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**ANALYSING THE IMPACT OF BLOCKCHAIN TECHNOLOGY ON THE
SUPPLY CHAIN AND FINANCIAL PERFORMANCE OF
AGRICULTURAL ORGANISATIONS IN ZIMBABWE**

By

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**A DISSERTATION/THESIS SUBMITTED IN PARTIAL FULFILLMENT OF THE
REQUIREMENTS FOR THE DEGREE OF BACHELOR OF BUSINESS STUDIES
HONOURS IN MANAGEMENT.**

APPROVAL FORM

The undersigned certify that they have supervised, read and recommended to the Africa University for acceptance a dissertation entitled:

“Analysing the Impact of Block-chain Technology on The Supply Chain and Financial Performance of Agricultural Organizations in Zimbabwe”

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DECLARATION FORM

I, Declan Alvis Murungweni, declare that this project “Analysis of the Impact of Block-chain Technology on The Supply Chain and Financial Performance of Agricultural Organizations in Zimbabwe” is my own work and was not copied from any source without acknowledging the source.

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Date

DEDICATION

My family and friends have been my inspiration throughout this dissertation, thus I dedicate it to you. I would also like to dedicate this dissertation to my supervisor Ms. Chirima who has offered unending support during my journey. Thank you all for your unwavering support, but the Almighty deserves all the honor for providing divine wisdom during this time. Glory be unto God

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ABSTRACT

The study's intention was to investigate how the adoption and implementation of blockchain technology can impact the agricultural supply chain and the financial performance of organisations in the agricultural sector. The study's statement of the problem revealed that hyper-inflation, drought and chief among them being the recent global pandemic of Covid-19, are issues that have affected the agricultural supply chain in Zimbabwe. The researcher's objectives outlined the challenges that can be faced by organisations in the agricultural sector as a result of adopting and implementing blockchain technology, the effectiveness of blockchain technology in improving the financial performance of agriculture organisations, other technological tools that can be effected to combat a decrease in organisational financial performance and improve supply chains, how blockchain technology can solve supply chain problems in the agricultural sector of Zimbabwe, how blockchain technology can be implemented in supply chain management by agriculture organisations in Zimbabwe and the impact of the adoption of blockchain technology on the financial performance and supply chains of organisations in the agricultural sector. Data was collected using a standardised questionnaire, annual financial reports, and business financial publications under the descriptive survey study design. According to the results, when blockchain technology is used, it can affect the supply chain and financial health of Zimbabwean agricultural organisations. The researcher offered suggestions for integrating blockchain technology into a firm successfully and efficiently.

Key Words: Blockchain Technology, Supply Chain, Industry 4.0, Financial Performance, Internet of Things

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CHAPTER I

1.0 INTRODUCTION

Innovation is a key term that has become the principal objective for many companies in a competitive market. This is because with innovation comes efficiency and with efficiency comes a positive contribution to companies' profitability and operation as a whole. Blockchain technology is an intriguing new technology that has become the main topic of innovation as a disruptive tool of industry 4.0 technologies. It is characterised as an open source, decentralised distributed database for storing transaction information (Kristoffer Francisco et al, 2018). This new phenomenon can be used to lower transaction costs, inject efficiencies into existing value chains and open new markets due to its ability to de-intermediate and improve transparency (Mohannad Alobid et al, 2022). Many industries in Zimbabwe have not yet utilised this technology, thus, this research seeks to assess the adoption and application of this technology and the resulting impact it can have on supply chain management of the agricultural sector in Zimbabwe. This chapter forms the basis of the study by focusing on the background of the study, statement of the problem, research objectives, research questions, significance of the study, assumptions, delimitations, limitations, the definition of terms and the summary.

1.1 BACKGROUND OF THE STUDY

The third industrial revolution saw the rise of the internet and information-based technologies that shifted the way industries and sectors did business. Agriculture is such a sector where information and communication technology was vastly applied in improving the supply chain, which is flow of goods and services and all processes that transform raw materials into final products with the aim of cutting excess costs and delivering products to the consumer faster and more efficiently (Jason Fernando, 2022). This is because due to ICT tools such as smart phones and the internet there was improved information and communication process along the supply chain (Abdulrahman Saidu et al, 2017). Barcodes have been effectively superseded by

Radio-Frequency Identification (RFID) and Quick Response (QR) codes (Gurtu and Johny, 2019). These technologies streamline the value chain process, enhancing its efficiency (Sari et al., 2021).

However, organizations still have difficulties with supply chain management transparency and product traceability (Erol et al., 2020) primarily when the database system handles transaction records separately and does not make them accessible to other chain stakeholders. Transactions are difficult to record and verify because of this issue (Rogerson and Parry, 2020). Despite the fact that data has been recorded in numerous situations, it cannot be guaranteed that these records are accurate because the database can be altered (Kalla et al., 2020). These shortcomings of ICT can be cured by blockchain technology through smart farming data management using internet of things technologies and data security along the supply chain through provenance traceability and food authentication (Weijun Lin et al, 2020). Rather than relying on centralised intermediaries such as banks, this technology allows two parties to transact directly using duplicate, linked ledgers called blockchains. This makes transactions more transparent than those provided by centralised systems and as a result, transactions are executed without relying on the explicit trust of the third party but on the distributed trust based on the consensus of the network (Kristoffer Francisco et al, 2018). Blockchain technology has its own validity to ensure verified transactions. Every move is reported to the blockchain where every participant of the blockchain is available with the data records. This available data cannot be modified or deleted which results in its immutability and transparency (Huma Hayat Khan et al, 2022).

GLOBAL PERSPECTIVE

The adoption and application of blockchain technology has been a major development in North America, disrupting sectors such as the finance sector with cryptocurrencies that use blockchain as a database. The adoption of this technology in North America dates back to 2008 when a pseudonym Satoshi Nakamoto created a peer to peer network that eschewed a central authority for issuing currency, transferring ownership and confirming transactions (Marco lansiti et al, 2017). According to the World Bank, the global blockchain market has registered significant gains, experiencing an impressive compound annual growth rate of 65% from 2015 to 2021 mainly due to its adoption in North America. During the same 6 year period from 2015

to 2021 the gross domestic product in North America according to the World Bank (2022) has increased from \$19,6 trillion to \$22.1 trillion. Part of the reason for the rise in GDP can be attributed to the application blockchain technology in the finance market in the form of cryptocurrencies, more specifically bitcoin, which has reached a market capitalisation of \$ 400 billion (Rahul Nambiampurath, 2022). Credible journalistic sites reiterate that the blockchain technology market has garnered a market value of US \$ 7, 36 Billion in 2022 and is expecting a positive compound annual growth rate of 84% in the forecast period 2022-2032 and reach a value of US \$ 3273.83 billion.

Though blockchain was first created and implemented to support cryptocurrency transactions, it has found application in different domains and sectors (Carson et al, 2018). Across sectors multiple use cases indicate the high potential of blockchain technology in achieving operations and supply chain management goals (Queiroz et al, 2020). In this regard major corporations in China such as IBM and Walmart have implemented a blockchain-based solution for tracking pork products in China thus providing transparency and full information about supply chain stages every individual product went through (Yiannas, 2017).

LOCAL PERSPECTIVE

Locally in Zimbabwe there has not been any implementation of blockchain technology. The agricultural supply chain in Zimbabwe has been weakened by an already critical food security situation arising mainly from macroeconomic conditions such as inflation. This is evidenced by a decrease in profitability by Seedco International from a profit of \$ 27 624 093 in 2019, down to a loss of \$2 457 454 in 2020, which was the peak of the pandemic and hyperinflation. Consecutive poor agricultural seasons due to El Nino-induced droughts and natural disasters such as cyclone Idai have worsened the situation (Tanyaradzwa Rukasha et al, 2021).

Research on blockchain technology for agricultural supply chains has significantly increased since 2018 (Huma Hayat Khan et al, 2022). Case in point, Bermeo-Almeida et al. (2018) performed a thorough literature assessment on blockchain technology in agricultural supply chains. In a different study, Kamilaris et al. (2019) explored the benefits and difficulties of applying blockchain technology to the supply chains for agriculture and food. Yadav and Singh

(2020) looked into the challenges that India's agricultural supply networks face in using blockchain technology. Even while the industry recognizes the potential of blockchain technology, there aren't many publications or reports on its successful use, particularly in agricultural supply chains. Very little study has been done so far that goes beyond conceptual analysis of the advantages and solutions that blockchain technology can provide for agricultural supply chains. The researcher therefore wishes to analyse the impact of blockchain technology on the financial performance of agricultural organisations, with the primary objective being to shed light on the significance of adopting blockchain technology as a remedy for the weakened agri-supply chain and financial performance of organisations in the agricultural sector in Zimbabwe.

1.2 STATEMENT OF THE PROBLEM

The poor financial performance of organisations under the agricultural sector can be charged on a number of issues namely hyper-inflation, drought and chief among them being the recent global pandemic of Covid-19. These issues in turn have also affected the agri-supply chain and financial performance of agriculture organisations in Zimbabwe. It is against this background that the researcher would want to explore the impact of blockchain technology, as a tool of industry 4.0, on the financial performance and supply chain management of organisations in the agricultural sector in Zimbabwe.

1.3 MAIN RESEARCH QUESTION

What is the impact of the adoption of blockchain technology on the financial performance and supply chains of organisations in the agricultural sector in Zimbabwe?

1.4 RESEARCH QUESTIONS

2. How can blockchain technology be implemented in supply chain management by agriculture organisations in Zimbabwe?
3. How can blockchain technology reduce agricultural supply chain problems in Zimbabwe?

4. What challenges can be faced by organisations in the agricultural sector when adopting and implementing blockchain technology?
5. How effective is blockchain technology in improving the financial performance and improving the supply chains of agriculture businesses and the agricultural sector as a whole?
6. What other technological tools can be used to combat a decrease in organisational financial performance and improve supply chains?

1.5 MAIN RESEARCH OBJECTIVE

To analyse the impact of the adoption of blockchain technology on the financial performance and supply chains of organisations in the agricultural sector

1.6 RESEARCH OBJECTIVES

2. To examine how blockchain technology can be implemented in supply chain management by agriculture organisations in Zimbabwe
3. To assess how blockchain technology can solve supply chain problems in the agricultural sector of Zimbabwe
4. To analyse the challenges that can be faced by organisations in the agricultural sector as a result of adopting and implementing blockchain technology
5. To establish how effective blockchain technology is in improving the financial performance and improving the supply chains of the agricultural sector
6. To explore other technological tools that can be effected to combat a decrease in organisational financial performance and improve supply chains.

1.7 SIGNIFICANCE OF STUDY

To the researcher

The research will be used as the basis of fulfilment of a degree programme by Midlands State University. The research will also broaden the student's knowledge pertaining to blockchain technology and its impact on financial performance.

To the organisations in the agricultural sector

The Zimbabwe agriculture sector will benefit from this research and will improve the general financial performance of organisations in that sector. This research will also provide valuable insight into how a technological tool such as blockchain technology can be harnessed to improve and reduce the risks associated with the supply chains of organisations in the agricultural sector. Recommendations from this study will be used as a basis for future technological tools and improvements that can be effected in agriculture to improve the financial performance of organisations.

Supply chain management

This research will aid supply chain managers of different sectors within the Zimbabwean economy on how best to improve supply chain systems and in turn influence them to adopt Blockchain technology.

1.8 LIMITATIONS

Time

The time period within which the research was undertaken was limited, however, use of the internet helped in assorting information relevant to the study.

Confidentiality

Confidential financial information of various organisations within the agricultural sector could not be accessed to aid in the research due to privacy policies.

Lack of reference

There are not many organisations in Zimbabwe that have adopted the use of blockchain technology which means ascertaining the implementation of the technology was difficult.

1.9 DELIMITATIONS

The research is based on the agricultural sector in the Zimbabwean economy. The study is covering operations from 2015 to 2022. The study is going to focus on the organisations within the agricultural sector of Zimbabwe.

1.10 ASSUMPTIONS

1. Data collection methods used will provide correct and accurate information for the research.
2. The environment will remain relatively stable such that the results and recommendations will be relevant.
3. All the information that was needed was accessible.

1.11 DEFINITION OF TERMS

Blockchain

Blockchain is a digitally distributed ledger or database of records, transactions or executed events that are shared across the participating parties. It is also known as a technology that can allow authenticated data communication between each player in a supply chain without the intermediation of a trusted central organisation.

Supply chain

This refers to the network of organisations, people, activities, information and resources involved in delivering product or service to a consumer. It encompasses everything from the delivery of source materials from the supplier to its eventual delivery to the end user.

Industry 4.0

Fourth industrial revolution that conceptualizes rapid change to technology, industries, and societal patterns and processes in the 21st century due to increasing interconnectivity and smart automation.

ICT

Information and communications technology (ICT) is an extensional term for information technology (IT) that stresses the role of unified communications and the integration of telecommunications (telephone lines and wireless signals) and computers, as well as necessary enterprise software, middleware, storage and audiovisual, that enable users to access, store, transmit, understand and manipulate information.

Hyperinflation

This is a term to describe rapid, excessive, and out-of-control general price increases in an economy. While inflation measures the pace of rising prices for goods and services, hyperinflation is rapidly rising inflation, typically measuring more than 50% per month.

Traceability

The quality of having an origin or course of development that may be found or followed.

Transparency

This is operating in such a way that it is easy for others to see what actions are performed. Transparency implies openness, communication, and accountability.

Immutability

This is the state of not changing, or being unable to be changed.

1.11SUMMARY

The agricultural sector of Zimbabwe has raised a need for technological advancement that will aid in rectifying and improving the supply chain management and financial performance of a dwindling sector. This was an introductory chapter and focused much on the background of the study, statement of the problem, research questions research objectives, limitations, delimitations as well as definition of terms.

CHAPTER II

2.0 INTRODUCTION

The primary goal of the chapter is to review pertinent concepts, notions, debates, and experiences from throughout the world related to the subject. The agricultural supply chain in Zimbabwe has been weakened and disrupted by natural and macro-economic issues and as a result, has yielded a negative financial performance of companies within the agricultural sector.

This chapter, therefore, wishes to analyse how blockchain technology can be a remedy to the agricultural sector in Zimbabwe as well as assess the benefits and challenges that may arise from its adoption. The chapter's objective is to advance knowledge of the potential impacts of blockchain technology on supply chain efficiency.

2.1 CONCEPTUAL FRAMEWORK

A conceptual framework, according to Patrick Regoniel (2015), directs the entire research process and acts as a "map" or "rudder" that will direct you towards achieving the goals or intent of your study. The researcher's synthesis of the literature on how to explain a phenomenon is represented, he added, in a conceptual framework. Given the researchers' prior knowledge of other researchers' points of view and observations on the topic of research, it lays out the steps that must be taken during the course of the investigation.

2.1.1 Blockchain Technology

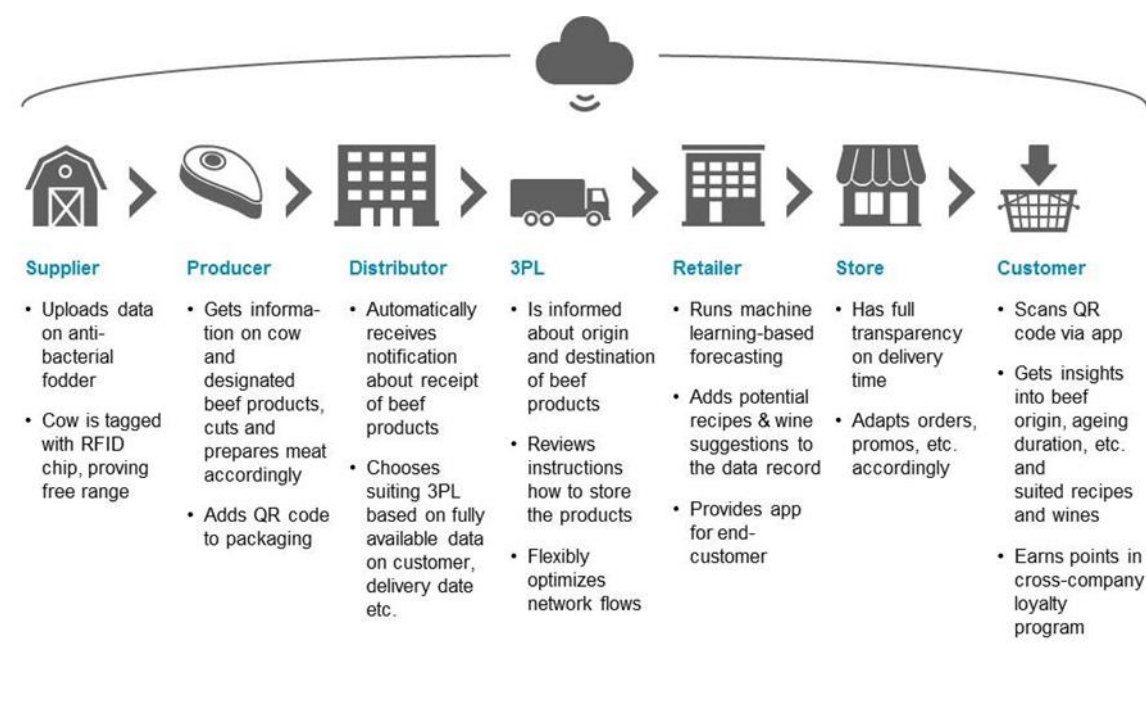
A blockchain is a shared distributed database or ledger between computer network nodes. It is a form of a Distributed Ledger Technology (DLT) and serves as an electronic database for storing data in digital form. Fran Casino et al (2019) defines blockchain as a distributed database that is organised as a list of ordered blocks, where the committed blocks are

immutable. The most well-known use of blockchain technology is for preserving a secure and decentralized record of transactions in cryptocurrency systems like Bitcoin. The innovation of a blockchain is that it fosters confidence without the necessity for a reliable third party by ensuring the fidelity and security of a record of data (Adam Hayes, 2022). The “blocks” in blockchain utilise cryptography to link. Each block includes transaction information, a timestamp, and a cryptographic hash of the preceding block (. Each block has a hash key, which is a distinct value produced by miners and contained in each block. Owners of computers known as miners give their computational resources to the network in order to validate fresh blocks for a blockchain. While processing ongoing transactions, participating miners compete to answer difficult arithmetic problems from a string of text to verify their validity in order to obtain a valid hash key (Ankalkoti & Santhosh, 2017). The blockchain's consensus mechanism, which ensures that all nodes and miners are in sync with one another and agree on which transactions are legal and added to the network, enforces this process. A hash key, which is a 64-digit hexadecimal integer that is generated once, is comparable to a fingerprint in that it is used to identify, create, and validate new blocks on a blockchain network (Khudnev, 2017). The essential function it performs in preserving the legitimacy of transactions on a blockchain network is what makes this hash key so significant. Private and public blockchains are the two main forms, and they differ in terms of who has access to read and write data on the blockchain (O'Leary, 2017). A user with permission to read can access data that is kept on the blockchain, whereas a person with permission to write can add data to the blockchain, for instance by creating or authorising transactions. Private blockchains are by definition permissioned. Information on the blockchain can only be viewed or written by authorised users. Consequently, a closed blockchain is another name for a private blockchain. Everyone can read public blockchains, which can either be unpermissioned or permissioned for writing (Markus and Bujis, 2022). Blockchain can be programmed with embedded instructions such as if-else and if-then statements to carry out actions when certain conditions are met and these instructions can be used to program smart contracts which are a self-executing contracts with the terms of the agreement between buyer and seller being directly written into lines of code (Markus and Bujis, 2022).

Blockchain technology however has found application in various sectors of the economy and has been dubbed as a remedy to frail processs within those sectors, an agricultural supply chain being one of them. Mohannad Aloid et al (2022) stated that e blockchain technology has proven

to be effective in the development of a wide range of industries, its use in other fields is also being expanded and agriculture is one such sector, where blockchain technology is being used to improve farm business operations. With regard to supply chain management, blockchain technology contains variables and elements that may affect the agricultural supply chain. These include transparency and traceability of information within the supply chain.

Fig 1. Illustration of an End to End blockchain-enabled supply chain of dry aged beef (Michael Lierow et al, 2022).



The illustration above seeks to show the relationship between blockchain technology and a supply chain. According to Fig 1. Above, all the players within the supply chain have full information about the product through the transparency provided by blockchain technology and they can also trace and track the whereabouts of the product. This ensures to lowering of fraud and issuing of counterfeit products. This follows the notion that blockchain increases transparency and traceability at each stage of the supply chain.

2.1.2 Supply chain

A supply chain is the whole process of creating and delivering a good or service, starting with the procurement of raw materials and ending with the delivery of the good or service to the final consumer. The supply chain outlines every step of the production process, including the tasks performed at each level, the information exchanged, the natural resources converted into useful materials, the human resources, and other elements that go into the finished good or service. This means that a supply chain is the backbone of many processes, whether in logistics or agriculture. According to Ieva Meidute-Kavaliauskiene et al (2021), in today's cutthroat corporate environment, supply chain management is widely viewed as a crucial instrument for cost reduction and enhancing economic performance. However, in order for businesses and industrial sectors to remain competitive, task-wise problems and supply management techniques must be modernized given new issues like the complexity, transparency, and flexibility needs for supply chains. Graham C Stevens (2007) suggested that the objective of managing the supply chain is to synchronise the requirements of the customer with the flow of material from suppliers in order to effect a balance between what are often seen as the conflicting goals of high customer service, low inventory investment and low unit cost. The design and operation of an effective supply chain is of fundamental importance to every company.

The design and operation of the supply chain is where blockchain comes in to play. In Zimbabwe, farmers were already facing difficulties in accessing markets because of inadequate infrastructure, low productivity levels, inconsistencies in supply and low quality due to poor post-harvest practices. The agri-supply chain and agricultural sector as a whole has been disrupted by inflation, natural disasters such as El Nino cyclone, and chief among them being the recent global pandemic of Covid-19 has). Rukasha et al (2021) also pointed out that among other factors, the Covid-19 pandemic caused unprecedented uncertainties in the global food supply chains, with impending bottlenecks in the labour markets, input industries, agriculture production, food processing, transport and logistics, as well as notable shifts in demand for food and food services.

2.2 EMPIRICAL LITERATURE REVIEW

An empirical literature review, also known as a systematic literature review, evaluates previous empirical studies in order to provide an answer to a specific research topic (David Anaan, 2019). An empirical literature review analyses earlier empirical studies to provide insight into a particular research question. Empirical literature reviews base their results on measurements and observations rather than information derived from ideas and assumptions.

2.2.1 CHALLENGES THAT CAN BE FACED DUE TO ADOPTION AND IMPLEMENTATION OF BLOCKCHAIN

2.2.1.1 Scalability

Scalability is both a risk and a barrier to implementation in businesses. Scalability is the maximum block size and the frequency of transactions over a certain period of time, and it is one of the key concerns of researchers and practitioners (Bettin-diaz et al, 2018). In other words, if processing and validating the necessary information takes longer the larger a block is. An article done by Gwyneth Iredal (2021) suggested that one of the main challenges in adopting blockchain is scalability. This is because usually blockchains work fine for a small number of users but when there is mass integration and an increase number of users on the network it can take days to process a single transaction. She further explained this remark by pointing out that this problem might lead to higher transaction costs and in turn will restrict more users on the network.

Ebru Gokalp et al (2018) further cemented this suggestion by pointing out that as block-chain network grows it increases storage and computational power demands, which means the network might have fewer with enough computing power to process and validate information on the block-chain thus leading to slower data validation. These systems frequently became slower, more expensive, and unworkable for a use-case like payment as the volume of transactions increases. Because of this, scale is preventing block-chain solutions from being accepted more widely (Codementor, 2022).

In similar stratum of thought, Dodo Khan et al (2021) stated that scalability in public block-chains is recognised as a vital issue that is affecting the performance and efficiency in block-

chain-associated applications. He further pointed out that public block-chain scalability is not a singular term, but rather a combination of various parameters that are interdependent. A public block-chain is one where anyone is free to join and participate in the core activities of the block-chain network. Anyone can read, write, and audit the ongoing activities on a public block-chain network, which helps achieve the self-governed, decentralized nature often touted when block-chain is discussed (Shobhit Seth, 2022). If a software solution does not scale well, it is not appropriate for industry adoption.

2.2.1.2 Security and Privacy issues

Block-chain benefits like cost savings, automation, etc. can be mediated by security, which is an important aspect that influences industry adoption and general public acceptance (Fleischmann and Ivens, 2019). Researchers and practitioners are also concerned about security and privacy in block-chain. In contrast to the protection offered by openness and traceability, the concerns in this situation pertain to hacker assaults, the possibility of losing all data stored in the system, and data security (Hokey Min, 2019). Security is regarded as a major risk and obstacle for businesses. The fear of revealing data outside of the company's borders justifies data security (Arnab Banerjee, 2018). There is a risk of disclosing strategic information to rivals in particular (Montecchi et al., 2019). Once more, this worry is related to a lack of understanding of the technology, a dearth of real-world examples, and the fact that block-chain technology is still in its infancy (Niels Hackius, 2017).

In the same vein, Sara Saberi (2019) suggested that data manipulation in supply chain networks can be a major concern due to data security and privacy concerns associated with block-chain. Block-chain technology is in its early development stages and is considered an immature technology that is yet to have its loopholes and risks rectified. Smita Bansod et al (2022) conjugated this line of thought by stating that without withstanding all its merits, block-chain solutions are subject to certain limitations like security threats and privacy issues which affect user identity, confidentiality and transparency on the ledger. Additionally, block-chain does not fully adhere to the General Data Protection Regulation and in some instances attackers have been known to follow the trail of transactions and identify the owner of those transactions.

Smita Bansod et al (2022) also suggested that the security and risk management aspects need further study in the block-chain environment and if block-chain-based technology is to become an ultimate architectural feature of tomorrow's web, then mitigation measures to overcome the risk of security and privacy are to be implemented in order to hinder data manipulation and enforce data privacy.

2.2.1.3 Legal Regulations

When discussing the adoption of new technologies and digital transformation, governmental backing and legal guidelines are crucial. Block-chain technology poses challenges to policymakers and regulators, mostly due to the decentralized nature of public, permission less block-chain-based networks (Primavera De Filipp et al, 2022). However, government regulations are viewed as an external obstacle to the adoption of block-chain technology, and the negative regulations that have been published by various governments about block-chain can worry markets and organizations who want to use block-chain technology to achieve their goals (Sara Saberi et al, 2019). According to Hokey Min (2019) since block-chain technology relies on a distributed ledger that can avoid government meddling, the government may put more pressure on block-chain users through various rules and legal limits, which could limit the utility of block-chain technology for certain purposes. A primary example is the government of India that prohibited the sale and exchange of a block-chain based technology of crypto currencies. Bettin-Diaz et al. (2018) claims that government initiatives and education are required to overcome this barrier.

The adoption of block-chain-based applications in various governments is still very limited and there is a lack of empirical evidence. The lack of law and regulatory support with regards to block-chain technology makes governments sceptical to adopt it since it is identified as the main environmental barrier of adoption (F R Batubara et al, 2018). This statement supports the notion that lack of regulation on block-chain technology enforces scepticism and makes it scary to adopt (Sara Saberi et al, 2019).

2.2.2 IMPLEMENTATION OF BLOCKCHAIN IN THE SUPPLY CHAIN

2.2.2.1 Tracking

Practitioners and researchers have been looking into novel applications of block-chain technology that might increase value, lower risks, and provide businesses a competitive edge. One of the industries where block-chain adoption has the most promise is supply chain management (Gupta, 2018). The most well-known food giant, Walmart, developed a scheme in 2016 to keep an eye on pigs in China and mangoes in the US by partnering with IBM to digitally track both domestic movements of pork from small Chinese farms to Chinese stores and international movements (Hackius and Petersen, 2017). The block-chain contains all of the sensitive data, including information about farms, factories, temperature, and transport. Only by combining RFID tags, sensors, and the usage of block-chain technology to store the necessary data was this control made possible. The outcome published by Walmart in 2017 showed that the technology reduces lead time from days to minutes and has a great capacity for cost savings (Kshetri, 2018). These results follow the suggestions by Hokey Min (2019) which stated that by adopting a radio frequency identification (RFID) system that works hand in hand with block-chain technology it can identify risks of potential security breaches and can capture the data regarding vehicle movement they can identify suspicious data trends.

In the same vein of tracking, Maersk, an integrated shipping company, launched pilot block-chain technology to enhance global supply chain flow transparency. Partnered with IBM, they established a block-chain-based platform called “TradeLens” in logistics in December 2018 (Park and Li, 2021). By allowing international trade on the "TradeLens" platform, which employs block-chain technology to allow users to trade in a "simple, secure, and real-time environment," Maersk anticipated that it would increase the transparency of its global supply chain. Park and Li (2021) further pointed out that Maersk analysed the trade trends of their terminal in India, and this showed that the simplified transaction processes by the block-chain-based system reduced their total operating costs. In particular, exporters and importers in

Mumbai reduced their costs by approximately 15% of total costs than before adopting block-chain technology.

2.2.2.2 Identify counterfeit products

Product counterfeiting happens when a product is sold pre-tending to be another product and it is consumer fraud and is commonly defined as a deceptive business practice that causes consumers to suffer financial or other losses (Kunal Wasnik et al, 2022). Everledger and Provenance, two block-chain solution providers, have conducted pilot projects and provided examples of typical use cases that show block-chain's potential for certifying the origin, authenticity, and integrity of goods like diamonds, wine bottles, luxury clothing, coffee beans, and medicines (Agi and Jha, 2022). Since a diamond's serial number, for instance, can easily be cut, the start-up Everledger adopts a different strategy and stores 40 data points that individually identify a diamond (Hackius and Petersen, 2017). A prospective buyer can easily establish whether the seller is the true owner of the diamond using these publicly accessible Block-chain records. Furthermore, Agi and Jha (2022) pointed out that in addition to providing traceability and making the whole history of products digitally available, block-chain promises to improve supply chain coordination and process efficiency and to achieve supply chain sustainability goals.

In the medical sector, the dangers posed by falsified and substandard medicines could inflict significant negative impact on patients' safety and treatment outcomes and eventually lead to waste and fraud in medicines access (Mackey and Nayyar, 2017). Jamil et al. (2019) estimate that over 30% of the world's pharmaceutical production is fraudulent. Additionally, certain medications do not adhere to government rules, making it more challenging to track their distribution and endangering people's health (Jamil et al., 2019). Mackey and Nayyar (2017) further pointed out that block-chain stands out as a potential revolutionizing technology framework to better ensure a modernized and 'digitized' drug supply chain that is more trustworthy, accountable, transparent, and protected from fake drug infiltrations. This could be done through barcodes or auto ID technology and patients could be empowered to check whether they received the actual drugs.

2.2.2.3 Internet of things

The Internet of Things (IOT) means everyday objects – essentially everything with a plug –get equipped with electronics and can exchange data over the internet (Hackius and Petersen, 2017). Such a volume of devices and data might be beyond the capacity of the server infrastructure used by the current internet architecture. Single servers pose a risk to data security since they are a single point of failure. IOT device connectivity and management are being looked at as potential solutions using the open Block-chain ledger (Hackius and Petersen, 2017).

Additionally, Intel created a seafood traceability project in 2017 to improve the accuracy of information obtained after fishing. IOT enabled the pilot to collect telemetry data for temperature control from the fishermen to the restaurant and save it on the block-chain. (Kshetri, 2018).

2.2.3 BLOCKCHAIN TECHNOLOGY EFFECTIVENESS IN IMPROVING FINANCIAL PERFORMANCE

2.2.3.1 Cutting out the middleman

In the banking and financial services domain, block-chain technology can simplify business processes while creating safe, trustworthy records of agreements and transactions (Phillip Treleaven et al, 2017). The majority of applications of block-chain technology has been in the financial sector and it is here where the technology has its origins (R Cole, 2019). From a financial point of view, Block-chain technology reduces administrative costs, human errors, frauds and contributes to the environment by minimizing waste (Treiblmaier, 2018). Eliminating such costs reduces expenses for businesses, allowing for a better chance at profitability hence improving the financial performance. These days, bookkeeping, transaction reconciliation, payment initiation, and other activities are all part of the banking and payment systems that rely on several intermediate clearing entities. These procedures are time-

consuming and expensive. Point-to-point payments via block-chain are possible, doing away while also lowering transaction costs. Paying across borders is also made simple as a result. (Guo & Liang, 2016).

2.2.3.2 Lower Operating Expenses

The usage of smart contracts is another approach that lowers expenses. Smart contracts can be configured to make automated payments in accordance with the terms, rights, and duties previously agreed to since they have the ability to self-validate virtual agreements (Hald and Kinra, 2019). The enhancement of warehouse management can save expenses associated with supplies, recalls, and uncertain demand thanks to traceability and transparency. In the same spirit of cost reduction to improve financial performance, Shashank Gupta (2018), stated that IBM and Maersk did a proof of concept (POC) in September 2016 which tracked a container of flowers from the Kenyan coast city of Mombasa to Rotterdam in the Netherlands. Simply put, the block-chain proof of concept is the process of verifying that the idea has the potential in a real-world situation with the aim being to determine whether the project is feasible and will function as planned (Henry Evans, 2022). In the Proof of concept, the shipping cost was \$2000, and the paperwork was estimated at about \$300 (15% of cargo value). So, the POC seems to be successful. With this pilot project success, Block-chain helps enable unprecedented, secure transparency across the global supply chain. It could also help in saving time and costs (Shashank Gupta, 2018) which could in turn lead to higher profitability.

The use of smart contracts as a form of block-chain technology application poses as a technological tool that can improve the financial performance of organisations. According to Hokey Min (2018), a smart contract is a computer protocol intended to facilitate, verify, or enforce contractual obligations by embedding contractual clauses such as collateral, bonding and delineation of property rights in the computer system and then automating contract execution. Furthermore, Hokey Min (2018) reiterates that smart contracts are self-verifying and self-executing agreements that can automate the contract life cycle to improve compliance, mitigate risk, and increase efficiencies across the enterprise by reducing transaction costs since they execute themselves. The technology reduces the cost of tracking and reconciliation thus allowing for basic administrative functions such as payroll management to be executed

seamlessly. This reduction in transaction costs is a reduction in a business's expenses hence improving its financial performance.

2.2.3.3 Asset protection

Global cybercrime damages are predicted to total \$6 trillion in 2021 and are expected to rise to \$10.5 trillion annually by 2025, however, block-chain could bring some relief (Kamal, 2019). Transparency, immutability and decentralisation allows the technology to bestow greater transactional security. Although block-chain technology is not a silver bullet due to the exploitable vulnerabilities on its operating system, the sophisticated math and software rules the technology uses makes it almost impossible for attackers to manipulate. According to (Kshetri, 2018), Block-chain technology's data structures have inherent security qualities because they are based on consensus, cryptography, and decentralization principles. Each new block of information connects to all the previous blocks in a way that it's nearly impossible to tamper with thus ensuring asset protection.

Implementing block-chain technology to encrypt geo-location data in the logistics sector will increase cargo visibility and, as a result, sharply reduce theft. Products can be automatically cross-checked using technologies like barcodes or hardware RFID integration. Whenever electronic records are reported, security and privacy are increased, providing everyone with a sense of security (Shashank Gupta, 2018). As a result, it is clear that block-chain technology offers a number of advantages. The benefits of encryption, immutability, and missioning are intrinsic. By establishing responsibility. The blame game between shippers, brokers, and carriers is played out at each stage of the process mitigated.

2.2.4 OTHER INDUSTRY 4.0 TOOLS THAT CAN AFFECT AND ULTIMATELY IMPROVE ORGS SUPPLY CHAINS

According to Diann Daniel (2022), fourth industrial revolution, or "industry 4.0," is the cyber-physical change of manufacturing. The phrase "Industry 4.0" refers to a government project in Germany that promotes networked manufacturing and a digital convergence of business, industry, and other operations. Furthermore, the author stated that due to industry 4.0 technologies, manufacturing processes from design through the end of the product lifecycle will be interconnected by all the new and evolving technologies created for humans to communicate with machines, for machines to communicate with one another and to achieve more complex goals, and for data to inform and optimise all the processes related to the manufacturing sector. The Industrial Internet of Things (IIOT), sometimes known as the Internet of Things (IOT), is a key component of this fourth industrial revolution. The digitalisation of supply chains involves a number of significant technologies in addition to IIOT, including cloud computing, artificial intelligence, CAD/CAM, intelligent enterprise resource planning (I-ERP), programmable logic controllers (PLC), automation/industrial robots, sensors/actuators, additive manufacturing, simulation, and other cutting-edge data exchange models (Ghadge A et al, 2019). Intelligent enterprise resource planning incorporates the use of Radio frequency identification, which according to Devansh Sanghavi (2019), is the standout tool amongst all the other technological tools of industry 4.0.

For manufacturing businesses, an efficient manufacturing warehouse system is vital. The logical next step for any warehouse management system is the adoption of Radio Frequency Identification through the addition of its capacity to "sniff" out items in shadows of crammed warehouse space, account for expensive assets, track and log movements without the need of manual processes, and more (Gerald Poe, 2021). A business may handle more transactions accurately and efficiently with the automated extension of RFID, improving the supply chain and cutting expenses. Gerald Poe (2021) added on to his point by stating that a business may handle more transactions accurately and efficiently with the automated extension of RFID, improving the supply chain and cutting expenses.

Another component of industry 4.0 technologies is Big Data analytics. According to Wesley Chai (2021), big data analytics is a type of advanced analytics that uses sophisticated applications that are powered by analytics systems and include aspects like predictive models, statistical algorithms, and what-if analysis. According to Ghadge A et al (2019), big data

analytics make it possible to use enormous amounts of data to increase production and efficiency. Furthermore, big data analytics enable businesses to derive value from massive amounts of data in order to boost process performance, process flexibility, and product personalisation (Wesley Chai, 2021). To enable swift and real-time fact-based decision-making, the collecting and analysis of data from many systems will become standard.

Cloud systems are another branch of the fourth industrial revolution, and they are referred to as remote servers on which enormous volumes of data from a variety of corporate systems, devices, equipment, and sensors are stored (Ghadge A et al, 2019). Sensitive data belonging to a company may generally be protected in cloud settings because they are typically quite secure. Cloud computing is also a crucial component of any business continuity plan since it allows for automated data backup and recovery on remote workstations (as opposed to traditional backup servers) and offers a way for smooth failovers or failbacks in virtualised or cloud environments as necessary. Moreover, Ghadge et al (2019) suggested that in order to provide flexible, on-demand access to technologies that support a company's ability to improve its service offerings and business operations from a digital perspective, cloud-based infrastructure must be adopted. This is because the capability of cloud computing also makes it easier for business IT departments and other departments to interact and cooperate more effectively. Additionally, technical requirements can be met by the cloud, and other business units can use them to grow and be more agile. The cloud's two sides are essential for improving a business. Jo Wessel Strandhagen et al (2019) added on to this line of thought by suggesting that cloud computing improves supply chain management because it improves coordination by allowing companies to share information between all actors within a supply chain. Reputable and credible sites state that big and prestigious companies such as Apple, Netflix, General Electric and E-bay have successfully incorporated cloud computing services in their organisations. According to credible websites, General Electric (GE) started its digital transformation in 2014, but three years later it selected Amazon Web Services (AWS) as its top vendor, relying on it to host more than 2,000 cloud-based apps and services.

Artificial Intelligence is the capacity of a digital computer or a robot controlled by a computer to carry out tasks often performed by sentient beings (B.J Copeland, 2021). Artificial intelligence (AI)-based supply-chain management solutions are anticipated to be effective tools

to assist enterprises in overcoming these difficulties. All company functions, from sales to procurement, may address the opportunities and limits with an integrated end-to-end approach. In addition, Artificial Intelligence has the potential to change the game due to its capacity to analyse massive amounts of data, comprehend relationships, provide visibility into operations, and promote smarter decision making. The supply chain's overall performance is improved, and risks are decreased, thanks to Industry 4.0-enabled capabilities like highly organised interconnections and real-time monitoring and control of materials, equipment, and SC parameters (Luthra and Mangla, 2018). The adoption of Industry 4.0 technologies also caused these networks' business models and management approaches to change.

2.2.5 HOW BLOCKCHAIN TECHNOLOGY CAN ENHANCE AGRI-SUPPLY CHAIN

A sophisticated system called the "agricultural supply chain" is in charge of the movement of agricultural goods on the market (Leng Kaijun et al, 2018). Farmers, transporters, warehouses, retailers, suppliers, and consumers are all part of the agriculture supply chain. Development of new products, operations, distribution, financing, marketing, and customer service are also included (Suchita Gupta, 2022). Additionally, a coordinated supply chain entails formalized connections between producers, merchants, processors, and customers. Many industries have discovered they can add value by implementing digital and analytics technologies to new business models and product offerings, and now players in the agriculture sector—from farmers to end users—are learning how these technologies can contribute to the optimization of the bafflingly intricate agriculture supply chain (Nicolas Dennis et al, 2020). Block-chain technology is one such technology that can optimise the complicated agricultural supply chain and also mitigate the many risks associated with it. This point was cemented by Rohit Sharma et al (2020) who suggested that with the exception of a few hazards like weather-related risks, biological risks, and environmental risks, all other risk elements can be optimized for improving the performance of the agricultural supply chain.

Other issues with supply chains that need to be resolved include widespread corruption among middlemen, a lack of transparency in how commodities move through the chain, and a lack of accountability from all parties involved (Malaya Dutta Borah et al, 2020). In order to address

this, according to Mulaya Dutta Borah, organizations must implement block-chain enabled systems that oversee the entire agricultural supply chain while upholding a high level of security and transparency. To ensure customer loyalty and confidence, it is crucial to disclose information about the sources of food goods. In essence, block-chain technology can make any fruit or vegetable as risk-free to purchase as those that are grown locally on a neighbouring farm (Gerald Poe, 2021). Food retailers lack a reliable method to confirm that all items were cultivated in accordance with the requirements set out by a particular supplier when using traditional supply chains. Because of this, major retailers like Walmart, Unilever, and Carrefour already use block-chain to track the origins of food goods (Kamilaris et al, 2019). Furthermore, there is a significant reduction in the amount of time needed to trace the source of food. It took over a week to identify the mangoes' source, to use Walmart as an example. Limiting the time it takes to track a product's source is essential since it allows merchants to isolate this product more rapidly, lowering the risk of injury to humans in the event that the product is subpar.

Reducing the risks associated with the product journey is one of the main goals of supply chain management, according to Kshetri (2018). Because it can track the flow of commodities in real time and improve visibility and transparency of operations, block-chain technology was introduced in this space with the promise of resolving the major issues with the supply chain (Kshetri, 2018). Due to the fact that all transactions will be certified by a group of partners, as was already noted, these advantages can increase the security of transactions and partner confidence (Hokey Min, 2019).

A smart contract can be applied to help enhance an agricultural supply chain. According to Zhao G et al (2019), a smart contract is a type of computer program that is executed by all consensus nodes in the network and is stored on the block-chain. Contractual provisions can be converted into code, saved in the storage file, and then operated automatically and independently in accordance with a set of rules depending on the information that was present in the transaction that triggered them. By using smart contracts, it is possible to minimize the requirement for trusted middlemen between parties and lower the likelihood of deliberate or unintentional exceptions.

Diann Daniel (2022) defines traceability in the supply chain as the ability to identify, track, and trace components of a product or substance as it moves from raw materials to completed items.

Many researchers have attempted to investigate the options from various perspectives in order to integrate block-chain technology in the current traceability system of the agricultural food value chain, such as an agricultural food value chain traceability system based on the joint use of RFID (Radio-Frequency Identification) and Block-chain (Zhao g et al, 2019). Another food traceability system based on block-chain and internet of things (IOT) that includes all the players in a smart agriculture ecosystem has been proposed by several writers. The system is dependable, transparent, self-managing, and ecological. Internet of Things (IOT) devices are employed to minimize human interaction (Mirabelli and Solina, 2020).

2.8 RESEARCH GAP

The researcher suggested that there is limited research with regard to the relationship between block-chain technology and the agricultural supply chain. The impact and effectiveness of block-chain technology and its impact on the financial performance and the agricultural supply chain has not been the focus of the few studies that have been done by various authors, rather, focus was laid mostly on others economic sectors such as retail or shipping. Due to these shortfalls, the researcher tried to analyse the importance of block-chain on supply chains and financial performance in agriculture by figuring out the benefits of block-chain adoption, the various forms within which it can be implemented and the problems that may arise thereafter.

2.9 SUMMARY

Chapter two gives a detailed review of related literature in conjunction with the impact of block-chain technology on the agricultural supply chain and financial performance of organisations within agriculture. Moreover, it serves to answer the various questions posed as a result of the implementation of this new technology. Additionally, the chapter covered the risks that come with and my eventually arise as a result of the adoption of block-chain technology but also paid close attention to its benefits. Chapter Three will include the researcher's process for collecting primary data pertaining to the research.

CHAPTER III

3.0 INTRODUCTION

The methods employed for data gathering and analysis are covered in a research methodology. The methodology chapter, a crucial section of a thesis, dissertation, or research paper, describes what the researcher did and how he or she did it so that readers may assess the validity and dependability of the study (Shona McCombes, 2019). The approaches utilized for data collection, analysis, and the study staging plan are compared in this chapter. The research design, demographic, sample, research tools used to collect various sorts of data during the study, validity and reliability, pretesting, data analysis techniques, and data presentation are all outlined in this chapter. The section finishes with an overview of the chapter.

3.1 RESEARCH DESIGN

The structure of the research endeavour is held together by the research design. In other words, a research design refers to the various methods of conducting research to address the topic being posed (Geoffrey Marczyk et al, 2005). Research design, according to Guy et al. (1987), is a set of steps for data collecting and analysis that are done to assess a specific theoretical perspective.

Put simply, a research design is only a structural framework for the many research methodologies and approaches that a researcher uses. There are numerous designs available for researchers to select from, including the Exploratory Research Design, Case Study Research Design, and Descriptive Research Design. Due to the newness of blockchain technology as a research topic and the fact that, to the researcher's knowledge, no attempts have been made to explore blockchain technology as a policy tool within the context of policy studies, an exploratory research strategy was chosen. This study aims to produce the initial concepts to broaden the nature and size of the research gap and evaluate blockchain from this new angle.

3.1.1 EXPLORATORY RESEARCH DESIGN

A first phase of qualitative data collection and analysis is followed by a second phase of quantitative data collection and analysis that expands on the findings of the first qualitative phase in the sequential exploratory technique (John W Cresswell, 2009). The first step is typically given more weight, and the data is combined by connecting the quantitative data collecting and qualitative data analysis. The major goal of this design is to investigate a phenomena, with the use of quantitative data and outcomes serving as an aid in the understanding of qualitative findings (John W Cresswell, 2009). The researcher employs a three-phase strategy, first collecting and analyzing qualitative data (Phase 1), then using the analysis to construct an instrument (Phase 2), and then administering the instrument to a sample of the population (Phase 3).

3.1.1.1 Advantages of Exploratory Research Design

The exploratory design's two-phase method (qualitative research followed by quantitative research), according to John W. Cresswell (2009), makes it simple to apply and easy to describe and report. It helps a researcher who wants to investigate a phenomenon and build on their qualitative results. According to Babin (2010), the exploratory study is easier to grasp since the researcher gets all the data necessary to properly define the issue and provides all relevant evidence.

3.1.1.2 Disadvantages of Exploratory Research Design

A limitation of the exploratory model is that it takes a significant amount of time to finish both data collection phases. Additionally, the researcher must decide which discoveries from the initial qualitative phase will be the focus of the following quantitative phase. Wyk (2001) further makes the case that the sample used in this study is unlikely to accurately represent or provide an average view of the overall population. He adds that it can be challenging to draw reliable conclusions in some situations due to a lack of statistical support.

3.1.2 DESCRIPTIVE RESEARCH DESIGN (DESCRIPTIVE SURVEY)

A statement-driven theory, data, or direction that establishes a link between variables and is used to describe behaviour and phenomena is what Picardi and Masick (2014) characterize as a descriptive survey. A wide range of research objectives can be achieved through descriptive research. However, only when the process is driven by one or more specific research questions, great thought and effort, and quite frequently exploratory research to clarify the problem and establish hypotheses, do descriptive data become valuable for solving problems. Self-report measures used in survey research include questions, assessments, and interviews. Masick and Picardi (2014).

3.1.2.1 Advantages of Descriptive Survey

A description can reveal a lot of information. It is helpful for locating variables and speculative constructions that may then be researched further using other techniques. When studying behaviours or events that cannot be researched in any other manner, descriptions can be utilized as an indirect test of a theory or model.

3.1.2.2 Disadvantages of Descriptive Survey

Since the environment is entirely natural and every element is there, determining the cause is practically impossible.

3.2 RESEARCH APPROACH

A research approach or research paradigm is a plan and procedure that progresses from broad hypotheses to particular methods for collecting, evaluating, and interpreting data (David Annan, 2019). Consequently, it depends on the kind of study issue being addressed. Research paradigms incorporate fundamental philosophical concepts and values about the nature of reality and the scientific pursuit of knowledge. Importantly, there are two schools of thought about science and knowledge which are positivism, which is quantitative, and phenomenology, which is qualitative (David Annan, 2019). They hold diametrically different views about the

research process and research design. There are two types of research approaches used in educational studies: qualitative and quantitative. In quantitative research, numerical data are collected by objective measurement and utilized to investigate or verify pre-set hypotheses. While qualitative research concentrates on understanding social processes from the perspective of human participants in a natural context, it typically requires a well-controlled environment.

3.2.1 Positivist (Quantitative Research)

The foundation of positivism is the study of social phenomena using numerical measurements and statistical analysis of those measurements. The majority of positivist research is quantitative in nature. It places a high value on the objectivity and dependability of discoveries and sees reality as a consistent phenomenon that can be observed and measured. This encourages repetition (David Annan, 2019). Positivism may not always be appropriate when used in social sciences and business research because not all social phenomena can be precisely and consistently quantified, decreasing the validity of the results. This approach was used for a specific objective namely:

3.2.1.1 To establish how effective blockchain technology is in improving the financial performance and improving the supply chains of the agricultural sector

In order to establish the effectiveness of a phenomenon such as blockchain technology, numerical data collected by objective measurement should be used to ascertain its effectiveness. The data collected should display the financial performance of an institution numerically before the adoption of blockchain and after the adoption of blockchain in order to determine the effectiveness of the technology.

3.2.1.2 To analyse the impact of the adoption of blockchain technology on the financial performance and supply chains of organisations in the agricultural sector

Analysing the financial performance of an organisation entails that the use of numerical information and data is mandatory. In order to answer this objective, the information collected should be consistently quantified and the results should be valid, thus, the need for a quantitative research.

3.2.2 Phenomenological (Qualitative Research)

The world, according to David Annan (2019), is a social construct, science is motivated by human interests, and the researcher, as a subjective being, is a component of the world they are observing. Trying to be objective is impossible. When compared to the practice of watching events in a genuine, real-life situation, the findings frequently have greater veracity and less artifice. It frequently enables scientists to create a more precise knowledge of such occurrences.

It frequently exhibits complexity and depth of comprehension of the details. The subjectivity of the researcher and the low dependability of the findings, in which two researchers may get different conclusions from their concurrent observations of the same phenomenon, jeopardize phenomenological motivated research occasionally. This research approach was applied in an attempt to answer the following research objectives:

3.2.2.1 To examine how blockchain technology can be implemented in supply chain management by agriculture organisations in Zimbabwe

In order to obtain an answer as to how blockchain can be implemented, qualitative research is necessary. The complexity and depth of how this new technology can be implemented can only be realised by observing real life situations where it has been applied and through the gathering of information through articles that are similar.

3.2.2.2 To assess how blockchain technology can solve supply chain problems in the agricultural sector of Zimbabwe

Assessing is evaluating or estimating the nature, ability, or quality of a particular phenomenon. In this case, evaluating is critically examining blockchain technology and it involves collecting and analysing information about a technology's activities, characteristics, and outcomes. Its purpose is to make judgments about the technology with regards to how it can solve supply chain problems particularly in the agricultural sector. Because of this, this objective can only be answered by a qualitative research.

3.2.2.3 To analyse the challenges that can be faced by organisations in the agricultural sector as a result of adopting and implementing blockchain technology

Analysing entails surveying, investigating, and exploring information about a particular phenomenon, in this case, the challenges that can be faced by organisations in agriculture as a result of blockchain technology adoption. Exploring data about the challenges that can be endured can only be effectively done if the research is qualitative.

3.2.3 Mixed Approach Research

According to David Annan (2019), researchers may use a blended strategy that draws from positivism and phenomenology after observing the benefits and drawbacks of positivistic and phenomenological biases in research. The researcher can improve the validity and reliability of the findings by utilising a variety of research techniques. By using the strengths of different approaches in the same study, one method's shortcomings can be mitigated. The use of a mixed-methodology design allows the researcher to combine aspects of both paradigms using the advantages of both when appropriate. This approach to research was applied to the following objective:

3.2.3.1 To explore other technological tools that can be effected to combat a decrease in organisational financial performance and improve supply chains

The qualitative aspect of the research was used in exploring the different types of technological tools that can be used in conjunction with aiding supply chain management. This was done in order to be as objective as possible. Analysing the effect on financial performance warrants the use of numerical data, thus, the quantitative aspect the research.

3.3 POPULATION

Pritha Bhandari (2022) defines a population as a group containing elements of anything to be studied, such as objects, events, organisations, and countries in order to draw conclusions. Furthermore, in research, a population doesn't always refer to people. It can mean a group containing elements under study, such as objects, events, organizations, countries, species, or

organisms. Therefore, for this study, the population comprised of seventy one companies within the agricultural sector of Zimbabwe.

3.4 SAMPLE

Picardi and Masick (2014), define sampling as an idealized representative group of the population comprising all traits that the population as a whole possesses. Put simply, a sample is a subset of the target population that the researcher intends to analyse in order to draw conclusions about the target population as a whole. Because of its practicality, sampling is a crucial component of research where the depth of the subject is more significant than its breadth (Beck and Manuel, 2008). Table 3.1 shows the aggregate distribution of the population's sample.

Table 3.1. Sample Framework

AGRICULTURAL ORGANISATION	RESPONDENTS
Irvine's Zimbabwe	5
Surrey Group	4
Suncrest Zimbabwe	3
Triple C Pigs	4
Seedco International	4
Total	20

Of the whole population, twenty respondents of different organisational positions, mostly in the finance, accounting and human resource departments, were selected as the required sample size.

3.4.1 Sampling Techniques

The name or other identifier of the specific process used to choose the entities for the sample is referred to as a sampling technique (Kamal, 2019). There are probability and non-probability sampling strategies, according to Fowler (2002). There are two types of sampling techniques: probability sampling and non-probability sampling. Purposive sampling is a non-probability

sampling approach, whereas random, systematic, and stratified sampling are all types of probability sampling. The below-discussed purposive strategies were used by the researcher.

3.4.2 Purposive Sampling

In order to identify and pick instances with a wealth of information and make the best use of the limited resources available, purposeful sampling is a technique that is frequently employed in qualitative research (Patton, 2002). Finding and choosing people or groups of people who have particular expertise in or experience with an interesting phenomenon entails doing this (Cresswell & Plano Clark, 2011). This sampling technique is normally used for small groups where representatives are chosen for each group by the researcher and not all members of the population have an equal chance of being represented in the sample.

3.4.3 Advantages of Purposive Sampling

This method enables the researcher to use judgment while responding to the research questions and attaining the study's objectives by classifying the respondents into applicable quotas and selecting the cases that would be most helpful to the study. Willis (2008) suggests that purpose sampling promotes respondents to be well-known specialists, which typically yields high-quality and reliable data collecting.

3.4.4 Disadvantage of Purposive Sampling

The incorporation of human judgement may at times prove to cause bias which may jeopardize the data collected.

3.5 DATA SOURCES

The data source is the place where the data that is being used in research originates. The researcher used both primary and secondary sources of data in the study.

3.5.1 Primary Sources of Data

Primary data focus on the extra information in order to update or improve the information collected from secondary sources. Interviews served as the primary data collection strategy.

The information gathered through surveys and interviews constitutes the primary data. Hox and Boeije (2005) define primary data as information gathered specifically for the study subject at hand using methods that work best for that problem. Additionally, as new primary data is gathered, it is added to the already-existing database of social knowledge. A research can be conducted without secondary data but research based on only secondary data is the least reliable and may have biases because secondary data has already been manipulated by human beings, thus, stressing the importance of primary data.

3.5.2 Advantages of Primary Sources of Data

The needs of the researcher at the time of data collection are specific to primary data. The type of data being gathered can be managed by the researcher. Compared to secondary data, it is accurate because the information is free from personal bias thus its legitimacy can be believed. Bokin (2009) claims that because the source data are unique and pertinent to the study's subject, there is a very high level of accuracy. The investigator collects data specific to the problem under study. There is no doubt about the quality of the data collected (for the investigator). If required, it may be possible to obtain additional data during the study period.

3.5.3 Disadvantages of Primary Sources of Data

Comparatively speaking, primary data is relatively expensive. Therefore, gathering primary data could be challenging. It takes a lot of time mainly due to ethical considerations such as consent and permissions.

3.5.4 Secondary Sources of Data

Wellman and Kruger (2003) state that secondary data might be quantitative or qualitative, contemporary or historical, and that it typically requires changes and confirmation before being used. Secondary data is information that already exists at the time of the inquiry, as opposed to primary data. When employed by a third party, they typically start out as primary data but end up being secondary. The researcher can simply compile or analyse data that has already been acquired rather than having to create it themselves. Secondary data can be collected from journals, internet publications, financial magazines, newspapers, government publications, and

Reserve Bank of Zimbabwe publications. Sometimes it is difficult to obtain primary data; in these cases getting information from secondary sources is easier and possible. Sometimes primary data does not exist in such a situation one has to confine the research to secondary data.

3.5.5 Advantages of Secondary Sources of Data

Secondary data are usually easily accessible to researchers and individuals because they are mostly shared publicly. Secondary data also allows the researcher to come up with new ideas from those already published. No hassles of data collection and it is less expensive

3.5.6 Disadvantages of Secondary Sources of Data

According to Babin (2010), the main drawback of using secondary data is that the sources used to contain data gathered for other projects that may be useless or inapplicable to the current study

3.6 RESEARCH INSTRUMENTS

According to (Sürücü & Maslakci, 2020), instruments are the methods for gathering data that will be used for analysis. How reliable and timely the information is will depend on the research methods used. The questionnaire and interview are data collection instruments that enable the researcher to pose questions to participants in search of information on the research topic. Each of these instruments has distinct features that enable the researcher to decide which is correct and appropriate for the specific data collection purpose (David Annan, 2019).

3.6.1 Questionnaire

The purpose of a questionnaire is to collect information from respondents about their attitudes, experiences, and opinions. Questionnaires are used to gather quantitative and/or qualitative data (Pritha Bhandari, 2021). The questionnaire consists of a number of standardised questions that are intended to collect the necessary data. The questions are intended to collect the information needed to test your theory. The researcher must pay close attention to the validity of the research instrument's findings and the dependability of respondents (David Annan,

2019). The questions can either be closed-ended or open-ended. Closed-ended, or restricted-choice, questions offer respondents a fixed set of choices to select from. Closed-ended questions are best for collecting data on categorical or quantitative variables. Open-ended, or long-form, questions allow respondents to give answers in their own words. Because there are no restrictions on their choices, respondents can answer in ways that researchers may not have otherwise considered. Because respondents provided a personal view without the researchers' or other people's influence, the use of questionnaires decreased manipulated or corrupted responses. Honest and objective comments were encouraged by anonymity and privacy evoked by questionnaires. According to Jackie Lohrey (2017), a questionnaire should assist in accomplishing the research objective. This research instrument was used to aid in the solving of a number of objectives namely:

3.6.1.2 To examine how blockchain technology can be implemented in supply chain management by agriculture organisations in Zimbabwe

The implementation of blockchain technology requires both closed-ended and open-ended questions that will give categorical and quantitative variables that are best for collecting the data. How this phenomenon can be implemented is a subjective issue, therefore, the use of a questionnaire will allow the research to grasp a variety of subjective responses from a variety of people with regards to the objective.

3.6.1.3 To analyse the challenges that can be faced by organisations in the agricultural sector as a result of adopting and implementing blockchain technology

Challenges faced as a result of a new type of technology are unique to every organisation and individuals alike. Because of this, a questionnaire is suitable to answer this objective because it will provide an array of different open-ended and closed-ended answers with reference to the challenges that may be faced by organisations in the agricultural sector.

3.6.1.4 To assess how blockchain technology can solve supply chain problems in the agricultural sector of Zimbabwe

This is another subjective objective that pertains to specific organisations within the agricultural sector. This means that blockchain technology can solve different supply chain problems for different organisations, therefore the use of a questionnaire will allow the researcher to get different answers on how blockchain can solve different problems.

3.6.1.5 Advantages of Questionnaires

Questionnaires provided a reference point because answers were provided in writing, allowing for the development of questions that were directly related to the research. According to Willis (2008), questionnaires provide for greater information analysis than unrestricted interviews. However, with questionnaires, there may be a limit on the amount of space available or the type of response that can be provided.

3.6.1.6 Disadvantages of Questionnaires

According to Fowler (2002), the issue with surveys is that respondents are unable to clarify anything they do not understand or in cases where the questionnaire is poorly structured. Given the small number of respondents, the space restriction on questionnaires presents additional difficulty.

3.6.2 Company Annual Reports

Annual reports are a form of secondary data and are comprehensive documents designed to provide readers with information about a company's performance in the preceding year. The reports contain information, such as performance highlights, a letter from the CEO, financial information, and objectives and goals for future years (CFI, 2022). For this research, this instrument of secondary data was used in order to gather financial data and answer the following objective:

1. To establish how effective blockchain technology is in improving the financial performance and improving the supply chains of the agricultural sector

This objective is quantitative in nature because it requires measuring the degree of influence that blockchain technology can have on a supply chain and the financial performance of

organisations. Thus, in order for the researcher to analyse the effectiveness of blockchain technology on a supply chain and financial performance, company annual reports were analysed by recording the profit margins of an agricultural organisation over a period of four years, 2018, 2019, 2020 and 2021. The second wave of the hyperinflationary economy started in 2019, therefore, the researcher will analyse the profitability of agricultural organisations from 2018 to 2021 in order to see just by how much profitability was affected by the economic problem. In conclusion, by observing the company annual reports, the findings will allow the researcher to see whether blockchain should be adopted by agricultural organisations or not, thus revealing its effectiveness.

3.6.3 Likert Scale

According to Dr Saul Mcleod (2008), the likert scale is a five (or seven) point scale that is used to allow the individual to express how much they agree or disagree with a particular statement. Reis et al (2004), states that the Likert scale is a summary of the respondent's viewpoint emphasizing their degree of agreement with the posed question or statement. The Likert scale provides five possible answers to a statement or question that allows respondents to indicate their positive-to-negative strength of agreement or strength of feeling regarding the question or statement (Dr Saul Mcleod, 2008). As shown in figure 3.2 below, the scale is a research model utilized as a closed-ended question form that offers respondents options from strongly agree to strongly disagree.

Table 3.2 The Likert scale

Item	Strongly Agree	Agree	Undecided	Disagree	Strongly Disagree
Points	1	2	3	4	5

3.6.3.1 Advantages of the Likert Scale

Since it employs a standard technique for gathering data, it is simple to comprehend. When working with quantitative data, it is simple to create reports, graphs, reports, and conclusions

from the responses. The respondents are free to be neutral if they so desire rather than being compelled to state any position.

3.6.3.2 Disadvantages of the Likert Scale

Because they are complicated, attitudes and beliefs are difficult to categorize using a scale. Ranked questions do not give respondents the opportunity to elaborate or provide justification for the stated level of satisfaction.

3.6.4 Justification

The researcher used the questionnaire to check for consistency in the wording of the questions and to judge how comparable the outcomes were. It can be advantageous to utilize questionnaires since they can be designed to restrict respondents' knowledge and define the questions that will be asked, simplifying data analysis. Since the researcher collected information from several agricultural organisations, the questionnaire took the researcher less time to complete. The adoption of interviews helped the researcher to draw more detailed conclusions than other research methods, taking into consideration nonverbal cues, off-the-cuff reactions, and emotional responses.

3.7 DATA COLLECTION PROCEDURES

Data collection is the process of gathering data for use in business decision-making, strategic planning, research and other purposes (Craig Stedman, 2022). Effective data collection provides the information that's needed to answer questions, analyse business performance or other outcomes, and predict future trends, actions and scenarios. With the help of the data they have collected, a researcher can evaluate their hypothesis. During the process, great attention is placed on obtaining reliable and accurate information that can be used to make judgments.

3.8 DATA VALIDITY

According to Fiona Middleton (2019), data validity is the extent to which the results really measure what they are supposed to measure and this is done by checking how well the results correspond to established theories and other measures of the same concept. In other words,

validity refers to how accurately a method measures what it is intended to measure. If research has high validity, which means it produces results that correspond to real properties, characteristics, and variations in the physical or social world.

High reliability is one indicator that measurement is valid. If a method is not reliable, it probably isn't valid. In general, a trustworthy and valid measurement is one that yields accurate data that can be replicated. In order to strengthen the validity of the study, the researcher developed specific and appropriate questions that addressed the study's issue.

3.9 DATA RELIABILITY

The definition of reliability refers to how consistent the findings from different studies on the same topic are in the same situation (Thunberg, 2021). The method for gathering and analysing data in order to achieve the highest level of reliability was covered in great detail in this chapter. Other researchers will find it simpler to do a comparative study in the future thanks to the in-depth explanation. In order to prevent a few outlier personalities from distorting the data's reliability, the researcher also chose a reasonably large sample size of 20 participants. Because they were given to persons who were knowledgeable about the research fields and the researcher was involved in the operations, the devices used for data collecting were reliable. The questionnaires used to collect the data included inquiries that were set up so that the responses are not prejudicial.

3.10 DATA PRESENTATION

A quantitative study's goal is to produce findings. In contrast to qualitative approaches, which utilise language to provide a framework for articulating the core of what the data reveal, quantitative methods use procedures and techniques to analyse data numerically. The researcher will eliminate troubling outliers and overlook non-responses while sorting the data. Through inspection, the acquired data will be cleansed, and incorrect data will, if necessary, perhaps be repaired. After gathering the data, the researcher compiled it and organized it into topic groups. Cross tabulation and graphics were used primarily to present the data. By examining frequencies in tables and graphs, the researcher will compare and analyse the data for variance.

3.11 DATA ANALYSIS

According to Reis et al. (2004), data analysis is carried out in order to draw a conclusion from the provided data. This means that a summary must be used for this purpose, and comparisons with the research questions must be performed to guarantee that the findings are credible and pertinent to the study. The mean, median, mode, variance, and standard deviation are among the modes that can be used to analyse data and draw conclusions. To draw conclusions from the research findings, the researcher followed this method. According to Reis et al (2004), the mode is the most frequently selected response by respondents.

For the objectives of this research, pie charts and tables will be useful to analyse and present data. There are many different ways that data can be presented. According to the uniformity of the questions posed on the influence of blockchain technology on the supply chain and financial performance of organizations in Zimbabwe's agriculture industry, the responses provided were sorted in accordance with the questions posed in the questionnaire.

3.11.1 Analysis Method Implemented

3.11.1.1 Pearson Correlation Coefficient

The Pearson Correlation Coefficient was implemented in order to answer the primary objective which reads:

1. To analyse the impact of the adoption of blockchain technology on the financial performance and supply chains of organisations in the agricultural sector

For this particular research, the researcher collected and analysed data using a quantitative approach. Data was collected using questionnaires, and an agricultural organisation's secondary data, which is Seedco international Ltd, was also used to gauge the understanding of the potential effect of blockchain technology. In order to decide the

relationship between the independent variables and the dependent variable, the Pearson correlation coefficient method was used. The Pearson correlation coefficient is a measurement of the linear link between two variables and can be used to quantify the relationship between two variables. Since there are two dependent variables, which are supply chain and financial performance, the researcher decided to use financial performance as the single dependent variable in order to answer the primary objective. In this research, the impact of blockchain technology will be quantified by using the numerical values that pertain to the extent to which the technology was adopted in Zimbabwe by agricultural organisations. Financial performance is a dependent variable measured by an organisation's return on capital employed. The Formula used to calculate the correlation coefficient is:

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{n\sum x^2 - (\sum x)^2} \sqrt{n\sum y^2 - (\sum y)^2}}$$

Where:

r = coefficient of correlation

If:

r = -1 it means a perfect negative linear correlation between two variables

r = 0 means no linear correlation exists between two variables

r = 1 means a perfect positive linear correlation exists between two variables

3.12 ETHICAL CONSIDERATIONS

Ethical considerations are a set of principles that guide the researcher's research designs and practices. The researcher must always adhere to a certain code of conduct when collecting data from people. The respondents participated in a legitimate study that was conducted by the researcher, and they did so voluntarily and with their agreement rather than under duress. The respondents' consent was required in order to avoid using improper influence or coercion to get information. All study-related information was used for this purpose and disseminated to the respondents in order to ensure that the research is transparent. The respondents were made

aware of the voluntary nature of participation as well as their freedom to opt out of the process completely or in part. No questionnaire requested this information from responders because their identities were kept hidden.

3.13 CHAPTER SUMMARY

The chapter's main topic was the researcher's research methodology, which included determining the study's design, data source, target population, sample techniques, data analysis, and data presentation. The rationale for the used sample procedures was also explained in this chapter. The chapter also looked at the research methods that were used to gather the data, highlighting problems and suggesting fixes. The presentation and analysis of the results will be covered in the following chapter.

CHAPTER IV

DATA PRESENTATION AND ANALYSIS

4.0 INTRODUCTION

The obtained data, both qualitative and quantitative, response rates, and the analysis of such data are all covered in this chapter. When necessary, graphical representations and empirical computations will be employed to analyse the quantitative data gathered. The headings offered will be in response to the study's goals and research questions.

4.1 Response Rate

Below is a comparison of successful and targeted interviews, along with a breakdown of the questionnaire and interview response rates.

Table 4.1: Questionnaire response rate analysis

Respondents	Issued	Response
Surrey Group	4	4
Suncrest Zimbabwe	3	3
Irvine's Zimbabwe	5	5
Triple C Pigs	4	4
Seedco International	4	4
Total	20	20

Twenty questionnaires were sent, and twenty were collected, giving a 100% response rate, according to an analysis of the respondents' rate on questionnaires and above (see Table 4.1). This was mostly caused by the managers' accessibility and ease of follow-up in all departments. The researcher delivered the questionnaires electronically through the Google

form format. This increased the efficiency with which the study took place and allowed the researcher to receive fast responses.

4.2 Questionnaire Presentation and Analysis

4.2.1 What is your gender?

Figure 4.1: Depiction of the genders of the respondents

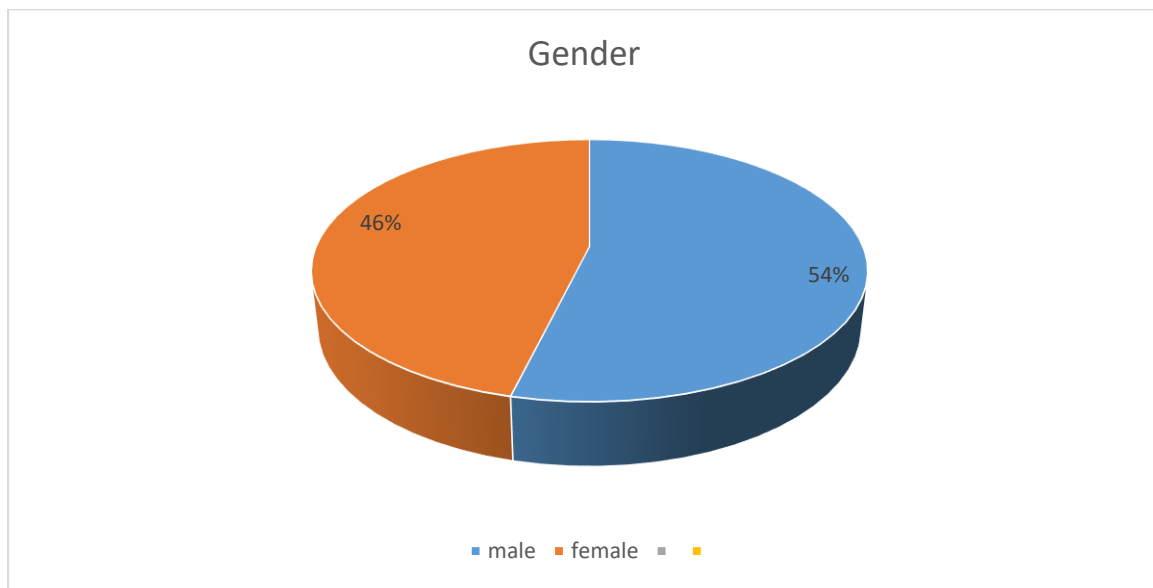


Figure 4.1 presents the percentage of the two genders that were involved in the questionnaire. 46% of the respondents were female, while 54% of the respondents were male. The benefits of incorporating the gender dimension include increased scientific creativity and excellence in answering questions throughout the survey. In this research, there was no large disparity between the genders of the respondents.

4.2.2 What is your age range?

Figure 4.2: Presentation of the age of the respondents

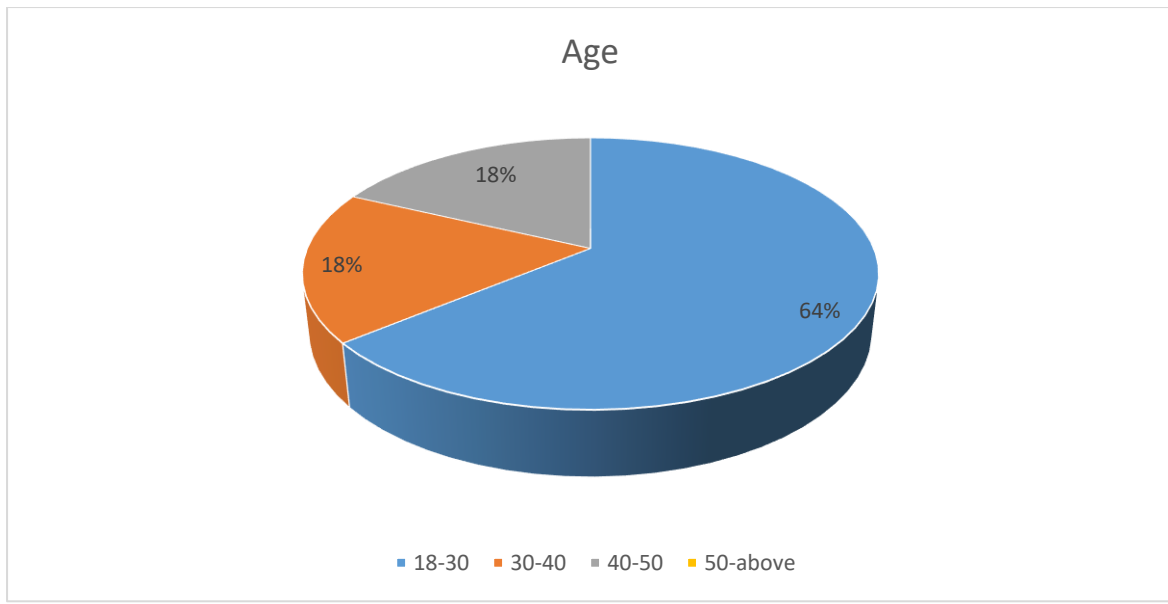
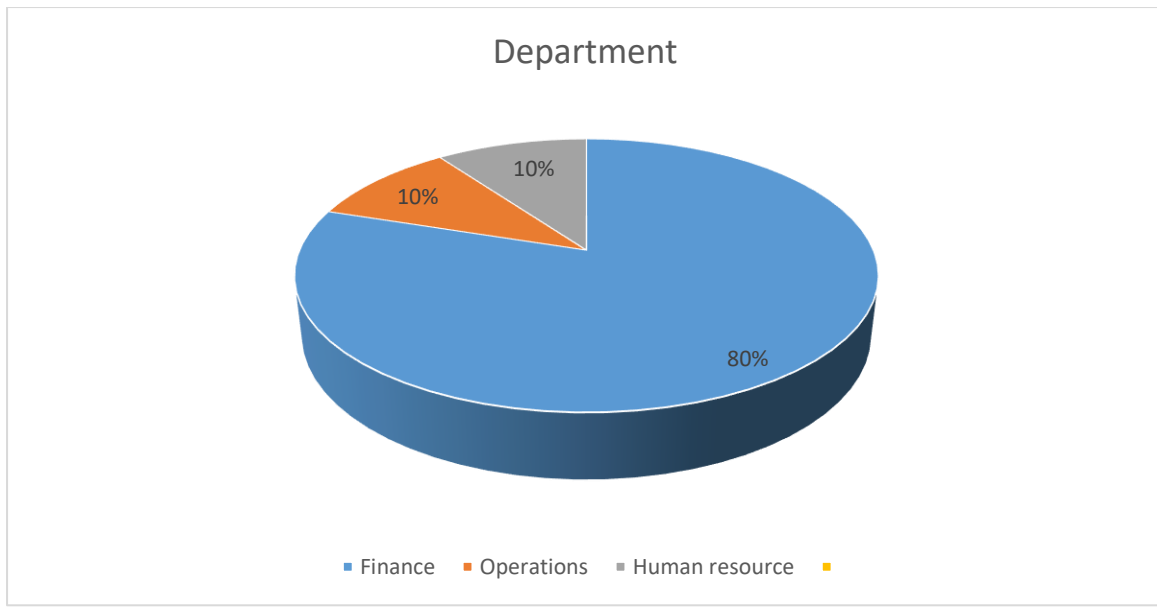


Figure 4.2 depicts that 64% of the respondent's ages ranged from 18 years to 30 years, whilst 18% of the respondent's age group ranged from 30 years to 40 years. Another 18% of the respondents belonged to the age group of 40 years to 50 years and none of the respondents were aged 50 years or above. Since block-chain technology is a new phenomenon, having the majority of the respondents being in the age group 18 years to 30 years is expected because younger age groups are more hip to technological advancements.

4.2.3 Which department do you work in at your organisation?

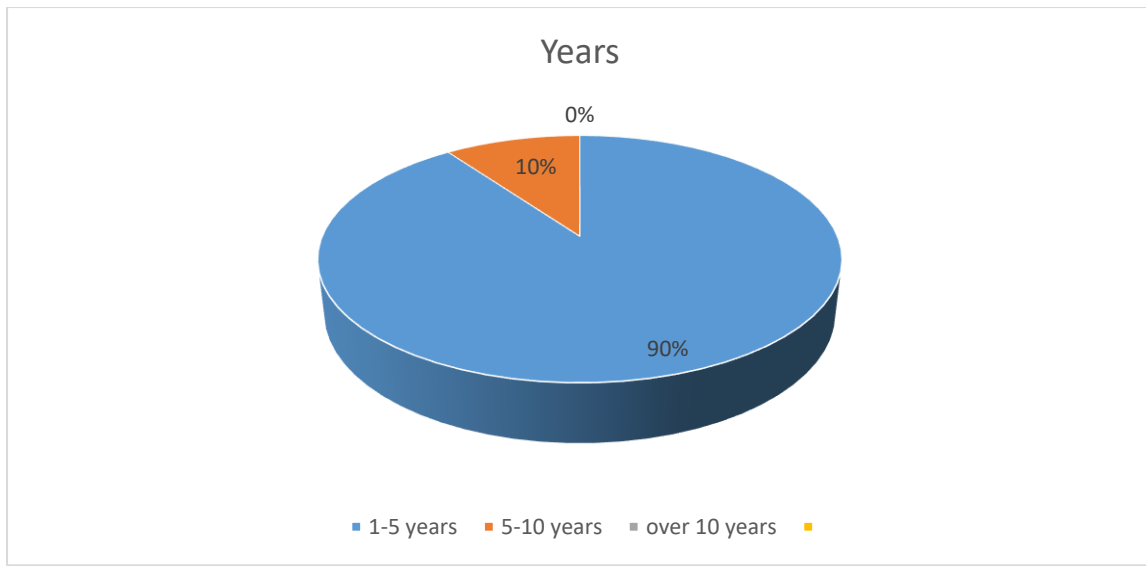
Figure 4.3: Department positions of the respondents



The majority of the respondents belonged to the finance department of their respective organisations, making up 80% of the respondents as a whole. 20% of the respondents belonged to the operations department and the human resource department, with 10% of respondents in each department respectively. Financial performance is one of the variables in the research, thus having the majority of the respondents in finance provides the research with more insight into how block-chain technology might impact the financial performance of agricultural organisations.

4.2.4 For how long have you been employed by your organisation?

Figure 4.4: Employment experience of the respondents



According to figure 4.4 above, 90% of the respondents have been employed at their respective organisations for 1 to 5 years. The remaining 10% have been employed for 5 years to 10 years. Due to the young age group of the majority of the respondents, the shorter period of employment, which is 1 year to 5 years, the employment experience of the majority of the respondents is not above 5 years.

4.2.5 State your highest academic qualification

Figure 4.5: Highest Academic Qualification

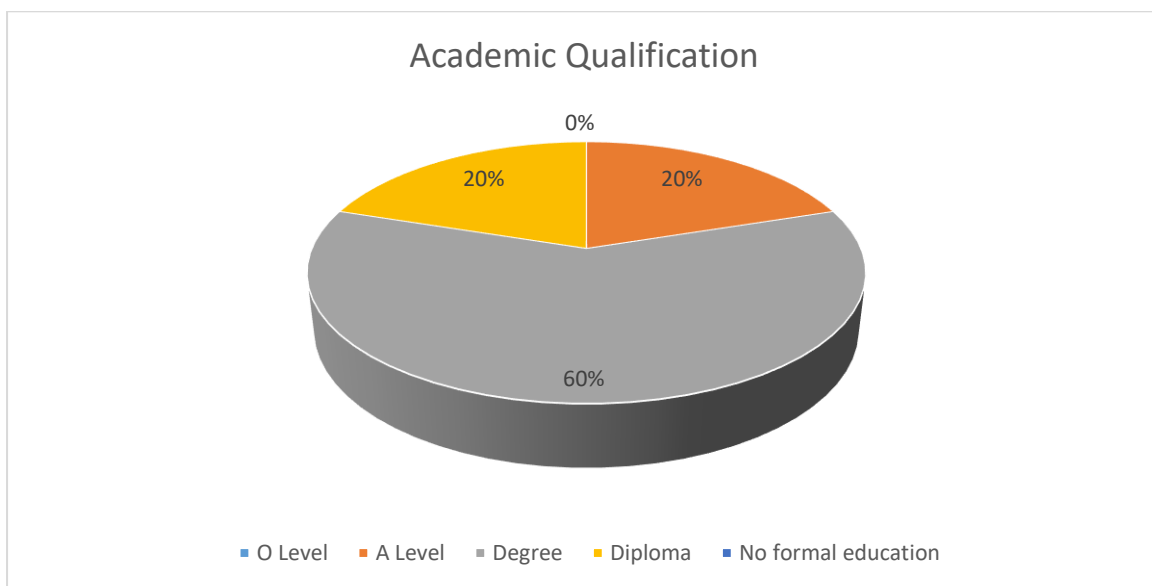
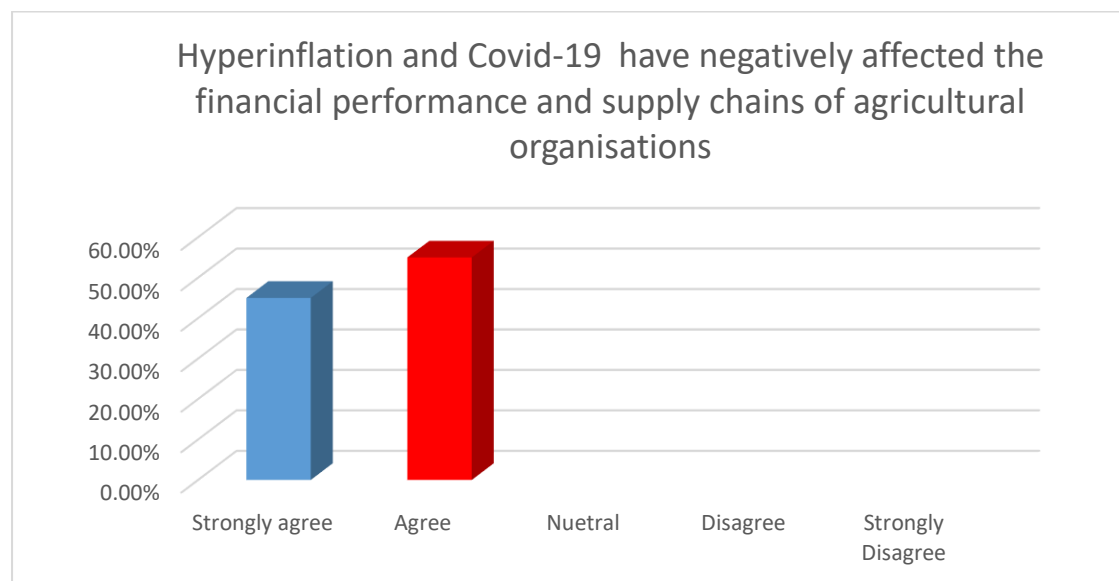


Figure 4.5 depicts that 60% of the respondent's highest academic qualification is a degree. The remaining 40% is distributed evenly at 20% each at both A level and O level. This makes the quality of responses more reliable because the majority of the respondents have a degree, which could be a master's or bachelors.

4.3 Analysing the impact of block-chain technology on the financial performance and supply chain of organisations in the agricultural sector

4.3.1 Hyperinflation and Covid-19 have negatively affected the financial performance and supply chains of agricultural organisations

Figure 4.6: Responses on the effect of hyperinflation and covid-19 on financial performance and supply chains

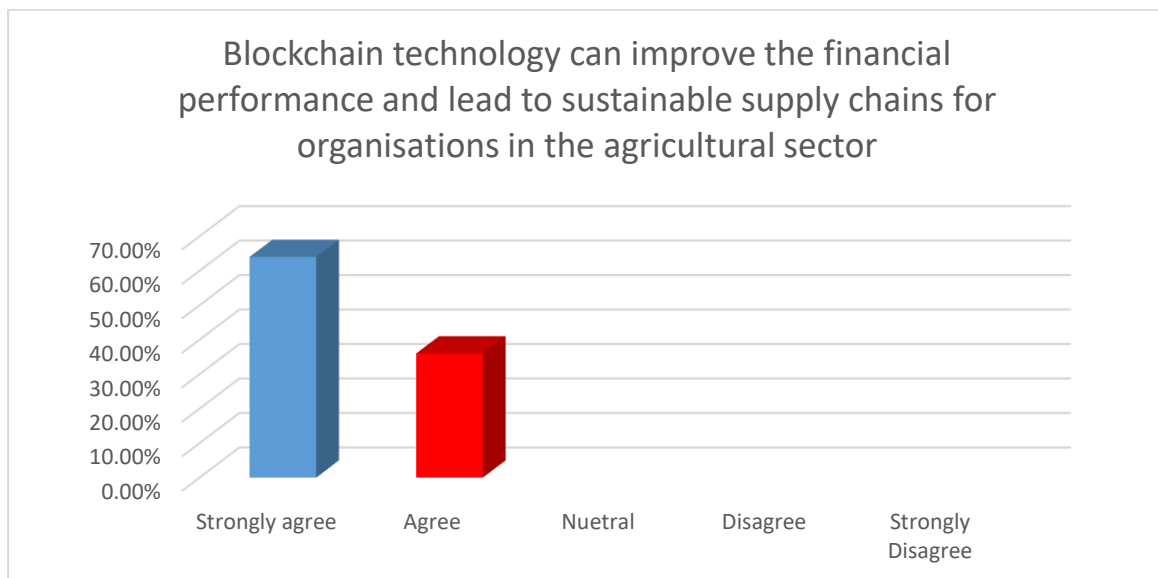


The majority of the respondents agreed that hyperinflation and covid-19 negatively affected the financial performance and supply chains of agricultural organisations. More specifically, 45% of the respondents strongly agreed with this notion and 55% simply agreed. In literature, Steven Munharo et al (2021) stated that covid-19 stretched the supply chains in Zimbabwe far beyond its capacity, especially with regards to healthcare. In the same vein, Huma Hayat Khan et al (2022) suggested that global food supply chains became rigid throughout the COVID-19 pandemic, generating the need to uplift the flexibility of agricultural supply chains with the

help of enhanced efficiency in agriculture product manufacturing, dispensation, and consumption. Therefore the responses to the questionnaire are in synchronisation with the knowledge written in literature.

4.3.2 Block-chain technology can improve the financial performance and lead to sustainable supply chains for organisations in the agricultural sector

Figure 4.7: Responses to block-chain technology improving financial performance and leading to sustainable supply chains for agricultural organisations



The findings figure 4.7 show that generally the respondents agreed that blockchain technology can improve the financial performance and lead to sustainable supply chains for agricultural organisations. More specifically, 64% of the respondents strongly agreed with this statement and 36% agreed. Friedman and Ormiston (2021) state that blockchain technology has been touted to have significant potential for supply chain sustainability and in this sense, blockchain technology is being framed as a potential sustainability-oriented innovation (SOI). Therefore, the idea that blockchain technology can lead to sustainable supply chains for agriculture organisations has been further cemented by the questionnaire.

4.3.3 If adopted, the overall impact of Block-chain technology on the agricultural sector will be positive

Figure 4.8: Response on the overall impact of block-chain technology on agriculture being positive

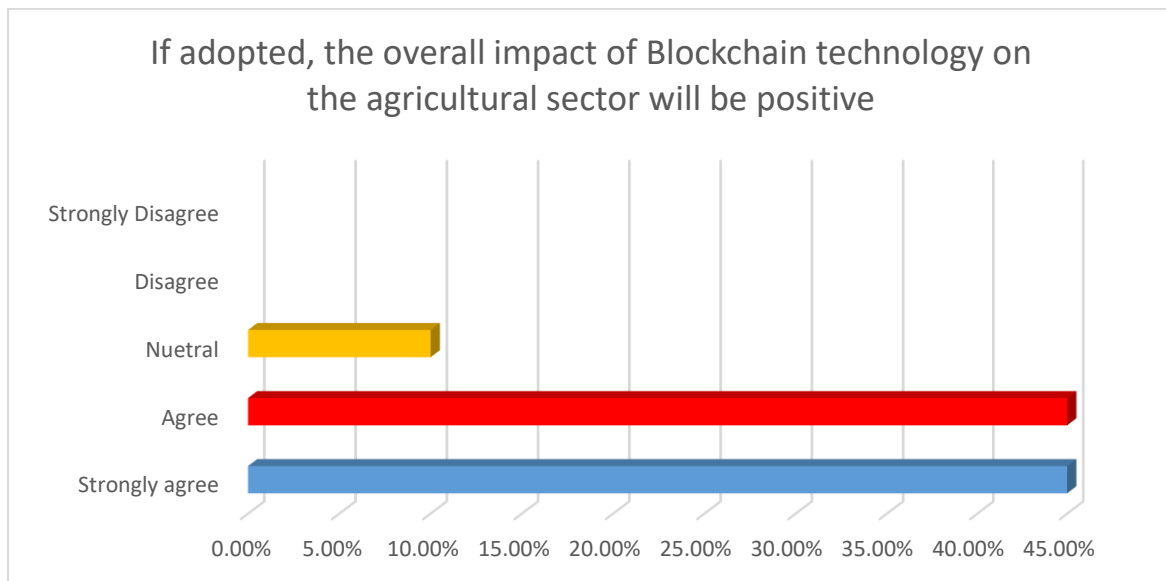


Figure 4.8 show that 45% of the respondents strongly agree that block-chain technology will be positive on agriculture and another 45% agree. 10% of the respondents are neutral on the matter, which means they neither agree nor disagree that block-chain technology will be positive. Andreas Sendros et al (2022) further reiterated these responses by stating that block-chain can increase transparency and accountability in supply chain networks and help detect counterfeit products easily and reduce intermediaries, thus, potentially benefiting the agricultural sector. The responses from the questionnaire and the information detailed in literature are similar in this sense.

4.3.4 The following attributes of block-chain technology allow it to enable a sustainable supply chain

Table 4.2: Attributes of block-chain technology

Attributes	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Total
i. Traceability	11	7	2			20
ii. Transparency	6	12	2			20

iii. Privacy	7	8	5			20
iv. Security	9	8	3			20

4.3.4.1 Traceability

Out of 20 respondents 7 (35%) agree that traceability is enabled by block-chain technology and 11 respondents (55%) strongly agree whilst 2 respondents (10%) are uncertain.

4.3.4.2 Transparency

6 out of 20 respondents (30%) strongly agree with the statement, as depicted by table 4.1, and 12 respondents (60%) agree with the statement. 2 respondents (10%) are uncertain.

4.3.5 Do you think blockchain technology has been adopted to a large extent by agricultural organisations in Zimbabwe?

Figure 4.9: Results of the extent to which agricultural firms in Zimbabwe have adopted blockchain

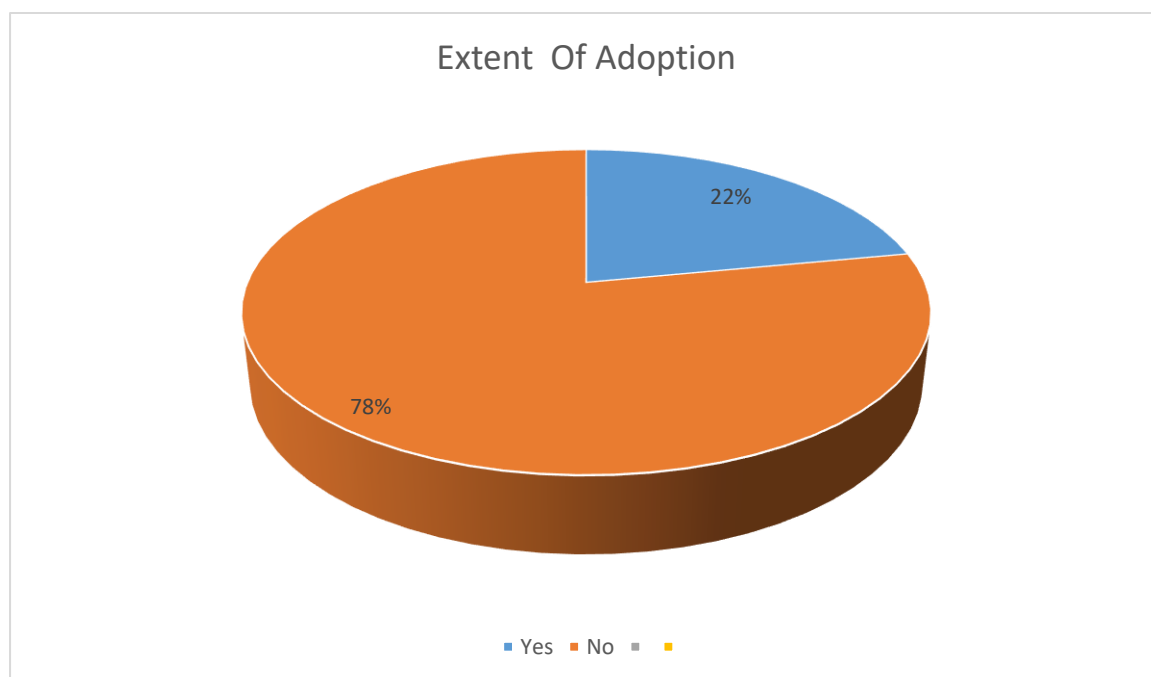


Figure 4.9 shows that more respondents disagree that blockchain technology has been adopted by agricultural firm in Zimbabwe by 56%. More specifically, 78% of the respondents do not agree with the statement that blockchain technology has been adopted to a large extent and only 22% of the respondents agree that blockchain technology has been adopted to a large extent by firms in Zimbabwe. In conclusion, the pie chart shows that generally blockchain technology is still in its infancy in Zimbabwean agriculture and has not yet been adopted to a large extent.

4.3.6 Which blockchain enabled technologies are agricultural firms in Zimbabwe currently utilising?

Responses

1. Radio-frequency Identification

Through the data collection on recognised products, Radio-frequency identification technology has assisted in resolving supply chain traceability issues. Because blockchain technology operates mathematically and blocks are produced to transport information, transactions must be verified by numerous users, which provides the required security to secure data transactions. As a result, blockchain technology and RFID go hand in hand. The marriage of RFID technology and blockchain can provide incredible value for companies. RFID transfers and captures product information, which is safeguarded by the blockchain. Zimbabwean cattle now tagged with ultra-high radio-frequency identification tags and registered on a traceability system. Each time the animal gets dipped, vaccinated or receives medical treatment, the tag logs the event onto the system (Zim Express Digital, 2022).

2. E-livestock Master-card solution

MasterCard's blockchain-based Provenance technology and E-Livestock Global unveiled a first-of-its-kind solution that would enable Zimbabwean farmers to prove the provenance and health records of their cattle while lowering risks for buyers. The

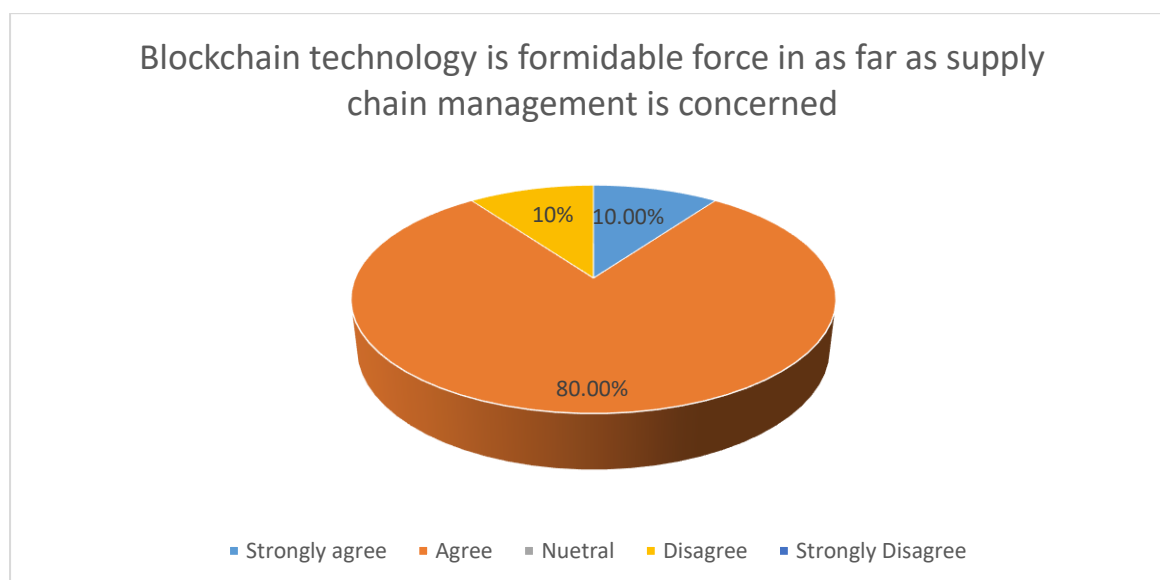
approach, a first in the Middle East and Africa, offers fresh hope to the nation's agricultural industry after a tick-borne disease outbreak in 2018 resulted in the loss of 50,000 cattle (Newsroom, 2021).

3. Cloud Systems

4.4 Examining how block-chain technology can be implemented in supply chain management by agriculture organisations in Zimbabwe

4.4.1 Block-chain technology is formidable force as far as supply chain management is concerned

Figure 4.10: Responses on block-chain technology being a formidable force in as far as supply chain management is concerned.

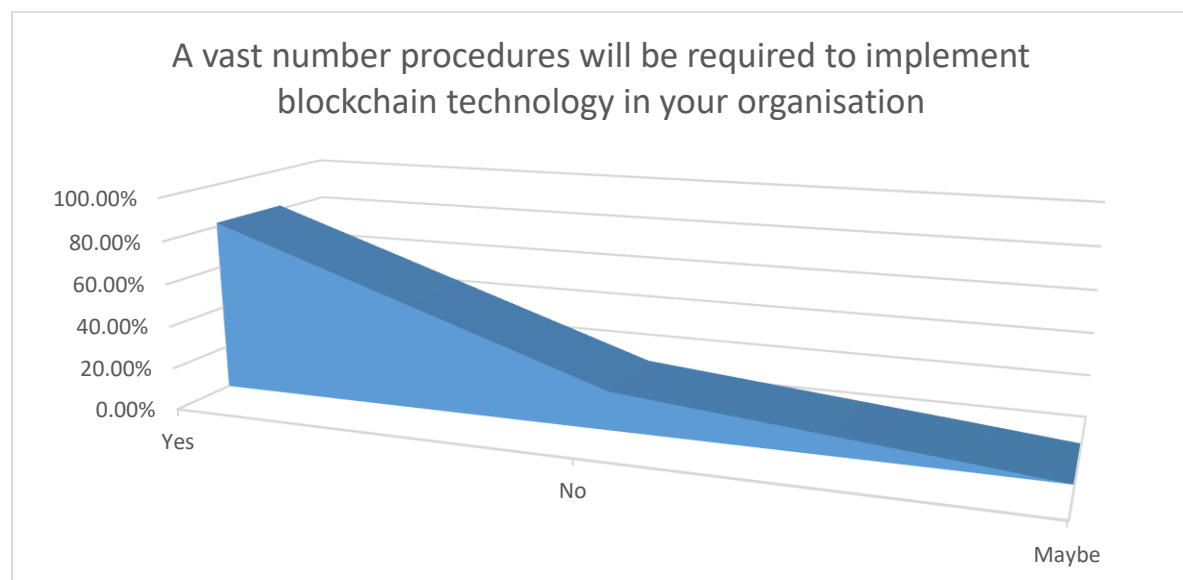


According to figure 4.9, the minority of respondents made up 20% of the responses, more specifically, 10% of the respondents disagree with the statement and another 10% strongly agree with the statement. However, 80% of the respondents agree with the statement. By

definition, something that is formidable is immensely great, therefore, the respondents by large agree that block-chain technology is immensely great and will improve supply chain management. Saberi et al (2019) agrees with the majority response because he suggested that block-chain technology is gaining momentum as an innovation that can drive sustainability in global supply chain management.

4.4.2 A vast number procedures will be required to implement block-chain technology in your organisation

Figure 4.11: A vast number of procedures will be needed to implement block-chain technology



In the diagram above, 80% of the respondents believe that a number of procedures will be required to implement the new phenomenon which is block-chain technology. Only 20% of the respondents disagree with the fact and none of the respondents were neutral. In the same vein, Eray Eliacik (2022) suggests that due to the rising costs in block-chain implementation, challenges in scalability implementation, and lack of adoption, a number of procedures and changes would be required by organisations in order to overcome these challenges and successfully adopt block-chain technology.

4.4.3 The implementation of block-chain technology will provide the following capabilities/ factors to your organisations agricultural supply chain.

Table 4.3: Implementation of block-chain technology providing capabilities

Capabilities/Factors	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Total
i. Scalability	4	5	8	3		20
ii. Low admin costs	8	9	3			20
iii. Identification of counterfeit products	9	7	4			20
iv. Tracking products	10	9	1			20

4.4.3.1 Scalability

Table 4.2 shows that 4 respondents 20 (20%) strongly agree with the idea that scalability is a capability provided by block-chain technology. 5 out of 20 (25%) respondents agree with the statement, 8 out of 20 students (40%) are uncertain and 3 respondents (15%) out of 20 disagree with the statement

4.4.3.2 Low administration costs

The majority of the respondents, 9 out of 20 respondents (45%), agree that block-chain technology will lead to low administration costs and 8 out of 20 respondents (40%) strongly agree. 3 out of 20 respondents (15%) were uncertain.

4.4.4 The implementation of block-chain technology will improve your organisation's financial performance through**Table 4.4: Improvement of organisation's financial performance**

PROCEDURE	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Total
i. Cutting out the middleman	12	6	2			20
ii. Lowering operating expenses	10	7	3			20
iii. Asset protection	9	9	2			20
iv. Increased security and efficiency	6	11	3			20

4.4.4.1 Cutting out the middleman

Table 4.3 depicts that 6 respondents out of 20 (30%) agree with the statement that cutting out the middleman will improve the financial performance of organisations. 12 out of 20 (60%) respondents strongly agree with the statement while only 2 respondents (10%) is uncertain with the statement.

4.4.4.2 Lowering operating expenses

7 respondents out of 20 (35%) agree that lowering operating expenses improves financial performance and the majority, 10 out of 20 respondents (50%), strongly agree with the statement. 3 respondents (15%) were uncertain.

4.4.4.3 Asset protection

The table shows that 9 out of 20 respondents (45%) agree with the statement, 9 out of 20 respondents strongly agree (45%) with the statement and finally 2 out of 20 (10%) students are uncertain.

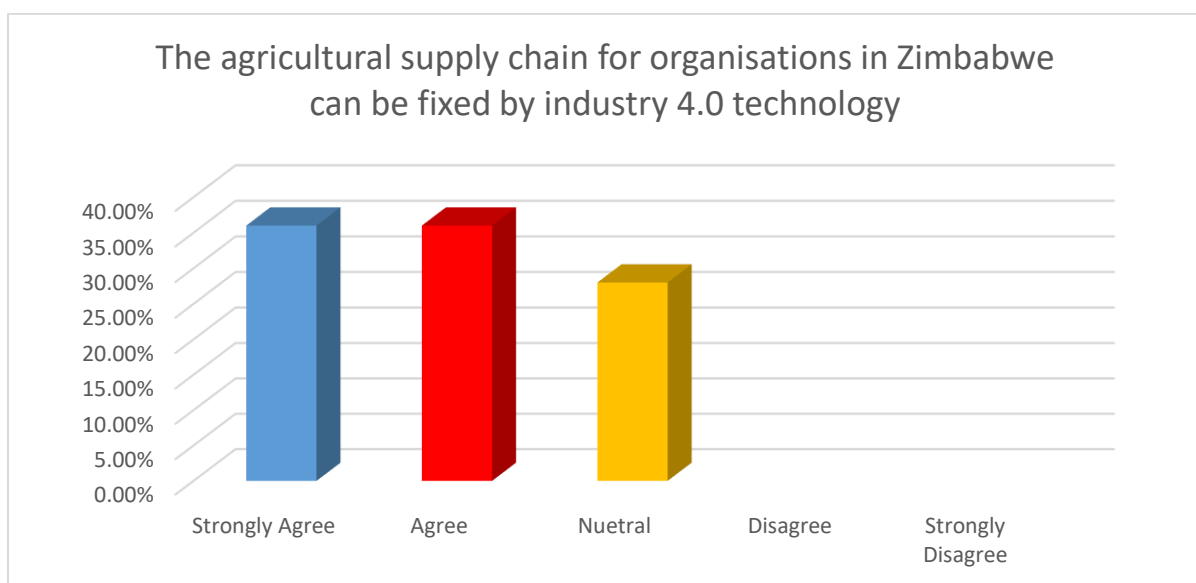
4.4.4.4 Increased security and efficiency

Table 4.3 shows that 6 out of 20 respondents (30%) strongly agree with the statement and 11 out of 20 respondents (55%) agree with the statement. Only 3 respondents (15%) were uncertain.

4.5 Exploration of other technological tools that can be effected to combat a decrease in organisational financial performance and improve supply chains

4.5.1 The agricultural supply chain for organisations in Zimbabwe can be fixed by industry 4.0 technology

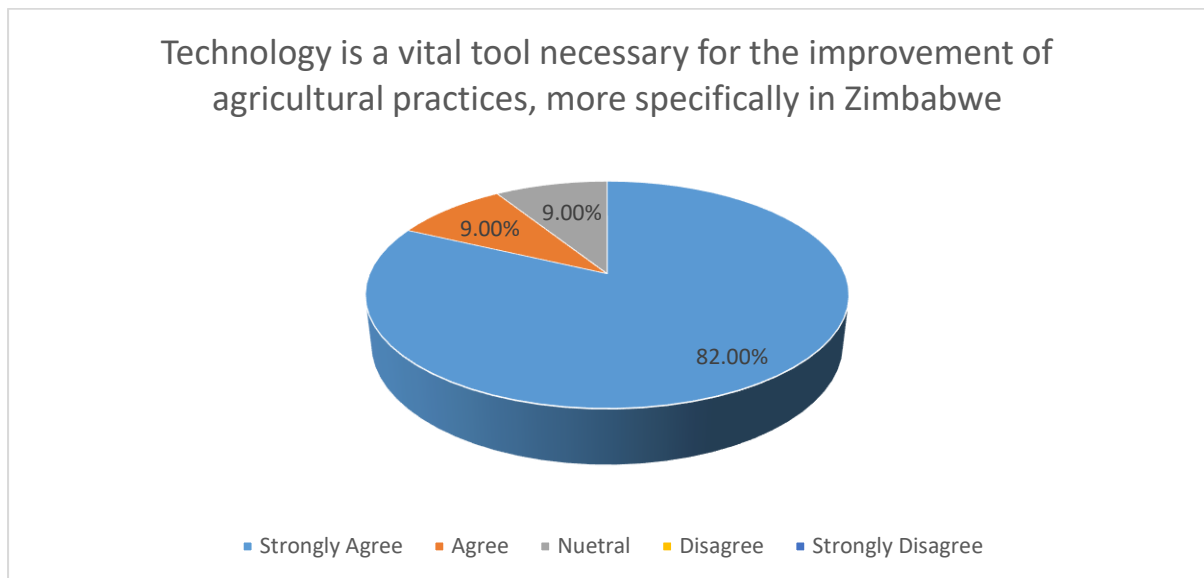
Figure 4.12: Responses to agricultural supply chains can be fixed by industry 4.0 technologies



The findings in figure 4.11 state that 36% of the respondents strongly agree with the statement that agricultural supply chains can be fixed by industry 4.0 technologies and another 36% agree with the statement. 28% of the respondents were neutral on the issue. Theofilos D. Mastos et al (2021) states that disruptive concepts such as industry 4.0 technologies such as advanced data analytics, forecasting techniques, IOT devices, and block-chain applications among others, are used to address the needs of modern supply chains which require supply flexibility, methods and processes increase productivity. The literature on industry 4.0 technologies supports the data received from the questionnaire.

4.5.2 Technology is a vital tool necessary for the improvement of agricultural practices, more specifically in Zimbabwe

Figure 4.13: Responses on technology being a vital tool necessary for improvement of agricultural processes



According to table 4.12, the majority of the respondents strongly agree with the idea that technology is a vital tool necessary for the improvement of agricultural practices by a margin of 82%. 9% of the respondents agreed with the statement and another 9% of the respondents are neutral on the matter. Lutz Goedde et al (2020) points out that agriculture must embrace a digital, technological, connectivity-fuelled transformation in order to overcome increasing demand and several disruptive forces, thus, confirming the results brought about by the research. Ayobami Adebayo (2021) further cemented this statement by stating that The benefits of modern technology adoption in agriculture cannot be exhausted, there is increased crop productivity, reduced impact on natural ecosystems, and increased worker safety. However, in order to achieve these goals, farmers need to understand the concept of modern farming and the use of technology.

4.5.3 The following industry 4.0 tools, excluding block-chain technology, are in the run to revolutionise agriculture and the agricultural supply chain

Table 4.5: Industry 4.0 tools in supply chain

Industry 4.0 tools	Strongly agree	Agree	Uncertain	Disagree	Strongly Disagree	Total
i. Industrial Internet of Things	8	10	2			20
ii. Radio frequency identification	11	9				20
iii. Big data analytics	8	9	3			20
v. Cloud systems	9	10	1			20

4.5.3.1 Industrial internet of things

According to the table above, 10 out of 20 respondents (50%) agree with the idea that the industrial internet of things is on the run to revolutionise agriculture and the agricultural supply chain. 8 out of 20 (40%) respondents agree with the statement and 2 respondents (10%) are uncertain about the statement.

4.5.3.2 Radio frequency identification

Table 4.4 shows that out of 20 respondents 9 (45%) agreed whilst 11 respondents (55%), which make up the majority, strongly agree with the statement.

4.5.3.3 Big data analytics

The table shows that the majority of respondents, 9 out of 20 (45%), agree with the statement that big data analytics will revolutionise agriculture whilst 8 out of 20 respondents (40%) strongly agreed with the statement. 3 out of 20 respondents (15%) were uncertain

4.5.3.4 Cloud System

Table 4.4 shows that out of 20 respondents, 10 (50%) agree that cloud systems are part of the industry 4.0 technologies that will revolutionise agriculture. 9 out of 20 respondents (45%) strongly agree with the statement. Only 1 respondent (5%) was uncertain.

4.5.4 Which other technological tools can be affected to combat a decrease in organisational financial performance and improve supply chains?

4.5.4.1 Responses given

1. Artificial Intelligence Tools

According to IBM (2020) artificial intelligence leverages computers and machines to mimic the problem-solving and decision-making capabilities of the human mind. In other words, it is the theory and development of computer systems able to perform tasks normally requiring human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages. Sudeep Srivastava (2022) states that better inventory management, smarter production, dynamic logistical systems, and real-time delivery controls are all products of artificial intelligence in the supply chain. AI in supply chain and logistics is primarily used to boost production and efficiency. Since supply chain management has become more digitalised, sustainability has increased. This has caused every company to ponder whether digital transformation on this scale can help their particular supply chain business.

2. Internet of things

Alexander S. Gillis (2022) defines internet of things as a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction. A person with a heart monitor implant, a farm animal with a biochip transponder, or an automobile with integrated sensors can all be considered "things" in the internet of things. Sergey Legchekov (2022) suggests that supply chain management is a multi-stage process that often involves several actors and each actor can leverage specific benefits of IOT. He further reiterates this by stating that IOT solutions are used by raw material suppliers to monitor their technological operations. For instance, they collect real-time information on crop conditions and livestock health in farming and agriculture and keep an eye on fire incidents.

3. Cloud based commerce networks

Cloud computing is the on-demand availability of computer system resources, especially data storage and computing power, without direct active management by the user. Accenture (2022) points out that a benefit of the cloud system is supply chain innovation. Cloud enables supply networks to be more accountable and sustainable. It aids businesses in utilizing cutting-edge technologies to lessen the environmental impact of their supply networks, increase resource efficiency, boost regulatory compliance, and enhance risk management. Companies can manage business performance and decisions based on a well-rounded perspective with the help of the cloud. They can take into account variety, growth, profitability, and sustainability all at once.

4.6 Analysing the challenges that can be faced by organisations in the agricultural sector as a result of adopting and implementing block-chain technology

4.6.1 What are the challenges that can be faced by organisations in the agricultural sector as a result of adopting and implementing block-chain technology?

4.6.1.1 Responses given

1. Ethical Considerations and Security

According to Sharif and Godhoosi (2022), the three key promises made by the block-chain, which are immutability, disintermediation (distributed verification), and automation, are what cause ethical problems for organisations. Immutability leads to the permanence of a person's previous actions, which poses moral dilemmas like privacy and transparency issues. Automation refers to the self-executing features of coded agreements known as smart contracts which presents difficulties connected to human dignity among others. Disintermediation raises ethical issues linked to responsibility and equitable opportunity.

2. It is costly

Wang and Wegrzin (2021) state that the initial costs of deploying a block-chain solution could be high. It costs money to hire block-chain developers, who typically charge more than regular developers because of their specific knowledge. A big price tag may also include fees for planning, licensing, and upkeep.

3. Competitiveness within the industry

Due to the hype and reverence behind block-chain technology, organisations within different sectors of different economies will try to adopt block-chain technology for various uses. In agriculture the need for improvement in supply chain management, especially in Zimbabwe, will make organisations in agriculture rush to adopt and attain the technology, hence making the industry extremely competitive for smaller organisations.

4.6.2 Agricultural organisations in Zimbabwe can overcome these challenges

Table 4.6: Responses to Zimbabwean organisations overcoming challenges

Responses	Strongly Agree	<u>Agree</u>	<u>Neutral</u>	<u>Disagree</u>	<u>Strongly Disagree</u>
<u>Percentage</u>	<u>27%</u>	<u>46%</u>	<u>18%</u>	<u>9%</u>	

Table 4.1 shows that the majority of the respondents, 46%, agreed that agricultural organisations can overcome the challenges that could be faced in adopting block-chain technology. 27% of the respondents strongly agreed with the statement, 9% of the respondents disagreed with the statement and 18% of the respondents were neutral on the matter.

4.6.3 These challenges can be avoided instead of overcome

Table 4.7: Challenges can be avoided instead of overcome

Responses	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Percentage	9%	46%	36%	9%	

The table above shows that more respondents were neutral than strongly agreeing on the statement. More specifically, 36% of the respondents were neutral and 9% of the respondents strongly agree. 46% of the respondents agree with the statement and 9% of the respondents disagreed with the notion.

4.7 Assessing how block-chain technology can solve supply chain problems in the agricultural sector of Zimbabwe

4.7.1 Block-chain technology can solve supply chain problems in the agricultural sector of Zimbabwe

Table 4.8: block-chain technology solving supply chain problems in the agricultural sector

Responses	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Percentage	55%	27%	9%		9%

55% of the respondents strongly agreed that block-chain technology can solve supply chain problems in the agricultural sector in Zimbabwe. 27% of the respondents agree, 9% of the respondents are neutral and another 9% strongly disagreed. The majority of the responses leaned more towards strongly agreeing and agreeing with the statement generally at about 82%.

4.7.2 Any suggestions as to how the agricultural sector as a whole can be improved so as to ensure sustainable supply chains and high financial performance

4.7.2.1 Responses

1. Increase in use of more advanced technology tools such as artificial intelligence
2. Adopting new technology
3. More alliances with first world country farmers and synergies

4. Biodiversity protection

4.7.3 The following factors enabled by block-chain technology aid in solving supply chain problems

Table 4.9: Factors enables by block-chain technology that aid in solving supply chain problems

FACTORS	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree	Total
i. Improved visibility and compliance over outsourced contract manufacturing	7	10	3			20
ii. Lower losses from grey/counterfeit market trading	9	7	4			20
iii. Reduce paperwork	12	8				20
iv. Increase traceability of material supply chain	13	7				20

4.7.3.1 Improved visibility and compliance over outsourced contract manufacturing

According to table 4.8, out of 20 respondents 7 (35%) strongly agreed that improved visibility and compliance over outsourced contract manufacturing aids in solving the supply chain. 10 out of 20 respondents (50%) agreed with the notion whilst 3 respondents (15%) were uncertain.

4.7.3.2 Lower losses from grey/counterfeit market trading

The findings in table 4.8 illustrate that 9 out of 20 respondents (45%) strongly agree that lower losses from grey market trading's are enabled by block-chain technology. 7 out of 20 (35%) respondents agree with the statement and 4 respondents were uncertain with the issue.

4.7.3.3 Reduce paperwork

Table 4.8, depicts that out of 20 respondents 12 of them (60%) strongly agreed that block-chain technology reduces paperwork and 8 respondents (40%) agree with the statement.

4.7.3.4 Increase traceability of material supply chain

13 out of 20 respondents (65%) strongly agree with the statement and 7 respondents out of 20 (35%) agree with the statement that block-chain technology will increase traceability of material supply chain.

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4.8 Pearson Correlation Coefficient

The results from the questionnaire shown in Figure 4.9 displays the extent to which blockchain technology has been adopted by agricultural organisations in Zimbabwe. It depicts that even though blockchain technology is emerging as a viable option to help improve the financial performance and supply chain of organisations, it is still in its infancy when it comes to the agricultural sector in Zimbabwe. This means that little to no application of the technology has been applied by major Zimbabwean based international businesses such as Irvine's Zimbabwe and Suncrest Zimbabwe. The agricultural sector in Zimbabwe does not yet fully understand blockchain technology. However, in its 2019 command magazine Seedco international Ltd suggested the adoption of a smart farm application that would assist in the networking of all supply chain participants. The smart farm application will also assist in tracking and monitoring the crops of farmers via blockchain assisted GPS and calculate feeds and assist in inventory management. The number of blockchain technology based applications adopted by the organisation from 2019 to 2021 is shown on the table below.

Table 4.10: Calculated return on capital employed and the extent of blockchain technology adoption

Years	Number of blockchain technology applications adopted	Return on Capital Employed (ROCE)
2019	3	27%
2020	3	8%
2021	2	7%
2022	2	9%

Source: Command magazine 2019 & Annual reports (2020 & 2021)

In order to ascertain the relationship between blockchain technology and the financial performance of agricultural organisations, the researcher analysed the financial statements of Seedco ltd and its extent of blockchain technology adoption, which is quantified by the number of blockchain applications it has adopted. Return on capital employed and profitability are the units of measurement used in the comparison. Therefore the independent variable (x) is the number of blockchain technology applications and the dependent variable (y) is the return on capital employed.

Results from the Pearson Correlation Coefficient

X	Y	$x = X - \bar{X}$	$y = Y - \bar{Y}$	x^2	y^2	xy
3	27	0.5	14.25	0.25	203.0625	7.125
3	8	0.5	-4.75	0.25	22.5625	-2.375
2	7	-0.5	-5.75	0.25	33.0625	2.875
2	9	-0.5	-3.75	0.25	14.0625	1.875
2.5	12.75	0	0	1	272.75	9.5
				$\sum X^2$	$\sum Y^2$	$\sum XY$

Table 4.11: Calculation of the Pearson Correlation Coefficient

$$r = \frac{n\sum xy - \sum x \sum y}{\sqrt{n\sum x^2 - (\sum x)^2} \sqrt{n\sum y^2 - (\sum y)^2}}$$

$$r = \underline{0.57523}$$

Table 4.11 shows the excel calculations of the Pearson Correlation Coefficient between number of blockchain application adopted and return on capital employed. The equation shows that the coefficient correlation between the two variables is 0.57523. The result shows that the variables are moderately correlated hence indicating that blockchain technology will have a positive impact on financial performance if adopted.

4.9 SUMMARY

This chapter focused on the presentation and analysis of the findings from the research. The next chapter will focus on the research summaries, conclusions, major findings, recommendations and suggestions for future researches.

CHAPTER V

SUMMARY, CONCLUSIONS & RECOMMENDATIONS

5.0 Introduction

This chapter summarises the study results and draws judgments based on how closely the research results match the empirical findings. The best methods were then lent and suggested by the researcher using the research findings in an effort to enhance supply chain management and the financial performance of agricultural organisations. The researcher's observations of inadequacies during the course of the research were used to formulate recommendations and potential enhancements.

5.1 Chapter Summaries

The first chapter introduced the research problem which was an investigation into the potential remedies to agricultural supply chains and low financial performance of agricultural organisations that were disrupted by a number of issues, hyperinflation and Covid-19 being some of them. Blockchain technology stood out to be the viable option that could help mend and improve the agricultural sector as a whole. The chapter also included the study's background, problem statement, research questions that led to the study's aims, significance of the study, delimitations and limitations, as well as the definitions of key terminology and assumptions.

Chapter two included a study of the literature by various writers and academics, providing information on the literature pertaining to supply chains and blockchain technology as well as pointing out any gaps in the research. It also included the conceptual framework, which represents the relationship between the variables, or the traits or qualities that the researcher intends to examine, that is anticipated to be seen. The chapter also includes a review of the empirical literature, which analyses earlier empirical studies to offer a response to the research questions.

The third chapter included the research methodology employed on gathering data, the population under study, data collection tools (questionnaires and annual reports), and how the researcher assured validity and reliability. The descriptive survey was employed by the researcher. The sample method utilised was purposeful sampling. Tables, pie charts, and graphs were used to illustrate the data, and the Pearson Correlation Coefficient was used for analysis.

The data findings from questionnaire respondents were elaborated on in chapter four. In the chapter, interpreted and analysed data were also given. In order to convey data effectively, statistical descriptions requiring the creation of tables, line graphs, pie charts, and bar charts were chosen. The statistical technique utilised to analyse the data was the Pearson Correlation Coefficient.

5.2 Major Findings

The following conclusions were reached by the researcher during the course of the study:

- ❖ In terms of application and adoption, blockchain technology is still in its infancy in Zimbabwe across all sectors, be it financial or agricultural. This made having a point of reference for the research difficult at most. However, a blockchain technology based master card application that tracks cattle affected with the tick-borne disease was recently launched in Zimbabwe. Hopefully this application will help increase the adoption of blockchain technology especially in the agricultural sector.
- ❖ A variety of challenges including having to adopt a number of procedures and lack of financial security hinder the implementation of blockchain technology in Zimbabwe. The hyperinflationary economy makes it even harder for local agricultural corporations to find the proper capital to finance the industry 4.0 technology that is blockchain technology.
- ❖ Through the aid of questionnaires, the researcher found out that though the technology might be expensive to adopt, it provides a number of advantages to the agricultural sector that can help boost the brittle supply chain and enhance financial performance of

agriculture organisations. These advantages include cutting out the middleman when performing transactions through the supply chain, lowering operating expenses, and increased security and efficiency when performing transactions and tracking the movement of agricultural produce on the supply chain, just to name a few.

- ❖ After implementing the Pearson Correlation Coefficient the researcher discovered that there is a positive relationship between blockchain technology and the financial performance of agricultural organisations. By comparing the extent of blockchain adoption with the return on capital employed, results showed that the variables are moderately correlated hence indicating that blockchain technology will have a positive impact on financial performance if adopted.
- ❖ With blockchain technology as the leading frontier in technological innovation globally, other fourth industrial revolution (Industry 4.0) technologies can be adopted and implemented to enable a sustainable agricultural supply chain in Zimbabwe. Through the aid of a questionnaire, the researcher found out that artificial intelligence, cloud based systems, and big data analytics are some of the fourth industrial revolution technologies that can help improve the agriculture sector and Zimbabwe and in turn the whole economy.
- ❖ Although there are many challenges that may hinder and block the adoption of blockchain technology in Zimbabwe, results showed that agricultural organisations can overcome these challenges with 27% of the respondents strongly agreeing with this notion.

5.3 Conclusion

The study was successful because it produced insights, suggestions and recommendations that can be used to successfully adopt blockchain technology and enable a reliable agriculture supply chain.

5.4 Recommendations

The following suggestions and recommendations should be implemented in order to achieve superior supply chain management practices and enhanced financial performance through the implementation of blockchain technology:

❖ **Policy that embraces new technology should be implemented by the government**

In order for blockchain technology to be vastly used in an economy that is still foreign to its capabilities, national policy pertaining to the positive adoption of blockchain technology should be implemented by the government. This policy could involve technology adoption grants for agriculture organisations to encourage a technological revolution in the agriculture sector in Zimbabwe.

❖ **Establish the viability and application cases for blockchain.**

The adoption and use of blockchain in the supply chain must be guided by a solid business use case. A use case is a usage scenario for a piece of technology. It can assist in figuring out whether blockchain is indeed the best technology for your business. Organisations should adopt a prescriptive approach with a use case that will produce results, best practices, and more than just hip technology.

Analyse the readiness of the digital networks, processes, and transactions within your organization, and concentrate on the intersections between your digital readiness and the best possible business value.

❖ **Determine the best areas for implementing blockchain**

In order to achieve the best organisational results with blockchain technology, evaluating the best areas for the implementation of blockchain technology should be a must. If as an organisation you want to use blockchain in your supply chain but are unsure of where to begin, search for areas that meet all of the following criteria:

1. Information is shared across numerous unconnected parties.
2. There isn't a single centralised organisation or authority that can be relied upon, and doing so would be dangerous.
3. There is a straightforward, uniform transactional procedure with clearly established data standards called electronic data interchange (EDI).
4. Each partner is motivated to embrace a technology and procedures because the value proposition is shared by all parties.
5. The digital asset has value in and of itself. This is the data that will be truly transferred in blockchain, like an electronic letter of credit.

❖ **Try to achieve data interoperability**

Interoperability is a characteristic of a product or system to work with other products or systems. Data management for blockchain technology should be compatible with the organisation's common enterprise resource planning tools.

❖ **Test the technology**

A pilot program with a portion of the supply chain is a terrific method to test any direction an organisation chooses to go with blockchain technology in the supply chain.

❖ **Recognise the volatility of blockchain technology**

Organisations should anticipate technological advances and act accordingly. While the architecture and underlying technology are crucial, they are also evolving quickly. Before most blockchain solutions become widely used, their technology is likely to alter. The market for blockchain platforms is substantial yet dispersed. Current blockchain services vary in their emphasis, with some concentrating on confidentiality and others on tokenisation or universal computing.

5.5 Suggestions for future Research

Blockchain technology is a volatile technology that is ever changing and evolving. Therefore, more studies have to be done and carried out to discover other applications of blockchain technology that can help organisations within various sectors and improve how business is conducted across the world.

5.6 Summary

The chapter summarised each chapter and included research findings, conclusions, recommendations, and ideas for additional study.

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APPENDIX A

QUESTIONNAIRES

INSTRUCTIONS

The questionnaire is in fulfilment with the completion of my dissertation study titled “Harnessing the impact of Blockchain technology on the Supply chain and financial performance of agricultural organisations in Zimbabwe”. Your involvement in this study is very important to me and my dissertation, and I hope you'll find it interesting to fill out this questionnaire. Your responses are very crucial to my study. Please keep in mind that even though I chose you to participate in this survey, you can skip any questions you'd rather not answer because it's entirely optional.

HOW TO FILL IN THE QUESTIONNAIRE

Please complete the questions by;

Ticking the box containing your favourable answer like this

X

SECTION A

1. Which department do you work in?

Finance ☐

Operations ☐

Human Resources ☐

2. For how long have you been employed by your organisation

1-5 years ☐

5-10 years ☐

over 10 years ☐

3. State your highest academic qualifications?’

No formal education ☐

O’level ☐

A’ level ☐

Degree ☐

Professional qualification ☐

Specify.....

Any other qualification (Specify) ☐

.....

Analysing the impact of blockchain technology on the financial performance and supply chain of organisations in the agricultural sector

1. The hyperinflationary economy and Covid-19 have adversely affected the financial performance and supply chains of agricultural organisations

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐

Strongly disagree ☐

2. Blockchain technology can improve financial performance and lead to sustainable supply chains for organisations in the agricultural sector

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Strongly disagree ☐

3. The following attributes of blockchain technology allow it to enable a sustainable supply chain

Attributes	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
i. Traceability					
ii. Transparency					
iii. Privacy					
iv. Security					

Specify.....

4. If adopted, the overall impact of blockchain technology on the agricultural sector will be positive

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Strongly disagree ☐

5. Do you think blockchain technology been adopted to a large extent by agricultural firms in Zimbabwe?

Yes ☐ No ☐

6. Which blockchain technologies are agricultural firms in Zimbabwe Currently using?

Examining how blockchain technology can be implemented in supply chain management by agriculture organisations in Zimbabwe

1. Blockchain technology is a formidable force for change as far as supply chain management is concerned

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐

Strongly disagree ☐

2. The implementation of blockchain technology will provide the following capabilities/factors to your organisations agricultural supply chain.

Capabilities/Factors	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
i. Scalability					
ii. Low admin costs					

iii. Identification of counterfeit products					
iv. Tracking products					

3. The implementation of blockchain technology will improve your organisation's financial performance through

PROCEDURE	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
i. Cutting out the middleman					
ii. Lowering operating expenses					
iii. Asset protection					
iv. Increased security and efficiency					

4. A vast number of procedures will be required to implement blockchain technology in your organisation

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐
 Strongly disagree ☐

Exploration of other technological tools that can be effected to combat a decrease in organisational financial performance and improve supply chains

1. The following industry 4.0 tools, excluding blockchain technology, are in the run to revolutionise agriculture and the agricultural supply chain

Industry 4.0 tools	Strongly agree	Agree	Uncertain	Disagree	Strongly Disagree
i. Industrial Internet of Things					
ii. Radio frequency identification					
iii. Big data analytics					
iv. Artificial intelligence					
v. Cloud systems					

2. The agricultural supply chain for organisations in Zimbabwe can be fixed by industry 4.0 technology

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Strongly disagree ☐

3. Technology is a vital tool necessary for the improvement of agricultural practices, more specifically in Zimbabwe

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Strongly disagree ☐

4. Which other industry 4.0 technological tools can be effected to combat a decrease in organisational financial performance and improve supply chains?

Analysing the challenges that can be faced by organisations in the agricultural sector as a result of adopting and implementing blockchain technology

1. What are the challenges that can be faced by organisations in the agricultural sector as a result of adopting and implementing blockchain technology?

2. Agricultural organisations in Zimbabwe can overcome these challenges

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Strongly disagree ☐

Specify

3. These challenges can be avoided instead of overcome

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Strongly disagree ☐

Specify

4. What are examples of such type of challenges

Assessing how blockchain technology can solve supply chain problems in the agricultural sector of Zimbabwe

1. Blockchain technology can solve supply chain problems in the agricultural sector of Zimbabwe

Strongly agree ☐ Agree ☐ Uncertain ☐ Disagree ☐ Strongly disagree ☐

2. The following factors enabled by blockchain technology aid in solving supply chain problems

FACTORS	Strongly agree	Agree	Uncertain	Disagree	Strongly disagree
i. Improved visibility and compliance over outsourced contract manufacturing					
ii. Lower losses from grey/counterfeit market trading					
iii. Reduce paperwork					

iv. Increase traceability of material supply chain					
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3. Any suggestions as to how the agricultural sector as a whole can be improved so as to ensure sustainable supply chains and high financial performance?

APPENDIX

EXCEL EXTRACT FROM THE PEARSON CORRELATION COEFFICIENT ANALYSIS

X	Y	$x = X - \bar{X}$	$y = Y - \bar{Y}$	x^2	y^2	xy
3	27	0.5	14.25	0.25	203.0625	7.125
3	8	0.5	-4.75	0.25	22.5625	-2.375
2	7	-0.5	-5.75	0.25	33.0625	2.875
2	9	-0.5	-3.75	0.25	14.0625	1.875
2.5	12.75	0	0	1	272.75	9.5
				$\sum X^2$	$\sum Y^2$	$\sum XY$

