



## AN ECONOMIC COMPARATIVE ANALYSIS OF EQUIPMENT OUTSOURCING AND OUTRIGHT PURCHASE FOR QUARRYING OPERATIONS AT FOUNTAIN COMPANY, AKURE, ONDO STATE

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Arowojolu, E. O. and Oniyide, G. O. (2025): An Economic Comparative Analysis of Equipment Outsourcing and Outright Purchase for Quarrying Operations at Fountain Company, Akure, Ondo State. *FUTA Journal of Engineering and Engineering Technology* /19(1), 172-180

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Received Date: 5.6.24

Accepted Date: 30.5.25

### Abstract

This study focused on evaluating the pros and cons of outsourcing and purchasing of quarry equipment for cost effective and efficient productivity for Fountain Construction Company, Akure, Nigeria. The study assessed the cost-effectiveness, considerations of outsourcing and purchasing strategies with the help of literature review and data analyses. The results show notable differences in prices, operational advantages, and strategic effects for mining companies interested in optimizing their machine procurement and management processes. This study provides practical options and consequences to the mining sector, specifically to Nigeria, for improving the decision support, operational efficiency and strategic procurement process. The study revealed a significant negative cost difference of ₦731,839,500.00 over four years, demonstrating remarkable cost efficiency when purchasing equipment.

**Keywords:** *Outsourcing, purchase, equipment, operational efficiency, quarrying*

### Introduction

Mining involves obtaining precious minerals or other rock materials from the earth by blasting and processing, and it involves a lot of equipment and technologies (National Geographic Society, 2022). The mining sector is famous for the heavy machinery and equipment that it relies on. Mining corporations often need help with the issues of environmental responsibility, financial performance, and operational productivity.

With these challenges, a growing number of mining companies have tended to resort to outsourcing as a viable strategy. Outsourcing mining equipment and related services provides many benefits, from cost savings to flexibility (Bingxu, 2023). Therefore, it is an excellent attraction for companies that aim to reduce operations costs and enhance their competitiveness in the global market (Obeng *et al.*, 2015). Mining enterprises can benefit from top-tier innovations and expertise without bearing any ownership cost or maintenance burden. Loading and unloading equipment is often outsourced to service providers who invest in modern machines and hire skilled operators to maximize output in mining operations.

The purchase and maintenance of mining equipment pose a heavy burden as a considerable amount of capital investment is required at once, as well as the operating costs that continue to show up day after day. When outsourcing, companies incur variable operational expenses instead of fixed capital expenditures. This flexibility is crucial for the smooth running of the business, especially in dynamic marketplaces, since it allows the business to be responsive to market fluctuations and scale its operations (Maley *et al.*, 2015).

Contracting also involves operational risks, whereas such risks as equipment failures or breakdowns are transferred to the service provider. Third-party service providers are usually best suited to deal with industry standards and regulations compliance; therefore, they relieve mining companies from most of the regulatory responsibilities (Steenkamp *et al.*, 2014). Besides that, the partners of the contracting company guarantee that the equipment will be supplied in conformity with safety and environmental policies, thus reducing the potential legal and environmental risks for the contracting company.

By outsourcing non-core functions like equipment management, mining companies can redirect their resources and attention to what they do best - exploration and resource extraction. This strategic shift allows managers to focus on leadership and business development, leveraging the expertise of professionals from outside the company (Visagie, 2012).

### **Purchasing of Mining Equipment**

Ensuring the quality of mining machinery is crucial in improving a mining site's technical efficiency. The latest engineering inventions of modern machinery include GPS navigation systems, real-time monitoring systems, and automation systems, which enable stable drilling, pinpoint blasting, and optimally streamlined material handling (Liu *et al.*, 2022). Modern, compliant equipment makes compliance with stringent safety regulations easier, ensuring the well-being of both workers and the environment. Newer mining equipment models are designed with improved safety features, such as collision avoidance systems, operator fatigue monitoring, and emergency response mechanisms (Dhillon, 2009).

Purchasing equipment allows mining companies to avoid the recurring expenses associated with leasing agreements, contributing to significant financial savings in the long run. While the initial investment in purchasing mining equipment can be substantial, it often results in long-term cost savings. New equipment generally involves less repair and maintenance. Thus, operational costs are reduced over the equipment's lifetime. The world is experiencing an unprecedented technological evolution in all domains, including mining. Investing in new machinery guarantees the use of state-of-the-art technology, efficiency, energy saving and eco-friendly effects. Another advantage is that Integrated Internet of Things (IoT) solutions, data analytics, and predictive maintenance technologies transform mining works, giving companies that invest in the latest equipment an edge over others (Sánchez and Hartlieb, 2020).

Modern machinery is engineered with environmental sustainability in focus. Sophisticated extraction and processing methods, including heap leaching and bioleaching, are some of the techniques that reduce environmental damage. Newer equipment models often adhere to stricter emissions standards, helping mining operations reduce their carbon footprint and meet environmental regulations (Aznar-Sánchez *et al.*, 2019). Investing in efficient, environmentally friendly mining equipment enhances a company's reputation and strengthens relationships with stakeholders, including investors, regulatory authorities, and local communities. Responsible mining practices, facilitated by advanced equipment, demonstrate a commitment to

environmental conservation and social responsibility, fostering positive relationships with all stakeholders (Hartlieb-Wallthor *et al.*, 2022).

This study examines the expenses associated with procuring mining equipment compared to leasing such equipment for extracting run-off minerals. To accomplish this goal, questionnaires were distributed to quarry managers and on-site visits were also carried out. Subsequently, the data collected from surveys and in-person visits were analysed.

Afeni *et al.* (2016) compared the cost of purchasing and leasing mine equipment as a strategy for production of run-off mines using Zibo FM Quarry and Roadstone Quarry, Ondo State, Nigeria, as a case study. The outcome of their study, which indicates that the payback period method favours the purchase of mine equipment within their case study, has significant practical implications.

Baatartogtokh *et al.* (2018) conducted a survey that helped them reach a conclusion with results that are generally consistent with the economic concepts. However, the questions concerning the risks of outsourcing (which are how prevalent outsourcing is, what activities are being outsourced, why companies are outsourcing, and the risks of outsourcing) and the identification of a mining company's core competencies remain unanswered. It is clear that, at present, outsourcing is done in a strategic sense, likely dependent on particular situations. Deng and Xu, (2023) study emphasises that original equipment manufacturers' equilibrium outsourcing strategies depend on the discount rate of component prices and the fixed investment cost of manufacturing.

Ilderov, (2017) discovered that companies that use outsourcing enjoy benefits such as total concentration on the critical product (production), strategic management, cutting down on direct costs in the structure of the end product cost, simplification of control, an increase in the liquidity of assets, and many more. The study also proved that outsourcing in the mining industry will enable modern production control tools and the application of advanced mineral mining technologies. Relly, (2013) emphasises that leasing offers a lot of flexibility and benefits, but these three—renting, leasing, and buying—have to be considered when deciding to acquire equipment and see what will work best.

Pitroda, (2015) studies the benefits of owning, leasing, and renting construction equipment. Leasing equipment is more desirable since it preserves the company's credit line while freeing up funds for more lucrative applications. Further lowering the risk associated with leasing and renting is that the equipment does not show up as a liability on the business's balance sheet.

Some of the most significant reasons for outsourcing are to help organisations focus on their core activities to reduce costs, provide short-term financial benefits, and improve their balance sheet. It also helps them increase flexibility to configure their resources to meet unstable market demands (Harland *et al.*, 2005).

The presented information has considered several aspects, such as cost, pros, cons, and strategies, for both outsourcing and buying decisions. Nevertheless, more empirical studies are needed, and a comprehensive and comparative study on the Nigerian context in outsourcing and purchasing options is also among the gaps and limitations identified. These gaps demonstrate that additional research in this field is needed. This research on the Fountain construction company in Akure, Nigeria, is intended to bridge the gap by investigating the current trends, collecting relevant data, and performing a detailed analysis.

**Material and Methods**

**Location and Geology of the Study Area**

The research is carried out in Fountain Construction Company, located at Akure-Owo Road, Akure North Local Government, Ondo State, Nigeria. Ondo State is located in the south-western part of Nigeria, within latitudes 5° 27' and 8° 09' N and longitudes 4° 00° and 6° 00° E, which cover an area of 10,724.31 km<sup>2</sup> (Akinluyi *et al.*, 2021). The state is a member of the region called the Niger Delta, where Nigerian oil wells can be found. There are two distinct geological regions in Ondo State: the region of sedimentary rocks in the south and Okitipupa, and the second is the region of Precambrian basement complex rocks in the north. The significant rocks in

Ondo State are granite and charnockite (Akinluyi *et al.*, 2018).

A questionnaire was distributed to industry experts to obtain insights into the current trend, the cost of outsourcing, and the purchase of equipment in order to make industry-relevant comparisons. The mine manager at Fountain Construction Company in Akure, Nigeria, answered the question. The company has been operational for over 15 years and has been operating in Akure for about the same time. Engaging in mostly quarry operations, the company is operational for 50 weeks a year and has a total output of 900 metric tonnes per day.

**Equipment Data/ Specification**

The following equipment with their specifications were considered during the research:

- I. Crusher – 150 tonnes/hour
- II. Dumper – 20 tonnes
- III. Excavator – 330 Hydraulic Excavator
- IV. Payloader – CAT 950G
- V. Wagon Drill – Tamrock

**Maintenance of Equipment**

Preventive maintenance services are carried out on the quarry equipment daily, weekly, and quarterly to maintain its optimum performance and improve its lifespan.

**Equipment Productivity**

The equipment under review was observed to perform at the expected rate.

**Access Road**

Only excavated road is needed, no need of road construction

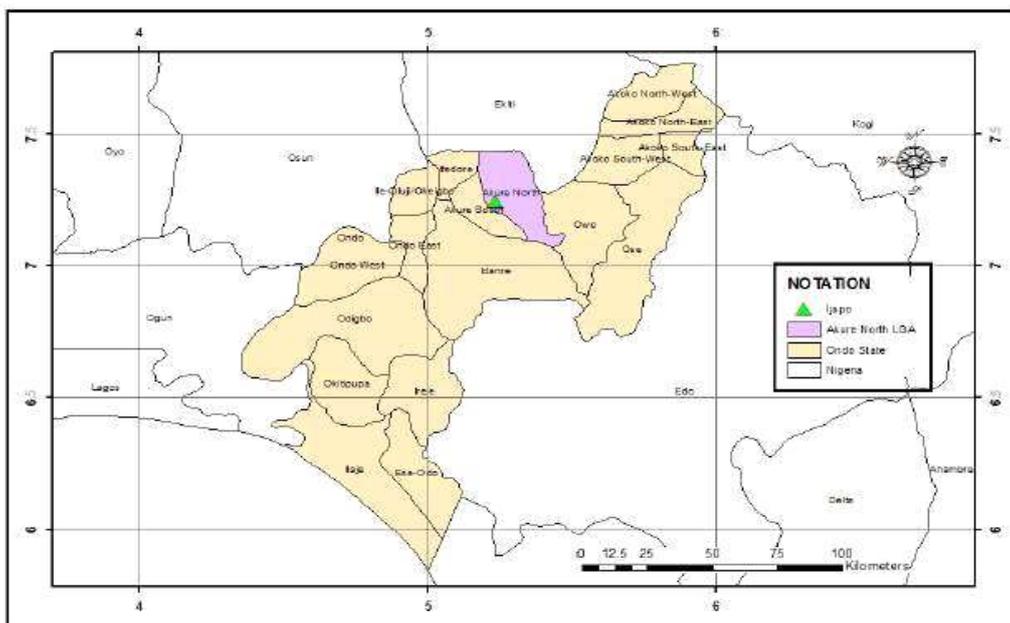


Figure 1: Map of the study area (Olusola *et al.*, 2018)

### Data Collection Methods

*Surveys:* Fountain Construction Company's quarry manager received the structured questionnaire. This method allowed for systematically gathering information and learning experiences connected to the mining equipment outsourcing and procurement processes. The organisational structure of the data collection approach guaranteed consistency, mainly focusing on essential areas of interest such as operation and financial contemplation.

*On-site Visits:* During on-site visits, complete observation and interviews were conducted to explore technical issues, the advantages and downsides of outsourcing, and equipment purchases for mining. This provided the avenue to make real-time performance assessments of the material deployed and look for the intricate elements that would not have been found using the survey responses alone. The quantitative data from the interviews allows for the research analysis to gain a deeper understanding of the practical implications and decision-making at Fountain Construction Company.

### Sampling Technique

*Target Group:* The sampling was centred on Fountain Construction Company's quarry manager, equipment procurement staff, and key decision makers. Such diversity was intended to achieve the assembly of points of view from as many different perspectives regarding the acquisition and utilization of apparatus as possible.

*Sampling Technique:* Convenience sampling, an easily applicable option, was used to engage participants in various roles. This approach was adopted due to its suitability in placing a questionnaire at the disposal of those readily available within the company, making it highly effective for collecting information from the people participating in the purchase and operation of the equipment. On the other hand, the outcomes may not be a real representation of the actual population due to the self-selection of participants, which could lead to bias.

### Data Analysis

A comprehensive statistical analysis was performed on the gathered survey data. This comprised:

1. The primary features of the data gathered from the surveys are summed up and described using *descriptive statistics*.
2. *Analysed correlations* between numerous variables to ascertain the direction and degree of linkages between purchasing or outsourcing decisions and different operational results at Fountain Construction Company.

These statistical tools were employed to determine relationships, coordinates, and probable cause-and-effect connections between outsourcing decisions or purchasing mining equipment and Fountain Construction Company's operational results.

### Ethical Considerations

1. *Informed Consent:* Participants were informed about the purpose and implications of their participation, and then willing consent was obtained from them. This step comprised supplying adequate information on the purpose of the research, procedure, and participation options.
2. *Confidentiality:* Stringent regulations about data privacy and anonymity were made. The responders' feedback was kept anonymous in addition to masked person names. The data was preferred to be stored securely where there was no chance of unauthorised or illegal access.

These significant ethical issues comprised ensuring participants' informed consent and keeping any shared information confidential, which made the research process validate the participants' rights and privacy.

### Limitations

1. *Sample Size:* This study demonstrates that the limited number of participants selected as a sample could affect the findings' representativeness. A small sample would only represent a specific segment of the community; thus, its conclusions might not be generalized.
2. *Subjectivity:* The various biases of the individuals involved in the study can distort the responses and ultimately impact the findings of the study. If the respondents understand the questions differently or hold varying personal views, it can make the research less objective.

### Research Validation

1. *Expert Consultation:* Engaging working professionals as experts in the field to provide their opinions would significantly enhance the value of the related findings. The experts' insights offer a more insightful view, aligning the research with the contemporary workplace environment and standards.

Hearing from the industry experts' experiences and knowledge provides a more in-depth evaluation of the methods, analysis, and results. This method corresponds to a validation procedure of the study design, thus increasing its reliability.

**Results and Discussion**  
**Equipment**

The mine manager provided a list of equipment used in the day-to-day operation. These included:

1. Complete Crusher
2. 2 Dumpers
3. 1 Excavator
4. 1 payloader
5. Wagon drill

**Assumptions**

1. **Outright purchase of Equipment:** The purchase of the equipment was done through direct purchase. i.e., No loans were utilized in the acquisition of the equipment.
2. **Exchange Rate:** The cost of obtaining the equipment was evaluated in US dollar and thus the exchange rate at the time of information gathering was ₦957.86/\$1.
3. **Residual Value:** The residual value of the different equipment is equated to the current market value of the fairly used equipment.
4. **Operation Cost:** The operation cost in both outsourcing and outright purchase is covered by the company.
5. **Equipment Size and Production Output:** The equipment sizes selected are appropriate for total output of 900 metric tonnes per day.

**Outsourcing Equipment**

The current cost of outsourcing this equipment was obtained. This is listed in Table 1.

The total cost for outsourcing to meet the daily output of 900 tonnes is ₦940,000 per day. The weekly cost and yearly cost of production is given below:

$$\begin{aligned} & \text{weekly cost of production} \\ & = \text{daily cost} \\ & \times 5 \text{ working days} \end{aligned}$$

$$\text{weekly cost of production} = \text{₦}940,000 \times 5$$

$$\text{weekly cost of production} = \text{₦}4,700,000$$

$$\text{Yearly cost of production} = \text{₦}4,700,000 \times 50$$

$$\text{Yearly cost of production} = \text{₦}235,000,000$$

Thus, over the period of 4 years is:

$$\begin{aligned} \text{Total Cost of Outsourcing} \\ & = \text{₦}235,000,000 \times 4 \end{aligned}$$

$$\text{Total Cost of Outsourcing} = \text{₦}940,000,000$$

**Purchasing Equipment**

In order to compute the Net Total cost of purchasing we would need to determine the initial cost and salvage value of the equipment. The salvage value is the estimated value of an asset at the end of its useful life. This is provided in Table 3 and it is calculated by subtracting accumulated depreciation from the original cost.

$$\begin{aligned} \text{Net Total Cost of Purchase} \\ & = \text{Initial Cost} \\ & - \text{Salvage Value} \end{aligned}$$

$$\text{Salvage Value} = \text{Original Cost} - \text{Accumulated Depreciation}$$

$$\begin{aligned} \text{Net Total Cost of Purchase} \\ & = \text{₦} 489,466,460 \\ & - \text{₦} 280,000,000 \end{aligned}$$

$$\text{Net Total cost of purchase} = \text{₦} 209,466,460$$

**Comparison between Outsourcing and Purchasing of Mining Equipment**

A cost comparison can be established by comparing the cost difference of production from outsourcing

**Table 1:** Daily cost of outsourcing mining equipment

S/N	Equipment	Cost/day	Quantity	Total Cost
1	Complete crusher	100000	1	100,000
2	Dumpers	50000	2	100,000
3	Excavators	150000	1	150,000
4	Payloader	140000	1	140,000
5	Wagon drill	450000	1	450,000
				<b>₦940,000</b>

**Table 2:** Cost of outright purchase of mining Equipment

S/N	Equipment	Dollar (\$) Cost	Qty	Naira Equivalent
1	Complete Crusher	150000	1	143,679,000
2	Dumpers	37500	2	71,839,500
3	Excavators	171500	1	164,272,990
4	Payloader	47500	1	45,498,350
5	Wagon drill	67000	1	64,176,620
				<b>₦489,466,460</b>

to that from the outright purchase of equipment. A positive cost difference indicates that the outright purchase of mining equipment is more expensive, and a negative value indicates that outsourcing is more expensive.

Cost Difference

$$= \text{Net Total Cost of Purchase} - \text{Total Cost of Outsourcing}$$

Cost Difference

$$= \text{₦ } 209,466,460 - \text{₦ } 940,000,000$$

Cost Difference = -₦ 730,533,540

The cost analysis above shows a negative cost difference of ₦ 730,533,540 over the course of 4 years. This implies that the purchase of equipment for mining activities is cost-efficient, saving over 75% of the cost when compared to outsourcing equipment.

**Discussion of Findings**

This study uniquely focuses on the leading practice of outsourcing and mining equipment purchase in Nigeria across sectors. It gathers data from a mining firm and conducts a thorough analysis to determine the most effective strategy, thereby making a significant contribution to the field. As can be seen in Tables 1, 2 and Figure 2, the cost of outsourcing is higher than outright purchase of the quarry equipment. There are many reasons that can be advanced for the cost difference. According to Lahiri *et al.*, (2022), observed that outsourcing may add to the complexity of production activities, thereby

leading to increasing costs. For instance, if drilling and blasting contracted out and there is delay in service delivery, it will affect all other operations such as loading and haulage, and even processing. Another reason for increased cost of outsourcing is that the service providers are few in number in Nigeria due to non-popularity of the method. Due to a lack of high-quality suppliers in some regions of the world, the mining outsourcing industry’s competition is becoming increasingly fierce (Baatartogtokh *et al.*, 2018).

Some of the services that are outsourced include engineering design, procurement, construction, maintenance, and even mining operations such as drilling and blasting (Sivakumar *et al.*, 2015).

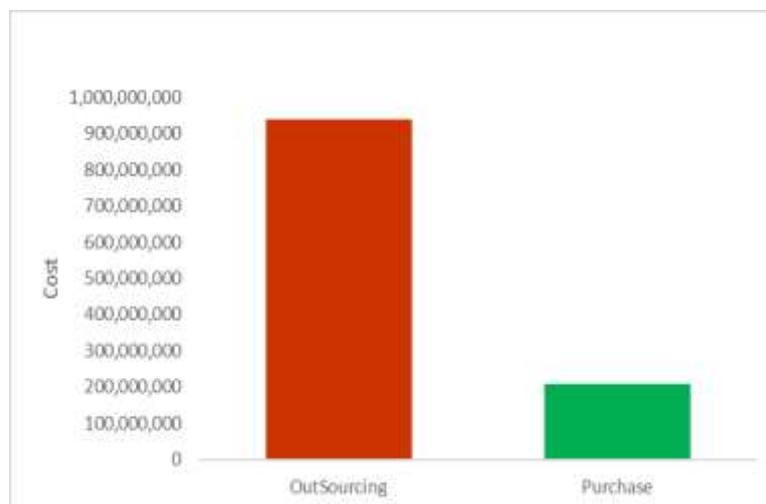
A study based on Canadian data shows that outsourcing has become typical for primary and large mining enterprises. The study revealed that about 89.7% of mining companies outsource or have outsourced services (Baatartogtokh *et al.*, 2018).

Table 4 presents the comparison of operational and health consideration between purchasing and outsourcing of quarry equipment based on the feedback received from questionnaire and personal communications during data collection. It can be inferred from the table that outsourcing will be good option if the cost the service can be lowered through competition by the service providers.

This study underscores the various advantages of outsourcing mining equipment. These include not only general cost savings but also specific ones such as reduced maintenance costs and increased

**Table 3:** Estimated Value of machine after a 4-year period

S/N	Equipment	Qty	Annual Depreciation Value (%)	Salvage Value (₦)
1	Complete Crusher	1	4.12	120,000,000
2	Dumpers	2	11.08	40,000,000
3	Excavators	1	18.15	45,000,000
4	Payloader	1	5.77	35,000,000
5	Wagon drill	1	9.4	40,000,000
				<b>280,000,000</b>



**Figure 2:** Cost of outsourcing and outright purchase

operational efficiency. Additionally, outsourcing offers flexibility in terms of equipment selection and usage, leading to safer operations.

Also, by buying mining equipment, enterprises can avoid recurring charges of leasing agreements that result in equipment obsolescence and ensure the latest innovations and improvements regarding energy consumption, environmental impacts, and efficiency.

As Afeni *et al.* (2016) emphasize, the idea of a payback period brings up concerns about equipment purchase, which is in line with the current study's position on cost-effectiveness. Baatartogtokh *et al.* (2018) focused on the strategic character of outsourcing, which works very well with the industry trends seen in Fountain Construction Company's study. Deng and Xu, (2022) explored the matter of outsourcing and enlarged the background for making the right decision.

Ilderov, (2017) argued for the benefits of outsourcing, such as the emphasis on particular activities and strategic management. This is precisely the subject that was studied in this research. Relly (2013) and Pitroda, (2015) detailed leasing advantages of cost savings and other benefits, supporting the research understanding of equipment operation. It should be noted that in future, if there is presence of many outsourcing service providers in Nigeria, there will be competition among the provider which will lead to reduction in the cost of outsourcing.

**Outsourcing Cost**

The cost analysis of outsourcing equipment indicated a daily cost of N 940,000 and an annual cost of N 235,000,000. This analysis provides a relative comparison of the buying options.

**Purchasing Cost**

The outright purchase cost, reported in Naira equivalents, was N 489,466,460, with a net total cost

of N 208,160,500 over four years after accounting for operation costs and salvage value.

**Cost Comparison**

The study revealed a significant negative cost difference of N 731,839,500 over four years, demonstrating remarkable cost efficiency when purchasing equipment. This is consistent with the literature, emphasising cost advantages and strategic considerations in purchasing equipment. The findings support that buying mining equipment outright is far more cost-effective than outsourcing. The broad literature analysis, combined with empirical data from Fountain Quarry Construction, adds a more sophisticated understanding of the elements that influence mining industry decision-making.

**Conclusions**

This research provides vital insights into the decision-making process between outsourcing and purchasing mining equipment, focusing on the Fountain Construction Company in Akure, Nigeria. The study found that buying mining equipment is more cost-effective than outsourcing, saving over 75% of the cost over four years. This method provides flexibility, reduces operational risks, and offers strategic benefits.

The study identified gaps in the existing literature, highlighting the need for more empirical studies in the Nigerian context and a broader comparison of outsourcing and purchasing decisions. The research's findings, backed by ethical considerations and rigorous validation techniques, offer practical recommendations for the mining industry, especially in Nigeria, to improve decision support, operational efficiency, and strategic procurement processes.

The study contributes to the existing literature by providing empirical insights into specific outsourcing and procurement patterns in Nigeria's mining industry. The findings have practical

**Table 4:** Comparison of operational and health consideration between purchasing and outsourcing

	<b>Purchase</b>	<b>Outsourcing</b>
Equipment Availability and Suitability	Readily available	May not be available when in use in another company
Equipment Efficiency and Performance	Less efficient, may not be handle by specialist	More efficient handling is by specialist
Maintenance and Repair Cost of Operation and Operational Flexibility	Additional cost lower	Has been factored in higher
Health, Safety, and Environmental (HSE) Considerations	Good compliance	Good compliance
Skill and Training Requirements	More training is required	Workers are well trained
Data and Technology Integration	Lower integration	Higher integration
Long-Term Sustainability and Risk Management	Higher	Lower

implications for mining companies seeking to enhance their equipment procurement and management processes, leading to increased operational efficiency and cost-effectiveness.

### Acknowledgments

The authors would like to acknowledge the

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