© APR 2026 | IRE Journals | Volume 9 Issue 10 | ISSN: 2456-8880
DOI: https://doi.org/10.64388/IREV9I10-1716299

Blockchain and Cloud Adoption in Health Information Systems: Evidence from a Nigerian Case Study

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Abstract- ***The digital transformation of healthcare systems increasingly relies on advanced technologies such as blockchain and cloud computing to enhance data security, accessibility, and operational efficiency. This study investigates the challenges and opportunities associated with adopting these technologies in clinical environments, using Kelina Hospital in Abuja, Nigeria, as a primary case study. A qualitative research design was employed, combining case study analysis with secondary data from academic literature, industry reports, and comparative hospital experiences. The findings reveal that early clinician involvement, continuous training, pilot testing, and cross-functional collaboration significantly influence successful Health Information Technology (HIT) adoption. The study applies the Technology Acceptance Model (TAM) and Change Management Theory to interpret adoption dynamics. Results indicate that organizational and human factors are as critical as technological capabilities. The study concludes with practical recommendations for healthcare institutions seeking to implement secure and scalable digital health systems.***

Index Terms- ***Blockchain; Cloud Computing; Health Information Technology (HIT); Electronic Health Records (EHR); Technology Acceptance Model (TAM); Cybersecurity in Healthcare.***

I. INTRODUCTION

The digital transformation of healthcare systems has become a critical priority in the 21st century, driven by the need to improve service delivery, enhance patient safety, and ensure efficient data management. Health Information Technology (HIT), particularly Electronic Health Records (EHRs), has significantly improved healthcare outcomes by enabling better clinical decision-making, reducing medical errors, and enhancing care coordination (Enahoro et al., 2023; Cresswell & Sheikh, 2015). However, traditional health information systems often rely on centralized architectures that are vulnerable to data breaches, limited interoperability, and inefficiencies in data sharing across institutions (Kassab et al., 2019; Saladdin & Handayani, 2025).

Emerging technologies such as cloud computing and blockchain are increasingly being explored to address these limitations. Cloud computing provides scalable, flexible, and cost-effective solutions for storing and managing large volumes of healthcare data, enabling real-time access and facilitating telemedicine and remote care services (Moghaddasi & Tabrizi, 2016; Hu et al., 2025). Additionally, the integration of big data analytics and artificial intelligence within cloud environments has further enhanced healthcare delivery by supporting predictive modeling and strategic decision-making (Akter et al., 2023; Nong et al., 2025).

Blockchain technology, on the other hand, introduces a decentralized and secure framework for managing sensitive health data. By leveraging cryptographic techniques and distributed ledger systems, blockchain ensures data integrity, transparency, and immutability, thereby addressing critical concerns related to data tampering and unauthorized access (Atadoga et al., 2024; Khan et al., 2026). Permissioned blockchain systems, in particular, have shown promise in healthcare environments by balancing transparency with privacy requirements (Hossain et al., 2024). Furthermore, blockchain-based applications such as smart contracts can automate processes including patient consent management and data access control, thereby improving operational efficiency (Velmovitsky et al., 2021; Nagar & Manoharan, 2024).

Despite these advantages, the adoption of blockchain and cloud technologies in healthcare remains uneven, particularly in developing regions. Challenges such

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as high implementation costs, limited technical expertise, infrastructural constraints, and regulatory uncertainties continue to hinder widespread adoption (Fayez et al., 2024; Agbeyangi et al., 2024). Additionally, concerns regarding scalability, energy consumption, and integration complexity further complicate implementation efforts (Guang-jian & Foysal, 2021; Salih & Kashmar, 2024).

Given these challenges, there is a growing need to critically examine the opportunities and barriers associated with blockchain and cloud adoption in healthcare. This study aims to explore these dynamics within a clinical context, providing insights into how healthcare institutions can effectively leverage these technologies to enhance data security, interoperability, and overall system performance.

II. MATERIALS AND METHOD

Research Design

This study adopts a qualitative research design combining case study analysis with secondary data review. The case study method is appropriate for investigating complex organizational phenomena such as technology adoption within real-world contexts where the boundaries between phenomenon and context are not clearly defined.

Case Study Selection

The primary case study is Kelina Hospital, Abuja, Nigeria, selected due to its engagement with digital health initiatives and its representation of a typical healthcare institution operating within a developing country context . Comparative insights were drawn from hospitals in Nigeria, the United States, and Kenya.

Data Collection

The study relies on secondary data sources including:

Table 1. Data Sources

Source Type	Examples
Academic literature	Peer-reviewed journal articles on Health IT adoption, blockchain in healthcare, cloud computing
Industry reports	Digital health market analyses, technology vendor white papers
Government and NGO publications	WHO reports, Nigerian Federal Ministry of Health documents, health system assessments
News and professional media	Healthcare IT news, case study reports from professional organizations

Data was collected through systematic searches of academic databases (PubMed, Google Scholar, IEEE Xplore) and targeted searches of government and industry websites. Search terms included combinations of electronic health records, blockchain healthcare, cloud computing hospital, Health IT adoption Nigeria, and digital health developing countries.

Data Analysis

First, thematic analysis was utilized to examine the secondary data sources in depth. This approach involved carefully reviewing the literature, reports, and case study materials to identify recurring patterns, trends, and relationships associated with the adoption of blockchain and cloud technologies in healthcare settings. Through an iterative coding process, key themes such as implementation challenges, success factors, user acceptance, infrastructural constraints, and organizational readiness were identified and categorized. This method enabled the researcher to synthesize diverse sources of information into coherent themes that reflect common experiences and critical determinants of Health Information Technology adoption.

In addition to thematic analysis, a SWOT (Strengths, Weaknesses, Opportunities, and Threats) analysis was conducted to provide a structured evaluation of the case study hospital. This analytical framework facilitated a comprehensive assessment of both internal and external factors influencing the adoption of blockchain and cloud technologies. The strengths and weaknesses focused on internal organizational capabilities, such as existing digital infrastructure, workforce readiness, and technical expertise, while opportunities and threats examined external influences, including regulatory frameworks, technological advancements, market trends, and cybersecurity risks. By integrating SWOT analysis, the study was able to present a balanced and strategic

understanding of the hospital's readiness and potential for successful technology implementation.

Theoretical Framework

This study is grounded in two well-established theoretical frameworks that provide a comprehensive lens for understanding technology adoption within healthcare organizations: the Technology Acceptance Model (TAM) and Change Management Theory.

The Technology Acceptance Model (TAM) serves as a foundational framework for explaining how users come to accept and utilize new technologies. It posits that two primary factors—perceived usefulness and perceived ease of use significantly influence an individual's intention to adopt a system. In the context of healthcare, this implies that clinicians and other healthcare professionals are more likely to embrace blockchain and cloud-based systems when they perceive that these technologies will enhance their job performance, improve patient care, and be relatively easy to learn and operate. Thus, TAM provides valuable insight into user behavior and highlights the importance of designing systems that align with clinical workflows and user expectations.

Complementing TAM, Change Management Theory emphasizes the organizational and human dimensions of technology implementation. It recognizes that the successful adoption of new systems extends beyond technical deployment and requires careful management of organizational change processes. This includes active stakeholder engagement, effective communication, leadership support, and continuous training. The theory also underscores the importance of iterative implementation strategies, such as pilot testing and phased rollouts, which allow organizations to adapt to new technologies gradually while minimizing disruption. By integrating Change Management Theory, the study acknowledges that sustainable digital transformation in healthcare depends on both technological innovation and the ability of organizations to manage change effectively.

III. RESULTS AND DISCUSSION

SWOT Analysis: Kelina Hospital

The SWOT analysis of Kelina Hospital reveals a nuanced readiness for the adoption of blockchain and cloud-based health information systems, shaped by both enabling factors and structural constraints within the Nigerian healthcare environment. On the one hand, the hospital demonstrates notable institutional strengths, including an existing foundation of digital infrastructure and a workforce that is receptive to technology-driven healthcare delivery. Its status as a private institution further enhances its agility in decision-making and investment, while its location in Abuja provides relatively better access to internet services and IT support. These factors collectively position the hospital as a viable candidate for digital transformation.

However, the analysis also highlights critical internal weaknesses that may hinder seamless adoption. The limited availability of blockchain expertise and existing staff training gaps suggest that significant capacity-building efforts will be required. Additionally, financial constraints and potential system integration challenges indicate that implementation may not be straightforward, particularly when aligning new technologies with legacy systems.

Table 2. Strengths

Factor	Description
Existing digital infrastructure	The hospital has implemented basic IT systems and electronic documentation
Skilled healthcare workforce	Medical professionals demonstrate openness to technology-assisted care
Private institution status	Greater flexibility in technology investment decisions compared to public hospitals
Urban location	Better access to internet connectivity and IT service providers in Abuja

Table 3. Weaknesses

Factor	Description
Limited blockchain expertise	Technical knowledge of blockchain architecture and implementation is scarce
Resource constraints	Budget limitations may restrict investment in advanced technologies
Integration challenges	Existing systems may not easily interface with new blockchain or cloud platforms
Staff training	Healthcare workers may require

Factor	Description
gaps	significant training to adopt new digital tools

Table 4. Opportunities

Factor	Description
Government digital health initiatives	Nigerian government support for digital health may provide funding or policy support
Growing cloud adoption	Increasing availability of cloud services tailored to healthcare needs
Partnership potential	Opportunities for collaboration with technology vendors, universities, or international health organizations
Patient demand	Growing patient expectations for digital access to health information

From an external perspective, several opportunities exist to support adoption. These include increasing governmental interest in digital health initiatives, the expanding availability of cloud-based healthcare solutions, and the potential for strategic partnerships with academic and technology institutions. Furthermore, rising patient expectations for digital access to healthcare services create a demand-driven incentive for innovation.

Conversely, threats such as cybersecurity risks, regulatory uncertainties, infrastructural instability, and dependence on external vendors underscore the complexity of implementation. These factors suggest that while adoption is feasible, it must be approached strategically, with attention to risk mitigation and sustainability.

Table 5. Threats

Factor	Description
Cybersecurity risks	Digital health systems are attractive targets for cyberattacks
Regulatory uncertainty	Legal frameworks for blockchain-based health data remain underdeveloped
Infrastructure reliability	Power supply and internet connectivity remain inconsistent
Vendor dependency	Reliance on external technology providers may create long-term risks

The findings of this study are consistent with existing scholarly literature, which emphasizes that the successful adoption of blockchain and cloud technologies in healthcare is not merely a function of technological availability but is strongly influenced by organizational readiness, governance structures, and user acceptance. Studies on health information technology implementation have shown that hospitals often face socio-technical challenges, where human factors and institutional processes play a decisive role in determining success (Cresswell & Sheikh, 2015; Saladdin & Handayani, 2025). In this context, the readiness observed at Kelina Hospital aligns with broader evidence that private and urban healthcare institutions are better positioned to adopt emerging digital health innovations.

The importance of clinician involvement identified in this study is strongly supported by the literature on digital health systems and electronic health records. Research indicates that user-centered design and stakeholder engagement are critical to ensuring that systems are effectively integrated into clinical workflows and improve patient outcomes (Enahoro et al., 2023; Hu et al., 2025). Similarly, blockchain-based healthcare solutions, such as the Hyperledger Fabric implementation reported by Agbeyangi et al. (2024), highlight that early engagement of healthcare professionals enhances system usability, trust, and adoption. This reflects the broader consensus that technologies perceived as useful and easy to use are more likely to be accepted in practice.

Furthermore, the findings underscore the critical role of capacity building and training, which has been widely identified as a major determinant of digital health adoption in developing contexts. Fayez et al. (2024) argue that affordability and adoptability challenges, including limited digital literacy, significantly constrain the implementation of health technologies in emerging economies. Without adequate training, healthcare workers may resist or underutilize new systems, thereby limiting their potential benefits. This aligns with evidence from cloud computing applications in healthcare, where successful deployment depends on user competence and institutional support structures (Moghaddasi & Tabrizi, 2016).

The study also highlights the importance of cross-functional collaboration, which is consistent with

research on IT governance and healthcare system integration. Effective implementation of blockchain and cloud technologies requires coordination among clinicians, IT professionals, and administrators to ensure interoperability, data security, and workflow alignment (Kassab et al., 2019; Hossain et al., 2024). Blockchain, in particular, introduces additional complexities related to privacy, scalability, and regulatory compliance, necessitating a multidisciplinary approach to system design and deployment (Atadoga et al., 2024; Khan et al., 2026). Moreover, the relevance of pilot testing and phased implementation strategies identified in this study is supported by empirical and review-based research. Incremental deployment allows healthcare institutions to address technical challenges, improve system performance, and build user confidence before full-scale implementation (Velmovitsky et al., 2021). This approach is particularly important in environments with infrastructural limitations, such as inconsistent power supply and internet connectivity, which remain key barriers in many developing healthcare systems.

Finally, the identified threats such as cybersecurity risks, regulatory uncertainty, and vendor dependency are widely documented in the literature on blockchain and digital health. While blockchain enhances data integrity and transparency, it also introduces new security considerations and governance challenges (Nagar & Manoharan, 2024; Salih & Kashmar, 2024). Similarly, the evolving regulatory landscape for digital health technologies necessitates adaptive policy frameworks to ensure safe and effective implementation.

In summary, the findings suggest that while Kelina Hospital demonstrates promising readiness for blockchain and cloud adoption, successful implementation will depend on aligning technological innovation with organizational capacity, stakeholder engagement, and robust governance mechanisms, as consistently emphasized across the literature.

IV. CONCLUSION

This study examined the adoption of blockchain and cloud technologies in healthcare, highlighting both opportunities and challenges within a developing country context. The findings indicate that successful Health IT implementation depends on a combination of technological innovation and effective organizational strategies.

Key determinants of success include clinician involvement, continuous training, cross-functional collaboration, and pilot testing. The study also reinforces the relevance of the Technology Acceptance Model and Change Management Theory in understanding healthcare technology adoption. Ultimately, healthcare institutions must adopt a holistic approach that integrates technical, organizational, and human factors to achieve sustainable digital transformation.

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