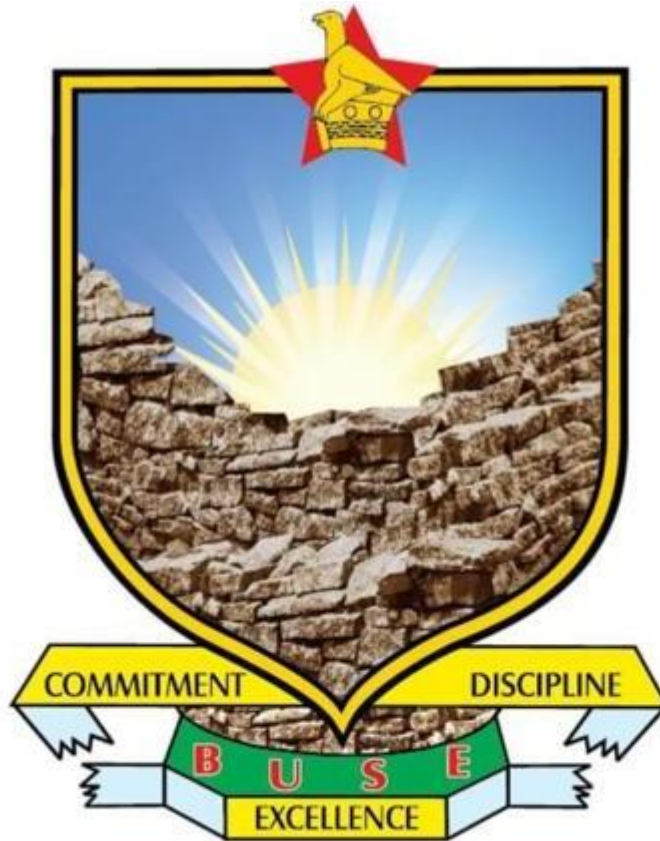


BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS



**ARTIFICIAL INTELLIGENCE FOR SUPPLY CHAIN RESILIENCE: THE
CASE OF ZIMBABWE.**

By

B201253B

**DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF THE
REQUIREMENTS OF THE BACHELOR OF COMMERCE (HONOURS)
DEGREE IN PURCHASING AND SUPPLY BINDURA UNIVERSITY OF
SCIENCE EDUCATION**

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ABSTRACT

The study aimed to assess the potential of Artificial Intelligence for enhancing the resilience of supply chains in Zimbabwe. Its main focus was to establish a relationship between adoption of Artificial Intelligence and the resilience of supply chains in Zimbabwe. The study's objectives were to explore the specific vulnerabilities faced by Zimbabwe's supply chains, identifying key vulnerabilities in the supply chains of Zimbabwe, evaluating the potential of Artificial Intelligence powered solutions to address identified supply chain vulnerabilities, investigating the key barriers for successful Artificial Intelligence adoption in Zimbabwe's supply chain ecosystem and assessing the effectiveness of Artificial Intelligence in improving supply chain resilience in Zimbabwe. A descriptive research design was utilised, and 60 participants were selected using stratified random sampling. Primary data was collected using questionnaires with a three-point and five-point Likert scale. The questionnaire's reliability and validity were tested, producing a Cronbach value of 0.817. SPSS version 20 was used to analyse the data, and descriptive statistics, frequency tables, correlation coefficient ($r=0.523$), and regression with a beta coefficient of 0.753 were used to ascertain the statistical significance of the factors. The study identified several capabilities of Artificial Intelligence that had a significant impact on enhancing the resilience of the supply chain in Zimbabwe which include reducing disruption impact, offering personalised solutions, more efficient resource allocation, demand forecasting and enabling innovation. The findings also revealed that stakeholders in the healthcare sector were more hesitant to adopt Artificial Intelligence solutions because data sensitivity issues are a significant challenge to them as healthcare often deals with sensitive patient data. Financial incentives and subsidies seem to be less desired compared to support that fosters knowledge, skills, and tailored solutions on Artificial Intelligence. To implement such measures successfully, it is crucial to have efficient systems and processes in place.

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CHAPTER I

INTRODUCTION

1.0 Introduction

The purpose of this dissertation is to explore the role of artificial intelligence in enhancing supply chain resilience in the specific context of Zimbabwe. Zimbabwe as a developing country with different economic, political, and infrastructural characteristics needs its own study to find out the challenges, opportunities, and potential impact of AI adoption on supply chain resilience. The research problem revolves around the need to understand how supply chain resilience is currently being practiced in Zimbabwe and to explore how the introduction of AI can contribute to its betterment. Firstly this dissertation will delve into the local supply chain landscape in Zimbabwe by examining the existing practices and then identifying the key challenges faced by stakeholders in the supply chain, and lastly assessing the potential of AI application to address these identified challenges and improve resilience.

1.1 Background of the study

The worldwide business arena has seen increasing volatility, complexity, and uncertainty in recent years. Things like natural disasters, geopolitical conflicts, economic crises, and pandemics have exposed the vulnerability of supply chains and the need for robust resilience strategies to counter these disturbances (Christopher & Peck, 2004).

Conventionally supply chain resilience has made use of reactive strategies like building creating buffer stocks, increasing redundancy and making use of contingency plans. These approaches have proven to be costly and are not meeting the level of agility and adaptability organisations require to effectively address dynamic disruptions. In the modern era, the potential of artificial intelligence has attracted significant interest as a means to enhance supply chain resilience (Sheu, S., Wu, C., & Chou, D 2005).

Artificial Intelligence incorporates technologies such as machine learning, natural language processing, and big data analytics, which enable systems to mimic human thinking, learn from experience, and make intelligent decisions (Ghadimi, Li, & Debo, 2019). The utilisation of AI capabilities, has made supply chain managers better able to leverage advanced analytics, automation, and predictive modelling to proactively identify risks, optimize operations, and develop agile response strategies.

Developed countries have made notable advances in adopting artificial intelligence to enhance their supply chain resilience but the developing countries are still lurking behind and their contexts remains relatively unexplored compared to other countries. Third-world countries, like Zimbabwe are facing unique challenges which include limited resources, declining infrastructure and political difficulties. These challenges call for a need to gain a deeper understanding of the potential benefits, challenges, and strategies for effectively adopting artificial intelligence in the betterment of the resilience of supply chains specifically within the Zimbabwean context (Ngai et al, 2021).

Zimbabwe is a country located in Southern Africa with a diverse economy with sectors such as agriculture, mining, manufacturing, and services. Zimbabwe has experienced various challenges threaten the resilience of its supply chains like economic instability, inflation, and infrastructural deficiencies. These factors are believed to be contributing to supply chain vulnerabilities and underscore the importance of developing resilient supply chain systems.

A comprehensive study on the application of AI for supply chain resilience in Zimbabwe, can help to address the research gap in developing country contexts. The dissertation seeks to explore the form that the resilience of supply chains in Zimbabwe is currently in, assess the potential impact of AI adoption, and then identify the challenges and opportunities associated with its implementation (Ubaru et al. 2023).

Hopefully the results of this study will have the potential to offer valuable insights to supply chain stakeholders, businesses, and policymakers in Zimbabwe. Such that they can be aided in making well-informed decisions regarding the implementation and integration of Artificial Intelligence technologies in their already existing supply chain operations. Additionally, this research will add to the existing body of academic literature by deepening the understanding of AI applications in promoting supply chain

resilience in third-world countries whose economic and business setups differ greatly from those of the developed world. Overallly this dissertation aims to contribute to the betterment of resilient supply chains in developing countries context and then provide practical guidance for the efficient adoption of AI in supply chain management.

1.2 Statement of the problem

Despite the growing acknowledgement of the importance of supply chain resilience in mitigating disruptions and uncertainties, Zimbabwe's supply chains face frequent challenges that deter their ability to effectively respond to disruptions stemming from natural disasters, political instability, infrastructural challenges, economic uncertainties stemming from fluctuations in economic variables like inflation rates and increasing complexities as the economy is transitioning to being a newly industrialised economy which is resulting in the emergence of new players in the supply chain. These disruptions lead to product shortages, increased cost, inefficiencies and the hindrance of economic growth and development. Traditional supply chain methods often struggle to adapt to these dynamic challenges. Therefore, there is a critical need to investigate and understand how artificial intelligence can contribute to improving supply chain resilience in Zimbabwe.

1.3 Research Objectives

1. To find out the specific vulnerabilities which are being faced by Zimbabwe's supply chains.
2. To identify key vulnerabilities in the supply chains of Zimbabwe.
3. To evaluate the potential of Artificial Intelligence powered solutions to address identified supply chain vulnerabilities.
4. To investigate the key barriers for successful Artificial Intelligence adoption in Zimbabwe's supply chain ecosystem.
5. To assess the effectiveness of Artificial Intelligence in improving supply chain resilience in Zimbabwe.

1.4 Research Questions

1. How do different sectors in Zimbabwe approach supply chain resilience?

2. Which specific vulnerabilities within the key sectors of the Zimbabwean economy pose the greatest threat to the resilience of the supply chains?
3. What is the overall potential of Artificial Intelligence in strengthening the resilience of Zimbabwe's supply chains across different sectors?
4. What are the critical barriers that hinder the successful adoption of Artificial Intelligence (AI) solutions for enhancing resilience within Zimbabwe's supply chain ecosystem?
5. To what extent can the implementation of Artificial Intelligence (AI) technologies enhance the resilience of Zimbabwe's supply chains, considering the specific structural context of the country?

1.5 Significance of the study

Zimbabwe faces specific challenges such as economic volatility, infrastructure limitations, and political instability. By investigating how AI can enhance supply chain resilience in this context, this study provides practical strategies and recommendations tailored to Zimbabwe's specific challenges and opportunities. Secondly, the study is of practical relevance as it offers insights applicable to real-world scenarios, helping businesses, policymakers, and practitioners enhance the resilience of their supply chains. Thirdly, it contributes to the understanding of AI's role in supply chain resilience, taking into account technological advancements and their impact on industries. The study's findings can guide organizations in leveraging AI technologies to optimize supply chain processes and mitigate risks. Additionally, the economic impact of supply chain disruptions can be reduced through the study's insights, fostering economic stability and growth. Lastly, the study contributes to knowledge advancement by filling a research gap and providing specific insights into supply chain resilience in a developing country like Zimbabwe's context. Its findings serve as a foundation for further research and academic discussions, benefiting academia, industry, and policymakers alike.

1.6 Assumptions

Assumption of AI Readiness: The research assumes that the necessary technological infrastructure and capabilities for implementing AI solutions in the supply chain context

are available in Zimbabwe. This includes access to computing resources, data storage, and AI tools or platforms that can be effectively utilized for enhancing supply chain resilience.

Assumption of Stakeholder Cooperation: The research assumes that there is a willingness among supply chain stakeholders, including businesses, government entities, and industry associations, to collaborate and share relevant data and insights. This cooperation is crucial for obtaining a comprehensive understanding of the supply chain ecosystem in Zimbabwe and for exploring the potential of AI adoption for resilience enhancement.

Assumption of Relevance of AI Applications: The research assumes that the AI applications and techniques explored in the study are relevant and applicable to the supply chain context in Zimbabwe. This includes assuming that AI algorithms, machine learning models, or other AI-based solutions can effectively address the identified challenges and contribute to improving supply chain resilience in the specific context.

1.7 Delimitations of the study

Geographic Delimitation: The study focuses specifically on the case of Zimbabwe and its supply chain context. The findings and recommendations may not be directly applicable to other countries or regions with different economic, political, or infrastructural characteristics. This research does not intend to provide a comprehensive analysis of supply chain resilience in other geographical contexts.

Time Delimitation: The study is conducted within a specific time frame, and the findings are limited to the conditions, challenges, and opportunities present during that time. Factors such as economic conditions, political stability, or technological advancements may evolve over time and could impact the relevance and applicability of the study's findings beyond the defined time period.

Sample Delimitation: The research may focus on a specific subset of industries, supply chain actors, or regions within Zimbabwe. This delimitation allows for a more targeted and in-depth analysis but may restrict the generalizability of the findings to other sectors or regions within the country.

Scope of AI Applications: The study delimits the exploration of AI applications to specific areas within the supply chain, such as demand forecasting, inventory

management, or logistics optimization. It may not cover the entire spectrum of AI applications or consider emerging AI technologies that may have relevance to supply chain resilience.

Data Availability: The study's findings and analysis depend on the availability and quality of data related to the supply chain ecosystem in Zimbabwe. Data limitations, such as incomplete or inaccessible data, may impact the depth and accuracy of the study's conclusions.

Resource Constraints: The research may be subject to resource constraints, such as time, funding, or expertise. These limitations may affect the scope of data collection, the size of the sample, or the depth of analysis, potentially influencing the comprehensiveness and generalizability of the study's findings.

1.8 Limitations

Generalizability: The findings and recommendations of the study may have limited generalizability beyond the specific case of Zimbabwe. The unique economic, political, and infrastructural conditions of Zimbabwe may limit the transferability of the study's conclusions to other countries or regions with different contexts.

Data Limitations: The study's analysis and findings may be constrained by the availability, quality, and reliability of data. Data gaps, incomplete records, or data biases may impact the accuracy and comprehensiveness of the study's conclusions and hinder the ability to draw robust insights.

Sample Size and Selection: The study's findings may be influenced by the size and representativeness of the sample used. The research has limitations in terms of the number of supply chain actors, industries, or regions included, potentially affecting the breadth and diversity of perspectives considered.

Time Constraints: The study's findings are based on a specific time frame, and the dynamics of supply chain resilience and AI adoption may evolve over time. Changes in economic conditions, technological advancements, or policy developments occurring after the study period may not be accounted for, potentially affecting the relevance and currency of the findings.

Resource Constraints: The study's scope and depth may be limited by resource constraints, such as time, funding, or expertise. These limitations may impact the extent of data collection, the ability to conduct in-depth analysis, or the inclusion of additional variables or factors that could provide a more comprehensive understanding of the research topic.

External Factors: The study may not account for all external factors that can impact supply chain resilience or AI adoption in Zimbabwe. Factors such as macroeconomic conditions, geopolitical events, or industry-specific dynamics may have indirect effects on the research topic but may not be fully addressed within the study's scope.

1.9 Definition of terms

Supply chain resilience: refers to the capability of a supply chain to cope with unforeseen, disrupting events (Adobor, 2020) and to recover quickly to its original level of performance, or to a new level required to maintain the expected operating, financial, and market performance (Ponomarov & Holcomb, 2009).

Artificial Intelligence (AI): Artificial Intelligence refers to the development of computer systems that can perform tasks that would typically require human intelligence, such as visual perception, speech recognition, and decision-making. AI involves the use of techniques such as machine learning, natural language processing, and computer vision to enable machines to learn from data and adapt to new situations (Russell and Norvig, 2016).

Supply Chain: A supply chain is a network of organizations, resources, activities, and technologies involved in the production, distribution, and delivery of goods or services from suppliers to end customers. It encompasses the flow of raw materials, components, finished products, information, and financial transactions across various stages, including procurement, manufacturing, transportation, warehousing, and retail (Chopra and Meindl, 2015).

Resilient Supply Chain: A resilient supply chain is characterized by its ability to anticipate, respond to, and recover from disruptions, while minimizing their impact on operations and maintaining customer satisfaction. It involves the integration of risk management practices, flexibility, redundancy, and agility to withstand and adapt to disruptions effectively (Pettit et al., 2010).

AI Adoption: AI adoption refers to the process of integrating and utilizing artificial intelligence technologies within an organization's operations, systems, or processes. It involves the implementation of AI algorithms, tools, or platforms to automate tasks, enhance decision-making, and improve efficiency and performance across various functions, including supply chain management (Chen et al., 2014).

Vulnerabilities: In the context of supply chains, vulnerabilities refer to the weaknesses or areas of exposure that can disrupt the smooth flow of products, information, or services. These vulnerabilities can arise from factors such as transportation disruptions, demand fluctuations, lack of coordination among supply chain partners, inadequate inventory management, or inadequate risk management practices (Christopher and Peck, 2004).

1.10 Abbreviations

AI- Artificial Intelligence

1.11 Summary

This chapter provided an overall overview to the dissertation by introducing the research problem, objectives, significance, and structure. It highlights the importance of Artificial Intelligence for supply chain resilience and emphasizes the need to investigate its application in the specific context of Zimbabwe. The chapter provides a clear direction for the subsequent chapters, laying the foundation for the comprehensive study on Artificial Intelligence adoption for supply chain resilience in Zimbabwe

CHAPTER II

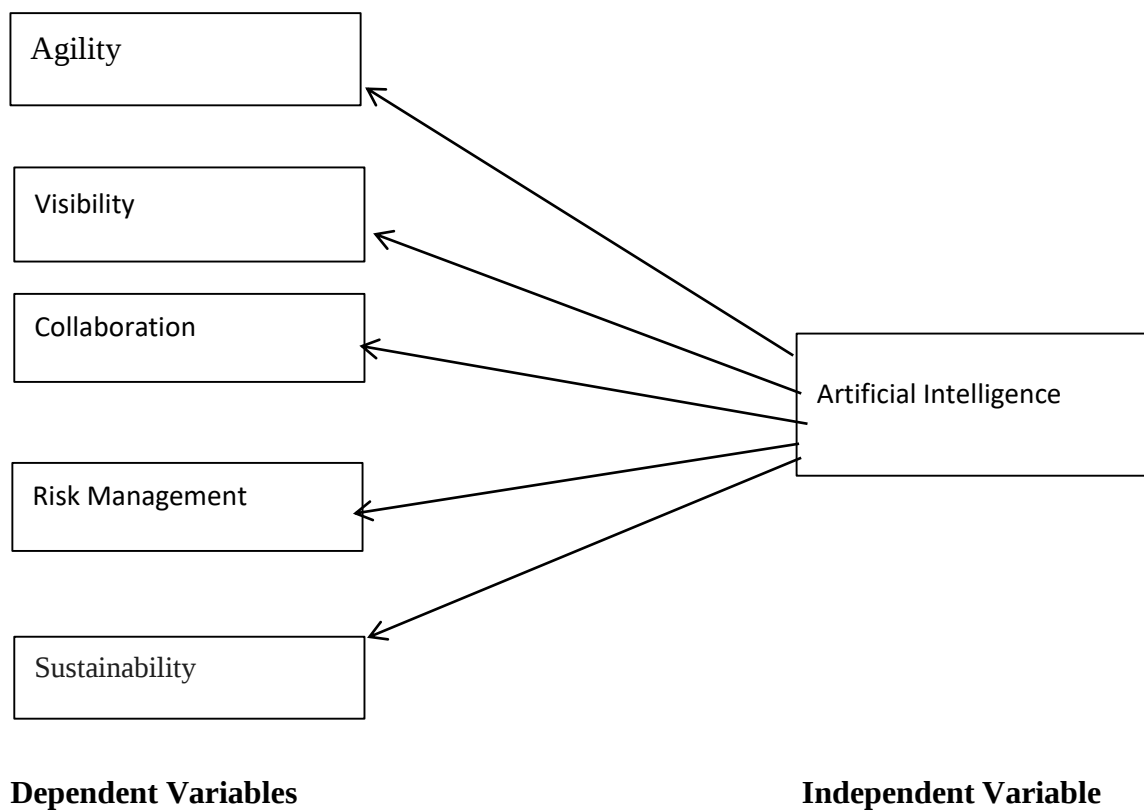
LITERATURE REVIEW

2.0 Introduction

To observe the research topics of this dissertation this review seeks to analyse different literatures relevant to the areas of interest. The review will delve into the theoretical and conceptual frameworks to get a base understanding of the research before finally reviewing the empirical evidence available in the field.

2.1 Conceptual framework and theoretical review

Figure 1. 1: Conceptual framework demonstrating the independent variables and the dependent variable



2.2 Theoretical Review

There are a number of theories pertaining to the concept of supply chain resilience which are the VUCA model which stands for Volatility, Uncertainty, Complexity, and Ambiguity, and it describes the characteristics of an environment or situation that is highly challenging and difficult to navigate. Whilst Artificial Intelligence has a fundamental theory which is called the neural network theory which focuses on how artificial neurons connected in networks can learn and process information.

2.2.1 VUCA Framework

Despite originating from the military domain this theory has transferred its use to the business world. Its abbreviations represent the characteristics of an environment or situation that is highly challenging and difficult to navigate standing for Volatility, Uncertainty, Complexity, and Ambiguity respectively. Volatility refers to the rapidity, scale, and unpredictability of changes that occur in surroundings or system. This can be rapid and unexpected changes in market conditions, customer preferences, regulations, and other influences that effect an organisation's operations. Uncertainty refers to the occurrences of wildcards in an organisations' environment which are difficult to predict. This necessitates the need for agility, adaptability, information acquisition and making informed decisions despite incomplete or conflicting data. Complexity refers to the sophisticated and interrelated nature of the components, associations, and dynamics within a system or environment. The connections among several factors and participants creates a web of complexities that position challenges for decision-making, problem-solving, and coordination. Organisations must develop systems thinking and embrace all-inclusive approaches to circumnavigate complexity effectively. Ambiguity refers to the lack of lucidity or multiple interpretations of information, situations, or events. To effectively deal with ambiguity it requires flexibility and the ability to tolerate and handle conflicting perspectives. The VUCA framework highlights the need for organizations to move away from traditional, rigid planning and management approaches and embrace agility, resilience, adaptability, vision and understanding of the environment.

2.2.2 Adaptive Cycle Model

Adaptive cycle is a simplified framework used to explain how complex systems, including economic and ecological systems undergo cycles of growth, consolidation, release, and reorganisation. Supply chains, like economic systems are inherently dynamic. Panarchy suggests that disruptions are inevitable and that periods of sudden collapse or release are normal features of complex systems. “Although developed initially to understand the change in ecological systems, the adaptive cycle framework has since been extended and applied to understand change and resilience in socio-ecological, economic and social systems” (Abel et al., 2006; Fath et al., 2015; Simmie and Martin, 2010). This means identifying potential vulnerabilities during the growth and accumulation phases and building in redundancy and alternate pathways when rigidity becomes a risk. Then planning for rapid reorganisation and experimentation after a disruption to bolster resilience.

2.2.3 Neural network theory

Neural network theory, is a theoretical framework in the field of artificial intelligence that models reasoning processes and behaviour by simulating the interconnectedness of neurons in the human brain. Neural network theory seeks to understand and mimic the way information is processed, stored, and retrieved in biological neural networks. Its key concepts are neural networks, connection weight, activation function and learning. Neural networks contain interconnected nodes, called artificial neurons or units, which simulate the behaviour of biological neurons. These units receive input signals, perform computations, and produce output signals that are passed to other units in the network. Pertaining to connection weights each connection between units in a neural network is given a connection weight, which defines the strength or importance of the connection. These weights can be adjusted during the learning process to enable the network to adapt and improve its performance. Each artificial neuron in a neural network applies an activation function to the weighted sum of inputs it receives. The activation function determines the neuron's output or activation level, which is then passed to other connected neurons. Lastly in Learning Neural network theory stresses the importance of learning algorithms for training neural networks. Learning algorithms adjust the connection weights based on input-output patterns presented to the network during the training phase. The aim is to optimise the network's performance by minimizing the difference between the desired output and the actual output.

2.4 Empirical Evidence

Chikozho, J., Mhlanga, L., & Mthembu, R. (2015). An Assessment of the State of Supply Chain Management Practices in Zimbabwean Manufacturing Companies.

This study employed a quantitative approach, using a questionnaire distributed to 120 manufacturing companies in Zimbabwe. The data was analysed using descriptive statistics and factor analysis. It found that basic supply chain management practices like supplier selection, inventory management, and transportation management were implemented to varying degrees by the companies. It however noted that more advanced practices like strategic partnerships, demand forecasting, and supplier development were less prevalent in Zimbabwe. Infrastructure limitations, including unreliable power supply and poor transportation networks, were identified as significant challenges to effective implementation of supply chain management practices like supply chain resilience. The study also emphasised that limited access to technology and skilled personnel as barriers to adopting advanced supply chain management practices.

Dumisani Mawonde, Casper Demberere and Regis Muchowe. (2021). An analysis of the effects of supply chain risk management on resilience to economic risk. A case of Pharmaceutical retailers in Zimbabwe.

This study by Mawonde et al. (2021) investigated the effects of supply chain risk management on resilience to economic risk in Zimbabwean pharmaceutical retailers. The researchers used a mixed-method approach of combining a descriptive research design with questionnaires and interviews. Their study concluded that supply chain risk management has a significant positive effect on resilience to economic risks for pharmaceutical retailers in Zimbabwe. The authors pointed out that supply chain risk management help businesses to better anticipate, prepare for, and respond to economic disruptions, ultimately enhancing their resilience.

Dumisani Mawonde, Lethy Simbabure, Lillian Kamvumbi and Peter Ngarize. (2022).The effects of supply chain resilience on purchasing performance during the Covid-19 period in Zimbabwe: A case of the Ministry of Finance and Economic Development.

In this study the authors used a quantitative research approach for their methodology and collected data using self-administered questionnaires distributed to employees in procurement, finance, administration, and budget departments. They found that these

supply chain resilience strategies including electronic procurement, buyer-supplier partnership, agility and local sourcing have a positive and significant effect on delivery time, but an insignificant effect on stock availability and purchasing costs in the ministry of finance and economic development during the Covid-19 period.

Adobor, H. (2020). Building supply chain resilience in emerging economies: A conceptual framework.

This study argued that traditional reactive strategies, like having buffer stocks and contingency plans, are often inadequate in mitigating the dynamic disruptions faced by supply chains in developing economies. The research pointed out that the challenges of emerging economies are unique and they include political issues, lack of adequate infrastructure and limited resources which hinder the adoption of using traditional reactive strategies to enhance supply chain resilience. Adobor (2020) proposed a conceptual framework which places emphasis on three fundamental pillars for building supply chain resilience which are collaboration, flexibility, and innovation. Collaboration fosters information sharing and joint risk management among supply chain actors. Flexibility enables adaptation to changing environments by developing agile processes and diverse sourcing strategies. Innovation encourages the implementation of advanced technologies and continuous improvement practices to enhance supply chain efficiency and responsiveness.

Mhlanga and Emmanuel Ndhlovu. (2016). The Impact Of Inflation On Supply Chain Management In Zimbabwe

This study by Mhlanga et al. (2016) investigates the impact of inflation on supply chain management in Zimbabwe. It study highlights the challenges faced by businesses due to the Zimbabwe's history of hyperinflation and currency fluctuations. Its key findings were that inflation increases procurement costs as the prices of raw materials and finished goods increase, disrupting budget planning and inventory management. Secondly it was found that Supply chain disruptions occurred in periods of hyperinflation as the unpredictable nature of inflation leads to supply chain disruptions as suppliers become hesitant to offer credit or fixed prices. It also pointed out decreased efficiency because of inflation as firms resort to short-term planning and frequent price adjustments, impacting efficiency and increasing administrative burdens. Inventory management challenges also occur as holding inventory becomes risky due to the

potential for rapid value erosion, leading to stock shortages or overstocking. Lastly inflation creates tension between buyers and suppliers as they negotiate pricing and payment terms which leads to straining of relationships with suppliers.

Modgil, S, Singh, RK and Hannibal, C. Artificial Intelligence for Supply Chain Resilience: Learning from Covid-19.

In this study the authors from the view of dynamic capabilities investigated the potential of Artificial Intelligence to develop supply chain resilience drawing from lessons encountered from the COVID-19 pandemic. It advocates AI as a solution to the challenges encountered by supply chains during the pandemic. The research points out five key areas where Artificial Intelligence can be beneficial which are transparency, last-mile delivery, personalization, minimising disruption and facilitating procurement. Pertaining to transparency AI can be used to improve the transparency of supply chains by providing real-time data on inventory levels, production, and transportation. This can help businesses to identify and mitigate potential disruptions. Secondly in last-mile delivery Artificial Intelligence is be used to optimise last-mile delivery routes and schedules, which can help to reduce costs and improve delivery times. Thirdly on personalisation AI systems are used to personalise the supply chain to meet the specific needs of individual customers helping businesses to improve customer satisfaction and loyalty. Fourthly for reducing disruption Artificial Intelligence is be used to predict and prevent disruptions to the supply chain, such as natural disasters or political unrest. Lastly in procurement Artificial Intelligence can be used to automate procurement processes and to identify the most reliable suppliers.

Agrawal, R., Awasthi, P., & Dubey, S. K. (2022). Artificial intelligence applications in supply chain management: A comprehensive review.

The purpose of this study was to provide a comprehensive review on Artificial intelligence applications in supply chain management. The authors highlighted the increasing complexity and dynamism of supply chains, stressing the need for innovative solutions to enhance efficiency and resilience. They classified AI applications in supply chain into five major areas which are demand forecasting as Artificial Intelligence techniques like machine learning and deep learning can analyse historical data and external factors to predict future demand more accurately. Secondly Artificial Intelligence is used in Inventory management to optimise inventory levels by taking

into account factors like demand forecasts, lead times, and safety stock requirements. Thirdly Artificial Intelligence is used for Transportation optimisation as it makes use of algorithms that can optimise transportation routes, schedules, and vehicle selection, leading to reduced costs and emissions. Artificial Intelligence is also used in Production planning and scheduling to assist in production planning by optimising resource allocation, scheduling maintenance, and predicting potential disruptions. Lastly Artificial Intelligence is used in risk management to analyse data to identify and assess potential risks in the supply chain, enabling proactive mitigation strategies.

Mariam ATWANI¹, Mustapha HLYAL, and Jamila ELALAMI (2022). A Review of Artificial Intelligence applications in Supply Chain.

This study inspected the existing literatures on the use of artificial intelligence in the Supply Chain. It charted the applications based on their use in four key supply chain processes which are forecasting and demand planning, procurement and purchasing, production management and inventory management, and transportation and distribution. In implication, according to the study, the most commonly used technique of AI is Artificial Neural Networks, which are usually used to find difficult patterns that humans cannot find. Then, another most predominant AI technique is Fuzzy Logic, which is a form of multiple-valued logic that handles the concept of partial truth.

Ngai et al. (2021). Artificial Intelligence Applications in Developing Countries: Opportunities and Challenges.

This research explored the growing interest in Artificial Intelligence adoption in developing countries. They recognised the potential benefits of Artificial Intelligence for helping economic growth, enhancing efficiency, and improving living standards. Artificial Intelligence can facilitate economic growth in developing countries as it can foster innovation, create new jobs, and improve productivity, leading to economic development. Artificial Intelligence can improve service delivery as it can be used in healthcare, education, and governance to advance service delivery and access for citizens in developing countries. They also stressed out that Artificial Intelligence has the potential to enhance efficiency as it can automate tasks, optimize processes, and reduce costs across various sectors in developing countries. . However, they also highlighted the substantial challenges that developing countries face in adopting and integrating Artificial Intelligence effectively. They pointed out that infrastructure

limitations due to lack of reliable internet access, computing power, and data infrastructure can deter AI adoption in developing countries. Another challenge they pointed out was skill and talent scarcity as developing countries may lack the skilled workforce required to develop, deploy, and maintain Artificial Intelligence systems. Affordability was also included as another factor challenging the adoption of Artificial Intelligence systems as the cost of acquiring, implementing, and maintaining AI technologies can be a barrier for many developing economies. Fourthly ethical considerations due to Issues like bias, transparency, and accountability need careful consideration when deploying AI in developing countries. Lastly regulatory frameworks were also presented as another challenge for AI adoption as lack of clear regulations and policies can create uncertainty and deter responsible Artificial Intelligence development and deployment in developing countries.

2.5 Gap Analysis

In this literature review in this section there were studies examining the current methods used for supply chain resilience in Zimbabwe and developing economies at large and some examined the use of Artificial Intelligence for supply chain resilience instead of focusing on traditional approaches. However there is notable lack of literature on the use of Artificial Intelligence for supply chain resilience in the context of a developing country specifically Zimbabwe. The existing literature on use of Artificial Intelligence in developing countries is on its general application in the supply chain but not on its use to enhance resilience. Hence there is a need for the study on the use of Artificial Intelligence to enhance supply chain resilience tailored to Zimbabwe.

2.6 Chapter Summary

The chapter examined the existing literature on the subject and was guided by the research goals and inquiries. It focused on abstract and theoretical models, along with factual proof. The author will proceed to the following section, which will present the research methodology.

CHAPTER III

RESEARCH METHODOLOGY

3.0 Introduction

The chapter focused on the research methodology used in the study, which aimed at gathering data on using Artificial Intelligence for supply chain resilience in Zimbabwe. The chapter covered various aspects of the study, starting with the research design then moving onto the research instruments, data collection procedures, statistical presentation and examination, and lastly a summation up of the chapter.

3.1 Research Design

Research design refers to the overall strategy employed to investigate the research questions. Research Questions are the guiding questions that drive the entire research effort because a well-designed research question defines the scope and direction of the inquiry.

The primary objective of the research is to examine how AI technologies can contribute to improving supply chain resilience in Zimbabwe, considering the exceptional socio-economic and logistical challenges faced in Zimbabwe. To do this a mixed methods approach was employed to comprehensively analyse the research questions. This approach combines quantitative and qualitative data collection methods to gain a holistic understanding of the current state of supply chain resilience in Zimbabwe and the potential impact of AI (Creswell & Plano Clark, 2018). Quantitative methods, characterized by numbers and statistics, excel at measuring variables, testing hypotheses, and uncovering patterns whereas qualitative methods, on the other hand, delve deeper into the subjective aspects through words, experiences, and meanings.

The synergy of these 2 methods is beneficial as merging data sources allows researchers to verify findings and identify potential discrepancies, leading to more robust conclusions known as triangulation (Gough, D et al, 2017). It also has potential for generating new insights as the interplay between quantitative and qualitative data can

spark new ideas and uncover unexpected relationships, fostering a deeper exploration of the research question. In this research a concurrent mixed methods was be used where data from both quantitative and qualitative methods are collected simultaneously in the form of a closed and open ended questionnaire.

3.2 Target population

The target population of the study comprised of supply chain professionals in Zimbabwe in both the private and public sector and they were considerably assumed to have the required data.

3.3 Sampling technique

Stratified sampling technique was used as 60 respondents were divided into subgroups based on the sector they worked in to proportionally represent both the public and private sector in Zimbabwe.

3.4 Types of data

The research made use of both primary data to achieve research objectives. This increases both research accuracy and completeness.

3.4.1 Primary data

The study made use of questionnaires as the primary data collection method. The data gathered was reasoned suitable for the determination of this study and allied with the research objectives and questions of this study. The study also attained updated information from the participants, which provided an accurate representation of the prevailing conditions during the research period. While mixed methods offer advantages, gathering first-hand information (primary data collection) can be challenging. It's time-consuming, and people might be unwilling to share details due to privacy worries. Furthermore, participation often hinges on convincing respondents, who may not be interested unless there are incentives.

3.5 Research instrument

The research utilised a research instrument that collects both quantitative and qualitative data, which is, questionnaires. The choice of this particular method was strategic. It

protects anonymity, which puts respondents at ease and reduces the likelihood of skewed results. Additionally, this method provides a comprehensive understanding of the variables being investigated.

3.6.1 Questionnaires

In an effort to gather unbiased and truthful data, the researcher decided to distribute paper questionnaires directly to participants. This approach allowed respondents to complete the questionnaires at their own convenience and interpret the questions based on their own understanding, minimizing any potential influence from the researcher. While this method ensured anonymity and potentially reduced the chance of skewed responses, it also came with some downsides. Distributing the questionnaires personally resulted in increased transportation costs compared to methods like online surveys. Additionally, there was a risk of a lower response rate due to participant disinterest or lost questionnaires that weren't returned. To mitigate this difficulty, the researcher used previous studies on the same concept for guidance.

3.7 Data Collection Procedure

In order to maximise participation, the researcher opted for a digital self-administered survey approach. They created a Google Form questionnaire and attached a cover letter to it. This questionnaire was then distributed to each chosen company within the sample group. To reach a wider audience and cater to different preferences, the researcher sent the survey via two channels email and WhatsApp with a link. To further boost response rates, they strategically sent reminders to a subset of the recipients who received the survey link through both email and WhatsApp.

3.8 Validity and reliability

3.8.1 Data Validity

The researcher took a meticulous step to ensure the effectiveness of the questionnaire – a pilot study. The researcher also randomly selected participants from small enterprises in Zimbabwe to complete a draft of the questionnaire (eight questionnaires in total). This pilot run served two key purposes. Firstly, it allowed the researcher to gauge how well respondents understood the questions. Secondly, based on this feedback, the

researcher could make necessary adjustments to the questionnaire before distributing the final version, ultimately enhancing the validity and accuracy of the data collected.

3.8.2 Data reliability

The researcher prioritized data reliability by implementing a two-pronged approach. Firstly, they strategically targeted a specific group of individuals for the survey. This group encompassed proprietors, high-ranking executives, mid-level managers, and a select few supervisors with substantial experience in procurement within their respective companies. By focusing on these knowledgeable individuals, the researcher aimed to acquire dependable and accurate information (Rea, L., & Parker, R. 2012). Secondly, the researcher employed Cronbach's alpha, a statistical measure of internal consistency, to assess the overall reliability of the interview data (Pallant, J, 2020). This statistical test helps determine whether the interview questions consistently measure the intended construct, strengthening the confidence in the findings.

3.9 Data Presentation and Analysis Procedures.

In the interest of clarity and conciseness, the researcher opted to present the collected data in a visually appealing way. Tables, graphs, and pie charts were utilized to transform the raw data into easily digestible formats. This approach avoided overwhelming the reader with extensive, unprocessed information that could be difficult to analyze and draw conclusions from. To achieve this visual presentation, the researcher leveraged software tools like Microsoft Excel Spreadsheets. Additionally, for in-depth analysis, SPSS version 20 was employed. It's important to note that descriptive statistics were the primary method used to analyze the data for the objectives which provided information for the dissertation in form of quantitative data whilst thematic analysis was used for objectives which provided qualitative data.

3.9.1 Data presentation

The section describes the process of data presentation, which is essentially transforming raw data into a comprehensible format to reveal its significance (Francis, G, 2010). In this study, the data originated from questionnaires and was compiled to provide a holistic view of the research topic. The researcher then employed a logical approach to present the findings. This involved categorising the data into thematic groups and utilising visuals like tables, graphs, and diagrams to effectively communicate the

meaning and insights gleaned from the data (Easterby-Smith et al, 2015). This selection of presentation methods is both well-founded and logical, as it caters to different learning styles and fosters a clear understanding of the research outcomes.

3.9.2 Data Analysis

Open-ended questions in the questionnaire were used to gather qualitative data on vulnerabilities (Objective 1) and barriers to AI adoption (Objective 4) and then techniques like thematic analysis were used to identify recurring themes and categorize the qualitative responses. This helped explore the specific types of vulnerabilities and the key reasons hindering AI adoption within Zimbabwe's supply chain. Closed-ended and Likert scale questions were used to collect quantitative data on the prevalence and severity of identified vulnerabilities for objective 2. Descriptive statistics like frequency tables and percentages summarised the data, revealing the most common vulnerabilities. For objective 3 which is evaluating AI's potential, questions gauged the perceptions of AI effectiveness against specific vulnerabilities. Here, descriptive statistics and correlation analysis were used to understand perceived alignment between AI solutions and vulnerability mitigation. For Objective 5 which is assessing the effectiveness of AI, questions targeted perceived improvements in supply chain performance metrics after AI adoption. Descriptive statistics and were used to analyse this data.

3.10 Chapter Summary

This chapter has delved into the specific methods used to conduct this research project. It not only explained the chosen methodology and the reasons behind that choice, but also offered a detailed breakdown of the data collection and analysis processes. The chapter outlined how questionnaires were utilised to gather information from a targeted population, while also specifying the sample size employed in the study. Following this chapter, the focus shifts to the data itself, presenting the findings and a thorough discussion of their implications.

CHAPTER IV

DATA PRESENTATION, ANALYSIS AND DISCUSSION

4.0 Introduction

This chapter delves into the analysis of data collected on AI implementation in Zimbabwean SMEs' supply chains. It will explore how the data is presented, interpreted, and discussed in relation to the existing theories on AI and supply chain resilience (introduced in chapter 2). The analysis will utilize tables, graphs, and charts to illustrate the findings and their connection to the study's objectives of improving supply chain resilience through AI. Ultimately, this chapter will provide recommendations for Zimbabwean firms on how AI can be leveraged to achieve cost reduction and enhance their competitive edge.

4.1 Response rate

table 4. 2: Percentage of the questionnaire response rate (n= 60)

Sector	Questionnaires distributed	Questionnaires responded	Respond Rates (%)
Transport & logistics	5	4	80
Retailing	24	23	95.83
Healthcare	10	10	100
Manufacturing	6	4	66.66
Agriculture	9	8	88.88
Finance	6	5	83.33
total	60	54	90

Source: Primary data (2024)

In the table 4.1 60 questionnaires were distributed to respective sectors and their responses were recorded as above. The response rate was 90.91% which is significantly considerable to consider as a unit of reference on decision making.

4.2 Reliability Test

table 4. 3: Reliability test

Reliability Statistics

Cronbach's Alpha	N of Items
0.817	34

Source: SPSS

The analysis shows a positive result for the questionnaire's reliability. This was determined by a statistical technique called Cronbach's alpha, which resulted a value of 0.817 in the SPSS software. This value falls within a range that's generally considered good (between 0.7 and 0.9 according to George & Marley, 2003). The questions in the survey are measuring the same underlying concept. There's a strong connection between the questions themselves meaning that someone who scores high on one question is likely to score high on others as well. This high Cronbach's alpha score shows that the data which was collected through the questionnaire is consistent and dependable.

4.3 Position held by respondents

table 4. 4: Positions held by respondents

job position

	Freque ncy	Percent	Valid Percent	Cumulative Percent
Valid Procurement Officer	20	37.04	37.04	37.04
LogisticsManager	6	11.11	11.11	48.04

Procurement clerk	26	48.14	48.14	96.18
General Mananger	2	3.70	3.70	100
Total	50	100.0	100.0	100

Source: SPSS

As illustrated in table 4.3 the majority of the respondents who participated in this research are Procurement Clerks as they made up 48.14% of the participants. Procurement Officer is the second most common job title, with 37.04% of respondents. Logistics Managers make up 11.11% of the sample, followed by General Managers at 3.70%. These figures confirm the validity of the response and data gained from this survey since an overwhelming majority of the respondents are supply chain specialist constituting 96.18% and so they are trusted to have a more accurate insight on matters related to the supply chain domain. Only 3.7% were general managers who played a general managerial role in their organisations but not being supply-chain professionals themselves.

4.4 Years of experience in industry

table 4. 4: Years of experience

Number of years in industry

	Frequency	Percent	Valid Percent	Cumulative Percent
Less than 1 year	5	9.25	9.25	9.25
1 – 3 years	20	37.03	37.03	46.28
4 – 7 years	9	16.66	16.66	62.94
Valid 8 – 10 years	8	14.81	14.81	77.75
10 years and above	12	22.22	22.22	100.0
Total	54	100.0	100.0	

Source: SPSS

4.5 Supply Chain Resilience Strategies used in Zimbabwe

Table 4. 5: Major Resilience Strategies used

Sector	Transport Options	Inventory Management	Diversification	Tech Solutions	Collaboration	Other
Transport & Logistics	72%	55%	80%	68%	40%	2%
Retailing	65%	38%	70%	45%	25%	8%
Healthcare	85%	62%	90%	75%	32%	4%
Manufacturing	58%	48%	82%	52%	35%	3%
Agriculture	70%	60%	88%	42%	18%	6%
Finance	60%	40%	75%	58%	28%	1%

Source: SPSS

Respondents in the logistics sector when surveyed, they were asked how they approach supply chain resilience in their organisation choosing all the options that they make use of from a list of provided industry standard resilience strategies Diversification was the most commonly used as it was selected by 80% of the participants in that sector. The survey also revealed that diversification of suppliers is also the most dominant choice for supply chain resilience in the retail (70%), healthcare (90%), manufacturing (82%), agriculture (88%) and finance (75%).

4.6 Threats to supply chain resilience in Zimbabwe

Table 4.6: Threats to supply chain resilience

Threat	Minimum	Maximum	Mean	Standard Deviation	Variance
Natural disasters	2	3	2.3	0.5	0.25
Political instability	1	3	1.8	0.8	0.64
Infrastructure deficiencies	1	2	1.5	0.5	0.25
Economic instability	2	3	2.7	0.4	0.16
Supplier disruptions	1	3	2.1	0.7	0.49
Demand fluctuations	2	3	2.4	0.5	0.25

Source: SPSS

Table 4.6 offers a detailed look at the data for the supply chain threats under investigation by the survey. It uses descriptive statistics to paint a picture of what the data reveals. The N column shows how many data points were included for each technique. The minimum and maximum columns show the lowest and highest values found in the data for each technique. The mean tells us the average value for each threat. Finally, the standard deviation and variance columns show how much the data points tend to vary around the average for each threat.

The results show that Economic instability has the highest mean score (2.7), while infrastructure deficiencies had the lowest mean score (1.5). Political instability has the highest standard deviation (0.8). This shows a wider range of rankings assigned by respondents indicating that supply chain players in Zimbabwe have got differing opinions on the effect of politics in disrupting the supply chain.

The variance follows a similar pattern, with political instability having the highest variance (0.64) and economic instability having the lowest variance (0.16). Overall, these results suggest that economic instability is perceived as the greatest threat to supply chain resilience in Zimbabwe than the other threats that exist, while infrastructural deficiencies are viewed least threatening.

4.7 Descriptive Statistics for AI's potential to improve the resilience of supply chains in Zimbabwe

Table 4.7: AI's potential to improve the resilience of supply chains in Zimbabwe

AI Potential for improving supply chain resilience	N	Min	Max	Mean	Std Deviation	Variance
Increasing Transparency	54	1	4	2.43	1.06	1.12
Offering Personalised solutions	54	3	5	3.96	0.88	0.77
Supporting Procurement strategy	54	1	3	1.96	0.86	0.74
Enhancing Last mile delivery	54	1	3	2.20	0.60	0.36
Reducing disruption impact	54	4	5	4.59	0.49	0.24

Demand forecasting	54	3	5	4.02	0.80	0.64
Increasing Flexibility and agile	54	2	5	3.44	1.17	1.37
Enabling Innovation	54	3	5	4.15	0.83	0.69
Fostering Collaboration	54	2	4	2.98	0.78	0.61
Optimising resource allocation	54	1	5	3.00	1.41	2.00

Source: SPSS

The results show that there is strong agreement among the participants on AI's potential to mitigate disruptions having the highest mean rating of 4.59. AI's potential to offer personalised solutions has the highest standard deviation (0.88). While the mean is high (3.96), indicating that there might be some disagreement about how well AI can personalize solutions. The potential of AI to Optimise resource allocation has the highest variance (2.00), suggesting more diverse views on AI's effectiveness in resource allocation. The data suggests a generally positive outlook on AI's potential. Most means fall between 2 and 4 (on a scale of 1-5), indicating respondents see AI as somewhat largely to moderately beneficial for various aspects of supply chain resilience.

4.8 Likelihood of adopting AI solutions in the next two years by sector in Zimbabwe

Table 4.8: Likelihood of adopting AI

Sector	Very likely	Likely	Neutral	Unlikely	Very unlikely
Agriculture	18.18%	0.00%	27.27%	27.27%	27.27%
Manufacturing	20.00%	30.00%	0.00%	40.00%	10.00%
Retail	11.11%	11.11%	11.11%	33.33%	33.33%
Healthcare	42.86%	28.57%	14.29%	14.29%	0.00%

Logistics & Transportation	30.00%	20.00%	10.00%	30.00%	10.00%
Other	14.29%	14.29%	14.29%	42.86%	14.29%

Source: SPSS

Fig 1.2 Likelihood by sector to adopt AI

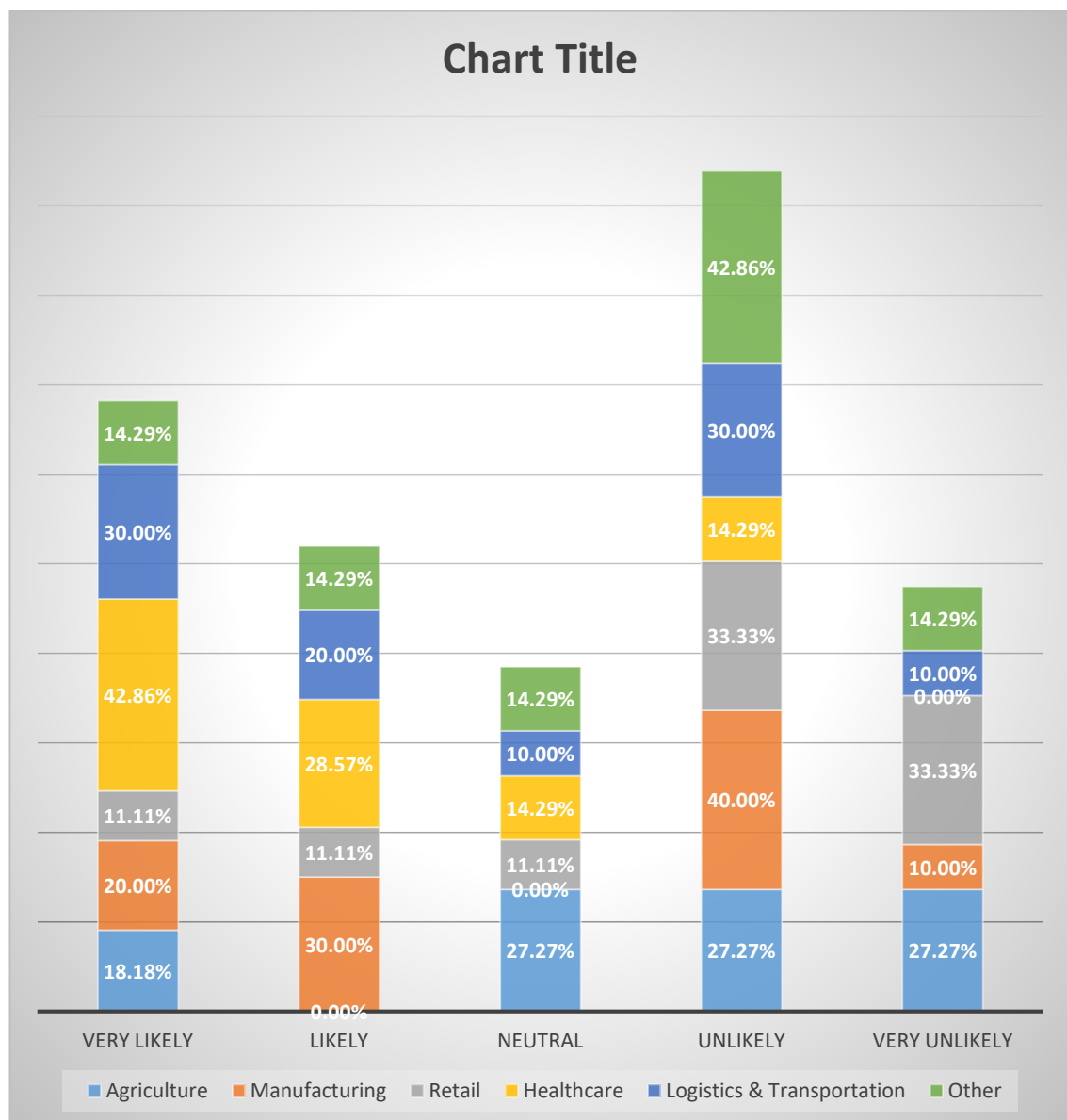


Figure 1.2 showing the likelihood by sector to adopt AI

Source: Microsoft Excel

The Healthcare sector shows the highest potential for AI adoption, with 71.43% (42.86% Very Likely + 28.57% Likely) of respondents indicating a positive outlook. Logistics and Transportation sector also shows a promising outlook, with 50% (30%

Very Likely + 20% Likely) of respondents leaning towards adoption. Manufacturing sector has a moderate interest in AI, with 50% (20% Very Likely + 30% Likely) considering adoption. Agriculture and Retail sectors appear to be the most hesitant, with both having a significant portion (54.55% for Agriculture and 66.67% for Retail) falling into the "Neutral," "Unlikely," or "Very Unlikely" categories. Overall the data suggests a cautious to moderate level of interest in adopting AI solutions within the next two years across various sectors in Zimbabwe. No sector has a clear majority favouring the Very Likely adoption.

4.9 Reason for not considering the adoption of AI solutions

Table 4.9: Reason for not considering adoption of AI

Reason for not considering adoption of AI solution	N	Min	Max	Mean	Std Deviation	Variance
Affordability Issues	54	4	5	4.52	0.50	0.25
Computing power limitations	54	1	5	3.00	1.41	2.00
Lack of expertise in the field	54	2	5	3.44	1.17	1.37
Ethical issues	54	1	2	2.37	0.31	0.10
Bureaucratic issues	54	1	4	2.72	1.10	1.21
Lack of reliable internet access	54	3	5	3.83	0.79	0.62

Source: SPSS

The table shows the perceived barriers to adopting AI solutions among respondents. The top concerns are Affordability Issues having the highest mean score (4.52) and a low standard deviation (0.50), indicating it's a major concern for most respondents with little variation in opinion. Lack of reliable internet access also has a high mean score (3.83) but a slightly higher standard deviation (0.79), suggesting it's a significant concern, but some respondents might be less affected than others. Ethical issues (2.37 mean score) has the lowest mean score, suggesting ethical concerns are a moderate barrier compared to others. Computing power limitations (3.00 mean score), While a concern, the standard deviation (1.41) suggests some might have access to sufficient computing power or believe it's a surmountable hurdle. Overall the high cost of AI

solutions and the lack of readily available infrastructure that is reliable internet are the limiting factors for wider adoption of AI in Zimbabwe's supply chains.

4.10 Barriers to AI Adoption

Table 4.10: Barriers

Challenges	Agriculture	Manufacturing	Retail	Healthcare	Logistics and Transportation	Other
Cost of implementation	45%	62%	58%	39%	71%	48%
Lack of technical expertise	38%	55%	42%	27%	65%	39%
Data security concerns	22%	31%	35%	48%	29%	25%
Resistance to change	27%	41%	38%	32%	54%	34%
Uncertain ROI	31%	48%	45%	29%	62%	42%

Source: SPSS

Table 4.10 highlights the perceived challenges to adopting AI solutions across various sectors in Zimbabwe. Cost of Implementation appears to be a significant barrier for most sectors, with Logistics and Transportation (71%) being the most concerned. This suggests that initial investment costs for AI solutions might be a major hurdle. Lack of Technical Expertise is another widespread challenge, particularly for Logistics and Transportation (65%) and Manufacturing (55%). This indicates a need for skilled professionals to implement and manage AI solutions.

4.11 Measures needed to address barriers for AI adoption by sector in Zimbabwe

Table 4.11 Measures needed to address barriers for AI adoption

Sector	Government Subsidies	Training Programs	Financial Incentives	Industry-Specific Solutions	Awareness & Education	Other
Agriculture	22%	58%	31%	47%	72%	4%
Manufacturing	35%	62%	44%	68%	65%	2%
Retail	18%	49%	27%	42%	81%	6%
Healthcare	15%	71%	29%	55%	84%	3%
Logistics & Transportation	27%	55%	38%	74%	69%	1%

Source: SPSS

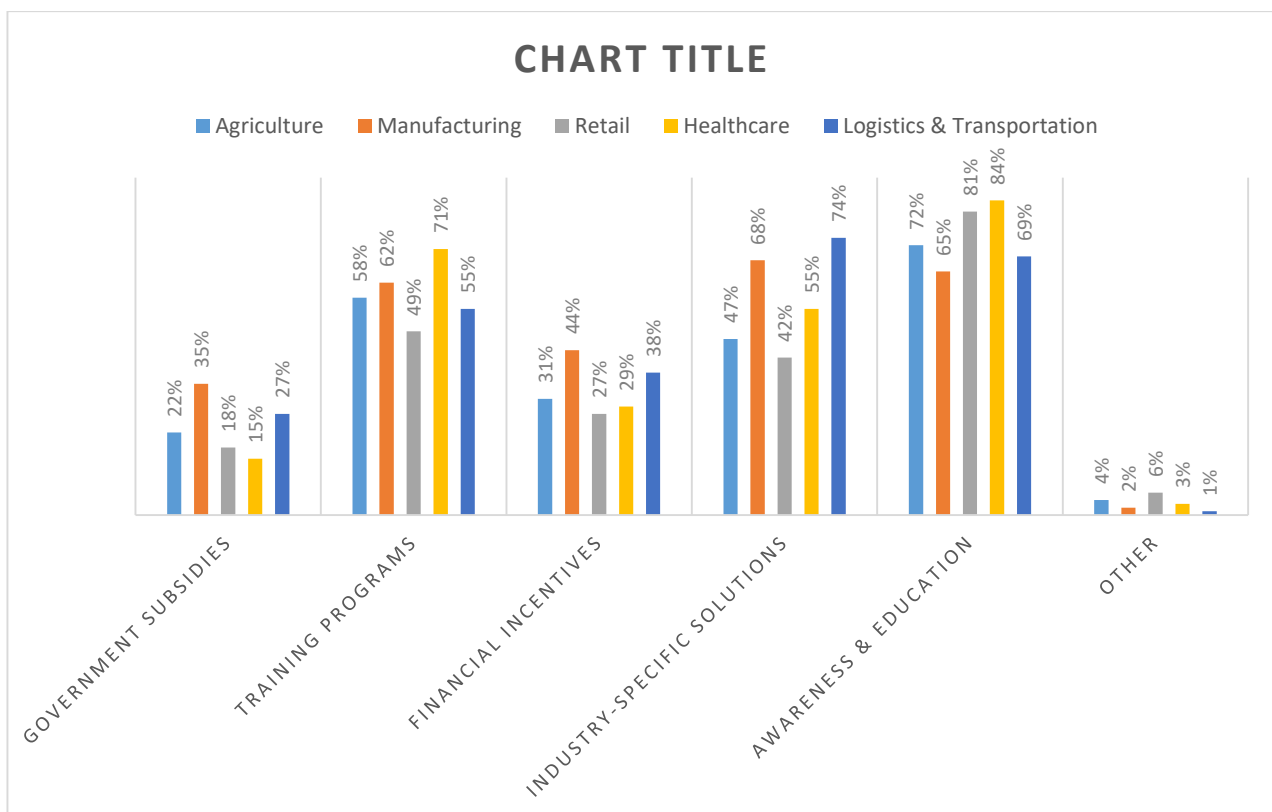


Figure 2 showing measures needed to address barriers to adoption of AI

Source: Microsoft Excel

Training Programs seem to be the most preferred support option across all sectors, with percentages ranging from 49% (Retail) to 71% (Healthcare). This suggests a strong desire for skill development to effectively implement and utilise AI solutions. Awareness & Education ranks second in most sectors, highlighting the need for broader

understanding of AI's potential benefits and applications. Percentages range from 65% (Manufacturing) to 84% (Healthcare).

This data suggests that training programs, awareness and education initiatives, and industry-specific solutions are the most preferred forms of support for AI adoption across various sectors in Zimbabwe. Financial incentives and subsidies seem to be less desired compared to support that fosters knowledge, skills, and tailored solutions.

4.12 Additional information

The last part of the questionnaire used for data gathering for the survey included a blank space for providing additional information on the challenges of AI adoption in Zimbabwean supply chains. This was done to gather qualitative data to supplement the quantitative data obtained from the respondents already. The respondents who provided this additional information were 67% of the total respondents. Respondents particularly those in the health sector wrote data sensitivity issues was a significant challenge as healthcare often deals with sensitive patient data. This helps explain why the Healthcare sector had the highest percentage (48%) score on data security concerns in table 4.10.

Another issue summarised from the additional information provided was the respondents' unwillingness to adopt AI solution as it brought more complexity to their work and the way they do things particularly those in the transport sector. This explains why the logistics and transport sector had the highest percentage score (54%) on resistance to change as indicated in table 4.10. The majority of the additional information written by the respondents showed potential hesitation from employees towards adopting new technologies.

4.13 Chapter Summary

This section of the dissertation includes an examination and evaluation of the information gathered by the investigator through the distribution of surveys. The data was presented in the form of tables and charts, and the respondents' personal information was reserved for ethical reasons. The final chapter will cover a summary of the findings, conclusions, and suggestions for future research.

CHAPTER V

SUMMARY, CONCLUSIONS AND RECOMMENDATION

5.0 Introduction

Chapter 5 of the research paper serves as a comprehensive overview, tying together the key points from the preceding chapters. In essence, Chapter 5 provides a clear picture of what the research accomplished, along with its significance and the potential possibilities it opens for future investigations.

5.1 Chapter Summaries

The opening chapter sets the stage for the entire dissertation. It dives into the core issue that is how can Artificial Intelligence bolster Zimbabwe's supply chain resilience? Given Zimbabwe's unique circumstances. The chapter indicated that the following chapters in the research will be delving into current practices, pinpoint vulnerabilities, and explore how AI can address these challenges. It also highlighted that traditional methods often fall short in the face of ever-changing disruptions. The chapter in addition brought to light the various assumptions, boundaries and limitations limiting this dissertation.

The following chapter was based on the literature review and theoretical review of other similar studies already undertaken to investigate the use of AI for supply chain resilience. This chapter looked at the existing theories of how Artificial Intelligence and resilience works to provide a theoretical framework for the study. It also aided in the identification of various uses of AI in enhancing the resilience of supply chains as well as the challenges of implementing it being faced in other developing countries with a similar setup to that of Zimbabwe. Chapter 2 of this dissertation also reviewed the various supply chain resilience techniques like electronic procurement, buyer-supplier partnership, agility and local sourcing already in use in Zimbabwe identified from other local studies in the country.

The Chapter 3 of this research focused on the methodology which was used to collect data needed for this research. It then pointed out the questionnaire as the research instrument which was utilised to gather data from respondents in the survey and the respondents were stratified into groups by the category of the sector they are in.

The succeeding chapter focused on analysing and presenting the data provided by the respondents on the questionnaires using tables and charts to visualise the data. The response rate for the questionnaires was 90%, while only 67% of those who responded opted to provide additional information. Descriptive statistics were used to draw meaning from the data using means, max, min, deviation and variance of the data which was provided to show how the data is relating to each other such that it can be used to make information which can be used to draw conclusion on the research topic at hand.

5.1 Major findings

This study has found that currently the most prevalent supply chain resilience strategy used by Zimbabwean firms in different sectors is diversification of suppliers as relying on a sole supplier can leave a firm vulnerable to supply side disruptions.

The research also discovered that economic instability that is problems like inflation and constantly volatile exchange rate fluctuations pose the greatest threat to the resilience of Zimbabwean supply chains.

Artificial Intelligence has large potential to enhance the resilience of Zimbabwe's supply chain across all sectors of the economy with its ability to mitigate disruptions being its greatest strength

Despite all the good adopting artificial Intelligence can achieve in strengthening the resilience of supply chains across all sectors of the Zimbabwean economy the cost of implementing it remains the biggest barrier for Zimbabwean companies.

5.2 Conclusions

The significantly positive result of the research was proved by the fact that all the research questions were answered. Basing on the outcome, it can be alleged that implementation of Artificial Intelligence technologies can enhance the resilience of

Zimbabwe's supply chains in the face of the unique challenges faced by the Zimbabwean economy.

5.3 Recommendations

The researcher would like to recommend the management and owners of firms to adopt and embrace Artificial Intelligence technologies as they have a large potential enhance the resilience of the supply chains such that their supply chain operations will not only cope up with current global technological trend but also be in a position to anticipate and counter disruptions before they happen. The researcher also recommends the government to start campaigns and training programs aimed at raising awareness and appreciation of Artificial Intelligence and its potential benefits to organisations across sectors inclusive of both private and public institutions.

5.4 Areas for further study

While implementing AI solutions can automate task and bolster supply chain resilience the researcher suggest that further research on the human element specifically explore how AI can complement human expertise in supply chain management within the Zimbabwean context.

RESEARCH QUESTIONNAIRE

Research Topic: Artificial Intelligence for supply chain resilience in Zimbabwe

Introduction

Thank you for participating in this research questionnaire. This study aims to understand how Artificial Intelligence (AI) can be leveraged to enhance the resilience of supply chains in Zimbabwe. Your responses will be instrumental in achieving this objective.

Confidentiality

All your responses will be kept strictly confidential. Your data will be anonymised and used solely for research purposes.

Instructions

Please answer all questions to the best of your ability. Some questions require quantitative data (numbers), while others seek qualitative insights (opinions).

Please indicate your answer by putting a tick/ x in the box.

Section A: Background Information

1. Industry Sector: (Please select one)

- | | |
|-----------------------------|-----|
| *Agriculture | [] |
| *Manufacturing | [] |
| *Retail | [] |
| *Healthcare | [] |
| *Logistics & Transportation | [] |
| *Finance | [] |

*Other (Please specify): _____

2. Job Title:

Please tick to indicate your job position from categories below?

- | | | |
|-------|---------------------|-----|
| (i) | Procurement Officer | [] |
| (ii) | Logistics Manager | [] |
| (iii) | Procurement Clerk | [] |
| (iv) | General Manager | [] |

3. Years of experience in your industry:

Less than 1 year [] 1 – 3 year [] 3 – 7 years [] 7 – 10 years [] 10 years and above []

Section B: Supply Chain Resilience in Zimbabwe

1. How does your organization currently approach supply chain resilience?

(Please select all that apply)

- | | |
|--|-----|
| * Diversification of suppliers | [] |
| * Inventory management strategies (e.g., safety stock) | [] |
| * Transport options | [] |
| * Technological solutions (e.g., forecasting software) | [] |
| * Collaboration with partners | [] |

* Other (Please specify): _____

2. In your experience, what specific vulnerabilities pose the greatest threat to the resilience of supply chains in your sector? (Rank 1-3, with 3 being the most significant threat)

- | | |
|---|-------------------|
| * Economic instability (e.g., inflation, currency fluctuations) | [1] [2] [3] |
|---|-------------------|

- * Political instability [1] [2] [3]
- * Infrastructure deficiencies (e.g., transportation, power) [1] [2] [3]
- * Natural disasters (e.g., droughts, floods) [1] [2] [3]
- * Supplier disruptions [1] [2] [3]
- * Demand fluctuations [1] [2] [3]
- * Other (Please specify): _____

Section C: Potential of Artificial Intelligence (AI) in Supply Chain Resilience

1. How can AI potentially improve the resilience of supply chains in Zimbabwe?

Please indicate the extent to which you agree to the below statements on the potential of AI to enhance supply chain resilience on a scale of 1 to 5

Key: 1= disagree 2 = small extent 3 = moderate extent 4 = larger extent 5= very large extent

Item No	AI Potential for improving supply chain resilience		1	2	3	4	5
SC1	Increasing Transparency						
SC2	Offering Personalized solutions						
SC3	Supporting Procurement strategy						
SC4	Enhancing Last mile delivery						
SC5	Reducing disruption impact						
SC6	Demand forecasting						
SC7	Increasing Flexibility and agile						
SC8	Enabling Innovation						

SC9	Fostering Collaboration						
SC10	Optimising resource allocation						

2. How likely are you to consider adopting AI solutions for your supply chain in the next two years? (Please select one)

* Very likely [] * Likely [] * Neutral [] * Unlikely [] * Very unlikely

3. If you are unlikely to consider adopting AI solutions, what are the reasons behind your hesitation?

Please indicate the extent to which you agree to statements on the reasons why you are unlikely to consider adopting AI solutions on a scale of 1 to 5.

Key: 1= never 2 = small extent 3 = moderate extent 4 = larger extent 5= very large extent

Item No	Reason for not considering adoption of AI solution		1	2	3	4	5
SC1	Affordability Issues						
SC2	Computing power limitations						
SC3	Lack of expertise in the field						
SC4	Ethical issues						
SC5	Bureaucratic issues						
SC6	Lack of reliable internet access						

Section D: Barriers to AI Adoption

1. What are the biggest challenges you foresee in implementing AI solutions within your supply chain? (Please select all that apply)

- * Cost of implementation []
- * Lack of technical expertise []
- * Data security concerns []
- * Resistance to change within the organization []
- * Uncertain return on investment (ROI) []
- * Other (Please specify): _____

2. What kind of support would be most helpful for organizations in Zimbabwe to overcome these barriers and adopt AI for their supply chains? (Please select all that apply)

- * Government subsidies for AI implementation []
- * Training programs on AI for supply chain professionals []
- * Financial incentives for early adopters []
- * Development of industry-specific AI solutions []
- * Increased awareness and education about AI benefits []
- * Other (Please specify): _____

Thank you for your valuable participation!

Additional Information:

If you have any further comments or insights on the challenges of AI adoption in strengthening Zimbabwe's supply chains, please feel free to share them in the space below.

References

- Abel, N., Cumming, D.H.M. and Anderies, J.M. (2006), "Collapse and reorganization in social-ecological systems: questions, some ideas, and policy implications", *Ecology and Society*, Vol.11No.1, p.17.
- Adobor, H. (2020). Building supply chain resilience in emerging economies: A conceptual framework. *International Journal of Logistics: Management*, 33(3), 429-449.
- Agrawal, R., Awasthi, P., & Dubey, S. K. (2022). Artificial intelligence applications in supply chain management: A comprehensive review. *Journal of the Indian Institute of Management Calcutta*, 17(1), 33-51.
- Chen, H., Chiang, R. H., & Storey, V. C. (2014). Business intelligence and analytics research: A tradition of fostering interdisciplinary research. *ACM Computing Surveys*, 47(4), 1-36.*
- Chikozho, J., Mhlanga, L., & Mthembu, R. (2015). An Assessment of the State of Supply Chain Management Practices in Zimbabwean Manufacturing Companies.
- Chopra, S., & Meindl, P. (2015). *Supply chain management: Strategy, planning, and operation* (6th ed.). Pearson.
- Creswell, J. W., & Plano Clark, V. L. (2018). *Designing mixed methods research* (3rd ed.). SAGE Publications.
- Dumisani Mawonde, Casper Demberere and Regis Muchowe. (2021). An analysis of the effects of supply chain risk management on resilience to economic risk. A case of Pharmaceutical retailers in Zimbabwe.
- Dumisani Mawonde, Lethy Simbabure, Lillian Kamvumbi and Peter Ngarize. (2022). The effects of supply chain resilience on purchasing performance during the Covid-19 period in Zimbabwe: A case of the Ministry of Finance and Economic Development.
- Easterby-Smith, M., Thorpe, R., & Lowe, A. (2015). *Engaging with qualitative research: A theoretical and practical guide*. SAGE Publications Ltd.

Francis, G. (2010). Data analysis and research design: Transforming data into meaningful information. SAGE Publications Ltd.

Ghadimi, P., Li, Y., & Debo, L. (2019). Artificial intelligence applications in supply chain management: A review. *International Journal of Production Research*, 57(12), 3957-3978.

Gunderson, L.H. and Holling, C.S. (Eds) (2002), *Panarchy: Understanding Transformations in Human and Natural Systems*, Island Press, Washington, DC

Mhlanga and Emmanuel Ndhlovu. (2016). *The Impact Of Inflation On Supply Chain Management In Zimbabwe*.

Modgil, S, Singh, RK and Hannibal, C. Artificial Intelligence for Supply Chain Resilience: Learning from Covid-19.

Ngai, E. W. T., Chau, P. Y. K., & Chan, F. T. (2021). Artificial Intelligence Applications in Developing Countries: Opportunities and Challenges. *Journal of Global Information Technology Management*, 24(2), 123-146.

Pallant, J. (2020). *SPSS survival manual: A step by step guide to data analysis using SPSS* (8th ed.). Routledge.

Pettit, D., Croxton, K. L., & Fiksel, J. (2010). Ensuring supply chain resilience: Insights from leading companies. *Supply Chain Management: An International Journal*, 15(5), 369-382.

Ponomarov, S. V., & Holcomb, M. C. (2009). Understanding supply chain resilience: Implications for international logistics. *Journal of Business Logistics*, 30(4), 121-143.

Rea, L., & Parker, R. (2012). *Designing and conducting social research*. SAGE Publications Ltd.

Russell, S. J., & Norvig, P. (2016). *Artificial intelligence: A modern approach* (3rd ed.). Pearson Education Limited.

Sheu, S., Wu, C., & Chou, D. (2005). Building enterprise resiliency with supplier flexibility. *IEEE Transactions on Engineering Management*, 52(3), 303-314.

Ubaru, C. I., Adebisi, B., Babatunde, L. Y., & Adepoju, O. I. (2023). Barriers and Opportunities for AI Adoption in Developing Countries: A Scoping Review. *Information Technology for Development*, 39(1), 189-213.

Online Sources

Gough, D., Thomas, D., & Shacklock, G. (2017). Mixed methods research: expanding the evidence base

Appendix: Letter of Approval

BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE



23 May 2024

To whom it may concern

Dear sir/madam

RE: APPLICATION FOR AUTHORITY TO CONDUCT RESEARCH.

I do hereby apply for authority to conduct a research on your organisations. I am a part four student studying towards a degree in Purchasing and supply with Bindura University of Science Education. My topic is “Artificial Intelligence for supply chain resilience: The case of Zimbabwe”. I am requesting for assistance with information from your organisation as well as authority to respond to my questionnaires.

I am in great hope of your response.

Yours faithfully

.....

B201253B

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