# Analyzing the Impact of the Adoption of Cloud Computing on Small and Medium Enterprises

**Bala Fatimah Kawu[1], Felix Ale[2,3], Rajesh Prasad[1], Emmauel Segun Shokenu[1], Jude Adeleke[1], Abdullahi Ayegba[1]**

[1]Department of Computer Science, African University of Science and Technology, Garki, Abuja, Nigeria

[2] Department of Systems Engineering, Institute of Space Science & Engineering, African University of Science & Technology, Abuja, Nigeria

[3] Centre for Space Earth Station & Observatory, National Space Research & Development Agency, Eruwa, Oyo State, Nigeria

**Paper Number: 240347**

***Abstract:***

*This study examines the impact of cloud computing adoption on small and medium enterprises (SMEs) in Nigeria, focusing on performance, sustainability, and competitiveness. Using survey data from SMEs across diverse sectors, the research applied quantitative analysis to evaluate adoption trends, benefits, and challenges. The results reveal that 89.1% of respondents have adopted cloud services, with significant improvements reported in efficiency (86.8%), cost reduction (86.3%), enhanced security (85.7%), and revenue growth (86.5%). Sectoral analysis shows that technology driven industries such as Fintech and Information Technology derive the greatest benefits, while traditional sectors like Manufacturing and Pharmaceuticals demonstrate slower but growing adoption. Comparative findings indicate that adopters consistently outperform non-adopters in business outcomes, confirming cloud computing as a strategic enabler of growth and sustainability. However, challenges including high costs, limited infrastructure, regulatory uncertainties, and cybersecurity concerns continue to hinder full utilization. The study concludes that cloud adoption not only strengthens SME performance but also positions the sector as a driver of national economic development, while highlighting the need for policies, infrastructure investment, and awareness initiatives to address persistent barriers.*

***Keywords:*** *Cloud Computing, Small and Medium Enterprises (SMEs), Nigeria, Digital Transformation, Competitiveness, Cybersecurity, Adoption Challenges*

## Introduction

The adoption of cloud computing has emerged as a transformative force for small and medium-sized enterprises (SMEs) across the globe, reshaping how businesses manage operations, store data, and deliver services. Cloud computing provides SMEs with cost-effective access to advanced technologies that were previously limited to large corporations, enabling them to compete effectively in a rapidly evolving digital economy (Odukoya, 2024). By reducing capital expenditure on IT infrastructure and promoting scalability, SMEs are increasingly leveraging cloud technologies to enhance operational efficiency, improve decision-making, and foster innovation (Jayeola et al., 2022).

In the Nigerian context, the adoption of cloud computing among SMEs has gained momentum due to its potential to address long-standing challenges such as poor infrastructure, high operational costs, and limited technological expertise (Ogidiaka et al., 2022). Despite these benefits, barriers such as inadequate internet penetration, cultural resistance, security concerns, and regulatory gaps still hinder widespread adoption. Studies have emphasized that while SMEs recognize the potential benefits of cloud technologies, practical adoption remains inconsistent across different sectors of the Nigerian economy (Ahmed & Saidu, 2022; Odero, 2021).

Globally, scholars have also noted the strategic role of cloud computing in driving sustainability and long-term competitiveness of SMEs. For instance, Al-Mutawa and Al Mubarak (2024) argue that cloud adoption enhances digital resilience and sustainability, while Oke et al. (2023) highlight barriers to implementation in developing economies such as Nigeria. Similarly, Oyewobi et al. (2023) underscore how digital technologies, including cloud computing and social media, significantly influence the performance of SMEs in Abuja and other parts of the country. These findings suggest that cloud adoption is not only a technological issue but also a socio-economic and cultural phenomenon that impacts organizational growth.

Awareness and perception of cloud technologies play an important role in shaping adoption decisions among SMEs. Duorinaa (2021) stresses that awareness levels among entrepreneurs strongly influence the pace of adoption, while Yakubu et al. (2024) reveal that socio-cultural and technological factors equally affect SME performance in Nigeria. Collectively, these insights highlight the need for further empirical studies to understand the impact of cloud adoption in Nigerian SMEs, especially in

relation to performance, sustainability, and competitiveness. This study, therefore, seeks to bridge this gap by investigating the impact of cloud computing adoption on SMEs in Nigeria.

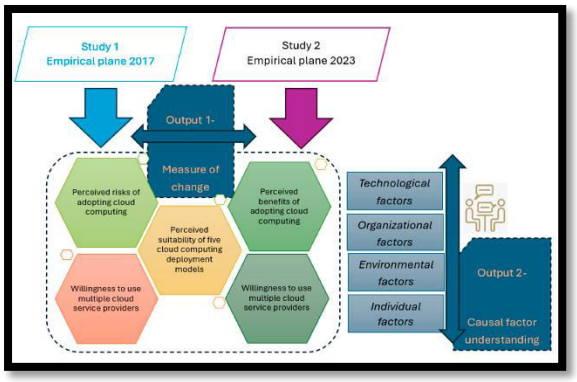


**Figure 1.** Empirical framework comparing perceptions of cloud adoption factors in Montenegrin SMEs across 2017 and 2023 (from "A Longitudinal Study on the Adoption of Cloud Computing in Micro, Small, and Medium Enterprises in Montenegro," *Applied Sciences*, 2024).

Figure 1 show that the adoption of cloud computing among small and medium enterprises (SMEs) can be understood through a comparative analysis of two empirical studies carried out in 2017 and 2023, highlighting the changes in perception over time. The diagram illustrates how initial concerns such as the perceived risks of adopting cloud computing and the willingness to use multiple providers evolved into greater emphasis on the perceived benefits and suitability of deployment models. It further connects these outcomes to broader technological, organizational, environmental, and individual factors, which together provide a deeper causal understanding of adoption patterns. Essentially, the figure demonstrates a shift from risk-oriented views to benefit-driven motivations, showing how SMEs increasingly recognize cloud computing as a valuable tool for efficiency, scalability, and innovation (Ognjanovi, Sendelj, DakoviC-Tadić, & KoZuh, 2024).

## II. Purpose of the Research

The purpose of this research is to examine the impact of cloud computing adoption on the performance and sustainability of small and medium enterprises (SMEs) in Nigeria. It seeks to identify the factors influencing adoption, the challenges faced, and the perceived benefits of cloud technologies among SMEs. This will provide insights for policymakers, service providers, and business owners to enhance adoption strategies and improve SME competitiveness (Jayeola et al., 2022; Odukoya, 2024; Al-Mutawa & Al Mubarak, 2024).

This research will be answering the following questions;

1. To what extent has the adoption of cloud computing influenced the performance and competitiveness of SMEs in Nigeria?

2. What factors determine the level of adoption of cloud computing among SMEs in Nigeria?
3. What challenges and barriers do SMEs in Nigeria face in the adoption and effective utilization of cloud computing?

## III. Review of Related Literature

Information and Communication Technology (ICT) has become a vital strategy for the growth and sustainability of small and medium-sized enterprises (SMEs), particularly in developing economies like Nigeria. Agwaniru (2023) emphasizes that the integration of ICT enhances SMEs' competitiveness by improving operational efficiency and providing access to global markets. In this context, cloud computing has been highlighted as a critical infrastructure that reshapes enterprise IT environments, enabling flexibility, cost savings, and scalability (Adeoye & Osibo, 2023). Furthermore, studies on cloud accounting adoption in SMEs reveal that organizational, technological, and environmental factors significantly influence implementation, as evidenced in Oman (Tawfik, Durrah, Hussainey, & Elmaasrawy, 2023). Similar concerns about trust and related challenges have been raised in the UK, where SMEs face barriers to adopting cloud computing due to issues of data privacy and reliability (Oyemike, 2023).

Trust has also emerged as a moderating factor in shaping cloud adoption intentions, especially in knowledge-intensive sectors such as academic libraries in North-Eastern Nigeria, where Yakubu, Kassim, and Husin (2025) demonstrated its critical role in adoption behavior. In the Nigerian construction industry, Omer et al. (2023) identified barriers such as cost, policy limitations, and technological readiness that hinder effective cloud utilization, while Oke, Kineber, Alsolami, and Kingsley (2023) further validated through structural equation modeling that cloud tools significantly contribute to sustainable construction practices. Beyond sector-specific challenges, digital transformation has been recognized as a driver of Nigerian SMEs' integration into the global business landscape, fostering innovation and resilience (Unegbu, Yawas, & Dan-Asabe, 2024). Collectively, these studies suggest that while cloud computing and ICT adoption hold transformative potential for SMEs, issues of trust, cost, and infrastructural readiness remain persistent challenges that shape the pace and extent of adoption.

## IV. Impact of cloud computing on SMEs

Cloud computing has had a profound impact on the growth and competitiveness of small and medium enterprises (SMEs), particularly in developing economies. By providing scalable

infrastructure, reduced IT costs, and access to advanced digital tools, cloud adoption enables SMEs to compete on a global scale and improve operational efficiency (Adeoye & Osibo, 2023; Unegbu, Yawas, & Dan-Asabe, 2024). It has been shown to enhance financial management through cloud-based accounting systems that improve transparency and decision-making (Tawfik, Durrah, Hussainey, & Elmaasrawy, 2023). Furthermore, trust and security remain crucial determinants of how SMEs realize these benefits, as highlighted in both developed and developing contexts (Oyemike, 2023; Yakubu, Kassim, & Husin, 2025). In Nigeria, cloud computing also plays a role in sustainability, particularly in sectors such as construction, where it supports innovation and resource efficiency despite barriers of cost and infrastructure (Omer et al., 2023; Oke, Kineber, Alsolami, & Kingsley, 2023). Overall, the adoption of cloud computing strengthens SMEs by promoting digital transformation, improving service delivery, and positioning them for long-term sustainability in competitive markets (Agwaniru, 2023).

**Table 1: Impact of cloud computing on SMEs**

| Impacts | Descriptions |
|---|---|
| **Cost Reduction and Control** | Cloud computing reduces upfront IT infrastructure costs by allowing SMEs to pay only for the services they use on a subscription or pay-as-you-go basis. This leads to increased efficiency and cost savings, making advanced IT tools affordable for smaller firms (Adeoye & Osibo, 2023; Unegbu, Yawas, & Dan-Asabe, 2024). |
| **Enhanced Business Value** | By outsourcing infrastructure and routine IT management to cloud providers, SMEs can devote more energy to enhancing business value and strategic objectives, rather than being overwhelmed by technical challenges (Agwaniru, 2023). |
| **Scalability and Flexibility** | Cloud services allow SMEs to easily scale operations up or down |

| | |
|---|---|
| | depending on demand. This flexibility ensures that businesses can expand their IT resources without heavy capital investments, supporting agility and competitiveness (Omer et al., 2023). |
| **Sustainability and Innovation** | In sectors such as construction, cloud adoption fosters sustainability by promoting resource efficiency, reducing waste, and supporting digital innovation (Oke, Kineber, Alsolami, & Kingsley, 2023). |
| **Improved Financial Management** | Cloud-based accounting enhances transparency, accuracy, and decision-making in SMEs by providing real-time access to financial data (Tawfik, Durrah, Hussainey, & Elmaasrawy, 2023). |

## V. Challenges of Cloud Computing

Despite its transformative potential, the adoption of cloud computing by SMEs is hindered by several challenges. Cost implications, lack of adequate infrastructure, and limited technical expertise are among the most cited barriers in developing economies like Nigeria (Omer et al., 2023). Trust-related issues, including concerns about data privacy, security, and reliability, have also slowed adoption across both developed and developing contexts, as SMEs remain cautious about migrating sensitive business information to the cloud (Oyemike, 2023; Yakubu, Kassim, & Husin, 2025). In addition, regulatory and policy uncertainties often discourage organizations from fully embracing cloud technologies, particularly in sectors that demand high compliance such as finance and construction (Oke, Kineber, Alsolami, & Kingsley, 2023). Beyond these, low awareness levels and cultural resistance to technological change continue to pose barriers, further widening the gap between the potential of cloud computing and its actual utilization among SMEs (Agwaniru, 2023; Unegbu, Yawas, & Dan-Asabe, 2024).

**Table 2 Challenges of Cloud Computing**

| Challenges | Descriptions |
|---|---|
| **High Cost and Limited Infrastructure** | Despite reducing some expenses, initial subscription fees, integration costs, and inadequate internet infrastructure remain significant obstacles for SMEs in Nigeria (Omer et al., 2023). |
| **Trust and Security Concerns** | Many SMEs are reluctant to adopt cloud computing due to concerns over data privacy, system reliability, and unauthorized access. Trust remains a moderating factor influencing adoption decisions (Oyemike, 2023; Yakubu, Kassim, & Husin, 2025). |
| **Regulatory and Policy Barriers** | Lack of clear regulations and compliance frameworks, especially in finance and construction, discourage SMEs from fully transitioning to the cloud (Oke, Kineber, Alsolami, & Kingsley, 2023). |
| **Awareness and Cultural Resistance** | Low awareness levels about cloud benefits, coupled with socio-cultural resistance to technological change, reduce adoption rates among SMEs in Nigeria (Agwaniru, 2023; Unegbu, Yawas, & Dan-Asabe, 2024). |

**Theoretical Framework**

This study is anchored on the Technology-Organization-Environment Framework (TOE), which explains organizational technology adoption through three contextual dimensions: technological, organizational, and environmental factors. The technological context refers to characteristics of the innovation such as perceived cost advantage, compatibility, security, and complexity; the organizational context includes internal factors such as firm size, management support, financial capacity, and IT readiness; while the environmental

context captures external pressures including regulatory frameworks, competitive intensity, and infrastructural conditions. Prior studies have shown that cloud computing adoption among SMEs is influenced by technological benefits and organizational preparedness (Jayeola et al., 2022; Ahmed & Saidu, 2022), as well as contextual challenges such as infrastructure limitations and regulatory uncertainty in Nigeria (Ogidiaka et al., 2022; Omer et al., 2023). Furthermore, research indicates that digital technologies enhance SME sustainability and competitiveness when organizational and environmental conditions are supportive (Al-Mutawa & Saeed Al Mubarak, 2024; Unegbu et al., 2024). Given that cloud adoption in Nigerian SMEs is shaped not only by technological attributes but also by internal capacity and external environmental constraints, the TOE framework provides a comprehensive and context-sensitive theoretical foundation for analyzing adoption determinants and their impact on SME performance in Nigeria.

**Research Gap and Study Contribution**

Although prior studies have examined cloud computing adoption among SMEs, existing literature presents several limitations. Many studies primarily focus on conceptual discussions or general determinants of adoption without linking adoption to measurable performance outcomes. For instance, Jayeola et al. (2022) conducted a systematic literature review identifying determinants of cloud adoption but emphasized the need for further empirical validation, particularly in developing economies. Similarly, Ahmed and Saidu (2022) reviewed technology adoption models but did not provide large-scale empirical performance comparisons within a national context.

In the Nigerian setting, studies such as Ogidiaka et al. (2022) and Duorinaa (2021) examined adoption challenges and awareness levels but were largely descriptive and limited in sectoral breadth. While Omer et al. (2023) and Oke et al. (2023) investigated barriers to cloud implementation, their analyses were concentrated within the construction sector, thereby limiting cross-sector generalizability. Likewise, Yakubu et al. (2025) explored trust as a moderating factor in adoption intention within academic institutions rather than SMEs broadly. These sector-specific approaches restrict a holistic understanding of cloud adoption across Nigeria's diverse SME ecosystem.

Furthermore, although studies such as Al-Mutawa and Saeed Al Mubarak (2024) and Unegbu et al. (2024) highlight the role of digital technologies in enhancing SME

sustainability and global competitiveness, limited empirical research has quantitatively compared cloud adopters and non-adopters to determine whether adoption translates into statistically observable performance advantages. Most Nigerian studies emphasize determinants or perceived benefits without conducting comparative performance analysis between adopting and non-adopting firms.

Additionally, international studies such as Ognjanović et al. (2024) provide longitudinal insights into cloud adoption dynamics; however, similar large-scale empirical evidence remains scarce within the Nigerian SME context. While Odukoya (2024) discusses the transformative potential of cloud computing for SMEs, the study does not incorporate multi-sector empirical comparison using a substantial sample size.

Therefore, a significant gap exists in the literature regarding large-scale, cross-sectoral, performance-based comparative analysis of cloud adoption among Nigerian SMEs.

This study addresses these gaps by analyzing data from 659 SMEs across fourteen industry sectors in Nigeria. Unlike prior research, this study:

1. Quantitatively compares cloud adopters and non-adopters within the same national context.
2. Measures actual performance outcomes (efficiency, revenue growth, cost reduction, security perception, competitiveness).
3. Integrates sectoral variation to assess differences across digital and traditional industries.
4. Employs a Technology Organization Environment (TOE) perspective to provide a structured theoretical foundation.

By combining large-sample empirical analysis, sectoral comparison, and performance measurement within a unified framework, this study offers a more comprehensive and context-sensitive understanding of cloud computing adoption and its impact on SMEs in Nigeria.

## VII. Research Methodology

This study employs a quantitative approach to examine the impact of cloud computing on SMEs in Nigeria. Data was obtained from 659 SMEs across sectors such as ICT, construction, education, and services through structured questionnaires. The responses were analyzed using Python for data analysis, applying descriptive statistical techniques to identify adoption trends and sectoral variations. The use of Python ensures accuracy, efficiency, and reproducibility of results, providing a strong basis for generating meaningful insights and practical recommendations (Creswell & Creswell, 2018).

## VIII. Method of Data Collection

For this study, data was collected using closed ended questionnaires, which are widely regarded as one of the most effective instruments for educational and social research due to their ability to gather structured responses from a large sample. The questionnaire was designed to capture information on the adoption and impact of cloud computing among SMEs in Nigeria. It comprised two sections: the first section focused on respondents' biodata, enabling the classification and categorization of participants, while the second section contained items directly aligned with the three research questions outlined in the introduction. This structure ensured that the survey responses provided relevant insights into the extent of cloud computing adoption, the influencing factors, and the challenges faced by SMEs in Nigeria.

## IX. Data Analysis

Data analysis was carried out through the application of machine learning methods using Python.

### Distribution of Respondents by Industry Sector

Figure 1 illustrate te distribution of respondents by industry sector reveals that the majority of SMEs surveyed are in the Fintech sector (34.5%), reflecting the rapid growth of digital finance and financial technology adoption in Nigeria. This is followed by Information Technology (13%), showing the critical role of IT-driven enterprises in leveraging cloud solutions. Other notable sectors include Pharmaceuticals (7.5%), Tech (7.4%), and Manufacturing (6.1%), which indicates that cloud computing adoption is not limited to service-oriented businesses but is also spreading across production and healthcare industries. Smaller but significant shares are observed in IT Consulting (3.5%), Small Businesses (3.3%), Transport (3.3%), Travel (3.2%), and Electronics (3.0%), reflecting the diverse application of cloud technologies across Nigeria's SME landscape.

This wide distribution across 14 sectors underscores the importance of cloud computing as a cross-cutting technology influencing different aspects of business operations. While Fintech and IT dominate due to their reliance on digital infrastructure, industries such as Energy, EdTech, Interior Design, Conglomerates, and Media, though smaller in proportion, demonstrate the increasing recognition of cloud computing as a driver of efficiency, scalability, and competitiveness. The spread across sectors provides a robust foundation for analyzing sector-specific challenges, opportunities, and the overall transformative impact of cloud adoption on SMEs.

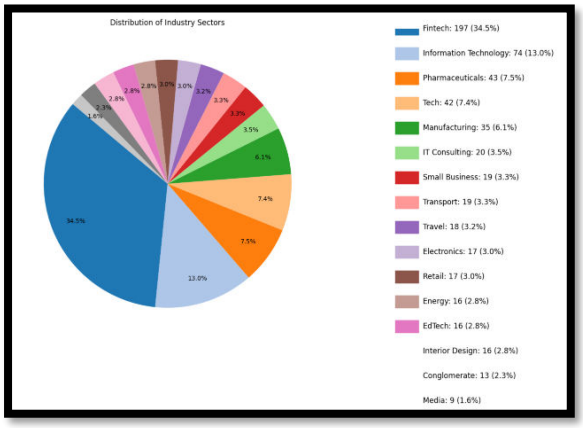


**Figure 2:** Percentage Distribution of SMEs Across Industry Sectors in Nigeria?

## Distribution of Respondents by Age Group

Figure 3 shows the distribution of respondents by age group indicates a fairly balanced representation across different age categories, with slight variations. The 18–20 age group accounts for 21.2% of the respondents, closely followed by those aged 27–29 (20.8%), 21–23 (20.3%), and 30+ (20.3%), showing that younger and middle aged individuals are almost equally engaged in SMEs adopting cloud computing. The smallest proportion is the 24–26 age group (17.3%), though still a significant share. This distribution highlights that cloud computing adoption within SMEs is not limited to a specific age demographic but is instead embraced across a diverse age range, reflecting inclusivity in technological adoption and the involvement of both early career and more experienced professionals.

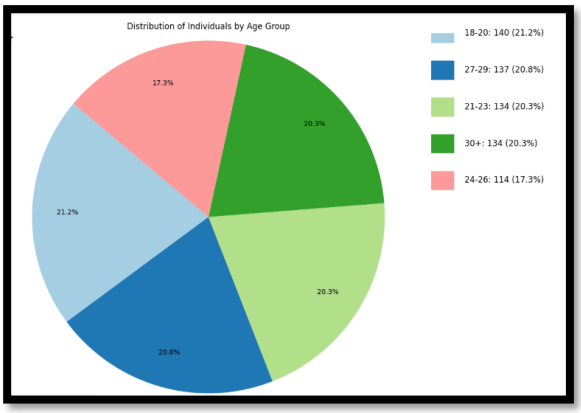


**Figure 3:** Percentage Distribution of SME Respondents Across Age Groups in Nigeria

## Distribution of Cloud Service Used

The distribution of cloud services used by SMEs, as illustrated in Figure 4, shows a nearly equal adoption of the three main service models, highlighting the diverse ways cloud technologies are utilized. Software as a Service (SaaS) takes the lead with 34.0%, reflecting its strong appeal among SMEs due to its affordability, ease of implementation, and access to ready-to-use applications without major infrastructure costs. This is closely followed by Platform as a Service (PaaS) at 33.8%, which indicates that many businesses are taking advantage of development platforms to efficiently build, test, and deploy applications. Infrastructure as a Service (IaaS) accounts for 32.2%, demonstrating that a considerable number of

SMEs rely on scalable computing and storage resources to meet operational demands. The near-even distribution across all three models underscores that Nigerian SMEs are adopting cloud solutions in a balanced way, tailoring services to fit their unique business needs.

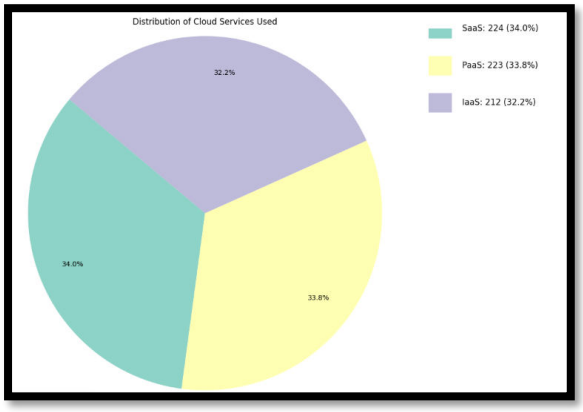


**Figure 4:** Percentage Distribution of Cloud Service Models (SaaS, PaaS, IaaS) Adopted by SMEs in Nigeria

## XI. Analysis of the Impact of Cloud Adoption Among SMEs

Table 3 presents the adoption of cloud computing among SMEs. Out of all respondents, 587 (89.1%) reported adopting cloud services, while only 72 (10.9%) have not. This overwhelming adoption rate demonstrates a clear shift toward cloud-based solutions, reflecting SMEs' recognition of the technology's benefits such as efficiency, scalability, and cost reduction. The findings suggest that cloud computing is no longer an emerging trend but is steadily becoming a mainstream practice among SMEs in Nigeria.

**Table 3: cloud adoption among smes**

| ADOPTED_CLOUD | Count | Percentage (%) |
|---|---|---|
| **YES** | 587 | 89.100000 |
| **NO** | 72 | 10.900000 |

Table 2 presents the distribution of responses across four key impact variables of cloud adoption among SMEs. On average, 86.3% of respondents reported positive outcomes, while only 13.7% disagreed, indicating a consistently high acceptance rate. Specifically, more than four out of five SMEs acknowledged improvements in efficiency, cost reduction, security, and revenue growth. This statistical consistency underscores the significant role of cloud computing in driving measurable business performance among Nigerian SMEs.

**Table 2: Distribution of Responses on Key Impact Variables of Cloud Adoption Among SMEs**

| Variable | Response | Count | Percentage (%) |
|---|---|---|---|
| **Improved_Efficiency** | Yes | 572 | 86.800000 |

| | | | |
|---|---|---|---|
| **Improved_Efficiency** | No | 87 | 13.200000 |
| **Reduced_Costs** | Yes | 569 | 86.300000 |
| **Reduced_Costs** | No | 90 | 13.700000 |
| **Enhanced_Security** | Yes | 565 | 85.700000 |
| **Enhanced_Security** | No | 94 | 14.300000 |
| **Revenue_Growth** | Yes | 570 | 86.500000 |
| **Revenue_Growth** | No | 89 | 13.500000 |

Figure 5 illustrates the distribution of Yes/No responses for improved efficiency, reduced costs, enhanced security, and revenue growth among SMEs. In all four variables, a significantly larger proportion of respondents selected Yes, confirming that cloud adoption is widely perceived as beneficial. This consistency demonstrates the strong positive impact of cloud technologies on SMEs' operational and financial performance in Nigeria.

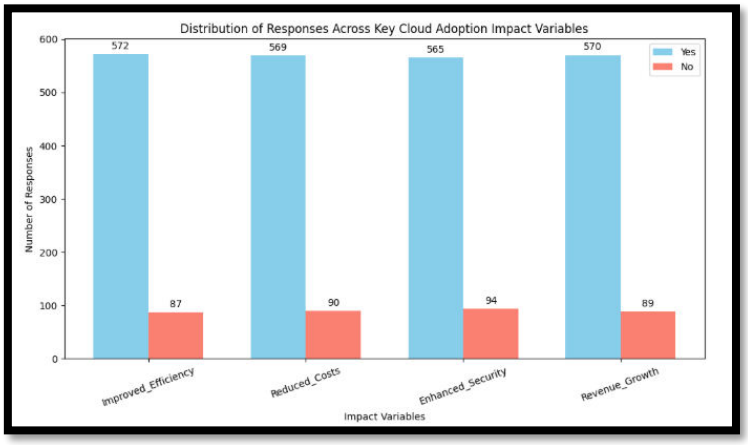


**Figure 5:** Distribution of Responses Across Key Cloud Adoption Impact Variables

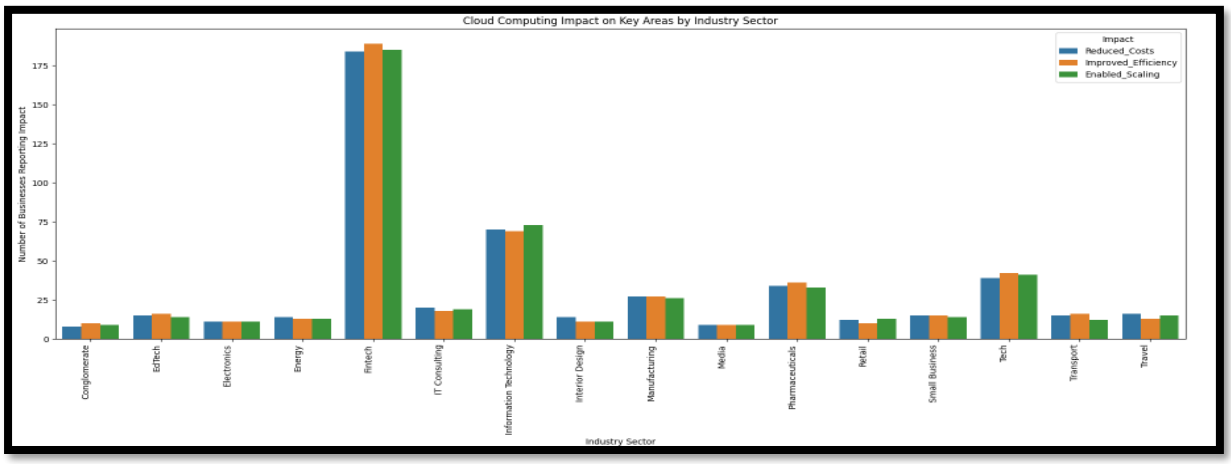


**Figure 6:** Cloud Computing Impact on Key Areas by Industry Sector

Figure 6 illustrates how cloud adoption influences SMEs differently across sectors in terms of cost reduction, efficiency, and scalability. Fintech and IT sectors report the highest benefits, showing strong alignment with digital infrastructure needs, while Manufacturing and Pharmaceuticals demonstrate moderate but growing gains. The pattern indicates that industries closer to technology adoption achieve faster performance improvements compared to traditional sectors. This supports the study's objective of analyzing sectoral variations in the impact of cloud computing on SME competitiveness and sustainability.

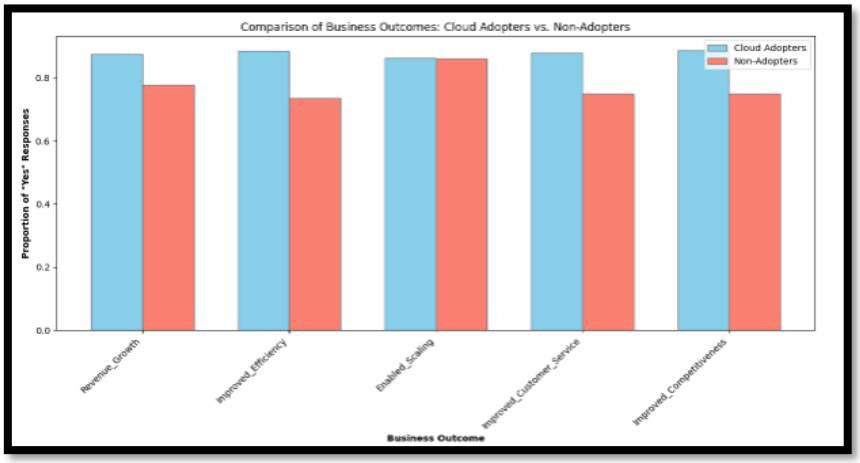


**Figure 7: Comparative Business Outcomes Between Cloud Adopters and Non-Adopters**

Figure 7 shows that SMEs adopting cloud services consistently report higher improvements in revenue growth, efficiency, customer service, and competitiveness compared to non-adopters. While scaling capability appears similar across both groups, adopters clearly achieve stronger overall business outcomes.


**Figure 8: Reported Performance Effects of Cloud Service Models (IaaS, PaaS, SaaS) among SMEs**

Figure 8 illustrates that SMEs using SaaS and PaaS report more diverse performance benefits compared to IaaS users. SaaS is strongly associated with backup, disaster recovery, and remote access, while PaaS emphasizes innovation and scalability. In contrast, IaaS users mainly benefit from avoiding infrastructure costs and overbuilding. These findings suggest that SaaS and PaaS deliver broader business value for Nigerian SMEs.

The impact analysis demonstrates that cloud adoption significantly enhances SME performance by driving cost reduction, operational efficiency, scalability, and competitiveness across sectors. Technology driven industries such as Fintech and IT record the strongest benefits, while traditional sectors show more gradual improvements. Comparative results further reveal that adopters consistently achieve superior outcomes in revenue growth, customer service, and innovation compared to non-adopters. The findings establish cloud adoption as a strategic catalyst for strengthening performance and ensuring long-term sustainability among Nigerian SMEs.

## XII. Analyzing the Challenges of the SMEs on the Cloud Platform

Despite the significant benefits of cloud adoption, many Nigerian SMEs continue to face barriers that hinder full utilization of cloud services. These challenges range from high costs and limited infrastructure to trust, security, regulatory, and cultural issues. Analyzing these obstacles is essential to understand adoption gaps and develop strategies that ensure SMEs maximize the value of cloud computing.

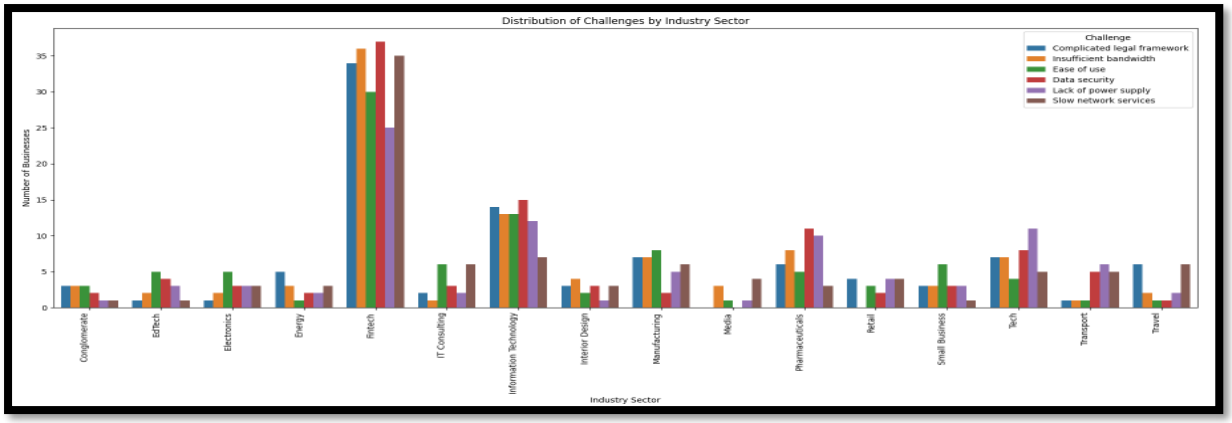


Figure 9: Distribution of Challenges by Industry Sector

Figure 9 illustrates the distribution of challenges experienced across various industry sectors. The data reveals that Fintech businesses face the highest concentration of challenges, particularly in areas such as ease of use, data security, lack of power supply, and slow network services, each exceeding 30

reported instances. Similarly, the IT Consulting and Pharmaceutical sectors report notable concerns with insufficient bandwidth and data security, while Retail and Manufacturing sectors experience moderate but consistent challenges across all categories. Interestingly, even traditionally less tech-reliant sectors like Energy, Education, and Transport still report critical issues, underscoring that challenges such as lack of power supply and insufficient bandwidth are pervasive across industries, not limited to technology-driven businesses.

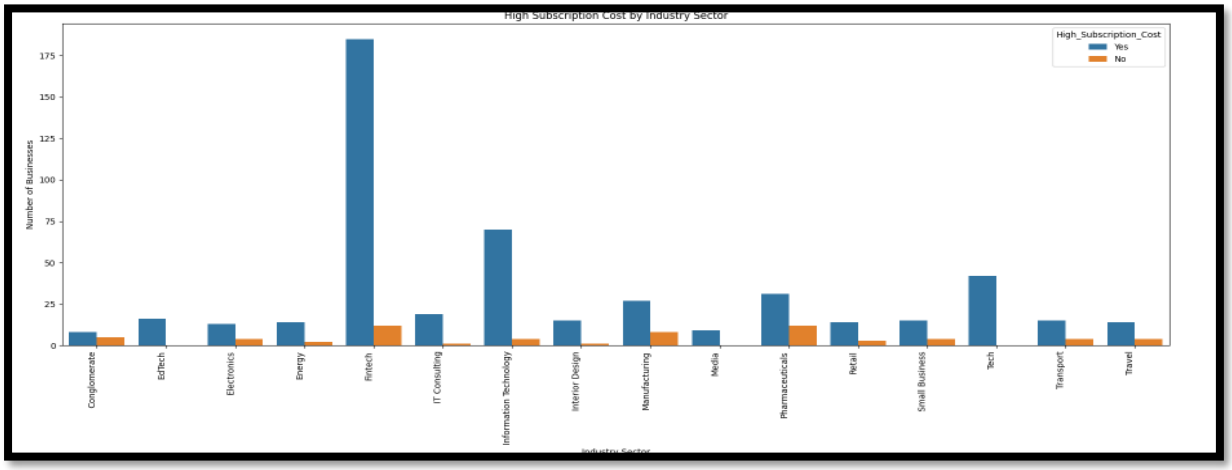


**Figure 10: High Subscription Cost by Industry Sector**

Figure 10 highlights the prevalence of high subscription costs as a barrier to cloud adoption across industries. Once again, Fintech leads with over 180 businesses reporting high subscription costs, followed by IT Consulting (around 70), Pharmaceuticals (about 35), and Tech (about 45). In comparison, sectors such as Education, Energy, Retail, and Transport report relatively lower numbers, generally fewer than 20 businesses per sector. The dominance of Fintech in this figure emphasizes the sector's reliance on digital infrastructure and subscription-based services, making high costs a critical concern. The pattern shows that while subscription costs affect nearly all industries, digital-first sectors like Fintech, IT Consulting, and Tech are disproportionately impacted due to their heavy dependence on cloud-based solutions.

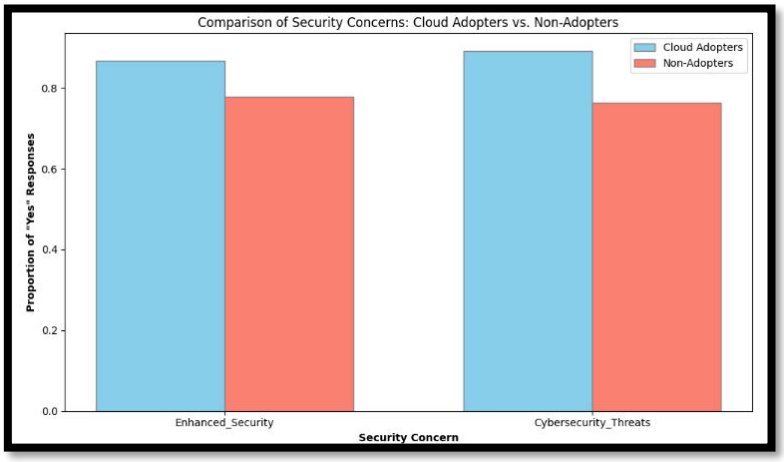


**Figure 11: Comparative Perceptions of Enhanced Security and Cybersecurity Threats Among Cloud Adopters and Non-Adopters**

Figure 11 highlight security as both a motivating factor and a persistent challenge for SMEs adopting cloud technologies. On one hand, the majority of adopters (86.71%) recognize enhanced security as a clear benefit of cloud services compared to non-adopters (77.78%). On the other hand, the higher proportion of adopters (89.10%) reporting cybersecurity threats relative to non-adopters (76.39%) suggests that greater reliance on the cloud also increases SMEs' exposure to digital risks. This dual perception reinforces the idea that while cloud adoption strengthens protective mechanisms, concerns over cyber threats remain a significant barrier to broader adoption. Addressing these concerns through stronger security frameworks, awareness campaigns, and tailored regulatory policies will be critical to ensuring SMEs can fully harness the benefits of cloud computing.

## XIII. Discussion

From the above analysis, it is evident that the adoption of cloud computing offers substantial benefits to Nigerian SMEs, enhancing efficiency, reducing operational costs, and improving competitiveness across industries. The results show that more than 86% of adopters reported gains in revenue growth, efficiency, and customer service, while sectoral analysis revealed that Fintech and IT enterprises enjoy the strongest advantages due to their digital orientation. In contrast, traditional industries such as Manufacturing and Pharmaceuticals recorded more gradual improvements, highlighting that the extent of impact is closely tied to sector-specific readiness and technological integration. Moreover, comparative findings between adopters and non-adopters further underscore that SMEs leveraging cloud services consistently outperform their counterparts in key business outcomes, positioning cloud

adoption as a critical enabler of growth and sustainability.

Despite these positive outcomes, the findings also reveal persistent challenges that shape the adoption process. Cost barriers, limited infrastructure, and regulatory uncertainties continue to hinder SMEs, particularly in resource-constrained sectors. Security remains a dual factor while 86.71% of adopters perceive enhanced protection, a higher percentage (89.10%) also acknowledge facing cybersecurity threats compared to non-adopters, reflecting the paradox of increased reliance on cloud systems. Additionally, issues of awareness and cultural resistance slow down adoption among older or less tech driven SMEs. These results suggest that while the potential of cloud computing is widely recognized, achieving its full benefits requires targeted policies, improved infrastructure, enhanced security frameworks, and continuous awareness campaigns. Together, these insights confirm that cloud adoption is both a driver of performance and a field of ongoing challenges for Nigerian SMEs.

## XIV. Conclusion

SMEs in Nigeria that have embraced cloud computing are already reaping immense benefits in efficiency, cost reduction, scalability, and competitiveness. These gains position them to contribute significantly to national economic development, as a more productive SME sector translates into improved goods and services for the local market. The widespread adoption of cloud technology will also foster a more skilled workforce, enhance GDP contributions, and strengthen the digital economy. Furthermore, it has the potential to reduce unemployment by creating new opportunities in innovation driven industries, thereby discouraging the persistent migration of young Nigerians in search of better prospects abroad. With increased competitiveness, SMEs can expand into export markets, reducing the heavy dependence on imports and easing pressure on the naira. Ultimately, cloud adoption strengthens SMEs as the engine of economic growth, advancing Nigeria's aspiration of becoming a globally competitive and digitally resilient economy.

## Reference

1. Odukoya, O. (2024, May). The transformative impact of cloud computing on small and medium-sized enterprises (smes): A comprehensive analysis. In *2024 International Conference on Smart Applications, Communications and Networking (smartnets)* (pp. 1-5). IEEE.

2. Jayeola, O., Sidek, S., Abd Rahman, A., Mahomed, A. S. B., & Hu, J. (2022). Cloud computing adoption in small and medium enterprises (smes): A systematic literature review and directions for future research. *International Journal of Business and Society*, *23*(1), 226-243.
3. Ogidiaka, E., Ogwueleka, F. N., Irhebhude, M. E., & Orji, U. (2022). Local cloud computing service adoption in Nigeria: challenges and solutions. *Int. J. Inf. Technol. Comput. Sci.(IJITCS)*, *14*(4), 1-13.
4. Oyewobi, L., Adedayo, O. F., Olorunyomi, S. O., & Jimoh, R. A. (2023). Influence of social media adoption on the performance of construction small and medium-sized enterprises (smes) in Abuja–Nigeria. *Engineering, Construction and Architectural Management*, *30*(9), 4229-4252.
5. Ahmed, A. A., & Saidu, A. A. (2022). Understanding determinants of cloud computing adoption: A review of technology adoption models. *International Research Journal of Science, Technology, Education, and Management*, *2*(2), 226-241.
6. Odero, E. A. (2021). *Framework for Adoption of Cloud Computing by Small and Medium-Sized Enterprises in Meru County* (Doctoral dissertation, kemu).
7. Al-Mutawa, B., & Saeed Al Mubarak, M. M. (2024). Impact of cloud computing as a digital technology on smes sustainability. *Competitiveness Review: An International Business Journal*, *34*(1), 72-91.
8. Oke, A. E., Farouk Kineber, A., Abdel-Tawab, M., Abubakar, A. S., Albukhari, I., & Kingsley, C. (2023). Barriers to the implementation of cloud computing for sustainable construction in a developing economy. *International Journal of Building Pathology and Adaptation*, *41*(5), 988-1013.
9. Duorinaa, E. (2021). AWARENESS LEVEL OF CLOUD COMPUTING SERVICES AMONG SMES. *Journal of Engineering, Applied Science and Humanities (JEASH)*.
10. Yakubu, M., Adamu, A., & Umar, H. U. (2024). Effect Of Socio-Cultural And Technological Factors On Perfor-Mance Of Small And Medium Scale Enterprises (Smes) In Nasarawa State, Nigeria. *Fulafia International Journal of Business and Allied Studies*, *2*(2), 168-189.

11. Ognjanović, I., Šendelj, R., Daković-Tadić, M., & Kožuh, I. (2024). A longitudinal study on the adoption of cloud computing in micro, small, and medium enterprises in Montenegro. *Applied Sciences, 14*(14), 6387.
12. Agwaniru, A. (2023). *ICT as a strategy for sustainable small and medium enterprises in Nigeria* (Doctoral dissertation, California Baptist University).
13. Adeoye, E., & Osibo, B. (2023). Cloud Infrastructure and Enterprise IT Environment. *International Journal of Latest Technology in Engineering, Management & Applied Science*, *12*(09), 22-30.
14. Tawfik, O. I., Durrah, O., Hussainey, K., & Elmaasrawy, H. E. (2023). Factors influencing the implementation of cloud accounting: evidence from small and medium enterprises in Oman. *Journal of Science and Technology Policy Management*, *14*(5), 859-884.
15. Oyemike, V. C. (2023). *Trust and related challenges influencing cloud computing adoption by UK SMEs* (Doctoral dissertation, Anglia Ruskin Research Online (ARRO)).
16. Yakubu, A. S., Kassim, A. M., & Husin, M. H. (2025). Moderating the role of trust toward intention to adopt cloud computing by academic libraries in North-Eastern Nigerian. *Journal of Librarianship and Information Science*, *57*(2), 551-567.
17. Omer, M. M., Kineber, A. F., Oke, A. E., Kingsley, C., Alyanbaawi, A., Rached, E. F., & Elmansoury, A. (2023). Barriers to using cloud computing in sustainable construction in Nigeria: a fuzzy synthetic evaluation. *Mathematics*, *11*( 4), 1037.
18. Unegbu, H. C., Yawas, D. S., & Dan-Asabe, B. (2024). the Impact of Digital Transformation on Nigerian Small and Medium-Sized Enterprises (Smes) in the Global Business Landscape. *Jurnal Mekanikal*, 66-85.
19. Oke, A. E., Kineber, A. F., Alsolami, B., & Kingsley, C. (2023). Adoption of cloud computing tools for sustainable construction: A structural equation modelling approach. *Journal of Facilities Management*, *21*(3), 334-351.
20. Agwaniru, A. (2023). *ICT as a strategy for sustainable small and medium enterprises in Nigeria* (Doctoral dissertation,

California Baptist University).

21. Adeoye, E., & Osibo, B. (2023). Cloud infrastructure and enterprise IT environment. *International Journal of Latest Technology in Engineering, Management & Applied Science, 12*(09), 22–30.
22. Tawfik, O. I., Durrah, O., Hussainey, K., & Elmaasrawy, H. E. (2023). Factors influencing the implementation of cloud accounting: Evidence from small and medium enterprises in Oman. *Journal of Science and Technology Policy Management, 14*(5), 859–884.
23. Oyemike, V. C. (2023). *Trust and related challenges influencing cloud computing adoption by UK SMEs* (Doctoral dissertation, Anglia Ruskin Research Online (ARRO)).
24. Yakubu, A. S., Kassim, A. M., & Husin, M. H. (2025). Moderating the role of trust toward intention to adopt cloud computing by academic libraries in North-Eastern Nigerian. *Journal of Librarianship and Information Science, 57*(2), 551–567.
25. Omer, M. M., Kineber, A. F., Oke, A. E., Kingsley, C., Alyanbaawi, A., Rached, E. F., & Elmansoury, A. (2023). Barriers to using cloud computing in sustainable construction in Nigeria: A fuzzy synthetic evaluation. *Mathematics, 11*(4), 1037.
26. Unegbu, H. C., Yawas, D. S., & Dan-Asabe, B. (2024). The impact of digital transformation on Nigerian small and medium-sized enterprises (SMEs) in the global business landscape. *Jurnal Mekanikal*, 66–85.
27. Oke, A. E., Kineber, A. F., Alsolami, B., & Kingsley, C. (2023). Adoption of cloud computing tools for sustainable construction: A structural equation modelling approach. *Journal of Facilities Management, 21*(3), 334–351.