure has a positive impact on BDA Capabilities	Supported
H1b	IT Human Resources have a positive impact on BDA Capabilities.	Supported
H1c	Financial Resources have a positive impact on BDA Capabilities.	Supported
H2a	EO's Risk-taking has a positive impact on BDA Capabilities.	Supported
H2b	EO's Proactiveness has a positive impact on BDA Capabilities.	Not supported
H2c	EO's Innovativeness has a positive impact on BDA Capabilities.	Supported
H3a	Organisational Resources (IT Infrastructure, IT Human Resources and Financial Resources) under the mediative effect of BDA capabilities positively impact Business Performance (Productivity, Profitability).	Supported
H3b	Entrepreneurial Orientation dimensions (Risk-taking, Proactiveness, Innovativeness) under the mediative effect of BDA Capabilities positively impact Business Performance (Productivity, Profitability).	Partially Supported
H4a	BDA Capabilities have a positive impact on Productivity.	Supported

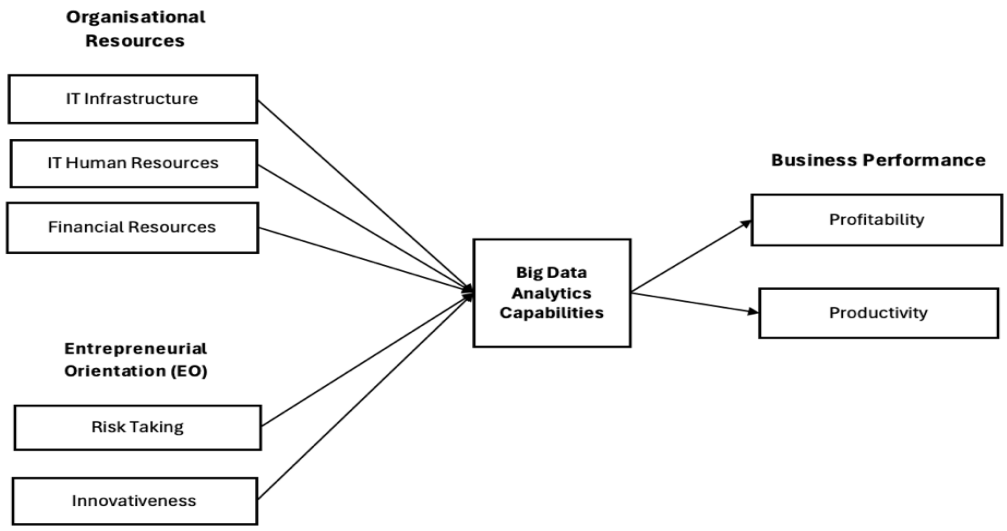

Figure 4: Resulting Framework

Chapter 5: Conclusion and Recommendations

In the preceding chapter, the presentation and analysis of the data was reported and discussed. This chapter concludes the study by summarising the key research findings based on the research aims and questions. The contributions and recommendations are discussed, as well as the limitations and directions for future work.

5.1. Key Findings and Conclusions

The main motivation for this study was to investigate the combined impact of organisational resources and entrepreneurial orientation dimensions on BDA capabilities and the mediating effect of BDA capabilities on the business performance of South African e-commerce SMMEs through an objective study based on quantitative data. In an effort to achieve the set objectives, a conceptual model was developed from the reviewed academic literature, serving as a guide for this study.

In addressing the main research question, the study first investigated the impact of organisational resources (IT infrastructure, IT human resources and financial resources) on the BDA capabilities of South African e-commerce SMMEs. This investigation revealed the positive impact of IT infrastructure, IT human resources and financial resources on BDA capabilities among these SMMEs. These findings indicate that South African e-commerce SMMEs consider their IT infrastructure to be an enabler in building BDA capabilities. Moreover, these findings indicate that South African e-commerce SMMEs have the necessary skills to utilise BDA capabilities, such as interpreting insights derived from their data to solve business problems. Lastly, these findings indicate the importance of having financial resources to invest in building BDA capabilities as this enables SMMEs to improve their profitability. The improved profitability creates an opportunity for these SMMEs to reinvest into innovative initiatives and to gain and retain an even more skilled workforce. Previous studies have also found that there is a positive influence from organisational resources on BDA capabilities. However, this study highlights the degree and importance of this in the South African e-commerce SMME context.

Secondly, the study investigated the impact of EO dimensions (risk-taking, proactiveness, innovativeness) on the BDA capabilities of South African e-commerce SMMEs. The findings revealed a significant positive influence from risk-taking and innovativeness on BDA capabilities. In contrast, the findings revealed that proactiveness has an insignificant

influence on BDA capabilities. These findings indicate that South African e-commerce SMMEs only consider the EO dimensions of innovativeness and risk-taking as influencing their investment and utilisation of BDA capabilities. Risk-taking may be particularly apparent to these SMMEs due to the complexities and other risks involved in the process of adopting BDA. In the dynamic business environment of e-commerce, adopting innovative solutions is a strategic choice and is intended to enhance sustainability. The insignificant influence of proactiveness on BDA capabilities may be due to the business' low maturity level. Organisations in the initial stages of maturity are still in their learning phase, where they use BDA capabilities for day-to-day business activities but do not proactively use BDA capabilities to build strategies.

Thirdly, this study investigated the mediating effect of BDA capabilities on the relationship between organisational resources, EO dimensions and the business performance of South African e-commerce SMMEs. The findings revealed that BDA capabilities significantly mediate the relationship between organisational resources (IT infrastructure, IT human resources, financial resources) and business performance (productivity and profitability). This highlights that South African e-commerce SMMEs are aware of the value that BDA capabilities create and the importance of organisational resources in the improvement of business performance. Additionally, the findings revealed the partial mediation of the relationship between EO dimensions (Risk-taking, Proactiveness, Innovativeness) and business performance (productivity and profitability). Innovativeness and risk-taking were found to significantly mediate business performance (productivity and profitability) compared to proactiveness. These findings suggest that South African e-commerce SMMEs achieve improvements in profitability and productivity when applying innovativeness and risk-taking through BDA capabilities.

Lastly, this study investigated the impact of BDA capabilities on the business performance of South African e-commerce SMMEs. The findings revealed a significant positive impact of BDA capabilities on business performance. The results suggest that South African e-commerce SMMEs have experienced increased productivity in business processes and improved profitability.

The study concludes that all three organisational resources positively impact BDA capabilities. Furthermore, these BDA capabilities play a positive mediating role in the relationship with business performance. In other words, improving IT infrastructure, human resources, and financial resources will improve BDA capabilities and business productivity

and profitability. Furthermore, the EO dimension of innovativeness and risk-taking plays an important part both directly on BDA capabilities and in modifying its influence on business performance. Therefore, in the South African e-commerce context, improving innovativeness and risk-taking significantly improves business performance.

5.2. Contributions and Recommendations

This study employed a multifaceted approach to understanding the complex dynamics that influence the business performance of South African e-commerce SMMEs. The study offers practical and theoretical contributions that can inform organisational resource allocation decisions, entrepreneurial strategies, and data-driven practices, ultimately promoting the growth and sustainability of SMMEs in the dynamic e-commerce landscape of South Africa. The study attempts to provide new insights and hence to add to current scholarly work on organisational resources, entrepreneurial orientation, and BDA capabilities in the unique context of South African e-commerce SMMEs.

At the time when this study was completed, no similar comparative studies had been identified in the South African context. This study, therefore, provides a framework for those in academia to test in future theoretical studies, specifically in the context of South Africa.

Practically, the importance of organisational resources has been highlighted as it indicates the major areas of investment needed to support the expansion and long-term sustainability of South African e-commerce SMMEs. The mediating analysis and direct impact of BDA capabilities analysis on business performance provide actionable insights on leveraging BDA capabilities to improve profitability and productivity.

5.3. Limitations and Direction for Future Work

Both the RBV and DCV theories are context-sensitive, and these findings should be considered limited in their generalizability and relevance to different contexts. Future research should therefore consider testing the framework in different contexts to ascertain the relevance of the results in those contexts and its greater generalisability.

Due the complexity of the concepts involved, the researcher had to bridge the knowledge gap for the research participants before administering the questionnaire. As the research method chosen for the study was quantitative, the results may not reflect the participants' underlying understanding of the research concepts. Future research should consider triangulation with other methodologies to assess the full impact of demographics on the results

and better insight into the area of research. The study was cross-sectional, future research should consider adopting the longitudinal time frame to collect more data.

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Appendix A: Questionnaire

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20 November 2022

Dear Sir/Madam,

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

The researcher, in this case Leshego Mogale, has chosen to conduct a study entitled "Investigating the impact of organisational resources, entrepreneurial orientation dimensions and big data analytics on business performance of South African e-commerce SMMEs". The study has been approved by the Ethics in Research Committee of the Faculty of Commerce, University of Cape Town.

The objective of the research is to investigate the impact of organisational resources and entrepreneurial orientation dimensions on BDA capabilities and the mediating effect of BDA capabilities on business performance of South African e-commerce SMMEs.

Your participation in this research voluntary. All information will be treated in a confidential manner and used exclusively for the purpose of this study. No individual names will be recorded or published. You will not be requested to supply any identifiable information, ensuring anonymity of your responses. You can choose to withdraw from the research at any time for whatever reason, in accordance with ethical research requirements. The data collection method will be an electronic survey questionnaire, taking approximately 10 to 15 minutes to complete.

This research has been approved by the Commerce Faculty Ethics in Research Committee. The findings of this research study will be compiled and presented to the University of Cape Town for academic purposes. If you are willing to participate in this study, please indicate.

Should you have any questions regarding this research, please feel free to contact me on mglmar007@myuct.ac.za or 084 502 5962

☐ I hereby indicate my willingness to participate in this research. I am aware that participation is voluntary and that I may choose to withdraw from this study at any time, should I choose to do so.

Sincerely,

Leshego Mogale
Researcher \ M.Com Student
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University of Cape Town
Email: mglmar007@myuct.ac.za

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Research Supervisor
Department of Information Systems
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Section 1 - Demographic Profile		
Age	18-30 years	
	31-40 years	
	41-50 years	
	More than 50 years	
Level of Education	No Qualification	
	Matric	
	Training Certificate	
	Higher Certificate	
	Diploma	
	University Degree	
	Postgraduate Degree	
Position	Business Owner	
	Business Partner	
	Business Manager	
Age of Business	<1 year	
	1-2 years	
	3-5 years	
	6-9 years	
	10+ years	
Number of Employees		
Product Offering	Automotive Parts & Accessories	
	Electronics (TVs, smart watches, etc.)	
	Groceries	
	Arts, Crafts & Sewing (paints, ceramics, etc.)	
	Home & Kitchen (furniture, coffee makers, etc.)	
	Office supplies (laptop stands, printer paper, etc.)	
	Pet supplies (cat/dog food, toys, etc.)	
	Books (print or digital), Magazines & Newspapers	

	Clothing	
	Beauty & Personal Care (cosmetics, shaving kit, etc.)	
	Toys & Games (board games, children's toys, etc.)	
	Garden & Outdoor (patio furniture, plants, etc.)	
	Exercise/Fitness supplies (at-home gym equipment, etc.)	
	Over-the-counter medicine	
	Cleaning supplies	
	Alcohol	
	Vitamins & Dietary Supplements	
	Tobacco, Pipes & Accessories	

Section 2 - Coding the Content

Where 1=Strongly Disagree, 2=Disagree, 3=Neither Agree nor Disagree, 4=Agree and 5=Strongly Agree, please indicate the extent to which you agree or disagree with the proposed statements by selecting the appropriate answer

		1=Strongly Disagree	2=Disagree	3=Neither Agree nor Disagree	4=Agree	5=Strongly Agree
IT Infrastructure	1. The e-commerce platform infrastructure we have adequately meets our current business needs in terms of connectivity, reliability, availability, and speed.					
	2. The e-commerce platform we use is scalable as the business grows					
	3. Our e-commerce platform is flexible					
	4. Our e-commerce platform can be tailored to meet our customers' needs					
IT Human Resources	1. We have the necessary technical, managerial, and other skills to use big data analysis					

	2. We are very capable of interpreting insights from our data to develop appropriate solutions.					
	3. We show a superior ability to learn new technologies.					
	4. We are very capable of using technology to solve business problems					
Financial Resources	1. Our business has sufficient financial resources to invest in innovation activities					
	2. Our business can obtain financial resources in a short time to support new strategic activities					
Entrepreneurial Orientation (EO): Innovativeness	1. We use technology to develop new products or services to introduced in the market					
	2. The use of technology has improved our products or services					
	3. We continuously examine the innovative opportunities for the strategic use					
Entrepreneurial Orientation (EO): Pro-activeness	1. We firmly believe that a change in the market creates a positive opportunity for us					
	2. Team members tend to talk more about opportunities rather than problems					
Entrepreneurial Orientation (EO): Risk-taking	1. We value the orderly and risk-reducing management process much more than the leadership initiatives for change					
	2. We like to “play it safe”					

	3. We like to implement plans only if they are certain.					
BDA Capabilities	1. When deciding to use BDA, we get all the insights we need.					
	2. Our experience has led us to believe that BDA can be successfully implemented					
	3. Our business has expertise in big data analysis software					
	4. We use data visualisation techniques to assist decision-makers in understanding complex information extracted from our business data					
	5. Our dashboards display information, which is useful for carrying out necessary business tasks					
	6. We perform BDA planning processes in a systematic and formalised ways					
	7. The use of BDA has improved our service to customers					
	8. The use of BDA makes work more efficient					
Business Performance - Profitability	1. Our customers are satisfied with our product quality					
	2. We deliver value to our customer					
	3. Our market share growth is significant in comparison to our competitors					
	4. We have seen improved profitability as compared to our competitors					

	5. We have seen improved sale growth as compared to our competitors					
	6. We have been able to retain our customers					
Business Performance - Productivity	1. We deliver new products in the market quicker and at the right time					
	2. We are able to acquire new customers					
	3. We are able to resolve customer queries quickly					
	4. We have seen improved productivity in the past year					

Appendix B: Ethical Approval

Faculty of Commerce

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24 11 2022

Leshego Mogale

Department of Information Systems

University of Cape Town

REF: REC 2022/11/013

Investigating the impact of organisational resources, entrepreneurial orientation dimensions and big data analytics on business performance of South African e-commerce SMMEs

We are pleased to inform you that your ethics application has been approved. Unless otherwise specified this ethical clearance is valid until 31-Dec-2023 .

Your clearance may be renewed upon application.

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

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

We wish you well for your research.

2022.11.24
22:36:19 +02'00'

Jacques Rousseau
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Appendix C: Item Coding

Item Code	Measure Statement	Construct
IT1	1. The e-commerce platform infrastructure we have adequately meets our current business needs in terms of connectivity, reliability, availability, and speed.	IT Infrastructure
IT2	2. The e-commerce platform we use is scalable as the business grows	
IT3	3. Our e-commerce platform is flexible	
IT4	4. Our e-commerce platform can be tailored to meet our customers' needs	
ITH1	1. We have the necessary technical, managerial, and other skills to use big data analysis	IT Human Resources
ITH2	2. We are very capable of interpreting insights from our data to develop appropriate solutions.	
ITH3	3. We show a superior ability to learn new technologies.	
ITH4	4. We are very capable of using technology to solve business problems	
FR1	1. Our business has sufficient financial resources to invest in innovation activities	Financial Resources
FR2	2. Our business can obtain financial resources in a short time to support new strategic activities	
EOI1	1. We use technology to develop new products or services to introduced in the market	Entrepreneurial orientation (EO): Innovativeness
EOI2	2. The use of technology has improved our products or services	
EOI3	3. We continuously examine the innovative opportunities for the strategic use	
EOP1	1. We firmly believe that a change in the market creates a positive opportunity for us	Entrepreneurial orientation (EO): Proactiveness
EOP2	2. Team members tend to talk more about opportunities rather than problems	

EOR1	1. We value the orderly and risk-reducing management process much more than the leadership initiatives for change	Entrepreneurial orientation (EO): Risk-taking
EOR2	2. We like to "play it safe"	
EOR3	3. We like to implement plans only if they are certain.	
BDA1	1. When deciding to use BDA, we get all the insights we need.	BDA Capabilities
BDA2	2. Our experience has led us to believe that BDA can be successfully implemented	
BDA3	3. Our business has expertise in big data analysis software	
BDA4	4. We use data visualisation techniques to assist decision-makers in understanding complex information extracted from our business data	
BDA5	5. Our dashboards display information, which is useful for carrying out necessary business tasks	
BDA6	6. We perform BDA planning processes in a systematic and formalised ways	
BDA7	7. The use of BDA has improved our service to customers	
BDA8	8. The use of BDA makes work more efficient	
BPF1	1. Our customers are satisfied with our product quality	Business Performance - Profitability
BPF2	2. We deliver value to our customer	
BPF3	3. Our market share growth is significant in comparison to our competitors	
BPF4	4. We have seen improved profitability as compared to our competitors	
BPF5	5. We have seen improved sale growth as compared to our competitors	
BPF1	6. We have been able to retain our customers	
BPD1	1. We deliver new products in the market quicker and at the right time	Business Performance - Productivity
BPD2	2. We are able to acquire new customers	
BPD3	3. We are able to resolve customer queries quickly	
BPD4	4. We have seen improved productivity in the past year	

Appendix D: Outer Loadings

	Big Data Analytics Capabilities	Business Performance - Profitability	Business Performance - Productivity	EO - Innovativeness	EO - Proactiveness	EO - Risk-taking	Financial Resources	IT Human Resources	IT Infrastructure
BDA1	0,810								
BDA2	0,839								
BDA3	0,816								
BDA4	0,825								
BDA5	0,786								
BDA6	0,791								
BDA7	0,800								
BDA8	0,751								
BPD1			0,763						
BPD2			0,774						
BPD3			0,731						
BPD4			0,738						
BPF1		0,705							
BPF2		0,739							
BPF3		0,790							
BPF4		0,705							
BPF5		0,821							
BPF6		0,792							
EOI1				0,871					
EOI2				0,838					
EOI3				0,715					
EOP1					0,924				
EOP2					0,933				
EOR1						0,933			
EOR2						0,886			
EOR3						0,767			
FR1							0,928		
FR2							0,865		
IT1									0,797
IT2									0,797
IT3									0,838
IT4									0,752
ITH1								0,832	
ITH2								0,886	
ITH3								0,858	
ITH4								0,877	

Appendix E: Cross-loadings

	Big Data Analytics Capabilities	Business Performance Profitability	Business Performance Productivity	EO Innovativeness	EO Proactiveness	EO Risk-taking	Financial Resources	IT Human Resources	IT Infrastructure
BDA1	0,810	0,587	0,590	0,402	0,359	0,419	0,445	0,518	0,549
BDA2	0,839	0,397	0,457	0,338	0,370	0,335	0,388	0,433	0,323
BDA3	0,816	0,515	0,432	0,429	0,323	0,306	0,389	0,417	0,340
BDA4	0,825	0,397	0,525	0,555	0,443	0,394	0,416	0,613	0,411
BDA5	0,786	0,564	0,512	0,416	0,394	0,221	0,415	0,507	0,419
BDA6	0,791	0,462	0,492	0,423	0,308	0,232	0,378	0,465	0,306
BDA7	0,800	0,376	0,406	0,385	0,293	0,226	0,368	0,393	0,322
BDA8	0,751	0,344	0,315	0,373	0,165	0,249	0,313	0,272	0,279
BPD1	0,428	0,503	0,763	0,533	0,384	0,256	0,383	0,577	0,431
BPD2	0,457	0,365	0,774	0,497	0,389	0,279	0,371	0,516	0,397
BPD3	0,425	0,325	0,731	0,329	0,438	0,246	0,344	0,452	0,384
BPD4	0,472	0,446	0,738	0,281	0,307	0,149	0,381	0,374	0,416
BPF1	0,402	0,705	0,397	0,259	0,088	0,199	0,246	0,222	0,352
BPF2	0,364	0,739	0,443	0,206	0,227	0,173	0,324	0,394	0,331
BPF3	0,511	0,790	0,390	0,289	0,269	0,244	0,427	0,398	0,357
BPF4	0,451	0,705	0,436	0,364	0,290	0,325	0,456	0,447	0,408
BPF5	0,443	0,821	0,460	0,363	0,247	0,245	0,448	0,422	0,438
BPF6	0,445	0,792	0,371	0,437	0,171	0,167	0,482	0,324	0,359
EOI1	0,490	0,475	0,514	0,871	0,497	0,221	0,469	0,706	0,389
EOI2	0,413	0,299	0,477	0,838	0,375	0,225	0,435	0,565	0,366
EOI3	0,349	0,224	0,306	0,715	0,177	0,272	0,221	0,359	0,155
EOP1	0,383	0,293	0,495	0,408	0,924	0,245	0,387	0,591	0,322
EOP2	0,405	0,242	0,440	0,428	0,933	0,169	0,424	0,554	0,307
EOR1	0,412	0,319	0,303	0,272	0,220	0,933	0,266	0,289	0,318
EOR2	0,306	0,215	0,258	0,232	0,194	0,886	0,195	0,265	0,246
EOR3	0,222	0,228	0,227	0,254	0,150	0,767	0,218	0,317	0,247
FR1	0,496	0,554	0,482	0,486	0,402	0,272	0,928	0,496	0,470
FR2	0,369	0,374	0,392	0,351	0,383	0,191	0,865	0,357	0,319
IT1	0,339	0,327	0,394	0,319	0,289	0,150	0,325	0,287	0,797
IT2	0,294	0,376	0,326	0,297	0,251	0,165	0,376	0,289	0,797
IT3	0,474	0,476	0,537	0,351	0,323	0,309	0,405	0,422	0,838
IT4	0,354	0,366	0,421	0,253	0,200	0,349	0,319	0,340	0,752
ITH1	0,489	0,431	0,573	0,552	0,502	0,343	0,471	0,832	0,495
ITH2	0,492	0,438	0,516	0,616	0,516	0,236	0,420	0,886	0,302
ITH3	0,491	0,411	0,513	0,571	0,525	0,209	0,378	0,858	0,314
ITH4	0,522	0,402	0,592	0,639	0,581	0,339	0,407	0,877	0,376