Factors affecting the adoption of Artificial Intelligence (AI) in the Supply Chain and Logistics Industry

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Plagiarism Declaration

Declaration

Hereby I, Tshwarelo Molopa, declare that "Factors affecting the adoption of Artificial Intelligence (AI) in the Supply Chain and Logistics Industry" is my own original work and that all sources have been accurately reported and acknowledged, and that this document has not previously in its entirety or in part been submitted at any university in order to obtain an academic qualification.

Full name: Tshwarelo Molopa Date:

Signature _____

Approved by

Supervisor name
Prof Osden Jokonya

Supervisor name

……. ……..

DECLARATION

I declare that this research report is my own, unaided work. It is being submitted for the degree of Master of Commerce in Information Management (e-Logistics) to the University of the Western Cape.

It has not been submitted before for any other degree or examination at this or any other University.

_____

Tshwarelo Molopa

_____

Date

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ABSTRACT

This study explores factors affecting the adoption of Artificial Intelligence in the Supply Chain and Logistics Industry in the Rpublic of South Africa. The study followed these objectives:

- to explore technological factors affecting the adoption of Artificial Intelligence in supply chain and logistics industry'
- to explore organisational factors that affect the adoption of Artificial Intelligence in the supply chain and logistics industry and
- to explore environmental factors that affect the adoption of Artificial Intelligence in the supply chain and logistics industry.

The study selected a quantitative approach with a convenient sampling of 200 employees in the South African supply chain and logistics sector. Data was gathered using a self-managed, online questionnaire. The return rate of the questionnaire was 24%. Reliability and validity tests were conducted on the data, demonstrating that the concept measures produced consistent, repeatable results and faithfully captured the constructs they were designed to evaluate.

The findings were that business units are committed to providing staff with the necessary training to support AI projects, with the majority of partcipants strongly agreeing with the sentiment. Besides, the majority of respondents agree that security is an important factor in the business when it comes to new technology adoption. A significant number of respondents think that AI can be difficult to deploy due to its various interdependencies, with half of the respondents believing that top managers are likely to invest in AI. The study further reveals that machine learning was the most popular algorithm implemented in the supply chain and logistics industry. The paper provides the expanding body of knowledge about AI adoption by leveraging factors from the T-O-E framework to explain adoption in the Supply Chain and Logistics industry.

Keywords: Supply Chain; Logistics; AI adoption; South Africa; Positivism; TOE framework

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LIST OF ABBREVIATIONS

AI	Artificial Intelligence
EDI	Electronic Data Interchange
ERP	Enterprise Resource Planning
IT	Information Technology
IoT	Internet-of-Things
RFID	Radio-frequency Identification
TOE	Technology, Organisation, and Environment Framework
VRP	Vehicle Routing Problem
1PL	First-Party Logistics
2PL	Second-Party Logistics
3PL	Third-Party Logistics

CHAPTER 1: INTRODUCTION

1.1 Background

Supply chain and logistics are slowly becoming intricate and supply chain managers are more into technological modernisations to inform the decision-making. Mukhamedjanova (2019) describes supply chain management as a method of handling the movement of goods and services, containing all activities that turn raw materials into finished goods, whereas logistics is described as the process of coordinating all important operations in the distribution of products from their place of origin to their end location (Sholihah, Samadhi & Nur, 2018).

In recent years, the focus on supply chain and logistics has moved from improving labour productivity to enhancing operational efficiency (El-Khalil & Zeaiter, 2015). Industry 4.0 is a theory that covers a range of technologies that enable rapid development in a variety of industries. It is expected to open new opportunities and improve traditional supply chain management processes (Ghadge, Kara, Moradlou & Goswami, 2020). Industry 4.0 aims to employ newly developed information technology like Cloud computing, Information Technology (AI) and Internet-of-Things (IOT) to automate existing manufacturing and industrial processes (Han, 2021).

Artificial intelligence plays an essential role in improving processes and functions in the supply chain and logistics. Toorajipour, Sohrabpour & Fisch (2021) describe AI as a huge topic of computer learning that concentrates on producing intelligent machinary that can execute assignments that would otherwise involve people's intelligence. Several studies have highlighted some of the advantages of integrating AI in supply chain and logistics, which include lower costs and risks, increased operational efficiency and improved customer service (Toorajipour, Sohrabpour & Fischl, 2021; Modgil, Singh & Hannibal, 2021). Pradhan and Agwa-Ejon (2018) study discovered that smart technology adoption is currently low, and the South African manufacturing industry, as well as its present workforce, will require improvements to compare the abilities essential for smart factories. Olaitan, Issah and Wayi (2021) conducted an investigation to construct a context to assess South African nation's willingness for the 4th industrial revolution, and it was revealed that the country had low technological competence and

a decline in digital technology willingness. In addition, skilled labour and technology infrastructure are scarce. There is a minimal understanding of the adoption of AI technology in the supply chain and logistics in South Africa. However, it is critical to understand the organisation's eagerness for the adoption of AI, as it may help in defining some of the difficulties and issues met with AI adoption.

This study seeks to explore factors affecting organisations from adopting artificial intelligence technologies in the supply chain. According to Savoury (2019) AI is being used in supply chain management companies for virtual assistants, CRM systems, and network monitoring, but many applications are still conceptual and have not generated commercial value, posing challenges.The author further alluded that understanding AI adoption success factors is crucial for academics, potential adopters, government, and vendors. Previous studies focus on techniques and applications, but organizational and managerial issues are overlooked. Empirical validation of AI characteristics, technology, organization, and environment contexts is lacking (Savoury, 2019).

The advent of cutting-edge technologies and industry disruptors have caused a major transformation in the logistics sector in recent years. Of these, AI has become the utmost unsettling forces, transforming the way businesses optimize and manage their supply chains. AI is a vital tool in logistics industry because of its capacity to process enormous volumes of data, make wise judgments, and forecast results. It is hardly surprising that by 2025, AI and machine learning (ML) would be the most widely used technologies (Savoury, 2019).

As noted by Telefonica (2023), while artificial intelligence (AI) offers various applications and benefits in the realm of logistics, numerous companies continue to underutilise its full potential due to the oversight of a crucial aspect of digital transformation - a fundamental shift in mindset and behaviour. In order to attain higher levels of profitability, efficiency, success, and development, logistics companies are modifying their resources. The author further stated that the increasing degree of competitiveness in the market, which compels logistics companies to make innovations, has accelerated all the developments pertaining to the incorporation of artificial intelligence in the logistics industry. Product placement and transportation tasks can be completed autonomously in automated warehouses. Telefonica (2023) notes that the implementation of artificial intelligence (AI) provides an effective mechanism for the allocation of appropriate resources in response to the varied activities that arise on a daily basis. AI systems have the ability

to analyse data and identify patterns to forecast future resource requirements accurately. This process helps ensure that the right resources are utilized optimally, and decision-makers can prioritize and assign tasks according to their importance. The use of AI technology helps organizations gain a competitive advantage by enabling them to use resources efficiently, lower expenses while raising the general standard of their operations.

Technology, Organisation, and Environment Framework (TOE) was employed to analyse the technological, organisational and environmental factors preventing the acceptance of artificial intelligence. The TOE is a commonly used model for assessing technology acceptance in organisations, and it has a formidable theoretical foundation and vigorous practical support compared to other models (Haroun, Gohar & Hanna, 2020). In earlier research, the TOE model has been shown to have high applicability and descriptive dominance in several technology adoption contexts. The outline has been utilised by many scholars to explore various IT adoption in organisations (Wang, Wang, & Yang, 2010, Savoury, 2019, Mariemuthu, 2019). This is guided by the TOE.

1.2 Research problem

Lee et al. (2018) state that supply chain operations are paving a new technological era that will fundamentally disrupt industries, manufacturing value chains and business practices. Since supply chains are constantly disrupted, businesses should strive to enhance their agility through the expansion and arrangement of AI technologies tailored to their operations (Scholten, Sharkey Scott & Fynes, 2019). A study by Hwang, Huang and Wu (2016) revealed that only 17% of companies surveyed have implemented AI in their supply chain function, however, there are total of 83% of companies that have not yet realised the importance or require to fit in AI technologies in the supply chain operations. Govender (2018) reported that in a study conducted by Letsema in 2018, over 65% of managers in South Africa that were interviewed showed little or no knowledge of the fourth industrial technologies.

Many studies have underlined the advantages of artificial intelligence in logistics and supply chains. However, studies on the aspects influencing the adoption of artificial intelligence in the country is scarce (Lin, Lee & Lin, 2016; Wang, Wang & Yang, 2010). There is a scarcity of research devoted to impediments during AI implementation in supply chain and logistics in the country. Numerous research studies have been done on the adoption of technology in an organisation (Lin et al., 2010). Another study by Mariemuthu (2019) investigated the barriers of adopting artificial intelligence in South Africa's banking industry using the TOE framework. However, there has been little to no work done in the supply chain and logistics industry. Numerous research studies have been conducted on the adoption of technology in an organisation (Lin et al., 2010). Another study by Mariemuthu (2019) investigated the barriers to adopting artificial intelligence in South Africa's banking industry using the TOE framework. However, there has been little to no work done in the supply chain and logistics industries. In summaryso a deeper comprehension of the elements that affect the adoption of artificial intelligence in the supply chain and logistics industry is required. In summary, there is a need for a better understanding of factors affecting the adoption of AI in the supply chain and logistics industry.

1.3 Aim of the Research

The study aims at attempting to assist in better documenting the factors that affect the adoption of artificial intelligence in supply chains and logistics by South African organisations.

1.4 The Study Research Question

The key research question for the study is presented below:

1.4.1 Main Research Question

What are the factors affecting the adoption of Artificial Intelligence in the supply chain and logistics industry?

1.4.2 Sub-Research Questions

i. What are the technological factors affecting the adoption of artificial intelligence in the supply chain and logistics industry?

ii. What are the organisational factors affecting the adoption of artificial intelligence in the supply chain and logistics industry?

iii. What are the environmental factors affecting the adoption of artificial intelligence in the supply chain and logistics industry?

1.5 Objectives of the Study

The study will address the following objectives:

i. To explore the technological factors affecting the adoption of artificial intelligence in the supply chain and logistics industry.

ii. To explore the organisational factors affecting the adoption of artificial intelligence in the supply chain and logistics industry.

iii. To explore the environmental factors affecting the adoption of artificial intelligence in the supply chain and logistics industry.

1.6 Location of the Study

The location of the study was in South Africa, conducted at companies in the supply chain and logistics industry, to better understand the factors affecting the adoption of artificial intelligence in supply chains and logistics by South African organisations.

Table1.5.1: Alignment of the primary research question to research sub-questions, method, and research objectives

What are the factors affecting the adoption of Artificial Intelligence in the supply chain and logistics industry?		
Sub-questions	Which research methods will be used?	Which research objectives will be achieved?
What are the technological factors affecting the adoption of artificial intelligence in the supply chain and logistics industry?	Data were collected from surveys.	To explore the technological factors affecting the adoption of artificial intelligence in the supply chain and logistics industry.
What are the organisational factors affecting the adoption of artificial intelligence in the supply chain and logistics industry?	Data were collected from surveys.	To explore organisational factors affecting the adoption of artificial intelligence in the supply chain and logistics industry.
What are the environmental factors affecting the adoption of artificial intelligence in the	Data were collected from surveys.	To explore environmental factors affecting the adoption of artificial intelligence in the

supply chain and logistics industry?		supply chain and logistics industry.

1.7 Delimitations and Assumptions

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The study focuses on organisational adoption as opposed to individual adoption. The empirical study conducted on technological adoption using the TOE, and it is industry-specific, focusing on AI adoption in the supply chain and logistics industries. While this study focuses on AI adoption in South Africa, future research could expand to other countries or industries.

1.8 Structure of the Research Study

The research study is divided into the following:

- *Chapter 1: Introduction*

This chapter presented the overall introduction of the study, providing context for the present state of AI adoption in South Africa and highlighting some of AI's potential for industry transformation. The difficulties of AI adoption in South Africa are also highlighted in this chapter, as well as the research gap. This chapter also emphasises the study's three main objectives,

- *Chapter 2: Literature Review*

This chapter gives an overview of theory of the supply chain, logistics and AI, followed by a breakdown of the primary activities within the supply chain and logistics. The importance of AI in supply chain and logistics is also discussed. The chapter concludes with a detailed examination of the implementation of AI in the South African supply chain and logistics industry. In addition, the chapter outlines the research's theoretical framework, focusing on the TOE framework's selection for the study. The chapter also looks at previous studies on technology adoption that uses the TOE paradigm.

- *Chapter 3: Research Methodology*

It explains the philosophy, design and research methods used for the study. The research methodology details how the investigation was carried out, its participants and the instruments and measurement devices that were used.

- *Chapter 4: Research Findings*

This chapter provides the results and summary of the data analysis covering the demographics and constructs variables. It also focuses on the interpretation of results. The Results and findings from quantitative research will be presented. and analysed using the visual aids of graphs and tables. These representations of the data allow for an efficient and accurate reflection of the information, providing a clear insight into the research conducted.

- *Chapter 5: Discussion of Results*

This chapter evaluates the data gathered and discusses the findings, considering previous studies. This section also depicts the inferences gained from the questionnaire analysis results, followed by recommendations for future research.

1.9 Chapter Summary

This section provides a short summary to the study, and the challenge that motivated this investigation is stated. The dissertation's key main objective, as well as its sub-objectives that talk to the general research topic, are also indicated. The significance of this investigation, as well as the preliminary study plan, are also discussed. The following chapter examines the literature on the role of AI in supply chain and logistics.

CHAPTER 2: LITERATURE REVIEW

2.1 Introduction

The preceding chapter provided an in-depth introduction to the research, which included a comprehensive overview of the study's background, including the context and past perspective of the issue at hand. Additionally, it introduced the problem statement and presented the study questions that the disertation sought to respond to. Moreover, this section elucidated on the study's objectives, including the specific goals and intended outcomes of the research. Finally, it provided a summary of the methodology used in the study, including the research design, data gathering strategies, and data analysis approaches. AI-improved instruments are being used throughout supply chains to improve effectiveness, decrease the influence of a global staff shortage and find improved solutions to move supplies from one spot to another location. Customer care focus vendors are using AI to understand their key population to improve planning about their future behaviour (Sagiroglu & Sinanc, 2013). The previous chapter presented the background, the problem statement, the study objectives and an overview of the study. AI-improved instruments are being used throughout supply chains to improve effectiveness, decrease the influence of a global staff shortage and find improved solutions to move supplies from one spot to another location. Customer care focus vendors are using AI to understand their key population to improve planning about their future behaviour (Sagiroglu & Sinanc, 2013). This section examine the literature on artificial intelligence, supply chain management and logistics. The chapter also provides a scholarly detailed definition of the supply chain. In addition, the chapter presents previous studies on AI adoption and the TOE model. In conclusion, the chapter also presents the application of AI in the supply chain within South Africa (Sagiroglu & Sinanc, 2013). This chapter reviews the literature on artificial intelligence, supply chain management and logistics. The chapter also provides a scholarly detailed definition of the supply chain. In addition, the chapter presents previous studies on AI adoption and the TOE framework. In conclusion, the chapter also presents the implementation of AI in the supply chain in South Africa.

2.2 Theoretical Framework

The theoretical outline for this dissertation is defined in this section. The section also presents previous TOE-based empirical studies of technological adoption. Technology, organisation and environment (TOE) is a model established by Tornatzky and Fleisher, and this framework defines the contributory factors in the adoption of technology (Zhu et al., 2006). The framework serves as a guide to the adoption and application of technological innovations by firms based on their technological, organisational and environmental contexts (Zhu et al., 2006).

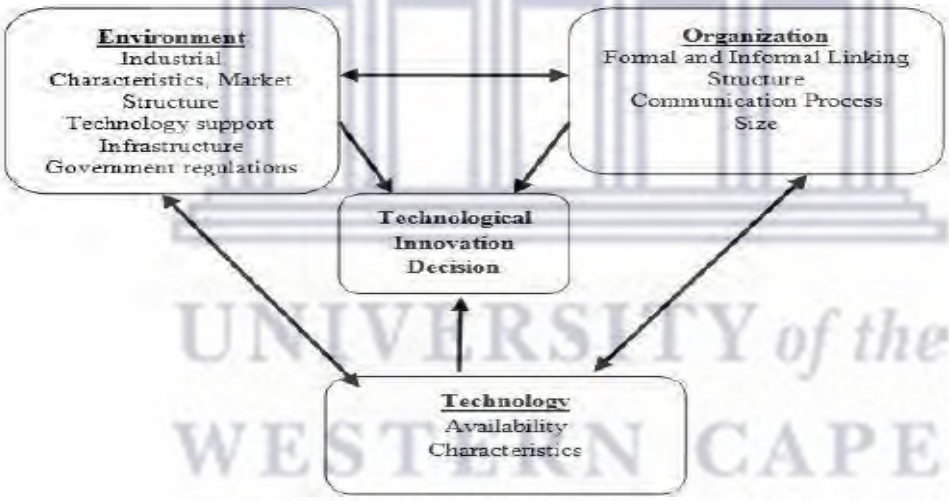


Figure 2.2: TOE framework Source: (Zhu et al., 2006).

2.2.1 Technology

The technological context encompasses both internal and external technologies already in use at the organization, as well as emerging technologies that may be relevant to it., as well as those which are at the time accessible in the market but are not yet being utilised by the company (Hwang, Huang & Wu,2016). Technology may comprise both equipment and processes. Existing technologies are crucial in the adoption procedure, since they restrict the magnitude and rate of

change in technology that a firm may make (Baker, 2012). According to Baker (2012) for new technology adoption to be successful, the organisation must have a solid IT infrastructure and technological abilities among workers.

Technological resources have been acknowledged as a significant influence in the effective adoption of technical improvements, like EDI, ERP and the digital market (Pan & Jang, 2008). According to Zhu et al. (2006) companies with advanced levels of clientele readiness, purchasers' readiness and competition in e-business operations is may grow, although more technologically advanced firms with a larger scale of business are more likely to succeed. Additionally, Zhu et al. (2004) noted that technology willingness is the most significant aspect contributing to adoption.

2.2.2 Organisation

The organisational framework describes the company's elements, such as its size, resources and management structure (Hwang, Huang & Wu, 2016). Nguyen and Petersen (2017) allude that there is an inverse connection between company size and the adoption of ICT. A company's size and scope are crucial factors affecting the adoption (Wang et al., 2003). Due to their flexibility and ability to adjust quickly, small and medium enterprises adopt new ICTs compared to larger companies that are inflexible (Kilangi, 2012). Research conducted onTOE model for examining the aspects influencing the adoption of IoT in China's agricultural supply chain indicated that the biggest obstacle to acceptance of technology was expensive (Lin, Lee & Lin, 2016). Other factors included technological resources (Pan & Jang, 2008).

2.2.3 Environment

The environmental factor refers to the context in which a business operates; the environment may incorporate the business market, buyers, players and the government (Hwang, Huang & Wu, 2016). A review of previous studies indicates that competitive pressures influence the adoption of information technology by SMMEs in third-world countries (Jere & Ngidi, 2020). A study conducted by (Mariemuthu, 2019) found that the adoption of AI in banking firms had a positive correlation with competitive pressure. Similarly, Li's (2008) research indicated that manufacturing

firms' adoption of e-procurement was influenced significantly by competitive pressures and exterior reinforcement. Additionally, Teo, Lin and Lai (2009) found that trading partners have a significant effect on the adoption of e-procurement.

2.3.4 Previous studies

Several studies highlighted the importance of TOE in understanding the adoption of advanced technologies in the supply chain (Awa, Ukoha & Emecheta, 2016 ; Savoury, 2019The TOE framework shown its resilience in the adoption of modern technologies.. A study by Wang, Wang and Yang (2010) suggested a TOE framework for examining RFID implementation in trading businesses that are looking to optimise supply chain prominence and procedural performance.

The research paper is guided by TOE based-model. The TOE framework exhibited its strength in improved technology adoption through these studies. Various quantitative studies have employed the TOE model to investigate the adoption of progressive technology at the business level (Awa, Ukoha & Emecheta, 2016; Savoury, 2019). The studies suggest that the adoption of innovations by firms can be studied utilising the TOE framework.

2.3 Industry 4.0.

There are radical changes in the way we live because of the Fourth Industrial Revolution, which is disruptive in every sector of business and it describes the distorting of limitations The TOE framework shown its resilience in the adoption of modern technologies.

The 4th industrial revolution has given businesses the potential to modernise their supply chain and logistics processes (Rennung, Luminosu and Draghici, 2016) and is the same as Industry 4.0. The term Industry 4.0 refers to the industrial sector's digitalisation (Javaid et al., 2020). Despite the potential of the fourth industrial revolution to deliver significant benefits to enterprises, firms will not benefit until their supply chain strategy is re-thought (Merlino & Sproġe, 2017). Industry 4.0 can bring significant changes and improvements to old logistics and their awareness. This is

because in aspects such as flexibility, organizations are achieving vitality and can only be done through the amalgamation of innovative intelligent technologies (Wang, 2016).

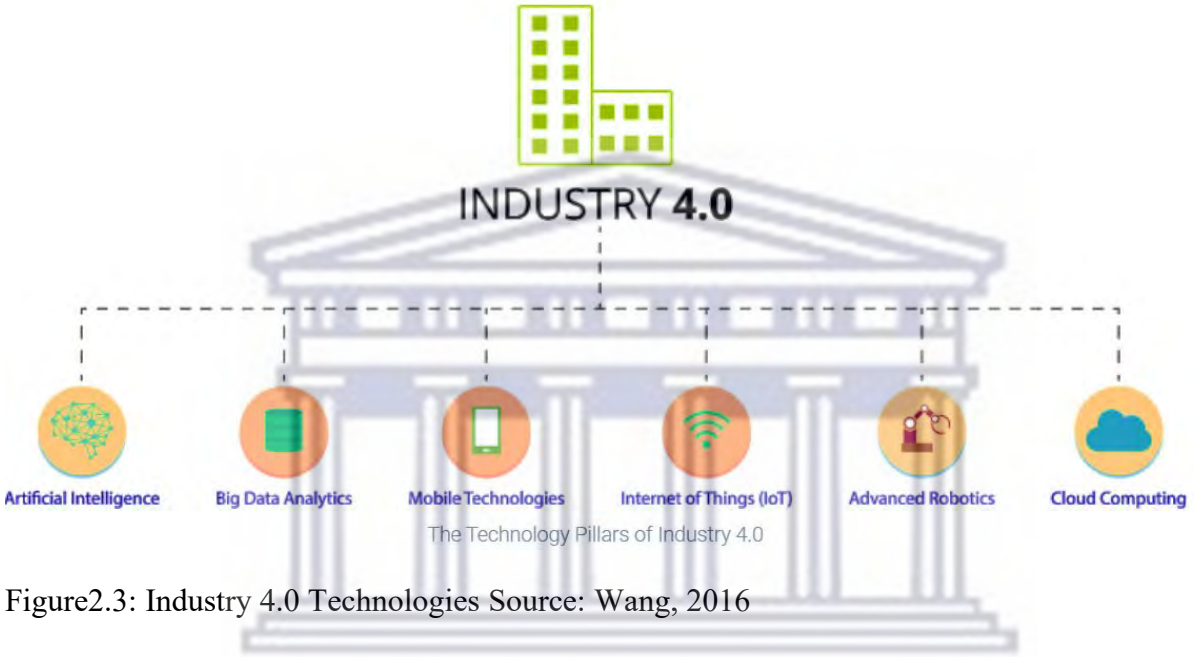


Figure2.3: Industry 4.0 Technologies Source: Wang, 2016

The figure above depicts significant Industry 4.0 technologies and are pioneered as follows:

- **Internet of things (IoT):** IoT links many physical items to the internet, enabling smart devices to communicate, monitor, and control goods, services, and information using standard protocols (Wang, 2016).
- **Big data analytics**: It is a sophisticated analytical method that processes large volumes of dynamic data, offering vital information to improve corporate planning and decision-making(Wang, 2016).
- **Artificial intelligence (AI):** AI is a computer system that enhances human intelligence through data and algorithms, and is widely used in various fields like routing, traffic management, maintenance, and security (Wang, 2016).
- **Cloud technologies:** They offer a dominant programme for storing and integrating IT resources, facilitating data accessibility from decentralized locations, forming a service-oriented architecture (Wang, 2016).

- **Autonomous robots:** Autonomous robots are intelligent, self-organizing machines capable of executing tasks without human guidance, available in various sizes, shapes, and the degrees of intelligence, movement, and autonomy(Wang, 2016).
- **Mobile Technilogies**: They are forceful virtual instruments that may efficiently and risk-freely simulateassess, refine, and manage actual systems or things in their digital representation (Wang, 2016).

2.4 Supply Chain Management

Supply chain management (SCM) is widely recognised as a fundamental part of most firms' performance and customer satisfaction. The complexity of supply chains has significantly increased within the previous 20 years because of the dynamic interchange of a variety of processes and structures. Several studies emphasised the significance of supply chain management in a business (Arora & Gigras, 2018).

Table 2.4: Definitions of Supply Chain Management

Author(s)	Definitions
Mentzer et al. (2001)	SCM entails the interaction of units concerned with the transfer of goods, money, data, and services from a provider to a client.
Grant et al. (2017)	Supply Chain Management refers to the practice of integrating the company's and its suppliers' business processes so that information, goods, and services are made available to customers at an added value.
Bozarth (2008)	Supply Chain Management involves maximising value for customers and obtaining a practical benefit through the management of relationships and activities across the entire supply chain.
Misra (2018)	The Supply Chain Management process entails synchronising policymaking and activities so that the correct number of products are delivered to the correct location

	and customer at the correct time, while minimising costs and satisfying service requirements.

In summary, strategic SCM, aims to increase customer value and preserve a competitive advantage.

2.4.1 Supply Chain 4.0

The requirement for new Industry 4.0 technologies has resulted in significant changes to the supply chain.. As manufacturing facilities and processes evolve, innovative technologies are being integrated into them, such as the IoT, cloud computing and analytics, and AI and machine learning (Ghobakhloo, 2018). Supply chain 4.0 is the implementation of the industry 4.0 idea in the content of the supply chain (Frederico et al., 2019). The concept of supply chain management The term "4.0" describes a recent advancement in supply chain management whereby digital technology predominates and resources and data are managed mostly through automated business networks.(Gilchrist, 2016).

Increasingly, companies are integrating digital technology into their supply chain management practices. These advancements are enabling organisations, their suppliers, and their potential customers to collaborate more and share information transparently (Barreto, Amaral & Pereira, 2017). The main advantages of Industry 4.0 in the supply chain are that it decreases the time taken to deliver products to customers, decreases the time taken to address an unexpected event and stimulates a considerable improvement in decision-making quality.

2.4.2 Purchasing in Supply Chain

Purchasing refers to the process of buying unprocessed resources from suppliers to manufacturers' premises (Schiele, 2019). Procurement is not just limited to the purchase of products or services on behalf of a company. Instead, it involves a holistic process that requires an in-depth

comprehension of the organization's requirements, identifying a supplier who can deliver those needs effectively, routinely assessing the performance of suppliers and negotiating deals that offer the most value at the most affordable cost. Such a comprehensive approach ensures that the procurement process is successful and enables businesses to achieve their operational and financial objectives. Traditional procurement procedures have historically been slow and hampered by inadequate systems and inconsistent processes. The primary goal of traditional procurement is to find the lowest-cost suppliers. (Van Weele & van Raaji, 2014). It has been regarded as the slowest project delivery strategy due to its linear approach (Van Weele & van Raaji, 2014).

2.4.3 Logistics in Supply Chain

There have been attempts to differentiate logistics from supply chain management, arguing that logistics is a subset of SCM. Typically, supply chain and logistics are used interchangeably.and are often misinterpreted. The supply chain is the overarching umbrella that encompasses all elements of a product's life cycle, from origin to end consumer, whereas logistics refers to the actions involved in transporting commodities from one location to another within the supply chain (Li, 2014).

Logistics is a crucial component of SCM, and its importance cannot be overstated. Transportation is recognised as one of the primary functions of the supply chain, and the definition of each type of party logistics provider is provided in greater detail.

a) 1PL: A *first-party logistics* provider refers to people or businesses that move products or cargo from point A to point B. Its internal corporate divisions manage all transportation and logistical operations. The first-party logistics provider might be a manufacturer, retailer or distributor (Li, 2014).

b) 2PL: A *second-party logistics* provider is an asset-based logistics mobile vehicle that has its modes of transportation and lease out services for them (Li, 2014).

c) 3PL: A *third-party logistics* company manages tasks, including incoming and outgoing transportation of goods. In this approach, 3PL suppliers become involved in the client's

company and are becoming increasingly important across the world (Li, 2014).

2.5 Logistics

2.5.1. Logistics 4.0

Logistic 4.0, often known as intelligent logistics or smart logistics is the most widely debated topic in logistics and supply chain management (Wang, 2016). The term Logistic 4.0 refers to the employment of emerging technology to increase the efficacy of logistics processes (Pfohl, Yahsi & Kuznaz, 2015). The impact of smart logistics on the supply chain has grown significantly and will continue to have an important impact. The advancement of smart logistics provides the potential to address labour-related issues within logistics (Feng & Ye, 2021).

The foundation for re-evaluating current logistics and supply chain practices is shifting from managing and improving individual functions to a more comprehensive and integrated strategic focus on value-added activities via digital transformation (Mussomeli, Laaper & Gish, 2017). Some of South Africa's major logistics businesses are already leveraging emerging digital technology to enable smart supply chains. Barloworld Logistics, a leading distributor in South Africa, explored the latest digital trends such as big data and online marketplaces. According to Barloworld (2019) re-engineering and integrating logistics operations account for more than 70% of potential business savings; this emphasises the need for firms to digitally transform.

2.6 Artificial Intelligence

Artificial intelligence is transforming every aspect of our lives, and the supply chain and logistics sectors are no exception (Kersten, Blecker & Ringle, 2019). The term artificial intelligence does not refer to a specific technology. It is a spot-on word for different technological methods (Sharma, Sharma & Jindal, 2021). Artificial intelligence and machine learning are frequently used interchangeably. Machine learning falls under the components of artificial intelligence that describes the velocity and assortment of data sets that are rapidly increasing in size (Sharma, Sharma & Jindal, 2021). In the supply chain spectrum, most firms employ AI to develop novel business strategies and improve overall performance (Toorajipour, Sohrabpour & Fischl, 2021). AI is well-known for its ability to automate processes and actions so that it can run without

the need for human interaction. Many uses of AI technology and techniques have grown so prevalent that we may no longer consider them to be AI-based, such as navigation applications, facial recognition and spam filtering, to mention a few (Tai, 2020).

The advent of the big data era has resulted in a much broader range of data mining and deep learning technologies in the supply chain landscape. As the size of data grows, data storage and processing are becoming increasingly difficult for businesses as the size of data increases. The broader battle is managing and deriving value from data collected to improve brand strategies and sales (Constantiou & Kallinikos, 2015). AI can analyse huge volumes of data, understand relations, give prominence to operations and support better policy formulation. AI is a potential match-marketer (Davenport et al., 2020).

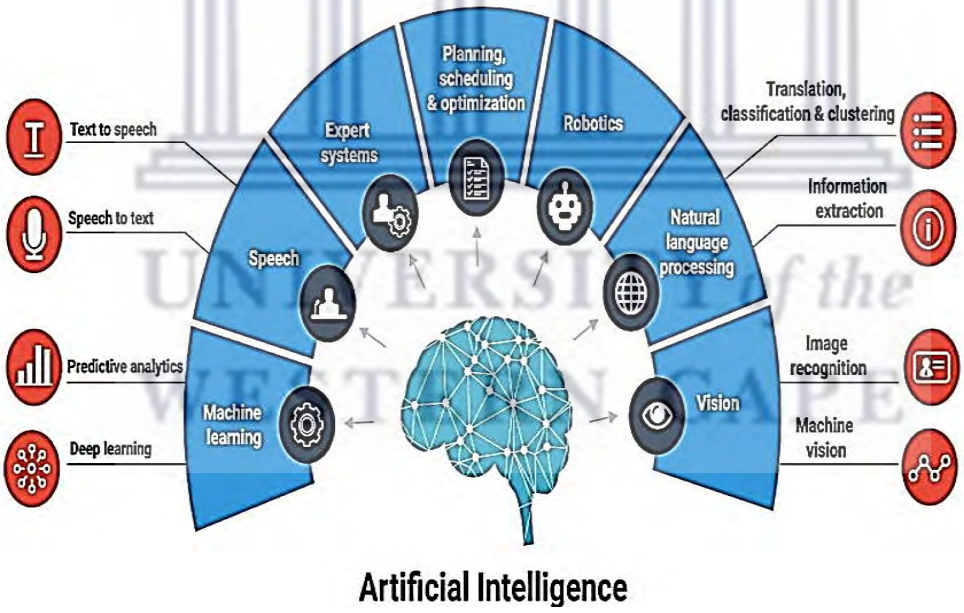


Figure 2.6: Basket of AI Technologies Reference Source: Kumar & Sheshadri, 2019

The following are some modern computer approaches and fields of artificial intelligence development that are illustrated in Figure 2.6 above:

Expert System: It refers to a computer-based knowledge management system that enables users to access a database and related information. These systems vary from simple regulatory systems to integrated development systems with vast knowledge bases, inference engines, and user interfaces. With the ability to offer valuable insights and recommendations, expert systems have proven to be a valuable tool for decision-making across different fields. (Kumar & Sheshadri, 2019).

Natural Language Processing: AI aims to teach computers to understand modern language, with Natural Language being the ultimate generation. Researchers in AI have created a natural language. interface utilising limited language and composition, analyzing language concepts through linguistic techniques, speech synthesis, machine translation, information recovery, extraction, and speech recognition (Kumar & Sheshadri, 2019).

Pattern Recognition: Pattern recognition is a continuous process in all living beings, involving data collection, pre-processing, character selection, model selection, training, and evaluation. It involves identifying and classifying patterns in a multi-dimensional space (Kumar & Sheshadri, 2019).

Robotics: Robotics, an AI subfield, involves motor and perceptive tasks, utilizing artificial intelligence techniques for automation through human control or predetermined programs (Kumar & Sheshadri, 2019).

Machine learning: It was created in 1959 by Arthur Samuel, an American pioneer in artificial intelligence and computer games. It can be used for supervised, unsupervised, reinforcement, and semi-supervised learning applications. (Kumar & Sheshadri, 2019).

Hamlet: The system is HAMLET (How about Machine Learning Enhanced Theses). It is a machine learning system developed by Harvard's Berkman Klein Center for Internet and Society, uses the doc2vec algorithm to estimate document similarity, including test user interfaces for a literature review buddy, uploaded file oracle, and recommendation engineincluding test user interfaces for a literature review buddy, uploaded file oracle, and recommendation engine (Kumar & Sheshadri, 2019).

2.6.1 AI Opportunities in SCM and Logistics

Disruptions and delays in the supply chain can have a substantial impact, resulting in increased costs, lost deliveries, halted manufacturing lines and unnecessary costs. In the new era of big data, supply chain operations have seen a far broader spectrum of data mining and deep learning technologies. As the volume of data grows, most firms are finding data storage and processing to be difficult undertakings (Jabin & Wani, 2018). Artificial intelligence for supply chain management and logistics is undoubtedly a technological advancement that will help most businessesBig data analytics will help make sense of the information by highlighting patterns and trends. Artificial intelligence will accelerate the process of uncovering trends and patterns with the help of decision-making algorithms (Kersting & Meyer, 2018). In the supply chain and logistics industry, artificial intelligence has been employed in a variety of ways. Companies that have successfully embedded AI in their operations have come to understand its capabilities to unravel some of the complex organisational problems of AI in Procurement 4.0.

Some studies have proved the importance of pushing forward with digital transformation in the procurement process (Bienhaus & Haddud, 2018; Chick & Handfield, 2015). In the current dynamic and intensely competitive business landscape, companies are realizing that the digital transformation process is essential to staying relevant and providing value to their clientele.

Product stock-outs or overstocking might occur because of a lack of accurate and timely data. The organisation's ability to collect real-time data may assist raise the accuracy of demand forecasts, resulting in higher inventory levels that satisfy customer expectations. Finding the proper suppliers is also one of the most difficult aspects of supply chain procurement (Jiang &Tian, 2009), and many businesses have encountered supply interruptions because of a lack of a systematic approach to choosing suppliers.

2.6.2 AI in Production 4.0

Production processes are complex procedures with numerous moving parts and activities occurring at the same time, making it difficult for organisations to choose where to focus their efforts to improve efficiency. Warehouse optimisation entails automating processes and figuring out ways

to save time, space and resources while decreasing mistakes and enhancing flexibility, communication and mobility (Nicole, 2019). Companies have been digitising their facilities for decades, using distributed and supervisory control systems, as well as sophisticated processes and controls in some situations. While this has enhanced operator visualisations, most organisations with large assets have not kept up with the newest advancements in analytics and decision-support systems that use AI. Operators continue to rely on their judgment. As the volume of data increases, it becomes more difficult to recognise trends, and common concerns and prioritise areas for improvement (Nicole,2019).

2.6.3 AI in Manufacturing 4.0

Manufacturing 4.0 is a term for conveying the goal of manufacturing digitisation. Today, machines dispensed on the factory floor are furnished with sensors that gather and contribute to a huge volume of data and record a broad variety of actions. Producers have begun to recognise the planned value of huge data analysis, and as a result, data is becoming a critical value for enhancing production competition. Unscheduled downtime has been pointed out as one of the biggest wastes in manufacturing (Dey, Chandramohan & Bansal, 2013). Various manufacturers have adopted a time-based approach when it comes to the maintenance of equipment. The time-based approach takes into consideration the age of the equipment and determines the time for maintenance routine (Ahmad & Kamaruddin, 2012). Like FIFO in accounting, maintenance is conducted frequently on older equipment.

A study by the ARC group (2019) on equipment failure has shown that equipment age accounts for only 18%, while 82% are random. This proves that a time-based approach is not reliable, as the equipment is preserved even when redundant. The best way to avoid unproductive maintenance procedures and the charges that go along with them for manufacturers is to influence industrial AI and data science. An AI-based resolution, on the other hand, accepts preserving tebibytes of data and operating machine learning algorithms on different computers in competition to estimate risks and identify when industrial apparatus is likely to end. Utilising AI to analyse huge volumes of data in real-time can optimise decision-making and give business users increased insight, whether

it is to reduce downtime of assets, improve manufacturing efficiency, automate production or plan events or detect anomalies - thereby improving performance (Kersting & Meyer, 2018)

2.6.4 AI in Distribution 4.0

One of the most difficult issues in the logistics environment is dealing with situations in which supplies are misdirected, delayed or cannot be identified (Yuan & Qiao, 2018). As the global economy entered the twenty-first century, logistics became an essential component of SCM and customer demand. The significance of logistics in SCM should not be underestimated, since transportation is considered one of the most essential supply chain activities. Regardless of the size of a company, logistical concerns may have a major impact to the whole supply chain network. Logistics is critical to cost and performance control in the supply chain (Zhiwen et al., 2020).

Efficient SCM is a crucial activity, yet traditional supply networks do not meet today's market demands. Converting traditional supply chains to digital supply chains assists in the removal of issues and the transformation of supply chains into fully integrated systems.

In the logistics landscape, organisations are faced with circumstances where deliveries are misdirected, delayed, or cannot be traced. The application of AI can create efficient logistics processes by optimising route, automation and tracking deliveries to make transporting goods through the supply chain faster and easier (Reuter, Brambring & Hempel, 2016). Proactive logistics processes empowered by AI have a high quality of service that exceeds customer expectations when it comes to on-time deliveries. This results in lower costs and fewer problems across the logistics network (Soleimani, 2018). The vehicle routing problem (VRP) refers to the process of determining a collection of inexpensive transport routes that depart from a centralised depot, service a set of established clienteles and return to the warehouse without breaching any restraints (Soleimani, 2018). Park (2001) established the application of the genetic algorithm, a subset of artificial intelligence used to address vehicle routing and timing issues.

2.7. **National Cybersecurity Policy Framework (NCPF)**

NCPF is a document aimed at creating a safer cyberspace in South Africa. It outlines roles for government, private, and civil society sectors, aiming to measure nation-wide security, combat cyber warfare by, develop and review laws, and measure trust in ICT use (Government Gazzette, 2015). The framework also aims to centralize cybersecurity coordination:

- To foster cooperation and coordination among all stakeholders.
- Promote universal partnership.
- Create necessary skills, research and development dimensions
- Promote a cybersecurity culture
- Reassure compliance to cybersecurity standards (Government Gazzette, 2015)

The NCPF aims to promote a secure cyberspace environment for e-commerce growth and an inclusive information society by identifying stakeholders like the state, public sector, society, and special interest groups to address cybersecurity threats. (Burmeister, Phahlamohlaka & Al-Saggaf, 2014).

The NCPF, South Africa's national cybersecurity strategy, has been criticized for being vague and general, lacking practical implementation strategies, as noted by Mohideen (2016). Jansen van Vuuren (2016) highlights the need for high-level cybersecurity frameworks to address various levels. The NCPF aims to encourage compliance with technical and operational standards, providing a national strategy for cybersecurity plans.

2.8 Summary

This section presented an outline of the theoretical foundations of some of the study's key concepts. The chapter outlined some of the opportunities for AI in supply chain and logistics, and the research model that will guide the study. The chapter that follows focuses on research methodology and design. Literature on AI, SCM and logistics is discussed. The chapter also provided a scholarly comprehensive definition of the supply chain. In addition, the chapter presented previous studies on AI adoption and the TOE framework. In conclusion, the chapter also presented the implementation of AI in the supply chain in South Africa.

CHAPTER 3: RESEARCH DESIGN AND METHODOLOGY

3.1 Introduction

The section outlines the study's methodology which describes how the study was conducted to meet the objectives. The research methodology discusses the philosophy, strategy, the approach, methods of the research and the data analysis. This describes how data were gathered and used. The research technique provides a profound insight into the factors influencing the adoption of AI in the South African supply chain and logistics business.

3.2 Research Design

Research design describes the journey that the investigator chooses to follow during the research road to find answers to the research (Walsham, 2014). This study adopts a quantitative research design.

3.2.1 Quantitative Research Design

As asserted by Walsham (2014), a quantitative research design is an empirical investigation of a social issue that seeks to test a theoretical framework through the measurement of variables using numerical data and statistical analysis. This approach aims to determine whether the generalized predictions of the theory hold true in precise conditions.

The principal goal of this study is to advance knowledge and give a thorough grasp of the different aspects that affect the supply chain and logistics industry's adoption of artificial intelligence.give a thorough grasp of the different aspects that affect the supply chain and logistics industry's adoption of artificial intelligence. Moreover, this study aims to attain a high degree of credibility and validity by applying a meticulous and detailed data analysis process. According to Daniel (2016), the quantitative research method is an appropriate approach to proving or validating hypotheses and conclusions through a systematic and statistical process. Through this rigorous investigation, this research hopes to provide new insights, knowledge, and recommendations to

facilitate the implementation of AI in supply chain and logistics. Quantitative methods look at numerical evidence which often includes the use of mathematical tools to interpret the results (Fujimori et al., 2014).

Positivism research has a strong preference for quantitative research because the goal is to understand and explain the actions of the research participants. The study focused on testing theory deductively from existing knowledge by developing proposed outcomes for the study.

3.2.2 Qualitative Research Design

Leedy and Ormrod (2019) described qualitative research design as an informative and realistic approach that focuses on studying phenomena in their natural context to advance in the experiences and perspectives of people. Unlike quantitative research, qualitative research does not rely on numerical values and models to present findings. Rather, it is concerned with gaining a deep understanding of complex situations and interpreting the meanings attached to them. Merriam (2019) further explained that qualitative research employs theories to elucidate and comprehend events and phenomena and generate new theories. Qualitative methods are especially suited when researching an unfamiliar topic, examining the inner perspectives of participants, or when the focus is on exploring a particular perspective or experience. To collect data, qualitative research relies on three main sources: interviews, observation, and documents.

3.2.3 Mixed Methods Research Design

Mixed methods are the blending of both qualitative and quantitative methodologies in the same study (Creswell, 2013). For instance, the quantitative technique helps the investigator to gather information from a larger sample, increasing the possibility that the findings can be applied to a wider population. The qualitative approach to research provides a more nuanced understanding of the problem being investigated by taking into account the perspectives of its participants. In contrast, quantitative data adds breadth to the study, whereas qualitative data offers a deeper exploration of the phenomenon in question. Furthermore, integrating both quantitative and

qualitative data in a study lead to a more wide-ranging and nuanced understanding of the research problem.

3.3 Research Philosophy

A set of presumptions and views regarding how experience develops is known as research philosophy. This may sound wise, yet while researching and expanding knowledge in a certain sector, that is precisely what is done.(Daynan & Mohan, 2017). The authors further say that Even when the knowledge development is being done in response to a specific issue within a given organization, it might not be as significant as broadening the concept of motivation. The three most popular research philosophies are interpretivism, critical realism, and positivism.

3.3.1 Critical Realism

A point of view is that objects that are known or experienced have an origin or nature that is regardless of whether someone is concerned about or perceives them. It assists researchers in developing or amending substantive ideas in each area by offering intellectual clarity on the essence of the universe (Dayma & Mohan, 2017). The main goal of critical realism is to explain what is observed and comprehended in terms of the primary types of experience that make up visible events.According to Fujimori et al. (2014), critical realists are primarily concerned with the study of reality as a fundamental philosophical inquiry. They argue that An extensive and well-organized ontology is essential to this research.. Ontology is the branch of philosophy that deals with the nature of existence and the categories of things that exist. As such, a robust ontology is vital for a better understanding of the underlying structures that govern the phenomena under investigation. Therefore, critical realists contend that a structured and well-conceived ontology is essential for the study of reality.

According to critical realists, reality is external and autonomous, but not easily accessible through observation and understanding. In critical realism, the first step in understanding the world

involves the approaches and actions that we encounter. The second step is that there is the rational proclamation that takes place following an experience when regressing to the underlying reality that may have given rise to them.(DuBenske et al., 2014). According to direct realism, the first step is sufficient. According to critical realists, the umpire has only seen a small amount of what they may have seen, or a small percentage of the entire set of genuine events that are occurring at any given time..

3.3.2 Interpretivism

Interpretivism is an ideology focused on subjectivist assumptions that assumptions are made up of verbal interchange of ideas and that actual or socially built meaning can only be investigated by social creations, such as perception or language (Gemma, 2018Similar to critical realism, interpretivism emerged as a critique of positivism.but from a partial view. According to interpretivism, because humans create meaning, they are eminent from physical subjects. Interpretivism explores these significances. Interpretivism is made of numerous strands, and the vital ones are hermeneutics, phenomenon and representative cooperation (Check & Schutt, 2012). Interpretivism is a philosophical approach that challenges the notion that human behavior and social phenomena can be studied as physical phenomena. According to this perspectiveInstead of trying to mimic natural science research, social science research needs to be different from it.. In support of this perspective, Saunders, Lewis, and Thornhill (2019) contend that social science study ought to concentrate on comprehending the subjective experiences and meanings that individuals attach to their social worlds. Interpretivists believe that the complexity of human behavior and social phenomena requires a different research methodology than that used in natural sciences.

Methodology: Interpretative research aims to understand people's experiences in natural settings, with assumptions about the multiplicity of realities informing the research process. The "grand tour" question is the first of several open-ended, descriptive, non-directional research questions that are followed by smaller inquiries.These sub-questions guide the methodology and methods used to answer the broad-based grand tour question, ensuring the inquiry remains broad and comprehensive (Creswell,2018).

3.3.3 Positivism

Positivism is the term used to define a method for the study of society that depends explicitly on systematic evidence, such as experimentations and statistics, to divulge the truth of how society functions (Check & Schutt, 2012). Positivism normally involves the application of existing theory to the advancement of hypotheses. Most positivist studies use quantitative approaches to categorise links or causal relationships. The researcher's participation in positivist investigations is confined to data collection and interpretation. Ultimately, the findings of such a study are utilised to inform theory and add to the literature (Saunders, Lewis & Thornhill, 2016). Positivism is a logical stance linked with natural scientists that require working with evident social authenticity to yield law-like generalisations (Saunders, Lewis & Thornhill, 2016). Organizations and other social entities are seen by the extreme positivist worldview as being just as real as physical objects and natural events. From an epistemological standpoint, this approach seeks to uncover observable and measurable facts and patterns. According to Costanzo (2014), Credible and significant facts can only be obtained from phenomena that are measurable and observable. This method places a strong emphasis on the value of objective observation and empirical data in social science research.The goal is to identify causal correlations in the data in order to construct generalisations that resemble laws, much as those made by scientists. (Gill & Johnson, 2010).

The philosophical approach observed in the study is positivism. In simple terms, positivism is a concept that is used to describe how we come to understand facts and truth. The primary aim of the positivist enquiry is to create explanatory correlational or causal relationships that contribute to the prediction and regulation of the phenomenon under study (Park, Konge & Artino, 2020).

Methodology of the positivism paradigm: This research aims to predict results, test theories, or determine relationships between variables. Quantitative researchers use defined ideas and problem statements to identify variables and their relationships (Creswell, 2018). The rhetoric nature of this paradigm emphasizes objectivity in data collection, using quantitative research designs to minimize bias.

3.4 Research Approach

Two research approaches identified in this study are the deductive approach and the inductive approach.

3.4.1 Inductive Approach

Inductive perceptive is commonly described as decentralised method for having any idea, wherein the researchers collect observations to construct an abstract concept or to describe a view of the phenomenon under study. To construct law-like generalizations similar to those made by scientists, the emphasis is on searching for causal correlations in the data.s (Lodico, Spaulding & Voegtle, 2010). Inductive reasoning begins with specific observations and measurements, progresses to the recognition of trends and anomalies and culminates in the development and formulation of some broad conclusions or hypotheses (Djamba & Neuman, 2003). Instead of using a pre-existing hypothesis, an inductive technique allows you to develop your own (Bryman, 2011). This approach aims to derive insights from a dataset to identify designs and relationships, which are used to creäte a theory. Despite this inductive approach, researchers may still use existing theories to formulate their research questions. Typically, this approach is associated with qualitative data collection and processing methods.

3.4.2 Deductive Approach

According to Prado, Chadha and Booth (2011), deductive reasoning is the act of concluding given theories that are likely to occurThe deductive research approach looks at a well-known theory or phenomenon and assesses its applicability under certain circumstances.. According to Prado et al. (2011), the deductive approach is more logical in nature. This approach begins with a theory and then formulates a new hypothesis, which is tested through observations to confirm or disprove the null hypothesis. This approach is useful for explaining causal relationships between factors and concepts. Furthermore, the deductive approach is often faster to conduct. Researchers using this

approach typically explore a well-established theory or phenomenon and determine its accuracy under specific conditions (O'Reilly, 2009).

The study adopted deductive reasoning. Vurro, Russo and Costanzo (2014) assert that positivist studies typically use a deductive methodology. The use of the deductive approach permitted the researcher to use structured questionnaires and execute statistical tests on the quantitative data. This approach was used, since it allowed the researcher to choose a theory, form hypotheses that were tested, examine the results and make conclusions from it.

3.5 Research Strategy

The various research strategies used in the research study include the experimental, survey and case study A survey refers to form of data collection that is widely used by researchers to obtain vast volumes of data from a limited number of people on a given subject. This method of data collection is often used to capture quantitative data (DuBenske et al., 2014) and lastlya case study evaluates a single unit to determine its salient characteristics and make generalizations (Ponto et al., 2011).

3.5.1 Experimental Strategy

By adjusting two sets of variables—one uses as a constant and the other to measure differences—experimental research uses a scientific method.. This type of research is usually employed in quantitative research methods (Ponto et al., 2011). The purpose of experimental research is to gather data that can be used to make informed decisions. For research to be scientifically acceptable, it must be conducted under appropriate conditions using experimental methods. The ability of researchers to show that changes in a variable are only the result of manipulating the constant variable and that a significant cause and effect link has been established is essential for the success of experimental studies..

The following are three types of experimental research design.

- Pre-experimental design involves observing groups after implementing cause and effect factors to determine whether further investigation is necessary (Fujimori et al., 2014).
- The most accurate type of study is true experimental research design, which uses statistical analysis to support or refute a theory. Only genuine design, out of the three forms of experimental design, is able to prove causation within a group.
- Quasi-experimental research design is more or less the same with to experimental design, but with some key differences. In this type of research, an independent variable is manipulated, but participants are not randomly assigned to groups. The assignment of a control group is also different from experimental design. In field situations when random assignment is either unnecessary or irrelevant, quasi-research is frequently employed. (Singleton, 2009).

3.5.2 Case Study

According to Dillman, Smyth and Christian (2014), a case study is an exploratory investigation that examines an event or situation in its actual setting, especially when it is difficult to draw obvious distinctions between the two. This section of the definition recognises that in real-life circumstances, it is not always easy to discern between the phenomena and the contextThe definition of a case study provided by Creswell (2013) takes into account a situation that is technically unique, draws from a variety of sources, and makes use of the theoretical prepositions that have been constructed previously to help direct data collecting and analysis. When it is difficult to discern between the phenomena and its setting, Ponto (2009) recommended using a case study as the research technique of choice.

A few distinguishable traits of a case study technique were also mentioned in the definition presented by Rashid et al. (2019). According to their definition, a case study is a methodology that combines a range of techniques to investigate a single event in its natural environment in order to get comprehensive understanding. Consequently, case study research is flexible enough to incorporate many research methodologies and is typically employed when obtaining comprehensive understanding of a certain phenomenon is necessary. Additionally, case study research can accept both quantitative and qualitative data, giving the researcher a vast variety of data to work with (Ponto, 2009). Even while case study research is a unique approach to research

that has several benefits and permits a thorough examination of the problems at hand, there are drawbacks to it. Yin (2009) listed some of the most prominent complaints of case study research, including its lack of rigor, bias, difficulty in generalizing, length of time, and production of heavy documentation. In response, it was mentioned that a case study's quality can be raised by adhering to the construct validity, internal validity, external validity, and reliability tests—all of which are typical of empirical research (Check and Schutt, 2012).

3.5.3 Survey

Survey research refers to the technique of gathering data that entails questioning a sample of people in order to obtain informationthe technique of gathering data that entails questioning a sample of people in order to obtain information. (Check & Schutt, 2012). This type of research allows for flexibility in participant recruitment and data collection methods. In survey research, one can employ qualitative research techniques like open-ended questions or quantitative techniques like statistically scored items, or a mix of the two. Due to their ability In social and psychological research, surveys are frequently used to characterize and investigate human behavior. (Singleton & Straits, 2009). For many years, survey research has been used to gather information from both individuals and groups. It can take many forms, from straightforward focused questions to more involved studies involving the use of numerous legitimate and trustworthy instruments. A few instances of surveys that are less rigorous are public opinion and marketing surveys, which also look at consumer behavior. The literature was carefully reviewed, and then data were gathered using a quantitative approach that involved the use of a survey. The questionnaire for the study was developed by the TOE Framework (Mariemuthu, 2019; Ghazilla et al., 2015; Doherty et al., 2013).

3.6 Unit of Analysis

In some circumstances, the research unit of analysis indicates what or who will supply the data and to what extent it will be aggregated for study (Zikmund et al., 2013). People working in South Africa's supply chain and logistics sectors will be the relevant Unit of Analysis.

Individuals working in South Africa's supply chain and logistics sectors, both in the public and commercial sectors, served as the study's unit of analysis..

3.7 Data Collection

To reach the appropriate target, prospective responders were sent the survey link via the LinkedIn website in order to conduct an online survey.(www.LinkedIn.com). The online questionnaire was available for completion from 1st August 2021 to 30th September 2021. LinkedIn was chosen as a platform for distributing the survey due to its large professional user base and the ability to target specific industries and job titles. The survey was intended to gather data on various aspects linked to the participants' professional experiences and opinions. The responses collected through the online questionnaire were analyzed to draw meaningful insights and conclusions.

In total, 200 individuals were selected from the South African LinkedIn. These individuals were from various levels in the supply chain and logistics sector. Using the handy sample technique, all respondents were contacted by emailing the survey link to possible respondents via the www.LinkedIn.com network. Convenient sampling is an approach in which the investigator picks participants based on their availability and the features that the researcher desires to investigate (Creswell, 2012). A total of 48 people responded to the survey, resulting in a ryielding a 24 percent response rate. Data were analysed using SPSS.

3.8 Instrument Development

To examine the adoption of AI in supply chain and logistics, A Likert-type scale with five points was used. Respondents' levels of agreement or disagreement with a statement were gauged using a scale that went from 1 (strongly disagree) to 5 (strongly agree). The Likert scale is a type of rating scale that is commonly used in survey research to measure people's opinions, attitudes, or behaviors. This type of scale is widely used because it provides a simple and effective way to operationalize personality traits or perceptions. The A flexible instrument, the Likert scale can be applied in a range of research settings, including social science and market research, and

psychological research, among others. It is a reliable and valid measure that has been widely used in research studies for many decades..

3.9 Assumptions And Limitations

There are some limitations to the study. To begin, this is a study at the organisational function level, so it focuses on the implementation of artificial intelligence in supply chain and logistics operations. Secondly, the scope of this research was limited to AI adoption in South African organisations in the supply chain and logistics industry, so generalisations to other industries within South Africa may not be possible.

3.10 Ethical Consideration

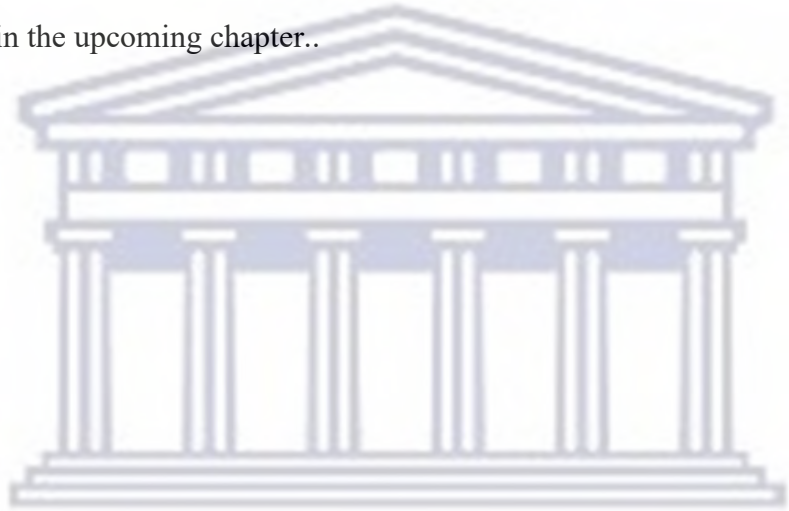
As a result, the information collected to create this study is stated to be the author's original work. Therefore, the author has noted and properly quoted the work of those cited in this study. The author adhered to the highest ethical principles when working on this study. Participation in the research wa private, anonymous and most importantly it was voluntary. The respondents had the freedom to get out of the activity at any time should they wished to do so. Respondents were requested to complete a consent form, and the form detailed all the information about the research. The principle of consent is to ensure that the respondent fully understands the implications of participation and freely gives the decision about whether to do so, without the exercise of any pressure or coercion.

3.11 Data Protection Act

Participant information was securely stored in a password-encrypted excel workbook. The information was only accessible to authorised participants.

3.12 Chapter Summary

The chapter dillustrated the various research philosophies and methodologies, as well as the methodology and strategies employed in the study. This chapter also discussed the research assumptions and limitations of the study. The chapter continued by going into detail about the unit of analysis and the data collection instruments utilized for the investigation. The ethical guidelines that were adhered to during the study's execution were covered in the chapter's conclusion. The study's conclusions and the procedures employed to guarantee data dependability and integrity are covered in detail in the upcoming chapter..



CHAPTER 4: RESEARCH RESULTS

This section depicts the study's findings. The chapter begins with data screening, which is the process of identifying and computing missing values. It examines the findings of the data acquired from the participants by looking at demographic descriptive statistics and, finally, the response frequencies of the TOE framework questionnaire.

4.1 Data Analysis

A total of 200 potential respondents were identified and contacted to participate in the survey. After 10 weeks of data collection, 48 responses were received, representing a 24% response rate. The response rate is comparable to that of other TOE research, such as the 22% response rate by Lin and Lin (2008) and Mariemuthu (2019) at 21%.

4.2 Validity and reliability

4.2.1 Validity

The 48 responses were reviewed for missing information. There was a total of 10 missing values across all survey questions. All missing values were computed with a Likert scale of zero (0). Perceived benefits had the greatest missing data, accounting for 2% of the total question results, At a reliability level of 0.8 and a 2 percent missing data percentage for both sample sizes, the sign was negative. The number of missing elements per survey question is shown in Table 4.2.1 below

Table 4.2.1: Missing data

Likert Scale	0	1	2	3	4	5	Total Responses	Percentage of missing values
Compatibility	1	11	15	57	81	27	192	0,5%
Skill	0	10	25	43	67	47	192	0,0%
Security	0	9	5	21	69	88	192	0,0%
Complexity	0	8	15	45	55	21	144	0,0%
Management Support	0	9	6	54	88	35	192	0,0%
Cost	1	7	20	46	76	42	192	0,5%
Perceived Benefits	4	8	3	46	85	46	192	2,1%
Size	3	26	32	61	47	23	192	1,6%
Competitive Pressure	0	6	34	61	65	26	192	0,0%
Partner Readiness	0	3	9	67	51	14	144	0,0%
Legal and Regulatory Requirements	1	16	22	47	37	21	144	0,7%

4.2.2 Reliability Testing

The reliability and validity of the sample data were calculated. In research, reliability testing refers to the consistency of a research study or measuring test. In this study, Cronbach's coefficient alpha was utilised to examine the consistency of the sample data. A Cronbach's alpha of.70 or higher is considered good,.80 or higher is considered better, and.90 or higher is considered exceptional. Table 4.2.2 shows the reliability analysis of the constructs which are mostly above the accepted level of 0.70. The Cronbach's alpha coefficient for most of the components is greater than 0.70, indicating that the measures are consistent. Cronbach's alpha coefficient for Legal & Regulatory

requirements was less than 0.70, indicating that the measure was unstable. This might be explained by the fact that the construct only had three indications, indicating that additional elements to explain these constructs will need to be discovered in future research.

Table: 4.2.2: Reliability Results

TOE	COMPONENT	Cronbach's Alpha	Number of Indicators
Technology	Compatibility	0.72	4
	Skill	0.82	4
	Security	0.78	4
	Complexity	0.76	3
Organization	Management Support	0.86	4
	Cost	0.87	4
	Perceived Benefits	0.95	4
	Firm Size	0.83	4
Environment	Competitive Pressure	0.82	4
	Partner Readiness	0.71	4
	Legal & Regulatory Requirements	0.64	3

Table 4.2.3 Summary of Questions

SECTION A: DEMOGRAPHIC DATA
Please can you provide the following demographic data about yourself and your business unit? What's your job category?
How long have you been in your current role?
Which of the following best describes your job function?
How long have you been in your current organisation?

Are you involved in information technology decision making in your business unit?

SECTION B: TECHNOLOGICAL FACTORS

Indicate which of the following AI algorithm has been implemented.

Machine Learning, Fuzzy Logic, Robotics System, Neural Networks, Natural Language Processing, Expert Systems, Not Implemented

Please indicate the year in which AI technology was first adopted in your business unit.

Compatibility

Please rate the degree to which you agree with the following statements

My company's IT infrastructure is capable of supporting AI.

The technologies used by our suppliers will be compatible with AI.

The technologies used by our customers will be compatible with AI.

Skills

My business unit has the necessary skills to support AI initiatives.

My business unit is committed to ensuring that employees are trained in AI.

My organization has a high degree of AI expertise.

My business unit will need to employ staff to support AI.

Security

Security is an important factor in technology adoption in my organization

Our existing infrastructure security supports data integrity

The current technology is secure, there are limited security breaches.

Security breaches can increase with new technology adoption

Complexity

AI adoption has a lot of technological interdependencies.

AI technology has a lot of uncertainties.

AI technologies are complex to implement

SECTION C: ORGANISATIONAL FACTORS

Management Support

Top management in my business unit are likely to invest funds in AI.

Top management in my business unit is willing to take risks involved in the adoption of AI.

Top management in my business unit is likely to consider the adoption of AI to gain a competitive edge.

Top management in my business unit is knowledgeable about AI.

Cost

AI technologies have high setup costs.

AI technologies have high running costs.

AI technologies have high maintenance costs.

My business unit constantly invests in new technologies to improve business operations.

Perceived Benefit

My business unit sees the value in investing resources into AI adoption.

Adopting AI is important in improving operational efficiency in my business unit.

Adopting AI is important in improving customer service.

Adopting AI is important in reducing operation costs.

Size

AI is ideally suited to larger organisations.

The size of my organisation makes it difficult to adopt AI.

The size of my business unit makes it difficult to adopt AI

The hierarchy in my organisation makes it difficult to adopt new technologies

Approximately how many employees work in your business unit?

Approximately how many employees work in your organisation?

SECTION D: ENVIRONMENTAL FACTORS

Competitive Pressure

My company would be under pressure from competitors to adopt AI.

Not embracing AI would put my company at a competitive disadvantage.

Our competitors are adopting AI.

My company is currently under pressure to adopt AI.

Partner Readiness

AI would be compatible with the technologies used by our partners

Our partners' IT infrastructure can easily be integrated with AI.

Our partners' infrastructure will have to be redesigned to implement AI.

Legal & Regulatory Requirements

I am aware of the IT regulations in my industry.

Regulations and policies will inhibit the adoption of AI in my business unit.

Current business laws and regulation support AI operations and adoption in my business unit
The government provides support for AI technology adoption

4.3 Demographics

This section discusses descriptive statistics and frequencies. The sample size for this study is 48 (N=48). This section discusses section A of the questionnaire, which is the demographics. The demographics statistics in this study included gender, age, faculty and level of study.

4.3.1 Respondent by Job Category

The figure below depicts the frequency distribution of the respondent's job category. The following job level was decoded: Professional: 1, Operational/Technical: 2, Manager/Supervisor: 3, Director: 4, Mid-Level: 5, Consultant: 6. Thus, 52% of respondents were professionally skilled personnel, followed by the operation/technical and managers/supervisors at 21 percent each and the remaining categories at 2 percent each. This demonstrates that most respondents had a certain level of sophisticated training and education and therefore there will be no hindrances in implementing AI in the supply chain management companies.

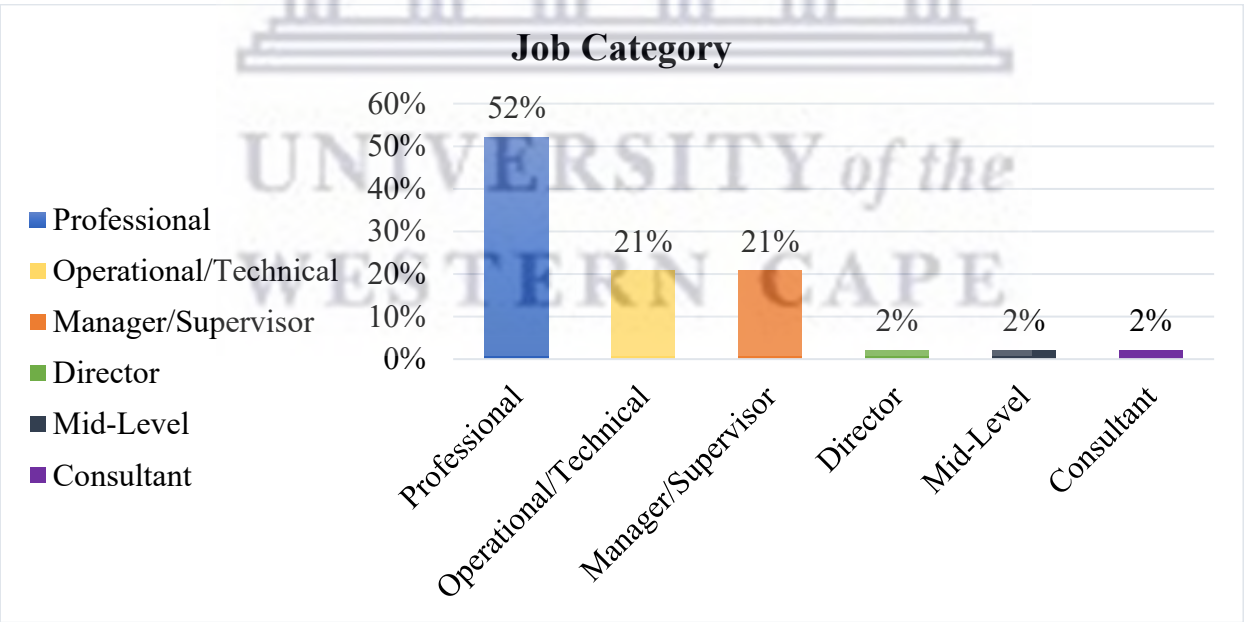


Figure: 4.3.1: Job category

4.3.2 Respondents By Years Employed at Organization

Figure 4.3.2 shows the percentage of respondents based on the number of years they have been with their employer. The figure reveals that most respondents have been with their employer for 2-4 years, accounting for 54% of the whole sample, whereas respondents with five or more years of work experience account for 25% of the total sample. One respondent had a missing value, accounting for 2% of the total respondents; yet this measure was deemed appropriate for the study overall. The remaining 19% of the respondents had been with their employer for 0 to 1 year. Respondents with industrial experience are well represented in the survey.

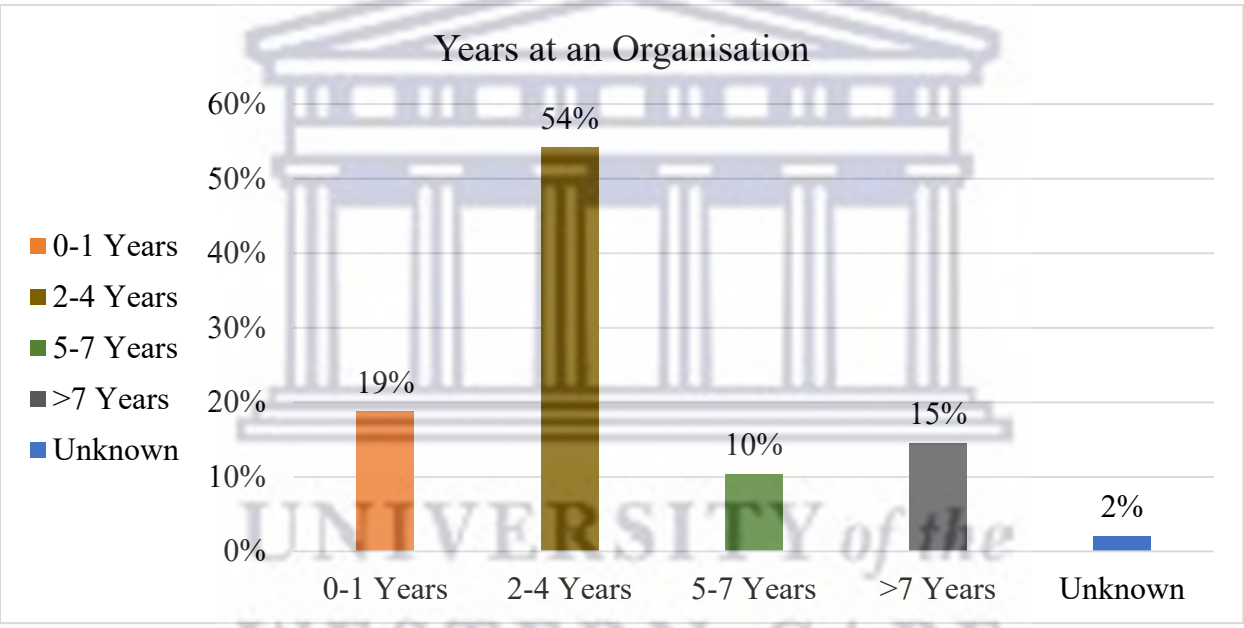


Figure 4.3.2: Years at an organization

4.3.3 Respondents By Years at Current Role

Figure 4.3.3 depicts the frequency of responses based on the number of years the responder has been in their current position. According to the results, 48% had been in their current role for 2-4 years, with respondents in their current role for a year or less accounting for 27% of the respondents. Furthermore, employees who have been in their current position for 5-7 years account for 17% of the total sample, with the remaining respondents have been in their current position for

over 7 years receiving the fewest responses (8%). According to the results, the majority of respondents have prior experience in supply chain and logistics functions.

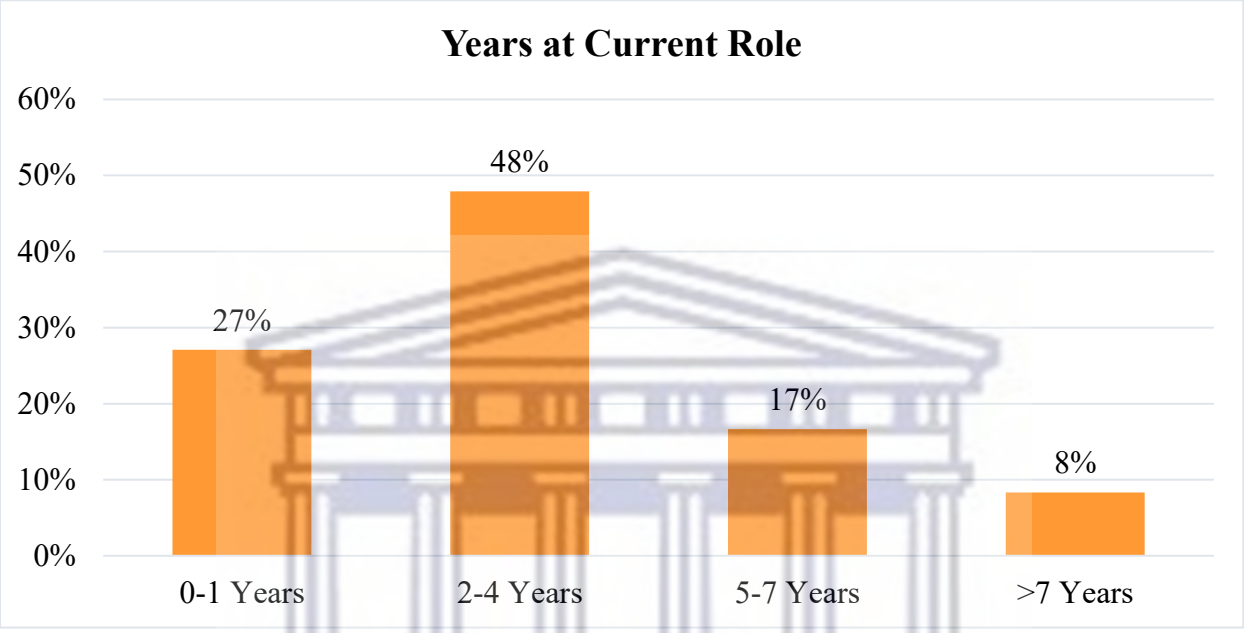


Figure 4.3.3: Years at current role

4.3.4 Respondents by Decision-Making Authority

Figure 4.3.4 shows the frequency of respondents' authority to make decisions in their business unit. This shows the respondent's level of responsibility when it comes to making technology adoption decisions. Also, 71% of those surveyed were found to be decision makers within their organisation, while the remaining 29% were non-decision makers. According to the results, the majority of

respondents have the authority to make technology adoption decisions in their organisations.

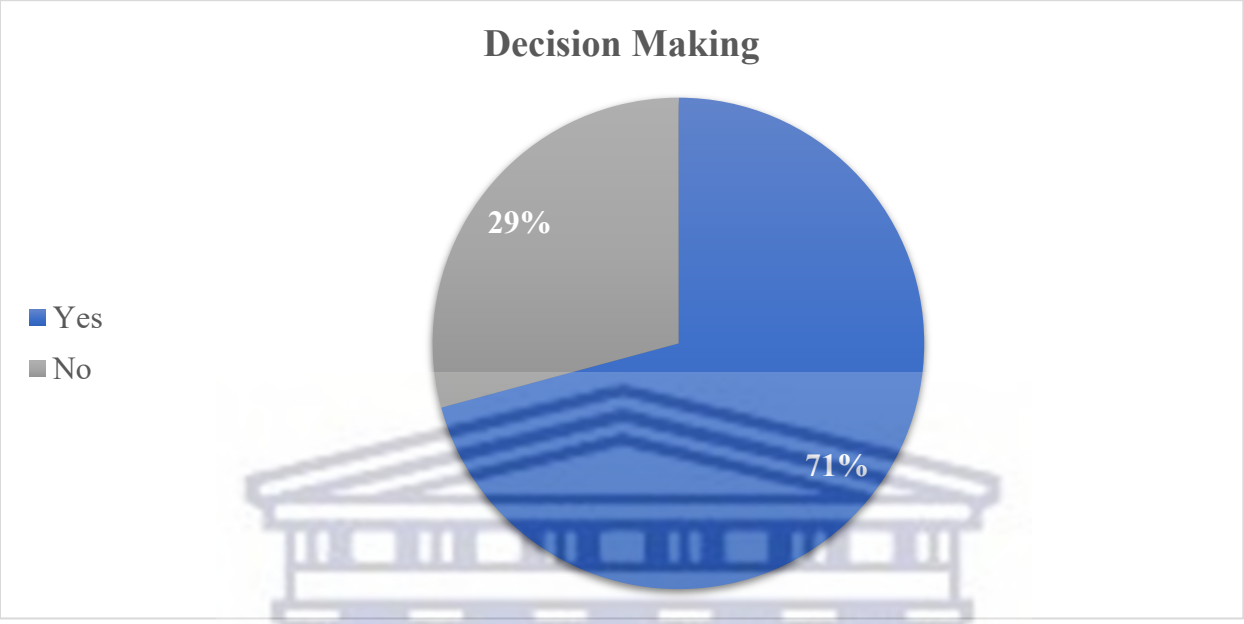


Figure 4.3.4: Decision-making

4.3.4 Summary of Demographics

According to the results of the study, respondents have typically experienced professionals with a specific level of education, skill or training to perform their work. 27% of the employees have been in their positions for a year or less. This suggests that respondents may have not been in the role long enough to witness technology adoption within their organisations. However, it has also been noted that the majority of responders have the authority to make choices in their organisations. Decision-makers are the major influencers and gatekeepers in an organisation's technology procurement. The results demonstrate that the majority of respondents have the authority to make technology adoption decisions, implying that they are part of the committee that decides technology adoption in their organisation.

4.4 Current AI Adoption

This section aims to gain insight into technology adoption across the respondent's organisation and business unit. Respondents were requested to highlight any AI technology implemented in their current operations, as well as the year in which the technology was adopted.

4.4.1 Respondents by AI Algorithm Implemented

The percentage of each AI algorithm's adoption status is shown in Figure 4.4.1. Respondents (n=48) were asked if they had implemented any of the AI technologies included in the type of AI technologies adopted. The AI technologies were classified on the questionnaire as follows: 0: No implementation, 1: Machine Learning, 2: Robotics Systems, 3: Expert Systems and 4: Natural Language Processing. Many respondents (38%) stated that they have not yet adopted AI in their organisation. Respondents demonstrated that Machine Learning was the most widely used, accounting for 29%, followed by Expert systems and Robotics, which accounted for 17% and 15%, respectively. The lowest was Natural language Processing technology, which had a rate of 2%. The researcher believes that the reason that only 2% of respondents are using the Natural Language Processing technology is because it is a new stimulus in AI.

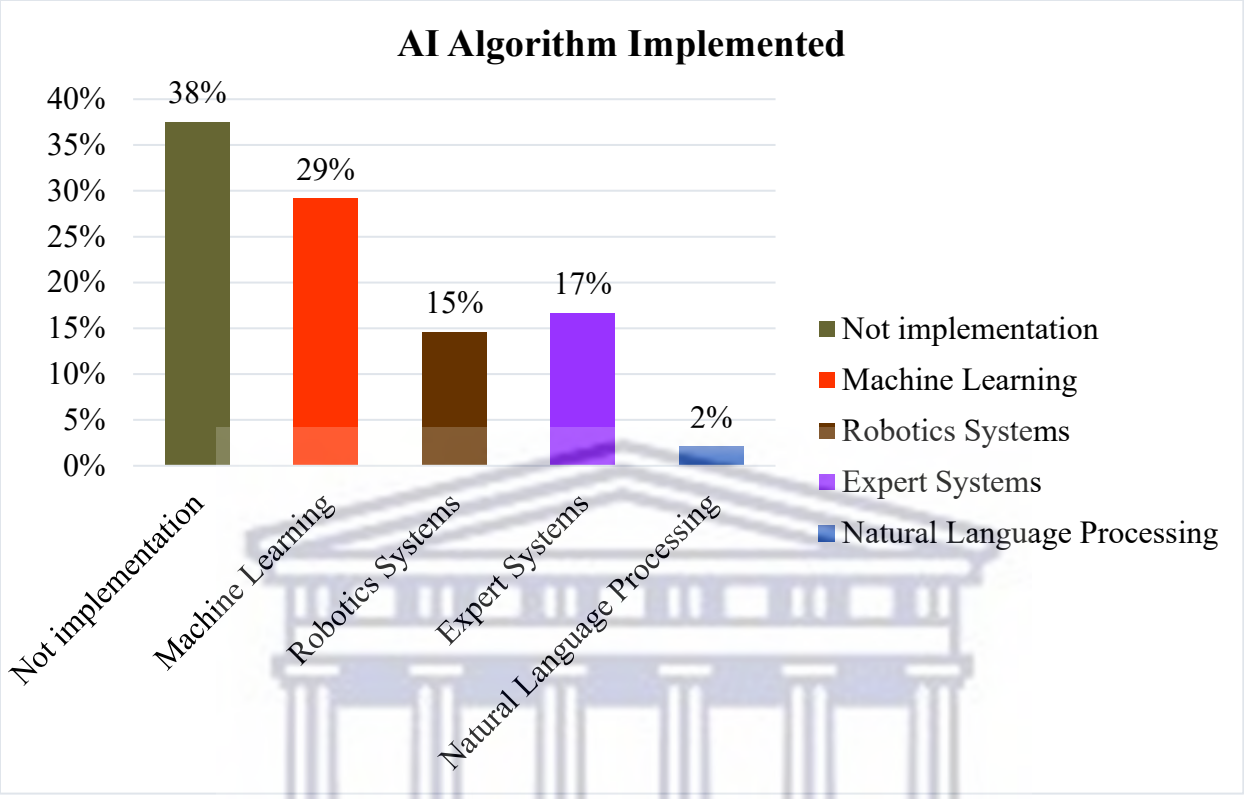


Figure 4.4.1: AI Algorithm implemented

4.4.2 Year AI Implemented

Figure 4.4.2 shows the frequency of respondents based on the year AI was implemented. The results reveal a rise in AI adoption between 2019 and 2020, with 2019 having the highest number of adoptions at 29%, followed by 2020 with a 10%. A total of 8% of the 30 respondents who had deployed AI were unsure of the year it was implemented. 38% of the respondents indicated that AI has not been implemented in their organisations.

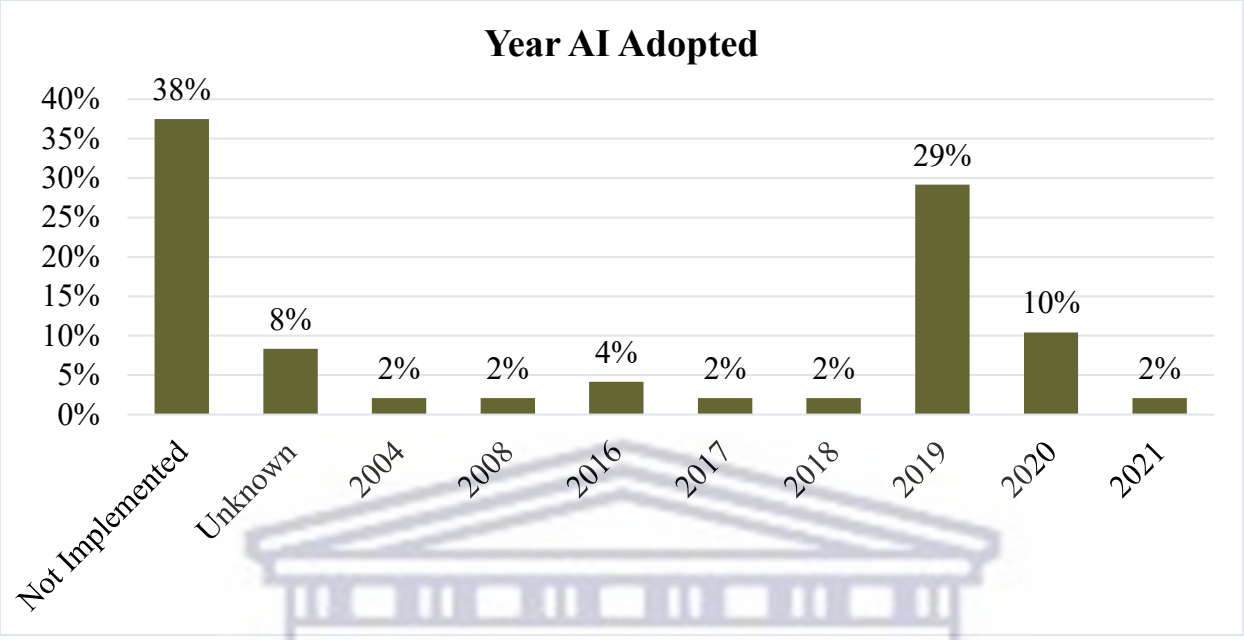


Figure 4.4.2: Year AI Adopted 1

4.5 Technological Factors

The section aims to comprehend the technological factors that influence an organisation's adoption of AI technology. Respondents were asked to rate the degree to which they think technology influences AI adoption.

4.5.1 Compatibility

4.5.1.1 My Company's IT infrastructure can Support AI

Figure 4.5.1.1 depicts a statistical summary of the question “My company's IT infrastructure capable of supporting AI?”. Many respondents believe their existing organisation's infrastructure can support AI initiatives, as evidenced by Strongly agree at 31% and agree at 42%, while 6% believe their infrastructure is incapable of supporting AI algorithms, as demonstrated by strongly disagree at 4% and disagree at 2%. 21% of respondents gave a neutral response, indicating that they are unclear about their existing IT infrastructure's ability to support IT. Individuals regard compatibility as an important technological feature that influences their decision to embrace new technology. Technology that aligns with existing values is more likely to be accepted. e

innovations that are incompatible with traditional processes are unlikely to spread quickly (Ghobakhloo et al., 2012).

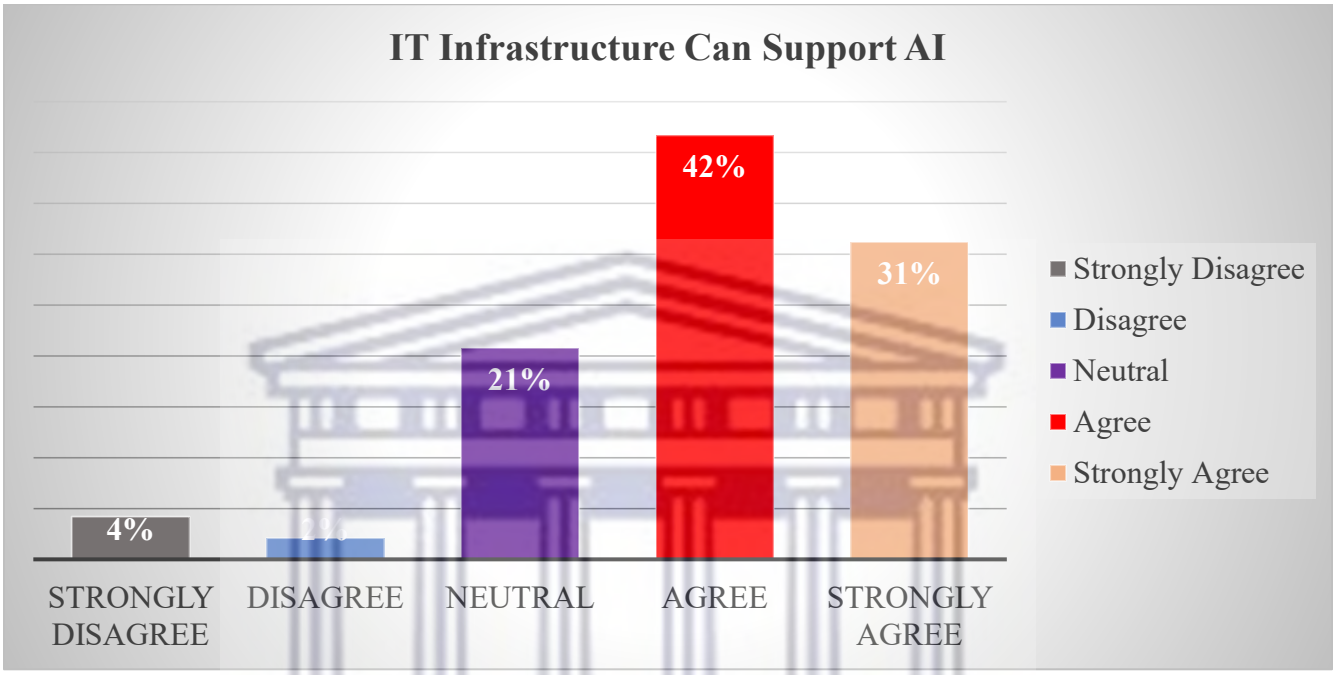


Figure 4.5.1.1: My company's IT infrastructure can support AI.

4.5.1.2 The Technologies Used by Our Suppliers Will Be Compatible With AI

Figure 4.5.1.2 presents frequencies of responses based on their supplier's infrastructure compatibility with AI. The following is a summary of the question "The technologies used by our suppliers be compatible with AI?".

Respondents had a more optimistic attitude. Over 44% of respondents agree that their customers' infrastructure can accommodate AI algorithms whereas 8% strongly agree. Several respondents have highlighted their supplier's infrastructure's inability to support AI initiatives, as shown by a disagreement and strongly disagree response, which accounts for 2% and 4% of the respondents, respectively. The lack of interoperability can greatly hinder the adoption of developing

technologies. According to a study, supply chain partners can put pressure on firms to adopt new technologies (Patterson et al., 2003).

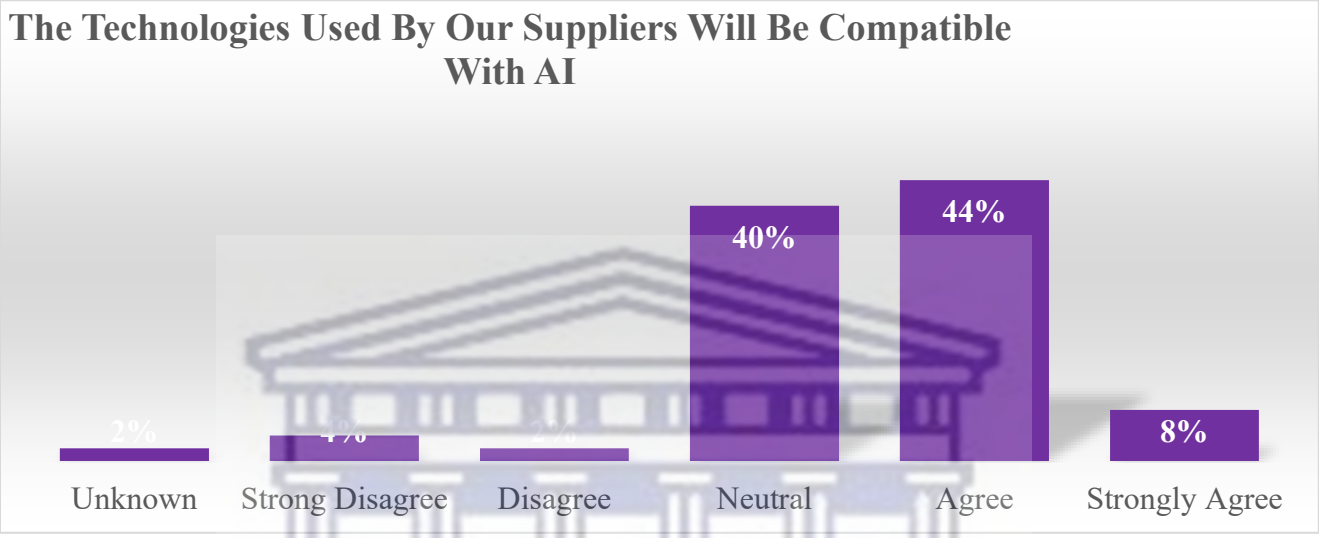


Figure 4.51.2: The technologies used by our suppliers will be compatible with AI.

4.5.1.3 The Technologies Used by Our Customers Will Be Compatible With AI

Figure 4.5.1.3 presents frequencies of responses based on the customer's infrastructure compatibility with AI-based on the question. Most respondents (43%) agree that their customers' infrastructure is well-equipped to manage AI initiatives. A third (35%) of respondents have taken a neutral approach, indicating a lack of awareness about the customer's infrastructure's compatibility with AI. Those who strongly disagree are represented by 6% of the response. Interoperability and compatibility concerns may develop while implementing a new product. Interoperability refers to the new system's capability to integrate with existing products or systems (Zang, 2019).

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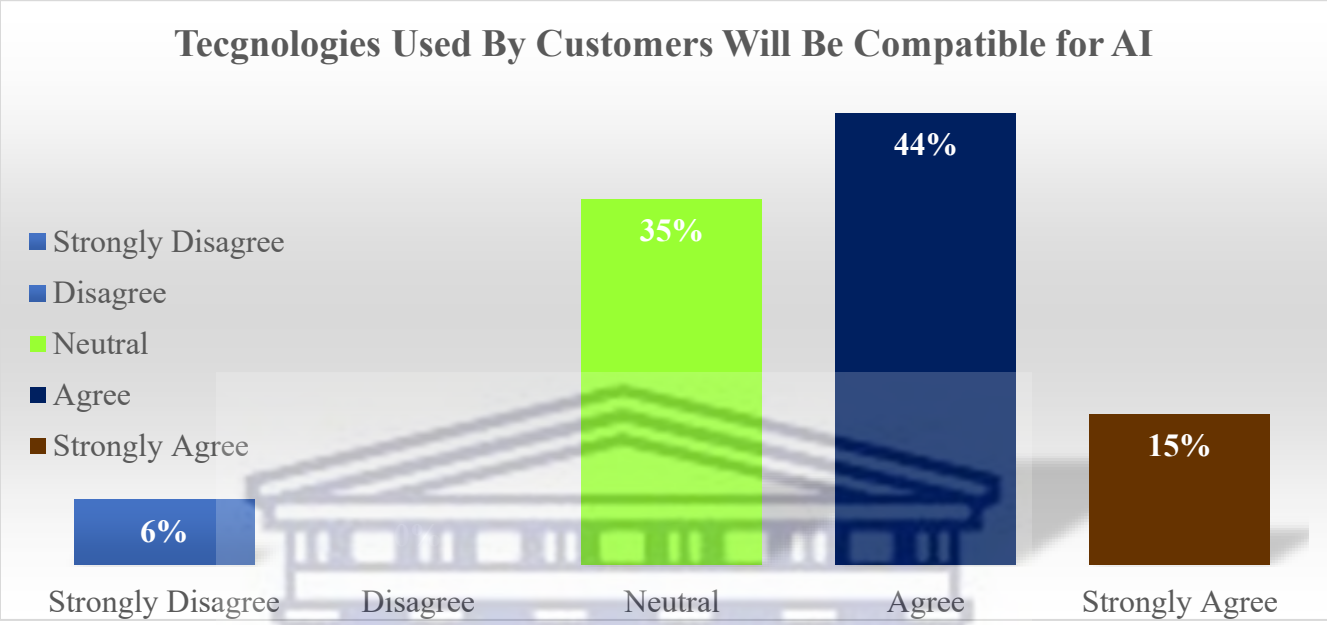


Figure 4.5.1.3: The technologies used by our customers will be compatible with AI.

4.5.1.4 Our Legacy Systems Are Consistent with AI Technology

Figure 4.5.1.4 depicts the frequency of respondents based on the organisation's legacy systems' ability to support AI projects. The graph depicts responses to the question "Our legacy systems consistent with AI technology?". The results show that the majority of respondents (40%) agree, and 2% strongly agree that their organisation's legacy systems should not be a barrier to AI implementation. However, a substantial number of respondents (23%) were neutral in their response, indicating uncertainty. There is also a strong perception among respondents that their legacy system will not be compatible with AI implementation, as demonstrated by 27% disagree and 8% strongly disagree. The firm's growth can be hampered by legacy infrastructure, thus organisations must evaluate the feasibility of integrating legacy systems and new technology (Tabim, Ayala & Frank, 2021).

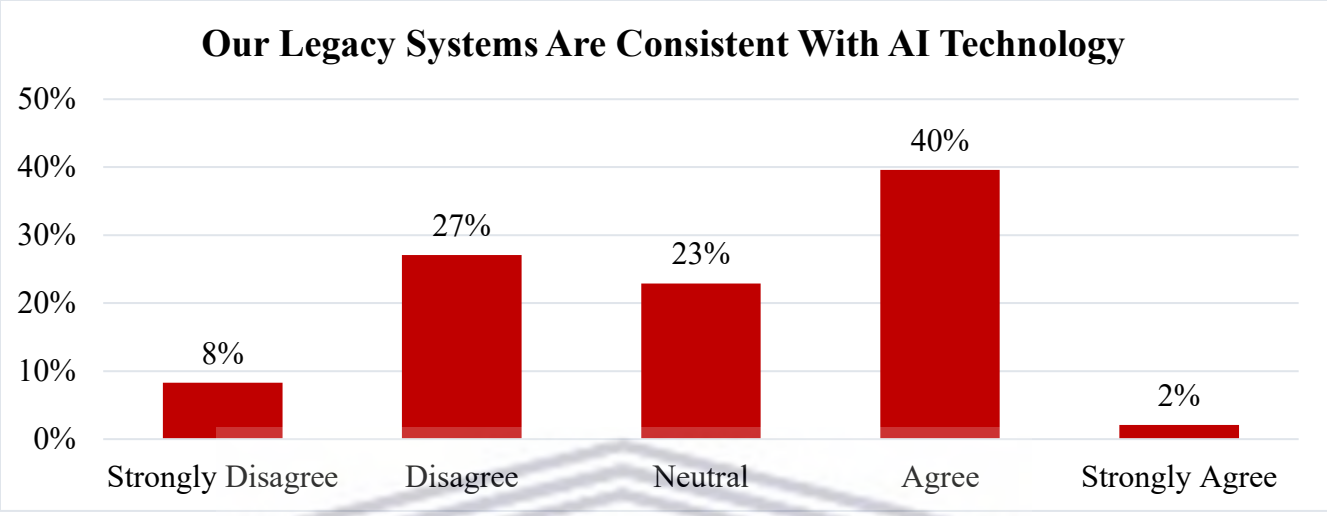


Figure 4.5.1.4: Our legacy systems are consistent with AI technology

4.6.1 Skills

4.6.1.1 My Business Unit Has the Necessary Skills to Support AI Initiatives

Figure 4.5.2.1 displays the frequency of responses based on AI skills within the business unit. Respondents were asked the question "My business unit has the necessary skills to support AI initiatives ". According to the results, 62% (1% Agree and 31% Strong agree) of respondents reflected a positive perception of the question, indicating that they believe their business unit has the skills to support AI, whereas 14% of the respondents disagreed and strongly disagreed, reporting a skill deficit. A substantial number of respondents were neutral in their responses. The results suggest that organisations have sufficient skills employees to support AI initiatives. It must also be noted that technology is constantly evolving, therefore, IT personnel should be trained regularly to keep up with technological advancements, as their expertise is critical to adopt AI technologies within an organisation (Manyika et al., 2017).

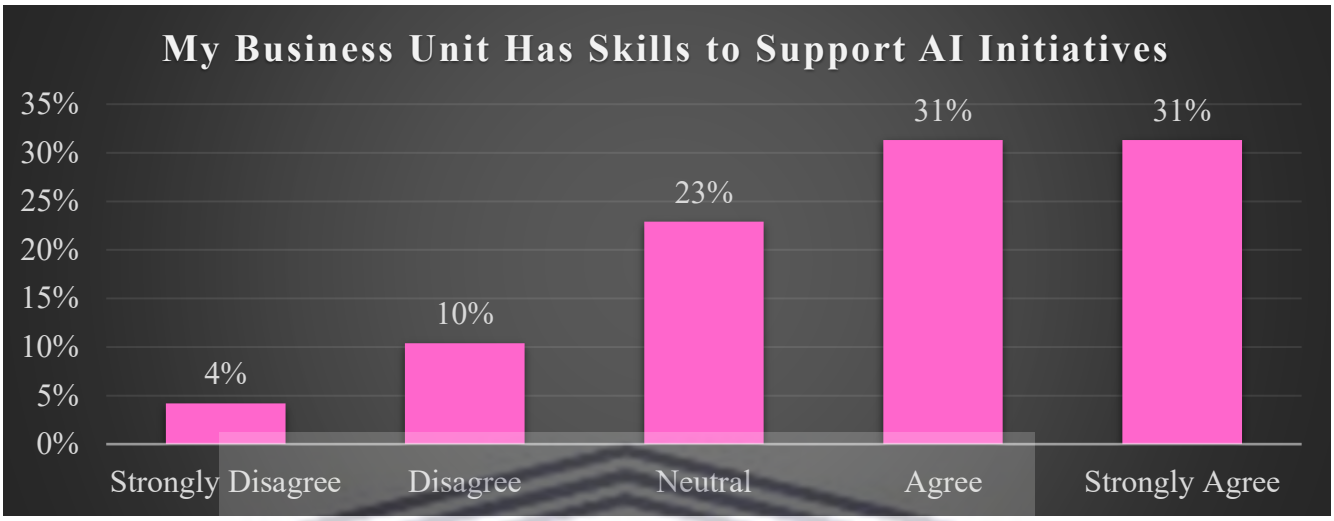


Figure 4.5.2.1: My business unit has the necessary skills to support AI initiatives

4.6.1.2 My Business Unit Is Committed to Ensuring That Employees Are Trained In AI

Figure 4.5.2.2 shows the frequency of responses based on the business unit's commitments to AI training. A summary hinges on the question "My business unit is committed to ensuring that employees are trained in AI". According to the results, 38% of respondents agree that their business units are committed to providing staff with the necessary training to support AI projects. This is also supported by the strongly agreed respondents. 21% of the respondents provided a neutral response, followed by a smaller 12% percentage that disagreed and strongly disagreed. According to the literature, AI training within an organisation reduces barriers and enhances acceptance of technology; thus, if organisations want to be better equipped to implement AI, they need to ensure that staff are knowledgeable and trained in AI (Lee & Kim, 2017). The results indicate that the majority of the respondents believe that there are training investment efforts and commitment within the organisation to ensure that employees are trained on AI.

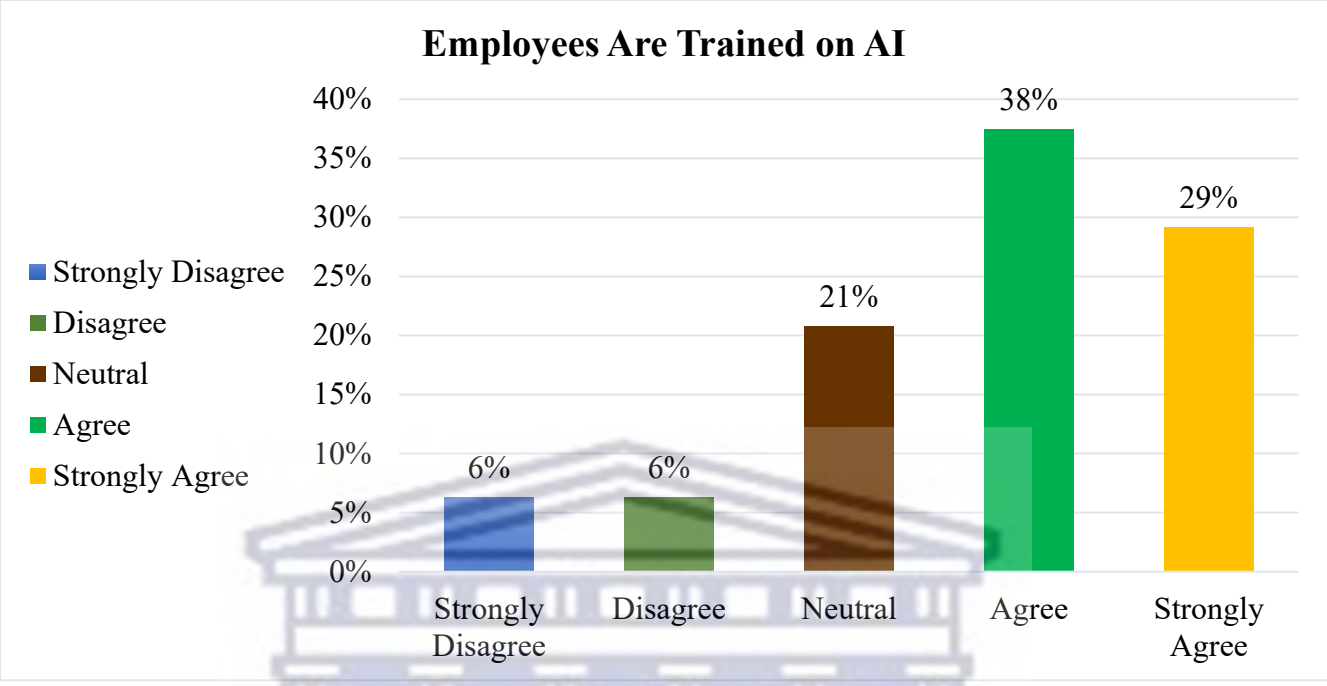


Figure 4.5.2.2: My business unit is committed to ensuring that employees are trained in AI

4.6.1.3 My Organisation Has a High Degree of AI Expertise

Figure 4.5.2.3 shows the frequency of responses based on the statement "My organisation has a high degree of AI expertise". It has been stated that many respondents (53%) believe that their organisations have the expertise and knowledge to support AI, and this is indicated by agreeing and strongly agreeing on sentiment. However, several respondents (27%) also acknowledged a shortage of expertise and this is evidenced by disagreeing and strongly disagree responses. Furthermore, 21% of the respondents were uncertain of the level of AI expertise within their organisation, as indicated by a neutral response. Rainey et al. (2021) emphasise the apparent lack of skills and knowledge for deploying AI solutions and the necessity for formalised AI education to equip present and potential workers for impending AI integration initiatives.

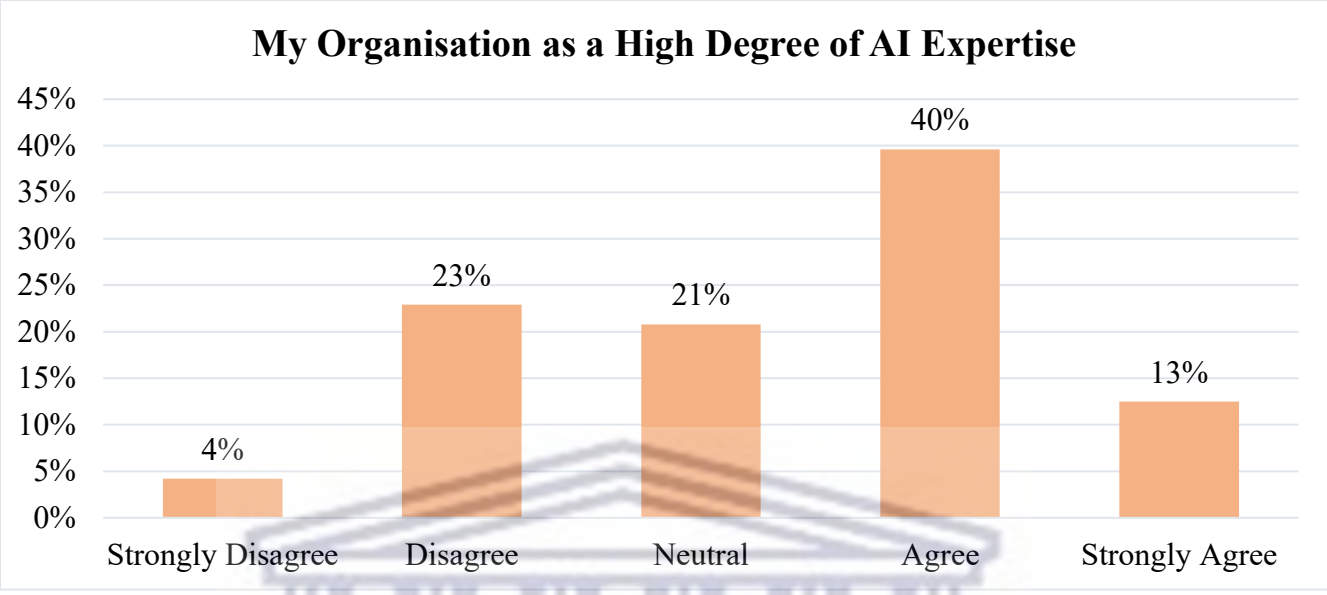


Figure 4.5.2.3: My organization as a high degree of AI expertise

4.6.1.4 My Business Unit Will Need to Employ Staff to Support AI

Figure 4.5.2.4 shows the frequency of respondents relating to the question "My business unit will need to employ staff to support AI". Most respondents agree that their business unit will need to employ a staff member who has expertise to support AI initiatives. This statement is further backed by strongly agreed sentiment, which accounts for 25% of the total respondents. Meanwhile, 25% were unsure, and this also relates to the previous question regarding existing skills within the organisation where 23% of the respondents were not certain. Companies must recruit IT professionals with AI expertise to provide the knowledge and skills and organisation required to develop complex AI technologies (Molla & Licker, 2005). The results reveal that there is a demand for AI skills, as indicated by the majority of respondents stressing the need for their business unit to hire additional people to assist with AI.

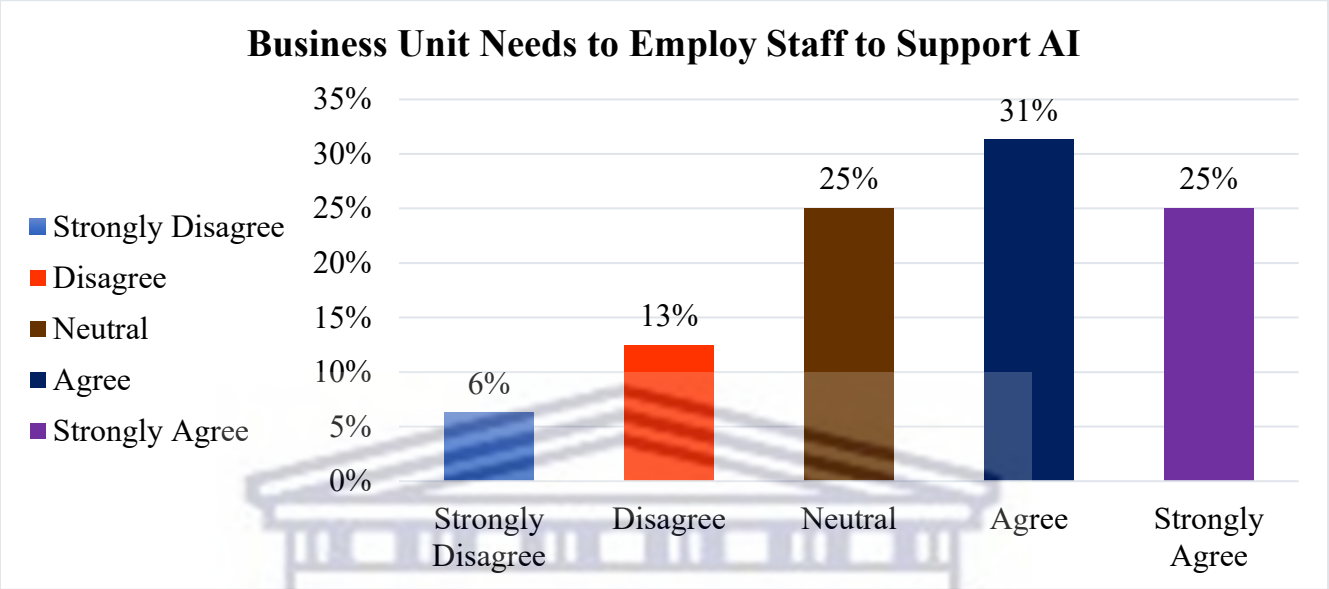


Figure 4.5.2.4: My business unit will need to employ staff to support AI

4.7.1 Security

4.7.1.1 Security Is a Crucial Factor in Technology Adoption in My Organisation

Figure 4.5.3.1 displays the frequency of responses based on AI security considerations throughout the organisation. The frequencies are related to the question "Security is a crucial factor in technology adoption in my organisation". According to the survey results, the majority of respondents (65%) agree that security is a crucial factor in the business when it comes to new technology adoption, and another 25% strongly agree. Approximately, 6% of those surveyed were neutral, indicating that they are unsure of the function and importance of security in technology adoption. It should be emphasised that only a few respondents disagree with security impeding technology adoption, as seen by 2% disagree and 2% strongly disagree. This shows that security is an essential element in the business when it comes to new technology. Today's highly competitive markets force firms to become more efficient, which is accomplished by implementing new or sophisticated technologies and systems. Because of unacceptable security level breaches, the contribution of sophisticated systems is frequently compromised (Doherty,

Anastasakisa and Fulford, 2013). The study's findings highlight the importance of security in the adoption of new technology.

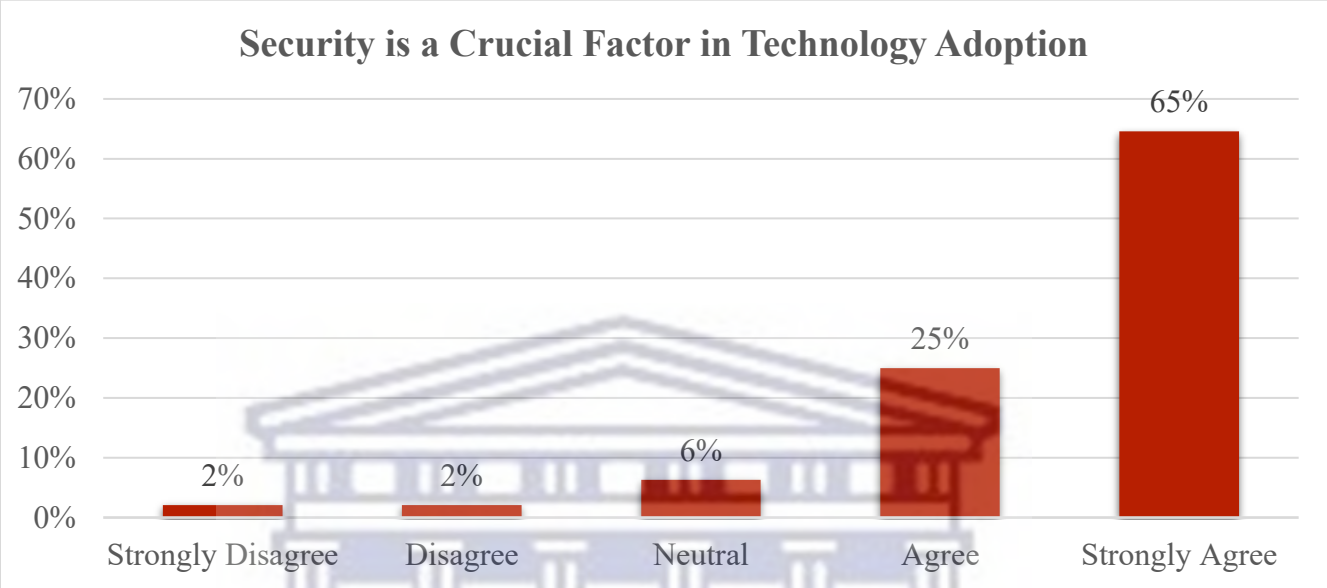


Figure 4.5.3.1: Security is a crucial factor in technology adoption in my organization

4.7.1.2 Our Existing Infrastructure Security Supports Data Integrity

Figure 4.5.3.2 illustrates the number of responses based on the existing security's ability to maintain data integrity. Participants were asked to respond to the question "Our existing infrastructure security supports data integrity". According to the results, a sizeable proportion of respondents (54 %) agree that the organisation's current security infrastructure can maintain data integrity. About 8% were neutral, and 4% strongly disagreed, suggesting that their current security infrastructure could be exposed to data integrity breaches. Data integrity breaches are regarded as one of the most damaging to organisations among a broad variety of potential security breaches. To avoid integrity breaches, organisations should devise a method of resolving the problems associated with preserving data integrity. (Kumar, Agrawal & Khan,2020). According to the results, data integrity breaches do not appear to be a concern, as the majority of respondents

indicated that their current infrastructure is secure and capable of maintaining data integrity.

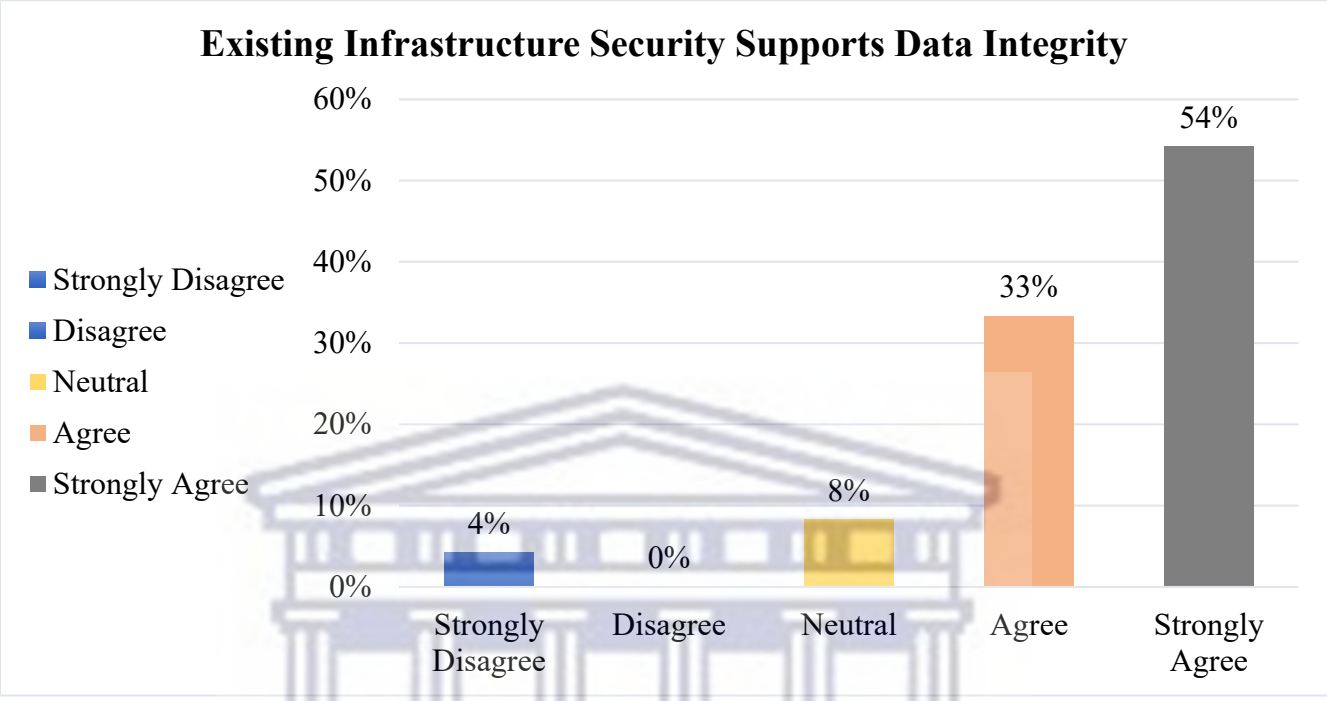


Figure 4.5.3.2: Our existing infrastructure security supports data integrity.

4.7.1.3 The Current Technology Is Secure, There Are Limited Security Breaches

Figure 4.5.3.3 illustrates the number of replies to the question "The current technology is secure, there are limited security breaches". Respondents were asked to rate how confident they are that their present technology is secure and that there are minimal security breaches. According to the results, the majority of respondents (81%) believe that current security measures can protect the infrastructure from security breaches, and this is based on the entire response from agreeing to strongly agree. 8 % disagreed and strongly disagreed, indicating a possible security breach in the current infrastructure. The remaining 10% responded with a neutral, which might be read as not being aware of any security issues. AI potentially creates a range of possible risks, and organisations are required to develop mitigation strategies (Zhu et al., 2006). The results reveal that most organisations have a well-secured infrastructure in place to limit security breaches.

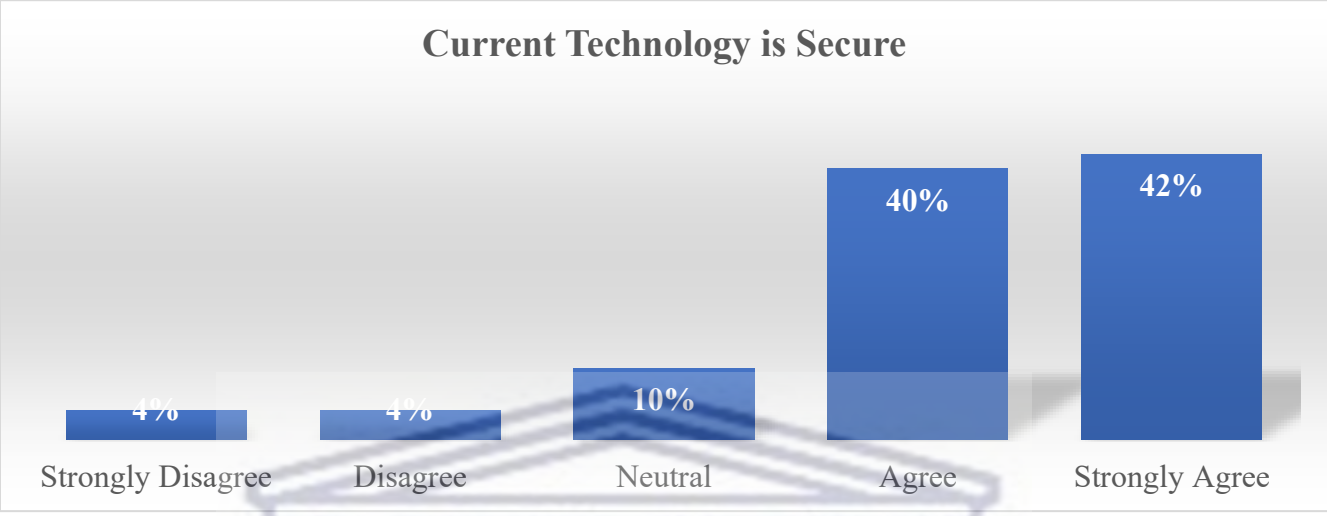


Figure 4.5.3.3: The current technology is secure, there are limited security breaches

4.7.1.4 Security Breaches Can Increase with New Technology Adoption

Figure 4.5.3.4 summarises the number of responses based on the increased risk of a data breach due to new technology implementation. Responses were based on the question "Security breaches can increase with new technology adoption". According to the results, many respondents (46%) agree that adopting AI will increase security breaches within their firm, whereas 23% strongly agree with this response. 19% of the participants were neutral. 12% disagreed and strongly disagreed with the possibility of more security breaches due to new technology adoption. These results suggest that most firms have the necessary measures in place to manage security breaches within their organisation. Despite the significant increase in security prevention and detection technologies, businesses continue to face security breaches, particularly data breaches. The costs of a data breach are rising, but the cost goes beyond financial penalties. Data breaches can have a major effect on a company's brand and share price (Ibrahim et al., 2020).

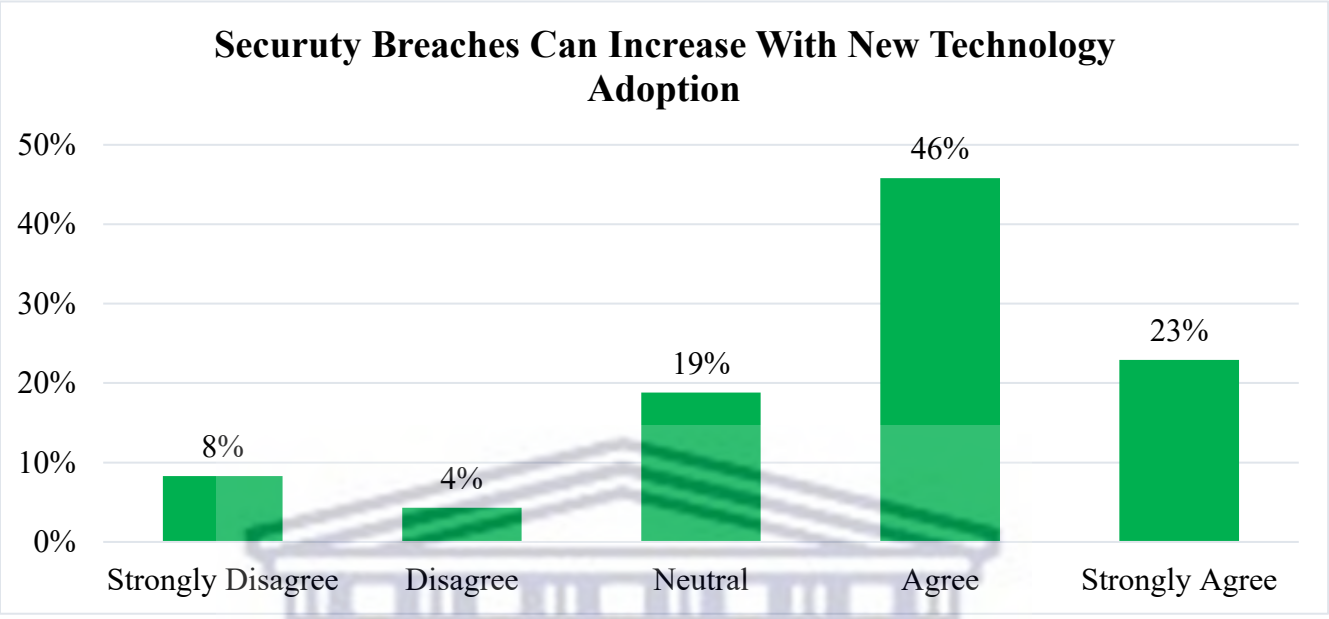


Figure 4.5.3.4: Security breaches can increase with new technology adoption

4.8.1 Complexity

4.8.1.1 AI Adoption Has a Lot of Technological Interdependencies

Respondents were asked to record the degree to which they believed AI adoption has a lot of technological interdependencies. Figure 4.5.4.1 provides a summary of responses to the question "AI adoption has a lot of technological interdependencies". A significant number of respondents (67%) think that AI can be difficult to deploy due to its various interdependencies, and this is derived from the agreed and strongly agreed response. The figure also shows that 27% of respondents were neutral, and this could be related to the state of AI adoption in their organisations. The remaining 6% disagreed. The results indicate that most respondents believe that deploying AI is difficult due to its relationship with other variables.

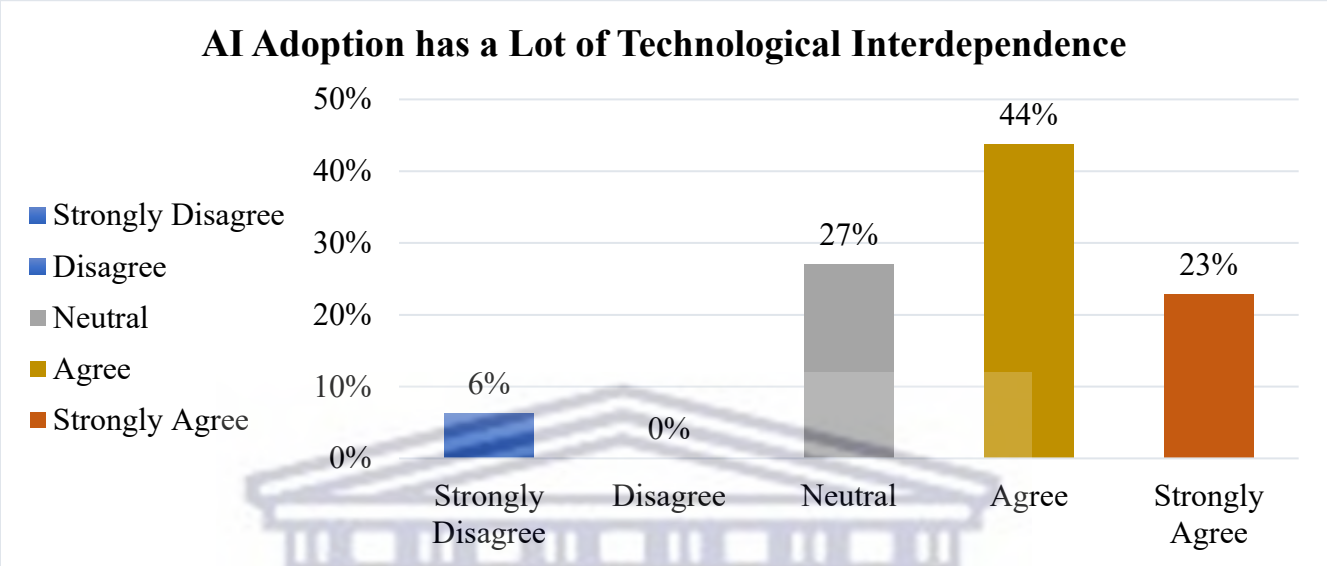


Figure 4.5.4.1: AI adoption has a lot of technological interdependencies.

4.8.1.2 AI Technology Has a Lot of Uncertainties

Respondents were asked to record the degree to the following question: "AI technology has a lot of uncertainties". It was recorded in the results in Figure 4.5.4.2; the majority of respondents (38%) agree that AI has uncertainties. 6% of the respondents further agreed by recording a strongly agreed response. 31% of respondents were neutral about whether AI technology has a lot of uncertainties or not. However, a total of 25% of the participants disagreed and strongly disagreed with that notion. When talking about artificial intelligence, an agent faces uncertainty in decision-making when he/she tries to perceive the environment for information. In circumstances where technology is not fully understood, organisations may build answers to these novel technologies by relying on organisations that they perceive to be successful (Liang et al., 2007). The results indicate that there is a lack of understanding of AI technology and that there is a need to interact deeply with AI educational programmes.

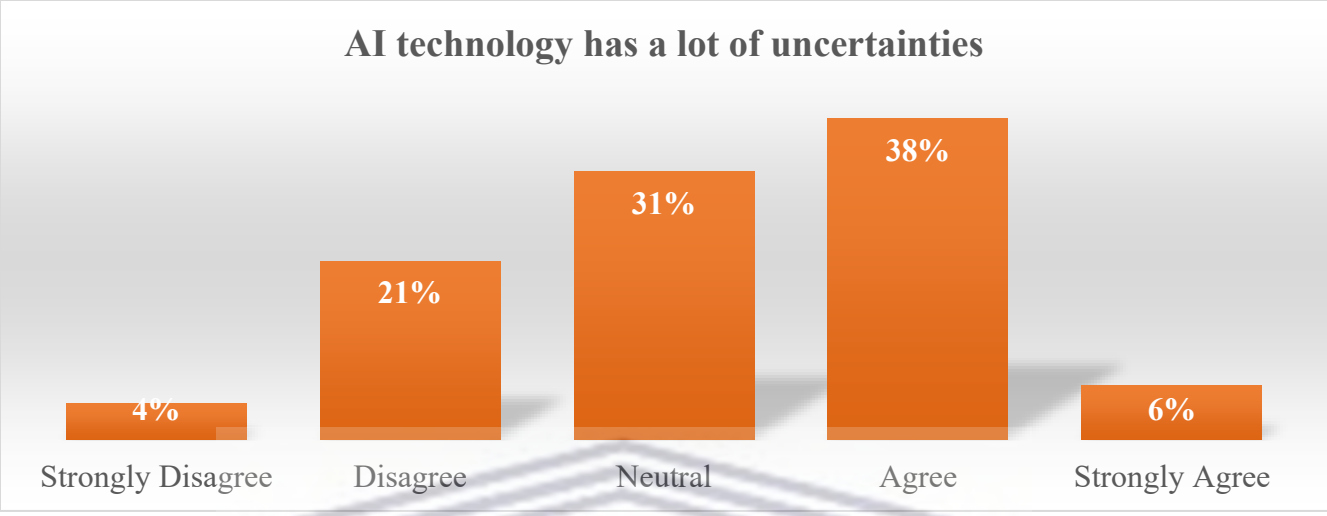


Figure 4.5.4.2: AI technology has a lot of uncertainties.

4.8.1.3 AI Technologies Are Complex to Implement

Respondents were asked to record the degree to which they believed that AI technologies are complex to implement. Figure 4.5.4.3 presents a summary of the respondent's frequency; this was based on the question "AI technologies are complex to implement". The results indicate that most of the respondents (35%) are unsure of the complexities surrounding the implementation of AI, whereas an accumulative 45% agreed and strongly agreed to believe that AI is difficult to implement. About 16% of respondents disagreed and strongly disagreed that AI is difficult to implement. The results suggest that there is continuous training in AI required to ensure employees are skilled in AI technologies.

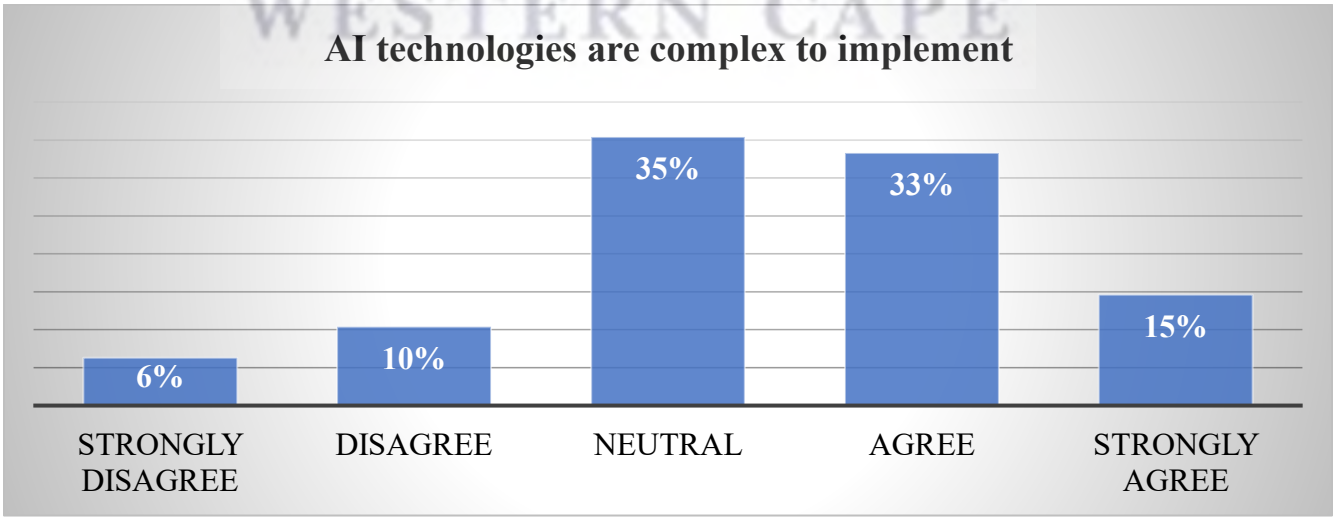


Figure 4.5.4.3: AI technologies are complex to implement

4.9 Organisational Factors

Tables below present frequencies of responses based on management support for AI adoption. Respondents were asked to rate the degree to which they think management supports the adoption of AI.

4.9.1 Management Support

4.9.1.1 Top Management in My Business Unit Is Likely to Invest Funds In AI

Respondents were asked to rate the likelihood that top management will invest funds in AI in their business unit. Figure 4.6.1.1 summarises the number of responses based on the question "Top management in my business unit is likely to invest funds in AI". According to the results, half of the respondents (50%) believe that senior management is likely to invest in AI, with 15% strongly agreeing. An additional 27 % were uncertain. The remaining 8% are responders that did not agree. According to a study by Lee and Kim (2007), when senior leadership endorses technology adoption initiatives, adequate resources can be committed and prioritised. The results of the study suggest that the majority of the respondents believe that senior leaders in their businesses are likely to commit resources in support of AI initiatives. The study's results show that senior executives are willing to invest in AI projects.

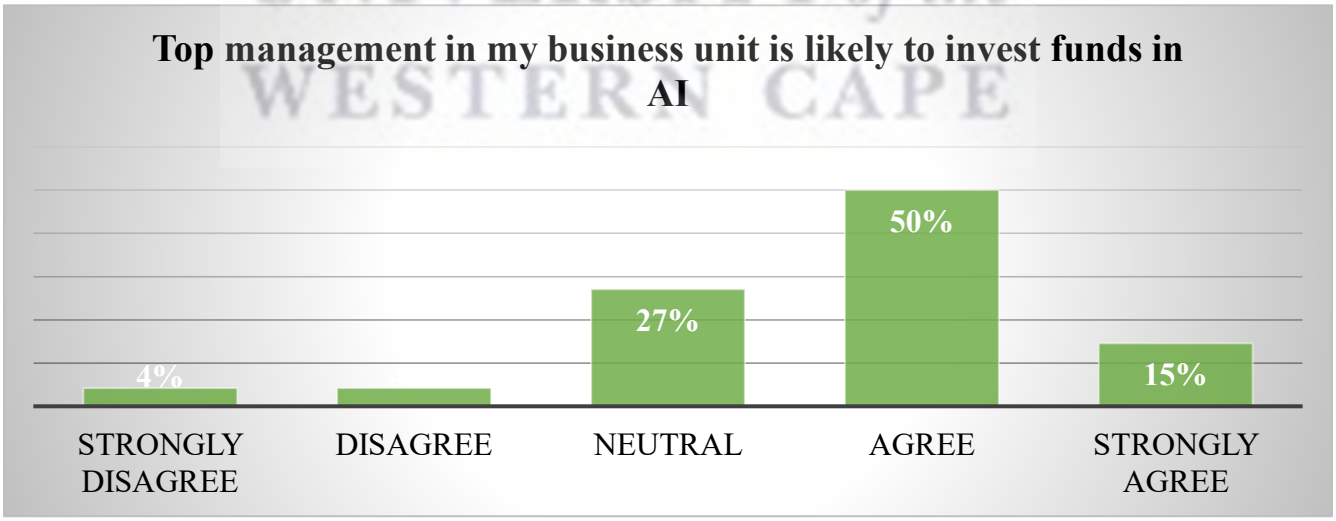


Figure 4.6.1.1: Top management in my business unit is likely to invest funds in AI

4.9.1.2 Top Management in My Business Unit is Willing to Take Risks Involved in The Adoption of AI

Respondents were asked to rate the degree to which they believed top management was willing to take risks associated with AI adoption. Figure 4.6.1.2 depicts the results of the question "Top management in my business unit is willing to take risks involved in the adoption of AI. According to the research results, the majority (48%) of respondents agree that top management in their business unit is willing to assume the risks associated with AI adoption, with 13% strongly agreeing. 29% of respondents were uncertain. The remaining 10% disagree, implying that they do not believe top management is willing to take the risks associated with AI adoption. Senior leaders are responsible for strategic technology adoption. Leaders must build strategic risk management strategies to identify and manage any risks associated with technology adoption (Vasile & Croitoru, 2012).

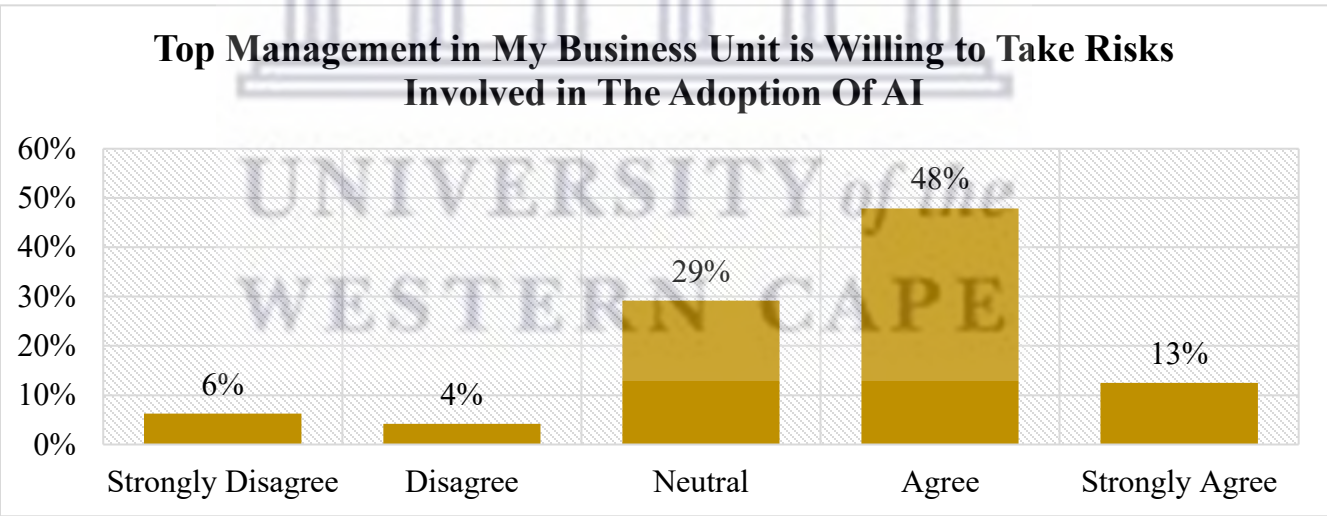


Figure 4.6.1.2: Top management in my business unit is willing to take risks involved in the adoption of AI

4.9.1.3 Top Management in My Business Unit is Likely to Consider the Adoption of AI to Gain a Competitive Edge

Figure 4.6.1.3 depicts the results of the question “Top management in my business unit is likely to consider the adoption of AI to gain a competitive edge”. Respondents were asked to rate how likely they thought top management in their business unit would consider using AI to gain a competitive advantage. According to the research results, a high proportion of participants (48%) agree that top management will adopt AI to gain a competitive advantage, with 29% strongly agreeing. 17% of those polled were undecided. At least, 2% disagreed and 4% strongly disagreed. As the sector becomes more competitive, businesses can gain a competitive edge in the market by implementing technological advancements (Chau & Kuan, 2001). The results demonstrate that top executives are willing to implement AI to stay ahead of the competition.

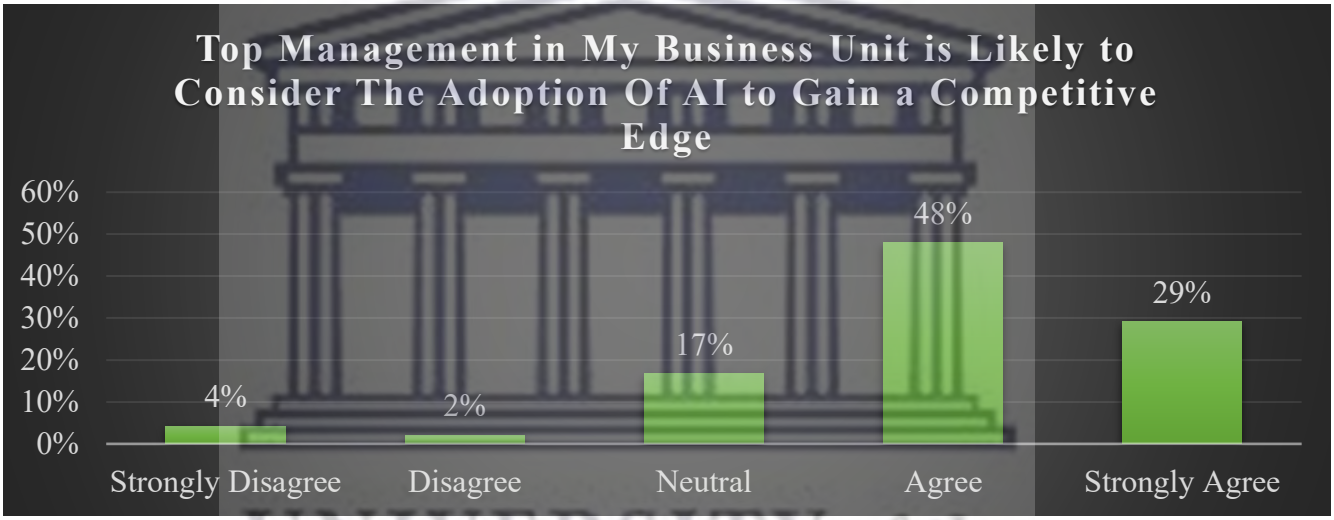


Figure 4.6.1.3: Top management in my business unit is likely to consider the adoption of AI to gain a competitive edge.

4.9.1.4 Top Management in My Business Unit is Knowledgeable About AI

Figure 4.6.1.4 depicts the frequency distribution of responses to the question “Top management in my business unit is knowledgeable on AI”. Respondents were asked to rate how informed they thought top management in their business unit was about AI. 40% of respondents are unsure whether top management is informed about AI. 37% of respondents believed that their leaders have appropriate knowledge of AI, and 16% strongly agreed in support. 6% of respondents acknowledged a lack of AI understanding among their executives, 2% disagree and 4% strongly disagree. Top management's knowledge of AI is essential because whenever the benefits of an

innovation are well recognised, the likelihood of other functional groups within the organisation adopting it increases (Rogers, 2004).

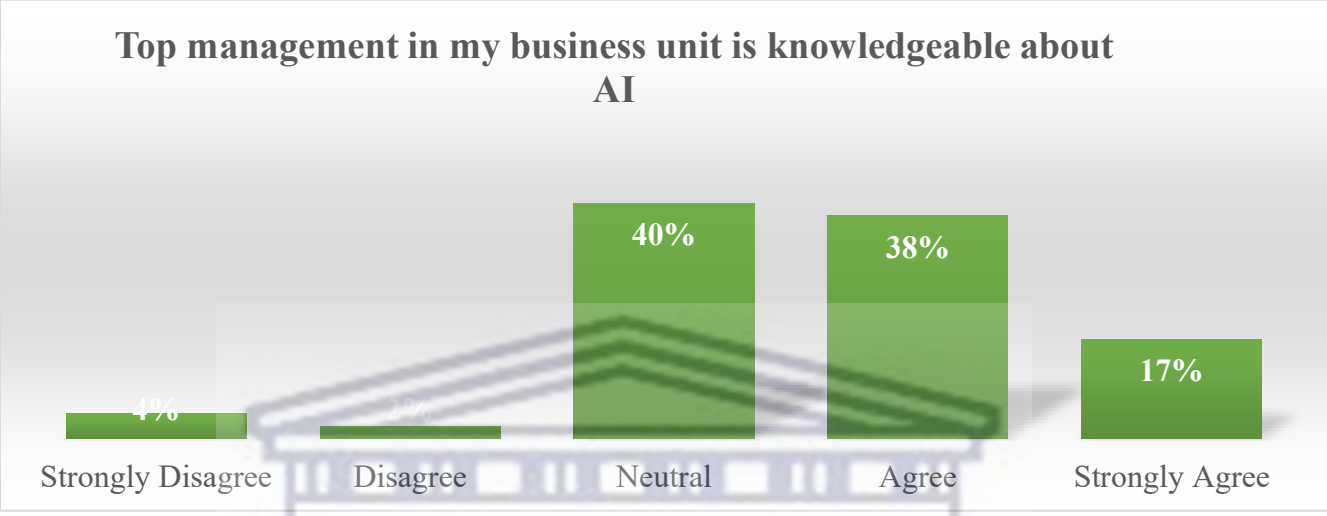


Figure 4.6.1.4: Top management in my business unit is knowledgeable about AI.

4.10 Cost

4.10.1.1 AI Technologies Have High Setup Costs

Respondents were asked to indicate how much they believed AI technologies had significant setup costs. Figure 4.6.2.1 depicts the answer to the question "AI technologies have high setup costs". According to the findings, the majority of respondents (35%) agree that AI has high start-up costs, while 27% strongly agree. A further 23% of participants were neutral, with the remainder disagreeing and strongly disagree, accounting for 4% of the total responses. Cost-benefit analysis is critical in guiding technology adoption decisions. It guided whether to continue innovation, as well as identifying alternative opportunities (Harrison et al., 2019). In summary, the results

indicated that the majority of respondents perceive AI is expensive to set up.

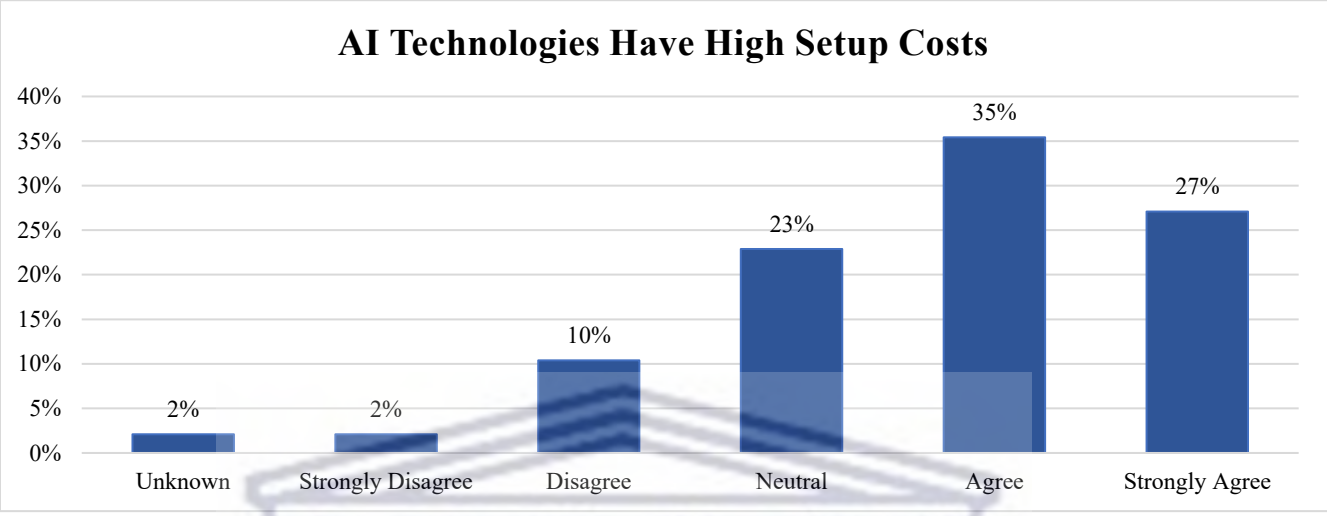


Figure 4.6.2.1: AI technologies have high setup costs.

4.10.1.2 AI Technologies Have High Running Costs

Figure 4.6.2.2 shows frequencies of response based on the question "AI technologies have high running costs". Respondents were asked to record the degree to which they believed AI technologies have high running costs. According to the results, the majority of respondents (40%) believe that AI has significant operating costs. On the other hand, 10% of respondents disagree with the sentiment, while another 6% strongly disagree with AI having significant operating costs. A further 21% provided a neutral response. AI technologies are expensive, although when compared to traditional technologies, AI is substantially less expensive. Despite the cost, organisations may deploy AI based on the benefits (Mariethu, 2019).

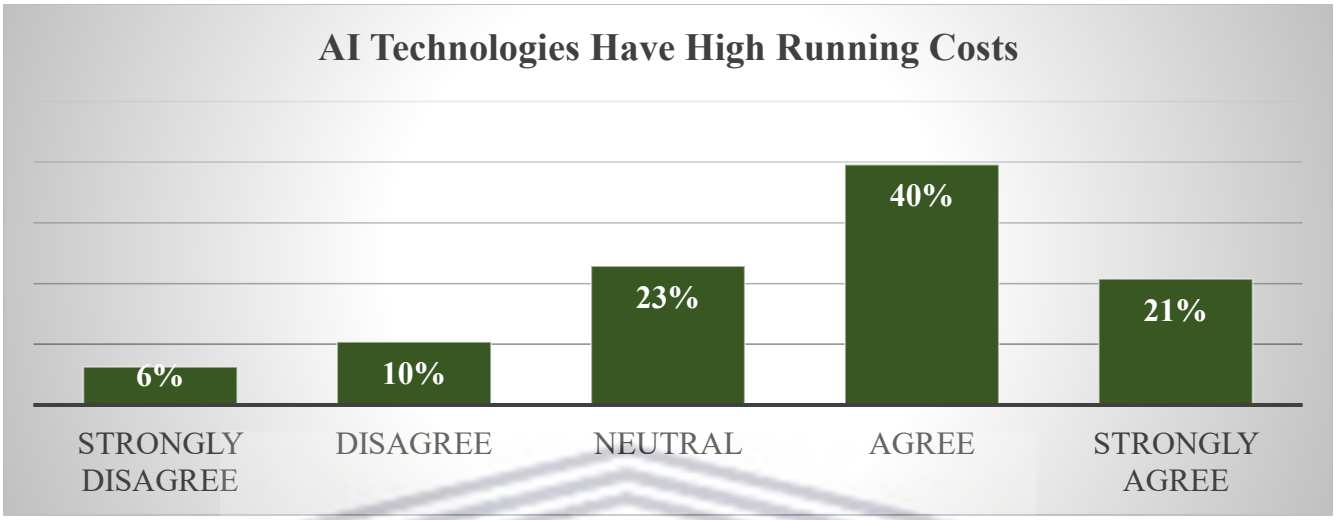


Figure 4.6.2.2: AI technologies have high running costs

4.10.1.3 AI Technologies Have High Maintenance Costs

Figure 4.6.2.3 depicts the frequency of responses to the question "AI technologies have high maintenance costs". Respondents were asked to rate their belief that AI systems had significant maintenance costs. According to the findings, 40 % of respondents agree that AI systems entail substantial maintenance expenses, and 19 % strongly agreed. 27 % were neutral, indicating that they are unsure about the costs of AI. A total of 15% of respondents disagreed, as indicated by the expressions disagree and strongly disagree.

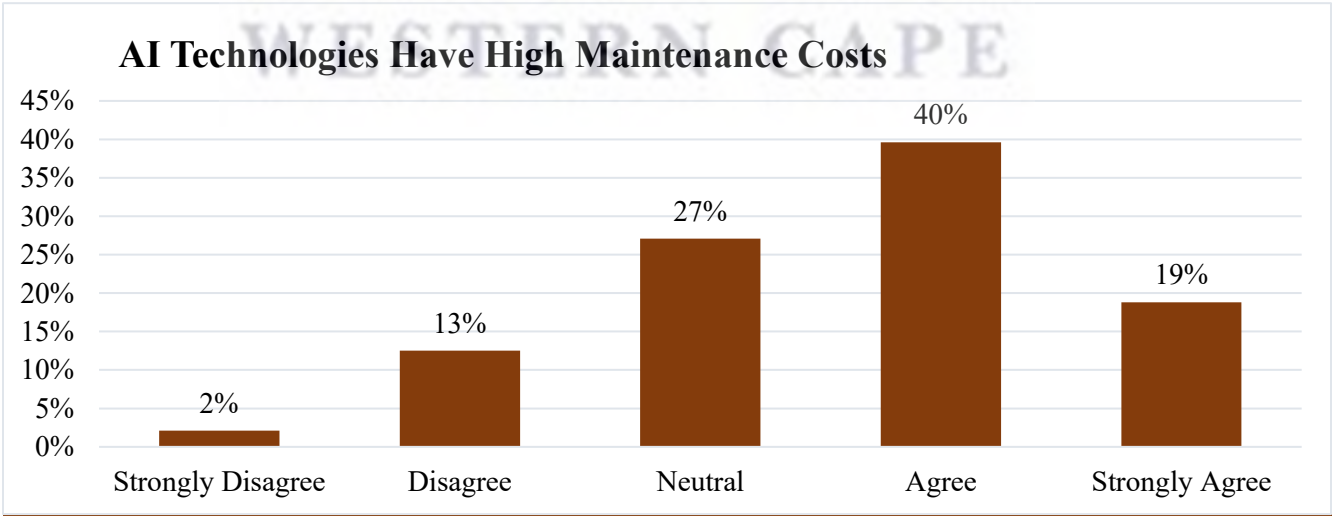


Figure 4.6.2.3: AI technologies have high maintenance costs

4.10.1.4 My Business Unit Constantly Invests in New Technologies to Improve Business Operations

Respondents were asked to record the degree to which they believed their business unit will invest in new technologies to improve business operations. Figure 4.6.2.4 shows frequencies based on the question "My business unit constantly invests in new technologies to improve business operations". According to the results, the majority (44%) of respondents agree that their company will invest in new technology to improve business operations. 23% of the participants were neutral, 8% disagreed and 4% strongly disagreed. It has been discovered that artificial intelligence has the potential to transform and automate business operations, as well as provide insights into the business value chain, allowing senior executives to make better-informed decisions (Chao, Yang & Jen, 2007).

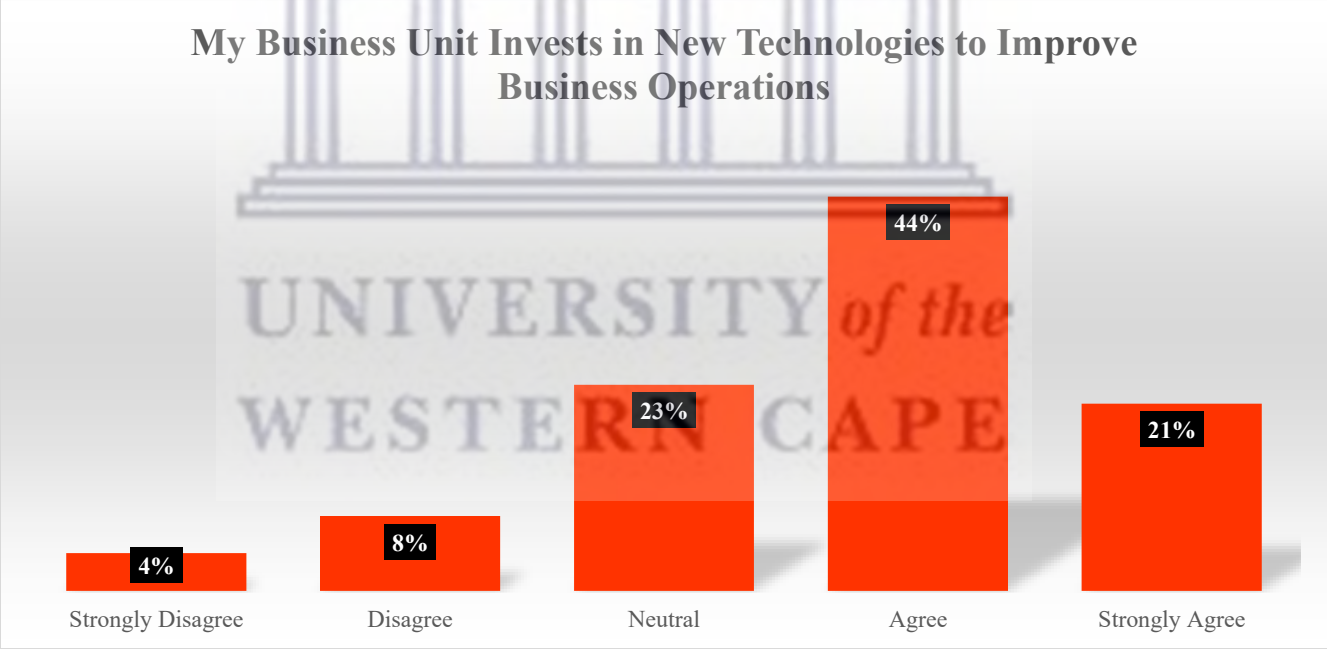


Figure 4.6.2.4: My business unit constantly invests in new technologies to improve business operations.

4.11 Perceived Benefits

The tables below present frequencies of responses based on the organisation's perceived benefits of AI.

4.11.1.1 My Business Unit Sees the Value in Investing Resources into AI Adoption

Respondents were asked to indicate how much value they believe their business unit sees in investing resources in AI adoption. Figure 4.6.3.1 shows the results of the question "My business unit sees the value in investing resources into AI adoption". According to the research results, 48% of respondents agree that their business unit recognises the value of AI resource investment, which is supported by 17% of respondents who gave a strongly agreed response. However, 4% of respondents disagreed with that notion. Furthermore, 29% of respondents gave a neutral response, and 2% of the respondents withheld their response. This is indicated by the unknown category. AI is becoming increasingly important in the supply chain and logistics industries. Increasingly, firms have begun to incorporate AI capabilities into operations and investment (Toorajipour, Sohrabpour & Fischl, 2021).

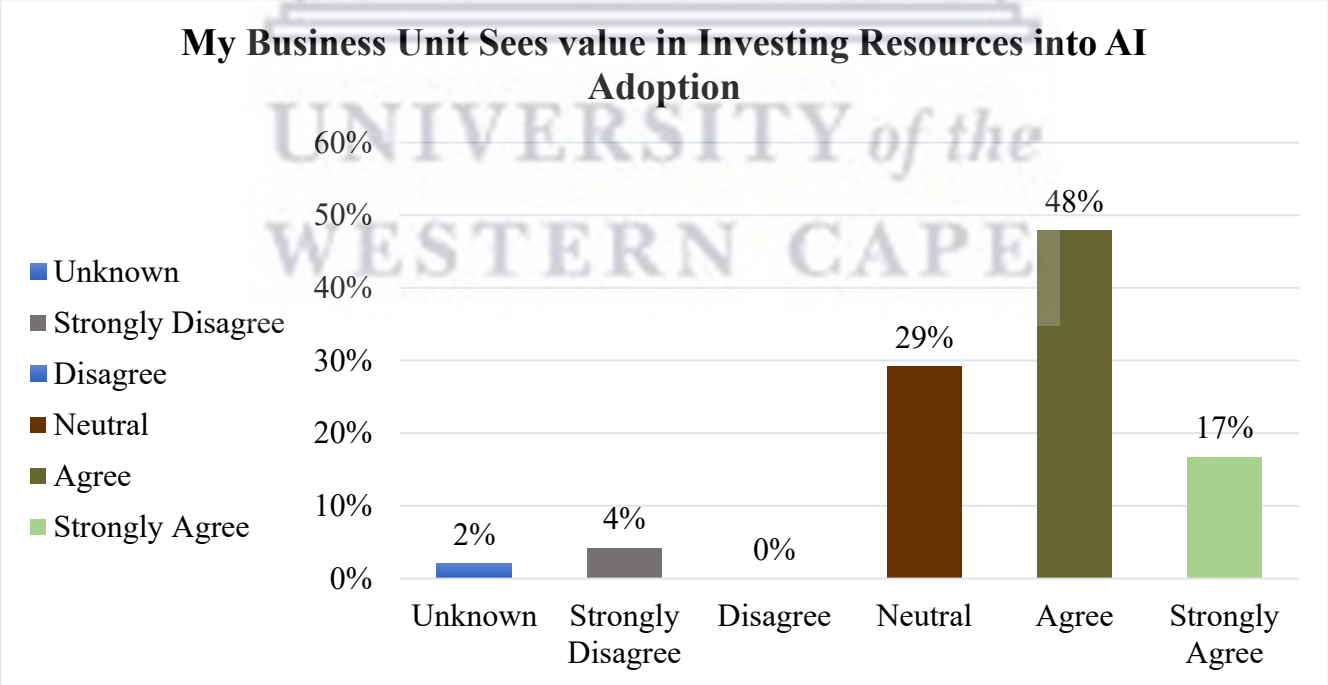


Figure 4.6.3.1: My business unit sees the value in investing resources into AI adoption.

4.11.1.2 Adopting AI Is Important in Improving Operational Efficiency in My Business Unit

Figure 4.6.3.2 depicts the frequency distribution of responses to the question "Adopting AI is important in improving operational efficiency in my business unit". Respondents were asked to rate how important they thought AI was in improving operational efficiency in their business unit. According to the research results, the majority of respondents (40%) believe AI is important for improving operational efficiency, and another 29% strongly agree. 2% of respondents withheld their response, as indicated by the unknown category. Furthermore, 25% gave a neutral response, indicating that they are unaware of the benefits of AI in improving operational efficiencies. The evolving needs of customers, as well as disruptive technology, have a significant effect on business operation. AI supports business owners in translating these difficulties into opportunities for development. Organisations must view AI as a strategic investment to boost business productivity (Enholm et al., 2021).

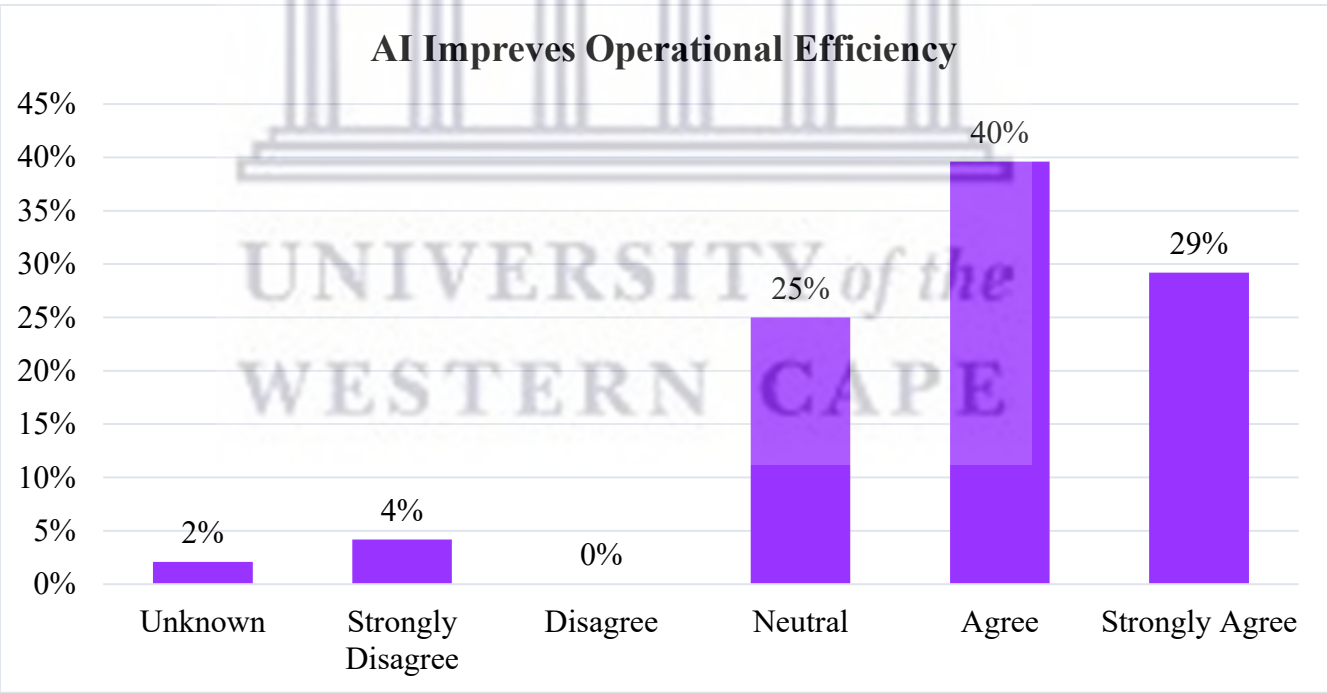


Figure 4.6.3.2: Adopting AI is important in improving operational efficiency in my business unit.

4.11.1.3 Adopting AI is Important in Improving Customer Service

Figure 4.6.3.3 depicts the frequency of responses to the question "Adopting AI is important in improving customer service". Respondents were asked to rate how significant they thought AI adoption was for enhancing customer service. According to the findings, the majority of respondents (44%) believe AI is critical to improving customer service. This viewpoint is endorsed by 25% of those who responded with a strong agreement. A substantial number of respondents were unsure of the role of AI in improving customer service, as seen by a 23% neutral response. Furthermore, 6% of respondents disagreed or strongly disagreed with the capability of AI in improving customer service. According to these results, It can be concluded that various forms of AI provide customer service departments with the ability to do more, thereby enhancing the customer experience. AI technologies can automate routine tasks, such as answering frequently asked questions, allowing customer service representatives to focus on more complex issues. Additionally, AI can provide personalized recommendations and solutions based on customer data, improving the overall customer experience. The use of AI in customer service has become increasingly prevalent in recent years, as companies recognize the potential benefits of this technology.Chatbots, for example, have become a significant aspect of customer service operations because they can manage several requests in real-time. This saves resources and effort while also allowing the company to resolve client complaints more effectively (Adam, Wessel & Benlian, 2021).

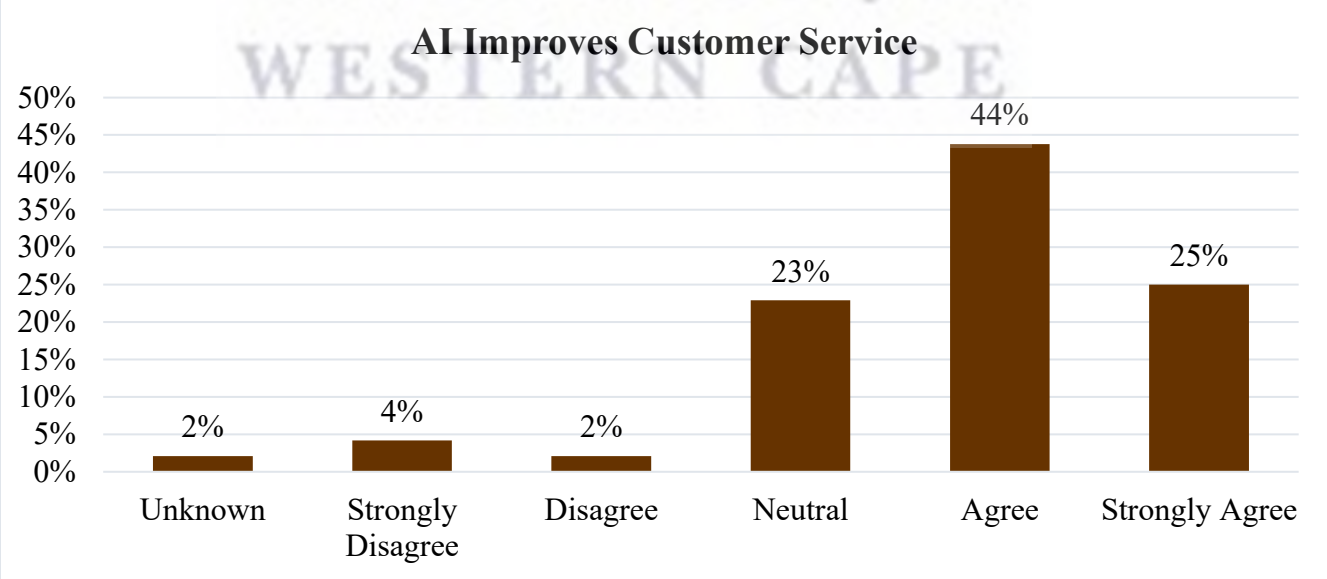


Figure 4.6.3.3: Adopting AI is important in improving customer service.

4.11.1.4 Adopting AI is Important in Reducing Operation Costs

Respondents were asked to rate how important they thought AI was in terms of lowering operating costs. The frequency of responses to the question Adopting AI is crucial in decreasing operating costs is depicted in Figure 4.6.3.4. According to the results, 46% of respondents believe AI can assist in reducing operating costs. Respondents who strongly agree account for 25% of the total response. The results also revealed that 19% of respondents were unsure of the importance of AI in lowering operational expenses, as indicated by a 19 percent neutral response. A further 8% disagreed with the role of AI in cost reduction, as measured by disagreeing and strongly disagreeing. Manyika et al. (2017) suggest that AI activities can empower firms to enhance their operations by reducing errors, improving quality and delivery, and performing tasks that may be beyond human capabilities. The use of AI can automate repetitive and mundane tasks, enabling employees to focus on more complex and creative work. Additionally, AI can analyze vast amounts of data more quickly and accurately than humans, providing valuable insights that can inform decision-making and improve business outcomes. The adoption of AI in business operations has become increasingly widespread in recent years, as companies recognize the benefits of this technology.

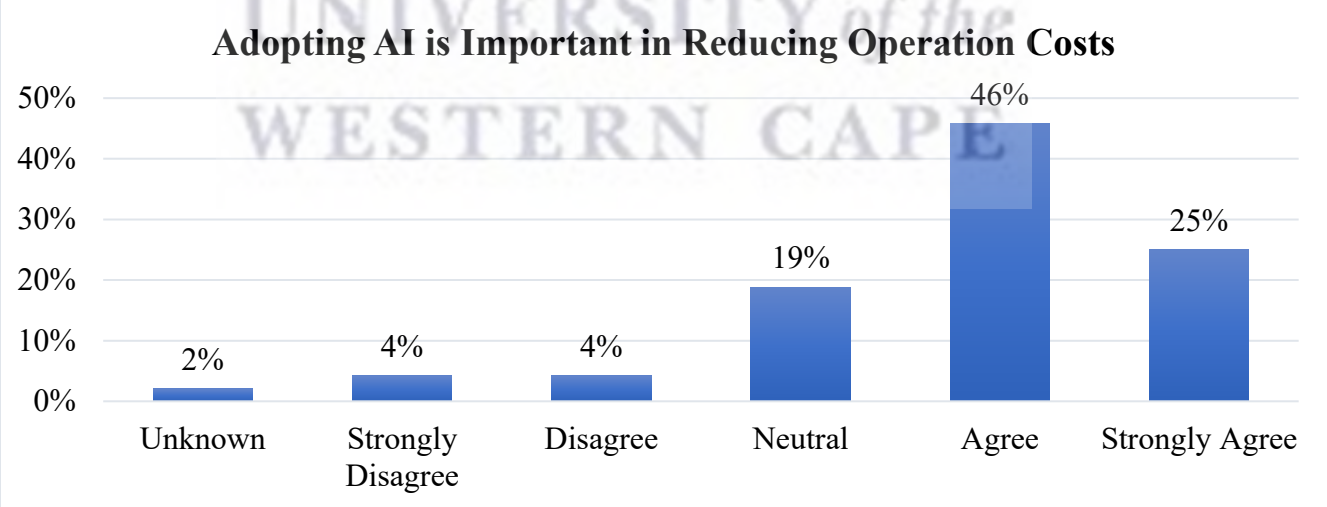


Figure 4.6.3.4: Adopting AI is important in reducing operation costs

4.12 Size

4.12.1.1 AI is Ideally Suited to Larger Organizations

The tables below present frequencies of responses based on firms' size and AI adoption

Figure 4.6.4.1 depicts the frequency of responses to the question "AI is best suited to larger organisations". Respondents were asked to indicate how much they believe AI is best suited to larger organisations. A larger portion of participants (38%) believe that AI is best suited to larger enterprises, with 17% strongly agreeing. A total of 16% of respondents disagree, indicating that AI is also appropriate for SMEs, as evidenced by both disagree and strongly disagree responses. A further 2% did not respond to this question. Many small and medium-sized business owners believe that artificial intelligence is only necessary for large corporations. It can help them compete on a whole new level with those corporations. According to Drydakis (2022) AI enables SMEs to increase their flexibility and respond quickly to constant emerging demand. AI also plays a key role in enhancing productivity for SMEs thus lowering business risks. It is crucial for small and medium-sized businesses to use AI since they require more prospects for growth than large corporations.

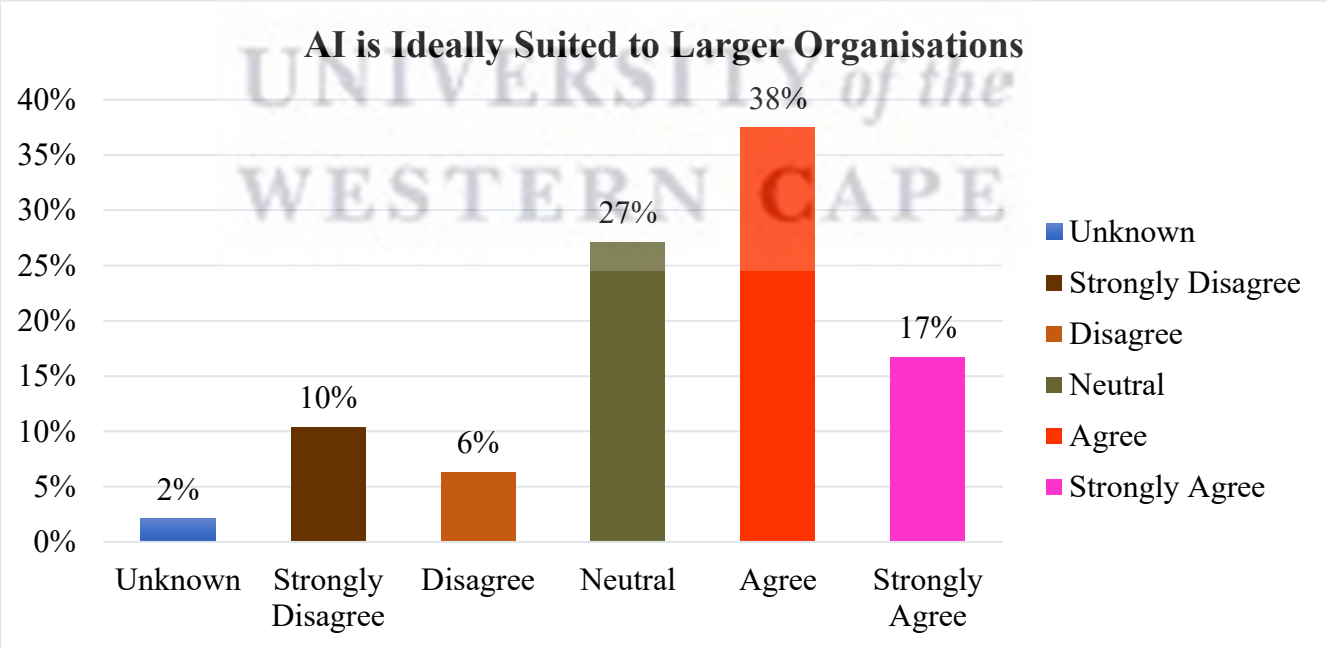


Figure 4.6.4.1: AI is ideally suited to larger organizations.

4.12.1.2 The Size of My Organisation Makes It Difficult to Adopt AI

Respondents were asked to indicate how much they considered the size of the organisation made AI adoption difficult. Figure 4.6.4.2 depicts the results of the question "The size of my organisation makes it difficult to adopt AI". The results indicate that a considerable proportion of respondents (33%) were unsure of the impact of organisation size on AI adoption, as indicated by a neutral response. The size of an organisation has an impact on AI adoption. This is according to 33% of respondents who agree and strongly agree with the question, while 13% and 19% disagree and strongly disagree with this view. A further 2% withheld their response to this question. The number of employees within an organisation is often used to determine its size (Mariethu, 2019). Larger organisations have more capacity to trial and prototype technologies, which helps reduce the risks of adopting new technology (Borgman et al., 2013).

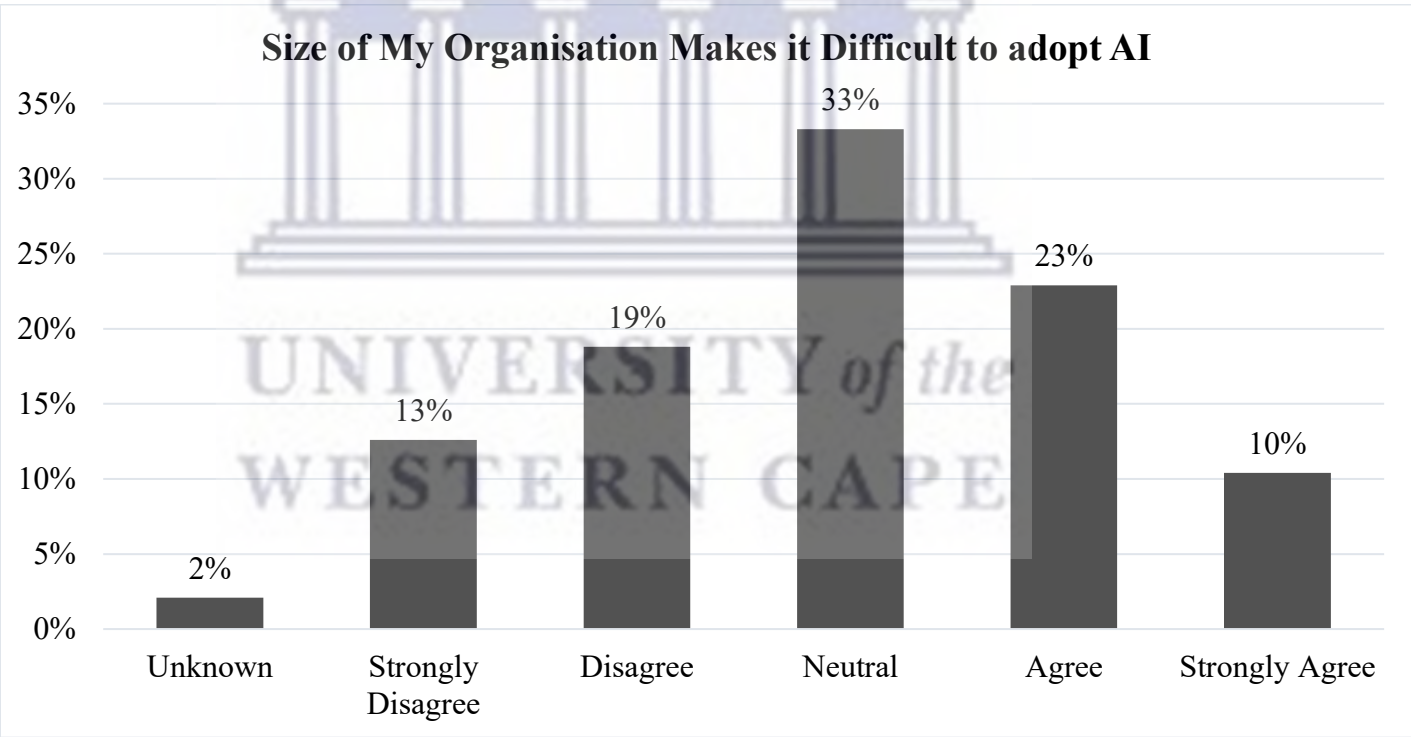


Figure 4.6.4.2: The size of my organization makes it difficult to adopt AI.

4.12.1.3 The Size of My Business Unit Makes It Difficult to Adopt AI

Respondents were asked to indicate how much they considered the size of their business unit made AI adoption problematic. Figure 4.6.4.3 depicts the results of the question "The size of my business unit makes it difficult to adopt AI". According to the findings, a substantial proportion of respondents (27%) were unsure of the impact of business unit size on AI adoption. 21% agree that the scale of the business unit makes AI adoption challenging, and this is reinforced by 8% who strongly agree, whereas 25% strongly disagreed. This is further supported by 17% who strongly disagree. Functional departments may be responsible for making decisions regarding the adoption of new technology in their areas since they are the end-users of AI technologies. According to Nguyen and Petersen (2017) there is an inverse connection between company size and the adoption of ICT. A company's size and scope are crucial factors affecting the adoption of technology (Wang et al., 2003). Due to their flexibility and ability to adjust quickly, small and medium enterprises adopt new ICTs compared to larger companies that are inflexible (Kilangi, 2012)

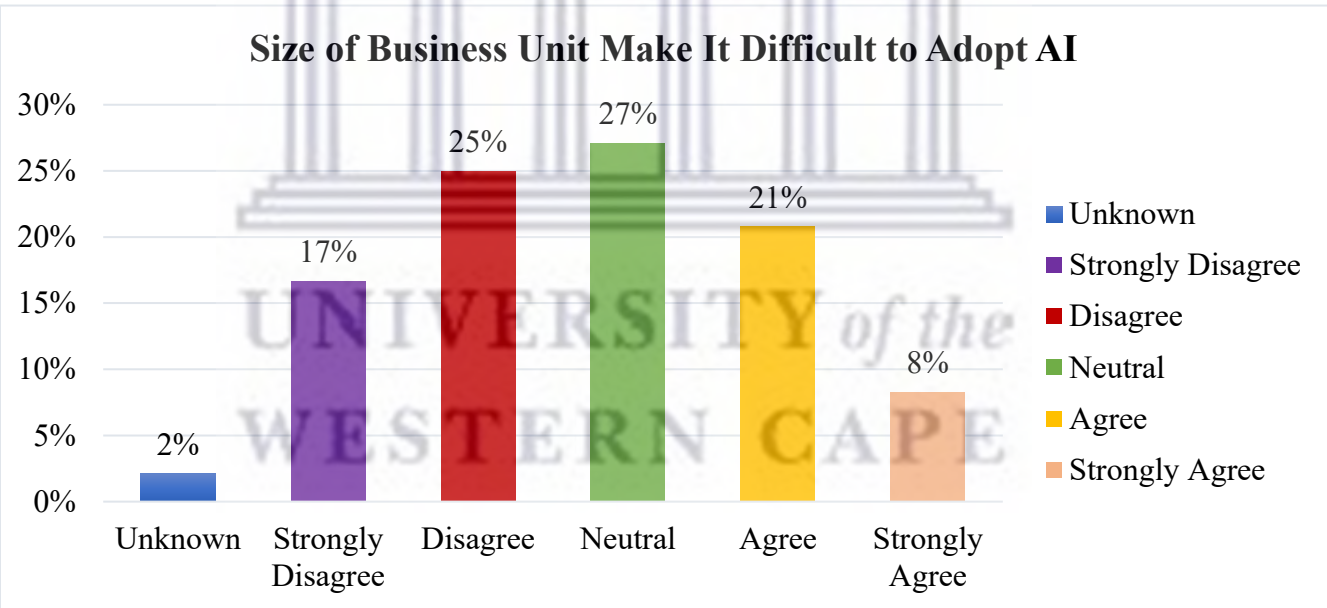


Figure 4.6.4.3: The size of my business unit makes it difficult to adopt AI

4.12.1.4 The Hierarchy in My Organisation Makes It Difficult to Adopt New Technologies

Respondents were asked to indicate how much they think the hierarchy in their organisation made it harder to adopt new technologies. Figure 4.6.4.4 depicts the results of the question "The

hierarchy in my organisation makes it difficult to adopt new technologies". According to the findings, the majority (40%) of respondents were unsure about the barriers to AI adoption provided by organisational structure hierarchy, whilst 17% agree that organisational hierarchy is a major hurdle in AI adoption, with 13 percent strongly agreeing. Furthermore, 17% of respondents disagree and 15% strongly disagree. Although it makes sense to assume that higher levels of management would significantly impact the adoption of technology given their interactions with those they report to.A study by Chelmis and Prasanna (2013) indicates that middle levels are more effective in influencing employees down the hierarchy.

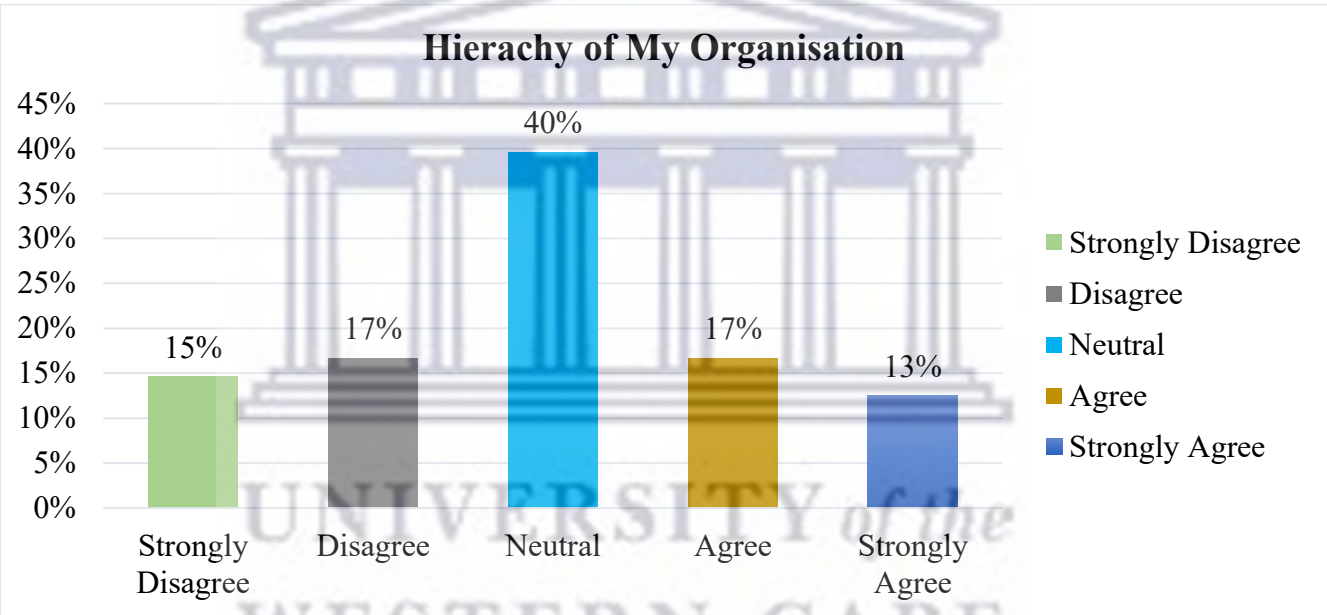


Figure 4.6.4.4: The hierarchy in my organisation makes it difficult to adopt new technologies

4.13 Environmental

4.13.1 Competitive Pressure

4.13.1.2 My Company Would Be Under Pressure from Competitors to Adopt AI

Figure 4.7.1.1 shows the frequency of responses based on an organisation's competitive pressure to adopt AI. Respondents were asked to indicate how much pressure they think the company will face from competition to use AI. The frequencies are based on the question "My company would

be under pressure from competitors to adopt AI". According to the results, a larger proportion of respondents (46%) feel that the business will experience competitive pressure to utilise AI, which is supported by 8% who strongly agree. 25% of respondents were neutral, 19% disagreed, and 2% strongly disagreed. Organisations confront the possibility of disruption because of new technologies and evolving client needs, and they must alter their in-house applications and IT systems to remain current and competitive. It should be mentioned in this context that innovative technologies are vital for firms to remain competitive (Tohãnean et al., 2020).

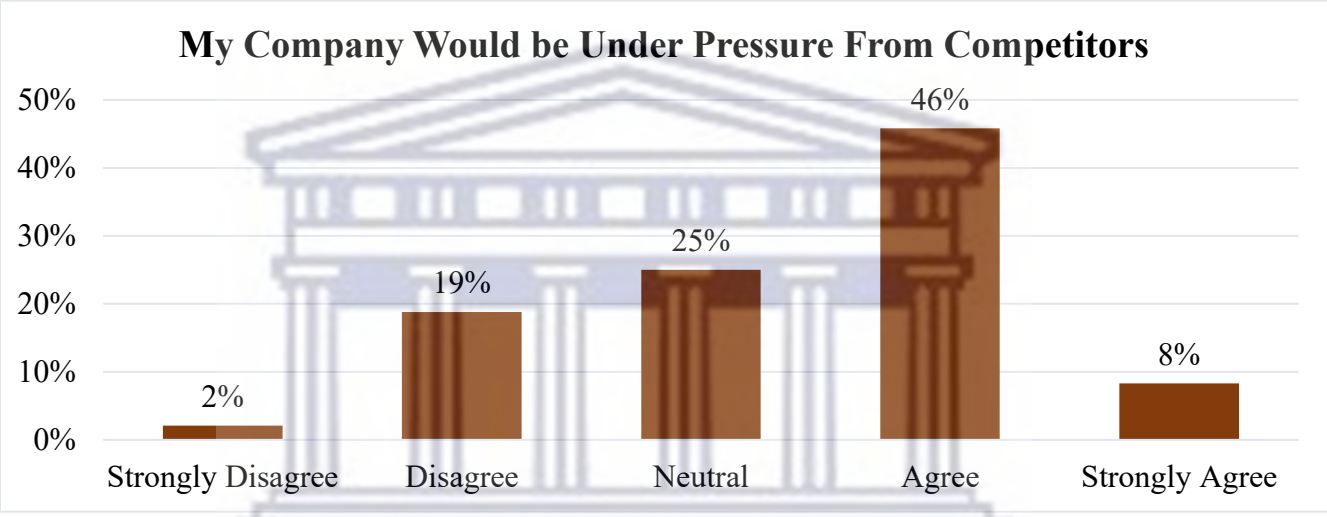


Figure 4.7.1.1: My company would be under pressure from competitors to adopt AI.

4.13.1.3 Not Embracing AI Would Put My Company at A Competitive Disadvantage

Respondents were asked to indicate to what extent they considered that not embracing AI would put the company at a competitive disadvantage. Figure 4.7.1.2 depicts the responses to the question Not embracing AI would put my company at a competitive disadvantage? According to the results, 40% of respondents agree that if the firm did not embrace AI, it would be at a competitive disadvantage. An additional 25% strongly agree with the theory, while 27% are unsure, as demonstrated by a neutral response. Furthermore, 6% disagree and 2% strongly disagree that their firm will not suffer a competitive disadvantage if AI is not implemented. According to Tohãnean et al. (2020) technology innovation can create a competitive advantage by providing novel strategies for firms to surpass their competitors.

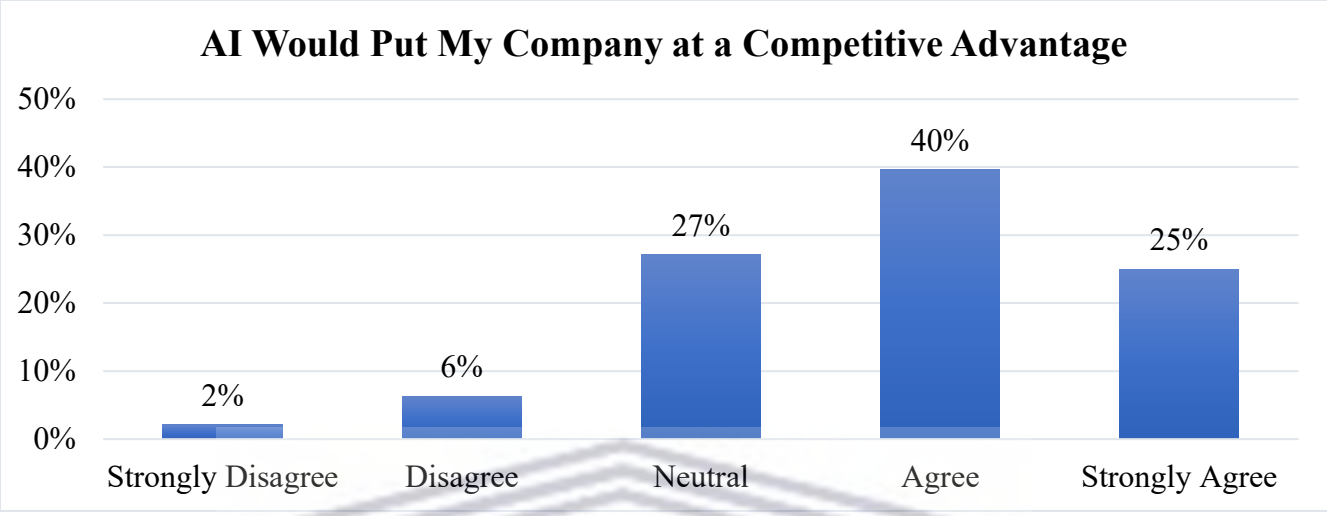


Figure 4.7.1.2: Not embracing AI would put my company at a competitive disadvantage.

4.13.1.4 Our competitors are adopting AI

Respondents were asked to rate the extent to which they believed competitors were implementing AI. Figure 4.7.1.3 depicts the frequency of responses to the question "Our competitors are adopting AI". According to the results, the majority of respondents (42%) were unsure about the state competitors' AI adoption. 27% of respondents believe their competitors are implementing AI, as indicated by 'Agree' responses, and the statement is supported by 15% of respondents who indicated 'Strongly Agree'. Respondents who disagree and strongly disagree account for 17% of all responses. Organisations must determine whether their competitors are using AI. Understanding environmental factors, such as competitor activities and operations, can alert a firm and improve its market responsiveness (Tuan, 2016).

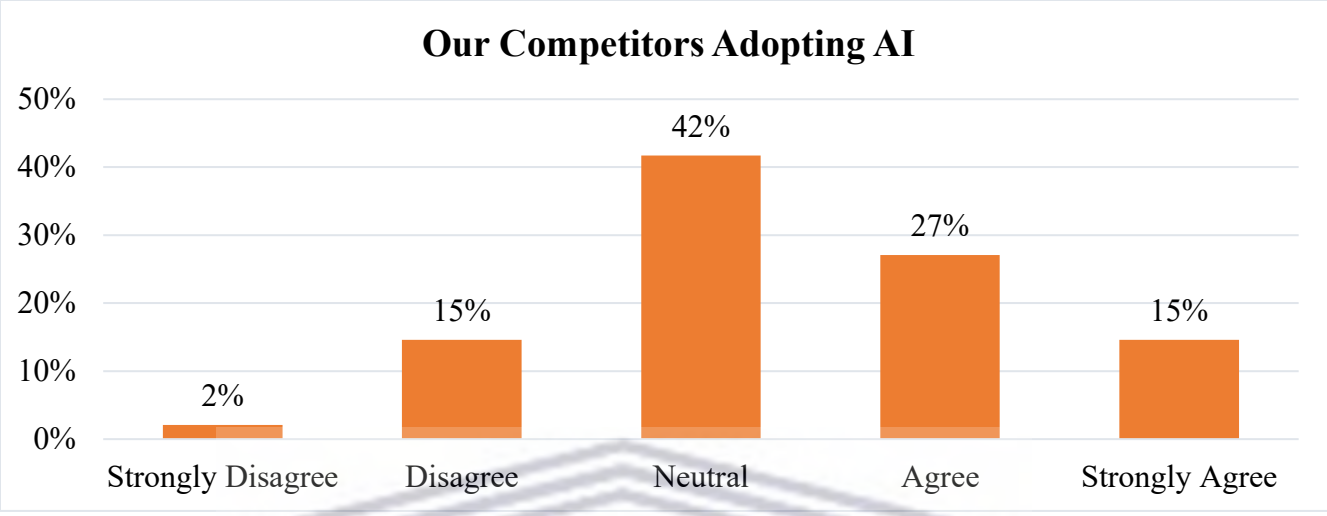


Figure 4.7.1.3: Our competitors are adopting AI.

4.13.1.5 My Company Is Currently Under Pressure to Adopt AI

Respondents were asked to indicate the extent to which they considered their company was now under pressure to implement AI. Figure 4.7.1.4 displays the results of the question "My company is currently under pressure to adopt AI". According to the results, one-third (33%) of respondents are unaware of the company's pressure to adopt AI, as indicated by a 'neutral' response. 23% of the respondents believed that their organisation is currently under pressure to adopt AI, and this is indicated by agree response and corroborated by 6% who marked 'strongly agree'. Furthermore, 31% disagree that their organisation is under any pressure to adopt AI, with 6% strongly disagreeing. Businesses that do not consider incorporating AI into their business strategy will be at a competitive disadvantage, which could have long-term effects (Brooks, Gherhes & Vorley, 2020).

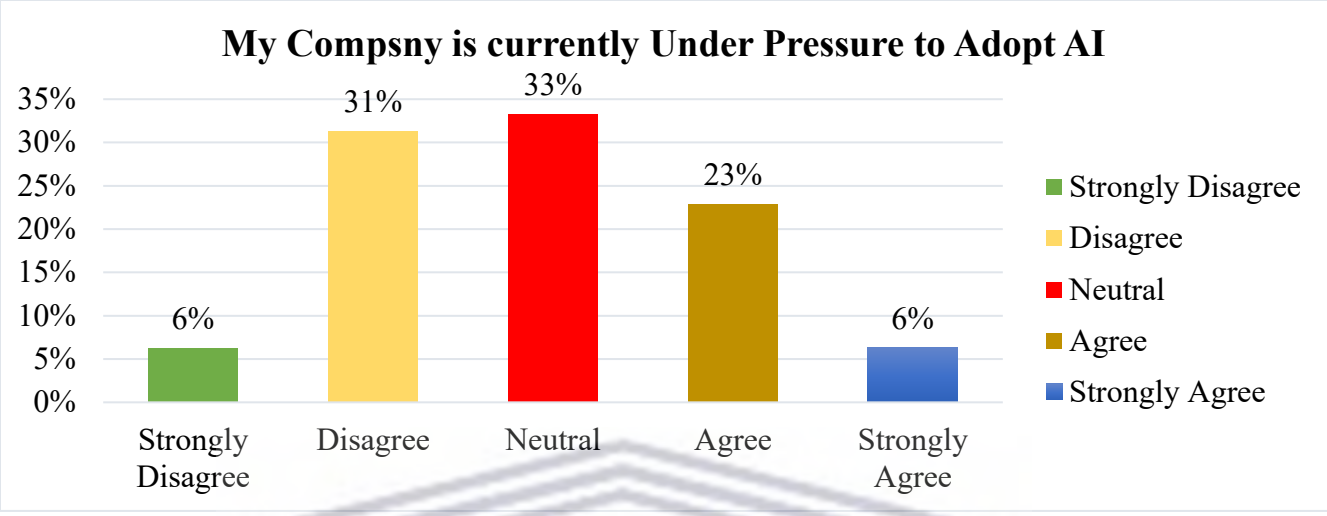


Figure 4.7.1.4: My company is currently under pressure to adopt AI.

4.14.1 Partner Readiness

4.14.1.1 AI Would Be Compatible with The Technologies Used by Our Partners

Figure 4.7.2.1 depicts the frequency of replies to the question, Would AI be compatible with the technologies utilised by our partners? Respondents were asked to rate how confident they were that their partner's technologies will be compatible with AI. According to the results, 40% of respondents agreed that their partner's technologies can enable AI algorithms, but the majority (44%) are unsure. 8% opposed, as shown by the 'disagree' response, indicating that they believe their partners' infrastructure is not ready to embrace AI. Software integrations are essential for successful technology partnerships. Certain ICT technologies cannot be used by any firm without the cooperation of its trading partner. Their implementation necessitates coordination and interaction through trade agreements (Ali, Kurnia & Johnston, 2011).

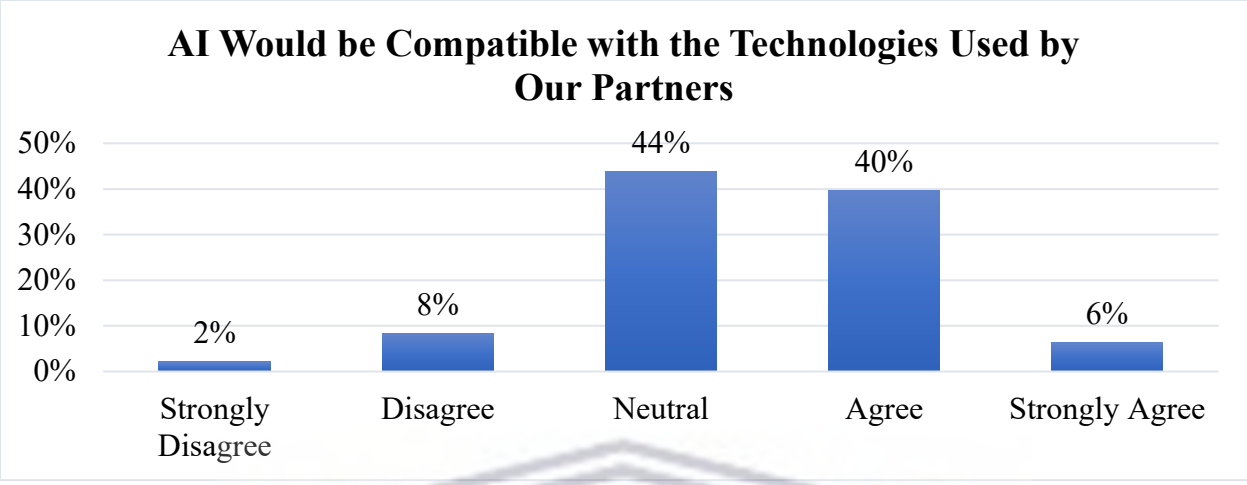


Figure 4.7.2.1: AI would be compatible with the technologies used by our partners.

4.14.1.2 Our Partners' IT Infrastructure Can Easily Be Integrated With AI

Respondents were asked the question "Our partners' IT infrastructure can easily be integrated with AI". Figure 4.7.2.2 depicts the response frequencies. According to the results, 40% of participants agree their partner's infrastructure easily supports AI projects, with an additional 8% strongly agreeing. The bulk of respondents was uncertain, accounting for 44% of responses - whereas 6% disagreed and 2% strongly disagreed. Maintaining electronic trading partner relationships is critical to the success of an inter-organisational system (IOS) network. (Son, Narasimhan & Riggins, 2005).

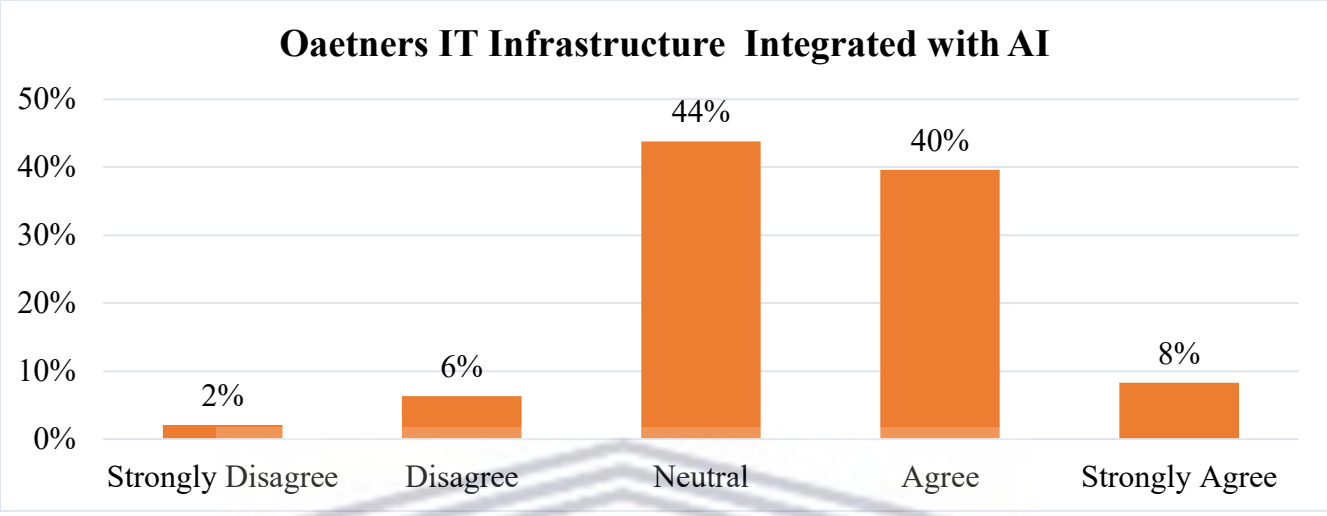


Figure 4.7.2.2: Our partners' IT infrastructure can easily be integrated with AI.

4.14.1.3 Our Partners' Infrastructure Will Have to Be Redesigned to Implement AI

Respondents were asked to record the degree to which they believed that their partners' infrastructure will have to be redesigned to implement AI. The results of this question are presented in Figure 4.7.2.3. Over half of those surveyed (52%) were unsure whether their partners' infrastructure would need to be updated to support AI. The study also indicates that 27% of respondents agree that their partner's infrastructure would need to be redesigned to support AI projects, with 15% strongly agreeing. 4% of respondents disagree, suggesting that their partners' infrastructure would need to be redesigned, with 2% strongly disagreeing. The result can be viewed as most suppliers are not yet ready to integrate AI into their operations, implying that some development will be necessary to accommodate these initiatives.

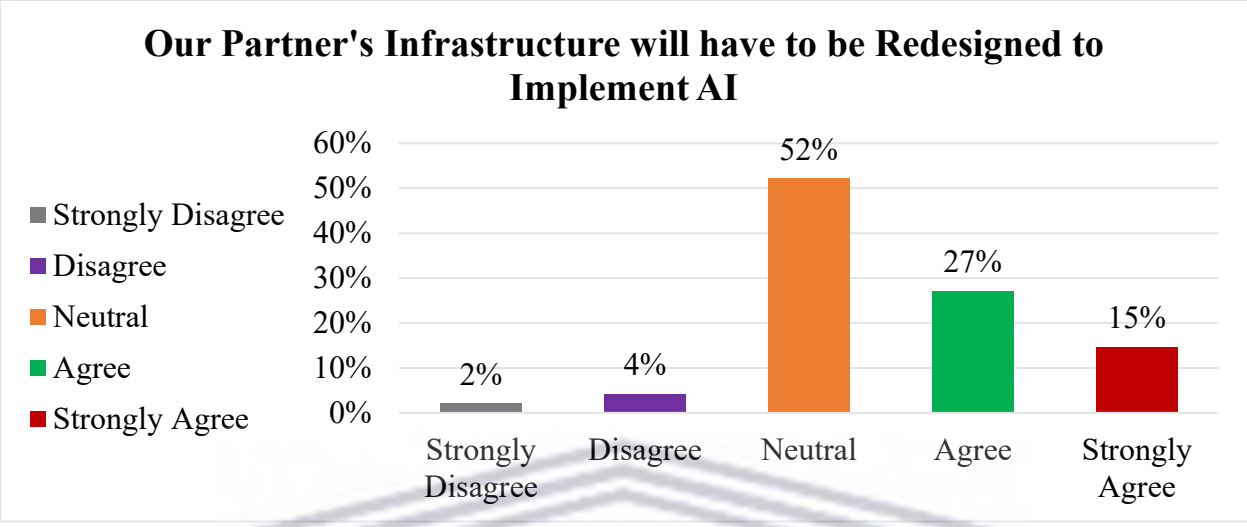


Figure 4.7.2.3: Our partners' infrastructure will have to be redesigned to implement AI.

4.15.1 Legal Requirement & Regulation

4.15.1.1 I Am Aware of The IT Regulations in My Industry

Respondents were asked to rate their familiarity with IT regulations in their industry. The results of the question "I am aware of the IT regulations in my industry". are shown in Figure 4.7.3.1. The findings reveal that the majority of respondents (66%) are aware of the rules and regulations that govern technology implementations, as evidenced by the 'Agree' and 'Strongly Agree' responses. 19% supplied a neutral response, indicating uncertainty, while the remaining 14% disagree and strongly disagree with any understanding of IT regulation in their industry. Employees must understand the rules and regulations that govern them. Regulation can either impede or promote technological advancement. There are tremendous security concerns surrounding the implementation of AI technology; governments frequently establish restrictions for organisations to manage these risks (Borgman et al., 2013).

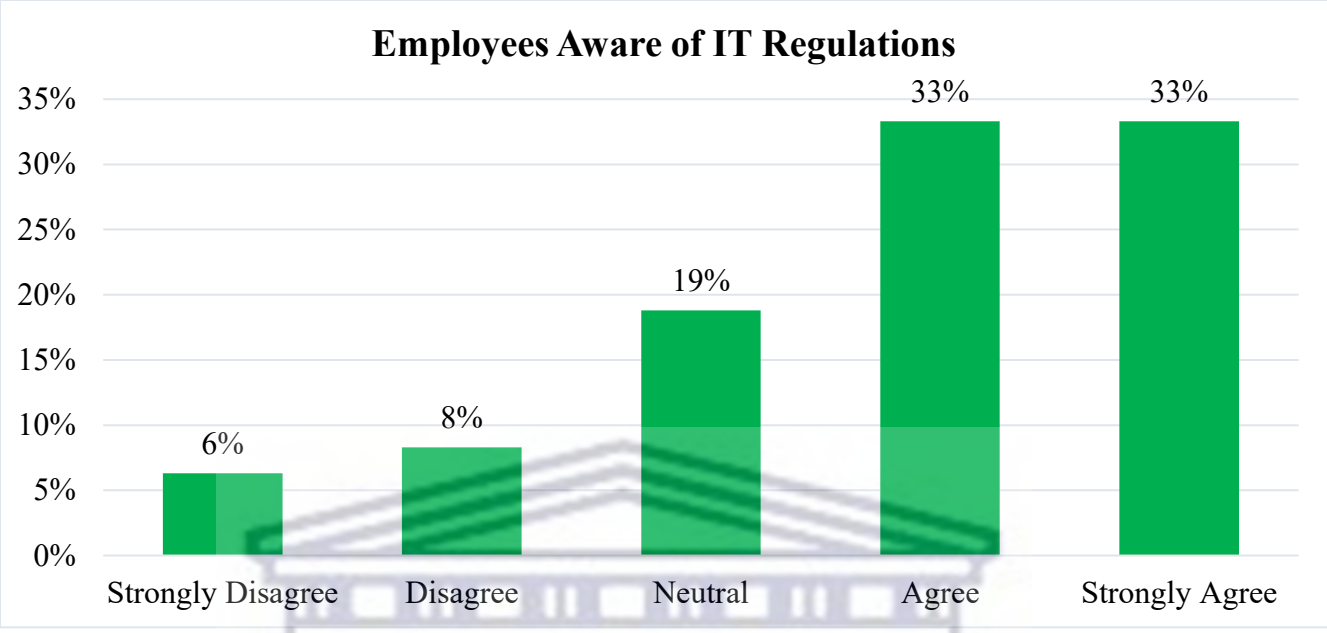


Figure 4.7.3.1: I am aware of the IT regulations in my industry.

4.15.1.2 Regulations And Policies Will Inhibit the Adoption of AI in My Business Unit

Respondents were asked to indicate how much they believe rules and policies will inhibit AI adoption in my business unit. Figure 4.7.3.2 displays the results of the question "Regulations and policies will inhibit the adoption of AI in my business unit". The majority of respondents (38%) expressed a neutral response, indicating that they are unsure about the potential restrictions that regulations and policies impose on AI adoption. A further 25% agree that regulations and policies can impede AI adoption, which is reinforced by 6% of those who responded with a 'Strongly Agree' response. 21 percent disagree with the latter, with 11 percent strongly

disagreeing.

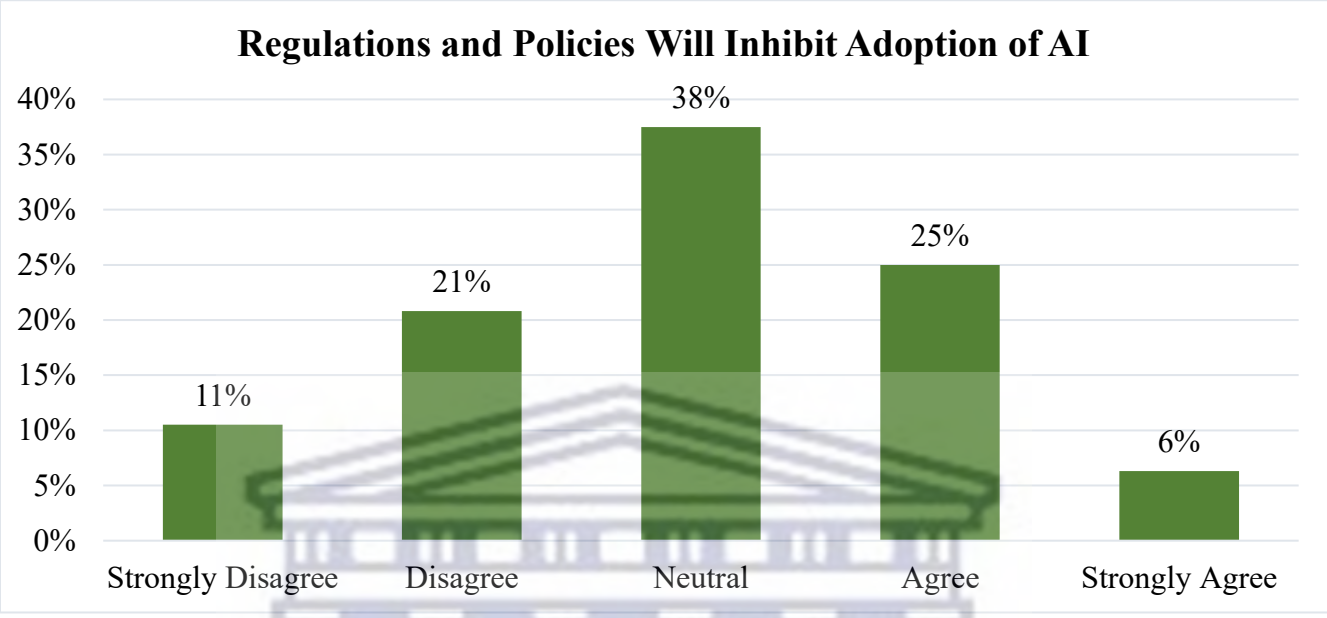


Figure 4.7.3.2: Regulations and policies will inhibit the adoption of AI in my business unit.

4.15.1.3 Current Business Laws and Regulations Support AI Operations and Adoption in My Business Unit

Respondents were asked to rate how much they believe current business laws and regulations favour AI operations and adoption. Figure 4.7.3.3 depicts the answers to the question "Current business laws and regulations support AI operations and adoption in my business unit". 42% of respondents were unsure about the impact of corporate laws and regulations on AI operations, while 19% agreed that business laws and regulations can support AI initiatives, with 4% strongly agreeing. 17% of respondents disagree, while 17% strongly disagree. 2% of those polled did not respond. According to the findings, most respondents are unsure about the role of corporate law

and regulation in advancing AI operations and acceptance.

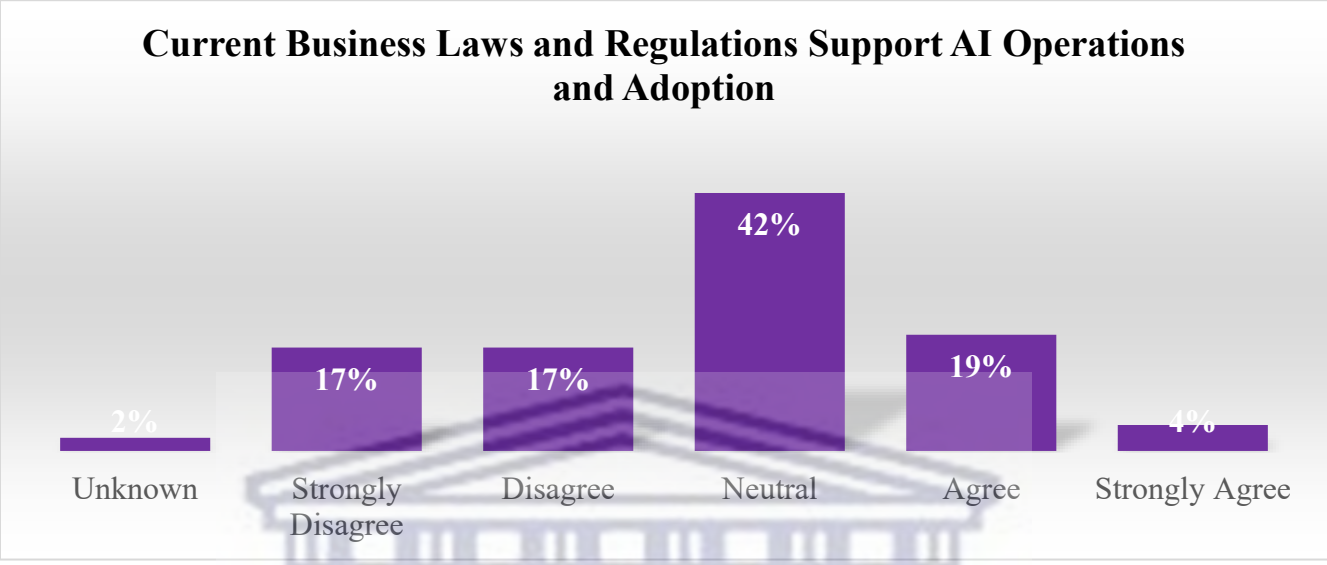


Figure 4.7.3.3: Current business laws and regulations support AI operations and adoption in my business unit

4.16 Analysis of Variance

One-way ANOVA was used to determine whether there were differences in respondents' attitudes toward AI adoption based on the number of years in a role. 'ANOVA' is used for the case of a quantitative outcome with a categorical variable that has two or more levels of treatment' (Fisher, 1954). The ANOVA results (Table 4.8) demonstrate a significant difference in how various groups perceive the compatibility of the existing infrastructure with AI adoption based on the number of years in a function. This is indicated by a p-value greater than 0.05 (YearsOnRole = 0.015).

		Sum of Squares	df	Mean Square	F	Sig.
TotComp	Between Groups	177,17	9	19,69	2,73	,015
	Within Groups	273,81	38	7,21		
	Total	450,98	47			

Table 4.8 ANOVA Results

4.16 Correlation Analysis

Correlation scores were calculated for technological factors, organisational factors and environmental factors for AI adoption. This study utilized the Pearson correlation coefficient to analyze the relationship between variables. The Pearson correlation coefficient is a statistical measure that is appropriate for data that contains ratio and interval measures. It indicates the strength and direction of the linear relationship between two variables. The "r" value can be positive or negative, indicating the direction of the relationship. A positive "r" value indicates a positive linear relationship, while a negative "r" value indicates a negative linear relationship. The magnitude of the correlation coefficient denotes the strength of the relationship, with a value closer to 1 or -1 indicating a stronger relationship. The Pearson correlation coefficient is a widely used statistical tool in research studies and provides valuable insights into the relationship between variables.

Table 4.8 indicates that technological factors have a positive and significant relationship with both organizational factors ($r = 0.616$; $p = 0.000$; p being ≤ 0.05) and environmental factors ($r = 0.649$; $p = 0.000$; p being ≤ 0.05). Although technological factors show a significant positive correlation with environmental factors ($r = 0.649$; $p = 0.000$; p being ≤ 0.05), this relationship is much weaker than is the case with organisational factors.

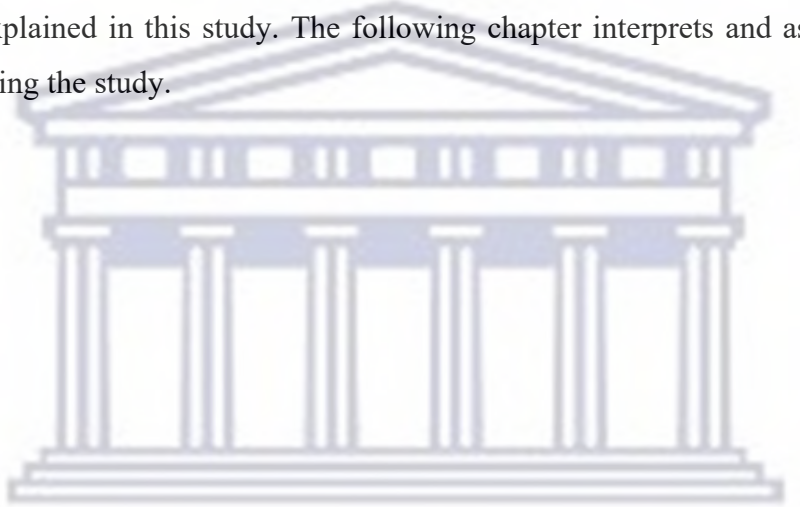
		Tottech	TotOrg	TotEnv
Tottech	Pearson Correlation	1,000	,616[a]	,649[a]
	Sig. (2-tailed)		,000	,000
	N	48	48	48
TotOrg	Pearson Correlation	,616[a]	1,000	,644[a]
	Sig. (2-tailed)	,000		,000
	N	48	48	48
TotEnv	Pearson Correlation	,649[a]	,644[a]	1,000
	Sig. (2-tailed)	,000	,000	
	N	48	48	48

a. Significant at .05 level

Table 4.9 Correlation Analysis

4.18 Chapter Summary

This chapter detailed the results of the study, which were examined using SPSS. The chapter went on to explain the results in terms of frequencies of the demographics, the state of AI adoption and the technological, organisational and environmental factors influencing AI adoption. Cronbach's alpha was used to determine the reliability of the responses, and an analysis of variance was also performed and explained in this study. The following chapter interprets and assesses the study results before ending the study.



CHAPTER 5: DISCUSSION AND CONCLUSION

This chapter concludes the research study by examining the study's main results and their implications for AI adoption in the Logistics and Supply Chain industry, as well as ideas for future research and the study's limitations. This chapter provides an outline of how the study was conducted to achieve its objective. It includes an overview of the previous chapters, discussion and interpretation of the findings, and an evaluation of the study. The overview section provides a summary of the topics covered in each of the previous chapters. The discussions and interpretation of the findings section focuses on the research objectives and presents an in-depth analysis of the study's findings. Additionally, the section highlights the study's contributions to the body of knowledge, as well as its challenges and limitations. The chapter concludes with the study's recommendations based on its limitations. These recommendations aim to provide insights for future research in the field and to enhance the study's contribution to the existing body of knowledge.

5.1 Discussions and Interpretation of Findings

This section presents an analysis and interpretation of the findings related to the research objectives and questions. The primary objective of this study was to investigate the factors that affect the adoption of artificial intelligence in the supply chain and logistics industry.

5.1.1. Demographic Findings

The study reveals that respondents are typically experienced professionals with specific education or training, and 27% have been in their positions for a year or less, suggesting they may not have witnessed technology adoption. However, the majority of respondents have the authority to make technology adoption decisions within their organization.

5.1.2 Discussion and implication of the technological factors

The first sub-objective was: *To explore technological factors affecting the adoption of Artificial Intelligence in the supply chain and logistics industry*. To answer this question several studies were reviewed regarding technological factors affecting AI adoption. The studies have highlighted technology compatibility, cost, skill, perceived benefits, security, top management and complexity as TOE variables that may impact technology adoption in a company.

The results of the study have highlighted that most of the respondents believe that AI can be challenging to deploy due to its numerous interdependencies. These results are consistent with those of Lin, Lee and Lin (2016), who identified complexity as a barrier to AI adoption. The results further highlighted that most respondents believe that AI adoption will increase security breaches within their organisations, and these results are supported by a study conducted by (Borgman et al., 2013), who believe that the security issues associated with using AI technology are a major concern that may make AI adoption less appealing. Infrastructure Compatibility with AI projects has also emerged as a concern for most respondents. Many researchers have found a favourable association between compatibility and intent to embrace an invention (Borgman et al., 2013; Wang, Wang & Yang, 2010; Lin, Lee & Lin, 2016). Furthermore, the results show that respondents believe that their organisation has sufficient AI skills, yet, this finding contradicts several studies (Manyika et al., 2017; Mariemuthu, 2019) that found skills to be a predictor of technology adoption.

Technology as progressive as AI can eliminate repetitive work, which can reduce the need for unqualified jobs. Other businesses have employed AI in data analysation to understand behaviour of buyers and to intensify customer movement. A key conclusion that can be stated is the elevated

level of utilisation of artificial intelligence in the existing economic plan. An additional finding from this study was that advanced technology being applied in firms with initiative training was less frightened by replacement and respondents who were concerned about artificial intelligence probably substituting jobs demonstrated to have fewer dealings with AI in their workplaces.

5.1.3 Discussion and implication of the organisational factors

The second sub-objective was: *To explore Organisational factors affecting the adoption of Artificial Intelligence in the supply chain and logistics industry*. Several studies on organizstional factors influencing AI adoption were evaluated in support of this question. The studies have provided insights into many of the organisational factors that are hindering AI adoption in an organisation.

The results of this study have found that respondents believe that AI is best suited to larger enterprises. Several studies have demonstrated that the size of a corporation has a beneficial effect on the adoption of new technology. This implies there is a relationship between technology adoption and organisation size (Aboelmaged, 2014; Wang, Wang and Yang, 2010). Drydakis (2022) believes that AI can help SMEs boost their flexibility and respond rapidly to constantly changing demands. As a result, it is even more critical for small and medium-sized enterprises to employ AI because they demand more opportunities for growth than giant corporations. According to Nguyen and Petersen (2017), there is an inverse connection between company size and the adoption of ICT. A company's size and scope are crucial factors affecting the adoption of technology (Wang et al., 2003). Due to their flexibility and ability to adjust quickly, small and medium enterprises adopt new ICTs compared to larger companies that are inflexible (Kilangi, 2012) Furthermore, the results have revealed that top management is inclined to promote AI initiatives. Top management commitment can also have a major beneficial influence on new technology adoption (Wang, Wang and Yang, 2010; Mariemuthu, 2019; Lee and Kim, 2007).

Another study further confirmed these results that top management support is critical in the adoption of new technology and this has previously been demonstrated to be associated significantly with adoption (Lee and Kim, 2007). Additionally, most respondents believe AI is expensive to implement, and a contrary study by Mariemuthu (2019) has it that "The cost is not significantly related to AI technology adoption". Lastly, the results of this study indicated that most of the respondents are familiar with the benefits and the value of AI in an organisation. Rogers (2004) discovered that when senior management comprehends the benefits of relating to innovation, the likelihood of other business functions within the organisation adopting that innovation increases. A study by Mariemuthu (2019) found that "The higher the perceived benefits of AI adoption, the more likely AI adoption will be".

5.1.4 Discussion and implication of the environmental factors

The third sub-objective was: *To explore Environmental factors affecting the adoption of Artificial Intelligence in the supply chain and logistics industry*. Several studies on organisational factors influencing AI adoption were evaluated in support of this question. The studies have provided insights into many of the organisational factors that are hindering AI adoption in an organisation.

Competitive pressure is the threat of losing a competitive edge that encourages a company to implement an innovation (Aboelmaged, 2014). Significant empirical research has identified rival pressure as a role in the spreading and adoption of an innovation (Kuan and Chau, 2001; Wang, Wang, and Yang, 2010; Chao, Yang and Jen, 2007). The results of this study have shown a high frequency of respondents who agree that their organisation will face competitive pressure and failure to implement AI. The study has further revealed a lack of knowledge regarding policies and regulations that govern AI technologies. Regulations imposed by government entities can have a positive or adverse effect on productivity (Baker, 2012). According to one study, security risks are a major concern for implementing technology, and as a result, governments can enforce restrictive rules and regulations for organisations, potentially making AI adoption less appealing (Borgman et al., 2013), although a study by Mariemuthu (2019) discovered that government regulations currently have no leverage and extraordinarily little influence on technology adoption.

5.2 Conclusion

The study sought to explore factors affecting the adoption of Artificial Intelligence (AI) in the supply chain and logistics industry. This study highlighted that there is a need for AI adoption, since it will increase security breaches within their organisations. Research finds uncertainty in top management support. Drawing from the findings, it can be concluded that competition in the supply chain and logistics companies is one of the factors that will contribute to AI adoption.

5.3 Implication For Academia

The paper contributes to the expanding body of knowledge about AI adoption by leveraging factors from the T-O-E framework to explain adoption in the supply chain and logistics industry. Through literature review, it was discovered that numerous studies have shown the benefits of artificial intelligence in logistics and supply networks. However, debatably, research into the factors influencing artificial intelligence adoption in South Africa is still in its preliminary stages. In South Africa, there is a scarcity of studies devoted to barriers to AI implementation in supply chain and logistics.

5.4 Limitations and Areas of Further Research

This study has a lower sample size and is confined to AI adoption in the supply chain and logistics industries. While this study primarily focuses on AI adoption in South Africa, future research may spread to other nations or industries. Technology deployment is a time dimension. It should be measured over time, and this study's results can only provide an overview of what is currently happening in the supply chain and logistics industry. However, a long-term study can provide an idea of what is happening over time. Lastly, the study's data gathering scope is limited, thus, more data is required to apply the results to other countries or sectors.

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APPENDIX A: RESEARCH QUESTIONNAIRE

SECTION A: DEMOGRAPHIC DATA

Please can you provide the following demographic data about yourself and your business unit?

What's your job category?

☐ Manager/Supervisor ☐ Professional ☐ Operational/Technical

Other (Please Specify)

How long have you been in your current role?

{Capture year only}

Which of the following best describes your job function?

☐ Sourcing ☐ Manufacturing ☐ Logistics
☐ Planning ☐ Warehouse
☐ Other (Please Specify)

How long have you been in your current organisation?
{Capture year only}

Are you involved in information technology decision making in your business unit?

☐ Yes No ☐

SECTION B: TECHNOLOGICAL FACTORS

Please complete the following:

Thinking only about your business unit, please indicate which of the following AI algorithm has been implemented.

☐ Machine Learning	☐ Fuzzy Logic	☐ Robotics Systems
☐ Neural Networks	☐ Expert Systems	☐ Natural Language Processing
☐ Not Implemented		

Please indicate the year in which AI technology was first adopted in your business unit.

{Capture only the year}

COMPATIBILITY

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

My company's IT infrastructure is capable of supporting AI.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

The technologies used by our suppliers will be compatible with AI.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

The technologies used by our customers will be compatible with AI.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Our legacy systems are consistent with AI technology.

1 2 3 4 5

SKILLS

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

My business unit has the necessary skills to support AI initiatives.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

My business unit is committed to ensuring that employees are trained in AI.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

My organization has a high degree of AI expertise.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

My business unit will need to employ staff to support AI.

1 2 3 4 5

SECURITY

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Security is an important factor in technology adoption in my organization

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Our existing infrastructure security supports data integrity

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

The current technology is secure, there are limited security breaches.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

Security breaches can increase with new technology adoption

1 2 3 4 5

Complexity

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

AI adoption has a lot of technological interdependencies.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

AI technology has a lot of uncertainties.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

AI technologies are complex to implement

1 2 3 4 5

SECTION C: ORGANISATIONAL FACTORS

Management Support

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Top management in my business unit are likely to invest funds in AI.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Top management in my business unit is willing to take risks involved in the adoption of AI.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Top management in my business unit is likely to consider the adoption of AI to gain a competitive edge.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Top management in my business unit is knowledgeable about AI.

1 2 3 4 5

Cost

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AI technologies have high setup costs.				
1	2	3	4	5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AI technologies have high running costs.				
1	2	3	4	5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
AI technologies have high maintenance costs.				
1	2	3	4	5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My business unit constantly invests in new technologies to improve business operations.				
1	2	3	4	5

Perceived Benefit

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

My business unit sees the value in investing resources into AI adoption.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Adopting AI is important in improving operational efficiency in my business unit.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Adopting AI is important in improving customer service.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

Adopting AI is important in reducing operation costs.

1 2 3 4 5

Size

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

AI is ideally suited to larger organisations.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree NeutralAgree Strongly Agree

The size of my organisation makes it difficult to adopt AI.

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

The size of my business unit makes it difficult to adopt AI

1 2 3 4 5

Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree Disagree Neutral Agree Strongly Agree

The hierarchy in my organisation makes it difficult to adopt new technologies

1 2 3 4 5

Approximately how many employees work in your business unit?

Approximately how many employees work in your organisation?

SECTION D: ENVIRONMENTAL FACTORS

Competitive Pressure

1 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

My company would be under pressure from competitors to adopt AI.

1 2 3 4 5

2 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Not embracing AI would put my company at a competitive disadvantage.

1 2 3 4 5

3 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
Our competitors are adopting AI.				
1	2	3	4	5

4 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
My company is currently under pressure to adopt AI.				
1	2	3	4	5

Partner Readiness

5 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

AI would be compatible with the technologies used by our partners

1	2	3	4	5

6 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Our partners' IT infrastructure can easily be integrated with AI.

1	2	3	4	5

7 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Our partners' infrastructure will have to be redesigned to implement AI.

1	2	3	4	5

Legal & Regulatory Requirements

8 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

I am aware of the IT regulations in my industry.

1	2	3	4	5

9 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Regulations and policies will inhibit the adoption of AI in my business unit.

1	2	3	4	5

10 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Current business laws and regulation support AI operations and adoption in my business unit

1	2	3	4	5

11 Please rate the degree to which you agree with the following statements by ticking the appropriate sentiment:

Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

The government provides support for AI technology adoption.

1	2	3	4	5

APPENDIX B: SURVEY PARTICIPATION CONSENT

Dear Participant,

I invite you to participate in a research study entitled: Factors Affecting the Adoption of Artificial Intelligence (AI) in the Supply Chain and Logistics Industry. I am currently enrolled in the MCom Information Management (E-Logistics) at the University of the Western Cape, and I am in the process of writing my master's Thesis.

The purpose of the research is to determine the factor affecting the supply chain and logistics companies in South Africa from incorporating artificial intelligence into their operations. The enclosed questionnaire has been designed to collect information on the technological, organizational and environmental factors affecting the adoption of AI.

Your participation in this research project is completely voluntary. You may decline altogether or leave blank any questions you don't wish to answer. There are no known risks to participation in the survey. Your responses will remain confidential and anonymous. Data collected from this research will be securely stored in a password-encrypted drive. The information will only be accessible to authorized participants. No one other than the researchers will know your answers to this questionnaire.

If you agree to participate in this project, please answer the questions on the survey as best you can. It should take approximately 10 minutes to complete. Should you have any questions regarding this research, feel free to contact my supervisor, Professor Osden Jokonya: ojokonya@uwc.ac.za

Thank you for your assistance in this important endeavour.

Sincerely yours,

Tshwarelo Molopa

APPENDIX C: LETTER FROM ETHICS COMMITTEE