



BINDURA UNIVERSITY OF SCIENCE EDUCATION

FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

RESEARCH PROJECT

**TITLE: THE IMPACT OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES
ON INVENTORY MANAGEMENT IN THE MINING SECTOR OF ZIMBABWE.
CASE OF BINDURA NICKEL MINE(TROJAN).**

BY

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FOR THE BACHELOR OF COMMERCE DEGREE IN PURCHASING
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RELEASE FORM

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Title of dissertation: The impact of Green Supply Chain Management practices on inventory management in the mining sector of Zimbabwe. Case of Bindura nickel mine(trojan), Degree to which dissertation was presented: Bachelor of Commerce Degree in Purchasing and Supply.

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DEDICATION

This dissertation is dedicated to Jesus Christ of Nazareth, my personal Lord and Savior. I am grateful for the knowledge and wisdom he provided me with in order to carry out this research.

In addition, I dedicate this dissertation to my mentor and father in the **Lord Prophet S. Chabwinja**, who has been a saintly promoter of my religion through these spirit-filled teachings. Without his prayers, this study would almost certainly not have been finished.

GOD BLESS YOU, I said to him.

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ABSTRACT

The research study focused on the influence of Green Supply Chain Management principles on inventory management in the mining industry of Zimbabwe, specifically Bindura Nickel Mine (Trojan). The study utilized the Theory of constraints, Lean theory and Institutional theory, as well as the independent variables, Green Supply Chain Management (GSCM) practices and the dependent variables, Mining Inventory Management systems. The research methodology followed a mixed methods approach with questionnaires and interviews used as data collection tools. The major findings showed that the GSCM practices most perceived in the mining industry were green manufacturing, green operations and logistics, green procurement and green waste management. The major impacts of GSCM were enhanced performance of the entire inventory management system and elimination and minimization of waste by reducing costs and enhancing efficiency. The major barriers to GSCM were lack of top management commitment, lack of organizational structures and encouragement and government policies and weak support systems. The major recommendations were top management commitment and leadership support on sustainability, using green supply chain analysis as a catalyst for innovation and integrating total quality environmental management into planning and operation processes. **Keywords:** *Green Supply Chain Management, Inventory Management, Mining, Impacts.*

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LIST OF ACCRONYMS AND ABBREVIATIONS

ERP	Enterprise Resource Planning
EOQ	Economic Order Quantity
CRS	Continuous Review System
GSCM	Green Supply Chain Management
GP	Green Procurement
JIT	Just-in-Time
MRP	Material Requirement Planning
SDGs	Sustainable Development Goals
SP	Sustainable Procurement

CHAPTER 1

1.1 Introduction

Green Supply Chain Management (GSCM) is an environmental innovation which integrates environmental concerns into supply chain management (Seman *et al.* 2012). The global phenomenon has been emphasized to be the basis of all operations around the world as it constitutes one of the Sustainable Development Goals (SDG). The African Development Bank, Guidance Note (2020), emphasized that Sustainable Procurement (SP) supports the objectives of sustainable development. Therefore, since SP aims to "promote public procurement practices that are sustainable in accordance with the national policies and priorities" (Target 12.7 of Sustainable Development Goal 12 on Sustainable Consumption and Production in the 2030 SDGs), it can be used to create synergies between the three pillars of sustainable development. Therefore, the research addressed the environmental, economic, and social organizational green management goals of the mining industry through the use of green supply chain management.

In order to attain a greener supply chain, preserve a competitive edge, and further corporate profit and market share goals, Rao and Holt (2005) argued that it is crucial to integrate environmental management principles throughout the whole supply chain management. The research explored the green supply chain management aspect focusing on the assessment of the effectiveness (purchasing cost and prices, quality of the product, purchasing systems) and efficiency (procedures and policies, management, stakeholders and information systems) in the mining sector. Through the GSCM, the research addressed the economic, social and environmental factors (triple-bottom-line of sustainability).

1.2 Background of the Study

Sustainable procurement was argued by ECE Policy Recommendation No.43 on Sustainable Procurement of the United Nations Centre for Trade Facilitation and Electronic Business UN/CEFACT (2019), as the process by private corporations or public authorities seeking to achieve the most appropriate equilibrium between social, financial, and environmental considerations when purchasing goods and services. The procuring team would be considering all the optimum options to ensure that the process is cost efficient throughout the entire life cycle of the business operation. These are the factors being taken into consideration by the mining sector in order to achieve their organizational goals and objectives.

The term "green supply chain management" (GSCM) refers to the incorporation of environmental considerations into all aspects of supply chain management, including product design, material sourcing and selection, manufacturing, delivery of the finished product to consumers, and management of the product's end-of-life after its useful life (Srivastava, 2007). The concept of GSCM has to be included in the procedures of organization as their structural component to ensure that there is high compliance and commitment towards inventory management to guarantee performance improvements. Through the Green Supply Chain Management initiatives, the mining sector will be taking their role in promoting sustainable development goals.

Due to the lacking of the green supply chain management systems in the mining sector, there has been an undermining capacity utilization and high operating costs that have been attributed to high inventory costs hence has negatively affected directly the profitability objective of the mining companies. These factors have been as a result of the inability of primitive inventory control systems to contribute in the maintenance of optimum inventory levels. According to Zimbabwe Mining Performance Report (2018), primitive inventory control systems have been the major causal factor leading to ineffective maintenance of optimum inventory levels that led the failure to either avoid shortage of stock or excess inventories by the mining companies in Zimbabwe.

The Zimbabwean government will be able to address social problems without jeopardizing the ability of the next generation to meet their own needs, according to Alibai (2017), because sustainable procurement is in line with environmental and social justice issues, social responsibility, and governance. Additionally, voluntarily enforced rules may result in the implementation of GSCM procedures due to worries about environmental deterioration. Using items with minimum packaging as an example, Bassett and Shandas (2010) promoted awareness of the acquisition and purchase of recycled content, and the Zimbabwean industries had to adopt the same regulations. Therefore, the research is valuable to how the country operates at large not being limited to the private mining sector only.

Chamber of Mines of Zimbabwe (2015), asserted that the mining sector has become one of the critical drivers of economic turnaround since the economy has moved from being an agro-driven economy to being a mining driven economy. The research has used the private owned mine, Bindura Nickel (Trojan) as the case study to investigate the inventory management systems in place and their performance. The information would assist the implementation of

green supply chain management and the impacts of the practices towards the inventory management.

According to the Zimbabwe Economic Report from 2018, issues such a lack of capital, frequent failures of aging machinery, high operational expenses, including the scarcity, and a high cost of materials are to blame for the underperformance of enterprises in the mining sector. According to the Confederation of Zimbabwe Industries mining sector survey report from 2018, companies in the mining sector have been operating at less than 40% of their capacity utilization for the past ten years, which has negatively hampered their ability to achieve their goals, particularly the profitability goal. When COVID-19 forced the cessation of operations during the nationwide lockdowns in 2020 due to the pandemic, the issue only became worse.

Hence to initiate the inventory management performance, through the green supply chain management, the government and the private sector has to work collaboratively in ensuring that there is accountability in the managing the operations so that there is compliance to the regulations that protects the environment by promoting green procurement. The adoption of green supply chain practices by an organization can minimize the risk of being prosecuted for not complying with the various environmental standards and for using unethical practices (Ravi and Shankar 2012) hence reduces the cost of the mining company and maximize on the profitability.

Therefore, it is against this background of the study that the researcher was encouraged to carry out a study on the impact of green supply chain management practices on inventory management in the mining sector of Zimbabwe.

1.3 Statement of the problem

Poor performance of the mining companies as evidenced by the capacity utilization of below 40% for the past years is partly blamed on primitive inventory control systems, they are using according to the Zimbabwe Economic Report (2018). Therefore, this has attributed to recurring problems in the Zimbabwe's mining sector that are probable to the absence of the green supply chain management practices that enhances performance of the inventory management systems at the mines. High operating expenses, a lack of capital, a lack of resources, the high cost of commodities, and frequent machine failures of outdated gear are all issues that contribute to the poor capacity utilization in the mining sector's inventory (Zimbabwe Mining Performance Report, 2018).

Therefore, the five fundamental components of a green supply chain management system—green waste management, green operations and logistics, green manufacturing, and green procurement—are all missing, which is why the aforementioned issues exist. If the recommendations from this study are successfully put into practice, these components would fix the issue.

1.4 Main objective

To assess the impact of green supply chain management practices on inventory management in the mining sector of Zimbabwe, a case-study of Bindura Nickel Mine (Trojan).

1.4.1 General Objectives

- i. To establish green supply chain management practices at Bindura Nickel Mine (Trojan).
- ii. To determine the impacts of green supply chain management practices on the central inventory management system of the mine.
- iii. To assess the barriers to the implementation of green supply chain management practices at Bindura Nickel Mine.
- iv. To recommend green supply chain management practices implementation and maintenance at Bindura Nickel Mine (Trojan).

1.5 Research questions

- i. What are the green supply chain management practices, Bindura Nickel Mine (Trojan) need to adopt and implement in order to enhance inventory management?
- ii. What are the impacts of green supply chain management practices on the central inventory management system of the mine?
- iii. What are the barriers to the implementation of green supply chain management at Bindura Nickel Mine?
- iv. Which green supply chain management practices can be recommended and implemented at Bindura Nickel Mine (Trojan)?

1.6 Statement of the hypothesis

H₀: Successful adoption and implementation of green supply chain management practices enhance the inventory management performance in the mining sector of Zimbabwe.

H₁: Successful adoption and implementation of green supply chain management practices does not enhance the inventory management performance in the mining sector of Zimbabwe.

1.7 Significance of the study

Firstly, the mine is lacking inventory systems that foster the use of the green supply chain concept which emphasize on the use of recycling, reuse, remanufacture, reduce emissions, energy consumption and other. In order to achieve the best findings, the research has integrated the theory with research factors. that successfully adoption of sustainable procurement would succumb the existing problems through comprehensive planning and management of inventory manage strategies. The implementation initiative was also supported by Theron and Dowden (2017) who argued in favor of strategic sustainable procurement practices by the private and public sectors hence the study channeled it towards the mining industry.

Bindura Nickel Mine and other privately held mining companies would benefit from the research's improved understanding of how to assess inventory management performance using a variety of measurement techniques that are directly related to the various purchasing strategies of each distinct group within the purchasing organization (Richardson and Svensson, 2018). Through adopting the GSCM practices, it enables the mining sector to realize the need for performance management since sustainability incorporated the triple bottom line that needs a balance on the social, economic and environment factors in the procurement industry.

Lastly, the researcher will acquire knowledge concerning the topic under investigation. Additionally, it will help me complete the requirements for my Bachelor of Commerce with Honors in Purchasing and Supply.

1.8 Assumptions

The research was based on the following assumptions:

- The implementation of the GSCM practices would enhance the performance of the inventory management in the mining sector.
- The delimitation of the study is sufficient completely to achieve the research objectives and provides a comprehensive outcome that satisfies the significance of this research.
- The research results would increase the performance of the mining industry and also enhance the knowledge of the researcher and the university at large.

- The research respondents would fill in accurately and complete all the questionnaires and answer to the questions truthfully as well as to the very best of their knowledge that would increase the adequacy and relevancy of their responses.
- The research would be completed within the stated timeframes with little to less challenges encountered by the researcher.

1.9 Delimitations of the study

The scope of the study would cover inventory management in the mining sector of Zimbabwe using the case of Bindura Nickel Mine (Trojan). The study will align with the sustainable development goals that seeks to balance the Social, Economic and Environmental factor therefore, the research introduces the Green Supply Chain Management. The major areas covered by the research are firstly, green procurement, green design, green operations and logistics, green manufacturing and lastly, green waste management systems at Bindura Nickel Mine.

1.10 Limitations

The research shall be limited in the inventory management systems of the mine and not have access to other organizational operations.

The research shall also be limited to time constraints, as the university time lines are not realistic, since the research study should be cover over two academic semesters but the work has been shifted to be done within one academic semester.

Also, the research would be limited in excess of the complex information from the mine, due to non-disclosure conditions in the employee contract therefore, the researcher might find resistance from respondents failing to disclose critical information for the research hence, the results of this study should be handled with caution.

1.11 Definition of terms

Procurement – According to the Chartered Institute of Purchasing and Supply (CIPS) (2013), procurement is the business management function that guarantees full identification, sourcing, access, and administration of the outside resources that a company requires or could need to achieve its strategic goals.

Inventory management – relates to the management of operations involved in the procurement of raw materials, their transformation into intermediate goods and completed items, and their transportation to ultimate consumers" (Srivastva, 2011).

Sustainable development – according to the Brundtland Report of the World Commission on Environment and Development, it is defined as “Development that meets the needs of the present generations without compromising the ability of future generations to meet their own needs”.

Sustainable procurement (SP) – UN/CEFACT(2019), defines SP as “a process whereby organizations meet their needs for goods, services, works and utilities in a way that achieves value for money on a whole life basis in terms of generating benefits not only to the organization, but also to society and the economy, whilst minimizing damage to the environment”.

Green Supply Chain Management - GSCM is defined as "integrating environmental thinking into supply chain management, including product design, material sourcing and selection, manufacturing process, delivery of the final product to consumers, as well as end-of-life management of the product after its useful life," by Srivastava (2007).

1.12 Chapter Summary

The chapter firstly introduced the topic under investigation that is the impact of green supply chain management practices on inventory management in the mining sector of Zimbabwe. Case of Bindura Nickel Mine (Trojan). This was followed by background of study, problems statement, study assumptions, research main and specific objectives and research questions. Furthermore, the chapter covered the significance of the study, delimitations and limitations of the research and lastly, defined the key terms commonly used in the study. This framework of chapter one, was used by the preceding chapter two on the review of related literature.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The literature review chapter consists of four (4) sections which are, theoretical and conceptual frameworks; empirical review; gap analysis and hypothesis and chapter summary. In the first section, the researcher looked at theoretical frameworks that explains and guide the GSCM and Inventory Management systems at the same time developed the conceptual framework factoring in the key variables of the research. The empirical review, explored and gathered evidence of other research studies which were conducted by other researchers or scholars in relation to this topic under investigation. The third section looked at the gap analysis and hypothesis followed by a chapter summary.

2.2 Theoretical and conceptual frameworks

Theories are unique in nature as they come from various sources in each discipline and more are always being created and applied across various fields and they are subjective to situation after situation. The research has managed to associate the research towards the following theories;

2.2.1 Theoretical frameworks

1. Theory of constraints

According to Goldratt (2004), the theory of constraints is a management philosophy that aims to enhance organizational performance or efficiency through improved output. According to the idea of constraints, a chain is only as strong as its weakest link, or constraint, hence it is important to adjust and manage the constraint as necessary (Kazim, 2008). Long lead times, a high level of unnecessary inventories, a lack of appropriate inventories, an excessive number of orders for the wrong materials, orders for urgent situations, a high degree of delegation and a lack of control over priority orders, which implies scheduling conflicts of the resources, are all flaws in the theory of constraints (Goldratt, 2004). The theory is applicable in the mining sector as the inventory management department also has realized the existence of the above listed problems.

The main principle of this theory emphasized that an organization is entitled to maximize on the production of every machine. The theory scope does not cover on assessing the operational performance by making sure of optimization of the flow of materials and value. The theory is significant to this study as it is applied to the production for the minimization of the inventory at the mine. At the same time, the mining firms will be enabled to have their operations run smoothly embracing the use of inventory management systems that can facilitate operational efficiency. Effective management of the constraints would allow the mine improve overall operational performance.

2. Lean theory

The Just-in-Time (JIT) concept of inventory control is expanded upon by the Lean theory. This hypothesis contends that it organizes the buffer stock to cut down on manufacturing waste. According to lean theory, produce's capacity to respond to consumer demand choices results in a reduction in stock levels, which is meant to save transportation costs for inventory. The argument made against the lean approach suggests that materials must be on hand when dealing with long-term collaboration, which includes exchanging data and information and trading partners across enterprises. Thus, the study acknowledges the significance of lean theory as an inventory control method that helps minimize wasteful inventory expenditures, thereby improving the profitability and effectiveness of enterprises or mining organizations.

3. Institutional theory

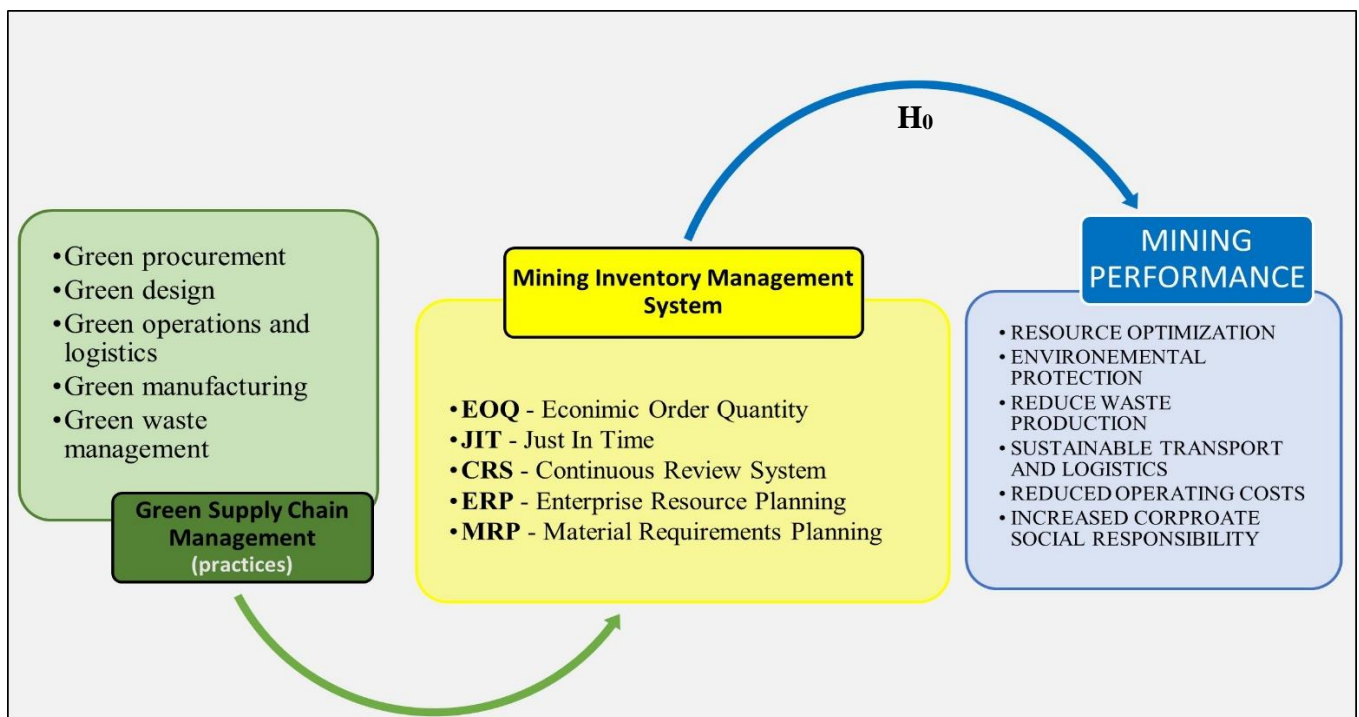
The theory was built on the concept of legitimacy rather than efficiency or effectiveness as the primary goal of the organizations. The theory examines the processes and mechanisms by which structures, rules, schemas and routines become established as authoritative guidelines for social behavior. The mining sector is one of the active and influential group of mining institutions either in the private or public entities which are therefore, guided by the guidelines for analyzing organization-environment relationships emphasizing more on the social rules, norms and expectations. This ensure that the operating organizations conform to the environment around it. During the procurement process and inventory management, the mining sector will be ensuring the green supply chain management practices are being followed and there are adverse contributions out of their activities.

The research combined the principles and provisions of these three theories in making sure that the mining organizations operate as institutions which initiate the green supply chain practices, to

effectively manage and control inventory to achieve the efficiency and optimization level. By so doing the mine would be influencing positively to the environment around it.

2.2.2 Conceptual Framework

The study was built under the assumption that successful adoption and implementation the green supply chain management practices enhances the inventory management performance in the mining sector of Zimbabwe. Therefore, the research concept was existed on the hypothesis that seek to establish the relationship between the key variables of the study that is the GSCM practices and the inventory management in order to determine the change in the performance within the mining sector. The concept is presented in the figure 2.1



Source: *Field Research (April, 2023)*

Figure 2.1: Conceptual framework

The figure 2.1 demonstrates the concept, in which the researcher was trying to establish the nature of the relationship between the variables and aligned with the hypothesis to give the expected operational outcome at the mine. The researcher has outlined the key entities within each of the key variables, which are the GSCM practices, the Mining Inventory Management

systems and Mining Performance as an outcome under the hypothesis (**H₀**) as described in chapter one.

2.3 Empirical Review

2.3.1 Green Supply Chain Management (GSCM) practices.

"Establish green supply chain management practices at Bindura Nickel Mine (Trojan)" is the research's primary goal. Due to this, the study quoted Dube and Gawande (2011), who described the GSCM as "the process of using environmentally friendly inputs and transforming these inputs into outputs that can be reclaimed and re-used at the end of their life cycle thus, creating a sustainable supply chain." The author's first thesis stressed that one way to "green" a supply chain is to make it more ecologically sustainable.

The scope of organizations varies from one organization to another, for instance differentiating themselves in a competitive market, some due to the obligation enforced by the regulations and laws, and some to ensure organizational performance enhancement. The scope of the GSCM is broad it ranges from implementation and monitoring to controlling of practices implemented through various Rs (Reduce, Re-use, Rework, Refurbish, Reclaim, Recycle, Remanufacture and Reverse logistic) in order to achieve the sustainable procurement and inventory operations throughout the entire procurement ecosystem.

It was implemented in the mining industry to ensure that production and manufacturing processes did not have an adverse environmental impact, according to Dube and Gawande (2011), who hinted that "the most commonly perceived enemy to environmental protection is manufacturing and production operations, through waste generation, ecosystem disruption, and depletion of natural resources." Therefore, GSCM practices were introduced to manage and reduce the impact of the human activities on the environment. According to the previous researches, the first green design literature came into context in 1991. Navin- Chandra's (1991) article was the first of the literature to consider the need for a green design to reduce the impact of product waste.

Thereafter, GSCM gained popularity in academics and practitioners aiming at reducing waste and preserving the quality of product-life and the natural resources. The GSCM practices falls under these five (5) categories: Green Procurement; Green design; Green operation and logistics; Green manufacturing and green waste management. These five categories have well defined principle that effectively and efficiently contribute to the smooth operation of mining

organization and companies and managing their involvement in the natural environments. The subcomponents summary of the GSCM practices are:

- Improving energy efficiency through conservation processes and machinery
- Using green energy sources in the mining operations.
- Working with green suppliers
- Recycling materials
- Using green transportation options
- Using recycled or recyclable packaging materials.
- Waste management throughout the supply chain cycle.
- Implementing green manufacturing and mining processes

2.3.2 Green Procurement

According to Dube and Gawande's (2011) reference, "Green Procurement" (GP) is a term used to describe a buying program that aims to guarantee that materials or goods are acquired in a way that will help the environment and that will also achieve the environmental goals established by the purchasing organization, in this case the mining corporations. The green procurement will ensure that mines are reducing the sources of wastage and promoting resource reduction, product recycling, reuse of materials and waste products and also, substitution of materials. During the strategy and planning stages in the mining organisations, supply chain managers ensures that procurement is done in sustainable manner for the purchasing of inputs, in addition to the traditional purchasing criteria of cost, quality, and delivery. This also ensures that the mine is dealing with sustainable suppliers.

2.3.3 Green Design

The green design was the high-level comprehensive stage at which the management team in any organisation would strategize the whole production process up to the type of the product to be produced that encourages environmental awareness. The designing and development of environment friendly products or services included recoverable products, which are technically durable, repeatedly usable, harmlessly recoverable after use and environmentally compatible in disposal. During the green design stage, strategist introduced the concept of life-cycle analysis.

According to Srivastava (2007), the life-cycle analysis was developed to evaluate the impact of goods on the environment and natural resource use during manufacturing. The measurement

included every phase, including raw material extraction, manufacture, distribution, remanufacturing, recycling, and disposal.

2.3.3 Green Manufacturing

The green design was the initial process for the green manufacturing because the strategy of how the manufacturing process was planned already. A well-structured green design framework allowed the avoidance of materials and energy wastage either due to inappropriate design, or due to excessive number of defects. This practice was a technique for minimum energy and resource consumption for production flow systems in order to reduce the use of virgin materials. The green manufacturing practices are based on three fields of study: pinch analysis; industrial energy and lastly energy and life cycle analysis (Dube and Gawande, 2011). Therefore, the mining sector would also be able to operate by improving energy efficiency through conservation processes and machinery and through the use of green energy sources.

2.3.4 Green waste management

The research observed that these practices are the pillars of GSCM since each pillar operates individually but it has a direct influence of the other. This came into attention, when the researcher discovered that successful green procurement, affects the green design. Green design is the framework of green manufacturing and waste management. Reverse logistics is a process that ensures items and resources are returned from the end user to the manufacturer so they may be recycled, reused, or refurbished. The GSCM will be enforced by the employment of the numerous R-processes (Reduce, Re-use, Rework, Refurbish, Reclaim, Recycle, and Remanufacture), which will be promoted through waste management techniques. Amemba and others (2013). Using a multi-objective location-allocation model backed by planning heuristics, simulate a solid waste management system (covering collection, transportation, burning, composting, recycling, and disposal).

2.3.2 Green operations and logistics

Lastly, the green operations and logistics is the integration of all the four GSCM practices to achieve same goals and objectives in an organisation making the mining sector productive and competitive. Green logistics are "the supply chain management practices and strategies that lessen the environmental and energy footprint of freight distribution," according to Rodrigue and Slack (2013). Material handling, waste management, packaging, and transportation are the

main topics. As a result, everything relating to GSCM processes is bundled under green operations and logistics.

The government and other stakeholders would be involved in the policy making and policy enforcement to ensure that mines amongst other organization are environmentally sustainable and eco-friendly. GSCM can also promote efficiency and synergy among business partners, helps to enhance environmental performance and reduces waste to achieve cost savings. (Rao and Holt, 2005)

The research would explore the Bindura Nickel Mine and identify the practices that are already in place and assess their impacts towards their inventory management systems. The research will also propose other practices in line with the perceptions of the research population as recommendations.

2.3.2 Impacts of Green Supply Chain Management practices on the central inventory management system.

The second objective of the study seeks, *“to determine the impacts of green supply chain management practices on the central inventory management system of the mine”*, therefore, the researcher gathered the impacts of the adoption/implementation of GSCM practices in other industries and sectors in the global, regional and local contexts.

Pembere (2016) conducted research on the performance of the supply chains for firms listed on the Nairobi Stock Exchange. The primary goal of the study was to determine the supply chain performance and green procurement practices of firms listed on the Nairobi Securities Exchange (NSE). The study used a quantitative approach and had a target audience of 64 respondents. The study employed open-ended and closed-ended questions on a self-administered questionnaire to obtain its primary data. Utilizing both descriptive and inferential statistics, the study was examined. According to the report, using green purchasing methods improves inventory management in particular. Customer service was enhanced, ordering costs were kept to a minimum, and inventory stock levels were decreased as a result of the performance gains.

In 2006, Qinghua Zhu investigated green supply chain management with a focus on the demands, procedures, and output of the Chinese car sector. The main finding of the study was that GSCM was able to enhance both their economic and environmental performance. Rao and Holt (2005) also took into account the fact that businesses in the South East Asian area that

used GSCM eventually improved their competitiveness and economic performance. These studies have provided a consensus towards the impacts of GSCM in their operations which clearly indicates that the mining sector have the capacity to obtain the same results.

Better air quality is one of the key advantages of adopting green manufacturing, claim Torres et al. (2010:143). The use of green manufacturing facilities and plants by a business influences many customers' purchasing decisions. When the mining sector adopts GSCM, it will meet customer demands since the inventory management system will make sure that the mine does not access dangerous materials. An organization's risk of facing legal action for violating numerous environmental regulations or for engaging in unethical behavior can be reduced by implementing green supply chain procedures (Ravi and Shankar 2012:31).

Mvubu, (2015) said that developing strong ties with suppliers in order to produce eco-friendly or environmentally friendly products is a key component of green procurement. In order for a company's environmental sustainability activities to be successful, suppliers are crucial (Ninlawan et al. 2010:45). In order to eliminate components that pose a possible risk to human health and hence remove all hazardous items from the shelves, suppliers can be closely watched by carefully examining every stage of the supply chain (Mvubu, 2015). Long-term, the inventory management system would have been able to safeguard both the general public and the mine workers.

Green waste management, in accordance with Ravi and Shankar (2012:273), comprises the minimization and elimination of waste while lowering costs and increasing efficiency. Recycling may be supported and promoted, and effective management of suppliers and resources can lead to lower manufacturing costs (Ravi and Shankar 2012:273). Greening strategies may increase resource utilization effectiveness while guaranteeing that costs are reduced via the use of green design. Additionally, reducing dangerous compounds can support environmental legislation and regulations. Benefits that might be seen include decreased expenses and improved efficiency.

By implementing green manufacturing techniques, an organization may differentiate its goods from those of its rivals, earning a competitive edge and attracting new lucrative customers. It develops a favorable reputation in the marketplace and strengthens the brand's image (Mandla, 2015). Additionally, many companies are now using the buzzword "maintaining GSCM" as they try to guarantee complete product distinctiveness by meeting customer demands. An intangible benefit is product distinctiveness and competitive advantage.

Through this empirical review, the researcher has managed to observe that effective implementation and adoption of the GSCM practices increase the productivity, efficiency and operational performance in all aspects of the organization including the inventory management systems as well. The evidence gathered has given the study more significance to be conducted in the mining sector in Zimbabwe and also allows the researcher to test the hypothesis.

Despite the impacts of the adoption of the GSCM, there are also barriers that hinders the implementation process and the researcher has gathered evidence as presented in the subsection

2.4 Gap analysis and hypothesis

Few literatures have been written in the regional and local contexts discussing the interaction between the GSCM and Inventory management systems in the context of Green Supply chain management for the mining sector. The scope of the research will include the primary drivers of GSCM and their implications for Supply Chain Management systems in order to improve performance and advance information in the public domain for academic and professional usage. This improves and advances information exchange among professionals and encourages collaborative and stakeholder participation in enterprises' planning stages for inventory management systems and supply chain operations as a whole.

2.5 Chapter Summary

In this chapter, the researcher discussed the existing theoretical and conceptual frameworks for the literature in regards to Green Supply Chain Management practices and inventory management systems. The conceptual framework was constructed on the research key variables, with the objective of observing the nature of the relationship towards the hypothesis. The chapter also, reviewed the empirical literature from past researches based on the research objectives and lastly explored the research gaps. The next chapter will look at the research methodology as a framework for gathering and analyzing of the data.

CHAPTER 3

RESEARCH METHODOLOGY

3.1 Introduction

The main topics of the research were reviewed in this chapter, including the research design, data collection methods, population definition, data sources and sample strategies, data analysis tools, and ethical issues. The major goal of this chapter was to examine and analyze the procedures and methodologies that are most appropriate for this research in order to gather pertinent data and achieve the goals of the study.

3.2 Research Design

The research design explained the methodological approach to be employed by the researcher in finding the solutions/answers to the research problem or research questions, this was also asserted by Fellows and Liu (2015). The nature of this research is exploratory and descriptive therefore, it seeks to establish, determine, assess and recommend the specific variables as outlines by the research objective. The general intent of the study was to assess the impact of green supply chain management practices on inventory management in the mining sector. To effectively accomplish this objective, the researcher initialized the empirical research design using the case study of Bindura Nickel Mine, in Bindura, Zimbabwe.

The empirical research allowed the research to consider the results of other researchers and use these as facts to support the results from the raw data gather by this research. The empirical results were used as supporting fact in the research discussion to be presented in the next chapter. The study employed the case-study research design in order to collect both the qualitative and quantitative data that was analyzed quantitatively and qualitatively respectively.

The Qualitative research design or approach allowed the research to explore the facts around the effects, impacts of the GSCM practices in the inventory management, though the thoughts, views and perception of the experienced informants in the field. The quantitative approach also afforded the research the opportunity to gather quantifiable data with regards to the frequencies and summations of which practices are commonly used in solving the undesirable phenomenon under investigation.

In order to complete the testing of the hypotheses, case-study survey technique also offered potential explanations for specific interactions between variables and created models of these relationships as well. It was pertinent to the study since it allowed for greater control over the research procedures and established connections between the study's key variables.

The strategy was also necessitated by being fully exposed to the operations on a single entity, that was the Trojan Mine as compared to be assessing multiple mines and drawing conclusions was going to be difficult for the researcher since each mine operates differently according to their environment and organizational structure or systems.

3.3 Population

Hawalдар *et al.* (2017) defined population as the target area from which the data used for the purpose of the research study was obtained from. The researcher therefore, aimed at focusing on the Green Supply Chain Management Practices in inventory management in the mining sector of Zimbabwe and exclusively directed at the case of Bindura Nickel Mine as the sample. At the mine the research, aimed collecting the data from relevant departments and professionals who had exposure in the management of inventory at the mine at a total of 40 people (staff members). The research targeted a sample size of 75.0% of the total population of all departments combined which was 30 individuals.

The researcher ensured that each department was represented by their key stakeholders. To the targeted sample, interviews are going to be scheduled and questionnaires are going to be administered looking forward to get responses following procurement team; operations or procurement managers, distribution officers, clerks amongst other crucial stakeholders approachable to assist with providing information needed by the research.

3.4 Sampling Techniques

The sampling technique used was stratified random, where the researcher refined the research population towards the private mining sector strata and further selected the Bindura Nickel mine as the sampling stratum. The research selection is biased in the procurement and management departments of the mine since they are responsible for the inventory management. The researcher administered questionnaire to 25 people and interviews 5 head of departments/managers. These respondents had equal chances of being interviewed and attending to the questionnaires.

3.5 Data and Data Collection Techniques

Aryal (2019) defines data as unprocessed, disorganized factual information. It doesn't have to be complicated or look random in order to be ordered and be of value. Additionally, the author hinted that data is a collection of individuals' values in relation to qualitative or quantitative aspects. Since the research was based on both qualitative and quantitative research methodologies and design, the researcher gathered both quantitative and quantitative data.

3.5.1 Secondary Data

Since secondary data does not employ raw primary data but rather already published sources from trustworthy and authoritative publications, the researcher selected secondary data as the information source for the literature review portion. According to Naoum (2019), secondary information offers a number of advantages over primary data collecting, thus it was more important for this research study. Information was gathered from a variety of trusted sources, including the inventory management prospectus, mining reports, newspapers, government statutory documents, journal articles, websites, and reports on key performance indicators, customer complaints, and corrective and preventive actions. The benefit of employing these as trustworthy and pertinent information sources for a research study was also stated by Basera et al. (2019).

3.5.2 Primary Data

Through the survey strategy and structure of this research model, the researcher had the opportunity to extract the raw facts and figures from Bindura Nickel Mine explaining and describing the possible reasons for particular relationships between variables in line with the inventory management and GSCM practices. It was relevant because it gave more control over the research process and, utilizing the sample size of 30 individuals, it was possible to generate findings that were a representative of the whole population at a lower cost than collecting the data for the whole of the mining sector around Zimbabwe.

3.5.2.1 Research methods / Research instruments

1. Questionnaires

The major way of gathering data for this survey research was the distribution of questionnaires, which was done successfully and quickly. This resulted in the quicker and cheaper collection of primary data from the intended demographic. The questionnaires were given out in two sets, each employing a different distribution strategy, and were self-administered. The researcher

obtained monitoring data showing that the initial batch of printed hardcopies were delivered by hand to the mine. The other set of questions were distributed electronically in the form of survey links via emails and the WhatsApp messaging service. The personnel at Trojan Nickel Mine cooperated well with the researcher.

2. Interviews

Interviews are associated with the following advantages, flexible and adaptable system of data collection. Also, interviews produced immediate responses with a high response rate. Interviews promoted swapping of the data and also the gestures. The researcher had an opportunity to clarify questions and managed to judge acceptability of honesty of the replies given by the repliers. The researcher had successful interview sessions, all the scheduled interviews came to pass, which was advantageous to the research study.

3.6 Data Analysis

In order to analyze and describe the findings from the statistical reports produced by the Statistical Package for Social Sciences (SPSS) application software, which supplied with the descriptive tools to test scores, the research employed descriptive, inferential mathematical tools, and explanatory language. In order to analyze and comprehend the quantifiable data on the effects of GSCM techniques on inventory management, the program created frequency distribution Tables. The link between the Green Supply Chain Management techniques and inventory management in relation to organizational performance was also tested using inferential statistics, such as the Chi-square test.

The conventional content analysis was utilized to interpret and discuss the research finding from the interviews and open-ended structured questions in the questionnaires. There quantitative and qualitative data was analyzed respectively as follow:

3.6.1 Quantitative Data Analysis

Since the research study used likert scales, closed-ended questions, and SPSS application software to collect quantitative data, the research presented the findings utilizing descriptive and inferential statistical methods of data analysis. Additionally, the research study produced mean score ranks and conducted correlation tests for these variables, which were then displayed as percentage frequency distributions. The data was shown in the form of tabulation, a bar chart, a pie chart, or a graph as category frequencies.

3.6.2 Qualitative Data Analysis

The researcher used the thematic analysis method for the data collected using the interviews for which responses of the same perspective were categorized under one theme or code so that the researcher was able to perform conventional content analysis on each team. The thematic method allowed the researcher to have solid factor or facts as the heading for the discussion. This enabled the researcher to effectively identify the relation of the main variables such as the impacts, barriers and strategies towards the adoption of the GSCM practices in the management of the inventory in the mining sector.

3.7 Reliability and Validity

Suleman and Gul (2015) assert that validity and reliability are the most crucial steps in validating and improving the research instruments because they imply that these concepts were taken into account when the research's chosen data collection methods were put into practice. This was done in an effort to avoid prejudice and incorrect judgmental responses, which were crucial to this research investigation. The mentioned procedures were carried out as follows:

3.7.1 Reliability

The consistency of a metric is something reliability is concerned about. Fellows and Liu (2015) confirmed that test-retest reliability, inter-item reliability, and inter-rate reliability are the three typical methods for estimating the dependability of the measures. In order to verify that different variables in the structured questionnaires had a specific level of consistency, the study used the inter-item reliability.

In addition, according to Fellows and Liu (2015), the internal consistency reliability was utilized to evaluate the validity of a summated scale where a number of components were added together to provide a final score. As the coefficient alpha focuses on the internal consistency of test subjects with regard to the staff's perceptions of the implementation of green supply chain management practices on inventory management, it was anticipated that the questionnaire respondent's results would demonstrate a high degree of consistency.

The result of the Cronbach's alpha test was anticipated to indicate a high level of reliability, which denotes that there was a significant correlation between the findings of two or more tests. According to Fellows and Liu (2015), Cronbach's alpha, which runs from 0 to 1.0, is a measurement of the internal reliability of the items on surveys. Given that questionnaires will be used as the primary method of data collection for this project, it reflects the degree to which

the items are measuring the same thing. The score exceeding 0.5 would be given more weight in social science research.

3.7.2 Validity

Valid is concerned with a measure's precision to examine the findings' applicability. A high reliability rating is thought to be the primary measure of the validity and applicability of the findings. Construct validity, according to Fellows and Liu (2015), relates to how well the variables that were used to measure the variables held true.

By using checks and balances both before and after the questionnaires were given out, the researcher conducted content (logical) validation to see how well the variables of measure addressed all aspects of the construct. After pre-validation, the instruments were dispatched to make sure they could support all study goals. Additionally, the researcher did a field pilot test before distributing the electronic survey forms. This allowed the researcher to test the questions on a limited sample size—a maximum of ten (10) people—and collect evaluations and feedback.

3.8 Ethical Consideration

Ethical considerations arise in the dissemination of findings and in the collection of data for qualitative/quantitative research, since the approach involves external stakeholders separate from the researcher's team. The researcher ensured that the following was observed by the research during the field data collection exercise:

- a. Seeking permission to access the premises as well to conduct the research
- b. Privacy and confidentiality.
- c. The informed consent of all participants.
- d. Risk and deception to be minimized.
- e. Any conflict of interest will be declared.
- f. Exploitation of researcher-participant relationships will be prevented.

3.9 Chapter summary

The chapter covered the research design which explored the approach and methods used. The researcher also covered the population and the sampling techniques and further extended to data collection techniques that made use of structured interviews and administration of questionnaires. The thematic method of analysis was also discussed together with inferential

statistical methods. The chapter concluded by discussion the considerations for validity, reliability and ethics. The next chapter will cover the data presentation, analysis and discussions

CHAPTER 4

DATA PRESENTATION, ANALYSIS AND DISCUSSIONS

4.1 Introduction

The researcher utilized the research methodology discussed in chapter three to collect the data using questionnaires and interviews. The collected data was therefore, presented using descriptive statistics (through tables, charts and graphs for frequencies), analyzed and discussed in this chapter in conjunction with the literature gathered in chapter two. Quantitative data utilized inferential statistics as the tools to present and analyze data with the aid of the Statistical Package for Social Science (SPSS) software whilst qualitative data was analyzed using the conventional content analysis in a thematic way. The chapter included the background information and research findings for each specific objective and discussions accordingly.

4.2 Background Information

4.2.1 Response rate

The researcher targeted (thirty) 30 staff individuals out of a population of 40 staff members from Trojan Nickel Mine, which represented 75.0% of the population. Out of the 30 individuals, 25 were to attend the research questionnaires and 5 were to be interviewed. Therefore, the research recorded 22 responses through the returned questionnaires and all 5 (five) scheduled interviews went successful giving a response rate of 88.0% and 100.0% respectively. The summary is presented in the table 4.1 as follows;

Table 4.1: Response rate summary

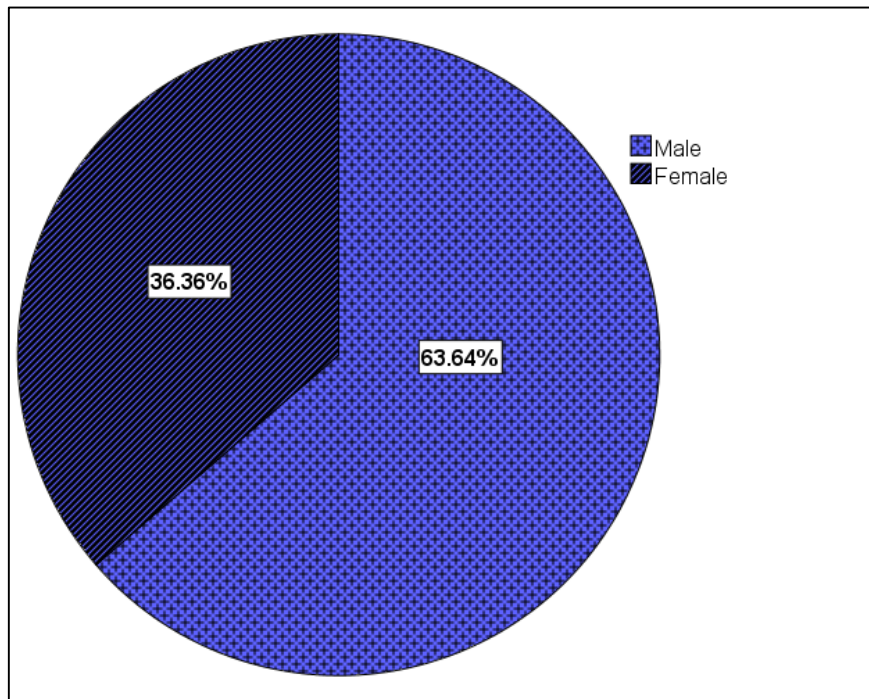
Category	Questionnaires	Interviews
Sample size	N = 25	N = 5
Total dispatched/Scheduled	25	5
Returned/Conducted	22	5
Non-Response/Not Returned	3	0
Percentages	88.0%	100.0%
Overall response rate	90.0%	

Source: *Field Research (May, 2023)*

The table 4.1 presented the summary of the responses for both the questionnaire and the interviews which gave an overall response rate of 90.0%. The correspondence received for this study by the Staff from the mine was outstanding which made the researcher aim to achieve the objectives of the study attainable since data was collected successfully.

4.2.2 Demographic Information

4.2.2.1 Gender analysis



Source: Field Research (May, 2023)

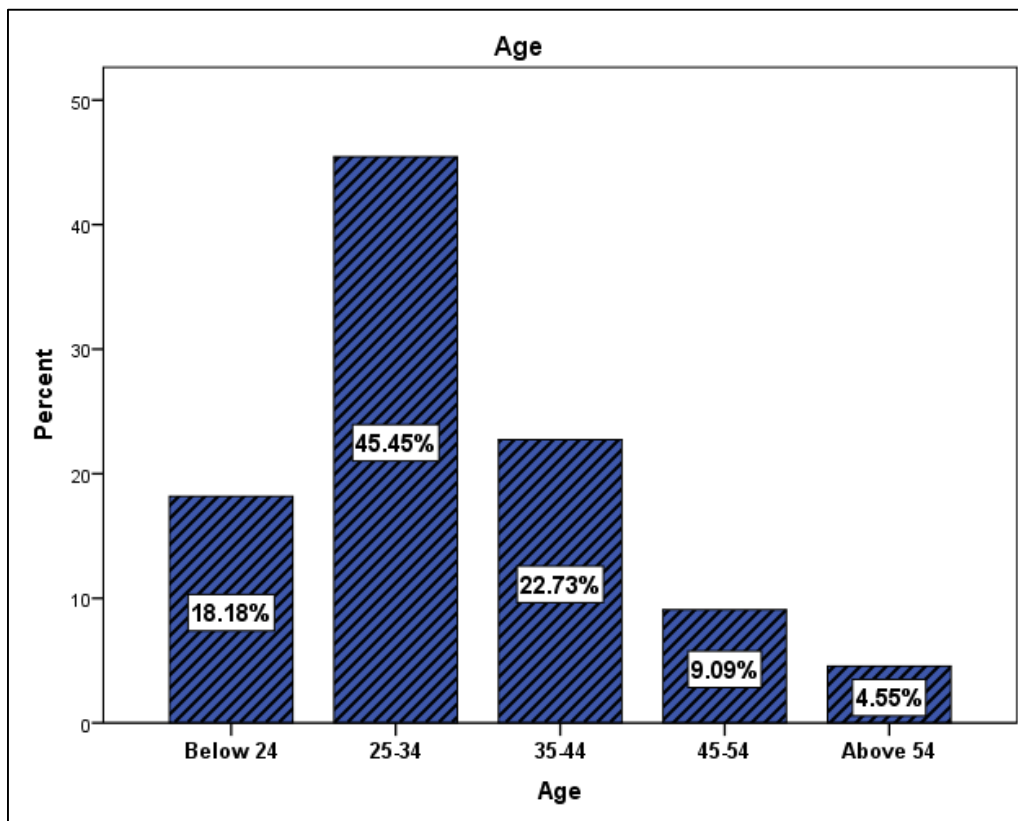
Figure 4.1: Gender analysis

The research observed that 63.6% of the population that attended the questionnaires were male participants. The results have shown that the mining activities are male dominated and the female participation is still slightly lower. On the conducted interviews, all the interviewees were also male. These results encourage more female participation even in the processes of offering formation towards research so that the percentage of 36.4 would be enhance in the future studies and recording a balance of gender.

4.2.2.2 Age analysis

The research observed the highest frequency 10 or 45.5% for the age group 25 to 34 followed by ages between 35 and 44 years with frequency distribution percentage of 22.7%. These results resembled the most experienced and proactive group of people who were informative and knowledgeable towards the study under investigation. The research gained more

confidence in the relevance of their contributions. Least responses came from age groups (45 - 54) and (above 54 years) with respondents' marginal frequency percentages of 9.1% and 4.5% respectively. These groups have been on the mine for a longer time and their working experience is outstanding hence the research observed that they were vital to the research due to the in depth of their understanding against the supply chain and inventory management systems of the mine. The results are presented in the figure 4.2



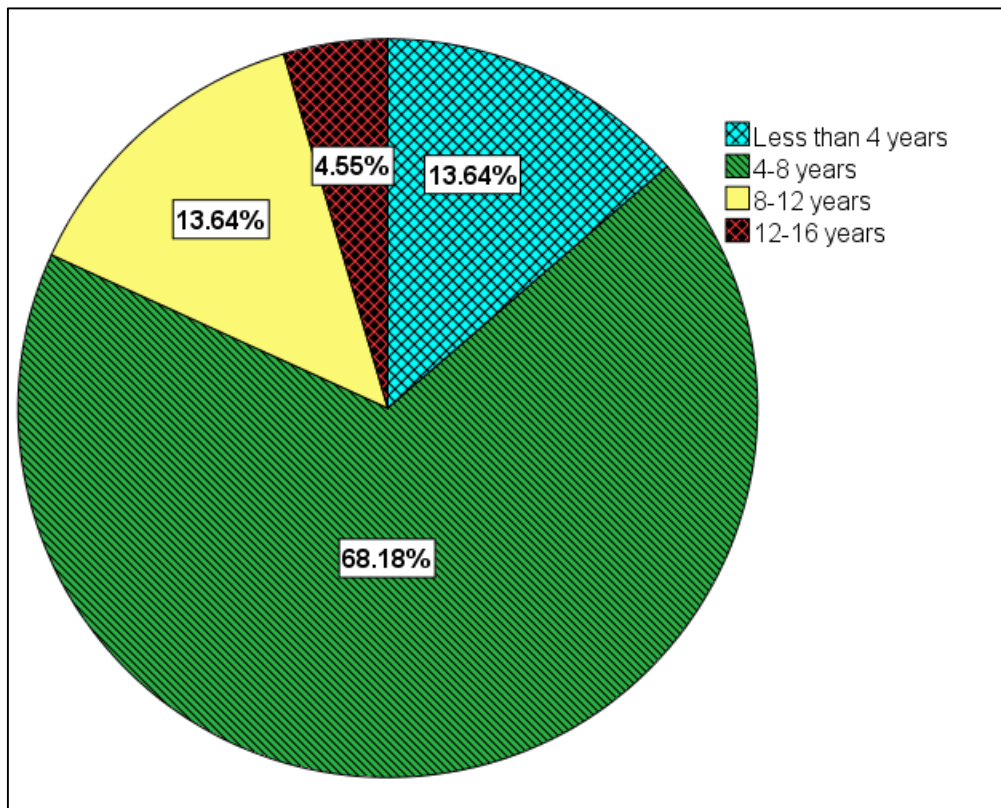
Source: Field Research (May, 2023)

Figure 4.2: Age group analysis

4.2.2.3 Working Experience assessment

The research recorded the highest frequencies of 15 out of 22 responses with percentages of 68.3% for respondents who has been in the mining sector for 4 (four) to 8 (eight) years followed by a frequency of 3 (13.6%) for respondents with less than 4 years and (8 to 12) years of working experience. The level of working experience for these groups was very vital and highly significant for the research as they contributed profound data and information to the research due to their in depth understanding of the mining industry, their primitive methods of operations and what impact was made when new technological systems came into operation that was impacting the inventory management and overall operational performance of the mine.

The marginal frequency distribution was 4.5% for those who spent between 12 to 16 years in the industry. The information is presented in the distribution Figure 4.3.



Source: Field Research (May, 2023)

Figure 4.3: Working experience analysis

4.2.2.4 Level of education distribution analysis

Table 4.2 Level of education distribution

Highest educational level of Respondent				
Level of Education	Frequency	Percent	Valid Percent	Cumulative Percent
Certificate/ Diploma	3	13.6	13.6	13.6
Bachelor	12	54.5	54.5	68.2
Master	5	22.7	22.7	90.9
Doctorate	2	9.1	9.1	100.0
Total	22	100.0	100.0	

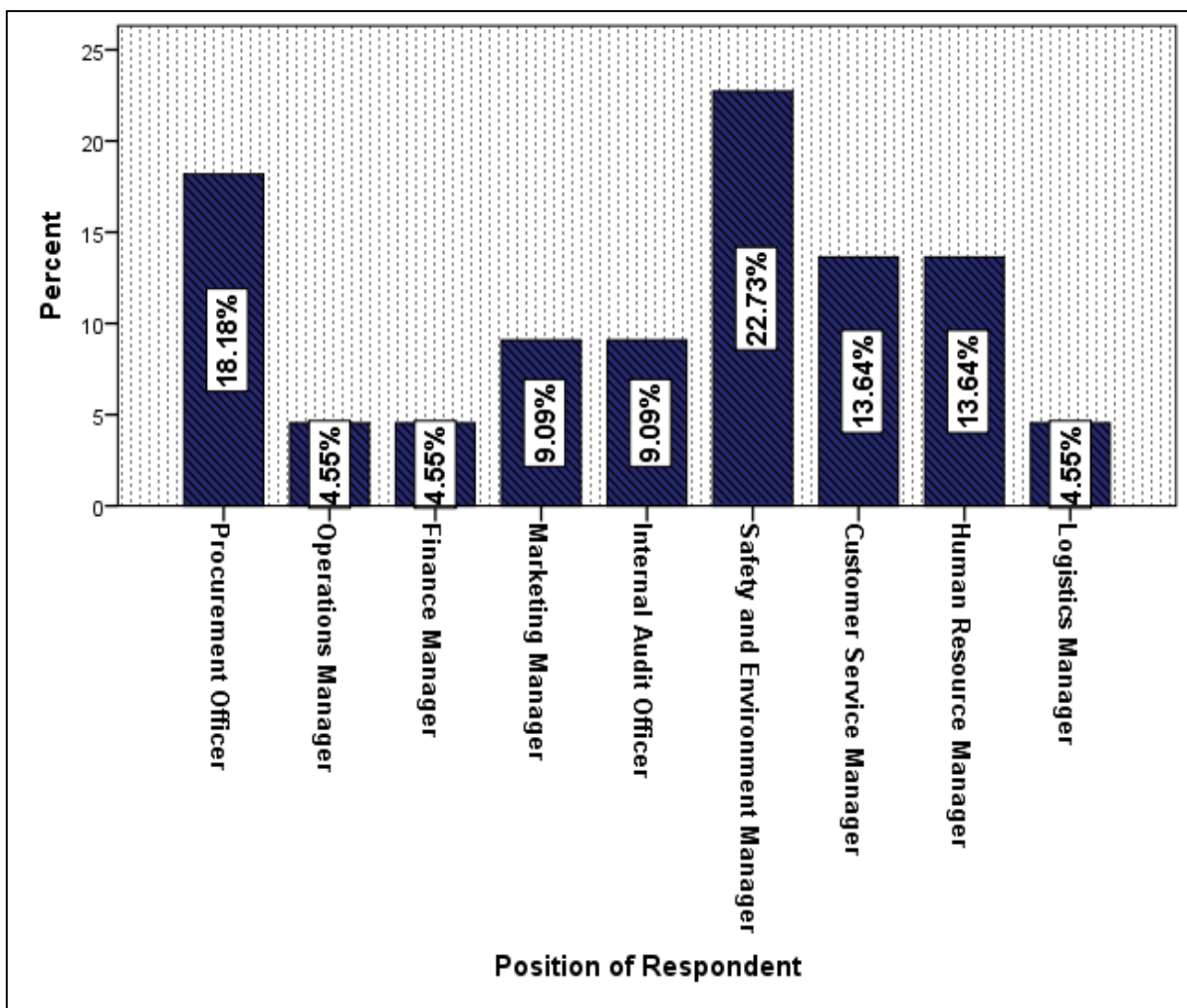
Source: Field Research (May, 2023)

The research recorded the highest frequency of 12 or 54.5% for the respondents who managed to attain a bachelor’s degree as their highest level of education. A moderate frequency of 5 (22.7%) achieved a master degree certification. Only 2 (9.1%) and 3 (13.6%) attained a doctorate and certificate/ diploma respectively. These results portrayed that the mining sector

if operated and run by learned people who are skilled with adequate techniques and knowledge in line with the phenomenon under investigation. Also, their level of education increases the value and adequacy of their participation in the research study as the researcher assumed that they have facts important to succumb the problem and enhance the operational performance of the mine through incorporating the GSCM practices to the mining inventory management systems.

4.2.2.5 Participants positions in the Mine

The research was attended by many departments across the mine and the summary of all the participants is presented in the figure 4.4. The highest frequencies were from Safety and environmental managers, procurement officers, customer service managers and human resource managers. The researcher managed to conduct a balance survey because all level management took part in the study including the operations manager, finance manager and logistics manager. The information was observed as follows;



Source: Field Research (May, 2023)

Figure 4.4: Positions of the respondents

4.2.3 Reliability Testing

The researcher also tested the reliability of the 35 variables used by the research questionnaires using the Cronbach's alpha testing tool. This was done to ensure if there was consistency in the way the research instruments were constructed and answered. The test results from the SPSS software are presented in the table 4.3 as follows:

Table 4.3: Cronbach's Alpha variable testing.

Variables	Cronbach's Alpha	N of items
Demographic Information	0.708	6
Green Supply Chain Management Practices.	0.558	2
The impacts of Green Supply Chain Management practices on the central inventory management system.	0.284	9
Green Supply Chain Management implementation barriers at Trojan Nickel Mine.	0.732	9
Strategies and best practices that can be adopted to overcome the above-mentioned barriers.	0.862	9
Overall reliability	0.820	35

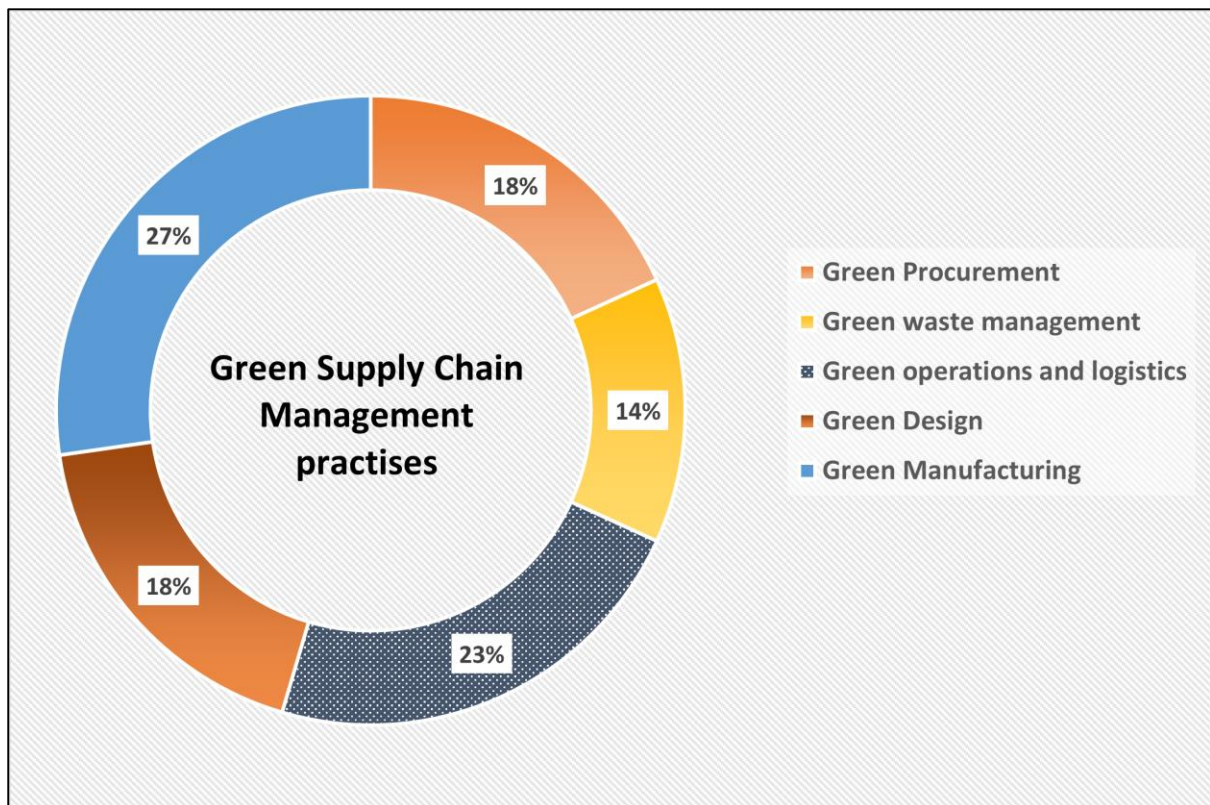
Source: Field Research (May, 2023)

The questionnaire had 35 variables for both sections A and B, which stretched from the demographic information to the perception of the staff towards the implementation of GSCM practices to enhance the green supply chain management in the mining sector for operational performance improvements. The instrument was attended to by 22 respondents and the research conducted a Cronbach's alpha reliability testing using the Cronbach's alpha test tool of SPSS software. The results recorded an overall alpha coefficient of 0.820, that signifies high internal consistency. According to George and Malley (2003), it is considered that any reliability coefficient with Cronbach's alpha greater than 0.70 considered acceptable in the social science studies. Hence, the study's Cronbach's alpha coefficient of 0.820 was acceptable.

4.3 Staff perceptions on Green Supply Chain Management practices on inventory management in the mining sector of Zimbabwe. (Specific Objective 1)

The research was a case a study of Trojan Nickel Mine in Bindura, to which 100.0% of the respondents concurred that it is a local owned private mine. The research general objective was

to, “assess the impact of green supply chain management practices on inventory management in the mining sector of Zimbabwe, a case-study of Bindura Nickel Mine (Trojan)”. To effectively observe the impacts, the researcher assessed the phenomenon through the research specific objectives and the first objective aimed at establishing the GSCM practices. This was achieved by assessing the types of the GSCM practices highly recommended to the mine and the inventory management systems operating. The results are presented in the figure 4. 5.



Source: Field Research (May, 2023)

Figure 4.5: Green Supply Chain Management Practices

The most perceived practices with the highest frequency percentages were the: Green Manufacturing (27%), green operations and logistics (23%) followed by green procurement and green waste management with (18%) both.

4.3.1 Green Manufacturing

The research had the highest concurrence rate towards these green practices to the mine as it enables the mining process to be more productive and efficient in the operations. The respondents highlighted that, through green manufacturing, there will be limited to no resource and energy wastages. The Material requirement planning (MRP) inventory management

system in place would allow that the material and all the inputs are procured prior to the execution of processes. The green manufacturing would also allow the reuse and recycling of material within the operation so that there would be reduced usage of new or virgin material to save on wastage and costs of production.

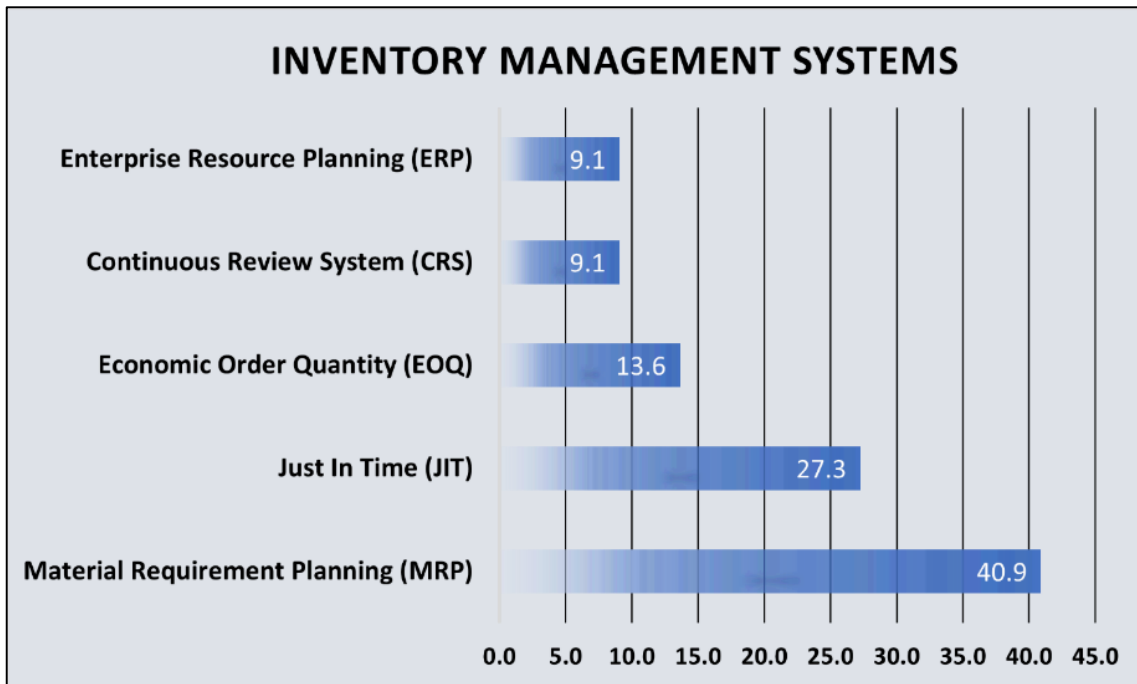
The informant 3 emphasized during the interview that, *“the mine has been facing high operating costs as a result of the failure to keep the inventory at optimum level hence, this resulted in machinery laying idle and procurement of expensive inputs due to pressure to recover the lost time. However, through the MRP and green manufacturing practice, the mining operation would be proactive and safe on costs”*.

The researcher, also observed that the introduction of the green manufacturing would enhance the inventory management systems main the MRP and the JIT, at the same time improvement the flow of work and operations. These are the indicators of improved operational performance. Furthermore, the mining operations would be more environmentally friendly through the use of energy and resources conservation operations plans and techniques.

Respondent 1 also argued that, *“green manufacturing and mining will also ensure that the mine is associated with suppliers that support green initiatives, therefore, the mine would ensure each commodity procured has passed the quality control tests and has a green product chip/seal on it”*. This was recommended so that the process of making the mine green had to involved all the internal and external stakeholders including the suppliers, to ensure that there would be a successful green procurement, designing and manufacturing systems at Trojan Nickel Mine.

4.3.2 Green Operations and logistics

According to the research finding towards the effective inventory management systems at the mine, the respondents concurred that the Material Requirement Planning (MRP) and Just in Time (JIT) were the most useful for the green operations and logistics with frequencies 40.9% and 27.3% respectively as shown in the figure 4.6



Source: Field Research (May, 2023)

Figure 4.6: Inventory Management Systems

The research managed to identify that the inventory management systems mentioned in figure 4.6 are the more effective when the responsible practitioners organize their operation using the green operations and logistics practice principles to achieve optimum results. The principles allow the mining sector to, be more productive and competitive in their entire operation. This concurred with the argument by Rodrigue and Slack (2013), who related green logistics as, “the supply chain management practices and strategies that reduce the environmental and energy footprint of freight distribution. It also, focuses on material handling, waste management, packaging and transport.”

Also, respondent 5 commented that, “*the mine needs green operations through the vision of the organization should speak towards supporting sustainability and also, there should be shared goals to ensure that every team member is doing their part in ensuring that green supply chain is harnessed in all levels and departments*”. The research therefore, summed the observation that the green operations and logistic has to be at the heart of Trojan Nickel Mine so that there would be improvement in the operational performance.

Successful green manufacturing is necessitated by effective green operations and logistics and green procurement. These practices are integrated therefore, they related to each other and work effectively when they are bundled up.

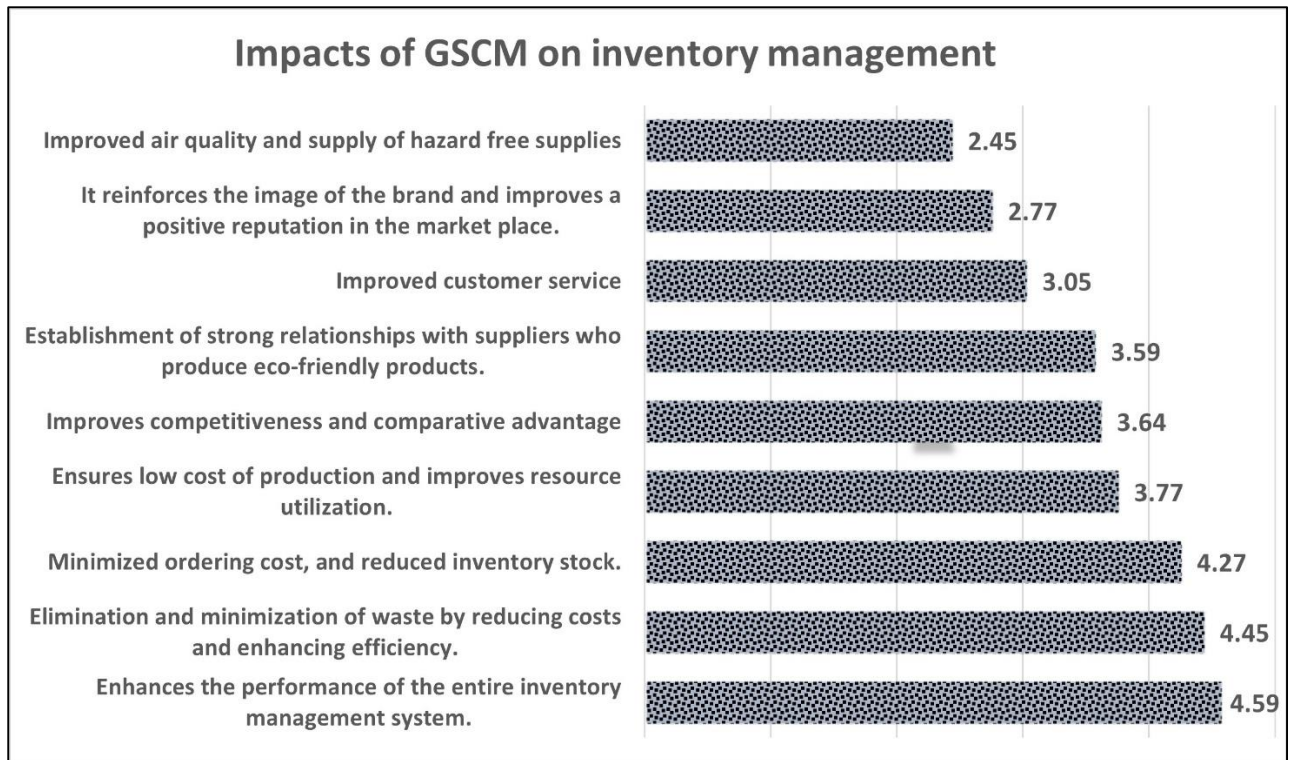
4.3.3 Green Procurement and waste management

These practices were ranked third from the results shown in the figure 4.5 and the research observed that they are a byproduct or complementary practices to the green manufacturing and green logistics and operations. This came into attention as waste management would have been planned in the green design manual and practices as well as the manufacturing would ensure that products/materials are returned from the end user to the producer in order to be recycled, reused or reconditioned. The principles of green procurement also highlight that, the mines are reducing the sources of wastage and promoting resource reduction, product recycling, reuse of materials and waste products and also, substitution of materials.

In conclusion, for the effective and optimum operational performance results that are exceptional, the mining sector should ensure that their JIT and MRP systems are up to date with the GSCM practices that is; green manufacturing, operations and logistics and supported by green procurement and waste management. It was discovered that the desired results are realized when there in integration of practices.

4.4 The impacts of Green Supply Chain Management practices on the central inventory management system. (Specific Objective 2)

The second specific objective seek to, “*determine the impacts of green supply chain management practices on the central inventory management system of the mine.*” This was achieved by assessing the extent to which the respondents concurred to the discovered impacts of GSCM to the mining sector from the reviewed literature. The researcher utilized a Likert scale to observe the mean score rankings of the results which ranged between 2.45 and 4.59 from the least to the most perceived respectively. The results are presented in the figure 4.7



Source: Field Research (May, 2023)

Figure 4.7: Mean score rankings of the impact of GSCM practices

The results in figure 4.7 present the mean score ranking on a scale of 1 to 5 from “To a very large extent = 5 scores” to the “Very small extent = 1 score” according to the staff’s perceptions. The summary of the first four (4) out of nine (9) impacts of GSCM on the central Inventory management system were;

- Enhances the performance of the entire inventory management system, ranked first with mean score 4.59.
- Elimination and minimization of waste by reducing costs and enhancing efficiency, ranked second with mean score 4.45.
- Minimized ordering cost, and reduced inventory stock, ranked third with mean score 4.27.
- Ensures low cost of production and improves resource utilization. ranked fourth with mean score 3.77.

The least perceived impacts were:

- ❖ It reinforces the image of the brand and improves a positive reputation in the market place with mean score 2.77 and

- ❖ Improved air quality and supply of hazard free supplies, which was perceived last with mean score 2.45

4.4.1 Discussion of the results

The research observed a frequency of 68.2% of the population concurring “to a very large extent” that GSCM enhances the performance of the entire inventory management system. The major emphasis was on the practices that seeks to improve the customers services, reduce inventory holding costs, minimizing the ordering costs, ensuring the mine has enhanced in the competitiveness. The practices become the operational framework of all the department since they cover the major activities such as manufacturing, planning and designing, administration, procurement and logistics as well as, waste management. According to Rao and Holt (2005), the practices also enhance the economic performance, therefore, the implementation brings ultimate positive changes to the entire mining operations.

Respondent 4, also alluded that, “*GSCM practices protects the human health by providing operating environment that are less hazardous and reduces environmental impediments and as well as insuring resource and material optimization*”. These remarks have indicated that these practices are championing the three pillars of sustainability (social, economic and environmental) through inventory management and mining operations. This was also supported by Mvubu, (2015) who argued that suppliers can be monitored by scrutinizing all the supply chain stages in order to eliminate components that cause potential risk to human health and thus remove all hazardous products from the shelves. The impact also aligned with, “Improved air quality and supply of hazard free supplies” that was ranked last.

The study also observed 50.0% concurring (to a very large extent) and 45.5% (large extent) toward factor that GSCM practices ensures elimination and minimization of waste by reducing costs and enhancing efficiency. This was necessitated by ensuring that all team members have done thorough green design, green manufacturing and green procurement and logistic to guarantee minimization of waste. This was aligned with the fact that the GSCM increases the execution of the following processes; reduce, Re-use, Rework, Refurbish, reclaim, recycle and remanufacture). Also, Amemba *et al.* (2013) postulated a model called a solid waste management system (including collection, transportation, incineration, composting, recycling and disposal) using a multi objective location-allocation model. Therefore, the mine would be operating a very high environmental protection level and very efficient in resource

management. The effect of these operations and practices also impacted the minimized ordering costs and a reduction of inventory stock at the same time.

The study also concurred that GSCM practices “ensures low cost of production and improves resource utilization” with above 60% of the population supporting to a larger extent and beyond. The impact has been realized after the mine has been recommended to be associated with green suppliers, and thorough the green design and manufacturing. The mine would be conserving energy and use alternatives to keep the mining operations sustainable using the modern technologies and new skills and techniques yielding outstanding performance results. Ultimately the mine would be recognized as green private mining company and earns a good reputation.

Therefore, the research recommends the adoption of GSCM practices as they encompass the entire mining or organization operations. That would be the opportunity for the old fashion inventory management systems to be modernized and become more effective for the performance of the entire organization to be enhanced.

4.5 Green Supply Chain Management implementation barriers at Trojan Nickel Mine. (Specific Objective 3)

The third specific objective seek to, “*assess the barriers to the implementation of green supply chain management practices at Bindura Nickel Mine*” The research achieved this by assessing the extent to which they concur to the most common barriers observed from empirical literature on a scale of 1 to 5, with 5 being the highest mean score and “N” represents the number of respondents. The average ratings fell between 4.68 and 1.27, with "the most" to "the least" perceived barriers to the implementation of GSCM practices. The outcomes are displayed in table 4.4.

Table 4.4: Mean score rankings

Barriers to GSCM implementation.	N	Mean	RANK
Lack of top management commitment.	22	4.68	1
Lack of organizational structures and encouragement.	22	4.41	2
Government policies and weak support systems	22	4.41	2
Insufficient training and education on sustainable development and Environmental Management.	22	4.18	4

Limited Access of Finance to Invest in Environmentally Sustainable Practices.	22	3.32	5
Lack of customers awareness and demand.	22	3.09	6
High Costs of Implementing Green Supply Chain Practices.	22	2.27	7
Organization's reluctance to adopt technology advancement.	22	1.91	8
Low demand for environmentally Friendly Products	22	1.27	9
Valid N (listwise)	22		

Source: Field Research (May, 2023)

The research observed the following as the first four (4) barriers:

- Lack of top management commitment (mean score = 4.68).
- Lack of organizational structures and encouragement. (Mean score = 4.41).
- Government policies and weak support systems (mean score = 4.41).
- Insufficient training and education on sustainable development and Environmental Management. (Mean score = 4.18).

4.5.1 Discussion of the results

Mandla (2018), argued that, “lack of top management commitment” was a barrier to GSCM implementation and the results has also concurred to the same notion with the barrier fetching a means score of 4.68. This was observed after 68.2% and 31.8% of the respondents strongly agree and agree respectively. The researcher is positively arguing that if the top management of the mine are ignorant towards this initiative it would be difficult to implement it due to lack of knowledge as well as benefits of it. Therefore, the top management that comprises of the key stakeholders, shareholders and managers of all department have to make a comprehensive plan together and allow the practices to be included in their company ethos as well as defining their systems of operations. Once the initiative has been introduced, it should would be also the responsibility of each team member to take accountability and ensure that the inventory management system procedures are following the GSCM practice principles to ensure the desired results and outcomes (operational performance).

The study also concurred that “Lack of organizational structures and encouragement” is another barrier to the implementation of GSCM practices with 54.5% and 36.4% of the population “strongly agree” and “agree” respectively. The major contributing factor was lack of lack of top management commitment. Also, the team member would be not aware of the major vision and goal of the company so that they can restructure their operations to meet new

operational measure that support GSCM. Also, the mining sector was argued by one of the respondents that they are entangled in the old and primitive methods of production and procurement which is now costly in a number of ways.

Therefore, there is need for innovation as well as implementation of new skills and techniques that embrace the new technology and methods of production. This is necessitated by continuous educating the team members and employing young minds to occupy positions of influence so that the change can be realized and once new results are noticed, the motivation to invest in knowledge and innovation can be promoted from the organizational level to the sectoral level. Hence, the second barrier is complementary to the fourth barrier with mean score (4.18) arguing that, “*insufficient training and education on sustainable development and Environmental Management*”, 45.5% of the population agreed to this notion.

The mining sector should encourage their staff members to continuously educate themselves either through the CPDs sponsored by their organizations or on a personal level. The universities and other educational institution have included the sustainability in their curriculum and synopsis. Therefore education, training and nurturing is critical to the mining sector with regards to GSCM practices and implementation to ensure that the inventory management systems are up to date.

Lastly, the researcher also observed that the country is lagging behind in some sector to implement the GSCM practices because of the governmental systems that is lacking polices and their supporting structure are weak to enforce these initiatives. The polices should ensure that no player or industrial participants should operate without these certifications for sustainability, environmental management plans and many more. The regulations should be enforced strictly so that the compliance will be high. This would abide with all the players or parties and stakeholder in the mining and distribution industry ensure that they operate with general plans and strategies for green manufacturing, green designing, green operations and logistics, green waste management and green procurement. By so doing, the inventory, management systems would be deemed to fall strictly within the scope of the practices.

4.6 Strategies and best practices that can be adopted to overcome the barriers to GSCM practices implementation. (Specific Objective 4)

The fourth and last specific objective of the research allowed the researcher to, “*recommend green supply chain management practices implementation and maintenance at Bindura Nickel Mine (Trojan)*” and this was achieved by evaluating the strategies that eliminate the barriers to the implementation of the GSCM practices. The results observed mean scores ranging between 1 and 2 since the respondents had to concur either “Y = YES” or “N = NO”, the strategy was useful to implement the GSCM practices. The information is summarized in the table 4.5.

Table 4.5 Response frequencies and mean score ranking for the strategies can be adopted to overcome barriers to the implementation.

Strategies to GSCM implementation	N	Y	N	Mean	RANK
Company can make collaboration with the certified EMS suppliers	22	27.3%	72.7%	1.73	9
Establishing company’s green image locally and globally	22	27.3%	72.7%	1.73	8
Reducing energy consumption and confining waste.	22	36.4%	63.6%	1.64	7
Reducing the usage of raw materials from virgin extraction	22	45.5%	54.5%	1.55	6
Green designing enabling environmentally friendly products which more genuinely accepted to be produced and procured	22	50.0%	50.0%	1.50	5
Mutual understanding and awareness for environment between product designer and suppliers	22	90.9%	9.1%	1.09	2
Integrating total quality environmental management into planning and operation processes	22	90.9%	9.1%	1.09	2
Using green supply chain analysis as a catalyst for innovation	22	90.9%	9.1%	1.09	2
Top management commitment and leadership support on sustainability.	22	100.0%	0.0%	1.00	1
Valid N (listwise)	22				

Source: Field Research (May, 2023)

The table 4.5 presented the results in descending order from the least effective strategies to the most effective ones and according to the mean score ranking, the first four (4) strategies to enhance the implementation of GSCM to the mining sector were as follows:

1. Top management commitment and leadership support on sustainability.

2. Using green supply chain analysis as a catalyst for innovation
3. Integrating total quality environmental management into planning and operation processes.
4. Mutual understanding and awareness for environment between product designer and suppliers

4.6.1 Discussion of the results

The solutions that were suggested by the majority were presented in the table 4.5 and the researcher observed that the solution required combined contribution of all the stakeholders and shareholder to share the same goal and vision. There should be no information asymmetry in the industry to ensure that everyone is moving together with time. The suggested strategies included the top management commitment and leadership support on sustainability, that ensure that at each level of operation, the organizational departments are headed by someone with the same goal for sustainability and greening the operations. The influence is realized from the top management level before it is shared to every staff member.

Once the industry has adopted the practices, there would be the use of green supply chain analysis as catalyst for innovation. This came into attention as new technologies would be used that are cost effective, resource optimization, energy conversation, waste management through reverse logistics (Reduce, Re-use, Rework, Refurbish, Reclaim, Recycle and Remanufacture). Therefore, the total operations would be integrated from the green designing, manufacturing, operations and waste management. That explains the other factor that was argued that the GSCM practices are implemented through, *“Integrating total quality environmental management into planning and operation processes.”*

The research also recommends that mutual understanding and awareness for environment between product designer and suppliers has to be reached for the success of the mining organizations. This ensures that the green concepts are harnessed from the beginning that include the suppliers and manufacturers of the supplies to the minors and mining operations. These factors of strategies were also complemented by the following:

Company can make collaboration with the certified EMS suppliers; Establishing company's green image locally and globally. Reducing energy consumption and confining waste as well as Reducing the usage of raw materials from virgin extraction. The research concluded by testing the hypothesis as shown in section 4.7

4.7 Hypothesis Testing and Conclusion

The research was based on an assumption and hypothesis that:

H₀: Successful adoption and implementation of green supply chain management practices enhances the inventory management performance in the mining sector of Zimbabwe.

H₁: Successful adoption and implementation of green supply chain management practices does not enhance the inventory management performance in the mining sector of Zimbabwe.

To validate the hypothesis, the researcher used the Chi-square testing to critic the value presented by the SPSS as it compared the correlation between the two main variables. The variables being the Green Supply Chain Management practices (independent) and inventory management system performance (dependent).

The table 4.6 presents the Chi-square testing between the variables {Green Supply Chain Management practices coupled with the (Inventory management systems)} and {impacts of the GSCM practices to the performance of the mining sector} and the results which presented that there the alpha (a) is 5cells (100.0%) and coefficient for (b) and (c) are both at 0 cells (0.0%) no cells that have expected frequencies less than 5, which conferred the assumption has not been violated and the study assumption (**H₀**) has been accepted which concludes that there is a positive relationship between the variables GSCM practices and inventory performance. Therefore, the study successfully confirmed successful adoption and implementation of green supply chain management practices enhances the inventory management performance in the mining sector of Zimbabwe and the barriers to implementation are succumbed by strategies suggested in section 4.6 The results are shown in the table 4.6.

Table 4.6 Chi-square testing

Test Statistics				
Variables		Chi-Square	Df	Asymp
Green Supply Chain Management Practices.		1.182 ^a	4	.881
Inventory Management Systems		8.455 ^a	4	.076
Enhances the performance of the entire inventory management system.		12.636 ^b	2	.002
Improved customer service		3.455 ^a	4	.485
Minimized ordering cost, and reduced inventory stock.		11.818 ^c	3	.008
Improved air quality and supply of hazard free supplies		2.000 ^c	3	.572
Establishment of strong relationships with suppliers who produce eco-friendly products.		11.818 ^c	3	.008
Elimination and minimization of waste by reducing costs and enhancing efficiency.		8.273 ^b	2	.016
Ensures low cost of production and improves resource utilization.		8.455 ^a	4	.076
Improves competitiveness and comparative advantage		2.000 ^c	3	.572
It reinforces the image of the brand and improves a positive reputation in the market place.		2.091 ^a	4	.719

a. 5 cells (100.0%) have expected frequencies less than 5. The minimum expected cell frequency is 4.4.
 b. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 7.3.
 c. 0 cells (0.0%) have expected frequencies less than 5. The minimum expected cell frequency is 5.5.

Source: Field Research (May, 2023)

4.8 Chapter Summary

The chapter managed to present, analyze and discuss the results with the aid of the methodology framework from the chapter 3. The researcher was within the scope of the research specific objectives and utilized the literature reviewed in chapter two support the research finding in the discussions. The chapter concluded by testing the hypothesis using the Chi-square testing and the results concluded in accepting the null hypothesis. The succeeding chapter is chapter 5, marking the last and final chapter for this research and it comprise of the research summary for major findings, conclusions and recommendations.

CHAPTER 5

CONCLUSIONS AND RECOMMENDATIONS

5.1 Introduction

The research summary of major findings, conclusions and recommendations are presented in this chapter. The chapter will be detailing the extent to which the research has achieved the research objectives. All the information was drawn from the findings from all the previous chapters. The main objective of the study was to assess the impact of green supply chain management practices on inventory management in the mining sector of Zimbabwe, a case-study of Bindura Nickel Mine (Trojan), achieved as follows:

5.2 Summary of major findings

The research study was, “the impact of Green Supply Chain Management practices on inventory management in the mining sector of Zimbabwe. Case of Bindura Nickel Mine (trojan).” The scope of the research aimed at assessing the impact of Green Supply Chain Management practices on inventory management in the mining sector of Zimbabwe, a case-study of Bindura Nickel Mine (Trojan). The researcher achieved this through the specific objectives as follows:

- ❖ To establish green supply chain management practices at Bindura Nickel Mine (Trojan).
- ❖ To determine the impacts of green supply chain management practices on the central inventory management system of the mine.
- ❖ To assess the barriers to the implementation of green supply chain management practices at Bindura Nickel Mine.
- ❖ To recommend green supply chain management practices implementation and maintenance at Bindura Nickel Mine (Trojan).

The research was based on the assumption that, (**H₀**) successful adoption and implementation of green supply chain management practices enhance the inventory management performance in the mining sector of Zimbabwe. The research was significant to the mining industry, supply chain industry and for academics in championing the implementation of GSCM practices under

sustainability. The research background was supported by the following theoretical frameworks: Theory of constraints, Lean theory and Institutional theory.

Furthermore, the researcher also developed a conceptual framework linking the depended and independent variables. The independent variable was Green Supply Chain Management (GSCM) practices and the depended variable was the Mining Inventory Management systems which was hypothesized for an outcome Mining Performance. The research also reviewed empirical literature based on the research objectives and identified the gaps in the literature.

The research methodology followed the mixed methods approach for the collection of quantitative and qualitative data. The research design was descriptive and exploratory in nature and questionnaires and interviews were used as the data collection tools. The population was of a total of 40 employees and the sample size was 75% of the population which exposed 30 staff members to the research survey which was defined by the stratified random technique.

The results of the study were presented, interpreted, and discussed using explanatory language, descriptive, and inferential mathematical tools. The statistical reports were produced by the Statistical Package for Social Sciences (SPSS) application software, which provided descriptive tools to test results. Comparatively, qualitative data was examined using the traditional method of content analysis.

The questionnaires and interviews recorded a response rate of 88.0% and 100.0% respectively and the overall response was 90.0%. The major participants were male (63.6%), with the population having ages between 25 to 34, with 68.3% having working experience between for 4 (four) to 8 (eight) years and their highest level of education was a bachelor's degree, with 54.5%. The highest frequencies were of participants were from Safety and environmental managers, procurement officers, customer service managers and human resource managers. From the 35 variables in the questionnaire, a reliability test Cronbach's alpha coefficient of 0.820 was recorded as overall which was acceptable for the social sciences.

5.3 Conclusions

The study results and findings enabled the researcher to arrive at the following conclusions for each specific objective as follows:

Objective 1: "To establish green supply chain management practices at Bindura Nickel Mine (Trojan)." The research observed these GSCM practices as the most perceived in the mining industry:

- ❖ Green Manufacturing,
- ❖ Green operations and logistics,
- ❖ Green procurement,
- ❖ Green waste management.

The most perceived inventory management systems were:

- ❖ Material Requirement Planning (MRP) and
- ❖ Just in Time (JIT)

Objective 2: “To determine the impacts of green supply chain management practices on the central inventory management system of the mine”. The first four (4) out of nine (9) impacts of GSCM on the central Inventory management system were;

- ❖ Enhances the performance of the entire inventory management system.
- ❖ Elimination and minimization of waste by reducing costs and enhancing efficiency.
- ❖ Minimized ordering cost, and reduced inventory stock.
- ❖ Ensures low cost of production and improves resource utilization

The least perceived impacts were:

- ❖ It reinforces the image of the brand and improves a positive reputation in the market place and
- ❖ Improved air quality and supply of hazard free supplies.

Objective 3: “To assess the barriers to the implementation of green supply chain management practices at Bindura Nickel Mine”. The research observed the following as the first four (4) barriers:

- ❖ Lack of top management commitment,
- ❖ Lack of organizational structures and encouragement.
- ❖ Government policies and weak support systems.
- ❖ Insufficient training and education on sustainable development and Environmental Management.

Objective 4: “To recommend green supply chain management practices implementation and maintenance at Bindura Nickel Mine (Trojan)”. The first four (4) strategies to enhance the implementation of GSCM to the mining sector were concluded as follows:

- ❖ Top management commitment and leadership support on sustainability.
- ❖ Using green supply chain analysis as a catalyst for innovation
- ❖ Integrating total quality environmental management into planning and operation processes.
- ❖ Mutual understanding and awareness for environment between product designer and suppliers

The research finalised by testing the Chi-square test to validate the relationship between the variables and the results observed the alpha (α) is 5 cells (100.0%) and coefficient for (b) and (c) are both at 0 cells (0.0%) no cells that have expected frequencies less than 5, which conferred the assumption has not been violated and the study assumption (H_0) was accepted. Therefore, the study successfully confirmed successful adoption and implementation of green supply chain management practices enhances the inventory management performance in the mining sector of Zimbabwe.

5.4 Recommendations

5.4.1 Recommendation to the Industry

Throughout the research literature and results, the researcher has managed to recommend the following to the mining industry and the supply chain industry. The recommendation are as follows;

- ❖ Top management commitment and leadership support on sustainability.
- ❖ Using green supply chain analysis as a catalyst for innovation.
- ❖ Integrating total quality environmental management into planning and operation processes.
- ❖ Mutual understanding and awareness for environment between product designer and suppliers
- ❖ Company can make collaboration with the certified EMS suppliers to have better relationship between them and quality assurance with no harm to the environment.
- ❖ Green designing enabling environmentally friendly products which more genuinely accepted to be produced and procured
- ❖ Supporting corporate social responsibility
- ❖ Reduction in risk of disruptions in energy and raw material supply
- ❖ Reducing energy consumption and confining waste.

- ❖ Allowing new team members to join existing organization with new ideas as well through the continuous professional development programs that enhance the knowledge of employees through education and training session periodically.

5.4.2 Recommendation to the student and the University

The study encourages the universities to continuously involve the students in the innovation and research programs to ensure that they keep on exploring and implementing new skills and contemporary technologies that enhance the Green Supply Chain Management, inventory management systems and supply chain and procurement at large.

Also, the young professionals and practitioners should be able to close the theoretical gaps and be innovative to apply the theories and concepts into tangible systems and procedures implementable in the mining industry for a positive change. During the industrial attachment the universities should ensure that the students are exposed to several real-life situations and be guided in creating solutions for them.

5.5 Suggestions for Further Study

Further studies are recommended by the researcher to extend the research to maintenance and upgrading techniques and procedure for the Green Supply Chain Management Practices in the blue-chip organisations of Zimbabwe or both the private and private mining sectors. These researches will ensure that companies will not aim at certification or implementation only but have a long-term planning to ensure everlasting results in purchase and supply performance as well organizational performance at large.

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APPENDICES

Appendix 1: QUESTIONNAIRE

THE IMPACT OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES ON INVENTORY MANAGEMENT IN THE MINING SECTOR OF ZIMBABWE. CASE OF BINDURA NICKEL MINE (TROJAN).

Please note that the information provided will be used for academic purpose only and will be treated with utmost confidentiality. Kindly answer the following questions by ticking (✓) in the appropriate box or by giving the necessary details in the spaces provided.

NB: This questionnaire contains two sections. Please complete all of them.

SECTION A: DEMOGRAPHIC INFORMATION

1 Gender

Male

Female

2 Age (Years)

Below 24	<input type="checkbox"/>
25-34	<input type="checkbox"/>
35-44	<input type="checkbox"/>
45-54	<input type="checkbox"/>
Above 54	<input type="checkbox"/>

3. Highest educational level of Respondent

Ordinary/ Advanced level	<input type="checkbox"/>
Certificate/ Diploma	<input type="checkbox"/>
Bachelor	<input type="checkbox"/>
Master	<input type="checkbox"/>
Doctorate	<input type="checkbox"/>
Other (Specify).....	<input type="checkbox"/>

4. Position of Respondent

Procurement Officer	
Operations Manager	
Finance Manager	
Accounting Officer	
Marketing Manager	
Internal Audit Officer	
Safety and Environment Manager	
Customer Service Manager	
Human Resource Manager	
Logistics Manager	
Other (Specify).....	

5. How long have you been in this position?

Less than 4 years	
4-8 years	
8-12 years	
12-16 years	
Above 16 years	

6. How can you describe ownership of your company?

Local	
Foreign	
Both	

SECTION B: STAFF PERCEPTIONS ON THE IMPACT OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES ON INVENTORY MANAGEMENT IN THE MINING SECTOR OF ZIMBABWE.

B1: Green Supply Chain Management Practices.

1. What are the green supply chain management practices, Bindura Nickel Mine (Trojan) need to adopt and implement in order to enhance inventory management? Please tick (✓) even more than one option.

Green Procurement	
Green waste management	
Green operations and logistics	
Green Design	
Green Manufacturing	

2. Which Inventory management systems does the Mine use to which the GSCM practices would be implemented to? Please select from the list below:

Material Requirement Planning (MRP)	
Just In Time (JIT)	
Economic Order Quantity (EOQ)	
Continuous Review System (CRS)	
Enterprise Resource Planning (ERP)	

B2: The impacts of Green Supply Chain Management practices on the central inventory management system.

3. To what extent do you concur to the following statements explaining the impacts of Green Supply Chain Management practices on the central inventory management system selected above?

NB: On a Likert scale rating of 1 to 5 please select the most suitable response where; 5 = To a very large extent, 4 = Large extent, 3 = Moderate extent, 2 = Small extent, 1 = Very small extent

Impacts of GSCM on inventory management	5	4	3	2	1
Enhances the performance of the entire inventory management system.					
Improved customer service					
Minimized ordering cost, and reduced inventory stock.					
Improved air quality and supply of hazard free supplies					
Establishment of strong relationships with suppliers who produce eco-friendly products.					
Elimination and minimization of waste by reducing costs and enhancing efficiency.					
Ensures low cost of production and improves resource utilization.					
Improves competitiveness and comparative advantage					
It reinforces the image of the brand and improves a positive reputation in the market place.					

Any other:

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B3: Green Supply Chain Management implementation barriers at Trojan Nickel Mine

4. To what extent do you concur to the following barriers to the implementation of green supply chain management at Bindura Nickel Mine? Using a scale of: 5 = strongly agree; 4 = agree; 3 = neutral; 2 = disagree; 1= strongly disagree.

Barriers to GSCM implementation.	5	4	3	2	1
High Costs of Implementing Green Supply Chain Practices.					
Lack of organizational structures and encouragement.					
Limited Access of Finance to Invest in Environmentally Sustainable Practices.					
Low demand for environmentally Friendly Products					

Insufficient training and education on sustainable development and Environmental Management.					
Government policies and weak support systems					
Lack of top management commitment.					
Organization's reluctance to adopt technology advancement.					
Lack of customers awareness and demand.					

Any other:

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.....

B4: Strategies and best practices that can be adopted to overcome the above-mentioned barriers.

5. What strategies can be adopted to overcome barriers to the implementation of Green Supply chain management in order to improve inventory management and performance of the mining industry in Zimbabwe? Please rank by a **selecting** the appropriate box according to their effectiveness.

Top management commitment and leadership support on sustainability.	
Reducing energy consumption and confining waste	
Using green supply chain analysis as a catalyst for innovation	
Integrating total quality environmental management into planning and operation processes	
Reducing the usage of raw materials from virgin extraction.	
Establishing company's green image locally and globally	
Company can make collaboration with the certified EMS suppliers	
Mutual understanding and awareness for environment between product designer and suppliers	
Green designing enabling environmentally friendly products which more genuinely accepted to be produced and procured	

Any other:

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THANK YOU.

Appendix 2: INTERVIEW QUESTIONS GUIDE

BINDURA UNIVERSITY OF SCIENCE EDUCATION



FACULTY OF COMMERCE

DEPARTMENT OF ECONOMICS

BACHELOR OF COMMERCE DEGREE IN PURCHASING AND SUPPLY

TOPIC: THE IMPACT OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES ON INVENTORY MANAGEMENT IN THE MINING SECTOR OF ZIMBABWE. CASE OF BINDURA NICKEL MINE (TROJAN).

Dear Valued Participant,

I am Timothy Chintuwa (B193245B) an undergraduate candidate at the Bindura University of Science Education, Bindura, Zimbabwe. Currently, I am conducting the above research with the main objective to assess the impact of Green Supply Chain Management practices on inventory management in the mining sector of Zimbabwe, using a case-study of Bindura Nickel Mine (Trojan). The outcomes of this research would help other mining organization in adopting the green supply chain management practices at large. The information gathered from this research will be strictly handled confidentially and be used for academic purposes only.

*Your help and cooperation in answering these interview questions is very important in order for me to be able to collect relevant data and carry out this research. Should you require further information, please do not hesitate to email me at **B193245b@.....** or call me at **+263 771 868 762***

Thank you for your time and cooperation.

DATE:/...../.....

LOCATION:

INTERVIEWER.....

INTERVIEWEE:

POSITION AT THE MINE:

The template comprises of set (4) sets of questions.

SET 1: GREEN SUPPLY CHAIN MANAGEMENT PRACTICES AT BINDURA NICKEL MINE (TROJAN).

1. Which mining department most influenced by the GSCM practices?

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2. Please select the most suitable practices for the mining operations.

Green procurement	
Green logistics	
Green manufacturing	
Green waste management	
Green transportation	

Other

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SET 2: IMPACTS OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES ON THE CENTRAL INVENTORY MANAGEMENT SYSTEM OF THE MINE.

3. What are the benefits of GSCM practices to the central management system?

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4. What are the shortcomings of operating using the GSCM practices?

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SET 3: THE BARRIERS TO THE IMPLEMENTATION OF GREEN SUPPLY CHAIN MANAGEMENT PRACTICES AT BINDURA NICKEL MINE.

5. What are the barriers to the implementation of green supply chain management at Bindura Nickel Mine?

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6. Which factors are most influential to the process?

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SET 4: RECOMMENDATIONS

7. Which green supply chain management practices can be recommended and implemented at Bindura Nickel Mine (Trojan)?

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Justify:

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..... **Thank You**

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