Exploring the role of AI to improve Analytics within Telco organisations.

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KEYWORDS

Data management; Artificial Intelligence; Business Analytics; Data Quality, Industry 4.0; Digital Transformation; Telecommunications; South Africa; Qualitative; TOE

Declaration

I, Avish Narandas, declare that this research report is my own work except as indicated in the references and acknowledgements. It is submitted in partial fulfilment of the requirements for the degree of Master of Management in the field of Digital Business at the University of the Witwatersrand, Johannesburg. It has not been submitted before for any degree or examination at this or any other institution.

Name: Avish Narandas Signature: 

Signed at: Douglasdale

On the: 8th day of February 2025

Abstract

The rapid rise of the Fourth Industrial Revolution (4IR), driven by AI, IoT, and robotics, is transforming industries globally. In South Africa's telecommunications (SA telcos) sector, the data explosion from mobile usage, network monitoring, and IoT applications present both opportunities and challenges. Despite being one of the fastest-growing ICT sub-sectors, the SA telco industry has struggled with customer sentiment, consistently ranking lower than banking, insurance, and retail in recent years.

AI and Business Analytics (BA) can enable real-time, automated insights, but South African telcos face challenges like fragmented systems and complex data management. Notably, 87 percent of big data and AI projects never reach implementation, emphasising the need for strategic AI adoption.

This study examines AI's role in enhancing analytics within SA telcos, focusing on adoption factors, benefits, and challenges.

Using the Technology-Organisation-Environment (TOE) framework, a qualitative, inductive approach was employed, gathering insights from 15 key stakeholders across three major SA telcos. Findings reveal that strategic roles influence AI initiatives, operational roles bridge adoption gaps, and technical roles drive implementation, also suggesting that organisations should consider their unique environment, challenges, and objectives when implementing AI to maximise its benefits.

By synthesising literature and industry insights, this research aims to minimise the gaps in existing knowledge and provides actionable recommendations. The findings offer valuable guidance for telco executives, policymakers, and scholars navigating AI adoption in SA's evolving digital economy.

Dedication

I dedicate this research report to all students who aspire to further their education but face obstacles beyond their control. May this work serve as a reminder that knowledge should be accessible to everyone, regardless of their circumstances. To those who dream of academic achievement but lack the opportunity, I hope for a future where barriers to education are removed, and every student has the chance to reach their full potential. This journey is not just mine - it belongs to all who strive for growth, resilience, and the pursuit of knowledge.

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This achievement reflects the collective encouragement and inspiration I have received.

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- **4IR** - Fourth Industrial Revolution
- **AI** - Artificial Intelligence
- **BA** - Business Analytics
- **BI** - Business Intelligence
- **BIA** - Business Intelligence and Analytics
- **CNNs** - Convolutional Neural Networks
- **DOI** - Diffusion of Innovations
- **DQNs** - deep Q-networks
- **DT** - Digital Transformation
- **GDPR** - General Data Protection Regulation
- **IB** - International Business
- **IOT** - Internet of Things
- **KPI** - Key performance indicator
- **ML** - Machine Language
- **MNEs** - multinational enterprises
- **NLP** - Natural Language Processing
- **NN** - Neural networks
- **OLAP** - Online Analytical Processing
- **PCA** - Principal Components Analysis
- **RL** - Reinforcement learning
- **RNNs** - Recurrent Neural Networks
- **ROI** - Return on Investment
- **SA** - South Africa
- **SA Telco** – South African Telecommunications
- **SVM** - Support Vector Machines
- **TAM** - Technology Acceptance Model
- **TOE** - Technology-Organisation-Environment
- **UTAUT** - Unified Theory of Acceptance and Use of Technology

CHAPTER 1. INTRODUCTION

1.1 Statement of purpose

This qualitative research explores the role of artificial intelligence (AI) to improve analytics in South African telco organisations.

1.2 Background of the study

The path to Industry 4.0 and the Fourth Industrial Revolution (4IR) is a narrative shaped by the evolution of technology and shifts in society. It commences with the First Industrial Revolution of the late 18th century, characterised by the introduction of mechanisation and steam power, followed by the Second Industrial Revolution in the late 19th century, marked by mass production and the advent of electricity. The emergence of computers and automation marked the onset of the Third Industrial Revolution in the latter part of the 20th century. Now, Industry 4.0 arises as the culmination of these advancements, driven by digital technologies like artificial intelligence (AI), robotics, and the Internet of Things (IoT), blurring the boundaries between the physical and digital worlds (Wolniak & Grebski, 2023b). AI has evolved significantly since its inception in 1955, now playing a critical role in reducing human intervention in complex health and business processes. It can recognize intricate patterns, make decisions, and provide accurate forecasts by processing various types of data, including text, images, and speech. In sectors like telecommunications (telco), AI adoption is rising rapidly due to increasing smartphone use and mobile data demand, although inadequate IT infrastructure in many regions still hampers its full potential (Elapanda et al., 2020).

This author further posits that this progression not only transforms industries and economies but also redefines lifestyles, work dynamics, and social interactions, promising unprecedented levels of efficiency, innovation, and interconnectedness. In the last thirty years, organisations increasingly rely on

data-driven tools for decision-making. Due to the vast amounts of data, ranging from web-based and mobile to sensor-generated, reaching terabyte and even exabyte scales, businesses can now obtain detailed, contextual, and valuable insights to enhance decision-making processes (F. Wang et al., 2022).

Statistics indicate that the total volume of data produced globally in 2021 reached around 79 zettabytes, with projections suggesting that this will double by 2025, as represented in Figure 1. This remarkable surge in data has been attributed to a phenomenon known as the "data explosion," characterised by a staggering 5000% increase in data interactions over the past decade (Nambiar & Mundra, 2022).

The convergence of these technologies presents both opportunities and challenges as it signifies a profound shift in the way industries operate and society's function. On one hand, it unlocks immense potential for innovation, efficiency gains, and improved quality of life. On the other hand, this convergence also brings forth a range of challenges, including concerns such as data management, data privacy and security, ethics, regulatory compliance, workforce displacement due to automation, and the digital divide widening inequalities (Aldoseri et al., 2023). These factors can be broadly categorised into three categories such as technological, organisational and environmental.

Typically, a failed business intelligence (BI) implementation cannot be attributed to a single factor, nor can a successful one be credited to just one reason. Moreover, the definitions of failure and success are often ambiguous and open to interpretation (Al-Okaily, Teoh, et al., 2023).

By regularly analysing data, companies can quickly adapt to market changes and stay competitive (Wolniak & Grebski, 2023a). By doing this, organisations can effectively navigate through this dynamic environment and remain competitive in the continuously evolving industrial ecosystem, as the reliance on emerging technologies and digital transformation highlights the crucial role of business analytics in achieving operational excellence (Wolniak & Grebski, 2023a).

Advanced business analytics (Analytics 4.0) integrates AI and big data using machine learning for real-time, automated, and adaptive insights (Nambiar & Mundra, 2022). Digital transformation is defined as the process focusing on the changes that digital technologies can bring about in a company's business model, products, or organisational structures (Nadkarni & Prügl, 2021).

The growing demand for AI highlights its importance for competitiveness, with companies investing in it to automate tasks and boost operational efficiency. (Elapanda et al., 2020). For example, Haefner et al., (2021) suggests that 60 percent of all occupations include approximately 30 percent of activities that can be automated.

Understandably, organisations in developed countries have better support when integrating intelligent technologies, compared to developing countries who suffer from poor data and upskilling issues (Al-Okaily, Teoh, et al., 2023). The author further posits that one of the fundamental concerns in business intelligence (BI) implementation lies in data quality which can jeopardise decision-making leading to operational inefficiencies and financial loss. In this context we will explore many factors that influence the adoption of AI to improve analytics and discuss the benefits and challenges within SA telcos.

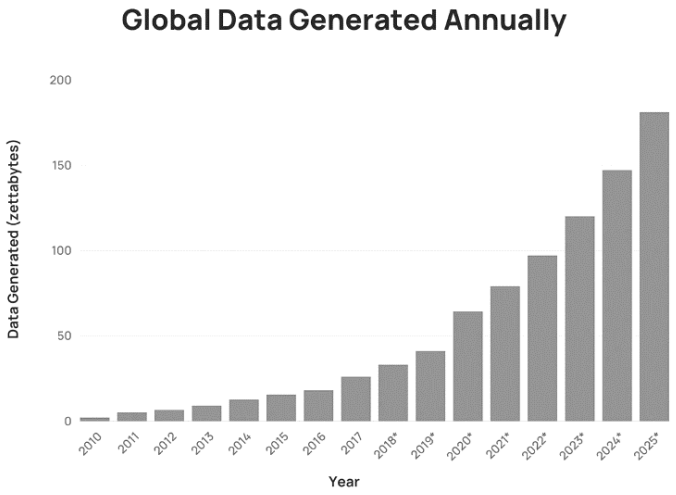

Figure 1. Data generated each year from 2010 to 2025 (estimated) **(Statista, 2024)**

1.3 Research problem

The telecommunications industry is at the forefront of the data explosion. Fuelled by factors like mobile data usage, the Internet of Things (IoT), 5G, and network monitoring, telcos generate massive amounts of data such as customer call records; network traffic logs; location data, and more which have to be processed and ingested into data warehouses and reported to drive business insights (Figure 2). While this data may offer valuable opportunities to enhance operations, tailor customer experiences, and foster innovation, its vastness and complexity often result in siloed systems within the organization, making it difficult to fully capitalize on its potential.

The telco industry has evolved over decades, with various systems implemented to manage various functions such as billing, network operations and customer service. These systems often operate independently, creating data silos. Integrating these legacy systems can be complex, expensive and time-consuming (Wolniak & Grebski, 2023a). This author posits that without a unified view of customer data, telcos struggle to personalise services, predict customer churn, and optimise network performance. The management of multiple data sources and the exponential volume of data in organisations due to the digital age potentially play a significant role for data led decision-making to remain competitive. However, the challenge is in transforming and managing this volume of data from multiple sources into meaningful insights for the business to consume (Raghupathi & Raghupathi, 2021).

Organisations often rely on data to produce insights about the past, present and future performance. Considering the volume of data and the analysis required, BA and AI solutions are essential to achieve this to unlock Analytics 4.0 (Alqhatani et al., 2022). This author emphasis that these solutions are heavily dependent on acquiring this data on time as well as the quality of the data, as it directly impacts the accuracy of the results.

This is based on the simple principle of “Garbage In, Garbage Out” (GIGO), therefore, it is essential to ensure that data is managed more effectively and verify the quality of the input data to ensure accurate outputs (Merhi, 2023a). This is one of the reasons why many organisations have not realised the benefits from their BI investments (Al-Okaily, Teoh, et al., 2023). Gartner (2024) predicts that by 2027, 80 percent of data and analytics (D&A) governance initiatives are likely to fail if there isn’t a real or perceived crisis to create urgency. Without a pressing issue, there may not be enough motivation or support to drive meaningful change.

Each year, poor data quality costs governments and private businesses billions of dollars in revenue. Data quality issues are projected to cost companies up to 12 percent of their sales (Hikmawati et al., 2021).

The World IT Project surveyed 37 developed and developing countries across five regions: U.S, Europe, Asia, Australia, and Latin America to provide a global view of key technological issues through a standardised methodology (Palvia et al., 2021). The author states that there are four core information technology issues that have been ranked high for majority of these global countries: networks/telecommunications; business intelligence/analytics; enterprise application integration; and mobile and wireless applications. Networks/telecommunications and business intelligence/analytics emerged as the top two IT issues faced globally and in South Africa (Palvia et al., 2021), establishing the need for these to be addressed.

Data generated from mobile and IoT devices will need to be managed as there are 100.26 million mobile phones in the telco SA, corresponding to an average of about 1.7 per person which is higher compared to the United States which has an average of 1.1 mobile phones per person as at 2022 (Worlddata.info, 2024).

According to (Stats SA, 2022), 79% of households had internet access, representing approximately 49 million people, reflecting a steady increase since 2011. This rise is largely driven by advancements in communication technology, especially the widespread adoption of mobile phones.

Telecommunications is one of the fastest-growing ICT sub sectors in the South African economy (ICLG, 2024). Despite this progress, the South African telco sector ranked last in terms of customer sentiment over the last two consecutive years compared to banking, insurance, and retail (ITWeb, 2022). This is due to widespread issues in customer service and network availability.

AI technologies are developing more quickly than the number of skilled professionals to handle the complexity and diversity of AI systems (Aldoseri et al., 2023). By prioritising AI-driven operational and customer service enhancements, leveraging social impact initiatives, and resolving fundamental service issues, telco organisations can bridge the sentiment gap and align their operations with their critical role in modern life (PWC, 2024).

While several studies provide valuable contributions, most of these lack the ability to explain the factors, benefits and challenges associated with the adoption of AI within the SA telcos to improve analytics capabilities. Therefore, the following research questions will be addressed in this study.

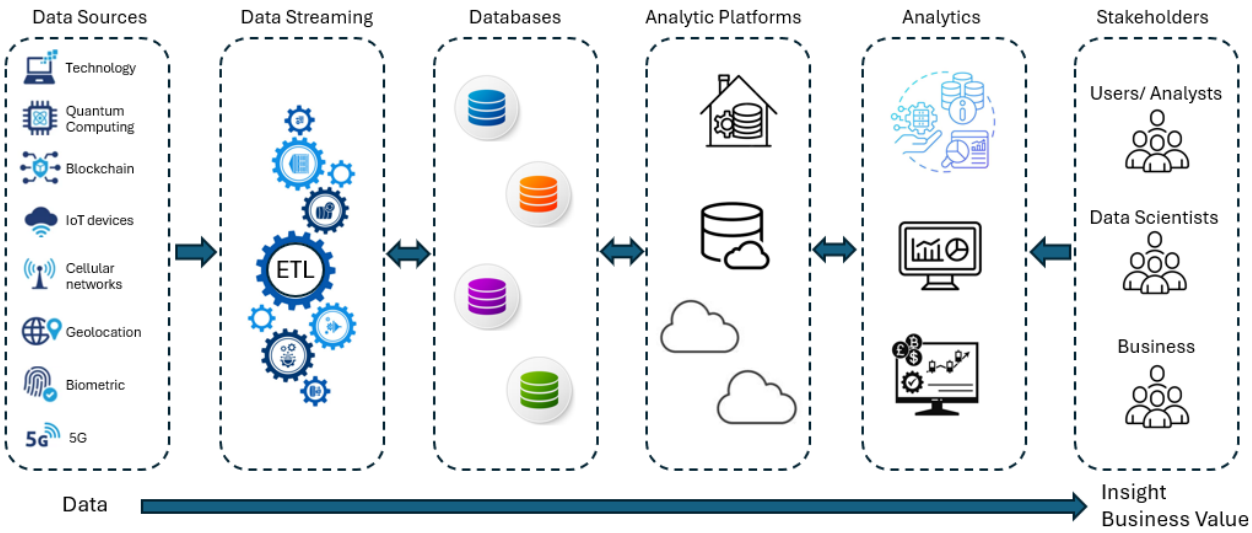

Figure 2. Author Constructed diagram depicting various sources of data to drive business insight.

1.4 Research questions

The objective of this study is to answer the following research questions:

RQ1: What are the factors that influence the adoption of AI to improve analytics in SA telcos?

RQ2: What are the benefits of AI adoption and analytics in SA telcos?

RQ3: What are the challenges of AI adoption and analytics in SA telcos?

1.5 Rationale

In the digital age, the volume and complexity of data generated by organisations have grown exponentially. A common theme highlighted in previous studies indicate that there are fundamental factors that influence the adoption of emerging technologies such as AI within an organisation. As data becomes more complex, the task of deriving meaningful and actionable insights from it has become more challenging to qualify data as a strategic asset (Rodgers et al., 2024).

An early mention of the data/information, knowledge, wisdom (D-I-K-W) hierarchy (Figure 3) draws inspiration from Ackoff's definition of knowledge (Rodgers et al., 2024). To cite Ackoff's words, *"An ounce of information is worth a pound of data. An ounce of knowledge is worth a pound of information. An ounce of understanding is worth a pound of knowledge"* (Ackoff, 1989). This early mention from Russell Ackoff's quote emphasises the increasing value of data, information, knowledge, and understanding. Data are raw facts without context, while information is organised data that provides meaning. Knowledge is derived from analysing information that offers actionable insights, making data more valuable. Understanding the synthesis and application of knowledge, enables effective decision-making and problem-solving, making it the most valuable. As one progresses from data to understanding, each step holds exponentially greater worth to enable advanced analytics (analytics 4.0), which may drive informed

decision-making and improve productivity to give organisations a competitive advantage.

Despite the increasing recognition of AI and data as strategic assets by firms, many have yet to fully realise their potential (Jarrahi et al., 2023). This lag appears to be largely attributable to what may be the leading global and South African technological challenges, Networks/Telecommunications and Business Intelligence/Analytics, previously highlighted by (Palvia et al., 2021). This author highlights organisational and environmental as other contributing factors.

Previous studies have predominantly focused on a narrow segment of AI applications, such as intelligent process automation and predictive analytics across various sectors (Stoykova & Shakev, 2023). Despite the significant attention digitalisation and AI have received, understanding of AI and business analytics initiatives remains limited in the SA telco context warranting an opportunity to explore this.

This research report made three key contributions. First, it offered a contextual contribution by addressing the limited research on the adoption of AI to unlock Analytics 4.0 in South African telcos. Second, it provided a theoretical contribution by exploring the applicability of the Technology-Organisation-Environment (TOE) framework to understand the factors that influence AI adoption. Lastly, this study investigated the associated benefits and challenges that influence the adoption of AI to improve analytics in South African telcos. The intended audience are scholars, practitioners, and management interested in this topic, helping them to identify ways to improve business analytics.

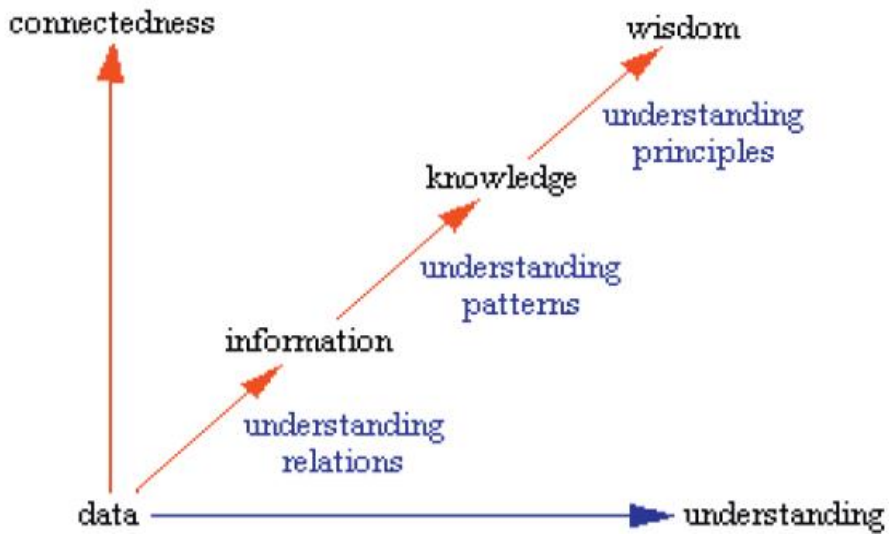

Figure 3. D-I-K-W hierarchy of Ackoff's explanation (Jifa, 2013)

1.6 Delimitations of the study

This study focused exclusively on large telecommunications organisations in developing countries like South Africa focusing on studies published within the last three years. The research utilised qualitative methods, such as interviews, and has considered the perspectives of key internal stakeholders, including data scientists; IT managers; business and data analysts.

Excluded from the study were international telco organisations that did not adopt AI. The research also excluded small and medium-sized enterprises (SMEs). Quantitative methods have not been used, however results from previous literature will be referenced to support this study.

1.7 Definition of terms

Analytics 4.0: Business analytics using artificial intelligence refers to the use of AI techniques to analyse large datasets to uncover valuable insights and information. This process helps businesses make better decisions by transforming raw data into meaningful knowledge (Gandomi et al., 2023).

Artificial Intelligence (AI): Artificial intelligence (AI) is the field of computer science focused on creating systems and machines that can perform tasks that typically require human intelligence, such as learning, reasoning, problem-solving, understanding language, and recognizing patterns (ISO/IEC 39794, 2021).

Big Data: Extensive datasets, defined by characteristics such as volume, variety, velocity, and variability, necessitate scalable technologies to enable efficient storage, processing, management, and analysis. The term "big data" is commonly used in various contexts, including to describe the scalable technologies employed to manage extensive datasets (ISO/IEC 20546, 2019).

Business intelligence: A developing technology that utilises data and advanced computational methods to uncover valuable business insights (Alqhatani et al., 2022).

Data integration: Data integration is the process of combining data from multiple sources and presenting it to users as a unified, cohesive view to support comprehensive analysis and decision-making (ISO/IEC 30145, 2020).

Data lake: Data lakes are central storage areas for keeping all types of raw data in their original form, including unstructured, semi-structured, and structured data, and can handle large volumes of data (Nambiar & Mundra, 2022).

Data models: The pattern of structuring data in a database involves organizing data in accordance with the formal descriptions defined by its information system, while also adhering to the requirements of the specific database management system (DBMS) being used (ISO/IEC 11179, 2023).

Digital Transformation: Digital business transformation is the process of using digital technologies and related skills to develop a strong, new business model (Lichtenthaler, 2021).

Data Warehouse: A data warehouse is a type of database in which data is

organized according to a relational model, enabling efficient storage, retrieval, and analysis of large volumes of structured information (ISO/IEC 29585, 2023).

Machine learning: Machine learning is a process through which a functional unit enhances its performance by acquiring new knowledge or skills, or by reorganizing existing ones, enabling it to adapt and improve over time (ISO/IEC TR 29119, 2020).

Raw Data: Data is a reinterpretable representation of information presented in a formalized manner that is suitable for communication, interpretation, or processing, whether by humans or automated systems (ISO/IEC 5259, 2024).

Telecommunications: Telecommunications involves the electronic exchange of information such as voice, data, and video over long distances through various technologies like wired phones, fiber optics, satellites, and wireless systems (Chai, 2023).

1.8 Assumptions

a) There is some level of AI adoption within South African telcos, providing a foundation for further enhancement in analytics.
b) AI technologies have the potential to significantly enhance data management and analytics processes within these organisations.
c) Terms like “data management”; “AI technologies”; “analytics” are understood by all participants and stakeholders involved in the study.
d) Participants use data in telco organisations to make business decisions.
e) That AI's ability to improve analytics in South African telco companies depends on user experience and understanding of the technology.
f) It is assumed that business analytics (BA) positively influences successful digital transformation, which in turn may lead to improved business outcomes Business analytics (BA) in Industry 4.0 fosters continuous improvement (Wolniak & Grebski, 2023a).

1.9 Chapter Outline

Chapter 1 highlighted Industry 4.0's role in digital transformation, the data explosion, and telcos' struggle with fragmented systems. AI and Business Analytics (BA) can unlock Analytics 4.0 if data challenges are addressed. South Africa's telco sector, ranking last in customer sentiment (ITWeb, 2022), underscores the need for AI-driven improvements.

CHAPTER 2. LITERATURE REVIEW AND THEORETICAL FRAMEWORK

2.1 Introduction

In the rapidly evolving telecommunications sector, the vast amount of data generated daily from customer interactions, network operations, and service usage presents both significant challenges and substantial opportunities. Effective business analytics are crucial for telecommunications firms seeking to enhance operational efficiency, improve customer satisfaction, and maintain a competitive edge (Mortaji & Shateri, 2023). Furthermore, the integration of business analytics and AI offers a substantial opportunity for organisations to unlock the potential of their data assets, drive innovation, and gain a competitive advantage.

Historically, analytics in this sector relied on traditional data processing and analysis methods. However, the increasing volume and complexity of data demand more advanced strategies. AI is a transformative technology with the potential to revolutionise business analytics. By leveraging machine learning, natural language processing, and advanced data analytics, AI can provide deeper insights, predictive capabilities, and automation, thereby enhancing decision-making processes (Mortaji & Shateri, 2023).

Recent advancements in computer hardware, network speeds, and processing algorithms have significantly propelled AI forward (Enholm et al., 2022). Despite these advancements, the issue of whether organisations can identify and access the data and information needed to support various types of decisions remains relevant (Parra et al., 2023). Using studies over the last three years, this research report aims to understand what factors influence the adoption of AI and examine the benefits and challenges associated to improve analytics within the context of South African telecommunications industry.

2.2 Definition of topic

2.2.1 Data

Data is a versatile and invaluable resource crucial for modern decision-making and innovation. Structured, unstructured, and semi-structured data each offer unique benefits and challenges across various fields. Organisational data includes master, transaction, and inventory data. Master data encompasses customer, supplier, material, and employee information, serving as an interface for BI by interacting with transactional data from various business areas (Hikmawati et al., 2021). This data plays a critical role in business processes and is exchanged across networks by multiple users. Master data complements BI by providing a valuable source of dimensional data.

There are various types of data, including unstructured, written, audio, video, and numerical data. These enormous amounts of data are gathered for a number of reasons, such as business performance, regulatory reporting and compliance (Raghupathi & Raghupathi, 2021).

As data volume and complexity grow, the ability to effectively collect, process, and analyse it, will be essential for driving progress and success in a data-centric world.

2.2.2 Business Analytics

The process of business analytics entails the examination, analysis, and interpretation of data to facilitate decision-making (Mortaji & Shateri, 2023). Organisations can acquire valuable insights into their past performance, predict future outcomes, and obtain recommendations for optimising their decisions by integrating descriptive, predictive, and prescriptive analytics, which are based on data patterns, trends, and anomalies (Mortaji & Shateri, 2023). This method not only assists businesses in making informed decisions but also allows them to establish a competitive edge in the marketplace. The role of business analytics

in achieving strategic and operational success will only become more critical as the significance of data continues to increase.

2.2.3 Artificial Intelligence

Artificial intelligence (AI) allows machines to learn from data and experience, making smart decisions through detailed analysis. In business, AI is used for complex data analysis, understanding natural language, and automating routine tasks. These abilities make AI a valuable tool for data-driven decision-making and boosting efficiency.

Exploring AI shows how it has evolved and its wide range of uses. Historically, McCarthy et al. (1955) as cited in Stoykova & Shakev (2023) laid the groundwork for AI by defining it as the science and engineering of creating intelligent machines. This foundational perspective has evolved, as seen in the definitions by Duan et al. (2019), who referred to AI as the ability of machines to learn from experience, adapt to new inputs, and perform human-like tasks.

Further expanding on the capabilities, Kühl et al. (2022) suggests that AI systems are designed to replicate these human cognitive functions, allowing them to perform tasks that typically require human intelligence, thereby enhancing efficiency, accuracy, and the ability to handle complex problems.

Stoykova & Shakev (2023) describe AI as computer systems that mimic human intellect by operating like humans in their decision-making processes. This shift from a purely scientific approach to a more integrated, human-like functionality highlights the progression in the understanding of AI.

According to Menzies et al. (2024), AI systems is scalable technology created to achieve specific goals set by humans using advanced data analysis and decision-making.

In the context of this study, AI is defined as a broad category of technologies enabling machines to perform tasks typically requiring human cognition.

2.2.4 Evolution of Analytics

The evolution of data analytics can be broadly categorised into four distinct phases: Analytics 1.0, 2.0, 3.0, and 4.0. Each phase represents significant advancements in how data is analysed and utilised for decision-making, reflecting the growing complexity and capabilities of analytical tools and methodologies.

The first phase, Analytics 1.0, focuses on descriptive analytics, which is concerned with understanding past events. It uses basic reporting and data visualisation tools, such as spreadsheets, databases, and early business intelligence platforms, to generate static reports and dashboards. These tools provide a comprehensive view of historical data, allowing organisations to monitor key performance indicators (KPIs) and track trends over time (Motjolopane & Chanza, 2023).

As the need for deeper insights grew, analytics evolved into Analytics 2.0, focusing on diagnostic analytics. This phase delves into data to understand why events occurred, using advanced statistical analysis, data mining, and Online Analytical Processing (OLAP). By uncovering the factors driving performance, it enables organisations to identify areas for improvement and develop more effective strategies (Motjolopane & Chanza, 2023).

The third phase, Analytics 3.0, introduces predictive and prescriptive analytics, moving beyond past events to forecast future outcomes and recommend actions. Predictive analytics uses advanced statistics, data mining, and machine learning to build models that anticipate future events and trends. These models help businesses manage risks and seize opportunities. Prescriptive analytics goes further by providing actionable recommendations, using optimisation techniques and simulations to suggest the best course of action. This phase helps organisations make proactive, data-driven decisions that enhance performance and competitiveness (Motjolopane & Chanza, 2023).

Analytics 4.0 is the most advanced level of analytics, integrating AI and machine learning to provide real-time, automated, and adaptive insights. It processes data

as it is generated, offering real-time information for dynamic decision-making and operational agility. Analytics 4.0 and Business Analytics are used interchangeably in previous studies as these terms are relatively new and is an emerging field (Raghupathi & Raghupathi, 2021; Gómez-Caicedo et al., 2022). Both are defined as enhancing decision-making through data-driven insights, however, in context of this study, Analytics 4.0 goes further by incorporating AI and real-time processing for more dynamic and automated capabilities. AI tools continuously learn and improve, while natural language processing (NLP) enhances user interaction (Motjolopane & Chanza, 2023).

2.2.5 Telecommunications

The telecommunications industry enables global communication through various technologies such as mobile phones, landlines, satellites, and the internet, with companies offering services like phone, cable, satellite TV, and online access. Since the early 2000s, the industry has shifted from being dominated by monopolies to a competitive landscape driven by liberalization, innovation, and the rapid rise of mobile and internet services, raising concerns about current and future vulnerabilities, especially with the growing use of artificial intelligence (Slimani et al., 2023).

2.3 ANALYTICAL FRAMEWORK

2.3.1 Theoretical Framework

The purpose of technology adoption models is to offer a structured framework for understanding the factors and processes that affect how individuals and organisations accept, integrate, and use new technologies. The following technology adoption models such as Acceptance Model (TAM), Diffusion of Innovation (DOI), UTAUT2 and Technology-Organisation-Environment (TOE) help to identify key influencers of adoption, predict behaviour, and evaluate barriers and facilitators. These models guide the design and implementation of

strategies to enhance technology acceptance, each having a unique purpose and relevance. The following models are compared to identify the most suitable one for guiding this study:

TAM:

The Technology Acceptance Model (TAM) suggests that perceived usefulness and ease of use has an influence on an individual's decision to adopt a technology. It is praised for its simplicity and clarity in understanding user acceptance and has been widely validated in various contexts (Davis, 1989). However, TAM focuses on individual users rather than organisational adoption and overlooks external factors like social influence and facilitating conditions.

DOI:

The Diffusion of Innovations (DOI) theory explains how, why, and at what rate new ideas and technologies spread through cultures, emphasising innovation characteristics, communication channels, time, and social systems. It considers both individual and organisational adoption and applies to a wide range of innovations and contexts (Rogers, 2003). Nonetheless, DOI can be complex and challenging to use, often requiring extensive data for thorough analysis.

UTAUT2:

UTAUT2 enhances the original UTAUT model by adding hedonic motivation, price value, and habit, providing a more complete understanding of technology acceptance, particularly in consumer contexts (Venkatesh et al., 2012). The focus on consumer behaviour makes UTAUT2 applicable for analysing user preferences and motivations, increasing its flexibility and relevance across various technologies and situations. However, these additions also increase the model's complexity, making it harder to apply and interpret, and often require extensive data collection. UTAUT2 may not fully address broader organisational or environmental factors influencing technology adoption and may require customisation for specific contexts, which can limit its generalisability.

TOE:

The Technology-Organisation-Environment (TOE) framework explains technology adoption at the organisational level by considering technological features, organisational characteristics, and environmental factors like industry and market conditions (Tornatzky et al., 1990). It provides a comprehensive view suitable for organisational analysis and is adaptable to various industries and technologies. However, implementing TOE can be challenging as it requires extensive data collection and analysis across multiple contexts.

Despite certain challenges the TOE framework is more relevant and applicable to this research because it is designed for organisational-level analysis such as South African Telco organisations. By considering technological, organisational, and environmental aspects, the TOE framework provides a well-rounded view by considering technology, organisation, and environment, making it suitable for the complex process of AI adoption in analytics. Its relevance is strengthened by its ability to account for industry-specific factors and market conditions in South Africa. Additionally, its flexibility and adaptability enable it to suit the unique requirements and characteristics of the telco industry in South Africa.

There are several benefits to applying the TOE framework for this research, such as a thorough understanding of AI adoption through the consideration of various contexts, insights relevant to the industry, and an emphasis on organisational adoption.

The TOE Theoretical Framework:

This section explores each context in detail, examining their interplay and their impact on an organisation's decision to adopt new technologies.

2.3.1.1 Technology Context

The technology context covers all technologies relevant to the organisation, including those currently in use and those available in the market. Even

unadopted innovations can influence the organisation's future by showing what is possible and suggesting ways to evolve (Tornatzky et al., 1990). Key aspects of the technology context include:

- Technology Readiness: This indicates how prepared an organisation is with its current technological infrastructure and the skills of its workforce. Organisations with a solid technological base and skilled employees are more likely to adopt new technologies efficiently.
- Relative Advantage: This refers to the perceived benefits of new technology compared to existing solutions. If the new technology provides significant improvements in efficiency, cost savings, or performance, it is more likely to be adopted.
- Complexity: The perceived difficulty in understanding and using new technology can act as a barrier to adoption. Technologies that are seen as complex and challenging to implement may encounter resistance within the organisation.

2.3.1.2 Organisation Context

The organisational context focuses on the characteristics and resources of the firm, including linking structures between employees, intra-firm communication processes, firm size, and the amount of slack resources (Tornatzky et al., 1990). Several factors play a crucial role in this context:

- Size: Larger organisations typically have more resources, making it easier for them to invest in and adopt new technologies. They also tend to have more formalised processes and structures that aid in integrating new technologies.
- Structure: The organisational structure, including the levels of centralisation, formalisation, and complexity, can influence technology adoption. For instance, highly centralised organisations may have a more efficient decision-making process, speeding up technology adoption.

- Top Management Support: The dedication and backing of top management are crucial for successful technology adoption. When top executives advocate for technological innovation, it highlights its importance to the entire organisation and helps overcome resistance to change.
- Slack Resources: Extra resources, like financial reserves, provide organisations with the added advantage needed to invest in new technologies without compromising their regular operations.

2.3.1.3 Environment Context

The environment context involves the external environment in which the organisation operates, including the industry structure, presence of technology service providers, and regulatory environment (Tornatzky et al., 1990). This context can facilitate or hinder technology adoption in various ways:

- Industry Characteristics and Market Structure: The adoption of technology can be significantly influenced by the competitive nature of the industry and its market structure. Companies operating in very competitive sectors could use new technology to gain a competitive advantage.
- Regulatory Environment: Government policies and regulations can either help or hinder technology adoption. Favourable rules and incentives can encourage organisations to adopt new technologies.
- Support Infrastructure: Access to external resources like technology vendors, consultants, and training programs can aid organisations in adopting new technologies. A strong support infrastructure can lessen the perceived complexity and risk of new technologies.

2.3.1.4 Interaction of Contexts

The TOE framework emphasises that technology adoption is not influenced by a single factor but by the interplay of technological attributes, organisational characteristics, and environmental factors. This holistic approach provides a

more comprehensive understanding of the multifaceted nature of technology adoption. For instance, an organisation with strong top management support (organisation context) may still struggle with technology adoption if the external regulatory environment is unfavourable (environment context) or if the technology is perceived as highly complex (technology context).

Innovation adoption is clearly influenced by a firm's technological, organisational, and environmental contexts. The TOE framework continues to be a valuable tool for researchers and practitioners, proving useful in studying various innovations and contexts. It remains one of the most prominent theories of organisational adoption.

2.3.2 *Conceptual Framework*

This section presents the findings from the research report, organised according to the themes identified during the examination of prior research. The results were derived through an analysis procedure aligned with the study methodology. To evaluate the body of knowledge on AI and business value, three interdependent focal areas are represented in Figure 4 such as technological, organisational, and environmental factors guided by the TOE to understand the influence of AI to improve analytics in SA Telcos.

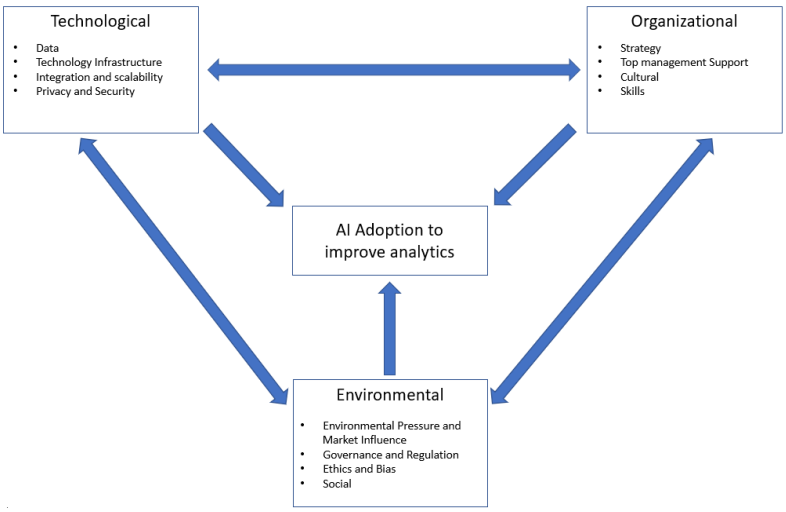

Figure 4. Conceptual model adopted from TOE theoretical framework.

2.4 What are the factors that influence the adoption of AI to improve analytics in SA telcos

Adopting AI for Analytics 4.0 is essential for organisations aiming to succeed in the industry 4.0 era. This shift relies on several factors identified from empirical studies which can be broadly categorised as technological, organisational, and environmental contexts.

2.4.1 Technological

The adoption of AI to enhance Analytics in the South African telecommunications industry is shaped by several technological factors.

2.4.1.1 Data Quality and Volume

Previous authors collectively underscore the crucial role of data quality, management, and availability in the implementation of AI and BI systems. While Merhi (2023a) emphasises the importance of data quantity, Al-Okaily et al. (2023) focuses on data quality and the challenges associated with maintaining it. Mohammad et al. (2022) and Medeiros & Maçada (2022) highlight the importance of data in driving innovation and supporting decision-making. The comparison also reveals the disparities in BI adoption between advanced and developing economies, as noted by Al-Okaily, et al. (2023). Collectively, these authors suggest that for AI to truly enhance Analytics 4.0 in industries like telecommunications, organisations must prioritise data quality, ensure robust data management and integration practices, and maintain substantial datasets.

2.4.1.2 Technology Supporting Infrastructure

Bany Mohammad et al. (2022); Enholm et al. (2022); Merhi (2023b) highlight the critical role of IT infrastructure in the adoption and implementation of AI systems. They agree that advanced, compatible, and robust infrastructure is essential for leveraging AI technologies effectively. Enholm et al. (2022) emphasised the need for substantial computational resources and cloud-based solutions, making high-

performance AI infrastructure accessible to organisations Enholm et al. (2022). Merhi (2023b) underscores the necessity of having the right hardware and software to facilitate system integration and communication. Bany Mohammad et al. (2022) primarily focused on the banking industry, arguing that an interconnected IT infrastructure is vital for enhancing business intelligence and analytics.

2.4.1.3 Integration Complexity and Scalability

The integration and scalability of AI systems are critical factors influencing their successful adoption and implementation. Elapanda et al. (2020) discusses the importance of ease of deployment and flexibility in AI systems, arguing that they should be compatible with existing technologies and adaptable to future updates. Merhi (2023b) highlights the critical role of integration, scalability, and flexibility in AI systems, emphasising the need for seamless communication with existing systems, effective data management, and the ability to accommodate additional data sources and attributes.

2.4.1.4 Cybersecurity and Privacy

In the context of AI adoption, cybersecurity and privacy are paramount concerns. Elapanda et al. (2020) stress the importance of a robust system design to prevent hacking and ensure system integrity. Merhi (2023b) defines security and privacy, as the necessity of protecting data to maintain stakeholder trust and proposing that these elements are crucial for responsible AI. Aldoseri et al. (2023) underline the need for specialised skills in cryptography and privacy-preserving techniques to safeguard AI systems.

Table 1. List of Technological factors influencing the adoption of AI.

Technological Factors	Source
2.4.1.1 Data Quality and Volume	(Bany Mohammad et al., 2022; Medeiros & Maçada, 2022; Merhi, 2023a; Al-Okaily, Al-Okaily, et al., 2023)
2.4.1.2 Technology Supporting Infrastructure	(Bany Mohammad et al., 2022; Enholm et al., 2022; Merhi, 2023b)
2.4.1.3 Integration Complexity and Scalability	(Elapanda et al., 2020; Merhi, 2023b)
2.4.1.4 Cybersecurity and Privacy	(Elapanda et al., 2020; Aldoseri et al., 2023; Merhi, 2023b)

Collectively, these authors underscore that a strong technological foundation is essential for successful AI adoption, enabling businesses to enhance decision-making, drive innovation, and stay competitive in a rapidly evolving digital landscape. Without robust integration, scalability, flexibility, and security measures, AI implementation faces significant barriers, particularly in dynamic environments where data protection and specialised expertise are critical.

Proposition 1 (P1): Successful adoption of AI for Analytics in South African telecommunications depends on a holistic technological approach that prioritises high data quality and volume, robust IT infrastructure, seamless integration and scalability, and stringent cybersecurity and privacy measures.

2.4.2 Organisational

2.4.2.1 Strategy:

Strategic alignment, comprehensive planning, and a focus on business objectives are crucial for AI adoption. Kitsios & Kamariotou (2021) and Enholm et al. (2022)

agree that alignment with AI must be incorporated into business strategies, while Merhi (2023b) and Alqhatani et al. (2022) identify the need for clear strategic thinking regarding AI implementation. Nambiar & Mundra (2022) and Motjolopane & Chanza (2023) advocate that a successful AI implementation starts with specific business objectives and requirements.

2.4.2.2 Cultural

The adoption of AI in organisations requires significant cultural changes, including fostering a data-driven and innovative culture, engaging employees to mitigate resistance, and emphasising mutual learning and experimentation. Nadkarni & Prügl (2021) and Enholm et al. (2022) stress the importance of aligning AI strategies with an organisational culture that values innovation and data. Merhi (2023b) and Wang et al. (2022) highlight the need for strategic thinking and employee engagement to avoid resistance.

2.4.2.3 Skills

The adoption of AI technologies is significantly influenced by the availability of technical expertise. Nadkarni & Prügl (2021) and Khan (2023) highlight the skills gap and the need for effective strategies to manage this gap. Wang et al. (2022) and Aldoseri et al. (2023) emphasised the growing demand for AI-related expertise and propose solutions such as education and interdisciplinary collaboration. Merhi (2023b) and Al-Okaily, Teoh, et al. (2023) identify the lack of training and skillsets as major barriers to AI and BI adoption, respectively, underscoring the importance of targeted training programs. Griva et al. (2023) and Jarrahi et al. (2023) agree that there should be more focus on reskilling, training, and mutual learning.

Wolniak & Grebski (2023a) and Bany Mohammad et al. (2022) stressed the need for skilled professionals to effectively leverage analytics tools and technologies.

2.4.2.4 Top and Middle Management Support

Top management support has been identified in prior studies as a critical factor for successful AI adoption. Duan et al. (2019) and Haefner et al. (2021) emphasised the need for managerial involvement at the strategic level. Enholm et al. (2022), and Merhi (2023a) highlight the importance of active engagement and resource allocation by top management. Koohang & Nord (2021) and Jarrahi et al. (2023) mention the role of leadership in fostering a culture of continuous learning. Nadkarni & Prügl (2021) focus on the need for dynamic capabilities in top management to align digital strategies. Laato et al. (2022) and Kar & Kushwaha (2023) underscore the continuous involvement of top management in setting KPIs and ensuring alignment with business goals.

Table 2. List of Organisational factors influencing the adoption of AI.

Organisational Factors	**Source**
2.4.2.1 Strategy	(Kitsios & Kamariotou, 2021; Alqhatani et al., 2022; Enholm et al., 2022; Nambiar & Mundra, 2022; Motjolopane & Chanza, 2023; Merhi, 2023b)
2.4.2.2 Cultural	(Enholm et al., 2022; Griva et al., 2023; Jarrahi et al., 2023; Leung et al., 2023; Merhi, 2023b; F. Wang et al., 2022)
2.4.2.3 Skills	(Nadkarni & Prügl, 2021; Bany Mohammad et al., 2022; F. Wang et al., 2022; Wolniak & Grebski, 2023a; Aldoseri et al., 2023; Al-Okaily, Teoh, et al., 2023; Khan, 2023; Merhi, 2023b)
2.4.2.4 Top and Middle Management Support	(Duan et al., 2019; Koohang & Nord, 2021; Nadkarni & Prügl, 2021; Haefner et al., 2021; Enholm et al., 2022; Laato et al., 2022; Jarrahi et al., 2023; Kar & Kushwaha, 2023; Merhi, 2023a)

These authors highlight that successful AI adoption requires a well-defined strategy, alignment with business goals, and strong top management support. Additionally, addressing organisational culture and the skills gap through education, training, and collaboration is crucial to overcoming adoption challenges and ensuring seamless integration.

Proposition 2 (P2): For successful AI adoption, organisations must align AI strategies with business goals, build a culture that supports innovation, address skills gaps with targeted training, and ensure strong support from top and middle management.

2.4.3 Environmental

2.4.3.1 External Market Influence and Customer demands

AI adoption is influenced by strategic considerations, environmental pressures, and market dynamics. Alqhatani et al. (2022) emphasise the need for business stakeholders to focus on performance and expansion. Enholm et al. (2022) and Bany Mohammad et al. (2022) discuss how external factors influence the adoption of AI technologies such as the introduction of new market products and the demands of customers. These create a competitive environment that pushes organisations to adopt advanced technologies. To remain competitive and meet these external challenges, organisations are compelled to integrate new technologies such as data warehouses and business intelligence and analytics (BIA). Merhi (2023a) presents a positive outlook on AI's future, indicating that the widespread optimism and anticipated growth in the AI industry will influence top executives to further adopt AI.

The authors differ in their focus and arguments regarding the drivers of AI adoption. Enholm et al. (2022) emphasises both competitive pressure and customer expectations, providing a dual perspective on the factors influencing AI adoption. Bany Mohammad et al. (2022) offer a sector-specific analysis of the banking industry, focusing primarily on competitive pressure. Al-Sai et al. (2022)

provides a broader view, highlighting the general need for technological innovation, driven by competitive pressures across various sectors.

2.4.3.2 Governance and Regulatory Compliance

Global Perspective on AI Regulation: Globally, policymakers are grappling with how to regulate AI effectively without stifling its potential. The challenge stems from the lack of a universally agreed definition of AI and limited understanding among policymakers. Consequently, many countries opt to develop national AI strategies that focus on research, talent development, ethics, and infrastructure rather than implementing rigid regulations (Elapanda et al., 2020; Enholm et al., 2022).

Regulatory Challenges: AI adoption faces significant regulatory challenges due to varying laws and regulations across different sectors and regions. The General Data Protection Regulation (GDPR) in the EU, for example, imposes strict rules on data privacy, making AI deployment more complex. In highly regulated sectors like healthcare and banking, compliance with laws and regulations is critical for AI adoption (Bany Mohammad et al., 2022; Enholm et al., 2022; Laato et al., 2022).

A study by Chinedu Alex Ezeigweneme et al. (2024) compares AI adoption and telecommunications regulation in the United States and Africa revealing that both have their unique challenges and shared aspirations. The United States benefits from a mature, centralised regulatory framework that supports rapid technological integration. In contrast, African countries are navigating a diverse regulatory landscape, focusing on enhancing regulatory effectiveness and promoting digital inclusion.

Both regions aim to balance fostering innovation with ensuring consumer protection, highlighting the interconnected nature of global AI governance. The lessons learned from each region's approach serve as valuable guides for policymakers and industry stakeholders worldwide, emphasising the importance

of connectivity, collaboration, and continuous evolution in the telecommunications landscape.

South African Context: South Africa has yet to formalise specific AI regulations (Hofmeyr & Suliman, 2024). However, the government has established the 4IR Commission to develop strategies for AI and digital transformation. Existing legal principles still apply to AI, indicating a commitment to harnessing the opportunities of the digital industrial revolution (Hofmeyr & Suliman, 2024).

2.4.3.3 Ethics and Bias

The discussion of ethical concerns in AI adoption is a common theme across various authors. Aldoseri et al. (2023) emphasises on broad ethical issues and the necessity of interdisciplinary collaboration, whereas Khan (2023) stresses that it is the duty of the telecommunication industry to integrate ethical principles into AI systems. Merhi (2023b) details specific ethical principles and challenges, focusing on moral dilemmas and biases in AI systems. Enholm et al. (2022) provides a comprehensive framework for ethical AI deployment, stressing the balance between accuracy and interpretability.

2.4.3.4 Social

(Mariani et al., **(2023)** underscore AI's role as a green innovation catalyst supporting environmental sustainability, (Zaripova et al., **(2023)** highlight the foundational importance of human expertise and ethical governance in leveraging AI effectively. Both perspectives are complementary, illustrating that the benefits of AI in business can only be fully realized when technological advancement is paired with environmental responsibility and ethical integrity.

Table 3. List of Environmental factors influencing the adoption of AI.

Environmental Factors	Source
2.4.3.1 External Market Influence and Pressure	(Alqhatani et al., 2022; Al-Sai et al., 2022; Bany Mohammad et al., 2022; Enholm et al., 2022; Merhi, 2023a)
2.4.3.2 Governance and Regulatory Compliance	(Elapanda et al., 2020; Enholm et al., 2022; Bany Mohammad et al., 2022; Enholm et al., 2022; Laato et al., 2022; Merhi, 2023b; Aldoseri et al., 2023; Chinedu Alex Ezeigweneme et al., 2024; Hofmeyr & Suliman, 2024)
2.4.3.3 Ethics and Bias	(Enholm et al., 2022; Khan, 2023; Merhi, 2023b; Aldoseri et al., 2023)
2.4.3.4 Social	(Mariani et al., 2023; Zaripova et al., 2023)

Each author provides unique insights into the complex factors influencing AI adoption across different contexts. Collectively, these perspectives emphasise the importance of ethical principles, strong governance frameworks, and accountability to ensure fairness, transparency, and responsible AI deployment.

Proposition 3 (P3): For effective AI adoption, organisations must navigate external market pressures, comply with varying regulations, and address ethical considerations to stay competitive and meet customer demands.

2.5 What are the benefits of AI adoption and analytics in SA telcos?

This section explores the benefits of using AI to improve analytics in the SA telco industry, leading to better decision-making, optimised operations, and enhanced customer experiences.

The adoption of AI in enhancing analytics has brought transformative benefits eg. decision-making and customer satisfaction to various industries including telcos (Bhima et al., 2023). This study explores the chronological development of AI's impact on analytics, highlighting key contributions from various scholars and practitioners from 2019 to 2024.

Duan et al. (2019) underscored the critical role of AI in improving decision-making processes. They argued that leveraging AI for decision-making is one of the most significant applications in AI history. AI's ability to process massive datasets and generate actionable insights allows organisations to make better, more informed decisions, setting the stage for the broader adoption of AI technologies in various sectors.

A thorough literature search was conducted (described in section 3.3), and by clustering the contexts of the reviewed literature, potential benefits of AI adoption emerged, there was no sufficient evidence of any conclusive or suitable frameworks used to conclusively identify all benefits, hence this qualitative study was carried out to understand if any others emerged in the context of SA telcos. These key findings are summarized in Table 4 and discussed in the following sections.

2.5.1 Operational Efficiency

Building on this foundation, Elapanda et al (2020) introduced the concept of self-healing platforms, which use AI for predictive and corrective management. These platforms optimise resources and reduce manual efforts, enhancing operational efficiency and reducing downtime in the telecommunications industry. Elapanda et al (2020) highlighted AI's capacity to address operational efficiency challenges by analysing data and resolving issues quickly and accurately, resource consumption monitoring, and API availability. This marked a significant advancement in utilising AI for maintaining and optimising telecommunications infrastructure.

2.5.2 Improved efficiencies

Kitsios & Kamariotou (2021) further expanded on the benefits of AI, emphasising its role in enhancing performance through speed, flexibility, customisation, scale, innovation, and decision-making. They noted that AI creates value across various organisational components by automating processes, obtaining knowledge from data, engaging consumers and employees, and developing new products and services. Additionally, they explored the nuanced relationship between AI and human decision-making, suggesting that while AI can make superior decisions in certain contexts, human critical thinking remains essential in others. This analysis highlighted the complementary roles of AI and human intelligence in organisational decision-making. The trend of integrating AI into business processes continued in 2022 with contributions from (Alqhatani et al., 2022) and (Laato et al., 2022). Alqhatani et al. (2022) asserted that the intelligent combination of business intelligence (BI) and AI provides a robust platform for operational management and decision-making, making day-to-day operations smoother and more efficient.

2.5.3 Transparency

Laato et al. (2022) highlighted the increasing use of AI by individuals with non-technical backgrounds, such as medical professionals and lawyers. They emphasised the necessity of transparent AI system explanations to build trust among end users, acknowledging the broader impact of AI across different professional domains. For telco organizations, fostering this trust can lead to smoother implementation of AI tools, higher user engagement, and more informed decision-making across all levels of the organization. Ultimately, trust in AI systems helps reduce resistance to change, enhances the credibility of AI-driven insights, and supports a culture of innovation that is vital in a competitive and fast-evolving industry.

2.5.4 Automation

Mortaji & Shateri (2023) highlighted the integration of business analytics and AI, emphasising AI's role in automating data pre-processing, improving decision-making, enabling predictive and prescriptive analytics, and delivering personalised customer insights. These capabilities are some of the contributors that may lead to substantial operational benefits, such as enhanced data quality, faster and more accurate decisions, and tailored customer experiences.

2.5.5 Minimise risks

In a telco organizations, reducing human errors through AI Merhi (2023b) can significantly improve the accuracy of network maintenance tasks and customer billing processes, areas where small mistakes can lead to service disruptions or customer dissatisfaction. 24/7 operational capability ensures constant network monitoring and quicker response to outages, reducing downtime and associated financial or reputational risks.

Meanwhile, AI-driven technological forecasting and market segmentation Mariani et al. (2023) allows telcos to better anticipate consumer demand for emerging services like 5G or IoT solutions. This helps them invest wisely, reduce the risk of launching irrelevant products, and stay ahead of competitors. Additionally, patent analysis powered by AI can help SA telcos protect their intellectual property and identify opportunities for strategic innovation partnerships, further reducing legal and competitive risks.

2.5.6 Improved Data Management

AI enhances data management by enabling faster, more accurate analysis of vast and complex datasets (Bhima et al., 2023; Faqihi & Miah, 2023). For SA telcos, this could translate into proactive and data-driven decision-making that improves operational efficiency, reduces costs, and boosts productivity. For example, AI’s ability to manage and analyse customer and network data enables better

segmentation, targeted marketing, and personalised services, enhancing customer retention and satisfaction.

Advanced techniques such as supervised learning help telcos predict customer churn, detect fraud, and optimize network performance (Mortaji & Shateri, 2023), directly impacting revenue protection and service reliability. Unsupervised learning allows telcos to uncover hidden patterns in customer behaviour and usage, helping tailor services and allocate resources more effectively.

They further posit that Unsupervised learning, employing clustering and dimensionality reduction techniques such as k-means and Principal Component Analysis (PCA), extracts insights from complex data to understand customer needs and optimise network capacity. Reinforcement learning (RL) and deep learning further bolster telecommunications by optimising network performance and enhancing customer service. RL algorithms optimise bandwidth and traffic, while deep learning techniques like Convolutional Neural Networks (CNNs) and Recurrent Neural Networks (RNNs) process large datasets to identify patterns and predict network congestion. Natural Language Processing (NLP) automates customer feedback analysis, enhancing service quality and customer satisfaction. Additionally, Menzies et al. (2024) discuss how AI-driven analytics transform operations and strategy for multinational enterprises, leveraging large datasets to produce actionable insights for decision-making in global markets, demonstrating the expanding influence of AI in international business. This helps telcos to strengthen their position in an increasingly competitive industry.

Table 4. List of benefits with the adoption of AI to improve analytics in SA telcos.

Benefits	**Source**
2.4.1 Operational Efficiency:	(Elapanda et al., 2020)
2.4.2 Improved efficiencies:	(Kitsios & Kamariotou, 2021)
2.4.3 Transparency	(Alqhatani et al., 2022; Laato et al., 2022)
2.4.4 Automation	(Mortaji & Shateri, 2023)

Benefits	Source
2.4.5 Minimise risks	(Mariani et al., 2023; Merhi, 2023b)
2.4.6 Improved Data Management	(Bhima et al., 2023; Faqihi & Miah, 2023; Menzies et al., 2024; Mortaji & Shateri, 2023)

The chronological development of AI adoption in enhancing analytics demonstrates a clear trajectory of increasing sophistication and integration. From improving decision-making and operational efficiency to driving innovation and competitive advantage. As AI technology advances, its role in transforming analytics and business processes is set to expand further, driving significant improvements in efficiency, decision-making, and customer satisfaction (Bhima et al., 2023).

Proposition 4 (P4): Adopting AI in South African telecommunications improves operational efficiency, transparency, data management to drive innovation and minimise risks ensuring that SA Telcos have a competitive advantage.

2.6 What are the challenges of AI adoption and analytics in SA telcos?

The integration of AI into the telecommunications industry presents significant benefits as discussed in the previous section. However, the challenges associated with AI adoption can disrupt business operations if not properly managed. These challenges extend across technical, operational, and organisational domains, highlighting the complexity of implementing and maintaining AI in organisations.

A thorough literature search was conducted (described in section 3.3), and by clustering the contexts of the reviewed literature, potential challenges of AI adoption emerged, there was no sufficient evidence of any conclusive or suitable frameworks used to conclusively identify all challenges, hence this qualitative study was carried out to understand if any others emerged in the context of SA

telcos. These key findings are summarized in Table 5 and discussed in the following sections.

2.6.1 Data Quality and Management

AI systems rely heavily on high-quality data for training and operation. In the telecommunications industry, data often comes from various sources and formats, leading to inconsistencies and inaccuracies (Merhi, 2023a). Ensuring data quality through cleaning, integration, and management is a critical challenge that requires significant investment in technology and expertise. Many misconceptions concerning AI stem mostly from the possible harm it can do by superseding human intervention (Merhi, 2023a). While AI can generate a range of options and probabilities for complex management tasks, managers and business owners must rely on their intuition and judgment to balance AI-driven recommendations with real-world conditions, ensuring informed and context-aware decision-making to avoid any misconceptions caused by AI.

2.6.2 Scalability and Integration

The complexity and cost of integrating AI solutions with existing telecommunications infrastructure can hinder widespread adoption. Many legacy systems may require extensive modifications or replacements, which can be prohibitively expensive. The inability to scale AI systems effectively to manage the vast volumes of data generated by telco networks can limit the benefits that AI can offer. This challenge can delay the deployment of AI initiatives, leading to missed opportunities for operational improvements and competitive advantage. According to current research, 87 percent of big data and AI projects never get implemented (Merhi, 2023a). Merhi further posits that should these systems fail, all the resources and efforts are wasted, and businesses lose out on the chance to benefit from all the benefits already mentioned.

2.6.3 Skill Gaps and Training

The shortage of specialised knowledge in data science, machine learning, and AI technologies within telecommunications organisations can impede the effective implementation of AI solutions. This skill gap requires significant investment in training and development programs or the hiring of new talent, both of which can strain organisational financial resources. The rapid pace of technological advancements further exacerbates this challenge, requiring continuous learning and adaptation. AI technologies are developing more quickly than the number of workers qualified to handle the complexity and diversity of AI systems (Aldoseri et al., 2023). This talent gap has the potential to obstruct AI advancement and adoption in several ways. Failure to address the skills gap can result in inefficient AI implementations and reduced return on investment.

2.6.4 Ethical and Regulatory Concerns

Navigating the complex regulatory environment related to data privacy and security is critical for telecommunications companies adopting AI. Ethical considerations, such as algorithmic bias and transparency, must be managed to maintain customer trust and compliance with regulations. Missteps in these areas can lead to legal repercussions, reputational damage, and loss of customer confidence. Additionally, addressing these concerns often requires substantial investments in compliance and ethical oversight mechanisms. As explainable AI methods improve, there is a chance that explanations produced could be biased or deceptive, which could have negative impacts (Aldoseri et al., 2023).

2.6.5 Cost and Return on Investment

The significant costs associated with implementing AI technologies, including infrastructure upgrades, software, and skilled personnel, present a significant barrier. Demonstrating a clear return on investment (ROI) is challenging but essential for justifying these expenditures. Organisations may struggle to balance

the financial benefits of AI initiatives with their costs, potentially leading to cautious or limited adoption of AI technologies. Process optimisation ROI quantification is a challenging task in business analytics (Wolniak & Grebski, 2023a). This challenge can prevent telco companies from realising the full potential of AI-driven efficiencies and innovations.

2.6.6 Change Management and Organisational Resistance

Significant changes in business processes and workflows due to AI adoption can encounter resistance from within the organisation. Employees may be reluctant to adapt to new technologies and processes due to concerns about job displacement or mistrust of the technology (Wolniak & Grebski, 2023a).

These concerns could slow down the implementation and reduce the effectiveness of AI solutions. Effective change management strategies are essential to overcome this resistance and ensure a smooth transition. Failure to manage change effectively can result in prolonged implementation timelines, increased costs, and suboptimal use of AI technologies.

2.6.7 Reliability and Performance

AI systems must be highly reliable and perform consistently in varying conditions, particularly in telecommunications where network performance and uptime are critical. Any failure or inconsistency in AI systems can have significant consequences, such as network outages or degraded service quality. Ensuring the robustness and reliability of AI models in real-world conditions is challenging and requires ongoing monitoring and maintenance. Unreliable AI systems can undermine trust in AI technologies and hinder their broader adoption. Sometimes the price of highly interpretable models has a negative performance impact (Aldoseri et al., 2023).

2.6.8 Data Privacy and Security

The vast amounts of sensitive data handled by telecommunications companies make data privacy and security paramount. AI systems must be designed with stringent security measures to protect against data breaches and ensure compliance with privacy regulations.

Big data and AI integration raises ethical and privacy challenges like ownership, control, bias, discrimination, privacy and transparency. Regulators may find it difficult to efficiently handle new issues because of the intricacy of the data represented by AI systems (Aldboush & Ferdous, 2023). Balancing the need for data access with privacy concerns is a persistent challenge. Failure to adequately address data privacy and security can lead to legal penalties, financial losses, and damage to the company's reputation.

2.6.9 Transparency and Explainability

AI systems, particularly those based on complex machine learning models, can often act as "black boxes," making it difficult to understand how decisions are made. Users are ignorant of how to use recommendations provided by AI. Many times, employees receive inadequate training in the workings and applications of artificial intelligence (Getchell et al., 2022). It is still a problem to create uniform assessment criteria to evaluate the explainability and interpretability of AI models to justify ROI (Aldoseri et al., 2023).

Table 5. List of challenges with the adoption of AI to improve analytics in SA telcos.

Challenges	**Source**
Data Quality and Management	(Merhi, 2023a)
Scalability and Integration	(Merhi, 2023a)

Challenges	Source
Skill Gaps and Training	(Aldoseri et al., 2023)
Ethical and Regulatory Concerns	(Aldoseri et al., 2023)
Cost and Return on Investment	(Wolniak & Grebski, 2023a)
Change Management and Organisational Resistance	(Wolniak & Grebski, 2023a)
Reliability and Performance	(Aldoseri et al., 2023)
Data Privacy and Security	(Aldboush & Ferdous, 2023)
Transparency and Explainability	(Getchell et al., 2022)

Failing to address the skills gap, data management, or ensure data privacy can lead to inefficient AI implementation, higher costs, security risks, and reduced return on investment. These challenges may prevent telcos from fully leveraging AI-driven efficiencies and innovations, potentially resulting in legal penalties, financial losses, and reputational damage.

Proposition 5 (P5): The successful adoption of AI in SA Telcos to improve analytics requires overcoming challenges related to data quality, scalability, skill gaps, ethical concerns, costs, organisational resistance, reliability, data privacy, and transparency.

2.7 Conclusion of Literature Review

This chapter examined current literature regarding AI adoption to improve analytics in SA telcos. By analysing recent and relevant studies, this research has provided valuable insights and guidance for scholars, practitioners, and management which needs to be considered in AI adoption strategies.

The exploration highlighted the factors, benefits and challenges of integrating AI into SA telcos. Refer to Table 8 for a summary of these research questions and propositions. The chronological development of AI in analytics demonstrated increasing demand for AI suggesting that this is essential for SA telco to improve decision-making, efficiency, and innovation. Scholars stressed the importance of successful AI implementation, data quality and upskilling to fully realise its potential to ultimately improve customer satisfaction. Overcoming these obstacles can unlock AI's transformative potential, bridging the gap between AI and human understanding for a reliable and transparent AI-powered future.

The lag in adoption is primarily due to the top two global and South African technological issues, Networks/Telecommunications and Business Intelligence/analytics, previously highlighted by Palvia et al., (2021). This underscores the need to adopt AI to improve analytics in developing countries like South Africa within the telecommunications sector.

CHAPTER 3. RESEARCH METHODOLOGY

This chapter details the methodology to explore the role of AI to improve analytics within South African telco organisations. This study adopts an exploratory research approach. This qualitative research focuses on collecting firsthand textual data and analysing it through interpretive methods, making it ideal for exploring under-researched phenomena. It aims to generate new insights and theories within a specific context and time, rather than producing broadly generalizable results (Taherdoost, 2022). It focuses on the research approach, strategy, and methods used to address the research questions and propositions from the research report, using the Saunders (2019) research onion framework (Figure 5).

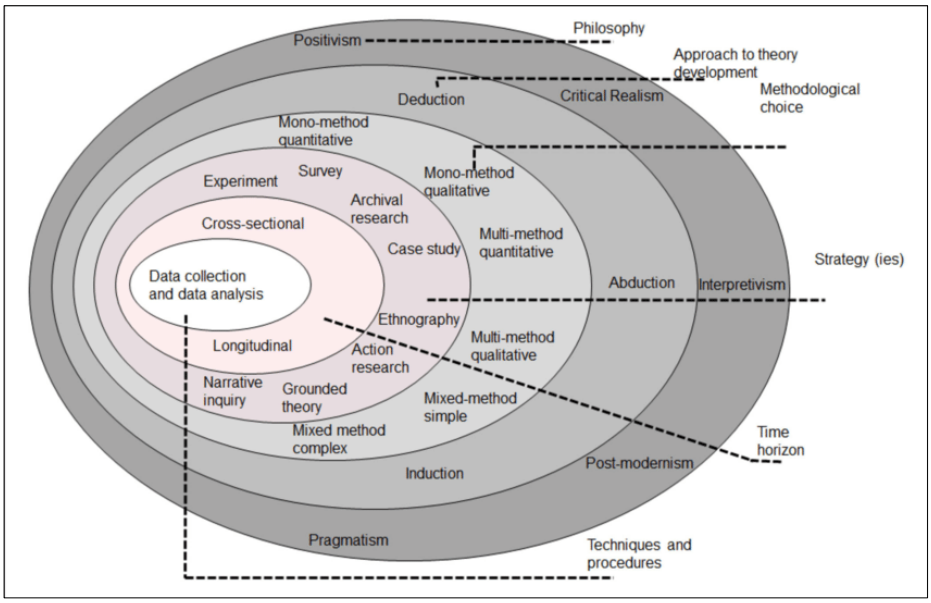

Figure 5. Research Onion framework, constructed by Saunders et al. (2019)

3.1 Research Paradigm

In the study exploring the role of AI in enhancing analytics within SA telco organisations, an interpretive research paradigm is employed to capture the subjective experiences and meanings associated with AI adoption (Creswell & Poth, 2018). The ontological stance follows constructivism, which posits that the

reality of AI's impact is socially constructed and varies among stakeholders (Lincoln et al., 2018). Epistemologically, the study is grounded in interpretivism, guiding the collection of qualitative data to explore the nuanced perceptions, applications, and contextual factors influencing AI-driven analytics (Bryman, 2016). From an axiological perspective, the research acknowledges the potential for researcher biases and prioritises ethical considerations, including transparency, respect for participant viewpoints, and the responsible interpretation of findings (Saunders et al., 2019).

3.2 Research approach

Qualitative research, guided by the TOE (Technological, Organisational, and Environmental) framework, is selected as the appropriate method to help explain how and why firms adopt innovations such as AI (Nguyen et al., 2022). This author suggests that unlike other models, it considers both internal and external factors by grouping them into three areas: technology, organization, and environment. The technological context covers current and new technologies relevant to the firm. The organizational context refers to the firm's size, structure, and resources. The environmental context includes external factors like industry trends, competitors, and government regulations. This inductive approach is fundamentally data-driven, with themes or secondary codes emerging directly from the data rather than being shaped by pre-existing theories (Clarke & Braun, 2017). This method was selected to generate new theories or models, such as grounded theory or phenomenological studies. Inductive methods are particularly effective when no existing theory adequately explains the phenomenon being studied as highlighted by Clarke & Braun.

This inductive approach provides a deep understanding of how AI technologies are perceived and used (Technological), how organisational factors like culture and leadership influence AI adoption (Organisational), and how external factors such as market conditions and regulations shape AI implementation (Environmental).

3.3 Research design

Semi-structured interviews were chosen to capture rich, detailed insights from 15 participants across three SA telco organisations. This interview method was adopted because it strikes a balance between structure and flexibility, allowing interviewers to explore key topics while encouraging participants to share detailed, personal insights (Y. Wang, 2024). This author suggests that this format supports the collection of rich, valid data through open-ended questions, while still maintaining enough consistency to compare responses across participants.

A purposive sampling was selected with the inclusion criteria that these participants have some experience with data as they are likely to provide rich, relevant, and insightful information aligned with the research questions. Selecting these participants were not based on successful implementation of AI, as such the reliability of the findings are not compromised. Five participants from each organisation were interviewed, ensuring balanced representation and consistent input across all cases through open-ended questions and probing. These interviews were time-consuming, resource-intensive, and subject to potential biases, with some data that was not be easily generalisable. Despite these challenges, the rich, contextual insights made interviews invaluable for this comprehensive qualitative research. The analysis is conducted at the individual employee level rather than at the organizational level.

3.4 Data collection methods

Interviews were conducted using Microsoft teams as well as written feedback to collect primary data and electronically recorded in a secure file location. Verbatims were then captured in Atlas.ti for further analysis. A systematic six-step thematic analysis process was followed (Figure 6), where each step was thoroughly explained and supported by examples, leading to the development of a conceptual model (Naeem et al., 2023). Step 1 is about transcribing and familiarising of the data collected and select key quotations. Step 2, keywords are

identified to capture recurring patterns and participant experiences. In the coding phase (Step 3), data are labelled with short phrases (first-order codes) to simplify the analysis. Theme development (Step 4) groups the codes into meaningful patterns (second-order codes). Step 5, conceptualisation refines emerging concepts using models or diagrams. Finally (Step 6), a conceptual model is developed, integrating findings to answer research questions and highlight the study's contribution.

Figure 6. six-step thematic analysis process (Naeem et al., 2023)

3.5 Population and sample

The following sections concentrate on the selected population and sample for the research study.

3.5.1 *Population*

The primary data collection involved semi-structured interviews and written responses from key stakeholders within the SA Telco industry that had experience in analytics. Technical, Operational and Strategic employees such as Chief Technology Officer; Data Analysts; Solutions Architect; Data Quality Assurance manager; Business Analyst; Data Scientist; Marketing specialist and Product Owners, were key participants who were directly involved in processes where AI could have a significant impact. Their insights helped to identify current challenges and further benefits.

3.5.2 *Sample and sampling method*

To explore AI's role in enhancing analytics within SA telcos, non-probability purposive sampling was used for its cost-effectiveness and targeted participant

selection (Omeihe & Harrison, 2024). Employees with relevant analytics and AI experience were deliberately chosen from systems, products, and operations to ensure diverse insights. Merhi (2023b) and Guest et al.,(2006) posit that having more than 12 interviews may lead to data saturation. This study reached saturation at participant 15, as no new themes emerged and responses began to repeat, indicating that sufficient data had been collected for a robust analysis. Therefore, no additional interviews were conducted to avoid data redundancy and unnecessarily increasing the workload for analysis (Grady, 1998). Participants were contacted through professional networks and internal referrals within their organisations. This targeted approach ensured that the selected individuals had the necessary experience and knowledge in analytics. This diversity was crucial to achieve inclusiveness in capturing a comprehensive view of AI's role in enhancing analytics in the SA telco sector.

Table 6. List of participant profiles that were interviewed to understand the adoption of AI to improve analytics in SA telcos.

Population	**Job Profile**	**Number of Participants**	**Reason**
Employees who have implemented or used data or AI technologies within the SA Telcos	Chief Technology Officer	1	To gain insights into strategic decisions and overall direction regarding AI adoption and its impact on organisational analytics capabilities.
	Data/ Solutions Architect	1	To understand the design and integration of data systems that support AI analytics, ensuring data infrastructure is optimised for AI applications.
	Marketing specialist	1	To explore how data is being consumed to target consumers and if AI solutions are adopted within the telco environment.
	Data Quality Assurance manager	1	To learn about the measures and standards in place to ensure data integrity and accuracy, which are crucial for effective AI-driven analytics.

Population	Job Profile	Number of Participants	Reason
	Business Analyst	3	To identify how AI-driven analytics influence business decision-making and processes, providing a link between technical capabilities and business outcomes.
	Data Scientist	3	To delve into the technical methodologies and models used in AI analytics, gaining insights into their practical applications and effectiveness in the telco industry.
	Data Analyst	3	To gather insights on how AI tools and techniques enhance data analysis processes and improve the accuracy and efficiency of analytics outcomes.
	Product Owner	2	To understand how AI-driven analytics influence product development and decision-making, as well as the prioritisation of features and enhancements based on analytical insights to improve sales.
Total Participants		**15**	

3.6 The research instrument

The study used semi-structured interviews as the primary instrument, guided by an interview schedule based on the literature review and theoretical framework. Section A covered participant demographics, while Sections B, C, and D explored AI adoption factors, benefits, and challenges in SA telcos. This format allowed for open-ended responses, providing deeper insights into participants' experiences.

Two pilot interviews were conducted in November 2024 to refine the process and ensure clarity. Interviews were held online via Microsoft Teams, recorded with consent for accurate transcription and analysis. Participants received a detailed interview guide, consent form, and research overview in advance (Appendices A - C).

3.7 Procedure for data collection

Participants were contacted via email with study details and confidentiality assurances. The interview guide was sent in advance for preparation, and participants could respond via recorded interviews or written feedback. Consent for recording was obtained, with sessions averaging 30-45 minutes for in-depth discussions. Transcribed interviews were securely stored for analysis.

This structured approach ensured ethical compliance, data security, and consistency, making the study replicable for future research.

3.8 Data analysis strategies and interpretation

The study used thematic analysis to examine AI’s role in enhancing analytics within SA telcos, identifying patterns in qualitative data through a structured five-phase process adopted from Bingham (2023). Data was organised (phase 1) and then sorted for relevance (phase 2), and coded using first and second-order themes (Grady, 1998) captured in Atlas.ti (phase 3). Findings were interpreted,

refined for accuracy, and aligned with the research narrative (Phase 4). A final report (phase 5), incorporating interview verbatims and potential data triangulation, ensured reliable insights and highlighted gaps in AI adoption literature while maintaining methodological rigor for future replication.

3.9 Possible limitations and challenges of the study

This study has a few limitations. The small sample size and qualitative approach may limit the generalisability of findings across the broader telco sector. Semi-structured approaches offer high validity but may carry some risk of lower reliability (Y. Wang, 2024), as this approach relies on their memory to gather insights. Semi-structured interviews could also introduce participant bias as these participants have been selected based on having some knowledge about data and could be influenced by personal perceptions or concerns about AI replacing jobs.

Time constraints restrict the study to a cross-sectional analysis, capturing data at a single point rather than over time. Interviews with participants were time-consuming, resource-intensive, and subject to potential biases, with some data that was not be easily generalisable. Literature was limited in the context of adopting AI to improve analytics within SA telcos, therefore other sectors were explored to also compare findings. The lack of quantitative data also affects external validity, making replication in different organisational contexts challenging. These factors should be considered when interpreting the findings.

3.10 Quality Assurance

Quality assurance was crucial to this study on exploring the role of AI to improve analytics within SA telco organisations. This was achieved by ensuring that the findings were trustworthy and accurately reflect the perspectives and experiences of the participants. By maintaining high standards of credibility, reliability, validity and confirmability, this research may provide valuable and actionable insights

that can effectively inform AI strategies within the telecommunications or other industries.

3.10.1 *Transferability*

Transferability in qualitative research refers to how well findings can apply to other contexts (Kakar et al., 2023). In this study, thick description and a consistent data collection process ensured transferability. Providing detailed contextual information about the study environment, participants, and AI technologies allows readers to assess relevance in similar settings. A standardised interview guide also maintained consistency, enabling replication in different contexts.

This study's insights extend beyond South African telcos, offering value to similar industries and regions (Tracy, 2010). By documenting participant selection, data collection, and analysis, the research provides a blueprint for future studies, supporting broader knowledge-sharing in AI adoption and business analytics.

3.10.2 *Credibility*

Credibility ensures that qualitative research accurately represents participants' experiences (Kakar et al., 2023). This study has maintained credibility by using a structured interview guide, selecting knowledgeable participants, and providing them with research details in advance to ensure well-informed responses. Member reflections were used to validate findings, ensuring accurate representation of AI's impact on SA telcos. This rigorous approach enhances trustworthiness, making the study valuable for stakeholders and replicable for future research (Tracy, 2010). Furthermore, maintaining credibility will enable future researchers to have confidence in the study's findings and potentially replicate the research under similar conditions.

3.10.3 *Dependability*

Dependability ensures consistency and stability in qualitative research by maintaining a logical and well-documented process (Kakar et al., 2023). This study ensured dependability through meticulous documentation, including an audit trail of data collection, decision-making, and analysis. Keeping detailed records, such as interview recordings and meeting notes, enhances traceability and replicability for future research. This approach strengthens the study's trustworthiness and supports further exploration of AI adoption in SA telcos.

3.10.4 *Confirmability*

Confirmability ensures that findings reflect participant responses rather than researcher bias (Omeihe & Harrison, 2024). This study maintained methodological transparency through audit trails, reflective journaling, and meticulous documentation of data collection and analysis. Using Atlas.ti, transcripts, and audio recordings further enhances traceability and validity, ensuring conclusions are rooted in participant data rather than assumptions.

3.11 Ethical considerations

Ethical clearance was obtained from the Wits Business School Ethics Committee to ensure compliance. Participant consent was secured, with anonymity maintained by using labels like "Participant 1" and "Company A." Confidentiality was guaranteed through consent forms, and participation was voluntary. The study adhered to ethical standards, ensuring accuracy, transparency, and data integrity while protecting participant privacy.

3.12 Schedule and timelines

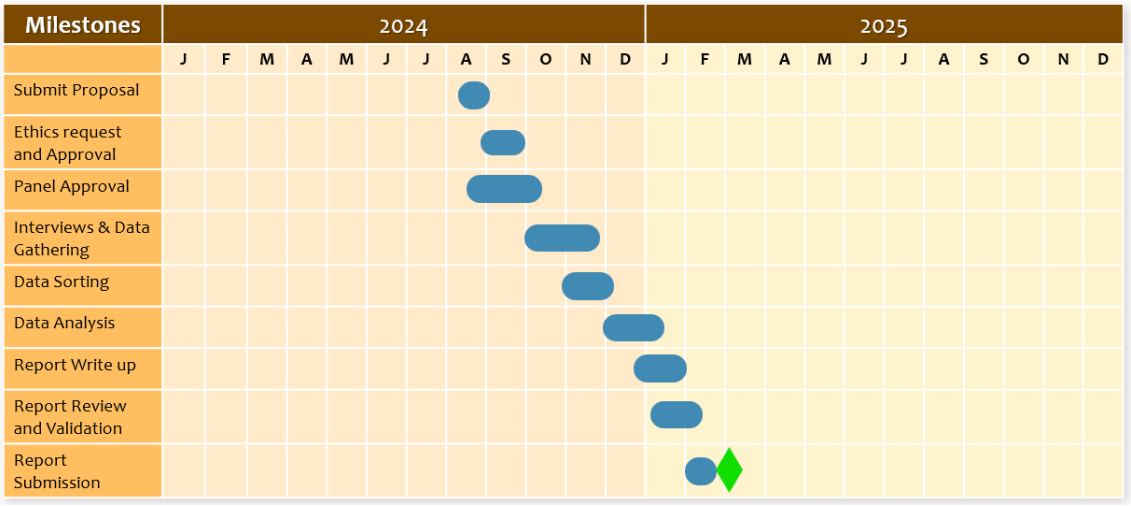

Figure 7. Timeline including milestones of the MMDB Research report.

Table 7. Summary of Methodologies that were used in this study to understand the adoption of AI to improve analytics in SA telcos.

Methodology	**Approach**
Research philosophy	Interpretivist
Research approach	Inductive
Methodological choice	Qualitative
Sampling Method	Non-probability purposive
Time horizon	Cross-sectional
Data collection	Triangulation: Semi structured Interviews supported with Secondary data
Data analysis	Thematic

Table 8. Consistency table: research questions, propositions, data collection and data analysis

Topic	Proposition	Interview Questions (Data collection details)	Data analysis method
Research question 1 (RQ1): What are the factors that influence the adoption of AI to improve analytics in SA telcos?			
Technological	**P1:** Successful adoption of AI for Analytics in South African telecommunications depends on a holistic technological approach that prioritises high data quality and volume, robust IT infrastructure, seamless integration and scalability, and stringent cybersecurity and privacy measures.	**Q1:** To what extent do you agree that aspects like data quality, IT infrastructure, integration, scalability, and cybersecurity influence AI adoption in telco organisations? What other technological factors are important in your organisation to adopt AI?	• TOE Framework, • Thematic analysis
Organisational	**P2:** For successful AI adoption, organisations must align AI strategies with business goals, build a culture that supports innovation, address skills gaps with targeted training, and ensure strong support from top and middle management.	**Q2:** To what extent do you agree that aligning AI with business goals, building a culture of innovation, addressing skills gaps, and having strong support from leadership influences AI adoption in telco organisations? What other organisational factors are important to adopt AI?	• TOE Framework, • Thematic analysis
Environmental	**P3:** For effective AI adoption, organisations must navigate external market pressures, comply with varying regulations, and address	**Q3:** To what extent do you agree that external market pressures, complying with regulations, and addressing ethical concerns influences AI adoption in telco organisations?	• TOE Framework, • Thematic analysis

Topic	Proposition	Interview Questions (Data collection details)	Data analysis method
	ethical considerations to stay competitive and meet customer demands.	What other environmental factors are important in your organisation to adopt AI?	
Research question 2 (RQ2): What are the benefits of AI adoption and analytics in SA telcos?			
Benefits	**P4**: Adopting AI in South African telecommunications improves operational efficiency, transparency, data management to drive innovation and minimise risks ensuring that SA Telcos have a competitive advantage.	**Q4:** How has AI adoption improved your organisation in relation to data analytics?	A thorough literature search (detailed in Section 3.3) revealed potential benefits of AI adoption through context clustering, but the lack of conclusive frameworks to identify all benefits prompted this qualitative study to explore additional insights within the context of SA telcos.
Research question 3 (RQ3): What are the challenges of AI adoption and analytics in SA telcos?			
Challenges	**P5:** The successful adoption of AI in SA Telcos to improve analytics requires overcoming challenges related to data quality, scalability, skill gaps, ethical concerns, costs, organisational resistance, reliability, data privacy, and transparency.	**Q5:** What challenges has your organisation faced in adopting AI to improve analytics?	A thorough literature search (detailed in Section 3.3) revealed potential benefits of AI adoption through context clustering, but the lack of conclusive frameworks to identify all challenges

Topic	Proposition	Interview Questions (Data collection details)	Data analysis method
			prompted this qualitative study to explore additional insights within the context of SA telcos.

CHAPTER 4. PRESENTATION OF FINDINGS

4.1 Introduction

This chapter presents the findings of exploring the role of AI to improve Analytics within SA telco organisations. The integration AI in telco organisations is shaped by diverse roles, qualifications, and experiences. Insights from 15 participants across three SA telco companies (Company A, B, and C) highlight how strategic, operational, and technical roles contribute to AI adoption and analytics enhancement. The analysis references participants' roles, tenure, qualifications, and feedback methods, providing a comprehensive view of their influence in response to the research questions and propositions highlighted in Chapter 3, Table 8.

4.2 Demographic profile of participants

Strategic roles, held by Participants 4, 8, 10, 12, 14, and 15, lead AI initiatives by aligning them with organisational objectives, resource allocation, and decision-making. Most possess advanced qualifications, such as master's degrees, and under 10 years of tenure, except Participant 7 and 15, who has over 11 years. Feedback was gathered through interviews (e.g., Participant 8) and written responses (e.g., Participant 15).

Operational roles, filled by Participants 2, 5, 7, 9, and 13, bridge strategy and execution in areas like digital enablement and financial planning. Positions include internship (e.g., Participants 6) to CTO (e.g., Participant 14).

Technical roles, represented by Participants 1, 3, 6, and 11, focus on implementing AI systems. Qualifications vary from no tertiary degree (Participant

1) to postgraduate degrees, with tenure spanning new talent (Participant 6) to over 11 years (Participants 1 and 11).

Gender demographics were collected to examine their potential influence on, or relevance to, participant feedback. The participant pool consists of 11 male participants and 4 female participants; however, no gender-related patterns or themes emerged from the data that would meaningfully inform the study's findings. As such, gender was not included as a variable in the analysis presented in this report. This sample of participants is not a representation of the gender disparity in SA telcos. Tenure patterns based on this sample reveal short tenures (≤5 years) dominate technical and operational roles, while long tenures (11+ years) are tied to senior positions (e.g., Participants 7, 11, and 15). Strategic participants mostly hold advanced degrees, such as Participants 4, 8, and 14 (Table 9).

Feedback methods combined interviews for real-time and deeper insights and written responses for reflective input (refer to Appendix F for participant verbatims and code groupings).

In conclusion, strategic roles direct initiatives, operational roles bridge gaps, and technical roles drive implementation, with tenure dynamics enhancing the understanding of AI in telco analytics.

Participant Name	Organisation Name	a) Type of organisation?	b) What is your qualification ?	c) Gender ?	d) What is your current role at the organisation?	Role Type	e) Do you have any influence on what technology is implemented at your organisation?	f) How long have you been employed at your organisation?	g) Which division and functional area do you work in?	h) Feedback Collection Method
Participant 1	Company A	SA Telco	No tertiary qualification	Male	Sales/Regional/stores as well as African markets sales and performance Analytics	Technical	Somewhat	6 to 10 Years	Data and Analytics looking at Vodacom group	Interview
Participant 2	Company C	SA Telco	Postgraduate	Male	Product Owner	Operational	Yes	<=5 Years	Digital Enablement	Written
Participant 3	Company C	SA Telco	Degree	Male	Head of digital content and the consumer area	Technical	Somewhat	<=5 Years	Digital Services in the consumer business area	Interview
Participant 4	Company B	SA Telco	Degree	Male	Manager: Digital Solutions (Advertising, Marketplace Platforms, SaaS)	Strategic	Yes	<=5 Years	Consumer and Small Business	Written
Participant 5	Company C	SA Telco	Postgraduate	Female	Portfolio Manager	Operational	Somewhat	6 to 10 Years	Group Digital Partnerships – I support all functional areas of the business	Written
Participant 6	Company B	SA Telco	Degree	Female	AI intern	Technical	Yes	<=5 Years	AI team, technology	Interview
Participant 7	Company A	SA Telco	Masters	Female	data asset manager	Operational	No	11> Years	I am in the financial planning and Analysis Division, part of the finance function and data asset manager management.	Interview
Participant 8	Company A	SA Telco	Masters	Male	lead data scientist, looking after a team of 18 in the data scientists	Strategic	Yes	6 to 10 Years	Group commercial and strategy team more specifically within that the big data AI and RPA division.	Interview
Participant 9	Company B	SA Telco	Degree	Male	Commercial manager within digital lifestyle services.	Operational	No	<=5 Years	business, digital lifestyle service	Interview
Participant 10	Company A	SA Telco	Degree	Male	data engineer.	Strategic	Yes	6 to 10 Years	Data analytics.	Interview
Participant 11	Company B	SA Telco	Postgraduate	Male	Data steward in business	Technical	Somewhat	11> Years	Enterprise Business	Interview
Participant 12	Company C	SA Telco	Masters	Male	Managing director for South Africa at the organisation	Strategic	Yes	<=5 Years	I work in commercial, so commercial implementation as well as managing and running of the day-to-day business.	Interview
Participant 13	Company B	SA Telco	Degree	Male	group strategic partnerships manager	Operational	No	<=5 Years	Group financial services and strategy	Interview
Participant 14	Company A	SA Telco	Degree	Male	Chief Technology Officer	Strategic	Yes	<=5 Years	Group Technology	Written
Participant 15	Company C	SA Telco	Postgraduate	Female	Executive Head: Digital Marketing	Strategic	Yes	11> Years	Brand and Comms, Digital Marketing in the Consumer business unit	No response

Table 9. List of participants who were interviewed (demographic profile).

4.3 RQ1: What are the factors that influence the adoption of AI to improve analytics in SA telcos?

Participant insights demonstrate the diverse priorities in AI adoption, underscoring the importance of collaborative strategies that integrate perspectives across all roles. All 15 participants have provided rich insights into these Technological, Organisational and Environmental factors which have been grouped by first and second order codes below for each proposition:

4.3.1 *Results pertaining to Proposition 1*

P1: Successful adoption of AI for Analytics in South African telecommunications depends on a holistic technological approach that prioritises high data quality and volume, robust IT infrastructure, seamless integration and scalability, and stringent cybersecurity and privacy measures.

Strategic leaders, such as Chief Technology Officers (Participant 14) and Managing Directors (Participant 12), tend to emphasise data governance, robust IT infrastructure, and regulatory compliance to ensure alignment with long-term goals. Technical participants, like data scientists (Participant 8) and engineers (Participant 10), tend to focus on data quality, integration, and scalability for operational feasibility. Operational roles, such as product owners (Participant 2) and portfolio managers (Participant 5), prioritise integrating AI into workflows and achieving user-centric outcomes as depicted in Figure 8, highlighting the first and second (L2) order codes.

(L2) Data Governance and Quality

Code: Data Governance Importance

Data governance emerged as an important factor according to Participant 8 stating that, *"Data governance data quality are probably the primary and most critical thing necessary in any organisation required as a prerequisite to actually*

adopt AI". Similarly, Participant 14 further noted the need for a holistic data strategy encompassing quality, governance, and privacy considerations.

Code: Garbage In, Garbage Out

Several participants emphasised the *"garbage in, garbage out"* principle, underscoring the importance of high-quality data inputs. Participant 7 articulated, *"What you put into AI is what you get out,"* stressing the impact of data quality on AI model outputs. Participant 11 elaborated, *"you need to make sure those inputs are of a high quality."* This perspective was shared by Participant 15, who noted that *"Poor data can lead to unreliable insights"*.

Code: ML/AI Platform Standardisation

Standardised AI platforms are crucial for managing data effectively. Participant 8 advocated for a *"scalable standardised machine learning AI platform,"* while Participant 12 discussed their organisation's use of technologies like AWS, Google Cloud, and Kubernetes to ensure consistency.

(L2) IT Infrastructure and Integration

Code: Robust IT Infrastructure

Robust infrastructure is essential for managing telco data volumes and AI processes. Participant 1 highlighted the need for capable systems, saying, *"You got to have something decent in place for all of AI to run on."* Participant 15 discussed the role of cloud-based platforms in enabling scalability and AI exploration. Additionally, Participant 12 pointed to AI's potential in optimising network performance, leveraging robust infrastructure. It was noted that Participant 7 who has significant experience in this field, has no influence on what technology is implemented in their organisation compared to Participant 6 who is an intern that has some influence on technology adoption. This stands out as an anomaly in the data set.

Code: Integration Challenges

Integration was identified as a significant challenge, particularly for legacy systems. Participant 5 explained, *"We have complex, legacy IT systems with*

siloed data... Integrating data requires sophisticated engineering." Participant 8 reinforced this view, noting the difficulties of aligning AI with existing analytics stacks.

Code: Scalability Needs

Scalability is a critical enabler of AI adoption. Participant 8 described the importance of AI solutions that can *"score models on your entire base,"* while Participant 15 noted their organisation's focus on handling increasing customer data volumes. Participant 12 emphasised the strain that scalability places on existing systems, including GPU and resource requirements.

(L2) Cybersecurity and Privacy

Code: Cybersecurity Concerns

Participants underscored the importance of cybersecurity in AI adoption. Participant 7 stressed the need to *"ensure that our data is secure... and abide by all the regulations."* Participant 15 pointed out that strict security protocols are key to gaining trust and advancing AI initiatives. Concerns over identity theft and data breaches were also highlighted by Participant 1 and Participant 12.

Code: Data Privacy and Compliance Tools

Data privacy and compliance tools are integral to cybersecurity strategies. Participant 14 noted the need for *"actively managing data privacy"* alongside a robust cybersecurity framework. Participant 8 highlighted the importance of avoiding data leaks through AI model outputs, while Participant 15 discussed collaboration between IT and compliance teams to meet privacy standards.

(L2) Regulatory and Ethical Compliance

Code: Regulatory Compliance

Compliance with South Africa’s data protection laws, such as POPIA, was emphasised as a foundational requirement. Participant 15 explained, *"Any AI system we consider adopting must align with these regulations."* Participant 8 noted that regulatory frameworks like ICASA and POPIA provide *"suitable guardrails for responsible data usage for AI."*

(L2) Technological Advancements

Code: AI Governance Tools

AI governance tools are critical for ensuring ethical and unbiased AI use. Participant 8 described AI governance as a *"function and a set of tooling"* to manage model inputs and outputs. Participant 15 noted the importance of avoiding biases in AI-driven decision-making, especially in marketing.

Code: Cloud-Native Technologies

Cloud-based technologies support seamless AI adoption. Participant 12 highlighted the importance of cloud-native solutions, stating, *"That's where infrastructure is moving to."* Participant 15 referenced tools like Microsoft Co-Pilot, which leverage cloud systems for efficient data processing.

Code: Automation Tools and MLOps

Automation tools and MLOps streamline workflows and enhance scalability. Participant 4 described technologies like edge computing and MLOps for managing AI models and workflows. Participant 15 noted how automation tools have already reduced repetitive tasks in their marketing workflows.

Code: Energy Efficiency in AI Operations

Energy efficiency is an emerging concern for AI operations. Participant 3 discussed the high-power demands of data centres and proposed solar energy as a sustainable solution in South Africa's climate stating that *"power consumption is going through the roof, so we have to look at other efficient ways to be able to power AI,"* suggesting that *"solar becomes an option*." Participant 12 linked energy efficiency to capital expenditures on legacy systems.

Code: Unified Data and AI Strategy

A unified strategy for data and AI is foundational for successful adoption. Participant 8 noted, *"Having this unified data and AI strategy is critical and foundational."* Participant 15 emphasised the importance of a broader organisational strategy, linking data quality, infrastructure, and cybersecurity as interdependent factors.

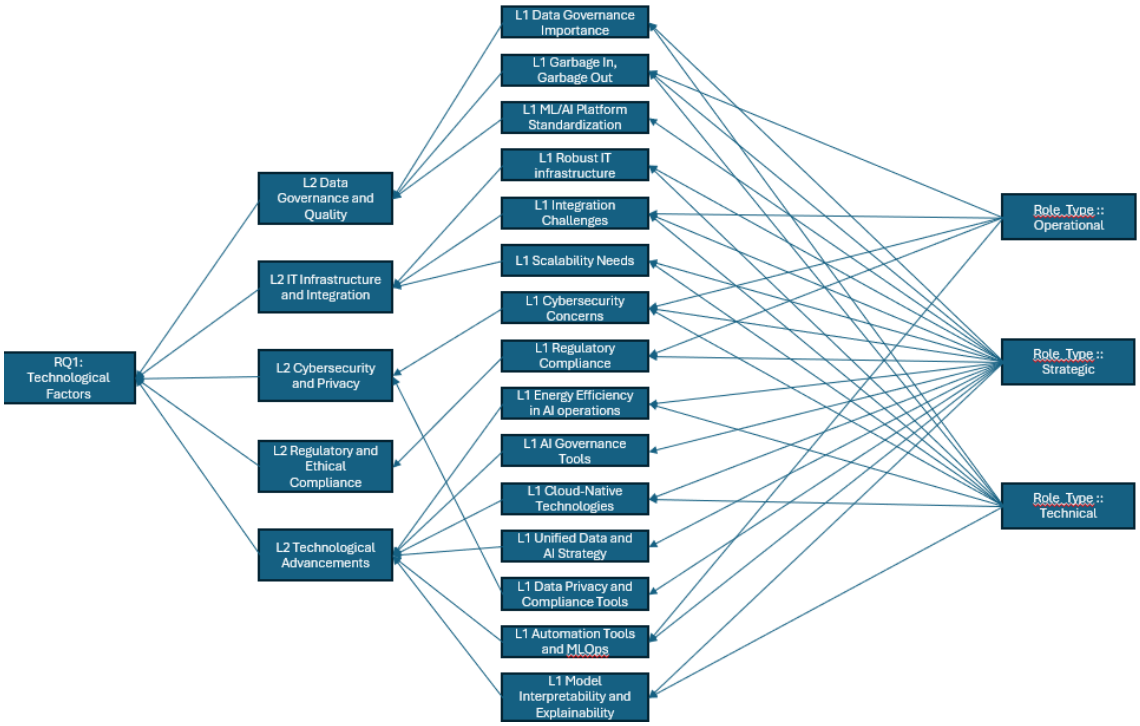

Figure 8. Technological Factors with associations of first (L1) and second-order (L2) codes influencing AI adoption

4.3.2 *Results pertaining to Proposition 2*

P2: For successful AI adoption, organisations must align AI strategies with business goals, build a culture that supports innovation, address skills gaps with targeted training, and ensure strong support from top and middle management.

Strategic leaders (Participants 12 and 14) focus on regulatory compliance, ethical considerations, and market pressures to align AI initiatives with societal and global expectations. Operational participants, such as portfolio managers (Participant 5) and commercial managers (Participant 9), emphasise customer-centric innovation and competitiveness. Technical roles, including data scientists (Participant 8) and engineers (Participant 10), highlight the importance of scalable infrastructure and governance as depicted in Figure 9, showing the first and second (L2) order codes with the associations.

(L2) Strategy and Collaboration

Code: Aligning AI with Business Goals

Alignment between AI initiatives and organisational objectives is essential. Participant 1 highlighted a top-down approach: *"From an organisation perspective, we have to just do it and then filter that strategy downwards."* Participant 5 emphasised that alignment ensures AI investments generate tangible business value, while Participant 8 added, *"Knowing where you want to apply AI and for what reason is critical."* Misaligned initiatives, as Participant 10 noted, lead to higher costs and fewer benefits. Examples such as adopting Microsoft Co-Pilot (Participant 15) demonstrated how aligning tools with productivity goals delivers measurable outcomes.

Code: Cross-Functional Collaboration

AI adoption requires cooperation across organisational teams. Participant 7 noted the challenge of silos, stating, *"You need more cross-functional teams."* Participant 15 shared that integrating marketing, IT, and operations teams enhanced AI implementation. Participant 9 emphasised that AI can identify opportunities for collaboration and skill optimisation among teams.

Code: Clear AI Strategy

A defined AI strategy drives success. Participant 14 suggested that investments must align with strategic priorities, ensuring scalability and reusability. Participant 13 emphasised balancing AI capabilities with business strategies, adding that addressing skill gaps plays a critical role. Participant 4 noted that a clear AI strategy also requires strong change management and collaboration.

(L2) Leadership and Culture

Code: Building a Culture of Innovation

A culture that supports innovation encourages experimentation and adoption. Participant 3 remarked, *"You have to trust the [AI] tool in order for it to become useful."* Participant 5 highlighted that fostering risk-taking and openness to technological change creates an ecosystem conducive to AI. Participant 13

pointed to leadership openness to exploration as a driving force for cultural innovation.

Code: Strong Leadership Support

Leadership support is pivotal for AI adoption. Participant 8 called it *"the most critical thing,"* requiring senior leaders to believe in AI's value. Participant 15 shared how executive backing of tools like Co-Pilot signalled its organisational priority. Participant 13 highlighted top-down initiatives, with leaders pushing for widespread AI adoption.

Code: Change Management Processes

Effective change management mitigates resistance to AI. Participant 1 observed that older generations were less willing to adopt AI, requiring behaviour shifts. Participant 14 stressed engaging stakeholders and managing change processes, while Participant 11 emphasised*, "Even the best tool in the world will still be useless without proper adoption processes."*

(L2) Skills and Knowledge

Code: Addressing Skills Gaps

Addressing AI-related skill gaps is critical. Participant 1 noted that not all employees are AI-literate, and Participant 14 stressed the importance of training programs to close these gaps. Participant 15 described how workshops helped employees understand AI tools, while Participant 8 highlighted the niche nature of AI skills and data science.

Code: Workforce Adaptation

Workforce readiness is essential for AI adoption. Participant 11 observed that employees must reskill to remain relevant in the evolving workplace as *"one of the biggest factors around deployment of these technologies."* Participant 15 added that AI requires teams to adjust workflows, with some resistance initially. Participant 9 suggested AI could help predict future skill demands, allowing proactive training.

(L2) Budgetary Constraints

Code: Adequate Funding

Funding is a major consideration for AI projects. Participant 2 mentioned that *“budgets for implementation and identifying in-house versus outsourcing are key considerations for AI adoption.”* Participant 8 observed that organisations often struggle to determine appropriate investment levels, while Participant 12 emphasised the resources required for infrastructure scalability and AI processing power.

(L2) Regulatory and Ethical Compliance

Code: Ethics and Governance

Responsible AI deployment requires ethical practices. Participant 9 noted that *“ethics and governance in our domain is crucial with the use of AI, and it’s important to follow best practices to ensure ongoing relevance.”* Participant 14 discussed AI ethics guidelines to mitigate risks, while Participant 15 emphasised avoiding biases or unfair practices in AI-driven insights.

(L2) Technology Implementation Issues

Code: Practical Use Cases

Clear use cases drive AI adoption. Participant 6 remarked, *"It can’t be a generic thing; you have to tell people within their function how to use it effectively as business or use cases."* Participant 15 shared that Co-Pilot helped teams generate actionable insights, improving decision-making.

Code: Data Management Practices

Robust data management is foundational. Participant 7 stressed the importance of a culture that values data from creation to usage. Participant 15 noted challenges in standardising marketing data, which hinder real-time insights. Participant 12 highlighted the scalability challenges posed by telcos’ vast data volumes.

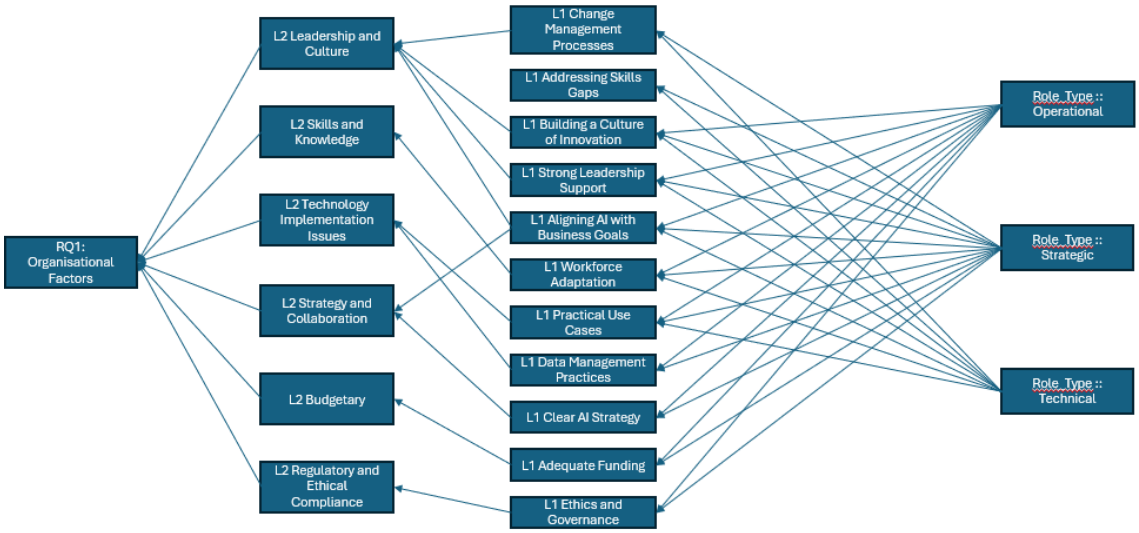

Figure 9. Organisational Factors with associations of first (L1) and second-order (L2) codes influencing AI adoption

4.3.3 *Results pertaining to Proposition 3*

P3: For effective AI adoption, organisations must navigate external market pressures, comply with varying regulations, and address ethical considerations to stay competitive and meet customer demands.

Strategic leaders (Participants 12 and 14) focus on regulatory compliance, ethical considerations, and market pressures to align AI initiatives with societal and global expectations. Operational participants, such as portfolio managers (Participant 5) and commercial managers (Participant 9), emphasise customer-centric innovation and competitiveness. Technical roles, including data scientists (Participant 8) and engineers (Participant 10), highlight the importance of scalable infrastructure and governance, represented in Figure 10, showing the first and second (L2) order codes with the associations.

(L2) Regulatory and Ethical Compliance

Code: Regulatory Frameworks Impact Adoption

Participants highlighted how regulatory environments significantly influence AI

adoption. Participant 1 noted, *"The first question we always get asked is... are you aware of the regulations as it is different in each country?"* Regulatory landscapes vary, creating uncertainty for telcos, as Participant 3 observed. However, Participant 8 pointed out that South Africa's regulators have created a conducive landscape for AI adoption compared to other African nations. Participant 15 emphasised that strict data protection laws like POPIA govern telco operations, while Participant 13 discussed the challenges of navigating regulations across multiple countries.

Code: Ethical Concerns and Transparency

Ethical considerations are paramount for building trust in AI. Participant 4 stressed that addressing *"data privacy, algorithmic bias, and transparency"* helps maintain public trust and aligns AI with societal values. Participant 15 described a focus on responsible AI use, while Participant 5 raised concerns about job loss and AI's societal impact. Participant 13 noted that businesses are increasingly prioritising ethics due to generative AI's growing importance. As Participant 12 remarked, external market pressures and ethical concerns often drive organisations to adopt AI responsibly.

(L2) Strategy and Collaboration

Code: Market Pressures Drive Adoption

External market dynamics strongly influence AI adoption. Participant 15 remarked, *"If competitors are leveraging AI... we can't afford to lag behind."* Participant 4 explained that telcos are driven by the need to stay competitive, meet customer demands, and innovate. Participant 13 added that many industry players have adopted AI, creating pressure to follow suit. Market pressures, as Participant 9 observed that organisations that delay adoption have a high risk of falling behind.

Code: Cross-Functional Integration

AI adoption requires collaboration across organisational functions. Participant 15 described how the *"Successful deployment of Co-Pilot involved input from IT to ensure technical feasibility, while business teams assessed its practical*

impact." Participant 12 emphasised aligning goals across teams to manage external pressures effectively. This approach optimises resource allocation and leverages the best skill sets for AI projects, as Participant 9 noted.

Code: Collaboration with Research Institutions

Fostering innovation involves partnerships with research institutions. Participant 8 suggested that *"we must foster that culture of innovation, we need to partner with research institutions as well.*" Participant 6 highlighted how research-driven approaches, like those in Chinese firms, enhance user-focused innovations.

(L2) Technological Advancements

Code: Technological Advancements

Participants acknowledged the importance of staying abreast of technological developments. Participant 4 noted that *"keeping pace with innovations like 5G, IoT, and cloud computing"* facilitate AI integration into telco services. Participant 14 highlighted AI's role in improving data analytics accuracy and speed, while Participant 15 warned against falling behind on emerging trends. Smart tools, as Participant 3 remarked, can enhance work efficiency when widely adopted and understood.

Code: Data Infrastructure Limitations

Challenges with data infrastructure hinder AI adoption. Participant 1 described limitations regarding "*on-premise server installations are slow due to volume of data and server speed,"* while Participant 15 noted that siloed and uncleaned data impede scalability. Participant 8 emphasised the need for standardised tooling and patterns to address these barriers.

(L2) Skills and Knowledge

Code: AI Talent Availability

The shortage of skilled AI talent poses a challenge. Participant 5 stating that *"we have a shortage of employees with specialized skills in AI, machine learning, and advanced data analytics. It is an expensive and competitive*

market for AI and data science talent expertise in AI and data science is scarce and costly." Participant 12 noted the limited local talent pool, requiring organisations to seek specialised skills externally.

Code: Inclusion

AI adoption must accommodate linguistic and cultural diversity. Participant 8 highlighted that *"Partnering with research institutions to build solutions for translation capabilities and native languages ensures we can democratise AI into the future."* Participant 14 agreed that addressing diverse languages ensures inclusive AI adoption.

(L2) Customer-Centric Innovation

Code: Customer-Centric Focus

A focus on enhancing customer experiences is critical. Participant 11 emphasised that *"every decision needs to have an understanding of the customer impact."* Participant 15 described how AI meets customer expectations through personalised, real-time insights. Participant 13 noted that customers evaluate AI's benefits in terms of cost reduction and productivity improvements.

(L2) Budgetary Constraints

Code: Budgetary Constraints

Cost is a major barrier to AI adoption. Participant 3 explained that rising inflation and currency devaluation strain telco budgets stating that *"Rand dollar exchange rates is always a factor"*, while Participant 10 noted that new technologies are often expensive initially. Participant 14 stressed that economic challenges influence the pace of AI investments.

(L2) Technology Implementation Issues

Code: Evolving AI Governance

AI governance is evolving to address ethical and operational challenges.

Participant 10 described how governance processes have matured with increased AI usage stating that *"as we started using AI more and more into our daily work, we are improving on the governance and best practises".* Participant 13 observed that telcos are developing internal governance models in the absence of fully established industry regulations.

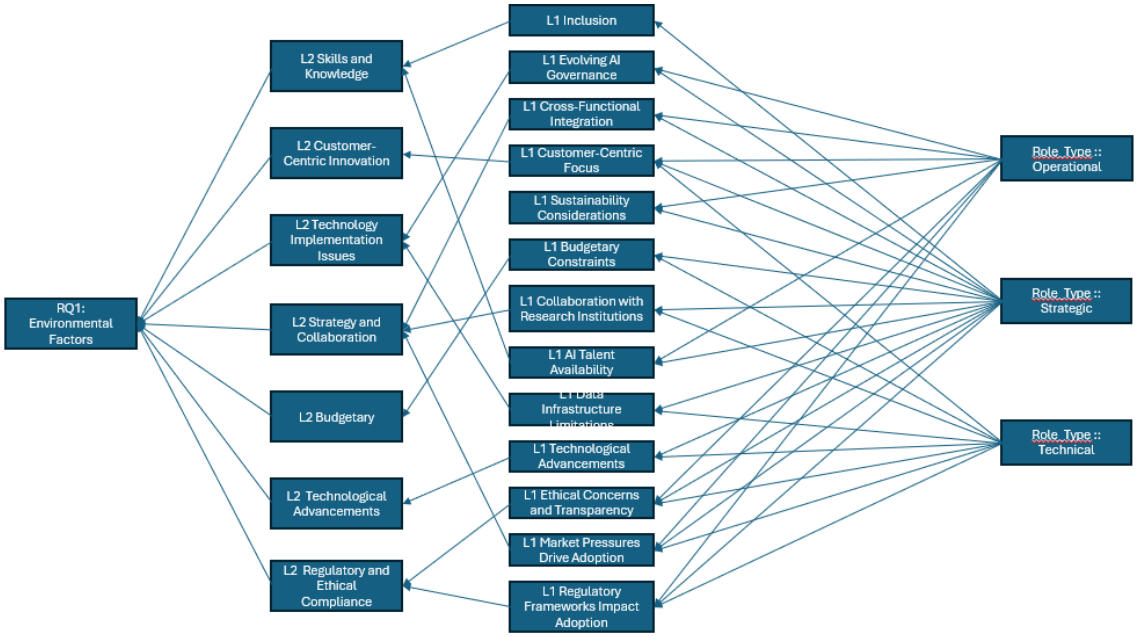

Figure 10. Environmental Factors with associations of first (L1) and second-order (L2) codes influencing AI adoption

4.4 RQ2: What are the benefits of AI adoption and analytics in SA telcos?

4.4.1 *Results pertaining to Proposition 4*

P4: Adopting AI in South African telecommunications improves operational efficiency, transparency, data management to drive innovation and minimise risks ensuring that SA Telcos have a competitive advantage.

The adoption of artificial intelligence (AI) in South African telecommunications has proven to be a transformative factor in driving operational efficiency, improving transparency, enhancing data management, and fostering innovation.

The benefits theme, focusing on how AI adoption improves data analytics, varies significantly across role types. Participants in strategic roles, such as Chief Technology Officers (Participant 14) and Managing Directors (Participant 12), highlight broader organisational benefits, including enhanced governance, improved decision-making, and operational efficiencies that align with long-term business objectives. For operational roles, like portfolio managers (Participant 5) and commercial managers (Participant 9), the emphasis is on leveraging AI for customer personalisation, fraud detection, and automated reporting to optimise daily workflows and improve customer experiences. In technical roles, such as data scientists (Participant 8) and engineers (Participant 10), the focus lies on predictive analytics and real-time insights, demonstrating how AI drives analytical advancements and identifies future trends. These distinct perspectives underscore how role type influences the perceived value of AI in addressing both operational and strategic challenges in data analytics. All 15 participants have provided rich insights into these benefits, represented in Figure 11 which have been grouped by first and second-order codes below for this proposition:

(L2) Operational and Analytical Enhancements

Code: Predictive Analytics

AI's predictive capabilities are fundamental for organisations to anticipate future trends and outcomes. Participant 7 mentioned using analytical models for *"early detection,"* allowing proactive measures to meet targets. Participant 8 emphasised AI’s ability to predict customer behaviour, forecast revenues, and call centre volumes. Similarly, Participant 9 discussed how AI tools can predict economic conditions, while Participant 15 highlighted its potential to deliver real-time marketing insights, enabling better campaign adjustments.

Code: Real-Time Insights

Real-time insights drive faster decision-making. Participant 4 remarked that AI

enables *"immediate data processing,"* while Participant 9 noted that organisations are beginning to use real-time data analysis for quicker responses to market changes.

Code: Improved Decision-Making

Participants highlighted AI's transformative role in data-driven decisions. Participant 3 emphasised *"speed to decision, speed to execution,"* while Participant 6 observed that AI reduces reliance on intuition, replacing it with data-backed forecasting. Participant 14 added that AI enhances accuracy and turnaround times in analytics, and Participant 12 noted its importance to infrastructure investments and operational decisions.

Code: Automation of Reporting

AI streamlines reporting processes, freeing up resources for strategic tasks. Participant 4 noted that *"AI automates reporting, reducing manual effort, enabling timely performance tracking"*. Participant 9 emphasised how automation shifts focus to analysis rather than routine tasks. Participant 15 shared how tools like Co-Pilot generate insights directly from datasets, improving efficiency.

Code: Fraud Detection

Fraud detection is a critical application of AI. Participant 1 stated that *"we are using AI and it's helped a lot in terms of raising alerts, anomaly detection such as fraud detection"*, and Participant 7 shared that AI systems have been implemented for this purpose. Participant 5 highlighted AI's role in enhancing cybersecurity through real-time detection of fraudulent activities, billing anomalies, and suspicious network behaviours.

Code: Operational Efficiency

AI improves efficiency by automating repetitive tasks and simplifying processes. Participant 10 noted how AI-assisted coding reduces errors and *"allows us to do our coding much faster*", while Participant 13 described how AI translates complex datasets into accessible formats. Participant 12 highlighted how AI drives operational improvements in CapEx and OpEx management.

Code: Enhanced Business Intelligence

AI strengthens business intelligence by providing advanced market analysis and competitive insights. Participant 5 shared how AI transforms data into actionable intelligence by *"conducting advanced market trend analysis to derive competitive advantage through complex data correlations"*, while Participant 8 highlighted its adoption across various domains, from ecommerce to fraud risk management. Participant 15 noted that AI simplifies complex processes, encouraging broader adoption.

Code: Customer Self-Service

AI is revolutionising customer service by enabling self-service solutions. Participant 3 described how intelligent agents reduce call centre costs *"because you don't have to have an agent in the seat to solve customer issues efficiently."* Participant 12 shared how AI in call centres facilitates first-call resolutions, minimising the need for outsourcing.

Code: Improved Governance

AI adoption reveals gaps in data governance, prompting organisations to strengthen oversight. Participant 8 noted that *"the more you adopt AI, the more you find your gaps in terms of data governance"*, while Participant 14 shared that their organisation established ethics guidelines and governance structures to ensure responsible AI use.

(L2) Customer-Centric Innovation

Code: Customer Personalisation

AI enhances customer experiences through personalised interactions. Participant 5 mentioned *"predictive customer churn analysis helps us identify and minimise churn and tailored recommendations."* Participant 7 described how machine learning models predict customer preferences, while Participant 15 noted that customers now expect timely, individualised interactions. Participant 12 added that AI-driven algorithms enable organisations to refine offerings based on user behaviours.

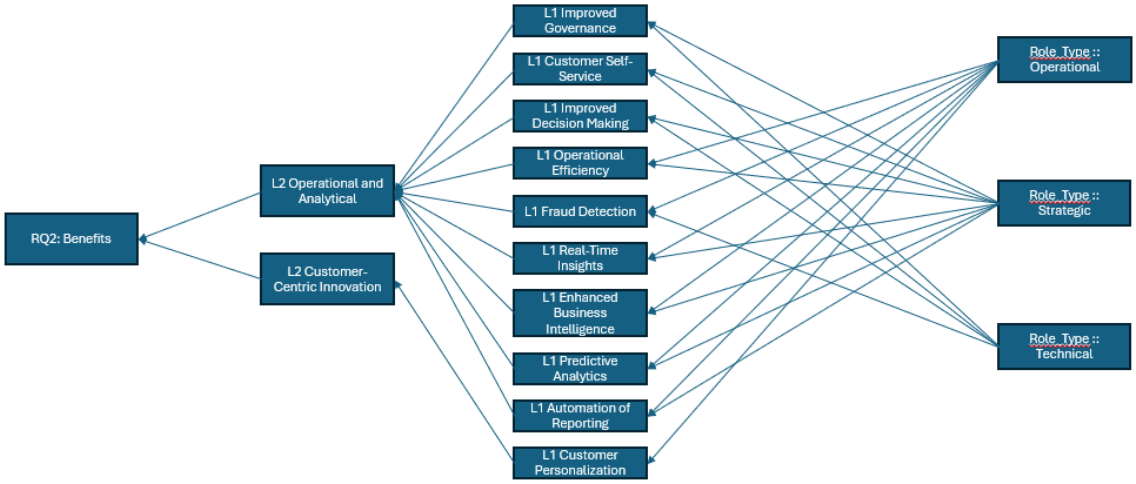

Figure 11. Benefits of AI adoption with associations of first (L1) and second-order (L2) codes

4.5 RQ3: What are the challenges of AI adoption and analytics in SA telcos?

4.5.1 *Results pertaining to Proposition 5*

P5: The successful adoption of AI in SA Telcos to improve analytics requires overcoming challenges related to data quality, scalability, skill gaps, ethical concerns, costs, organisational resistance, reliability, data privacy, and transparency.

Adopting AI to improve analytics in South Africa's telecommunications sector involves addressing several interrelated challenges. These challenges include data quality, scalability, skill gaps, ethical concerns, costs, organisational resistance, reliability, data privacy, and transparency. The challenges faced in AI adoption differ across role types, reflecting varied priorities and responsibilities. Participants in strategic roles, such as Chief Technology Officers (Participant 14) and Managing Directors (Participant 12), emphasise challenges like integrating AI with legacy systems, high implementation costs, and ensuring alignment with business goals, which are critical for long-term scalability and organisational

impact. Operational roles, such as portfolio managers (Participant 5) and commercial managers (Participant 9), highlight issues like data silos, resistance to change, and skill shortages, demonstrating their focus on overcoming practical barriers to streamline workflows and enhance productivity. Technical roles, including data scientists (Participant 8) and engineers (Participant 10), focus on data quality issues, infrastructure limitations, and slow adoption of standardised tools, reflecting their responsibility for ensuring that AI solutions are technically robust and effectively implemented. These perspectives underscore how role types shape the prioritisation of environmental challenges in AI adoption, from strategic planning to operational execution and technical integration (Figure 12). Participants provided rich insights into these challenges. All 15 participants have provided rich insights into these challenges which have been grouped by first and second order codes below for this proposition:

(L2) Data Governance and Quality

Code: Data Quality Issues

Data quality emerged as a fundamental challenge. Participant 4 described issues like *"inaccurate, incomplete, or inconsistent data,"* which impede AI's ability to generate reliable insights. Participant 14 warned that *"poor data quality can lead to erroneous assumptions and biases,"* which undermine AI models. Participant 13 emphasised that *"if your data's bad, you need to go back and fix your data,"* as AI models rely heavily on input quality.

Code: Data Silos

Fragmented data across departments poses significant barriers. Participant 9 noted the lack of standardisation, with *"each division's data team working on their own,"* limiting organisational-wide AI adoption. Participant 15 highlighted the challenges of *"cleaning and preparing siloed data,"* delaying the realisation of AI benefits.

Code: Lack of Governance

Data governance is often inadequate. Participant 1 noted, *"Each team is on their own,"* slowing data adoption. Participant 8 observed that without

standardisation, organisations lack *"consistent patterns of implementation,"* which impedes scalability.

(L2) IT Infrastructure and Integration

Code: Integration with Legacy Systems

Legacy systems are a significant hurdle for AI adoption. Participant 4 remarked, *"Integration with legacy systems is a big issue for us"* Participant 14 noted that integrating AI tools with existing infrastructure requires substantial effort. Participant 12 elaborated, *"Trying to get those systems to speak to AI technologies, which are much more advanced, is really difficult."*

Code: Infrastructure Limitations

Existing infrastructure often cannot support AI's demands. Participant 12 highlighted that current setups *"infrastructure cannot handle AI tasks without significant investment."* Participant 15 pointed to cloud-based platforms as a solution for handling large datasets. However, as Participant 5 noted, *"Compatibility issues between legacy systems and modern AI technologies"* remain prevalent.

(L2) Technology Implementation Issues

Code: Skill Shortages

A shortage of skilled professionals poses a challenge. Participant 5 stated, *"We have a shortage of employees with specialised skills in AI, machine learning, and advanced data analytics."* Participant 12 noted that hiring external experts often results in higher costs and a lack of local knowledge.

Code: Limited Understanding of AI

Many employees lack an understanding of AI's potential. Participant 13 mentioned that people need *"a lot of training and practice"* to use AI effectively. Participant 6 emphasised empowering employees to understand how AI benefits their roles, as adoption lags without this knowledge.

Code: Cultural and Mindset Shift

Adopting AI requires a cultural shift. Participant 7 noted the need for *"upskilling and a different mindset."* Participant 6 described resistance to AI due to trust issues and a preference for manual processes.

(L2) Resistance and Organisational Barriers

Code: Resistance to Change

Organisational resistance is a major barrier. Participant 15 stated that *"some team members are hesitant to rely on AI-driven insights, preferring manual processes they were more comfortable and familiar with."* Participant 12 added that convincing employees to transition to cloud-based technologies is particularly challenging.

Code: Slow Adoption of Tools

Participant 11 cited *"technological deficiencies"* and long processing times as factors slowing down AI integration. Participant 8 noted that the lack of standardised tools results in *"tough-to-maintain solutions"* and scalability issues.

(L2) Budgetary Constraints

Code: High Implementation Costs

The high cost of AI implementation hinders adoption. Participant 8 stated, *"AI solutions are really costly,"* especially when considering infrastructure, tools, and training. Participant 7 noted that budget limitations often restrict the choice of technologies and platforms.

(L2) Job Concerns

Code: Fear of Job Loss

AI adoption raises concerns about job displacement. Participant 3 mentioned that AI technologies, such as self-service bots, could *“put hundreds of people out of their jobs.”* Participant 13 highlighted fears that new technologies might render certain roles redundant.

(L2) Strategy and Collaboration

Code: Alignment with Business Goals

Alignment between AI initiatives and business goals is critical. Participant 8 emphasised the importance of collaboration between business and data science teams to ensure AI meets organisational objectives. Participant 11 highlighted the need to *"understand the objectives and potential use cases"* to prioritise development effectively.

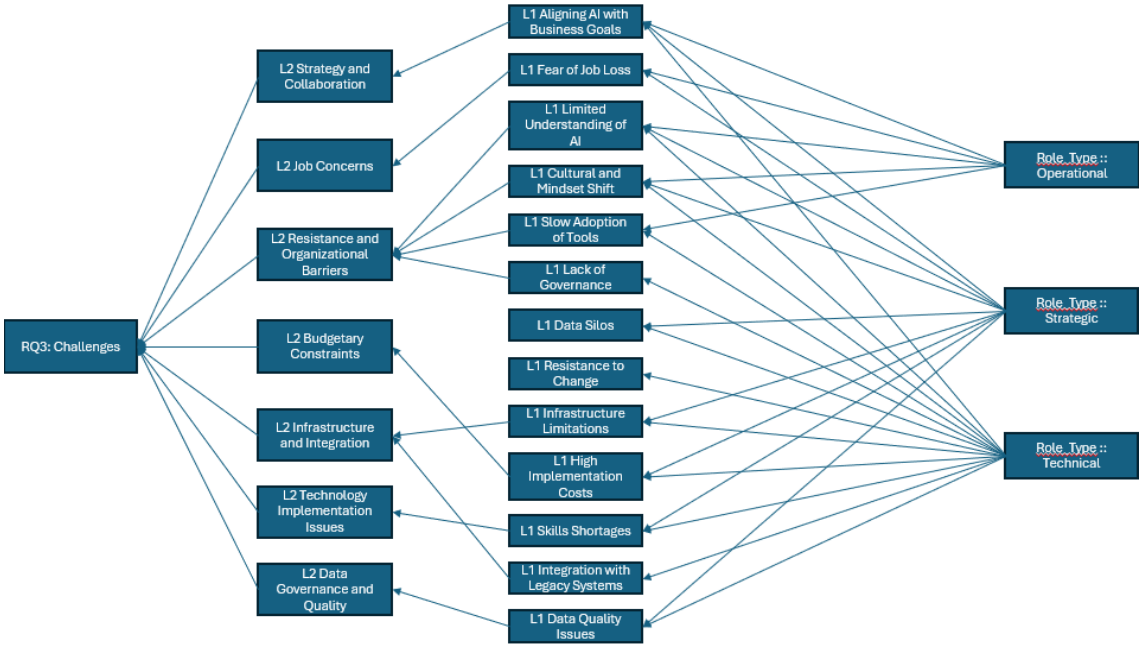

Figure 12. Challenges of AI adoption with associations of first (L1) and second-order (L2) codes

4.6 Summary of the findings

RQ1: What are the factors that influence the adoption of AI to improve analytics in SA telcos?

The adoption of AI to improve analytics in SA telcos is influenced by multiple factors, with role type playing a pivotal role in shaping perspectives and organisational approaches. Strategic, operational, and technical roles contribute

uniquely to addressing technological, organisational, and environmental enablers and barriers.

Proposition 1 highlights how role type influences the prioritisation of technological factors. Strategic roles emphasise long-term alignment with organisational goals, data governance, and leadership support. Technical roles focus on addressing data quality, scalability, and infrastructure challenges, while operational roles prioritise integration and user-centric functionality. Successful AI adoption requires high data quality, seamless system integration, and robust IT infrastructure, underpinned by a focus on cybersecurity and compliance. By adopting a holistic approach that integrates these elements, SA telcos can ensure trust, scalability, and sustainability in AI implementation. Technological factors (P1) word cloud is depicted below (Figure 13). The figure below was generated based on the number of word occurrences that appeared across all participant verbatims for RQ1 (P1). A threshold of seven was set on Atlas.ti to exclude many verbs and display mainly nouns. The colours in this figure are used solely to enhance readability and do not relate to any other findings.

Figure 13. Technological factors word cloud (P1)

Proposition 2 underscores the multidimensional nature of organisational approaches to AI adoption. Strategic roles drive alignment with business goals, foster innovation, and provide leadership support. Operational roles emphasise practical implementation and cross-functional collaboration, while technical roles tackle skills gaps and technical barriers. Organisations must align AI initiatives with their strategic objectives, foster a culture of innovation, and invest in skills development and leadership support. Ethical practices, robust data management, and adequate funding are critical to ensuring the long-term success and scalability of AI initiatives. Organisational factors (P2) word cloud is depicted below (Figure 14). The figure below was generated based on the number of word occurrences that appeared across all participant verbatims for RQ1 (P2). A threshold of seven was set on Atlas.ti to exclude many verbs and display mainly nouns. The colours in this figure are used solely to enhance readability and do not relate to any other findings.

Figure 14. Organisational factors word cloud (P2)

Proposition 3 focuses on the influence of role type on perceptions of environmental factors. Strategic roles prioritise regulatory compliance, ethics, and responding to market pressures. Operational roles emphasise customer-centric innovation and competitive dynamics, while technical roles address data infrastructure and governance challenges. To navigate these environmental complexities, organisations must invest in cross-functional collaboration, technological advancements, and evolving governance structures. Addressing skills gaps, ensuring regulatory alignment, and maintaining ethical considerations are essential for sustaining responsible AI adoption. An Environmental word cloud for this proposition is depicted below. Environmental factors (P2) word cloud is depicted below (Figure 15). The figure below was generated based on the number of word occurrences that appeared across all participant verbatims for RQ1 (P3). A threshold of seven was set on Atlas.ti to exclude many verbs and display mainly nouns. The colours in this figure are used solely to enhance readability and do not relate to any other findings.

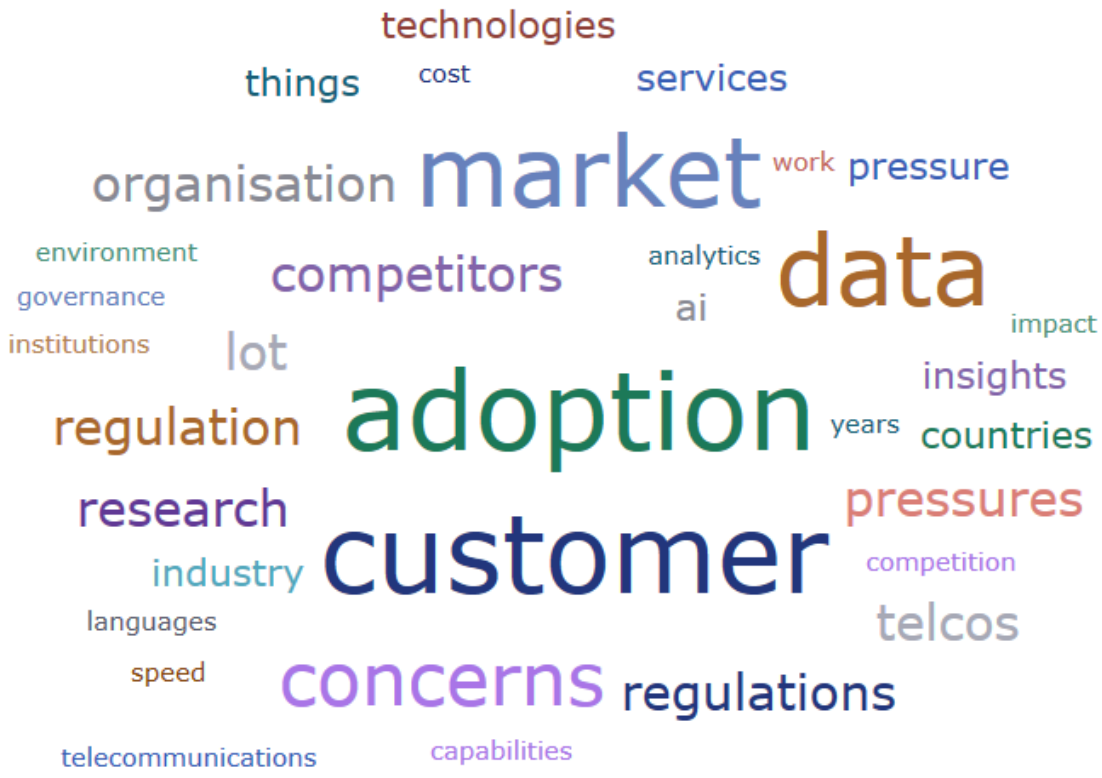

Figure 15. Environmental factors word cloud (P3)

AI adoption in South African telecommunications requires a cohesive strategy that integrates technological, organisational, and environmental factors. By leveraging the unique perspectives and contributions of strategic, operational, and technical roles, organisations can navigate the complexities of AI adoption. Prioritising data quality, governance, regulatory compliance, innovation, and cross-functional collaboration ensures that the transformative potential of AI is unlocked sustainably and responsibly.

RQ2: What are the benefits of AI adoption and analytics in SA telcos?

AI adoption in South African telecommunications delivers significant benefits, with the perceived value varying by role type. Each role describes unique benefits that contribute to the overall organisational goals described in proposition 4.

Strategic roles highlight the organisational benefits of AI, particularly in enhancing governance, decision-making, and aligning analytics with business objectives. AI empowers leaders to make data-driven decisions, improving resource allocation and fostering innovation. Strengthened governance practices also ensure the ethical and responsible application of AI, aligning its use with regulatory and business standards.

Operational roles emphasise AI's impact on customer personalisation, workflow optimisation, and cross-functional collaboration. AI enhances customer-centric innovations through tailored experiences and improved service delivery. Additionally, operational efficiency increases as AI automates repetitive tasks, streamlines workflows, and enables smoother integration across departments, supporting agile responses to market demands.

Technical roles focus on AI's capabilities in predictive analytics, real-time insights, and automation. These advancements enable the identification of trends, improved forecasting accuracy, and timely decision-making. By leveraging AI's

analytical power, technical teams contribute to creating a robust data ecosystem that supports innovation and enhances organisational agility.

Overall, AI adoption in South African telcos drives operational efficiency, fosters customer-centric solutions, and supports strategic decision-making. Predictive analytics, real-time insights, and automation deliver competitive advantages, while personalised customer interactions and improved governance ensure ethical implementation. These benefits position AI as a transformative tool for modern telecommunications organisations, enabling them to thrive in a dynamic and competitive landscape. A Benefits (P4) word cloud is depicted below. The figure below was generated based on the number of word occurrences that appeared across all participant verbatims for RQ2 (P4). A threshold of seven was set on Atlas.ti to exclude many verbs and display mainly nouns. The colours in this figure are used solely to enhance readability and do not relate to any other findings.

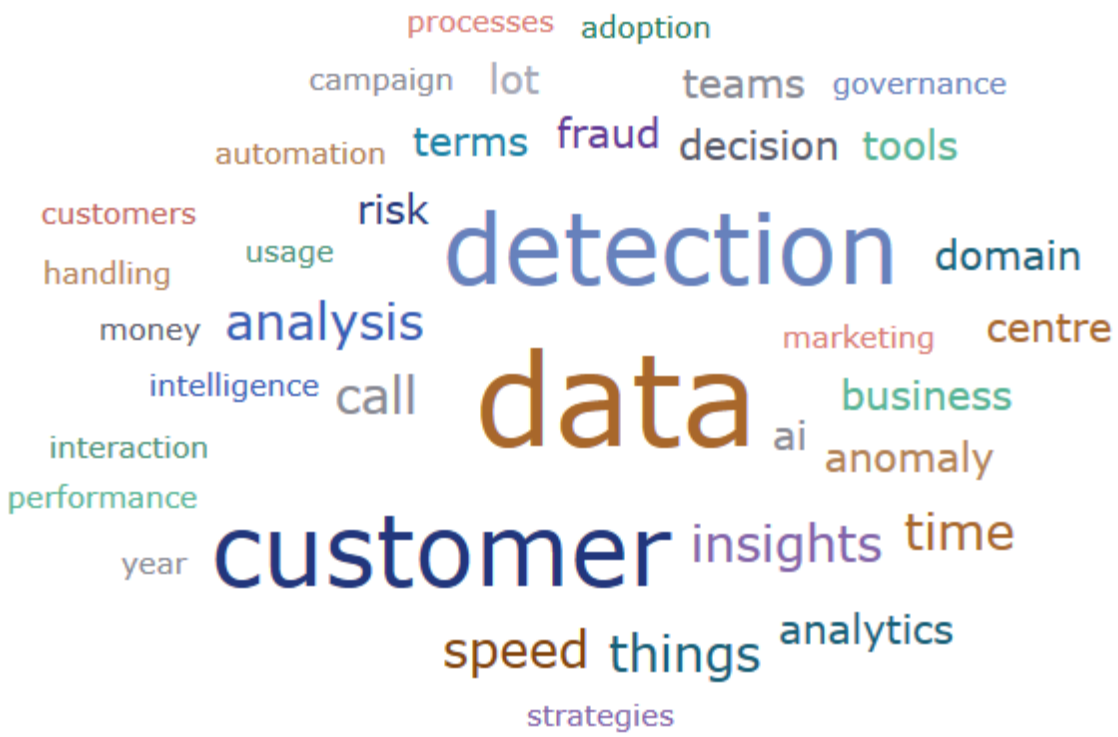

Figure 16. Benefits word cloud (P4)

RQ3: What are the challenges of AI adoption and analytics in SA telcos?

AI adoption in South African telecommunications faces distinct challenges shaped by the priorities of strategic, operational, and technical roles. These challenges highlight the complexities of integrating AI into analytics and underscore the need for a multifaceted approach.

Strategic roles identify challenges related to aligning AI with organisational goals, managing integration with legacy systems, and addressing the high costs of implementation. These barriers require careful planning and resource allocation to ensure AI initiatives align with long-term business strategies while delivering measurable value.

Operational roles emphasise obstacles like fragmented data silos, resistance to change, and the need for cross-functional collaboration. Breaking down data silos and fostering a culture of adaptability are critical to enabling seamless AI adoption and achieving operational efficiency.

Technical roles focus on issues such as poor data quality, infrastructure limitations, and the lack of standardised tools. These challenges hinder the scalability and reliability of AI systems, necessitating investments in infrastructure upgrades and data governance practices to create a robust analytical foundation.

The successful adoption of AI in South African telcos requires addressing these challenges collectively. Skill gaps, resistance to change, and ethical concerns must be tackled through targeted training, leadership support, and transparent governance. Additionally, fostering a culture of innovation and collaboration is vital for embracing AI at all organisational levels. By overcoming these hurdles, telcos can unlock AI's potential to enhance analytics, drive efficiency, and maintain a competitive edge in a rapidly evolving industry. A Challenges (P5) word cloud is depicted below. The figure below was generated based on the number of word occurrences that appeared across all participant verbatims for RQ3 (P5). A threshold of seven was set on Atlas.ti to exclude many verbs and display mainly nouns. The colours in this figure are used solely to enhance readability and do not relate to any other findings.

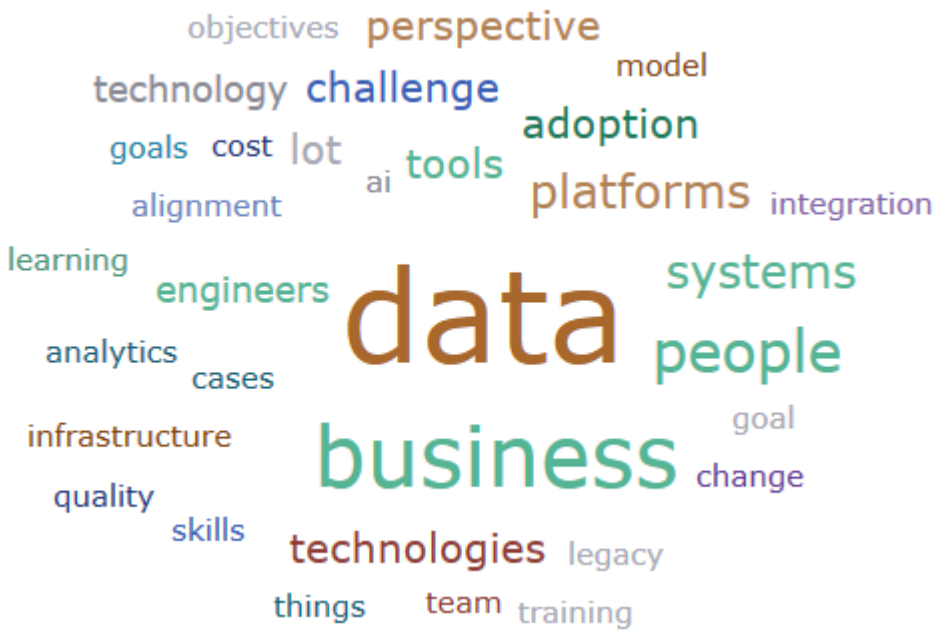

Figure 17. Challenges word cloud (P5)

Figure 18 presents a high-level framework for AI adoption in telecommunications, structured around three research questions (RQs) and related propositions (Ps) to summarise this chapter. At the apex, AI Adoption emerges as the ultimate outcome, shaped by these interconnected factors, benefits, and challenges. The framework underscores the need for a holistic approach where organisations leverage AI's benefits, mitigate challenges, and develop strategic solutions to drive innovation and maintain a competitive edge.

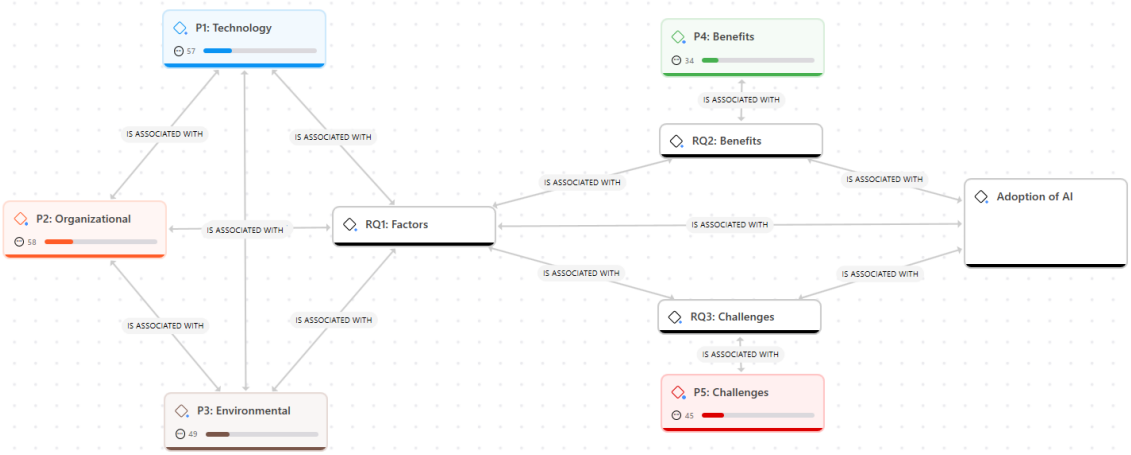

Figure 18. Interconnected research questions, propositions related to factors, benefits and challenges for AI adoption within SA telcos.

Code frequency and distribution:

An analysis of the frequency distribution (Figure 19) across thematic categories reveals that the most prominently referenced theme throughout the study was Organisational (406), indicating a strong focus on internal structures, processes, and dynamics within the participating organisations. This was closely followed by the Technology theme (399), suggesting that technological aspects such as infrastructure, tools, and systems were also a central concern among participants. The Environmental theme (343), encompassing external influences such as market conditions, regulation, and competition, was also frequently discussed, however to a slightly lesser extent.

When examining the distribution of responses across the research questions, it is evident that RQ1: What factors influence adoption, received the most attention with a total of 1,141 references across all participant groups. This substantial frequency highlights a widespread interest in identifying and understanding the enablers and barriers relevant to the adoption process. In contrast, RQ2: Benefits (238) and RQ3: Challenges (315) were mentioned far less frequently, indicating that while outcomes and obstacles were acknowledged, they were secondary to the deeper exploration of influencing factors.

These findings suggest that participants were primarily concerned with the foundational conditions necessary for successful implementation and integration, rather than with the consequences or impediments that arise thereafter. This frequency distribution is also split by demographics highlighting indicating the type of feedback, gender, organisation name, qualification, role type and tenure.

Details regarding participant verbatims including 1st and 2nd order codes can also be referenced in Appendix F.

			P1: Technology 57	P2: Organizational 58	P3: Environmental 49	P4: Benefits 34	P5: Challenges 45	RQ1: Factors 163	RQ2: Benefits 34	RQ3: Challenges 45
Feedback_Method :: Interview	10	133	34	33	28	20	24	94	20	24
Feedback_Method :: Written	5	97	23	25	21	14	21	69	14	21
Gender :: Female	4	77	19	18	14	14	17	51	14	17
Gender :: Male	11	153	38	40	35	20	28	112	20	28
Organisation_Name :: Company A	6	88	24	26	19	11	15	69	11	15
Organisation_Name :: Company B	5	73	16	16	15	11	16	46	11	16
Organisation_Name :: Company C	4	69	17	16	15	12	14	48	12	14
Organisation_Type :: SA Telco	15	230	57	58	49	34	45	163	34	45
Qualification :: Degree	7	85	13	22	25	12	16	60	12	16
Qualification :: Masters	3	66	24	13	9	10	13	45	10	13
Qualification :: No Tertiary qualification	1	14	5	4	3	2	1	12	2	1
Qualification :: Postgraduate	4	65	15	19	12	10	15	46	10	15
Role_Type :: Operational	5	48	6	13	12	10	9	31	10	9
Role_Type :: Strategic	6	143	41	34	28	19	30	102	19	30
Role_Type :: Technical	4	39	10	11	9	5	6	30	5	6
Tenure_Bands :: <= 5 Years	8	109	24	27	26	15	20	76	15	20
Tenure_Bands :: >= 11 Years	3	66	17	18	11	10	14	46	10	14
Tenure_Bands :: 6 to 10 Years	4	55	16	13	12	9	11	41	9	11
Totals			399	406	343	238	315	1141	238	315

Figure 19. Frequency distribution of codes from Atlas.ti based on Research Questions and Propositions across participant demographics

CHAPTER 5. DISCUSSION OF THE FINDINGS

5.1 Introduction

This chapter examines the key factors influencing AI adoption within SA telco organisations. By integrating insights from existing literature and real-world participant experiences, it highlights areas of alignment and uncovers critical gaps ultimately aiming to optimise the potential of AI in this sector guided by the research questions and propositions presented in Chapter 2. To gather a list of relevant authors, a well-defined search strategy using a combination of keywords for example “AI”; “telcos”; “SA”; “Data”; “Analytics”, Boolean operators, and inclusion/exclusion criteria tailored to the research objectives were used and experimented with. Multiple academic databases such as Science Direct, Scopus, Google Scholar, Springer, and IEEE Xplore were searched to capture a broad range of peer-reviewed literature within the last five years. The search process was documented and iteratively refined to address any gaps, to gather as many authors that were representative of the scholarly landscape on the topic.

5.2 Discussion pertaining to Research Question 1

5.2.1 *Discussion pertaining to Proposition 1 (P1)*

a. ***Data Quality and Volume***

The authors, such as Merhi (2023a) and Al-Okaily et al. (2023), emphasise the importance of data quality, governance, and availability for AI adoption. Merhi highlights data quantity, while Al-Okaily et al. focus on data quality challenges. Participants align with this emphasis, such as Participant 1’s *“junk in, junk out”* analogy and Participant 8’s assertion that *“data governance and data quality are…critical.”*

While the authors take a theoretical perspective, participants provide operational insights, citing challenges like data silos (Participant 4) and lack of standardisation (Participant 9). Participant 15 highlights that *"data requires significant cleaning and preparation,"* bridging the gap between theory and practice. Other considerations, such as AI governance and ethical compliance, are mentioned by participants like Participant 14, who calls for strategies addressing privacy alongside data quality.

b. ***Technology Supporting Infrastructure***

Authors, including Bany Mohammad et al. (2022); Enholm et al. (2022); Merhi (2023b), underscore the need for robust, scalable IT infrastructure, particularly emphasising computational resources and cloud platforms. Participants reinforce this, as Participant 1 states, *"You got to have something decent in place for AI to run on."* Participant 15 adds that *"Moving to more robust cloud-based platforms has been key to handling large datasets and ensuring the organisation can explore AI options without major hardware limitations."*

Other participants enrich this perspective by addressing industry-specific challenges, such as telecoms' unique data volumes (Participant 12) and tools like edge computing and MLOps (Participant 4).

c. ***Integration Complexity and Scalability***

Elapanda et al. (2020) and Merhi (2023b) stress the importance of seamless integration, flexibility, and scalability in AI systems. Participants echo these views, as Participant 8 highlights integration challenges within existing data stacks, while Participant 14 emphasises that *"AI capabilities are built for scalability and reusability."*

Participants expand on the authors' insights by addressing operational barriers, such as legacy systems (Participant 3) and resource demands (Participant 12). Tools like Kubernetes and AWS (Participant 12) and collaborative platforms (Participant 15) provide actionable strategies to mitigate these challenges.

Participants also connect scalability to organisational readiness, as Participant 8 stresses the need for standardised machine-learning platforms.

d. ***Cybersecurity and Privacy***

The authors (Elapanda et al., 2020; Aldoseri et al., 2023; Merhi, 2023b) agree that cybersecurity and privacy are crucial to AI adoption, stress the importance of robust system design, specialised skills, and ethical governance. Participants support these views, with Participant 7 stating the importance of secure and private data management and Participant 14 emphasising *“building digital trust.”*

Participants extend the discussion by addressing region-specific regulations like South Africa’s POPIA (Participant 15) and operational challenges, such as avoiding vulnerabilities in model results (Participant 8). Governance structures and AI ethics are also prioritised, as Participant 14 describes the need for ethical guidelines to mitigate risks.

5.2.2 *Identified Technology Gaps in literature (P1)*

a. ***Technology Partners***

Participant 3 highlights the importance of technology partners like AWS, Google, or Microsoft in shaping AI adoption, stating, *"partnering with a Microsoft house, Google House or Amazon House are important because ultimately the tools are scalable, and your technology partners can positively influence the type of things you can do with it in our organisation."* However, existing literature such as (Bany Mohammad et al., 2022; Medeiros & Maçada, 2022; Merhi, 2023a; Al-Okaily, Al-Okaily, et al., 2023) do not describe how organisations choose these partners or how such partnerships influence strategic AI integration. The participant data also lacks details on how organisations align vendor partnerships with their AI goals, indicating a need for further research on decision-making processes and strategic alignment.

b. ***Practical Use Cases***

Participant 3 stresses the need for clear, specific AI use cases, noting, *"It can't be like a generic thing like use it to summarise your notes... You have to tell people like within your business unit how to use AI to solve a problem."* Authors such as (Bany Mohammad et al., 2022; Enholm et al., 2022; Merhi, 2023b) focus on generic AI applications, offering limited guidance on solving specific organisational problems.

Summary of Technological factors (P1)

The alignment between authors and participants reflects a shared understanding of key factors influencing AI adoption, with participants contributing additional insights into practical challenges, regulatory contexts, and ethical considerations. However, participants identified some gaps overlooked by the authors, including the critical role of technology partners in shaping AI strategies and the importance of clear, function-specific use cases. While the literature broadly addresses AI adoption, it lacks detailed exploration of how organisations choose and align technology partners with strategic goals or leverage specific use cases to address practical challenges. Addressing these gaps would enhance understanding of the operational dynamics and strategic considerations necessary for effective AI-driven innovation.

5.2.3 *Discussion pertaining to Proposition 2 (P2)*

a. ***Strategy***

Alignment between authors and participants underscores the necessity of aligning AI initiatives with organisational goals to ensure value creation. Authors like Kitsios & Kamariotou (2021) and Nambiar & Mundra (2022) emphasise strategic alignment and planning to avoid inefficiencies. Participant 5 reflects this view, stating, *"Aligning AI with business goals is arguably the most crucial factor."* Practical examples provided by participants, such as Participant 15's mention of

Microsoft Co-Pilot aligning with productivity goals, enrich the theoretical perspectives. Challenges like skill gaps highlighted by Participant 13, *"there's a lot of skills gaps that needs to be addressed,"* add further complexity. This alignment indicates that strategic clarity is essential for maximising AI's transformative potential.

b. ***Cultural***

Both authors and participants agree on the importance of fostering a culture of innovation, experimentation, and openness. Nadkarni & Prügl (2021) and Wang et al. (2022) highlight the need for an innovative and data-driven culture. Participant 14 reiterates this by stating, *"Building a culture of innovation is a key factor."* Practical insights, such as Participant 3's emphasis on trust in AI, *"You got to trust AI in order for it to become useful,"* complement the authors' views. Challenges like mindset changes, noted by Participant 7, *"a different mindset change as well as a culture change,"* point to the operational hurdles in achieving cultural transformation. Both perspectives converge on the idea that cultural readiness is critical for sustainable AI adoption.

c. ***Skills***

The alignment highlights the role of technical expertise and targeted training in addressing the skills gap. Authors such as Nadkarni & Prügl (2021) and Al-Okaily, Teoh, et al. (2023) stress the need for education and reskilling to overcome barriers. Participants, such as Participant 14, affirm this by stating, *"Having the right training programmes and access to learning is critical."* Additional insights, like Participant 9's suggestion that *"AI can be used to continuously assess what skills we have,"* underscore innovative solutions to skills management. Cross-functional collaboration, as emphasised by Participant 7, *"You need more cross-functional teams,"* highlights the interdisciplinary approach necessary for technological implementation. These insights underline the systemic and individual efforts required to address the skills gap.

d. ***Top and Middle Management Support***

Leadership support is recognised as a critical factor by both authors and participants. Authors like Duan et al. (2019) and Koohang & Nord (2021) emphasise strategic involvement and fostering a learning culture. Participant 15 mirrors this by stating, *"Our executive team's backing of AI tools... has sent a clear message that adopting AI is a priority."* Practical challenges, such as generational resistance noted by Participant 1, *"I've seen the older generations not wanting to adopt it,"* reflect the nuanced role of leadership in managing change. Participant 15's focus on clear communication, *"Clear communication about the benefits... helped ease this transition,"* complements authors' emphasis on engagement and alignment. Collectively, these perspectives underscore that robust top and middle management support is foundational for successful AI adoption.

5.2.4 *Identified Organisational Gaps in literature (P2)*

a. ***Adequate Funding:***

Participant data underscores funding as a critical factor in AI adoption, yet this is insufficiently addressed in prior literature such as (Duan et al., 2019; Koohang & Nord, 2021; Nadkarni & Prügl, 2021; Haefner et al., 2021; Enholm et al., 2022; Laato et al., 2022; Jarrahi et al., 2023; Kar & Kushwaha, 2023; Merhi, 2023a). Participant 2 highlights, *"Budgets for implementation and identifying in-house versus outsourcing are key considerations for AI adoption."* Participant 8 notes a significant challenge, observing that *"Looking at funding most organisations, including telcos, do not have a strong understanding of what is the right gearing on the investment for AI."*

Summary of Organisational factors (P2)

While the literature and participant insights show general agreement on the importance of organisational factors such as strategy; culture; skills; and

leadership in AI adoption, participants offer additional practical depth through examples like skill gaps and the need for trust-building. However, certain key gaps emerge that are absent in prior literature. These include the critical role of financial readiness, the influence of technology partners on AI strategy, and the need for tailored, function-specific use cases. Addressing the gap such funding mechanisms may strengthen the framework for effective AI implementation and innovation in organisations.

5.2.5 *Discussion pertaining to Proposition 3 (P3)*

a. *External Market Influence and Pressure*

The alignment between authors and participants underscores the importance of competitive dynamics, customer expectations, and societal concerns as critical drivers of AI adoption. Authors such as Alqhatani et al. (2022) and Enholm et al. (2022) emphasise that external pressures from market competition and technological innovation necessitate the integration of advanced AI systems. Bany Mohammad et al. (2022) and Al-Sai et al. (2022) highlight how these dynamics create an urgency for businesses to remain competitive, while (Merhi, 2023a) focuses on optimism surrounding AI growth as a motivator for adoption.

Participants reflect these themes with practical examples. Participant 5 notes, *"External market pressures such as competitive landscape and industry transformation have the most pressing influence on AI adoption,"* and Participant 15 states, *"If competitors are leveraging AI to improve decision-making and customer experiences, we can't afford to lag behind."* Similarly, Participant 4 highlights the dual pressures of competition and customer demands, stating, *"The need to stay ahead of competitors and meet evolving customer demands drives telcos to adopt AI for enhanced efficiency, personalised services, and innovation."* These insights resonate with authors' focus on competitive dynamics while adding depth through sector-specific contexts.

Additionally, Participant 14 introduces ethical and societal dimensions, noting, *"Government and societal concerns in some markets around AI adoption put pressure on organisations like us to demonstrate an ethical approach in implementing this technology."* This reflects a broader view of external market influences, complementing the authors' emphasis on competitive and customer-driven factors.

b. ***Governance and Regulatory Compliance***

Both authors and participants highlight the complexity and necessity of regulatory compliance in AI adoption. Authors such as Elapanda et al. (2020) and Enholm et al. (2022) discuss global challenges in balancing innovation with effective regulation, while (Hofmeyr & Suliman, 2024) focus on South Africa's evolving regulatory landscape. Data protection laws, such as GDPR and POPIA, are highlighted as significant constraints by Bany Mohammad et al. (2022) and Laato et al. (2022).

Participants provide practical perspectives on these challenges. Participant 1 observes, *"Do you have the right approval and are you aware of the regulations as it is different in each country?"* and Participant 13 notes, *"We have South African regulation for when we work within the South African context, but in our organisation we work across different countries and we have to take into account the different regulations in those countries."* These insights align with the authors' emphasis on cross-border regulatory complexities.

Participant 15 highlights data protection, stating, *"Telcos operate under strict data protection laws, such as POPIA,"* reflecting the operational implications of compliance. Participant 10 adds, *"When we started with the use of AI... the governance process was not very solid. But as we started using more and more into our daily work, we are getting those governance and best practices."* This iterative approach to governance complements authors' discussions on the evolving nature of regulatory frameworks.

c. ***Ethics and Bias***

Authors such as Aldoseri et al. (2023) and Khan (2023) emphasise the critical role of ethical principles in ensuring fairness, transparency, and accountability in AI systems. Enholm et al. (2022) highlights the need for frameworks balancing accuracy and interpretability, while Merhi (2023b) focuses on addressing biases and moral dilemmas.

Participants align with these views by emphasising the practical importance of ethics in AI adoption. Participant 4 states, *"Addressing issues like data privacy, algorithmic bias, and transparency helps maintain public trust and align AI initiatives with societal values,"* while Participant 15 notes, *"It's important to avoid biases or unfair practices in how AI-driven insights are applied."* These perspectives mirror the authors' theoretical emphasis on transparency and fairness.

Participants also highlight corporate responsibility, with Participant 1 stating, *"You need to make a customer aware that we've been analysing your data previously for operational or marketing needs,"* reinforcing Aldoseri's emphasis on transparency. Additionally, Participant 12 reflects on ethics as a driver of trust, stating, *"AI can also be brought into the organisation to address any ethical concerns. It can be there for transparency; it can be some form of public trust or corporate reputation."* This aligns with Merhi's argument that ethical AI practices enhance stakeholder trust and corporate legitimacy.

5.2.6 *Identified Environmental Gaps in literature (P3)*

a. ***Energy Efficiency in AI Operations***

Participant data highlights critical energy and environmental challenges in AI adoption, which have been absent in prior literature. Participant 12 states, *"telcos actually spent a lot of the CapEx budget to safeguard and protect old technology that has a lot of reliance on energy."* Participant 3 underscores escalating power

demands, noting, *"if the power consumption for AI goes through the roof... solar should become an option."* Participant 7 adds, *"We need to ensure we abide by certain ethics in the environment."* Issues such as energy efficiency, sustainable infrastructure, and ethical environmental considerations in AI operations have not being addressed in existing literature such as (Enholm et al., 2022; Khan, 2023; Merhi, 2023b; Aldoseri et al., 2023). Addressing these issues is essential for balancing innovation with sustainability.

Summary of Environmental factors (P3)

The environmental factors influencing AI adoption, such as External Market Influence, Governance and Regulatory Compliance, and Ethics and Bias, reflect strong alignment between the literature and participant insights. Both emphasise the importance of competitive pressures, regulatory agility, and ethical integrity. However, participant data reveals some critical gaps overlooked in the literature, particularly regarding energy efficiency, sustainable infrastructure, and ethical environmental considerations. Insights, such as the energy demands of AI systems and the need for alternative solutions like solar power, highlight the importance of addressing these challenges to balance innovation with sustainability. Bridging these gaps is essential for fostering responsible and effective AI adoption.

5.3 Discussion pertaining to Research Question 2

5.3.1 *Discussion pertaining to Proposition 4 (P4)*

The adoption of artificial intelligence (AI) technologies has demonstrated a profound impact across various organisational domains, as highlighted by authors and participants alike. This report delves into six key areas where AI has shown transformative potential: operational efficiency, improved efficiencies, transparency, automation, minimising risks, and improved data management. While the authors provide theoretical frameworks and advanced use cases,

participants offer tangible examples of real-world applications that align closely with these concepts, providing a holistic view of AI's role in modern organisations.

a. ***Operational Efficiency***

AI's role in optimising processes, reducing downtime, and streamlining decision-making is a key theme. Elapanda et al. (2020) highlight the concept of self-healing platforms, which leverage AI for predictive and corrective management, resource optimisation, and quick resolution of operational issues. These platforms improve infrastructure efficiency and reduce manual intervention.

Participants mirror these theoretical insights with practical examples. Participant 10 emphasises how AI tools enhance coding speed and accuracy, reducing manual errors: *"We are using one of the AI tools that allows us to do our coding much faster, review our codes, and understand errors, helping us do things faster."* Similarly, Participant 12 notes, *"It's driven improvements like efficiencies and revenue such as CapEx and OpEx handling, resulting in faster decision-making."* These real-world examples illustrate the tangible benefits of AI in operational workflows, aligning with Elapanda's assertions.

b. ***Improved Efficiencies***

AI significantly enhances organisational performance by improving speed, accuracy, and scalability. Kitsios & Kamariotou (2021) argue that AI supports data-driven decision-making and fosters innovation while maintaining a complementary relationship with human intelligence. Participants validate these points, focusing on the measurable outcomes of AI implementation.

Participant 3 underscores the speed benefits, stating, *"It's speed to decision, speed to execution, speed to result, speed to recommendation."* This aligns with Kitsios & Kamariotou's discussion on AI's ability to accelerate processes. Furthermore, Participant 15 highlights AI's role in streamlining data-related tasks: *"AI tools like Co-Pilot have streamlined data-related tasks and reporting,*

improving decision-making processes." These examples demonstrate AI's ability to drive performance improvements across various organisational functions.

c. ***Transparency***

Transparency is vital for fostering trust, meeting ethical standards, and ensuring regulatory compliance. Alqhatani et al. (2022) and Laato et al. (2022) underscore the importance of explainable AI systems that are accessible to non-technical users while addressing ethical concerns and compliance requirements.

Participants expand on these ideas by connecting transparency to external pressures and emerging ethical challenges. Participant 13 observes, *"Ethical concerns around AI did not exist three years ago... generative AI is actually top of mind of a lot of businesses and consumers, and you have to have that ethical consideration around copyright, personal information, and trademarks."* Additionally, Participant 12 links transparency to regulatory compliance, stating, *"External market pressures, complying with regulations, and addressing ethical concerns does influence many organisations to adopt AI."* These insights illustrate the evolving role of transparency in building trust and navigating ethical complexities, complementing the authors' broader discussions.

d. ***Automation***

AI's automation capabilities reduce repetitive tasks and improve resource allocation. Mortaji & Shateri (2023) highlight how AI automates data pre-processing, decision-making, and advanced analytics, leading to faster and more accurate outcomes.

Participants validate this perspective with specific examples. Participant 4 notes, *"AI automates reporting, reducing manual effort and enabling timely performance tracking."* Meanwhile, Participant 15 highlights AI's transformative impact on marketing workflows: *"Automation tools have already reduced repetitive tasks, and incorporating AI would likely build on that by offering more advanced*

solutions." These examples demonstrate how automation streamlines workflows, allowing organisations to reallocate resources toward strategic initiatives.

e. ***Minimising Risks***

AI plays a critical role in reducing risks through capabilities like fraud detection, anomaly identification, and enhanced cybersecurity. Merhi (2023b) emphasises AI's ability to reduce human errors and provide continuous operational oversight, while Mariani et al. (2023) discuss its role in technological forecasting and organisational innovation.

Participants provide concrete examples of these capabilities. Participant 5 describes, *"AI-driven fraud detection and security allow us to have real-time detection of fraudulent activities and suspicious network behaviours, anomaly detection in billing systems, and user authentication."* Similarly, Participant 1 highlights AI's role in raising alerts and detecting anomalies, stating, *"We are using AI, and it's helped a lot in terms of raising alerts, anomaly detection, and fraud detection."* These practical insights underscore AI's effectiveness in safeguarding operations and mitigating risks.

f. ***Improved Data Management***

AI's ability to manage large datasets, identify patterns, and enhance decision-making is a cornerstone of its value. Bhima et al. (2023) and Faqihi & Miah (2023) discuss AI's capacity for faster, more accurate data analysis and its role in producing actionable insights. Mortaji & Shateri (2023) further highlight advanced techniques like supervised and unsupervised learning, which optimise network performance and customer service.

Participants align closely with these theoretical insights while addressing the challenges of data governance and compliance. Participant 8 notes, *"The more you adopt AI, the more you find your gaps in terms of data governance."* Participant 15 emphasises the importance of compliance, stating, *"Compliance teams worked to ensure implementation met necessary privacy standards."*

These observations reflect the iterative nature of AI-driven data management and the importance of robust governance frameworks.

5.3.2 *Identified Benefit Gaps in literature (P4)*

a. ***Skills development***

There is insufficient research in existing literature such as (Bhima et al., 2023; Faqihi & Miah, 2023; Menzies et al., 2024; Mortaji & Shateri, 2023) to explain AI's role in fostering skills development within organisations, particularly in enabling continuous learning, experimentation, and closing skill gaps.

Participant 5 noted, *"Building a culture of innovation creates an ecosystem conducive to AI experimentation that encourages risk-taking, continuous learning and an openness/less resistance to technological disruption/change."* The need for targeted AI literacy programs was highlighted by Participant 1, who explained, *"Everyone is not a sql developer, and as much as I can write some basic SQL, AI can help me learn more advance scripts to do my job better."*

Summary of Benefits (P4)

The alignment between the authors' views and participants' insights highlights AI's benefits in areas like efficiency, data management, automation, and risk reduction. While the authors focus on theory, participants add practical perspectives, emphasising AI's role in fostering innovation and building skills.

Participants raised additional points missing from the authors' focus, such as the ability of AI to assist with continuous learning and upskilling. These findings stress the importance of further research into how AI can support skills development, particularly in sectors like telecommunications, where it drives innovation and competitiveness.

5.4 Discussion pertaining to Research Question 3

5.4.1 *Discussion pertaining to Proposition 5 (P5)*

The discussion of challenges surrounding AI adoption in the telecommunications sector highlights significant alignment between theoretical perspectives and participant insights. By examining critical factors such as data quality, scalability, skill gaps, ethical concerns, cost, change management, reliability, data privacy, and transparency, a nuanced understanding emerges of the barriers organisations face and the efforts required to overcome them. The alignment and contrasts between authors' discussions and participant verbatims reveal both shared concerns and unique operational insights.

a. ***Data Quality and Management***

Merhi (2023a) emphasises that AI systems depend on high-quality data, and inconsistencies, inaccuracies, and improper storage hinder their effectiveness. Participants echo this concern. For example, Participant 4 identifies *"inaccurate, incomplete, or inconsistent data"* as a persistent issue, while Participant 12 elaborates on the lack of proper data management at the start of AI implementation, noting, *"A lot of it was inaccurate, outdated, wasn't properly stored, wasn't properly managed."* These insights align with Merhi's assertion that significant investment in cleaning and organising data is required to ensure AI success. Participant 14 extends the discussion by highlighting the cascading risks of poor data quality, such as *"erroneous assumptions, biases, and cascading effects,"* emphasising the foundational importance of robust data governance.

b. ***Scalability and Integration***

Merhi (2023a) underscores the challenges of integrating AI with legacy systems and achieving scalability to handle the massive data volumes in telecommunications. Participants provide corroborating evidence, with

Participant 4 stating, *"Integration with legacy systems: Big issue for us!"* and Participant 12 noting, *"Trying to get those systems to speak to AI technologies, which is a lot more advanced, is really difficult."* These comments align with the theoretical focus on the costs and complexities of integration. Scalability issues also resonate, with Participant 15 observing, *"Our organisation deals with increasing amounts of customer data, and any AI system we adopt must handle this growth effectively."* Participant 8 adds that the lack of standardised tooling complicates scalability efforts, enriching the discussion by pointing to the operational inefficiencies that result from inconsistent integration practices.

c. ***Skill Gaps and Training***

Aldoseri et al. (2023) highlight the shortage of expertise in AI, machine learning, and advanced data analytics, highlighting the strain this creates on organisational resources. Participant 5 reflects this by stating, *"We have a shortage of employees with specialised skills in AI, machine learning, and advanced data analytics."* Participants also address the financial burden of hiring external expertise, as noted by Participant 8: *"Data scientists are quite expensive, machine learning engineers are really expensive."* Additionally, Participant 12 points to the lack of localised expertise, stating, *"There isn't much expertise in the ecosystem for us to pull on locally as it stands."* These comments align with the authors' emphasis on training and hiring investments as critical components of addressing skill gaps.

d. ***Ethical and Regulatory Concerns***

Aldoseri et al. (2023) underscores the challenges of compliance with regulations and managing ethical concerns like algorithmic bias. Participants resonate with this perspective, with Participant 7 highlighting, *"We need to ensure... a responsible way to use the technology."* Regional regulatory complexities, such as compliance with GDPR and POPI in South Africa, are mentioned by Participant 12, who states, *"There's also compliance with regulations that is required, data privacy and protection laws such as your GDPR or POPI."*

Participant 8 provides a regional example of regulatory guardrails, underscoring their role in responsible AI adoption.

e. ***Cost and Return on Investment (ROI)***

Wolniak & Grebski (2023a) discuss the high costs of AI adoption, including infrastructure upgrades and skilled personnel, and the difficulty in quantifying ROI. Participants echo this concern, with Participant 4 referencing *"high implementation costs"* and Participant 14 noting external pressures such as inflation and energy costs, which further strain budgets. Participant 10 points out the potential for costs to decrease over time due to competition, adding a forward-looking perspective that complements the authors' discussion.

f. ***Change Management and Organisational Resistance***

Wolniak & Grebski (2023a) highlight resistance to change as a major barrier to AI adoption, driven by concerns about job displacement and mistrust of AI. Participant 13 reflects this fear, stating, *"People do have a fear that they're going to be replaced."* Participant 15 adds, *"Adopting AI represents a shift in how teams operate, and not everyone is immediately open to changing established workflows."* These insights align with the authors' emphasis on the need for effective change management strategies to mitigate resistance and ensure smooth transitions.

g. ***Reliability and Performance***

Aldoseri et al. (2023) emphasise the importance of reliable AI systems in telecommunications, noting that performance failures can undermine trust. Participants align with this view, with Participant 12 highlighting infrastructure limitations: *"Currently the type of infrastructure that we have implemented doesn't cater to a lot of that."* Participant 15 underscores the importance of robust platforms, stating, *"Moving to more robust cloud-based platforms have been key to handling large datasets."* These observations reinforce the authors' focus on the need for ongoing investments in infrastructure and maintenance.

h. ***Data Privacy and Security***

Aldboush & Ferdous (2023) stress the importance of robust security measures and compliance with privacy regulations to protect sensitive data. Participant 12 reflects this by noting the prevalence of cybersecurity threats: *"We see it on a day-to-day with people hacking your payment methods or your payment gateway."* Participant 15 adds that IT and compliance teams work collaboratively to meet privacy standards, aligning with the authors' emphasis on organisational commitment to privacy and security.

i. ***Transparency and Explainability***

Getchell et al. (2022) and Aldoseri et al. (2023) highlight the challenges of AI systems as "black boxes," emphasising the need for standardised evaluation criteria for explainability. Participant 6 reflects this concern, stating, *"Issues around feeling a sense of distrust towards the AI, like I don't know where this thing gets its formulas from."* Participant 8 links explainability to governance, noting, *"Model interpretability and explainability ties in square with the aspect around us ensuring... we are not biasing our results."* These comments underscore the operational importance of addressing transparency and explainability to build trust and facilitate adoption.

5.4.2 *Identified Challenge Gaps in literature (P5)*

a. ***Challenges in Aligning AI with Business Goals***

Previous studies, such as Aldboush and Ferdous (2023), have not explored how AI initiatives align with business objectives. While existing research emphasises challenges, it overlooks how AI is misaligned with strategic priorities making it difficult to measure success.

Participant 8 highlighted the need for collaboration between technical and business teams, stating, *"A major challenge has been business alignment and strong business alignment as well because often what can happen is data*

scientist teams or the individuals who are actually doing the data science work sit either in the technology domain or the business domain, but having them closer to the business allows them to become subject matter experts and create that alignment right."

Participant 11 emphasised the importance of defining objectives and use cases, explaining, *"If you go into a development of a solution without understanding the objectives first, you don't really know what to build. But I think it's important to understand the potential use cases for AI technology and the objectives that you want to achieve out of those use cases. That allows you to prioritise your development."*

Summary of Challenges (P5)

The alignment between the authors' discussions and participant feedback highlights common challenges in AI adoption, including data quality, scalability, skill gaps, ethical concerns, cost, change management, and data privacy. While the authors provide theoretical frameworks, participants add practical perspectives on organisational and operational barriers.

Participants emphasise the need to align AI initiatives with business goals by bridging technical and business domains that were absent in previous literature. These findings call for a holistic approach that integrates technical solutions, strategic investments, and governance to ensure successful AI adoption. Further research is needed to develop frameworks that support this alignment, particularly in sectors like telecommunications.

	Topic	Source	Aligned with Participants
RQ1: What are the factors that influence the adoption of AI to improve analytics in SA telcos?			
P1: Successful adoption of AI for Analytics in South African telecommunications depends on a holistic technological approach that prioritises high data quality and volume, robust IT infrastructure, seamless integration and scalability, and stringent cybersecurity and privacy measures.			
Technological Factors	Data Quality and Volume	(Bany Mohammad et al., 2022; Medeiros & Maçada, 2022; Merhi, 2023a; Al-Okaily, Al-Okaily, et al., 2023)	(Participant 1, 4, 9, 14, 15)
	Technology Supporting Infrastructure	(Bany Mohammad et al., 2022; Enholm et al., 2022; Merhi, 2023b)	(Participant 1, 4, 12, 15)
	Integration Complexity and Scalability	(Elapanda et al., 2020; Merhi, 2023b)	(Participant 3, 8, 12, 14, 15)
	Cybersecurity and Privacy	(Elapanda et al., 2020; Aldoseri et al., 2023; Merhi, 2023b)	(Participant 7, 8, 14, 15)
	* Technology Partners	[Identified gap]	(Participant 3)
	* Practical Use Cases	[Identified gap]	(Participant 3)
P2: For successful AI adoption, organisations must align AI strategies with business goals, build a culture that supports innovation, address skills gaps with targeted training, and ensure strong support from top and middle management.			
Organisational Factors	Strategy	(Kitsios & Kamariotou, 2021; Alqhatani et al., 2022; Enholm et al., 2022; Nambiar & Mundra, 2022; Motjolopane & Chanza, 2023; Merhi, 2023b)	(Participant 5, 13, 15)
	Cultural	(Enholm et al., 2022; Griva et al., 2023; Jarrahi et al., 2023; Leung et al., 2023; Merhi, 2023b; F. Wang et al., 2022)	(Participant 3, 7, 14)
	Skills	(Nadkarni & Prügl, 2021; Bany Mohammad et al., 2022; F. Wang et al., 2022; Wolniak & Grebski, 2023a; Aldoseri et al., 2023; Al-Okaily, Teoh, et al., 2023; Khan, 2023; Merhi, 2023b)	(Participant 7, 9, 14)

	Top and Middle Management Support	(Duan et al., 2019; Koohang & Nord, 2021; Nadkarni & Prügl, 2021; Haefner et al., 2021; Enholm et al., 2022; Laato et al., 2022; Jarrahi et al., 2023; Kar & Kushwaha, 2023; Merhi, 2023a)	(Participant 1, 15)
	* Adequate Funding	[Identified gap]	(Participant 2, 8)
P3: For effective AI adoption, organisations must navigate external market pressures, comply with varying regulations, and address ethical considerations to stay competitive and meet customer demands.			
Environmental Factors	External Market Influence and Pressure	(Alqhatani et al., 2022; Al-Sai et al., 2022; Bany Mohammad et al., 2022; Enholm et al., 2022; Merhi, 2023a)	(Participant 4, 5, 14, 15)
	Governance and Regulatory Compliance	(Elapanda et al., 2020; Enholm et al., 2022; Bany Mohammad et al., 2022; Enholm et al., 2022; Laato et al., 2022; Merhi, 2023b; Aldoseri et al., 2023; Chinedu Alex Ezeigweneme et al., 2024; Hofmeyr & Suliman, 2024)	(Participant 1, 10, 13)
	Ethics and Bias	(Enholm et al., 2022; Khan, 2023; Merhi, 2023b; Aldoseri et al., 2023)	(Participant 1, 4, 12, 15)
	* Energy Efficiency in AI Operations	[Identified gap]	(Participant 3, 7, 12)
RQ2: What are the benefits of AI adoption and analytics in SA telcos?			
P4: Adopting AI in South African telecommunications improves operational efficiency, transparency, data management to drive innovation and minimise risks ensuring that SA Telcos have a competitive advantage.			
Benefits	Operational Efficiency:	(Elapanda et al., 2020)	(Participant 10, 12)
	Improved efficiencies:	(Kitsios & Kamariotou, 2021)	(Participant 3, 15)
	Transparency	(Alqhatani et al., 2022; Laato et al., 2022)	(Participant 12, 13)

	Automation	(Mortaji & Shateri, 2023)	(Participant 4, 15)
	Minimise risks	(Mariani et al., 2023; Merhi, 2023b)	(Participant 1, 5)
	Improved Data Management	(Bhima et al., 2023; Faqihi & Miah, 2023; Menzies et al., 2024; Mortaji & Shateri, 2023)	(Participant 8, 15)
	* Skills development	[Identified gap]	(Participant 1, 5)
RQ3: What are the challenges of AI adoption and analytics in SA telcos?			
P5: The successful adoption of AI in SA Telcos to improve analytics requires overcoming challenges related to data quality, scalability, skill gaps, ethical concerns, costs, organisational resistance, reliability, data privacy, and transparency.			
Challenges	Data Quality and Management	(Merhi, 2023a)	(Participant 14)
	Scalability and Integration	(Merhi, 2023a)	(Participant 4, 8, 12, 15)
	Skill Gaps and Training	(Aldoseri et al., 2023)	(Participant 5, 8, 12)
	Ethical and Regulatory Concerns	(Aldoseri et al., 2023)	(Participant 7, 8, 12)
	Cost and Return on Investment	(Wolniak & Grebski, 2023a)	(Participant 4, 10, 14)
	Change Management and Organisational Resistance	(Wolniak & Grebski, 2023a)	(Participant 13, 15)
	Reliability and Performance	(Aldoseri et al., 2023)	(Participant 12, 15)
	Data Privacy and Security	(Aldboush & Ferdous, 2023)	(Participant 12, 15)
	Transparency and Explainability	(Getchell et al., 2022)	(Participant 6, 8)
	* Challenges in Aligning AI with Business Goals	[Identified gap]	(Participant 8, 11)

Table 10. Alignment of research questions and propositions between authors and participants including identified gaps (*) in literature.

5.5 Conclusion

This chapter explores research findings linked to the three research questions, bridging theory and real-world applications. It integrates literature and participant insights to provide a holistic view of the factors, benefits, and challenges shaping AI adoption in SA telcos.

For Research Question 1, the chapter examines foundational elements such as data quality, technology infrastructure, integration complexity, and cybersecurity. The analysis highlights how these factors influence AI adoption and identifies gaps in literature, including the role of technology partners and the importance of tailored use cases. By blending theoretical insights with operational challenges, the discussion sheds light on the practicalities of adopting AI in complex environments like telecommunications.

For Research Question 2, the focus shifts to the organisational aspects of AI adoption, including strategy, culture, skills development, and leadership support. The section explores how aligning AI initiatives with business goals, fostering a culture of innovation, addressing skill gaps, and ensuring robust leadership support are essential for maximising AI's transformative potential. Participant insights provide practical examples that complement the literature while identifying gaps such as financial readiness and the need for targeted training programs.

For Research Question 3, the section delves into external factors such as market pressures, governance, regulatory compliance, and ethical considerations. It highlights the critical role of competitive dynamics, customer expectations, and societal concerns in driving AI adoption. The discussion also uncovers gaps in the literature, such as energy efficiency and sustainability, emphasising the need for responsible innovation that balances technological advancement with environmental and ethical considerations.

CHAPTER 6. CONCLUSIONS & RECOMMENDATIONS

6.1 Introduction

This study explored the role of AI in enhancing analytics within SA telcos, emphasising AI's significance in processing vast amounts of data to generate valuable insights. The research was structured across five chapters, examining the potential factors influencing AI adoption, its benefits, and associated challenges within the telco sector.

Chapter 1 established the foundational context of Industry 4.0, characterised by AI, IoT, and robotics, and its impact on digital transformation. The rapid "data explosion" with global data volumes reaching 79 zettabytes in 2021 and expected to double by 2025 (Nambiar & Mundra, 2022), poses both opportunities and challenges for telcos. The problem statement highlighted how telcos generate large volumes of data from mobile usage, network monitoring, and IoT applications but struggle with fragmented systems and complex data management. AI and Business Analytics (BA) were identified as critical solutions to unlocking Analytics 4.0, provided that challenges related to data quality, timeliness, and system integration are addressed. Despite its rapid growth, South Africa's telco sector ranked last in customer sentiment for two consecutive years, reinforcing the need for AI-driven improvements (ITWeb, 2022).

Chapter 2 presents recent studies on AI adoption that was categorised into technological organisational, and environmental factors introducing the first research question (RQ1) What are the factors that influence the adoption of AI to improve analytics in SA telcos. AI adoption offers benefits such as operational efficiency, enhanced data management, and competitive advantage, but challenges include data privacy concerns, skill shortages, high costs, and organisational resistance. Notably, 87 percent of big data and AI projects never reach implementation (Merhi, 2023a), emphasising the need for strategic AI

adoption highlighting the need to (RQ2) What are the benefits of AI adoption and analytics in SA telcos, and (RQ3) What are the challenges of AI adoption and analytics in SA telcos.

Chapter 3 detailed the qualitative research methodology, employing an inductive approach guided by the TOE framework. This approach allowed for an in-depth analysis of AI adoption from the perspectives of key stakeholders across three large SA telco organisations. The study explored how AI technologies are perceived, how organisational culture and leadership impact adoption, and how external market conditions and regulations shape implementation.

Chapter 4 presented findings from 15 participants across three companies (A, B, and C), showing how strategic, operational, and technical roles influence AI adoption. Strategic roles provide direction, operational roles bridge gaps, and technical roles drive implementation. Factors such as tenure, qualifications, and feedback methods contributed to a comprehensive understanding of AI's impact on telco analytics.

Chapter 5 synthesised insights from both literature and real-world participant experiences, identifying alignment areas and critical gaps.

6.2 Conclusions regarding research question 1 (RQ1)

AI adoption in South African telcos is influenced by technological, organisational, and environmental factors. While literature and participant insights align on key themes, participants identified gaps that require further exploration to optimise AI implementation.

Technological Factors (P1)

Both literature and participants agree on the importance of regulatory compliance, ethical considerations, and strategic AI adoption. However, participants highlighted overlooked gaps, such as the role of technology partners in shaping AI strategies and the need for clear, function-specific use cases. While

research broadly discusses AI adoption, it lacks detail on how organisations select and integrate technology partners or tailor AI to specific business challenges. Addressing these gaps may improve understanding of AI's operational and strategic impact.

Organisational Factors (P2)

Literature and participants align on the role of strategy, culture, skills, and leadership in AI adoption. However, participants emphasised additional factors such as financial readiness, funding mechanisms, and technology partner influence, which are largely absent in prior studies. The lack of AI-specific funding strategies hinders large-scale implementation. Addressing these financial and strategic gaps may strengthen AI adoption frameworks and drive innovation in organisations.

Environmental Factors (P3)

Literature and participants agree on the importance of market competition, regulatory compliance, and ethical considerations. However, participants identified sustainability concerns, including AI's high energy consumption and the need for alternative power sources like solar energy. These factors are rarely addressed in existing research but are crucial for balancing innovation with environmental responsibility. Incorporating sustainable AI infrastructure is essential for responsible and long-term adoption.

6.3 Conclusions regarding research question 2 (RQ2)

The alignment between the authors' views and participants' insights highlights AI's benefits (P4) in efficiency, data management, automation, and risk reduction.

Participants stress the ability for AI to assist with continuous learning and upskilling, a point not deeply explored in existing literature. This highlights AI's impact beyond technology.

6.4 Conclusions regarding research question 3 (RQ3)

Both literature and participant insights highlight key AI adoption challenges (P5), including data quality, scalability, skill gaps, ethical concerns, costs, change management, and data privacy. While the authors provide theoretical frameworks, participants offer practical perspectives on organisational and operational barriers.

A critical gap identified by participants is the need to align AI initiatives with business goals, bridging the technical and strategic domains often overlooked in literature. This calls for a holistic approach that integrates technical solutions, strategic investments, and governance to ensure AI success.

6.5 Recommendations

The adoption of AI in South African telecommunications (telco) organisations requires collaboration among key stakeholders, including executives, corporations, policymakers, technology providers, and employees. While AI has the potential to enhance Analytics, challenges such as data governance, infrastructure limitations, regulatory constraints, and workforce skills shortages must be addressed to unlock its full benefits.

6.5.1 *Executives*

Executives should align AI with business strategy, invest in workforce upskilling, and enhance data governance to ensure compliance with regulations like POPIA supported by Gartner (2024) suggesting that by 2027, 80 percent of data and analytics (D&A) governance initiatives are likely to fail if there isn't a real or perceived crisis to create urgency. This was also emphasised by Participants 8 and 15. Corporations must modernise IT infrastructure, implement explainable AI (XAI) for transparency, and form strategic partnerships with AI vendors to facilitate seamless AI integration.

6.5.1 *Corporations*

Participant 8 emphasised the importance regarding Model Interpretability and Explainability, therefore corporations need to modernize IT infrastructure, implement explainable AI (XAI) for transparency and trust, and form strategic partnerships with AI vendors. Tailored and interoperable AI solutions that integrate with legacy systems may be critical for operational scalability and innovation.

6.5.2 *Policymakers*

Policymakers play a pivotal role by developing sector-specific AI governance aligned with POPIA, enabling regulatory sandboxes to test innovative solutions, and expanding research and development tax incentives to include AI projects in telecommunications. Participants 4, 8 and 12 described the need for funding to support the business. Therefore, targeted investment in AI education and skills development through SETAs, the National Skills Fund, and strategic partnerships with universities is recommended.

6.5.3 *Technology providers*

Technology providers must offer affordable, locally relevant AI solutions with support for indigenous languages described by Participants 8 and 14, and legacy system integration mentioned by Participants 3 and 5. Partnerships with telcos and local institutions to deliver training and capacity-building initiatives should further drive adoption, especially among smaller operators.

6.5.4 *Employees*

Employees should embrace continuous learning and AI literacy described by Participants 7, 11, and 14, to maximize the value of AI-driven insights and improve decision-making and efficiency.

Ultimately, telco organizations must tailor their AI strategies to their specific environment, challenges, and goals. By fostering a collaborative AI ecosystem, the South African telecommunications sector can enhance operational efficiency, customer experience, and digital resilience for long-term growth and innovation.

6.6 Suggestions for further research

AI is transforming the telecommunications industry; however, technological challenges continue to limit its full potential. To address these gaps, future research should focus on key areas such as fostering stronger technological partnerships to enhance AI integration and infrastructure that may highlight other benefits and challenges.

Workforce development remains a critical priority as AI redefines job roles and skill requirements. Research should examine operating models, strategies for reskilling employees and balancing automation with human expertise to bridge organisational gaps effectively. In addition, future studies should explore sustainability strategies to address the environmental challenges associated with AI adoption, ensuring long-term viability and responsible implementation.

Further research is also needed on AI adoption in small and medium enterprises (SMEs), as these organisations often face unique resource constraints. Complementing this, quantitative impact assessments are essential to evaluate AI's financial returns, operational efficiencies, and improvements in customer experience.

By investigating these areas, future research can provide valuable insights to help telecommunications companies develop effective, sustainable, and responsible AI-driven strategies, ultimately maximising AI's transformative potential in the industry.

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Appendix A: Participant Information Sheet (PIS)

University of the Witwatersrand, Johannesburg

Dear Participant,

My name is Avish Narandas, and I am a student at Witwatersrand Business School in Johannesburg, completing my Master's in Management in the field of Digital Business. As part of my studies, I am undertaking a research project under the supervision of Michael Sony. The purpose of this study is to **explore the role of artificial intelligence (AI) in improving analytics within South African telecommunications (Telco) organisations.**

As a key resource in the Telco industry, you are invited to participate in a virtual interview that will take approximately 30 - 45 minutes. The objective of this study is to understand how AI can enhance analytics processes and contribute to better decision-making within your organisation.

This research project does not pose any risks to you or the organisation. Your participation will be anonymous, and no personal information will be requested from you. There are no costs involved for you to participate in this study. Your participation is voluntary, and you may withdraw from the interview at any point.

Please let me know if you require any further information. My email address is 2739847@students.wits.ac.za, alternatively on my mobile: +27845554319.

Your participation in this research study would be greatly appreciated.

Thank you for considering participating in this study.

Yours sincerely,

Avish Narandas (+27845554319)

University of the Witwatersrand, Johannesburg

Appendix B: Participant consent form

I, ..., agree to participate in the research study on exploring the role of AI to improve analytics within South African Telco organisations. I understand that my participation is voluntary and that I have the right to withdraw from the study at any time without any consequences.

By signing below, you acknowledge that you have been informed about the study and understand the nature of your participation.

Participant Consent: (please tick)

- ☐ Yes / ☐ No: I agree that my participation will remain anonymous.
- ☐ Yes / ☐ No: I agree that the researcher may use anonymous quotes in their research report.
- ☐ Yes / ☐ No: I agree that the interview may be audio recorded.
- ☐ Yes / ☐ No: I agree that the information I provide may be used anonymously by other researchers following this study.

Signature of Participant:

Signature: _____
Name: .....
Date: .....

Appendix C: Interview Guide

Section A: Demographic Data:

a) Type of organisation?
b) What is your qualification?
c) Gender?
d) What is your current role at the organisation?
e) Do you have any influence on what technology is implemented at your organisation?
f) How long have you been employed at your organisation?
g) Which division and functional area do you work in?

The table below outlines the primary interview questions, the related aspects of the conceptual framework, and the specific research questions these interview questions aim to address.

Section B: **RQ1: What are the factors that influence the adoption of AI to improve analytics in SA telcos?**	
#	**Question**
1.	To what extent do you agree that aspects like data quality, IT infrastructure, integration, scalability, and cybersecurity influence AI adoption in telco organisations? What other **technological** factors are important in your organisation to adopt AI?

2.	To what extent do you agree that aligning AI with business goals, building a culture of innovation, addressing skills gaps, and having strong support from leadership influences AI adoption in telco organisations? What other **organisational** factors are important to adopt AI?
3.	To what extent do you agree that external market pressures, complying with regulations, and addressing ethical concerns influences AI adoption in telco organisations? What other **environmental** factors are important in your organisation to adopt AI?
Section C: **RQ2: What are the benefits of AI adoption and analytics in SA telcos?**	
4.	How has AI adoption **improved** your organisation in relation to data analytics?
Section D: **RQ3: What are the challenges of AI adoption and analytics in SA telcos?**	
5.	What **challenges** has your organisation faced in adopting AI to improve analytics?

Appendix D: Ethics approval

Graduate School of Business Administration
University of the Witwatersrand, Johannesburg

Wits Business School

Wits Business School Ethics Committee
Constituted under the University Human Research Ethics Committee (Non-Medical)

Ethics Clearance Certificate

Ethics protocol number: WBS/DB2739847/663
This certificate is only valid with a legitimate ethics protocol number and signed by the Researcher (below).

Project title	Exploring the role of AI to improve Analytics within Telco organisations.
Investigator / Researcher	Mr Avish Narandas
Nature of Project	MM (Digital Business)
Decision of the Committee	Approved, provided stakeholders and participants are guaranteed confidentialty.
Issue Date of Certificate	02/09/2024
Expiry date	Date of submission of the project / research report
Chairperson	Dr Ayanda Magida ☎ +27 11 717 3953 ✉ ayanda.magida@wits.ac.za

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Declaration by Researcher

One copy must be signed by the Researcher and returned to the Chairperson of the Wits Business School Ethics Committee.

I fully understand the conditions under which I am authorized to carry out the abovementioned research and I guarantee to ensure compliance with these conditions. Should any departure to be contemplated from the research procedure as approved I undertake to resubmit the protocol to the Committee.

Signature

01/ 11/ 2024
Date:

Appendix E: Title approval

UNIVERSITY OF THE WITWATERSRAND, JOHANNESBURG

Private Bag 3 Wits, 2050
Fax:
Tel:

Reference: Ms Jennifer Mgolodela
E-mail: jennifer.mgolodela@wits.ac.za

27 August 2024
Person No: 2739847
PAG

Mr AM Narandas
PO Box 11460
Midrand
Vorna Valley
1686
South Africa

Dear Mr Avish Narandas

Master of Management: Approval of Title

We have pleasure in advising that your proposal entitled *Exploring the role of AI to improve analytics within Telco organisations.* has been approved. Please note that any amendments to this title have to be endorsed by the Faculty's higher degrees committee and formally approved.

Yours sincerely

Mrs Marike Bosman
Faculty Registrar
Faculty of Commerce, Law and Management

Appendix F: 1st and 2nd Order Codes based on participant verbatims

Research Question	Proposition	Interview Question	Theme	2nd Order Codes	1st Order Codes	Participant	Verbatim
RQ1: What are the factors that influence the adoption of AI to improve analytics in SA telcos?	P1: Successful adoption of AI for Analytics in South African telecommunications depends on a holistic technological approach that prioritizes high data quality and volume, robust IT infrastructure, seamless integration and scalability, and stringent cybersecurity and privacy measures.	1a) To what extent do you agree that aspects like data quality, IT infrastructure, integration, scalability, and cybersecurity influence AI adoption in telco organisations?	Technological	Data Governance and Quality	**Data Governance Importance**	Participant 1	"There has to be data governance to control the data quality because... if the data is junk, it's not going to work."
			Technological	Data Governance and Quality	**Data Governance Importance**	Participant 8	"Data governance data quality are probably the primary and most critical thing necessary in any organisation required as a prerequisite to actually adopt AI right? So critical factor, definitely data quality, data governance."
			Technological	Data Governance and Quality	**Data Governance Importance**	Participant 15	"Data quality is essential because poor data can lead to unreliable insights. In our case, we've seen challenges with incomplete or inconsistent data from customer interactions."
			Technological	Data Governance and Quality	**Data Governance Importance**	Participant 12	"If you look at our CapEx and our OpEx expenditure, if you look into optimise OpEx cost, which is our core goal as a leadership team. If you do not have any data, or insightful type of decisions made out of it ultimately falls apart. So for us, there's definitely a lot of gaps."
			Technological	Data Governance and Quality	**Data Governance Importance**	Participant 14	"It's important to have a good data strategy focused on data quality, data governance, and addressing privacy and security considerations."
			Technological	Data Governance and Quality	**Garbage In, Garbage Out**	Participant 1	"Junk in, junk out, right?"
			Technological	Data Governance and Quality	**Garbage In, Garbage Out**	Participant 7	"Obviously what you put into AI is what you get out, so you need to ensure that your quality of your data where your AI models are built upon is of good quality so that whatever you get out is relatively good data."
			Technological	Data Governance and Quality	**Garbage In, Garbage Out**	Participant 15	"Poor data can lead to unreliable insights."
			Technological	Data Governance and Quality	**Garbage In, Garbage Out**	Participant 11	"what you put in is what you get out, right? So the AI is just something that you're gonna put on top of your data to try and draw insights or benefits out of. You have before you even decide to bring the AI in, the first step is to understand your objectives. Once you understand your objectives, you need to understand your inputs to achieve your objectives. And then you need to make sure those inputs are of a high quality."
			Technological	IT Infrastructure and Integration	**Robust IT Infrastructure**	Participant 1	"You gotta have something decent in place for all of AI to run on."
			Technological	IT Infrastructure and Integration	**Robust IT Infrastructure**	Participant 4	"Robust IT infrastructure is equally vital, as telecoms require scalable computing power and storage to manage the vast data generated by their networks"
			Technological	IT Infrastructure and Integration	**Robust IT Infrastructure**	Participant 15	"Moving to more robust cloud-based platforms has been key to handling large datasets and ensuring the organization can explore AI options without major hardware limitations."

Research Question	Proposition	Interview Question	Theme	2nd Order Codes	1st Order Codes	Participant	Verbatim
			Technological	IT Infrastructure and Integration	**Robust IT Infrastructure**	Participant 12	"when it comes to IT infrastructure, right? You can actually start what we start to see in telcos like, you know, a lot of these factors that are available from an AI or a benefit perspective, is that we start seeing like a lot of people like in our industry and start using the knock with AI algorithms to pick up on the network performance or service performance where they goes up or down, where it can be optimised."
			Technological	IT Infrastructure and Integration	**Robust IT Infrastructure**	Participant 14	"One of the critical factors in the adoption of AI is the importance of leveraging existing data capabilities and developing a robust AI use-case pipeline."
			Technological	IT Infrastructure and Integration	**Integration Challenges**	Participant 1	"If there's segmented or siloed data, AI won't work properly."
			Technological	IT Infrastructure and Integration	**Integration Challenges**	Participant 5	"We have complex, legacy IT systems with siloed data from multiple sources. Integrating data from diverse systems like billing, customer service, network management, and marketing requires sophisticated data engineering which we do not have."
			Technological	IT Infrastructure and Integration	**Integration Challenges**	Participant 15	"AI tools need to work seamlessly with existing platforms, and I've seen how our IT team works hard to integrate AI-driven tools like Co-Pilot with everyday workflows."
			Technological	IT Infrastructure and Integration	**Integration Challenges**	Participant 8	"The challenge is how you integrate it on top of your existing data and analytics stack within your organisation."
			Technological	IT Infrastructure and Integration	**Scalability Needs**	Participant 3	"But then you've still got the legacy systems in place. So cleaning up those environments are helping us to be able to scale much more and use AI tools to do the jobs that we that we need to."
			Technological	IT Infrastructure and Integration	**Scalability Needs**	Participant 8	"Scalability is critical and AI solutions like building a machine learning models that allow you to know not only score the model on a segment of customers but being able to score those models on your entire base."
			Technological	IT Infrastructure and Integration	**Scalability Needs**	Participant 14	"AI capabilities are built for scalability and reusability where possible."
			Technological	IT Infrastructure and Integration	**Scalability Needs**	Participant 15	"Our organization deals with increasing amounts of customer data, and any AI system we adopt must handle this growth effectively."
			Technological	IT Infrastructure and Integration	**Scalability Needs**	Participant 12	"It's also resulted in a lot of strain on our existing systems because it requires more GPU processing, it requires a lot more resources put behind it just to actually get it to work."
			Technological	Cybersecurity and Privacy	**Cybersecurity Concerns**	Participant 1	"people being scared about AI and like, obviously I think movies creates a stigma around AI. So I'm like, everyone is afraid of, like, identities being stolen. Its like robots taking over the world. So there's a risk"
			Technological	Cybersecurity and Privacy	**Cybersecurity Concerns**	Participant 14	"It's important that we invest in building digital trust, including actively managing data privacy and having a robust cybersecurity strategy."
			Technological	Cybersecurity and Privacy	**Cybersecurity Concerns**	Participant 7	"We need to ensure that our data is secure. We keep our customers' data private and we abide by all the regulations in terms of ensuring that it's fine."
			Technological	Cybersecurity and Privacy	**Cybersecurity Concerns**	Participant 15	"AI tools must adhere to strict security protocols, and I've observed how this has been a key consideration in the limited AI adoption we've had so far."
			Technological	Cybersecurity and Privacy	**Cybersecurity Concerns**	Participant 12	"we see it on a day-to-day where you know, cybersecurity with people hacking your payment methods or your payment gateway or trying to at least breach in actual Telco data"

Research Question	Proposition	Interview Question	Theme	2nd Order Codes	1st Order Codes	Participant	Verbatim
			Technological	Regulatory and Ethical Compliance	**Regulatory Compliance**	Participant 7	"We need to ensure like in terms of ethics, and a responsible way to use the technology... And with adoption of AI, a lot of the regulations and standards are forming now."
			Technological	Regulatory and Ethical Compliance	**Regulatory Compliance**	Participant 15	"In South Africa, telcos operate under strict data protection laws, such as POPIA. Any AI system we consider adopting must align with these regulations."
			Technological	Regulatory and Ethical Compliance	**Regulatory Compliance**	Participant 8	"We have ICASA. Beyond that, we have laws around data movement, data adoption in the form of POPI. So the combination of the two creates what I think are suitable guardrails for responsible data usage for AI."
			Technological	Regulatory and Ethical Compliance	**Regulatory Compliance**	Participant 12	"There's also a compliance with regulations that is required, data privacy and protection laws such as your GDPR or POPI in South Africa."
		1b) What other technological factors are important in your organization to adopt AI?	Technological	Technological Advancements	**AI Governance Tools**	Participant 8	"Data governance is actually a function and a set of tooling comes along with it... AI governance, right, which looks at the different attributes of a subscriber that go into building a machine learning model or AI model."
			Technological	Technological Advancements	**AI Governance Tools**	Participant 15	"AI could influence customer interactions and decision-making, particularly in marketing campaigns. It's important to avoid biases or unfair practices in how AI-driven insights are applied."
			Technological	Technological Advancements	**AI Governance Tools**	Participant 12	"AI adoption in telecommunications not only just about having advanced algorithms or powerful models, for me it's more of a comprehensive approach"
			Technological	Technological Advancements	**Model Interpretability and Explainability**	Participant 6	"Issues around feeling a sense of distrust towards the AI, like I don't know where this thing gets its formulas from and I know how I work, so I'll just do it by hand... how AI is framed regarding model explainability and interpretability."
			Technological	Technological Advancements	**Model Interpretability and Explainability**	Participant 8	"Model interpretability and explainability ties in square with the aspect around us ensuring that from an AI governance point of view we are not biassing our results towards certain parts of the population."
			Technological	Data Governance and Quality	**ML/AI Platform Standardization**	Participant 8	"I think the other critical factor is having a scalable standardised machine learning AI platform available in an organisation."
			Technological	Data Governance and Quality	**ML/AI Platform Standardization**	Participant 15	"Using tools like Co-Pilot integrated into platforms like Excel and Teams, different departments can easily share and interpret data."
			Technological	Data Governance and Quality	**ML/AI Platform Standardization**	Participant 12	"We are familiar with a lot of the solutions in place. We use AWS technology today, we use Google Cloud technology. A lot of those type of things we have in place, we use Kubernetes."
			Technological	Technological Advancements	**Cloud-Native Technologies**	Participant 12	"what comes to mind is like cloud-based computing and cloud native technologies. Because I mean that's super important. That's where infrastructure is moving to"
			Technological	Technological Advancements	**Cloud-Native Technologies**	Participant 15	"The use of tools like Microsoft Co-Pilot is supported by cloud-based systems that allow seamless access and processing of data."
			Technological	Technological Advancements	**Cloud-Native Technologies**	Participant 3	"likes of are you a Microsoft house, Google House or Amazon House are important because ultimately the tools that your hyperscalers in that sense or your technology partners are bringing in influences the type of things you can do with an organisation."

Research Question	Proposition	Interview Question	Theme	2nd Order Codes	1st Order Codes	Participant	Verbatim
			Technological	Technological Advancements	**Automation Tools and MLOps**	Participant 4	"Other technologies are the like of edge and cloud computing for real-time and scalable processing, MLOps tools for managing AI models, and automation platforms for seamless workflows."
			Technological	Technological Advancements	**Automation Tools and MLOps**	Participant 15	"In our marketing workflows, automation tools have already reduced repetitive tasks, and incorporating AI would likely build on that by offering more advanced solutions."
			Technological	Technological Advancements	**Automation Tools and MLOps**	Participant 5	"Data Processing and Management Technologies such as advanced data lakes, stream processing capabilities, real-time data ingestion tools, data governance platforms and metadata management systems are crucial given that AI is only effective when there is an abundance of data."
			Technological	Cybersecurity and Privacy	**Data Privacy and Compliance Tools**	Participant 4	"Data governance and privacy technologies ensure compliance and security, while interoperability standards and real-time analytics enhance integration and decision-making."
			Technological	Cybersecurity and Privacy	**Data Privacy and Compliance Tools**	Participant 14	"Actively managing data privacy and having a robust cybersecurity strategy."
			Technological	Cybersecurity and Privacy	**Data Privacy and Compliance Tools**	Participant 15	"Our IT and compliance teams worked together to ensure that its implementation met all necessary privacy standards."
			Technological	Cybersecurity and Privacy	**Data Privacy and Compliance Tools**	Participant 8	"Cybersecurity, another critical aspect... we have to be quite conscious in terms of the type of solutions we build ensuring that we don't create opportunities to leak data through our model results."
			Technological	Technological Advancements	**Energy Efficiency in AI Operations**	Participant 3	"the power you need to be able to power these data centres and the AI engines, you especially when you when you're starting to use NVIDIA chips your H100 chips and that sort of thing, your power consumption is going through the roof, so you've gotta look at other, more efficient ways to be able to power those things, you know, in a sunny in a sunny environment like South Africa, solar becomes an option."
			Technological	Technological Advancements	**Energy Efficiency in AI Operations**	Participant 12	"Over the past two years as it stands, telcos actually spent a lot of the CapEx budget to safeguard and protect old technology that has a lot of reliance on energy."
			Technological	Technological Advancements	**Unified Data and AI Strategy**	Participant 8	"Having this unified data in AI strategy is critical and foundational and a key technological cofactor for adoption of AI to ensure value add."
			Technological	Technological Advancements	**Unified Data and AI Strategy**	Participant 15	"It's important to have a broader strategy when considering AI adoption in our organization."
			Technological	Technological Advancements	**Unified Data and AI Strategy**	Participant 12	"The quality of data, infrastructure integration, scalability, and having the protocols to ensure cybersecurity is taken care of are the fundamental foundation for getting AI adoption."
	P2: For successful AI adoption, organizations must align AI strategies with business goals, build a culture that supports innovation, address skills gaps with targeted training,	2a) To what extent do you agree that aligning AI with business goals, building a culture of innovation, addressing skills gaps,	Organizational	Strategy and Collaboration	**Aligning AI with Business Goals**	Participant 1	"if you have that top down approach, you know that in from an organisation perspective, we have to just do it and then just filter that strategy downwards."
			Organizational	Strategy and Collaboration	**Aligning AI with Business Goals**	Participant 5	"Aligning AI with business goals is arguably the most crucial factor as it directly determines the strategic relevance of AI initiatives and ensures AI investments generate tangible business value."
			Organizational	Strategy and Collaboration	**Aligning AI with Business Goals**	Participant 14	"Aligning AI with business goals is essential for telcos to become AI-native organizations that embed AI into key aspects of the business to drive efficiency and growth."
			Organizational	Strategy and Collaboration	**Aligning AI with Business Goals**	Participant 15	"Microsoft Co-Pilot was introduced primarily because it aligns with the company's goal of improving productivity and collaboration across teams."
			Organizational	Strategy and Collaboration	**Aligning AI with Business Goals**	Participant 8	"Aligning AI with business goals... knowing where you want to apply AI and for what reason is critical, and that all starts with aligning your chief commercial and strategy officers in terms of understanding every business vertical."

Research Question	Proposition	Interview Question	Theme	2nd Order Codes	1st Order Codes	Participant	Verbatim
	and ensure strong support from top and middle management.	and having strong support from leadership influences AI adoption in telco organisations?	Organizational	Strategy and Collaboration	**Aligning AI with Business Goals**	Participant 10	"Aligning with business goal is always the key. Any programme or project which is not aligned with business goal will end up into creating more cost for the company and less benefits."
			Organizational	Leadership and Culture	**Building a Culture of Innovation**	Participant 3	"I think the culture of using it is super important within an organisation. So you got to work with the thing, you got to trust the thing in order for it to become useful, knowing that if you use a tool like that, you know that you've got that trust, that the results that have come out are going to be for the best interests of you and the organisation in terms of the decision you make."
			Organizational	Leadership and Culture	**Building a Culture of Innovation**	Participant 14	"Building a culture of innovation is a key factor. It's important to foster an environment that supports experimentation and creativity."
			Organizational	Leadership and Culture	**Building a Culture of Innovation**	Participant 5	"Building a culture of innovation creates an ecosystem conducive to AI experimentation that encourages risk-taking, continuous learning and an openness/less resistance to technological disruption/change."
			Organizational	Leadership and Culture	**Building a Culture of Innovation**	Participant 15	"The adoption of new technologies like Co-Pilot reflects a broader push to encourage experimentation and forward-thinking."
			Organizational	Leadership and Culture	**Building a Culture of Innovation**	Participant 9	"AI also allows a company to be able to experiment a bit more because there's a lot of data and science behind it, so there's more room for experimentation, learning, and adaptation within an organisation."
			Organizational	Leadership and Culture	**Building a Culture of Innovation**	Participant 12	"Building a culture of innovation, addressing skill gaps, and having strong leadership support are critical factors of influencing adoption within the telco organisation."
			Organizational	Leadership and Culture	**Building a Culture of Innovation**	Participant 13	"The openness of senior management to investigate AI. Having a culture of exploration within the organisation is very important and also a willingness to experiment is critical."
			Organizational	Skills and Knowledge	**Addressing Skills Gaps**	Participant 1	"Everyone is not AI literate in AI skills right, like as much as I can write SQL coding, I might not be able to know how to code an AI bot"
			Organizational	Skills and Knowledge	**Addressing Skills Gaps**	Participant 14	"Having the right training programmes and access to learning is critical in addressing the relevant skills gaps."
			Organizational	Skills and Knowledge	**Addressing Skills Gaps**	Participant 15	"Many employees needed workshops and resources to understand how to use it effectively, demonstrating the importance of closing knowledge gaps for successful implementation."
			Organizational	Skills and Knowledge	**Addressing Skills Gaps**	Participant 6	"I think the challenge would lie in in whether or not they have the skills to use data to to make decisions."
			Organizational	Skills and Knowledge	**Addressing Skills Gaps**	Participant 8	"AI skill sets have always been something quite niche... but the skill gaps are absolutely critical, both from a technology perspective and from a platform building type perspective, and also from a data science perspective."
			Organizational	Skills and Knowledge	**Addressing Skills Gaps**	Participant 11	"the organisation has made available all of the necessary things to be able to reskill or upskill yourself. So there's nothing stopping every single individual from identifying a potential development path for themselves to make them to allow themselves to remain relevant in the organisation. The problem is some people are just not willing to change"
			Organizational	Leadership and Culture	**Strong Leadership Support**	Participant 1	"I think from a leadership perspective they are pushing for it, so they've realised that this is important and I think that each leader's like all the team, different team leaders like as you go lower down, I'm like obviously an executive saying that we're going to adopt"
			Organizational	Leadership and Culture	**Strong Leadership Support**	Participant 14	"Aligning AI with business goals, building a culture of innovation, addressing skills gaps, and having strong support from leadership are fundamental to the successful adoption of AI."

Research Question	Proposition	Interview Question	Theme	2nd Order Codes	1st Order Codes	Participant	Verbatim
			Organizational	Leadership and Culture	**Strong Leadership Support**	Participant 4	"I strongly agree that aligning AI with business goals, fostering a culture of innovation, addressing skills gaps, and securing leadership support are critical for AI adoption in telecoms."
			Organizational	Leadership and Culture	**Strong Leadership Support**	Participant 15	"Our executive team's backing of AI tools like Co-Pilot has sent a clear message that adopting AI is a priority for the organization."
			Organizational	Leadership and Culture	**Strong Leadership Support**	Participant 8	"The leadership influence is probably the most critical thing to have senior leadership members that believe in the value that AI can provide."
			Organizational	Leadership and Culture	**Strong Leadership Support**	Participant 13	"There's lots of training and there's a lot of sort of top-down push for AI to really be adopted and be used effectively in the organisation."
		2b) What other organisational factors are important to adopt AI?	Organizational	Leadership and Culture	**Change Management Processes**	Participant 1	"I've seen the older generations not wanting to adopt it. But yeah, so there's definitely some kind of change in the behavioural or workforce change that needs to happen."
			Organizational	Leadership and Culture	**Change Management Processes**	Participant 14	"Change management, stakeholder engagement including policymakers, potential partners etc."
			Organizational	Leadership and Culture	**Change Management Processes**	Participant 4	"Additionally, a clear AI strategy, strong change management, cross-functional collaboration, ethical practices, adequate funding, and a customer-centric focus are essential."
			Organizational	Leadership and Culture	**Change Management Processes**	Participant 15	"Clear communication about the benefits of Co-Pilot and gradual implementation helped ease this transition."
			Organizational	Leadership and Culture	**Change Management Processes**	Participant 12	"If it's not something that's captured from the top down and it's not part of the culture, then it falls apart."
			Organizational	Leadership and Culture	**Change Management Processes**	Participant 11	"If you don't deliver that change and bring about that adoption properly, then even the best tool in the world will still be useless. This is why I believe that organisational factors are more important in successful adoption than technological factors."
			Organizational	Strategy and Collaboration	**Cross-Functional Collaboration**	Participant 7	"You need more cross-functional teams. And then there's a lot of teams working in silos. So to get things across the line, you need that integration points."
			Organizational	Strategy and Collaboration	**Cross-Functional Collaboration**	Participant 15	"AI adoption often requires different teams—such as marketing, IT, and operations—to work closely together."
			Organizational	Strategy and Collaboration	**Cross-Functional Collaboration**	Participant 9	"AI would be able to identify which departments would be able to have opportunities to work together and collaborate as well as to leverage skill sets within different functional teams at its optimum to being efficient."
			Organizational	Strategy and Collaboration	**Clear AI Strategy**	Participant 4	"Additionally, a clear AI strategy, strong change management, cross-functional collaboration, ethical practices, adequate funding, and a customer-centric focus are essential."
			Organizational	Strategy and Collaboration	**Clear AI Strategy**	Participant 14	"AI investments must be aligned with strategic priorities and that AI capabilities are built for scalability and reusability where possible."
			Organizational	Strategy and Collaboration	**Clear AI Strategy**	Participant 15	"Without clear alignment between AI initiatives and the organization's objectives, there's often hesitation to invest in these technologies."

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			Organizational	Strategy and Collaboration	**Clear AI Strategy**	Participant 13	"As you need to balance the capabilities of AI with the business strategy and in order to do that alignment, there's a lot of skills gaps that needs to be addressed."
			Organizational	Budgetary Constraints	**Adequate Funding**	Participant 2	"Budgets for implementation and identifying in-house versus outsourcing are key considerations for AI adoption."
			Organizational	Budgetary Constraints	**Adequate Funding**	Participant 8	"Looking at funding most organisations, including telcos, do not have a strong understanding of what is the right gearing on the investment for AI."
			Organizational	Budgetary Constraints	**Adequate Funding**	Participant 15	"Leadership-driven approach has ensured that the necessary resources, such as funding and training, are made available."
			Organizational	Budgetary Constraints	**Adequate Funding**	Participant 12	"it requires more GPU processing, it requires a lot more resources put behind it just to actually get it to work."
			Organizational	Regulatory and Ethical Compliance	**Ethics and Governance**	Participant 9	"Maybe in terms of like ethics and governance in that space because this can help deploy practises and always be relevant in that sense and with the development of AI and the pace that that's moving is definitely a place for AI to be in terms of ethics and governance."
			Organizational	Regulatory and Ethical Compliance	**Ethics and Governance**	Participant 14	"Developing and deploying AI responsibly is a priority. We have established AI ethics guidelines and governance structures to address potential risks."
			Organizational	Regulatory and Ethical Compliance	**Ethics and Governance**	Participant 15	"It’s important to avoid biases or unfair practices in how AI-driven insights are applied."
			Organizational	Regulatory and Ethical Compliance	**Ethics and Governance**	Participant 12	"AI can also be brought into the organisation to address any ethical concerns. It can be there for transparency, it can be some form of public trust or corporate reputation."
			Organizational	Technology Implementation Issues	**Practical Use Cases**	Participant 6	"It can’t be like a generic thing like use it to summarize your notes... You have to tell people like within your function, you can use it to do this. And here is the tool, here’s how fast you can work, this is how accurate it is."
			Organizational	Technology Implementation Issues	**Practical Use Cases**	Participant 15	"Using Co-Pilot, teams can quickly generate insights from existing datasets, which has made it easier to analyze campaign performance and refine our marketing strategies."
			Organizational	Technology Implementation Issues	**Practical Use Cases**	Participant 13	"There's still a lot more that needs to be unpacked to the point where I would say the organisation is being quite careful in AI adoption and they're really pushing through the culture and training aspect of it ahead of quickly implementing something for the sake of doing it."
			Organizational	Technology Implementation Issues	**Data Management Practices**	Participant 7	"I think you need the depth culture, that culture of data, the culture of innovation, the culture of driving, the importance of data from the time you create it to the time you use it."
			Organizational	Technology Implementation Issues	**Data Management Practices**	Participant 15	"Marketing data from different campaigns often needs to be manually standardized before analysis, making it difficult to leverage AI for real-time insights."
			Organizational	Technology Implementation Issues	**Data Management Practices**	Participant 14	"Data quality is often one of the most overlooked requirements but is the foundation to leveraging the capabilities of AI."
			Organizational	Technology Implementation Issues	**Data Management Practices**	Participant 12	"There was also the scalability of the infrastructure in the beginning stages due to amounts of data that telcos have. They have billions of transactions."
			Organizational	Skills and Knowledge	**Workforce Adaptation**	Participant 11	"One of the biggest factors around deployment of these technologies in AI means that the people that were doing the job before AI came along are at risk of losing their jobs unless they find themselves reskilling themselves to be able to operate in the new world."

Research Question	Proposition	Interview Question	Theme	2nd Order Codes	1st Order Codes	Participant	Verbatim
			Organizational	Skills and Knowledge	**Workforce Adaptation**	Participant 14	"Adequate training programmes and the upskilling of our employee base across the organisation."
			Organizational	Skills and Knowledge	**Workforce Adaptation**	Participant 15	"Adopting AI represents a shift in how teams operate, and not everyone is immediately open to changing established workflows."
			Organizational	Skills and Knowledge	**Workforce Adaptation**	Participant 9	"AI can be used to continuously assess what skills we have and the skills on demand and almost looking into the future and what skills will be required using AI given the current function."
	P3: For effective AI adoption, organizations must navigate external market pressures, comply with varying regulations, and address ethical considerations to stay competitive and meet customer demands.	3a) To what extent do you agree that external market pressures, complying with regulations, and addressing ethical concerns influences AI adoption in telco organisations?	Environmental	Regulatory and Ethical Compliance	**Regulatory Frameworks Impact Adoption**	Participant 1	"The first question we always get asked is like, do you have the right approval and are you aware of the regulations as it is different in each country?"
			Environmental	Regulatory and Ethical Compliance	**Regulatory Frameworks Impact Adoption**	Participant 3	"So the regulation of how this happens is I think it's creating an environment for telcos of, of uncertainty"
			Environmental	Regulatory and Ethical Compliance	**Regulatory Frameworks Impact Adoption**	Participant 14	"We see the influence of various regulations and policies influencing the execution of our global strategies."
			Environmental	Regulatory and Ethical Compliance	**Regulatory Frameworks Impact Adoption**	Participant 8	" I think what's great in South Africa like I mentioned is the regulators have created a good landscape for AI adoption. Unlike some of our African countries. Other African countries we have been exposed to as well where either the lack of regulation or over regulation has led to limited AI adoption."
			Environmental	Regulatory and Ethical Compliance	**Regulatory Frameworks Impact Adoption**	Participant 15	"Telcos operate under strict data protection laws, such as POPIA."
			Environmental	Regulatory and Ethical Compliance	**Regulatory Frameworks Impact Adoption**	Participant 13	"We have South African regulation for when we work within the South African context, but in our organisation we work across different countries and we have to take into account the different regulations in those countries."
			Environmental	Strategy and Collaboration	**Market Pressures Drive Adoption**	Participant 3	"The speed at which you can launch product to market I think is something that I think all telcos are trying to really adapt now because of what and the speed at which you know, competition is releasing products into market."
			Environmental	Strategy and Collaboration	**Market Pressures Drive Adoption**	Participant 14	"Government and societal concerns in some markets around AI adoption put pressure on organisations like us to demonstrate an ethical approach in implementing this technology."
			Environmental	Strategy and Collaboration	**Market Pressures Drive Adoption**	Participant 4	"The need to stay ahead of competitors and meet evolving customer demands drives telcos to adopt AI for enhanced efficiency, personalized services, and innovation."
			Environmental	Strategy and Collaboration	**Market Pressures Drive Adoption**	Participant 15	"External market pressures play a major role... If competitors are leveraging AI to improve decision-making and customer experiences, we can’t afford to lag behind."
			Environmental	Strategy and Collaboration	**Market Pressures Drive Adoption**	Participant 5	"External Market Pressures such as competitive landscape and industry transformation have the most pressing influence on AI adoption. Competitive dynamics such as market differentiation through AI capabilities and pressure to match competitor technological capabilities."

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			Environmental	Strategy and Collaboration	**Market Pressures Drive Adoption**	Participant 9	"If competition is starting to adopt it, and if you don't, you are going to be two steps or three steps behind"
			Environmental	Strategy and Collaboration	**Market Pressures Drive Adoption**	Participant 12	"External pressures, compliance, and all of those type of things can have a massive profound impact on any type of AI adoption... to try to be ahead of your competitors or meet customer expectations."
			Environmental	Strategy and Collaboration	**Market Pressures Drive Adoption**	Participant 13	"Be it that many players within the telecommunications industry have started adopting AI in different aspects of the organisation, so there's a pressure to not be left behind against your competitors."
			Environmental	Regulatory and Ethical Compliance	**Ethical Concerns and Transparency**	Participant 1	"from a corporate responsibility, you need to make a customer aware that fine, we've been analysing your data previously for operational or marketing or sales needs"
			Environmental	Regulatory and Ethical Compliance	**Ethical Concerns and Transparency**	Participant 15	"There is a focus on ensuring that AI tools are used responsibly."
			Environmental	Regulatory and Ethical Compliance	**Ethical Concerns and Transparency**	Participant 4	"Addressing issues like data privacy, algorithmic bias, and transparency helps maintain public trust and align AI initiatives with societal values."
			Environmental	Regulatory and Ethical Compliance	**Ethical Concerns and Transparency**	Participant 5	"There are ethical concerns pertaining to the implementation of the technology. These include AI bias and fairness, algorithmic transparency, customer data privacy, potential workforce displacement and the larger societal impact of AI technologies."
			Environmental	Regulatory and Ethical Compliance	**Ethical Concerns and Transparency**	Participant 14	"Currently government and societal concerns in some markets around AI adoption put pressure on organisations like us to demonstrate an ethical approach in implementing this technology."
			Environmental	Regulatory and Ethical Compliance	**Ethical Concerns and Transparency**	Participant 7	"We need to ensure we abide by certain ethics in the environment, you are taking care of the specific environment, you allowing people access to information or to services they didn't have before."
			Environmental	Regulatory and Ethical Compliance	**Ethical Concerns and Transparency**	Participant 10	"Mostly the ethical concerns, and I think depending on company's culture and company's strategy and policies, it may be a little bit lenient in towards adoption or not adopting AI."
			Environmental	Regulatory and Ethical Compliance	**Ethical Concerns and Transparency**	Participant 12	" external market pressures complying with regulations and addressing ethical concerns does influence many organisations to adopt AI."
			Environmental	Regulatory and Ethical Compliance	**Ethical Concerns and Transparency**	Participant 13	"Ethical concerns around AI did not exist three years ago... generative AI is actually top of mind of a lot of businesses and consumers, and you have to have that ethical consideration around copyright, personal information, and trademarks."
		3b) What other environmental factors are important in your organisation to adopt AI?	Environmental	Technological Advancements	**Technological Advancements**	Participant 4	"Keeping pace with innovations like 5G, IoT, and cloud computing supports AI's integration into cutting-edge telecom services."
			Environmental	Technological Advancements	**Technological Advancements**	Participant 14	"AI adoption in various aspects of data analytics including faster turnaround times with improved accuracy and richer insights."
			Environmental	Technological Advancements	**Technological Advancements**	Participant 15	"Staying updated on emerging trends and advancements ensures we don’t fall behind."
			Environmental	Technological Advancements	**Technological Advancements**	Participant 3	"I think they are Smart Tools that can be used more effectively within the organisation if there is broad adoption that one can see that if you can use this tool and are given the opportunity to understand and how to use it, it can be adopted in order to improve the way I do work."

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			Environmental	Technology Implementation Issues	**Data Infrastructure Limitations**	Participant 8	"The slow adoption of standardized tooling, standardized patterns, has led to tough to maintain solutions, inability to scale at times."
			Environmental	Technology Implementation Issues	**Data Infrastructure Limitations**	Participant 15	"While we collect a lot of data from various customer touchpoints, much of it is stored in silos or requires significant cleaning and preparation."
			Environmental	Technology Implementation Issues	**Data Infrastructure Limitations**	Participant 1	"I think with AI becomes like it's you need a lot of power behind it and working on premises like on Prem kind of like server installations. You always run into a problem with size and speed and RAM and whatever it's it's limited to an extent and especially with the amount of data that we keep on consuming and storing every year,"
			Environmental	Skills and Knowledge	**AI Talent Availability**	Participant 5	"We have a shortage of employees with specialized skills in AI, machine learning, and advanced data analytics. It is an expensive and competitive market for AI and data science talent."
			Environmental	Skills and Knowledge	**AI Talent Availability**	Participant 12	"The last thing that I have picked up is that there isn't much expertise in the ecosystem for us to pull on locally as it stands."
			Environmental	Strategy and Collaboration	**Collaboration with Research Institutions**	Participant 8	"We must foster that culture of innovation, we need to partner with research institutions as well."
			Environmental	Strategy and Collaboration	**Collaboration with Research Institutions**	Participant 6	"I was having a conversation with this lady... she was saying the interesting thing with Chinese companies is they spend more money on research and development... They do extensive research on who their users are, what their users like, and then they create a prototype."
			Environmental	Budgetary Constraints	**Budgetary Constraints**	Participant 3	"So cost is always an issue, OK.I can't speak for our competitors in the market, but you know the organisation I'm working for is, you know and you know we've gone through a lot of, cost constraints. We look at a lot of cost efficiencies, Rand dollar exchange rates has always a factor. So your ability to be able to spend on new technologies in this down edge I think is different to where 10-15 years ago for telcos where there was almost a blank cheque."
			Environmental	Budgetary Constraints	**Budgetary Constraints**	Participant 14	"the telecommunications industry like many others at the moment is facing unprecedented challenges due to rising inflation, energy costs and currency devaluation which puts pressure on telco budgets and influences the rate of AI adoption"
			Environmental	Budgetary Constraints	**Budgetary Constraints**	Participant 10	"Adopting any new technologies is always expensive. Once things become easier and less cheaper as more and more competition, create these AI products and then the prices go down."
			Environmental	Sustainability Considerations	**Sustainability Considerations**	Participant 7	"We need to ensure we abide by certain ethics in the environment, you are taking care of the specific environment, you allowing people access to Information or to services they didn't have before."
			Organizational	Skills and Knowledge	**Inclusion**	Participant 8	"Partnering with research institutions to build solutions for translation capabilities and native languages ensures we can democratise AI into the future."
			Organizational	Skills and Knowledge	**Inclusion**	Participant 14	" aided in the ability to address various languages and factor in cultural diversity. "
			Environmental	Customer-Centric Innovation	**Customer-Centric Focus**	Participant 11	"We should focus on how does the objective work for the organisation and specifically and most importantly how does it enhance the customer experience. The reason you exist is for your customer, right? So every decision needs to have an understanding of the customer impact."
			Environmental	Customer-Centric Innovation	**Customer-Centric Focus**	Participant 15	"Customers expect personalized and timely interactions. AI has the potential to meet these expectations by improving analytics and delivering real-time insights."
			Environmental	Customer-Centric Innovation	**Customer-Centric Focus**	Participant 14	"improved customer engagement, insights and relationship management"

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			Environmental	Customer-Centric Innovation	**Customer-Centric Focus**	Participant 13	"Customers are coming not to understand what AI fundamentally is, but they're viewing it from a benefits perspective. So they're saying, well, how can AI benefit me? How can it lower my costs? How can it increase my productivity?"
			Environmental	Strategy and Collaboration	**Cross-Functional Integration**	Participant 12	"Bringing stronger alignment to goals and ideas, that is driven by factors that is required to have an adoption, such as external market pressures."
			Environmental	Strategy and Collaboration	**Cross-Functional Integration**	Participant 15	"Successful deployment of Co-Pilot involved input from IT to ensure technical feasibility, while business teams assessed its practical impact."
			Environmental	Strategy and Collaboration	**Cross-Functional Integration**	Participant 9	"It will help optimise the resources to ensure that the best people and the best skill sets are doing the right function rather than just being a purely top down approach in terms of getting work done."
			Environmental	Technology Implementation Issues	**Evolving AI Governance**	Participant 10	"Things are slowly becoming clear. When we started with the use of AI at that time, I think the governance process was not very solid. But as we started using more and more into our daily work, we are getting those governance and best practises"
			Environmental	Technology Implementation Issues	**Evolving AI Governance**	Participant 15	"Ethical concerns shape how and when we choose to adopt AI technologies."
			Environmental	Technology Implementation Issues	**Evolving AI Governance**	Participant 13	"AI regulation is still being drafted and still pretty much in its infancy. So in the industry, the telecommunications providers have been largely allowed to work on an AI strategy internally and come up with the governance models internally."
RQ2: What are the benefits of AI adoption and analytics in SA telcos?	P4: Adopting AI in South African telecommunications improves operational efficiency, transparency, data management to drive innovation and minimize risks ensuring that SA Telco's have a competitive advantage.	4) How has AI adoption improved your organisation in relation to data analytics?	Benefits	Operational and Analytical Enhancements	**Predictive Analytics**	Participant 7	"Like analytical models, they use it for predictive analytics in terms of doing early detection like if you're not going to reach a specific target, this is what you can do."
			Benefits	Operational and Analytical Enhancements	**Predictive Analytics**	Participant 8	"Adopting AI gives us predictive power, allowing us to predict what's going to happen, what a customer is going to do next, forecast revenues, and forecast call centre volumes."
			Benefits	Operational and Analytical Enhancements	**Predictive Analytics**	Participant 9	"AI can be utilised to understand economic conditions where the AI tools will be able to predict or give an indication of the economic environment within the next few months, based on the history."
			Benefits	Operational and Analytical Enhancements	**Predictive Analytics**	Participant 15	"Connecting AI tools to marketing dashboards could provide real-time insights into campaign performance."
			Benefits	Operational and Analytical Enhancements	**Real-Time Insights**	Participant 4	("Real-Time Insights") "AI enables real-time insights for faster decision-making and immediate data processing."
			Benefits	Operational and Analytical Enhancements	**Real-Time Insights**	Participant 9	"The key thing within the organisation that's starting off is like real time analysis and processing of data."
			Benefits	Operational and Analytical Enhancements	**Improved Decision-Making**	Participant 3	"It's speed to decision, speed to execution, speed to result, speed to recommendation."
			Benefits	Operational and Analytical Enhancements	**Improved Decision-Making**	Participant 6	"I think it will improve how things are done moving forward because then you have data backing business decisions. It's not just the hunch. I think more forecasting."

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			Benefits	Operational and Analytical Enhancements	**Improved Decision-Making**	Participant 14	"AI adoption in various aspects of data analytics including faster turnaround times with improved accuracy and richer insights."
			Benefits	Operational and Analytical Enhancements	**Improved Decision-Making**	Participant 15	"AI tools like Co-Pilot have streamlined data-related tasks and reporting, improving decision-making processes."
			Benefits	Operational and Analytical Enhancements	**Improved Decision-Making**	Participant 12	"Our organisation makes every decision based on data or an outcome... whether we're going to spend more money in building infrastructure, it's a data-driven decision."
			Benefits	Customer-Centric Innovation	**Customer Personalization**	Participant 5	"AI has improved customer experience and personalization across all of our platforms and customer interfaces. Predictive customer churn analysis helps us identify and retain at-risk customers. We are able to offer personalized recommendations based on individual subscriber usage patterns."
			Benefits	Customer-Centric Innovation	**Customer Personalization**	Participant 15	"Customers expect personalized and timely interactions."
			Benefits	Customer-Centric Innovation	**Customer Personalization**	Participant 7	"We've got our personalised offers that we also use our machine learning model to say if they find this is what the customer would prefer based on their usage behaviour."
			Benefits	Customer-Centric Innovation	**Customer Personalization**	Participant 12	"We can ask questions based on AI algorithms created by AI and interaction, advancing personalized offerings for these users."
			Benefits	Operational and Analytical Enhancements	**Automation of Reporting**	Participant 4	("Automation of Reporting") "AI automates reporting, reducing manual effort and enabling timely performance tracking."
			Benefits	Operational and Analytical Enhancements	**Automation of Reporting**	Participant 15	"Using Co-Pilot, teams can quickly generate insights from existing datasets."
			Benefits	Operational and Analytical Enhancements	**Automation of Reporting**	Participant 9	"automated reporting with AI requires less manual intervention therefore freeing up resources to focus on strategic analysis."
			Benefits	Operational and Analytical Enhancements	**Fraud Detection**	Participant 1	" we are using AI and it's helped a lot in terms of raising alerts, anomaly detection such kind of things you know such as Fraud detection"
			Benefits	Operational and Analytical Enhancements	**Fraud Detection**	Participant 5	"AI-driven fraud detection and security allows us to have real-time detection of fraudulent activities and suspicious network behaviours, anomaly detection in billing systems and user authentication, enhanced cybersecurity through intelligent threat detection and prevention."
			Benefits	Operational and Analytical Enhancements	**Fraud Detection**	Participant 7	"They do use it for fraud detection with anomaly detection items as well. They have implemented it."
			Benefits	Operational and Analytical Enhancements	**Operational Efficiency**	Participant 10	"It is helping a lot so we are using one of the AI tool that allows us to do our coding much faster so we can ask questions, we can review our codes we can also understand the errors that we are getting in the code and that is helping us do things faster. We are using it for documentation processes as well"
			Benefits	Operational and Analytical Enhancements	**Operational Efficiency**	Participant 13	"It has helped us to translate complex spreadsheets and databases into an easy-to-understand language... It has allowed non-analytical people to make analysis."

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			Benefits	Operational and Analytical Enhancements	**Operational Efficiency**	Participant 15	"Automation tools have already reduced repetitive tasks, and incorporating AI would likely build on that."
			Benefits	Operational and Analytical Enhancements	**Operational Efficiency**	Participant 12	"It's driven improvements like efficiencies and revenue such as CapEx and OpEx handling so that we could actually do it easier, resulting in faster decision-making."
			Benefits	Operational and Analytical Enhancements	**Enhanced Business Intelligence**	Participant 5	"AI has improved our business intelligence by transforming how we understand and leverage our data. We are able to conduct advanced market trend analysis and derive competitive intelligence through complex data correlations."
			Benefits	Operational and Analytical Enhancements	**Enhanced Business Intelligence**	Participant 15	"AI has demonstrated how it can simplify complex processes and add value, encouraging teams to explore more AI-driven solutions."
			Benefits	Operational and Analytical Enhancements	**Enhanced Business Intelligence**	Participant 8	"we managed to adopt AI across a number of different verticals. Be it like I mentioned, consumer enterprise networks, in our ecommerce domain as well, our financial services, and fraud and risk domain as well. So it's really evolved the level of data-driven decisioning that we can make significantly, and probably the reason why at present we still get investment year on year in this domain."
			Benefits	Operational and Analytical Enhancements	**Customer Self-Service**	Participant 3	"Customer self-service, you know, being able to ensure that you are engaging with a customer where you're actually saving money because you don't have to have a bum in the seat and a call centre, but you've got that intelligent agent that's actually helping you to able to solve a customer's issue."
			Benefits	Operational and Analytical Enhancements	**Improved Governance**	Participant 8	"The more you adopt AI, the more you find your gaps in terms of data governance."
			Benefits	Operational and Analytical Enhancements	**Improved Governance**	Participant 15	"Compliance teams worked to ensure implementation met necessary privacy standards."
			Benefits	Operational and Analytical Enhancements	**Improved Governance**	Participant 14	"We have established AI ethics guidelines and governance structures to address potential risks and ensure ethical AI development."
			Benefits	Operational and Analytical Enhancements	**Customer Self-Service**	Participant 12	"I'll go back to the example that I gave earlier, which was around the call centre and how it's helped us with query handling or customer complaints just by routing them using AI, it's allowed them to have first call resolution, which means that we don't really need to be paying an outsource business to be handling that for us."
RQ3: What are the challenges of AI adoption and analytics in SA telcos?	P5: The successful adoption of AI in SA Telco's to improve analytics requires overcoming challenges related to data quality, scalability, skill gaps, ethical concerns, costs, organisational resistance,	5) What challenges has your organisation faced in adopting AI to improve analytics?	Challenges	Data Governance and Quality	**Data Quality Issues**	Participant 4	"Data Quality Issues: Inaccurate, incomplete, or inconsistent data."
			Challenges	Data Governance and Quality	**Data Quality Issues**	Participant 14	"Poor data quality can lead to erroneous assumptions, biases and have a cascading effect."
			Challenges	Data Governance and Quality	**Data Quality Issues**	Participant 15	"Incomplete or inconsistent data from customer interactions require significant effort to clean and prepare before leveraging tools like Co-Pilot."
			Challenges	Data Governance and Quality	**Data Quality Issues**	Participant 12	"One of the biggest things that we did see in the beginning was the quality of data that we're feeding through to the through to the AI algorithms didn't make sense. A lot of it was inaccurate, it wasn't outdated, wasnt properly stored, wasn't properly managed. It was also the case of where, the quality of the data wasn't great."

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	reliability, data privacy, and transparency.		Challenges	Data Governance and Quality	**Data Quality Issues**	Participant 13	"The quality is actually very important because if you have outdated information or you have information in the wrong places, the AI model can only interpret what the data is, so it's not the AI's fault. If your data's bad, you need to go back and fix your data."
			Challenges	IT Infrastructure and Integration	**Integration with Legacy Systems**	Participant 4	"Integration with Legacy Systems: Big issue for us!"
			Challenges	IT Infrastructure and Integration	**Integration with Legacy Systems**	Participant 14	"Integrating AI with existing systems and IT infrastructure has also been a significant hurdle."
			Challenges	IT Infrastructure and Integration	**Integration with Legacy Systems**	Participant 15	"Ensuring that tools like Co-Pilot work seamlessly with our existing systems has required considerable effort."
			Challenges	IT Infrastructure and Integration	**Integration with Legacy Systems**	Participant 12	"Integration with legacy systems has always been a challenge. Trying to get those systems to speak to AI technologies, which is a lot more advanced, is really difficult."
			Challenges	Technology Implementation Issues	**Skill Shortages**	Participant 5	"We have a shortage of employees with specialized skills in AI, machine learning, and advanced data analytics."
			Challenges	Technology Implementation Issues	**Skill Shortages**	Participant 8	"Data scientists are quite expensive, machine learning engineers are really expensive, data engineers who know how to work on big data platforms are really expensive as well."
			Challenges	Technology Implementation Issues	**Skill Shortages**	Participant 15	"Many employees needed time and training to understand how to use AI effectively."
			Challenges	Technology Implementation Issues	**Skill Shortages**	Participant 12	"We faced having to go out to external markets, which comes with higher consulting rates and people that are actual experts but don't have local knowledge of the ecosystem or challenges we face here."
			Challenges	Budgetary Constraints	**High Implementation Costs**	Participant 4	"High Implementation Costs: The investment in infrastructure, tools, and training."
			Challenges	Budgetary Constraints	**High Implementation Costs**	Participant 8	"AI solutions are really costly and I would say, you know what goes with the tech you select, is the cost."
			Challenges	Budgetary Constraints	**High Implementation Costs**	Participant 7	"I think overall any or most organisations have budget limitations, right? So there's only certain technologies you can use, certain platforms we can use, and platforms we expose to."
			Challenges	Resistance and Organizational Barriers	**Resistance to Change**	Participant 4	"Resistance to Change: Organizational resistance to adopting new technologies."
			Challenges	Resistance and Organizational Barriers	**Resistance to Change**	Participant 15	"Some team members were initially hesitant to rely on AI-driven insights, preferring manual processes they were more comfortable with."
			Challenges	Resistance and Organizational Barriers	**Resistance to Change**	Participant 12	"Getting people to understand that you're no longer need a data centre, you can start using cloud based technologies. It's very difficult to enforce the change in understanding within the ecosystem"

Research Question	Proposition	Interview Question	Theme	2nd Order Codes	1st Order Codes	Participant	Verbatim
			Challenges	Data Management and Governance	**Data Silos**	Participant 4	"Data Silos: Fragmented data across different systems and departments."
			Challenges	Data Management and Governance	**Data Silos**	Participant 15	"Much of our data is stored in silos or requires significant cleaning and preparation."
			Challenges	Data Management and Governance	**Data Silos**	Participant 9	"The department's work in silos, whereas like each division data team is working on their own. So there's that lack of standardisation across in terms of what the organisation would like to achieve from an AI perspective."
			Challenges	Data Management and Governance	**Lack of Governance**	Participant 1	" I don't think we have achieved that data officer at the moment, which is why a lot of these things around data adoption or like analytics is happening very slow. It's each team is on their own"
			Challenges	Data Management and Governance	**Lack of Governance**	Participant 8	"Data governance the third thing is, you know from a technology platform perspective, we've been slow to adopt and standardise on our platforms and tools and the challenge with that is that don't get consistent patterns of implementation from your data scientist, your ML engineers, data engineers."
			Challenges	Resistance and Organizational Barriers	**Slow Adoption of Tools**	Participant 8	"The slow adoption of standardized tooling, standardized patterns, has led to tough to maintain solutions, inability to scale at times."
			Challenges	Resistance and Organizational Barriers	**Slow Adoption of Tools**	Participant 15	"The learning curve has slowed down the full adoption of AI tools for analytics."
			Challenges	Resistance and Organizational Barriers	**Slow Adoption of Tools**	Participant 11	"challenges around adoption from a user perspective that because of technological deficiencies and doesn't work, it takes long to run and that that talks back to the first point around integration into the architecture."
			Challenges	Skills and Knowledge	**Limited Understanding of AI**	Participant 6	"I think until we get to a point where people feel empowered and they understand how it can help them in their very specific role, then the rate of adoption will just lag."
			Challenges	Skills and Knowledge	**Limited Understanding of AI**	Participant 15	"There was a noticeable learning curve when Microsoft Co-Pilot was introduced."
			Challenges	Skills and Knowledge	**Limited Understanding of AI**	Participant 13	"People are still trying to understand how prompting a generative AI model can actually benefit them. There's a lot of training that they still need to do, there's a lot of practise that they need to do."
			Challenges	Skills and Knowledge	**Cultural and Mindset Shift**	Participant 7	"There's also a bit of upskilling required and a different mindset change as well as a culture change... It is a different type of skills a person needs."
			Challenges	Skills and Knowledge	**Cultural and Mindset Shift**	Participant 15	"The adoption of new technologies like Co-Pilot reflects a broader push to encourage experimentation and forward-thinking."
			Challenges	Skills and Knowledge	**Cultural and Mindset Shift**	Participant 6	"People might not use the things, might not be interested in using AI necessarily more so from like just a skills perspective or they prefer to do things manually. They don’t want to use an AI model, they don’t trust it."
			Challenges	Job Concerns	**Fear of Job Loss**	Participant 3	"Big business in South Africa is call centres. You know, suddenly you've got smart self-service AI bots and you and you're putting hundreds of people out of their jobs."

Research Question	Proposition	Interview Question	Theme	2nd Order Codes	1st Order Codes	Participant	Verbatim
			Challenges	Job Concerns	**Fear of Job Loss**	Participant 13	"People do have a fear that they're going to be replaced and they do have a fear of is this new technology going to make my role redundant."
			Challenges	IT Infrastructure and Integration	**Infrastructure Limitations**	Participant 5	" We also experience compatibility issues between legacy systems and modern AI technologies."
			Challenges	IT Infrastructure and Integration	**Infrastructure Limitations**	Participant 15	"Moving to more robust cloud-based platforms has been key to handling large datasets."
			Challenges	IT Infrastructure and Integration	**Infrastructure Limitations**	Participant 12	"Currently the type of infrastructure that we have implemented doesn't cater to a lot of that. Infrastructure cannot handle AI right now without putting behind proper investment to actually upgrade it."
			Challenges	Strategy and Collaboration	**Alignment with Business Goals**	Participant 8	" a major challenge has been business alignment and strong business alignment as well because often what can happen is data scientist teams or the individuals who are actually doing the data science work sit either in the technology domain or the business domain, but having them closer to the business allows them to become subject matter experts and create that alignment right."
			Challenges	Strategy and Collaboration	**Alignment with Business Goals**	Participant 11	"The challenge there is to understand the value, right, you kind of doing a cost benefit analysis against assumptions around benefits. So that's always a challenge. If you go into a development of a solution without understanding the objectives first, you don't really know what to build. But I think it's absolutely important to understand the potential use cases for AI technology and the objectives that you want to achieve out of those, those use cases. That in itself allows you to prioritise your development. Where do you should you focus first? What are you trying to achieve? I think it's that whole concept of understanding Kpi's, objectives and use cases and people is a necessary step towards the roll out."