

Technology Review of the Nigerian National Health Insurance Authority: Gaps and Strategic Digital Interventions

¹Rukayat Abdulkarim and ²Joshua Abah

¹African Aviation and Aerospace University, Abuja.

²Nile University of Nigeria, Abuja.

*Corresponding authors' email: joshua.abah@nileuniversity.edu.ng

ABSTRACT

The National Health Insurance Authority (NHIA) Act of 2022, which replace the Nigeria's National Health Insurance Scheme (NHIS) as the country's health insurance system, represents a significant paradigm shift in the quest for Universal Health Coverage (UHC). However, Nigerians are yet to fully tap the intended benefits of the scheme due to existing operational and technological limitations. This technical review paper presents a system analysis report of how technology is adopted to enhance the operations of the scheme by adopting the system analysis and design to software engineering approach. In this approach, an extensive operational and technological system study of the NHIA scheme was conducted. Interviews, record review, and physical inspection of operational processes were used to gather information. Records shows that basic gaps exists in data integration, interoperability, claims processing, and service provider monitoring which has greatly impacted on the effective delivery of the scheme leading to revenue leakage, poor access to healthcare, inadequate healthcare delivery, and poor record system. This paper therefore presents a proposal design which is a locally tailored digital framework; robust, optimize operations, minimize revenue leakage, and scale health equity across Nigeria. The proposed design addressed existing technological and operational gaps which will be implemented to provide a National Health Information Management Framework based on a National Electronic Health Record (EHR) platform that is centralized and capable of providing an improved health outcome and enrollee experience.

Received: 26 Aug. 2026

Accepted: 19 Sept. 2026

Published: 24 Sept. 2026

Keywords: Digital Health, Digital Intervention, Enrolle access, Healthcare delivery, Nigerian Health Insurance Authority, Technology

INTRODUCTION

The National Health Insurance Scheme (NHIS) was established to ensure that all Nigerians, regardless of location or financial level, have equitable, accessible, and continuous access to healthcare services. The scheme enables enrollees to select their preferred Health Maintenance Organisations (HMOs) and healthcare providers (Federal Republic of Nigeria, 2022). All Nigerian citizens and legal residents were required by law to have health insurance when the NHIS changed to the National Health Insurance Authority (NHIA) in May 2022 (Federal Republic of Nigeria, 2022). The authors (Adewale, 2024; Ajayi *et al.* 2022) noted that despite this progressive legislative shift, majority of people are at risk of incurring enormous out-of-pocket medical expenses because real population coverage is still below 10%. One key characteristics of the NHIA subscribers is frequent mobility; where enrollees can relocate or change location any time away from their healthcare providers. In a highly mobile population such as Nigeria, a location-based, and provider-specific strategy has become less effective. Workers are frequently relocated, redeployed, promoted, or transferred due to societal demands, economic pressures, professional obligations, or security concerns. This create gaps in healthcare access since the current NHIA framework is largely static and does not sufficiently accommodate this degree of mobility. According to Oluwasina *et al.* (2026); Ajayi *et al.* (2022), although financial, socio-political, and structural factors also play a significant role in the service delivery and low enrolment figures, the absence of a contemporary, integrated, and robust information and

communication technology (ICT) infrastructure in the existing NHIA capable of overseeing a decentralized, multi-tiered health ecosystem is a major structural barrier. The mandate to "provide and maintain ICT infrastructure and capability for the integration of all data on health schemes in Nigeria" is specified by Section 1(I) of the NHIA Act 2022. To achieve this mandate, a comprehensive system analysis of the existing operating architectures, the discovery of technical flaws, and the development of dependable digital interventions are all required.

For instance, the inability to transfer medical records is a serious problem. Here, majority of healthcare facilities still use digital systems that are isolated from one another or paper-based data. This implies that when patients switch providers or change location, it is difficult to transmit their medical histories. At best, they provide a medical summary and leave the enrollees to provide a verbal narration of their health conditions. As a result, medical errors are more common, tests are often repeated, healthcare expenses rise, and continuity of service is jeopardized. Furthermore, there is still no cohesive national health data infrastructure, and health information systems from hospitals, HMOs, and NHIA are operated in a fragmented and disjointed manner. Hence, effective planning, monitoring, decision-making, and fraud detection inside the system are all weakened due to these lapses.

To address such challenges, Cloud computing, blockchain technology, artificial intelligence (AI), mobile health solutions, and interoperable health information systems are examples of recent technological developments that provide

workable, scalable, and long-lasting solutions to these challenges (Oluwasina *et al.* 2026). By utilizing these technologies, NHIA would be able to meet its primary mandate of providing equitable and continuous healthcare access for all Nigerians by transitioning from a paper-dependent, location-bound system to a smart, digital, and patient-centered national health insurance framework. Therefore, this paper provide a technology-oriented system analysis of the NHIA to identify technological and operational gaps which when implemented could provide a National Health Information Management Framework based on a National Electronic Health Record (EHR) platform that is centralized and capable of providing an improved health outcome and enrollee participation.

MATERIALS AND METHODS

To better understand the exiting NHIA scheme, the system analysis and design (SAD) approach to software engineering was adopted. System Analysis and Design (SAD) is a structured approach used in software engineering to understand a problem or organizational need, determine the

requirements of a proposed information system, and design a solution that effectively meets those requirements (Satzinger *et al.* 2016; Senn, 1989). It provides a bridge between identifying a problem and developing a working software system. Data was collected using interview, physical inspection, and record review data collection techniques.

Structural and Architectural Review of the Current NHIA System

The administrative organogram of the NHIA technological ecosystem consists of three layers (see figure 1), namely:

- The regulator (NHIA), which accredits actors, manages the Basic Health Care Provision Fund (BHC PF), and oversees regulatory framework.
- The intermediaries like the mutual health associations (MHAs) and health maintenance organizations (HMOs) handle operational purchasing and risk pooling.
- The providers, which include primary, secondary, and tertiary healthcare facilities (HCFs).

The administrative structure of the NHIA technological ecosystem is represented in figure 1.

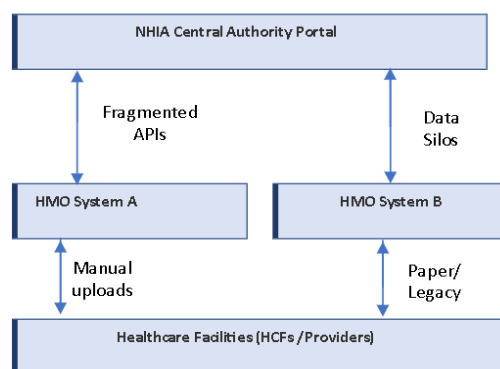


Figure 1: Administrative Structure of the NHIA Technological Ecosystem

Typically, the operational data route functions in four areas:

- Enrollee Identity Management (EIM): Decentralized enrolment captures information from State Social Health Insurance Agencies (SSHIA) and regional offices. Instead of real-time, data synchronization with national registers is still mostly batch-driven.
- Premium Collection and Fund Allocation (PCFA): This is handled by the government sector remittance guidelines and the Central Bank of Nigeria's Treasury Single Account (TSA) system for formal sector capitations.
- Encounter Management and Claims Billing (EMCB): This relies primarily on paper-based formats submitted by HCFs to individual HMOs or legacy electronic portals.
- Enrollee Encounter Verification (EEV): This is managed at point-of-care using physical identity cards, paper rosters, or isolated, offline verification files.

Technological Gaps and Vulnerabilities

A thorough system audit reveals systemic technical constraints that reduce productivity, encourage premium leaks, and deteriorate user satisfaction. The core technological vulnerabilities identified in the existing system are highlighted below.

- Disjointed architectural data and lack of interoperability: Different HIMS are used by the NHIA, SSHIA, and private HMOs; hence, the system lacks standard syntactic and semantic interoperability protocols (such as OpenHIM or HL7 FHIR architecture) that prevent automated data exchange (InStrat, 2023). As a result, verifying an enrollee's

data across state borders or between public and private providers requires manual reconciliation. This causes delay and, in most cases, impedes healthcare delivery. It also makes roaming of patients practically impossible, as they cannot access healthcare outside of their registered HCF.

- Vulnerabilities in identity verification and identity cloning

Without an active, real-time cryptographic callback mechanism, the system is vulnerable to identity fraud, dual enrolment, and service cloning, as it relies on physical or simple static QR-code ID cards (Where unauthorized individuals access care using a registered beneficiary's card). The current workflow lacks integration with the National Identity Management Commission (NIMC) API for real-time National Identification Number (NIN) biometric validation at the point of care (Goswami & Mondal, 2026).

- Manual claims processing and fraud propagation

A significant portion of processing secondary and tertiary claims is done by hand or necessitates large spreadsheet downloads. This absence of automated adjudication causes a number of serious problems:

- Prolonged delays in provider reimbursements (often exceeding 60–90 days).
- High rates of administrative mistakes and manual typing vulnerability to billing fraud from dishonest providers, such as upcoding, unbundling, and phantom billing (Voto & Ngepah, 2025).

d. Disjointed supply chain and “Stock-Out” blind spots

Accredited facilities’ pharmacy inventory levels are not visible in real time to the central authority. This gap in visibility creates arbitrary drug out-of-stock reporting (“stock-outs”), which forces enrollees to pay out-of-pocket for medications that are technically covered by their premiums (*Adewale, 2024*).

RESULTS AND DISCUSSION

From the technological gaps and vulnerabilities identified in Section 2.2, the design and implementation of a framework that addresses those gaps becomes an imperative.

Proposed Technological Solutions and Interventions

To address these issues and develop a resilient national health insurance infrastructure, the NHIA should adopt a modular, cloud-native, and API-first architectural framework as presented in figure 2.

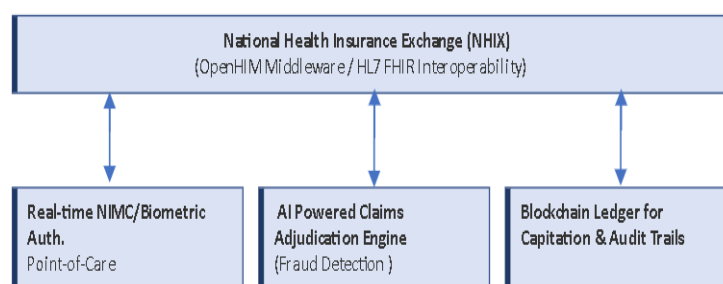


Figure 2: Proposed Modular, Cloud-Native, and API-First Architectural Framework for the NHIA

i. Unified National Health Insurance Exchange (NHIX)

The NHIA should use HL7 FHIR (Fast Healthcare Interoperability Resources) data models to provide a central open-source interoperability middleware layer (e.g., based on OpenHIM or Apache Camel). This architectural layer eliminates data silos while retaining localized autonomy by serving as a centralised routing hub that integrates national, state, and private HMO information in real-time.

ii. Biometric and Cryptographic Point-of-Care Verification

Enrolment systems must directly link a user's National Identification Number (NIN) to their health insurance profile in order to prevent identity fraud. Low-bandwidth, decentralized biometric tokens or time-bound dynamic cryptographic validation through USSD and mobile apps should be used for point-of-care validation. This guarantees that verification can take place offline in remote places and synchronize after a network connection is made (*InStrat, 2023*).

iii. AI-Powered Automated Claims Adjudication Systems
Replacing manual review procedures with an AI-driven, rule-based processing engine can automate to a large percentage, the routine clinical claims task. The technology can quickly identify abnormalities, upcoding, or unusual billing velocity prior to disbursement by directly comparing diagnostic codes (ICD-11) with procedure guidelines, drug pricing indices, and prior-authorization records (*Oluwasina et al. 2026*).

iv. Blockchain-Based Distributed Ledger Technology for Auditable Capitation

An immutable, tamper-proof audit trail is produced by implementing a private, permissioned blockchain ledger (such as Hyperledger Fabric) to monitor fund distributions from the BHC PF and the central NHIA pool to HMOs and primary care providers. This openness ensures that capitation funds consistently reach frontline healthcare facilities by directly combating governance flaws and premium manipulation (*Shuaib et al. 2025*).

v. Roadmap for Strategic Implementation

To provide these technological enhancements in a sustainable manner, the NHIA must ensure a balance between regional infrastructural limitations and high-tech solutions as follows:

a. Phased Rollout: Digital interventions should begin with a multi-phase implementation roadmap to methodically reduce deployment risks:

- i. **Phase 1:** Implement the core NHIX interoperability layer, standardize API specifications, and mandate NIN-to-scheme linkage for all new enrolments, while an update for old enrollees can follow as an update for NIN linkage.
- ii. **Phase 2:** Launch the automated claims engine in a few pilot tertiary institutions, integrate state insurance plans (SSHAs), and implement mobile/USSD offline verification capabilities.
- iii. **Phase 3:** Implement predictive data analytics for public health surveillance and scale complete end-to-end automation across the country.

b. **Hybrid Offline-First Engineering:** An “offline-first” architectural design is required for software systems installed in rural primary healthcare centres (PHCs). These applications store transactional data locally in encrypted SQLite or CouchDB environments and automatically reconcile with the national cloud registry via incremental synchronization when cellular networks (2G/3G) become available.

CONCLUSION

In this paper, a report of system analysis of the NHIA technological adoption was presented. Records showed major operational and technological gaps in the NHIA scheme which include, disjointed architectural data and lack of interoperability, vulnerabilities in identity verification and identity cloning, manual claims processing and fraud propagation, and disjointed supply chain and “Stock-Out” blind spots which are responsible for some of its existing limitations and under-performances in service delivery. The paper proposed a design framework consisting of unified national health insurance exchange, biometric and cryptographic point-of-care verification, AI-powered automated claims adjudication systems, blockchain-based distributed ledger technology, and a roadmap for strategic implementation that addresses those limitations to be implemented in future work.

RECOMMENDATIONS

To achieve the mandate of the NHIA, which is universal healthcare in Nigeria, we recommend that;

1. the authority must be transformed from a disjointed ecosystem into a high-performance digital network.
2. the authority implements an interoperable data interchange which may significantly lower administrative overhead, decrease fraud, and do away with out-of-pocket medical costs.
3. enforce strong identity management through national registries and
4. implement automated claims processing.

Investing in this digital health infrastructure is essential for providing equitable, national healthcare that goes beyond simply improving operations.

ACKNOWLEDGEMENT

This research is funded by Tetfund Institutional Based Research (IBR) of the African Aviation and Aerospace University, Abuja with grant number AAAU/IBR/2026/BATCH 2.

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