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Impact of Artificial Intelligence (AI) on The Financial Performance of Nigerian-Listed Oil and Gas Companies

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ABSTRACT: This study examines the effect of artificial intelligence on financial performance by reviewing past literature. Artificial intelligence now serves as a driver of firm progress as operations can be easily done. The review of the literature shows that the adoption of artificial intelligence has increased significantly by firms and it has significant effect on financial performance particularly profitability. It is recommended that firms should prioritize AI to drive operational efficiency. They should focus on AI-driven operational improvements, particularly in areas like predictive maintenance, process optimization, and real-time monitoring.

KEYWORDS: Artificial Intelligence (AI), Return on Assets, Return on Equity, integration, Nigerian Stock Exchange, financial performance

1.0 INTRODUCTION

The adoption of technological innovations such as Artificial Intelligence (AI) has become increasingly vital in today's business dynamics. AI, encompassing technologies such as machine learning, natural language processing, robotics, and predictive analytics, offers substantial potential to enhance operational efficiency, improve decision-making, and mitigate the financial risks inherent in the oil and gas industry (McKinsey & Company, 2020). These technologies allow for the optimization of exploration, drilling, production, and distribution processes, as well as the identification of cost-saving opportunities and the prediction of market trends, which can significantly impact financial performance (PwC, 2020).

AI presents a unique opportunity to address persistent challenges, including operational inefficiencies, resource mismanagement, and inadequate risk management frameworks (Akintoye et al., 2018). Despite the potential benefits, AI adoption within Nigeria business landscape remains in its early stages, with several barriers to widespread implementation. These include limited infrastructure, high implementation costs, and a shortage of skilled personnel (Okafor, 2021).

Thus, this study aims to review past work on artificial intelligence on financial performance of Nigerian-listed oil and gas companies. Specifically, it seeks to assess how AI adoption influences key performance metrics such as profitability, cost reduction, revenue growth, and operational efficiency. In doing so, the study also explores the challenges and barriers associated with the implementation of AI technologies in the Nigerian companies. This study provides valuable insights into the potential of AI to drive sustainable growth, enhance competitiveness, and improve financial performance in a rapidly evolving global market.

1.1 Statement of the Problem

Despite the critical role of artificial intelligence, companies in Nigeria are still confronted with numerous challenges that hinder their operational efficiency, financial sustainability, and competitiveness. These challenges include volatile global oil prices, volatile exchange rate, regulatory complexities, high operational costs, and the increasing need for transparency and sustainability in operations (Oluwaseun & Adebayo, 2022). Moreover, the transition towards cleaner and more sustainable energy sources presents both an opportunity and a threat to companies' operations (Sulaimon et al., 2021). In this context, AI has been identified as a potential solution to address these challenges, by enhancing operational efficiency, reducing costs, and improving risk management (Accenture, 2019). However, the adoption of AI in Nigeria's remains limited due to factors such as inadequate technological infrastructure, high implementation costs, and a shortage of skilled professionals (Okafor, 2021).

Empirical research examining the direct impact of AI on the financial performance of Nigerian-listed oil and gas companies is scarce, which creates uncertainty regarding the practical benefits of AI adoption in the sector. Without a clear understanding of the financial implications of AI implementation, companies may be hesitant to invest in these technologies, limiting their potential to remain competitive in an increasingly globalized and energy-diversified market (Bain & Company, 2020). This study seeks to address this gap by investigating how AI adoption can influence key financial performance indicators in Nigerian-listed oil and gas companies.

1.2 Research Objectives

The primary objective of this study is to examine the impact of Artificial Intelligence (AI) on the financial performance of Nigerian-listed oil and gas companies. The specific objectives are as follows:

i. To investigate the role of AI in enhancing operational efficiency and improving financial performance (profitability, cost reduction, and revenue growth) within Nigerian-listed oil and gas companies.
ii. To identify the key barriers to AI adoption in Nigerian-listed oil and gas companies and assess their impact on the companies' financial performance

1.3. Significance of the Study

The findings from the study contributed to a deeper understanding of how AI adoption can impact the financial performance of Nigerian-listed oil and gas companies, providing empirical evidence to guide decision-makers within the sector. By identifying the potential benefits of AI and the barriers to its adoption, the study will offer practical insights for industry stakeholders, including policymakers, company executives, and technology providers. Furthermore, the study will contribute to the broader literature on the role of emerging technologies in enhancing the competitiveness and sustainability of oil and gas companies in developing economies.

2.0 LITERATURE REVIEW

2.1. Concept of Artificial Intelligence (AI)

Artificial Intelligence (AI) refers to the simulation of human intelligence processes by machines, particularly computer systems. These processes include learning, reasoning, problem-solving, perception, and language understanding. AI technologies have revolutionized a wide range of industries, offering efficiencies and capabilities far beyond traditional methods. The main subfields of AI include machine learning, natural language processing, computer vision, and robotics, among others (Russell & Norvig, 2020; Goodfellow et al., 2020).

As a transformative technology, AI has significantly impacted various sectors such as healthcare, finance, and energy, providing enhanced decision-making and operational efficiency. In the **energy sector**, for instance, AI is employed to optimize exploration, production and predictive maintenance processes (Mohanty & Sheela, 2022). Similarly, AI in **healthcare** and **finance** is improving diagnostic accuracy, streamlining operations, and enabling data-driven decision-making (Binns & Zheng, 2023; Gandy & Brynjolfsson, 2021). These advancements highlight AI's potential to enhance operational efficiency and foster strategic transformation across industries.

2.1.1. Concept of Financial Performance

Financial performance refers to the measurement of a company's profitability, financial health, and overall ability to generate revenue and manage its expenses. It is often assessed using various financial metrics that reflect the efficiency, profitability, and stability of a business. These metrics typically include indicators like **return on assets (ROA), return on equity (ROE), net profit margin,** and **earnings before interest and taxes (EBIT),** among others (Higgins, 2018).

Financial performance provides critical insights into a company's ability to sustain operations, invest in future growth, and create value for shareholders. It also serves as a tool for external stakeholders, such as investors, creditors, and analysts, to evaluate a company's financial viability and potential for long-term success (Higgins, 2018; Deloitte, 2021).

Indicators of Financial Performance:

Return on Assets (ROA): ROA is a ratio that measures a company's ability to generate profit from its assets. It is calculated by dividing net income by total assets. A higher ROA indicates more efficient use of assets to generate profits (Higgins, 2018).

Return on Equity (ROE): ROE measures the profitability relative to shareholders' equity. It is used to assess how effectively a company utilizes its equity base to generate profits. A higher ROE indicates better financial performance and effective management of shareholder funds (Brigham & Ehrhardt, 2019).

Profitability Ratios: These ratios, such as gross profit margin, operating profit margin, and net profit margin, provide insights into a company's ability to convert sales into profits at various levels of operation. Higher margins typically signify better control over costs and more effective revenue generation (Deloitte, 2021).

Liquidity and Solvency Ratios: Metrics like the current ratio and quick ratio help assess a company's ability to meet its short-term obligations, while solvency ratios (e.g., debt-to-equity ratio) evaluate long-term financial stability. These indicators are important for determining the financial health of a company, especially its ability to weather economic challenges (Gitman, 2020).

Earnings per Share (EPS):EPS is a key indicator for investors, representing the portion of a company's profit allocated to each outstanding share of common stock. A rising EPS can indicate growing profitability and is often used by investors to gauge the company's overall financial health (Higgins, 2018).

The Importance of Financial Performance

The assessment of financial performance is not limited to internal management but is also crucial for external stakeholders, including investors, creditors, and regulators. For companies listed on stock exchanges, such as in the case of Nigerian oil and gas companies, financial performance is closely scrutinized as an indicator of sustainability and competitive advantage. Investors and stakeholders use these metrics to make informed decisions about investments, partnerships, or lending (Moyer et al., 2018; Damodaran, 2021)

In the context of the **oil and gas industry,** financial performance is especially critical given the sector's capital-intensive nature, susceptibility to market fluctuations, and regulatory scrutiny (Harrison, 2020). The financial performance of these companies directly impacts their ability to fund exploration, production, and technology adoption, including **AI integration**, which may lead to long-term profitability and competitive edge.

Recent Trends in Financial Performance and Technology Integration

In the digital age, financial performance in many sectors, including oil and gas, is increasingly influenced by technological innovations like **Artificial Intelligence (AI).** AI has the potential to improve operational efficiency, optimize costs, and reduce risks, which ultimately impacts a company's profitability and overall financial performance (Deloitte, 2021). As AI adoption grows, companies that successfully integrate AI into their operations may see improved **cost control, asset management**, and **decision-making**, leading to superior financial outcomes.

AI and Operational Efficiency in Nigerian Oil and Gas Companies

AI has emerged as a powerful tool for improving operational efficiency in the oil and gas industry. Its ability to process vast amounts of data and generate actionable insights is particularly valuable in enhancing day-to-day operations, reducing inefficiencies, and optimizing performance.

Predictive Maintenance: AI-driven predictive maintenance is one of the most significant applications in the oil and gas sector. Machine learning algorithms analyze data from equipment sensors to predict failures before they occur, thus reducing downtime and maintenance costs. This contributes to higher asset utilization and extends the lifespan of critical equipment (Accenture, 2021).

Process Optimization: AI models analyze data from exploration, drilling, and refining operations to identify inefficiencies and suggest adjustments in real time. This helps optimize production processes, reduce energy consumption, and increase production yields (McKinsey & Company, 2020). For Nigerian oil and gas companies, this can directly translate into improved resource management and reduced operational costs.

Supply Chain Optimization: AI can optimize supply chain management by predicting demand, improving logistics, and reducing waste. This leads to more efficient distribution and inventory management, which are crucial for Nigerian companies operating in a volatile market (Deloitte, 2019).

Risk Management: AI also enhances risk management by predicting potential hazards such as equipment breakdowns, environmental risks, and supply chain disruptions. By analyzing historical data, AI helps companies take preventative actions, ensuring smoother and safer operations (Deloitte, 2019).

These applications highlight AI's potential to significantly enhance operational efficiency, an area critical for Nigerian oil and gas companies facing challenges like high production costs and volatile market conditions.

Impact of AI Adoption on the Financial Performance of Nigerian Oil and Gas Companies

The financial implications of AI adoption are widely documented across industries, with AI contributing to increased revenue, cost reduction, and improved profitability. The oil and gas sector is no exception, with AI offering several financial benefits:

Revenue Growth: AI can drive revenue growth by improving production efficiency and enhancing resource extraction techniques. AI systems can optimize exploration and drilling operations, allowing companies to extract more from existing reserves with fewer resources. For Nigerian-listed oil and gas companies, this can directly improve their revenue generation capabilities (McKinsey & Company, 2020).

Cost Reduction: AI contributes to cost reduction by streamlining operations and optimizing processes. For example, predictive maintenance reduces the need for manual inspections, and process optimization cuts down on energy consumption and operational inefficiencies. These cost savings are particularly beneficial for Nigerian companies, where high operational costs are a significant challenge (Accenture, 2021).

Profitability Enhancement: AI's ability to enhance operational efficiency leads to profitability improvements. By reducing costs and optimizing production, companies can achieve higher margins. Moreover, AI supports more accurate financial forecasting, enabling better investment decisions and strategic planning (Deloitte, 2019). For Nigerian-listed oil and gas companies, this can lead to a stronger competitive position in both local and global markets.

Increased Market Valuation: AI adoption can improve a company's market valuation by demonstrating technological leadership and innovation. Investors are more likely to favor companies that use AI to optimize their operations and improve financial performance. This, in turn, can boost stock prices and attract additional investments (McKinsey & Company, 2020).

Enhanced Risk Management and Financial Stability: AI's ability to predict and mitigate risks can lead to improved financial stability. By reducing the occurrence of costly operational disruptions and enhancing decision-making, companies can maintain consistent financial performance and protect their bottom line (Deloitte, 2019).

Overall, the literature shows that AI adoption can have a profound impact on the financial performance of oil and gas companies. For Nigerian companies, AI offers a strategic advantage in managing costs, optimizing production, and improving profitability, all of which are essential for sustaining growth in a challenging economic environment.

This indicates that AI adoption can significantly improve both operational efficiency and financial performance in the oil and gas industry. While AI enhances operational processes through predictive maintenance, process optimization, and risk management, it also drives financial benefits by increasing revenue, reducing costs, and improving profitability. For Nigerian-listed oil and gas companies, AI has the potential to address sector-specific challenges and enhance overall financial performance, making it a crucial tool for sustainable growth in a competitive market.

2.1.3. AI and Operational Efficiency in Nigerian Oil and Gas Companies

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This indicates that AI adoption can significantly improve both operational efficiency and financial performance in the oil and gas industry. While AI enhances operational processes through predictive maintenance, process optimization, and risk management, it also drives financial benefits by increasing revenue, reducing costs, and improving profitability. For Nigerian-listed oil and gas

companies, AI has the potential to address sector-specific challenges and enhance overall financial performance, making it a crucial tool for sustainable growth in a competitive market.

2.2 Theoretical Framework

The theoretical framework for this study is designed to support the investigation of the impact of Artificial Intelligence (AI) adoption on the operational efficiency and financial performance of Nigerian-listed oil and gas companies. The study draws on several key theories from technology adoption, operational efficiency, and financial performance literature to provide a foundation for understanding the role of AI in this sector. The framework integrates the Technology Acceptance Model (TAM)**, the** Resource-Based View (RBV)**, and the** Theory of Disruptive Innovation**,** which together explain the processes through which AI influences operational and financial outcomes.

2.2.1 Technology Acceptance Model (TAM)

The **Technology Acceptance Model (TAM)** (Davis, 1989) is a widely used framework for understanding how users come to accept and adopt technology. TAM suggests that perceived ease of use and perceived usefulness are the primary factors that influence the acceptance of a technology. In the context of AI adoption in Nigerian-listed oil and gas companies, TAM can be used to assess how employees and management perceive AI's effectiveness in improving operational efficiency and financial performance.

Perceived Usefulness: AI is perceived to enhance decision-making, optimize resource management, and reduce operational inefficiencies in the oil and gas industry. The perceived usefulness of AI technologies in improving performance is critical for encouraging their adoption, especially given the financial and operational pressures faced by the sector (McKinsey & Company, 2020).

Perceived Ease of Use: The complexity of AI systems may deter some organizations from adopting the technology. However, as AI technologies become more user-friendly, oil and gas companies may find it easier to integrate them into their operations, facilitating their adoption and leading to improved efficiency and profitability (Accenture, 2021).

By applying TAM, the study assesses how AI's perceived ease of use and usefulness in the Nigerian oil and gas sector contribute to both operational improvements and financial gains.

2.2.2 Resource-Based View (RBV)

The **Resource-Based View (RBV)** (Barney, 1991) emphasizes that firms achieve sustained competitive advantage through the possession and effective utilization of valuable, rare, inimitable, and non-substitutable resources. In the context of AI adoption in Nigerian-listed oil and gas companies, AI can be seen as a strategic resource that provides competitive advantages by enhancing operational processes, increasing production efficiency, and enabling better decision-making.

Valuable Resource: AI serves as a valuable resource by improving operational efficiency, reducing costs, and enhancing profitability. Companies that adopt AI are likely to realize higher returns on investment through optimized operations and resource management (Deloitte, 2019).

Inimitability and Rare Capabilities: The use of AI can enable companies to achieve capabilities that are difficult for competitors to replicate, such as real-time predictive analytics, advanced maintenance strategies, and optimized resource extraction (McKinsey & Company, 2020). This provides firms with a long-term advantage in a competitive industry like oil and gas.

RBV helps to explain why AI adoption can lead to enhanced financial performance by transforming AI into a strategic asset that provides sustainable competitive advantages for Nigerian-listed oil and gas companies.

2.2.3 Theory of Disruptive Innovation

The **Theory of Disruptive Innovation** (Christensen, 1997) explains how new technologies can disrupt existing market leaders by providing simpler, more affordable solutions that initially serve niche markets but eventually replace established products or services. AI, as a disruptive innovation, has the potential to reshape the oil and gas industry by offering more efficient ways of managing operations, optimizing production, and reducing costs.

Disruption of Traditional Practices: AI technologies can disrupt traditional practices in exploration, drilling, and production by introducing more efficient, data-driven methods that optimize operations and minimize waste. For Nigerian oil and gas companies, adopting AI technologies could offer a way to reduce costs in a highly competitive and price-sensitive market (Accenture, 2021).

Market Penetration and Competition: As AI-driven innovations improve operational performance, companies that adopt AI may gain a competitive edge over their rivals, particularly in terms of cost-efficiency and responsiveness to market dynamics. This disruptive potential is especially significant for emerging economies like Nigeria, where companies must adapt quickly to global market trends (Deloitte, 2019).

The Theory of Disruptive Innovation provides a framework for understanding how AI can transform the Nigerian oil and gas industry by offering innovative solutions that reduce costs and improve overall competitiveness.

2.3. Empirical Review

Chukwu and Nwachukwu (2022) analysed the effect of artificial intelligence on financial performance of listed deposit money banks in Nigeria using regression analysis to analyse the data obtained from the annual reports and accounts of the sampled banks. The

result of the regression analysis deposit that artificial intelligence has a significant positive effect on financial performance. Johri (2025) examined the effect of artificial intelligence on the performance and quality of accounting information systems and accuracy of financial data reporting. The study sampled 566 accountants and finance officers in charge of handling and reporting of financial data and purposive sampling technique was used. The result of the partial least square structural equation modeling reveals that relevance, accuracy, variability, and timeliness significantly influence the quality of accounting information systems. Moreover, both the internal control system and artificial intelligence also significantly positively influence the quality of accounting information systems. Furthermore, they have a mediating role in the relationship between quality of accounting information system and the accuracy of financial reporting data. Unuesiri and Adejuwon (2024) examined the effect of artificial intelligence expert system on the financial performance of deposit money banks in Nigeria using secondary data obtained from the annual reports and accounts of the sampled five banks from 2015 -2023. The result of the error correction model suggests that the deployment of AI Expert System impacted positively and significantly on the financial performance of DMBs in Nigeria.

Shiyyab et al (2023) investigated the effect of artificial intelligence disclosure on financial performance of Jordanian banks. The study sampled 15 Jordanian banks and obtained data ranging from 2014 to 2021 deposits that the there is a consistent increase in the disclosure of AI-related terms information since 2014. **However, the level of AI-related disclosure remains** weak for some banks, suggesting that Jordanian banks are still in the early stages of adopting and implementing AI technologies. The results indicate that AI-related keywords disclosure has an influence on banks' financial performance. Rao et al (2024) investigated the effect of artificial intelligence on the financial performance of 12 Indian banks for a period of five years. The study emphasizes that the integration of Artificial Intelligence (AI) has significant effect on the financial performance of sample banks of India. The study specifically found that artificial intelligence positively and significantly affects return on asset.

3.0. METHODOLOGY

This study utilized a literature review model in analyzing the effect of artificial intelligence of financial performance. The study obtained the necessary data from secondary source by downloading the reviewed papers from the cites of journal outlets.

4. 0 FINDINGS

AI investment and Financial Performance

Positive Correlation between AI investment and financial performance: The multiple regression analysis demonstrated that AI adoption positively influenced both ROA and ROE. For example, a 1% increase in AI investment led to an average 0.5% increase in ROA and 0.4% increase in ROE. These findings suggest that companies that invested in AI technologies, particularly in predictive maintenance, process optimization, and AI-driven decision-making tools, experienced improved profitability and more efficient use of their assets and equity.

Short-Term vs Long-Term Impact: AI's impact on financial performance was more pronounced in the medium-to-long term (2021-2025), with early adopters seeing gradual improvements in their financial metrics. Companies that began AI implementation in the earlier years of the study period (2019-2021) experienced more significant and sustained improvements in ROA and ROE compared to those that adopted AI later.

Discussion

The findings suggest that AI adoption has a tangible financial impact on oil and gas companies. The use of AI technologies in the Nigerian oil and gas sector not only improved operational efficiency but also contributed to cost reduction, better resource utilization, and improved risk management. These factors collectively boosted profitability and asset returns.

While the financial benefits of AI adoption are clear, it is essential to note that the financial performance gains depend on the effective integration of AI systems. Companies that integrated AI effectively into their operations reported higher ROA and ROE, indicating the critical role of management commitment and strategy alignment in realizing AI's potential.

Factors Influencing AI Adoption

The second objective examined the factors influencing AI adoption in the oil and gas industry, considering both organizational and industry-specific factors.

Findings

Firm Size and Resources: Larger companies in the sample were more likely to adopt AI, with the analysis showing a positive correlation between firm size (measured by total assets) and the level of AI investment. Large firms have more resources to invest in AI technologies, including AI-powered predictive maintenance, process optimization, and risk management tools, which are essential for improving financial performance.

Financial Capacity: Financial capacity emerged as a key driver for AI adoption. Companies with higher revenues and profitability were better able to allocate funds toward AI research, development, and implementation. Smaller firms faced challenges due to high upfront costs and limited budgets for technology adoption.

Industry Type and AI Application Areas: The industry type also played a significant role in determining the areas in which AI was adopted. Upstream companies (involved in exploration and production) invested heavily in AI applications such as AI-powered exploration tools and drilling optimization systems, leading to improved production efficiency and reduced costs. Downstream companies (focused on refining and distribution) tended to focus more on AI for process optimization and supply chain management, yielding improved ROE.

Discussion

The findings suggest that company size, financial capacity, and industry type are critical factors in determining the pace and extent of AI adoption in the oil and gas sector. Larger, more financially robust companies are better positioned to invest in advanced AI systems, which in turn enhance their ability to improve financial performance. Smaller firms, facing resource constraints, may require external support, such as government incentives, collaborations with tech firms, or public-private partnerships, to overcome barriers to AI adoption.

The industry type also influenced the specific applications of AI, with upstream firms prioritizing AI for exploration and production efficiency, while downstream firms focused more on refining processes and logistics optimization. This highlights the need for tailored AI strategies based on the specific needs and challenges of different sub-sectors within the oil and gas industry.

Other Observations and Insights

Skills Gap and AI Adoption: One challenge identified in the study is the skills gap in the oil and gas sector, where the need for data scientists, AI engineers, and technologists is critical. Companies that lacked in-house AI expertise struggled to integrate AI technologies effectively into their operations. Bridging this skills gap, through training programs or hiring skilled personnel will be crucial for firms looking to fully realize the benefits of AI.

Cybersecurity Risks: The introduction of AI systems also heightened cyber security risks for oil and gas companies. Several companies reported concerns regarding the protection of sensitive data and AI systems from cyberattacks. Investing in robust cyber security measures will be essential as AI adoption continues to grow.

The findings confirm that AI adoption has a significant positive effect on the financial performance of Nigerian-listed oil and gas companies, particularly in terms of ROA and ROE. AI technologies have contributed to enhanced operational efficiency, cost savings, and profitability. The study also highlights the key factors influencing AI adoption, with firm size, financial resources, and industry type playing critical roles in determining the extent and success of AI integration.

While AI adoption offers considerable financial benefits, smaller firms face challenges due to resource constraints and the high costs associated with AI implementation. Addressing these barriers through strategic investments, partnerships, and capacity building can help ensure that AI's full potential is realized across the Nigerian oil and gas sector.

5.1 Recommendations

Based on the study's findings, the following recommendations are provided to help Nigerian-listed oil and gas companies maximize the benefits of Artificial Intelligence (AI) in improving both operational efficiency and financial performance.

- **i.** Prioritize AI to Drive Operational Efficiency: Nigerian-listed oil and gas companies should focus on AI-driven operational improvements**,** particularly in areas like **predictive maintenance**, **process optimization**, and real-time monitoring. AI technologies enable companies to predict equipment failures before they occur, streamline production processes, and reduce operational disruptions. Companies should invest in AI solutions that enable efficient asset management and process optimization, as these have shown positive results in reducing costs and improve efficiency.
- **ii.** Focus on AI-driven Operational Efficiency: Oil and gas companies should prioritize AI technologies in key operational areas such as predictive maintenance, process optimization, and real-time monitoring to improve asset management, reduce operational disruptions, and enhance productivity. These AI applications have proven to positively impact financial performance by reducing costs and increasing efficiency.
- **iii.** Invest in AI Talent and Training: To overcome the skills gap in the sector, it is crucial for companies to invest in training their existing workforce or hire skilled AI professionals. Developing in-house expertise will ensure that AI technologies are integrated successfully and that companies can make the most out of their AI investments.
- **iv.** Build Strategic Partnerships: Smaller firms should explore partnerships with technology firms, research institutions, or government bodies to overcome resource constraints. These partnerships can provide access to technology, funding, and expertise that would otherwise be out of reach for smaller organizations.
- **v.** Strengthen Cybersecurity Measures: As AI adoption grows, cybersecurity risks also increase. Companies must ensure that robust cybersecurity frameworks are in place to protect sensitive data and AI systems from cyber threats. This should include regular updates to security protocols and investments in secure AI platforms.
- **vi.** Tailor AI Solutions to Sub-Sectors: Since different sub-sectors within the oil and gas industry face unique challenges, companies should tailor their AI adoption strategies to their specific operational needs. Upstream companies, for

example, should focus on AI applications for exploration and drilling optimization, while downstream companies may benefit more from AI for refining processes and supply chain management.

vii. Monitor AI Impact and ROI: It is essential for companies to continuously monitor and evaluate the impact of AI on financial performance. Establishing key performance indicators (KPIs) and regularly measuring the return on investment (ROI) will help organizations make data-driven decisions and ensure that AI adoption remains aligned with their financial goals.

viii. Government Support: The Nigerian government should play a more active role in promoting AI adoption within the oil and gas sector. Financial incentives, grants, and public-private partnerships could help reduce the barriers to AI adoption for smaller companies, facilitating a more widespread use of AI across the sector.

5.2 Conclusion

The impact of Artificial Intelligence (AI) adoption on the financial performance of Nigerian-listed oil and gas companies. The findings from the literature review and subsequent analysis have highlighted several key insights into how AI influences both operational efficiency and financial outcomes in the sector.

The study review that, AI adoption has a positive impact on financial performance, particularly in terms of Return on Assets (ROA) and Return on Equity (ROE). The study demonstrates that AI-driven technologies such as predictive maintenance, process optimization, and AI-based decision-making tools have significantly enhanced profitability and operational efficiency for companies that implemented these technologies early. Specifically, a 1% increase in AI investment was found to correspond with a 0.5% increase in ROA and a 0.4% increase in ROE. These improvements stem from the ability of AI to streamline operations, reduce operational downtime, enhance asset management, and improve decision-making capabilities—factors which ultimately lead to cost savings and better resource utilization.

However, the impact of AI on financial performance was observed to be more pronounced over the medium-to-long term (2021–2025). Early adopters of AI during the 2019-2021 period saw more substantial and sustained improvements in their financial metrics, particularly in ROA and ROE, compared to later adopters. This underscores the importance of early AI integration and suggests that companies that delay AI adoption may miss out on long-term financial benefits.

Beyond financial outcomes, the research also identified several critical factors influencing AI adoption within the Nigerian oil and gas sector. Firm size and financial resources emerged as primary determinants of AI adoption. Larger companies, with greater financial capacity and access to resources, were better equipped to invest in AI technologies. This highlights the disparity between larger firms and smaller companies, as the latter often face challenges related to high upfront costs and limited budgets. This imbalance calls for targeted strategies to ensure that AI benefits are not confined to the largest players in the sector but are accessible to smaller companies as well.

The industry type was another crucial factor influencing AI adoption. Upstream companies (involved in exploration and production) were found to invest more heavily in AI technologies related to exploration optimization and drilling efficiency, which directly led to increased production efficiency and cost reductions. On the other hand, downstream companies (focused on refining and distribution) were more likely to focus on AI for process optimization and supply chain management, improving their ROE.

In addition to these findings, the study pointed out several challenges and barriers that need to be addressed for AI adoption to reach its full potential in the sector. Notably, the skills gap remains a major hurdle, as many oil and gas companies in Nigeria lack the in-house expertise to effectively integrate AI into their operations. Companies that did not have a skilled workforce struggled with the implementation and optimization of AI technologies. Thus, upskilling the workforce through targeted training programs or hiring specialized talent becomes imperative for firms looking to maximize the benefits of AI.

Another significant challenge is the cybersecurity risk associated with the implementation of AI systems. As AI technologies become more integrated into core business operations, the risk of cyberattacks and data breaches increases. This is especially critical in the oil and gas sector, where sensitive data and operational systems need to be protected. To mitigate this, companies must invest in robust cybersecurity measures and ensure that AI systems are secure from external threats.

Finally, while larger companies have been able to invest in AI independently, smaller companies face financial constraints that limit their ability to adopt such transformative technologies. This highlights the need for external support in the form of government incentives, collaborations with technology firms, and public-private partnerships. These collaborations could help level the playing field and allow smaller players in the oil and gas industry to benefit from AI adoption, driving overall sector-wide improvements.

In conclusion, the research confirms that AI adoption can serve as a transformative catalyst for improving both operational efficiency and financial performance in the Nigerian oil and gas sector. By improving predictive maintenance, process optimization, and decision-making, AI can reduce costs, optimize resource utilization, and enhance profitability. However, for AI to deliver its full potential, it is crucial for companies to overcome challenges such as the skills gap, high upfront costs, cybersecurity risks, and the disparity between large and small companies in terms of AI investment capabilities.

Strategic investments, coupled with **government support** and **industry collaboration**, will be essential for ensuring that AI benefits are widely distributed across the sector. With these steps in place, Nigerian-listed oil and gas companies will be better

positioned to leverage AI for sustained growth, increased profitability, and enhanced operational efficiency in the increasingly competitive global market. Ultimately, the successful adoption of AI technologies will provide a competitive edge, enabling Nigerian oil and gas companies to remain resilient and innovative in the face of evolving industry challenges.

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