DIGITAL HEALTH TECHNOLOGY ADOPTION FOR ENHANCED OPERATIONAL EFFICIENCY IN THE NATIONAL HEALTH INSURANCE AUTHORITY (NHIA) IN SOUTHEAST NIGERIA

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ABSTRACT

The study examined the adoption of digital health technologies to enhance operational efficiency at the National Health Insurance Authority (NHIA) in Southeast Nigeria. The broad objective of this study was to determine how the integration of digital health technologies can enhance operational efficiency at the National Health Insurance Authority (NHIA). The study adopted a cross-sectional survey design. Quantitative data were collected through a structured questionnaire from 408 respondents across selected NHIA provider health facilities, comprising healthcare professionals (clinical and non-clinical staff). Descriptive statistics were analysed using simple percentages and charts, while the Partial Least Squares - Structural Equation Modeling (PLS-SEM) was deployed to test the hypothesized relationships between the study variables with the aid of SmartPLS 4.1 software, ensuring reliability (Cronbach's $\alpha > 0.7$), convergent, and discriminant validity. The findings revealed that digital health technology adoption proxies of electronic health records and electronic claims management systems positively and significantly influence operational efficiency dimensions of patient data accuracy, and process optimisation. The study recommends continuous investment in digital health infrastructure, workforce training, and supportive policy frameworks to institutionalize technology-driven efficiency within NHIA operations. In conclusion, adopting digital health technology presents a sustainable pathway toward achieving transparency, accountability, and optimal performance in Nigeria's health insurance system.

Keywords: Digital Health Technology; Operational Efficiency; Electronic Health Records; Electronic Claims Management; Process Optimisation

1. Introduction

The evolution of technology as a driver of operational efficiency has progressed through successive industrial revolutions that fundamentally reshaped organizational processes. The first and second industrial revolutions mechanized production and introduced electricity, significantly

improving physical labour productivity. The third industrial revolution marked the emergence of digital computing, which enabled automation and computerized data management systems that enhanced workflow coordination and information processing. Currently, the fourth industrial revolution, characterized by advanced technologies such as artificial intelligence (AI), cloud computing, blockchain, big data analytics, and the Internet of Things (IoT), has transformed how organizations design, manage, and optimize operational processes across sectors (Schwab, 2016). In Nigeria, the adoption of technological innovations began gradually with the introduction of computers and telecommunication systems in the 1980s and early 1990s. The expansion of internet connectivity in the mid-1990s marked a turning point, enabling broader digital transformation across industries (Ayotunde, 2012). Over the past two decades, the rapid pace of technological advancement has reshaped the operational efficiency landscape globally and within Nigeria. The healthcare sector, in particular, has benefited significantly from digital transformation initiatives that have addressed administrative inefficiencies and improved service coordination (Davenport & Ronanki, 2018). Innovations such as electronic health records (EHRs), automated billing platforms, telemedicine, mobile health applications, and real-time analytics systems have enhanced both clinical and administrative outcomes by reducing errors, improving accountability, and enabling timely decision-making (WHO, 2019).

Digital health technologies (DHTs) represent an integrated set of systems, tools, and applications that leverage information and communication technologies to support healthcare delivery, management, and monitoring across the continuum of care (Toth, 2024). The adoption of digital health technologies involves embedding these systems into organizational workflows to transform processes, improve stakeholder interactions, and enhance service efficiency (Zaoui & Souissi, 2020; Satuluri, 2021). Organizations that successfully adopt digital technologies are better positioned to achieve operational flexibility, enhance collaboration, and respond to changing service demands (Hanelt et al., 2020). Within the healthcare sector, technology adoption has been associated with improved productivity, cost efficiency, and streamlined administrative processes, particularly in areas such as claims processing, enrolment management, and customer engagement (Musaigwa & Mutula, 2022; Mwangi et al., 2024). Globally, the healthcare insurance industry has experienced a wave of digital transformation driven by the pursuit of universal health coverage (UHC) and improved access to healthcare services (Hogan et al., 2018). Digital platforms have replaced manual systems in many countries, enabling seamless data exchange, efficient claims processing, and improved customer experience. Technologies such as artificial intelligence, machine learning, and predictive analytics are increasingly being deployed to enhance operational workflows and reduce processing delays (Kruger & Ni Bhroin, 2020; Mwangi et al., 2024). These innovations have enabled insurance providers to improve transparency, minimize administrative errors, and deliver faster and more responsive services to clients (Adzakpah & Dwomoh, 2023; Popov et al., 2022).

Despite global progress, Nigeria's health system continues to face persistent structural challenges, including inadequate funding, fragmented service delivery, weak regulatory oversight, and limited

access to affordable healthcare services, particularly among rural populations and informal sector workers. In response to these challenges, the National Health Insurance Authority (NHIA) was established to improve healthcare accessibility through risk pooling and health financing mechanisms. However, nearly two decades after its establishment, the scheme continues to experience low population coverage rates, limited transparency, and operational inefficiencies that constrain its effectiveness (Uzochukwu et al., 2015). Historically, the Nigerian health insurance sector relied heavily on manual and paper-based processes, which limited efficiency and slowed service delivery (Adeniyi et al., 2019). Recent policy efforts by the Federal Government of Nigeria have emphasized digital health integration as a strategy to improve healthcare financing, service delivery, and institutional performance (Onwujekwe et al., 2019; Okuzu et al., 2022). However, gaps remain in the effective utilization of digital technologies to improve enrolment processes, claims management, and overall service delivery within the NHIA framework (Nandi & Schneider, 2020). These challenges are particularly evident in the Southeast region of Nigeria, where disparities in healthcare infrastructure and digital readiness persist despite relatively higher levels of urbanization (Onoka et al., 2013). Many NHIA operations in this region remain largely paper-based, resulting in duplication of records, processing delays, data inconsistencies, and increased vulnerability to fraud. Limited ICT infrastructure, weak interoperability among systems, poor data management practices, and inadequate enforcement of digital health policies further constrain the effective adoption of digital technologies (Okuzu et al., 2022).

Operational efficiency remains a critical determinant of performance in health insurance institutions, as it directly influences service quality, customer satisfaction, and institutional sustainability. Operational performance in health insurance organizations is commonly evaluated based on efficiency, responsiveness, reliability, and customer satisfaction, particularly in relation to the use of technology-enabled systems (Tangen, 2015; Kieny et al., 2018). Efficient claims processing, accurate data management, and timely communication with beneficiaries are essential components of effective health insurance operations (Albrecher et al., 2019). Although existing literature highlights the importance of digital health technologies in improving healthcare delivery, there remains limited empirical evidence on their role in enhancing administrative efficiency within health insurance schemes, particularly in low-resource settings such as Nigeria. Many studies have focused on clinical applications or national-level policy frameworks, with minimal attention to regional disparities in technology adoption and operational capacity. In Southeast Nigeria, few empirical investigations have systematically examined how NHIA healthcare providers utilize digital health technologies, the extent to which these tools improve operational efficiency, and the barriers that hinder their effective implementation. This study seeks to fill the identified gaps by conducting an in-depth investigation into how adoption of digital health technologies is being leveraged to enhance operational efficiency in NHIA healthcare centres within Southeast Nigeria.

2. Conceptual Review

Concept of Digital Health Technology

The digitalisation of healthcare systems has given rise to the development and rapid expansion of digital health technology (DHT), which continues to play a transformative role in improving healthcare delivery and operational management. Digital health technology has emerged as a critical tool for enhancing healthcare accessibility, communication, and service coordination among healthcare professionals and patients (Moshood et al., 2022; WHO, 2021). As healthcare institutions shift from traditional paper-based processes to digital systems, DHT provides innovative solutions to longstanding challenges related to data management, service delivery, and operational inefficiencies. Digital health technology broadly refers to the collection of technological tools, systems, and platforms designed to store, manage, transmit, and analyse health-related information (Alolayyan et al., 2020; Kaplan, 2020). The integration of DHT into healthcare operations represents a transition toward a digital ecosystem capable of streamlining workflows, improving communication among stakeholders, and supporting data-driven decision-making (Okolo et al., 2024). This transition is particularly significant in complex healthcare environments where timely access to accurate information is essential for efficient service delivery and effective management.

Digital health technology encompasses a wide range of tools and applications, including electronic health records, mobile health applications, telemedicine platforms, wearable health devices, and health information management systems. These technologies support remote patient monitoring, electronic prescribing, teleconsultation, and digital data exchange, thereby enhancing healthcare delivery and improving population health outcomes (Mathews et al., 2019). Through these applications, digital health solutions promote preventive healthcare, strengthen patient engagement, and enhance service accessibility, ultimately transforming traditional healthcare delivery models into more responsive and patient-centred systems (Olusanya & Peter, 2024). Beyond clinical benefits, digital health technology also contributes significantly to organizational performance by improving managerial, financial, and operational outcomes. Studies have demonstrated that the adoption of digital technologies enhances efficiency across management processes, organizational development, and service delivery functions (Oyekale, 2017; Yap et al., 2017). The availability of robust technological infrastructure supports service quality, enhances customer satisfaction, and promotes organizational reliability. However, the effective utilisation of digital health technology requires adequate investment in infrastructure, skilled personnel, and supportive policies to ensure sustainability and long-term benefits (Kinley, 2012; Moshood et al., 2022). Furthermore, digital health technology facilitates improved transaction accuracy, reduces operational delays, and enhances information flow across healthcare systems. These improvements contribute to reduced processing costs, improved administrative efficiency, and elimination of inefficiencies associated with manual record-keeping and fragmented communication systems (Moshood et al., 2022). Consequently, digital health technology has become a fundamental component in modern healthcare systems, enabling institutions to deliver more efficient, reliable, and responsive services.

Components of Digital Health Technology

Digital health technology comprises multiple interconnected components that collectively support healthcare delivery and management. Although the scope of digital health continues to evolve, several core components are widely recognized as central to its functionality.

Electronic Medical Records (EMRs)

Electronic Medical Records (EMRs) serve as centralised digital repositories that store comprehensive patient medical information, including diagnoses, treatment plans, laboratory results, medication records, and immunisation history (Olusanya & Peter, 2024). EMRs enable healthcare providers to access patient information quickly, facilitating informed decision-making and improving care coordination (Honavar, 2020). The digitalisation of patient records through EMRs enhances workflow efficiency and promotes accurate documentation, thereby improving service quality.

Electronic Health Records (EHRs)

Electronic Health Records (EHRs) extend the capabilities of EMRs by enabling the secure sharing of patient information across multiple healthcare providers and facilities. EHR systems support coordinated healthcare delivery by allowing authorized users to update and retrieve patient information in real time (Salleh et al., 2021). Additionally, EHR systems include automated alerts and reminders that support preventive care and timely interventions, contributing to improved healthcare outcomes.

Mobile Health Applications (mHealth)

Mobile health applications utilise smartphones and mobile devices to support healthcare delivery and patient engagement. These applications enable individuals to monitor medication adherence, track symptoms, schedule appointments, and communicate directly with healthcare providers (Kapoor, 2022). mHealth solutions empower patients to actively participate in their healthcare management, leading to improved treatment adherence and better health outcomes (Adebara et al., 2017).

Wearable Health Devices

Wearable health devices include fitness trackers, smartwatches, and medical-grade monitoring equipment that continuously track physiological indicators such as heart rate, physical activity, and sleep patterns. These devices provide real-time health data that supports early detection of health risks and improves chronic disease management (Yasar, 2023). The integration of wearable devices into healthcare systems enhances patient monitoring and supports data-driven healthcare decisions.

Importance of Digital Health Technology in the Healthcare Industry

Enhanced Access to Healthcare

Digital technologies play a crucial role in improving healthcare accessibility, particularly in remote and underserved areas. Telemedicine and mobile health applications allow patients to consult healthcare providers remotely, reducing geographical barriers and enabling timely access to medical advice (Olusanya & Peter, 2024; Channi, 2022). These technologies reduce travel costs and minimize delays associated with traditional appointment systems, thereby improving healthcare utilization (Jahankhani & Kendzierskyj, 2019). In addition, wearable devices and remote monitoring technologies enable continuous tracking of patients with chronic conditions. Healthcare providers can monitor patient data in real time and provide timely interventions when necessary (Stoumpos et al., 2023). This proactive approach enhances disease management and improves patient outcomes.

Improved Patient Care

Digitalisation has significantly enhanced patient care by enabling healthcare providers to access and analyse patient data efficiently. The availability of electronic health records and digital analytics tools supports accurate diagnosis and individualized treatment planning (Binci et al., 2022). Real-time data access allows healthcare professionals to identify emerging health risks, monitor treatment effectiveness, and improve clinical decision-making. Furthermore, digital health technologies promote collaboration among healthcare professionals by facilitating seamless communication across departments and institutions (Meske et al., 2019). This collaborative environment improves continuity of care and strengthens patient safety, ultimately enhancing overall healthcare quality (Belliger & Krieger, 2018).

Increased Operational Efficiency

Digital health technologies significantly improve operational efficiency within healthcare organisations by automating administrative tasks and optimizing workflow processes. Functions such as appointment scheduling, billing, and record management can be digitised to reduce manual errors and administrative burdens (Olusanya & Peter, 2024). Automation of routine tasks enhances processing speed and ensures greater accuracy in service delivery (Dionisio et al., 2023). Moreover, digital workflows support effective communication among healthcare teams, enabling faster decision-making and coordinated service delivery (Tortorella et al., 2023). These improvements result in better resource utilization, reduced operational costs, and enhanced service efficiency. Consequently, digitalisation has become an essential strategy for healthcare institutions seeking to maintain competitiveness and deliver high-quality services in an increasingly technology-driven environment (Jahankhani & Kendzierskyj, 2019).

The Concept of Operational Efficiency

Operational efficiency refers to an organization's ability to optimally utilize its resources, processes, and technologies to minimize operational costs while maximizing output and service quality (Osazefua, 2019). It reflects the extent to which an organization converts inputs into desired outputs with minimal waste, thereby enhancing productivity and organizational performance

(Kaydos, 2020). Within the healthcare insurance sector, operational efficiency is particularly significant because efficient processes contribute to cost savings, improved customer satisfaction, and enhanced financial sustainability (Taheri et al., 2020; Yi et al., 2021; Tran et al., 2020). In insurance organizations, operational efficiency is commonly assessed using measurable indicators such as expense ratios, claims processing time, underwriting efficiency, and investment management effectiveness (Bilbao-Tero et al., 2022; Olarinre et al., 2020). These indicators provide insights into how well an organization manages its financial and administrative processes. Efficient utilization of technology and streamlined workflows are critical drivers of improved performance across these indicators (Moretto & Caniato, 2021). As insurance operations involve large volumes of transactions and data management activities, improving operational efficiency remains a strategic priority for sustaining competitiveness and delivering quality services.

Technological advancement has introduced significant improvements in operational efficiency within the insurance industry. Traditionally, insurance operations depended heavily on manual processes such as policy issuance, premium calculation, and claims processing, which were often time-consuming and prone to human error. However, the integration of information technology (IT) systems has enabled the automation of these processes, thereby reducing manual intervention and enhancing accuracy (Taheri et al., 2020; Albasheir, 2023). Automated workflows allow insurance organizations to process transactions more efficiently, improve service turnaround times, and reduce operational bottlenecks. For example, policy issuance processes that previously required extensive paperwork and manual documentation are now conducted through digital platforms, enabling customers to submit applications electronically and receive prompt responses based on predefined criteria (Majumdar, 2021). Similarly, claims processing has been significantly enhanced through digital systems that allow customers to submit claims online along with supporting documents. These systems automatically evaluate claim validity and calculate settlements, improving both speed and accuracy in claims management (Albasheir, 2023). The ability to respond quickly to customer inquiries, policy modifications, and service requests enhances organizational responsiveness and strengthens customer confidence in service delivery (Moretto & Caniato, 2021).

Beyond routine administrative functions, digital technology adoption has also transformed data management practices within insurance organizations. Digital storage systems enable insurers to securely maintain large volumes of data, reducing reliance on physical storage and minimizing the risk of data loss or misplacement (Bilbao-Tero et al., 2022). Furthermore, the integration of data analytics tools enables insurers to analyse customer behaviour, assess risk profiles, and identify market trends. These capabilities support data-driven decision-making, improve underwriting processes, and facilitate the development of tailored insurance products suited to diverse customer needs (Olarinre et al., 2020). Operational efficiency driven by digital health technology also contributes to cost reduction and improved resource utilization. Automation reduces labour-intensive activities and operational redundancies, allowing organizations to allocate resources more strategically and minimize overhead expenses (Leksono, 2020). This cost efficiency enables

insurers to offer competitive service packages while maintaining financial stability. Additionally, digital communication tools and cloud-based platforms enhance collaboration among departments by enabling real-time information sharing, which is particularly beneficial for handling complex cases that require multidisciplinary coordination. The continuous integration of digital health technologies into insurance operations therefore represents a strategic pathway toward achieving sustained operational efficiency and improved service performance (Albasheir, 2023).

2.3 Hypotheses Development

Electronic Health Records (EHRs) and Patient Data Accuracy

Electronic Health Records (EHRs) are digital systems designed to capture, store, and share patient information across healthcare settings. Unlike traditional paper-based records, EHRs provide real-time access to patient data, including medical history, medications, laboratory results, and treatment records, thereby supporting clinical decision-making and administrative efficiency (WHO, 2021). Globally, the adoption of EHR systems has improved healthcare workflows, reduced medical errors, and enhanced patient safety (Adler-Milstein & Jha, 2017). In regions such as sub-Saharan Africa, including Nigeria, EHR systems are gradually being adopted to improve patient record management and support digital health initiatives within national health insurance frameworks (Obi et al., 2022). Patient data accuracy refers to the extent to which patient information correctly reflects an individual's clinical and demographic details. Hoerbst & Ammenwerth (2010) assert that accurate records are essential for effective diagnosis, treatment, and claims processing, while inaccurate data can lead to errors, duplication of services, and operational inefficiencies (Häyrinen, Saranto, & Nykänen, 2008). EHR systems enhance data accuracy through standardized documentation, automated validation features, and secure data storage (WHO, 2021). However, Okeke et al. (2021) highlights challenges such as limited infrastructure, inadequate training, and partial digitization as significant barriers to effective implementation, particularly in developing regions (Akanbi et al., 2012;). Given the role of EHR systems in improving documentation reliability and reducing administrative errors, their adoption is expected to positively influence patient data accuracy in healthcare institutions. Thus, we hypothesize that:

H_1: Electronic Health Records (EHRs) significantly affect Patient Data Accuracy

Electronic Claims Management Systems and Process Optimisation

Electronic Claims Management Systems (eCMS) have become an essential component of modern healthcare administration, particularly in the management of financial transactions between healthcare providers and insurance agencies. ECMS refers to digital platforms that enable healthcare institutions to prepare, submit, track, and reconcile insurance claims electronically, thereby replacing traditional paper-based methods (HIMSS, 2022). Scholars have noted that the traditional claims management process is often slow, labour-intensive, and susceptible to documentation errors and fraud, especially in resource-constrained settings characterized by poor

infrastructure and limited technological capacity (Okeke, Ezenwafor, & Azih, 2021). In contrast, the adoption of electronic claims systems has been associated with faster reimbursement cycles, improved billing accuracy, and enhanced transparency in healthcare financial transactions (Schoen et al., 2013). Process optimisation in healthcare refers to the systematic redesign of administrative and service workflows to improve efficiency, reduce delays, and enhance service delivery outcomes. Digital technologies such as eCMS support process optimisation by automating repetitive tasks, integrating clinical and billing information, and enabling real-time communication across healthcare units (Kumar & Bauer, 2021). Empirical studies indicate that healthcare institutions utilizing digital workflow systems demonstrate improved turnaround times, reduced operational bottlenecks, and increased workflow standardization. However, in many developing healthcare systems, including Nigeria, persistent challenges such as manual documentation, fragmented information systems, and poor workflow design continue to hinder efficient claims processing and service delivery (Okpani & Abimbola, 2015). The integration of eCMS is therefore expected to enhance workflow efficiency by minimizing delays, improving coordination, and reducing administrative errors within healthcare institutions (WHO, 2021; Blaya, Fraser, & Holt, 2010). Given the importance of efficient workflow management in healthcare operations, the adoption of Electronic Claims Management Systems is expected to significantly enhance process optimisation within NHIA healthcare facilities.

H_2: Electronic Claims Management Systems significantly affect Process Optimisation

3. Methodology

Research Design

Research design refers to the systematic plan that guides the collection, measurement, and analysis of data in order to address research questions and achieve specified study objectives. It outlines the procedures, methods, and techniques employed in gathering and analysing data, as well as the justification for selecting those approaches. This study adopted a descriptive survey research design, employing a quantitative approach to obtain relevant data from respondents within the National Health Insurance Authority (NHIA) healthcare facilities. The descriptive survey design was considered appropriate because it enables the systematic collection of data from a defined population and facilitates the examination of relationships among study variables without manipulating the research environment.

The population for this study comprised 8,439 staff members working in selected public hospitals accredited under the National Health Insurance Authority (NHIA) in the southeast. The population included both clinical staff (doctors, nurses, and laboratory scientists) and non-clinical staff (hospital administrators and desk officers) involved in NHIA-related operations. These groups were selected due to their direct involvement in healthcare delivery and administrative processes related to digital health technology. The sample size for the study was determined using Cochran's formula for large populations, which is widely applied to ensure adequate representation in quantitative studies. The application of this formula produced a final sample size of 408

respondents, considered sufficient for reliable analysis. The study employed a stratified purposive and snowball sampling technique to select participants.

Operational Measures of Variables

The independent variable for this study is digital health technology adoption. It was decomposed into two dimensions: electronic claims management systems and electronic health records (EHRs). These dimensions were adopted from literature emphasizing them as components of digital (health) technologies (WHO, 2021; Kumar & Bauer, 2021). Each dimension was measured using (5) five statement items, yielding a total of 10 items. Example items include: 'Patient records are accurately maintained in the electronic system'; and 'Claims are processed faster using the electronic platform'.

Operational efficiency was operationalized using two dimensions: patient data accuracy and process optimisation. These variables were adapted from Häyrinen, Saranto, & Nykänen (2008). Each latent variable has five indicators, making it a total of 10 statement items. Example items included: 'Patient data entries are mostly error-free'; and 'We complete tasks in fewer steps due to automation'. All the statement items across the variables were anchored on a five-point Likert scale ranging from 1 (strongly disagree) to 5 (strongly agree).

Data Analysis Technique

Two main statistical techniques were employed to analyse the data. First, respondents' demographic characteristics were summarized using descriptive statistics, including percentages, means, standard deviations, and visual charts. Second, the study hypotheses were tested using Partial Least Squares—Structural Equation Modeling (PLS-SEM) via SmartPLS version 4.1. PLS-SEM was used to evaluate the relationships between the latent variables, specifically digital health technology adoption and operational efficiency (independent and dependent variable respectively). This technique was chosen because it allows simultaneous assessment of regression paths, route analysis, and factor loadings, making it particularly suitable for exploratory and predictive research in complex models.

4. Results and Discussion

Survey Response Rate

A total of 408 questionnaires were administered to the respondents of the selected NHIA provider hospitals. Of these, 379 were correctly completed and returned, representing a response rate of 93%.

Descriptive Statistics

Table 1. Summary Analyses of Demographic Profiles of Respondents

Variable	Frequency	Percent
Gender		
Male	135	64.3
Female	243	35.7
Total	**378**	**100**
Age		
18-35	184	48.7
36-60	181	47.9
60+	13	3.4
Total	**378**	**100**
Educational Qualification		
Diploma/RN	25	6.6
B.Sc./MBBS/B.NSC.	229	60.6
M.Sc./MBA	96	25.4
Ph.D.	28	7.4
Total	**378**	**100**
Years in Service		
0-5 Years	47	12.4
6-10 Years	88	23.3
11-15 Years	110	29.1
16-20 Years	81	21.4
20+ Years	52	13.8
Total	**378**	**100**

Source: Field Survey, 2026

Table 1 above shows the summary of the analyses on the demographic details of the respondents. The gender distribution showed that among the 378 respondents, 64.3% were male (135), while 35.7% were female (243), indicating a higher representation of males in the selected NHIA provider hospitals. In terms of age, the majority of respondents were between 18–35 years (48.7%) and 36–60 years (47.9%), suggesting a workforce that is largely in the early to mid-career stages. Only a small proportion (3.4%) were above 60 years, reflecting limited representation of senior or near-retirement staff. Regarding educational qualification, most respondents held a B.Sc./MBBS/B.NSC degree (60.6%), followed by M.Sc./MBA holders (25.4%). A smaller percentage had Ph.D. qualifications (7.4%), while Diploma/RN holders comprised 6.6% of the sample. This indicates a highly educated workforce, predominantly with first-degree qualifications. Experience-wise, respondents were fairly evenly distributed across service durations, with the largest group having 11–15 years of experience (29.1%), followed by 16–20

years (21.4%) and 6–10 years (23.3%). The least represented were those with 0–5 years (12.4%) and 20+ years (13.8%), showing a mix of early-career and experienced staff within the workforce.

Measurement Model

In line with the guidelines of Ringle et al. (2015), the PLS-SEM analysis was carried out in two phases: first, the measurement model, followed by the structural model. The measurement model was examined to ensure the constructs' reliability and validity, using key metrics including factor loadings, indicator reliability, and Average Variance Extracted (AVE).

Table 2 shows the factor loadings for all measurement items, with electronic health records and electronic claims management systems exhibiting loadings above the acceptable threshold of 0.70. Similarly, the indicators for patient data accuracy and process optimisation demonstrated standardized loadings exceeding the recommended level (Hair et al., 2020). Consequently, all items were retained for further analysis.

Table 2: Measurement Model Evaluation

Latent Variables	Indicators	Loadings (>0.70)	Indicator Reliability (>0.50)	AVE (>0.50)	Composite Reliability (Pc) (>0.70)	Cronbach's Alpha (CA) (0.70-0.90)
EHR	EHR_1	0.932	0.867	0.806	0.947	0.938
	EHR_2	0.947	0.897			
	EHR_3	0.947	0.897			
	EHR_4	0.865	0.748			
	EHR_5	0.785	0.616			
ECM	ECM_1	0.938	0.880	0.806	0.942	0.940
	ECM_2	0.868	0.753			
	ECM_3	0.868	0.753			
	ECM_4	0.890	0.792			
	ECM_5	0.923	0.852			
PDA	PDA_1	0.945	0.893	0.858	0.960	0.958
	PDA_2	0.894	0.799			
	PDA_3	0.952	0.906			
	PDA_4	0.907	0.822			
	PDA_5	0.932	0.869			
PO	PO_1	0.961	0.924	0.850	0.963	0.956
	PO_2	0.959	0.920			
	PO_3	0.871	0.759			

	PO_4	0.898	0.806			
	PO_5	0.917	0.841			
Note: EHRs = Electronic Health Records, ECMs = Electronic Claims Management System, PDA = Patient Data Accuracy, PO = Process Optimisation.						

Source: SmartPLS 4.1 Output on Survey Data, 2026

Table 2 presents the results of the measurement model on the reliability and convergent validity of the study instrument. The assessment of Cronbach's alpha and composite reliability showed satisfactory outcomes, with all values exceeding the recommended threshold of 0.7. Similarly, the squared factor loadings of individual items (indicator reliability) met the minimum benchmark of 0.50. Furthermore, convergent validity was confirmed through the Average Variance Extracted (AVE), as each construct recorded an AVE value greater than 0.5, thereby validating the constructs' convergent validity.

Table 3: Fornell-Larcker Criterion Discriminant Validity

	AVE	**EHR**	**ECM**	**PDA**	**PO**
EHR	0.806	**0.898**			
ECM	0.806	0.027	**0.898**		
PDA	0.858	0.491	0.015	**0.926**	
PO	0.850	0.021	0.032	0.042	**0.922**
Note: EHRs = Electronic Health Records, ECMs = Electronic Claims Management System, PDA = Patient Data Accuracy, PO = Process Optimisation.					

Source: SmartPLS 4.1 Output on Survey Data, 2026

Table 3 shows the assessment of constructs' discriminant validity using Fornell and Larcker's (1981) criterion. By comparing the correlations of the latent constructs with the square roots of AVE, the discriminant validity of the latent variables was determined. The square roots of the AVEs were greater than correlations across latent components, indicating that the research instrument in this study had appropriate discriminant validity.

Structural Model (Test of Hypotheses)

The structural model was assessed using path coefficients (β) and coefficients of determination (R^2) to evaluate the study hypotheses. This approach measured the strength, direction, and significance of the relationships, with significance tested via bootstrapping. The R^2 values indicated the model's explanatory capability, reflecting how effectively the exogenous constructs predicted the endogenous variables. Additionally, effect sizes (f^2) were calculated following Cohen's (1988) guidelines to assess the practical significance of each relationship, where values of 0.02–0.15 denote a small effect, 0.15–0.35 a medium effect, and above 0.35 a large effect. Path coefficients were interpreted similarly, with 0.10–0.29 considered weak, 0.30–0.49 moderate, and ≥0.50 strong relationships.

Table 4: Results of Hypotheses Testing

Hypotheses	Path Coefficient	Standard Error	T-value	P-value	Decision
EHR -> PDA	0.558	0.036	15.53	0.000	Supported
ECM -> PO	0.563	0.038	14.75	0.000	Supported
Note: EHRs = Electronic Health Records, ECMs = Electronic Claims Management System, PDA = Patient Data Accuracy, PO = Process Optimisation.					

Source: SmartPLS 4.1 Output on Survey Data, 2026

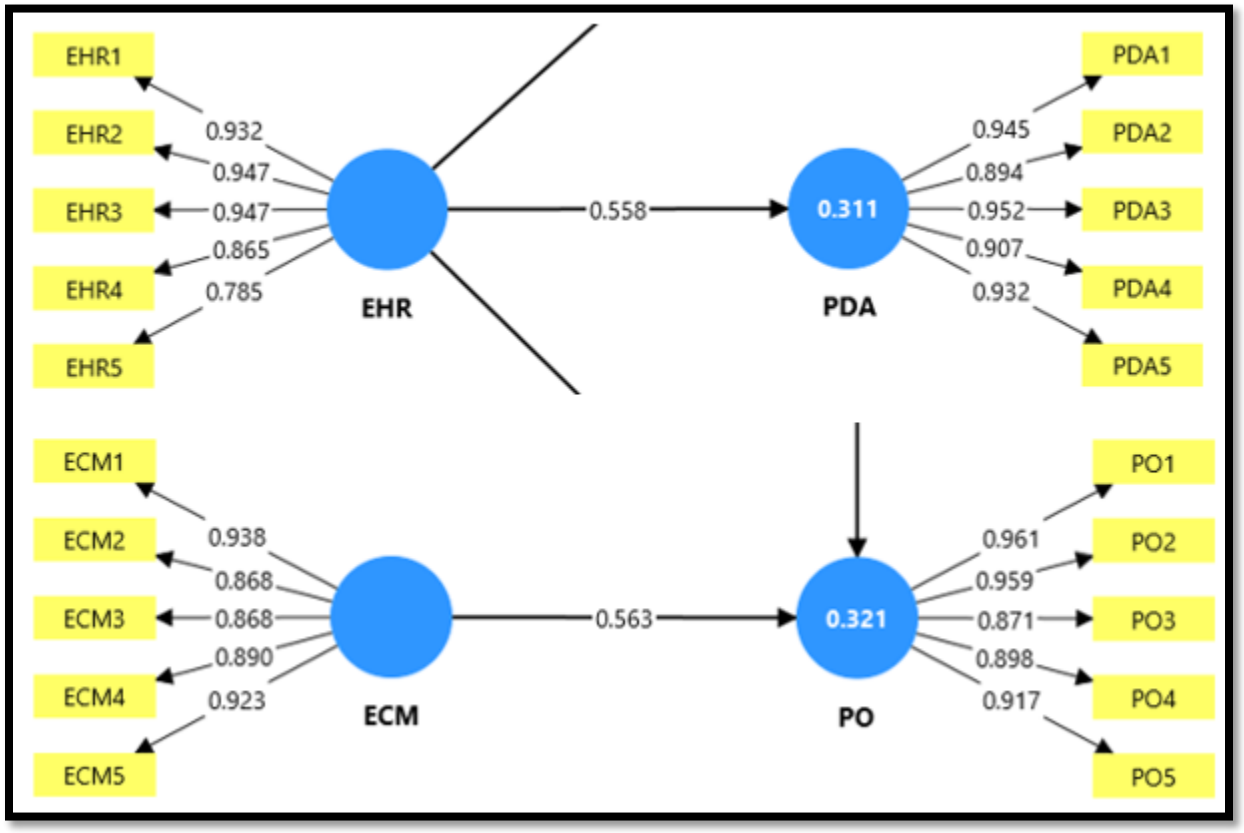

Figure 1: Path Coefficient of Latent Variables (main effects) EHRs, PDA, ECMs and PO

Table 4 and Figure 1 shows significant paths between Electronic Health Records (EHRs) and Patient Data Accuracy (PDA) ($\beta = 0.558$; $t = 15.53$; $p < 0.05$) and Electronic Claims Management Systems (ECMs) and Process Optimisation (PO) ($\beta = 0.563$; $t = 14.75$; $p < 0.05$). Hence, both hypotheses were supported

Table 5: Predictive Accuracy, Predictive Relevance, and Effect sizes (f^2)

Paths	Correlation coefficient (r)	Predictive Accuracy r^2	Adjusted r^2	Effect Size f^2	Predictive Relevance Q^2
EHR -> PDA	0.585	0.342	0.340	0.352 Large	0.312

ECM -> PO	0.630	0.397	0.395	0.366 Large	0.351

Source: SmartPLS 4.1 Output on Survey Data, 2026

Table 5 presents the correlation, predictive accuracy, effect size, and predictive relevance of the hypothesized relationships. The results indicate a strong correlation between Electronic Health Records (EHRs) and Patient Data Accuracy (PDA) ($r = 0.585$), with a predictive accuracy of $R^2 = 0.342$ and an adjusted $R^2 = 0.340$. The effect size ($f^2 = 0.352$) is large, while the predictive relevance ($Q^2 = 0.312$) confirms the model's ability to accurately predict improvements in patient data accuracy. Likewise, Electronic Claims Management Systems (ECMs) show a strong correlation with Process Optimisation (PO) ($r = 0.630$) and high predictive accuracy ($R^2 = 0.397$; adjusted $R^2 = 0.395$), with a large effect size ($f^2 = 0.366$) and good predictive relevance ($Q^2 = 0.351$).

4.5 Discussion of Findings

The study investigated the impact of digital health technology adoption on the operational efficiency of NHIA healthcare providers in Southeast Nigeria. Specifically, it examined how Electronic Health Records (EHRs) and Electronic Claims Management Systems (ECMs) influence key performance outcomes, including patient data accuracy and process optimisation.

Hypothesis one stated that electronic health records (EHRs) affect patient data accuracy. The results support this hypothesis, revealing a strongly significant and positive effect of electronic health records on patient data accuracy. This implies that hospitals with effective EHR systems are more likely to maintain accurate, reliable, and consistent patient information. Such findings align with the position that digital record systems minimize human error, enhance clinical documentation, and improve the overall quality of healthcare delivery. In line with this, Kruse et al. (2018) systematically reviewed EHR impacts and concluded that digital records foster greater accuracy by minimizing redundant data entry and ensuring synchronization of patient information across hospital departments. Further corroborating this, Nguyen et al. (2014) reported that EHR use improved the reliability of patient records and reduced discrepancies between recorded information and actual clinical conditions. These results are also consistent with Al-Khasawneh et al. (2022), who observed that hospitals that fully integrated EHR systems experienced fewer medical errors and enhanced coordination of care, which ultimately improved patient outcomes. Collectively, these empirical findings validate the current study's results by demonstrating that EHR adoption has a substantial role in enhancing patient data accuracy and reliability.

Hypothesis two stated that electronic claims management systems affect process optimisation. The result shows a strongly significant and positive effect of electronic claims management systems on process optimisation. This finding implies that when hospitals deploy ECMS to handle health insurance claims, they experience fewer administrative errors, faster reimbursement cycles, reduced paperwork, and streamlined workflows. This finding is consistent with the work of Bailey et al. (2025), in a study using the French national claims database, found that electronic claims

processing reduced costs and improved the timeliness of reimbursements, highlighting the direct impact of ECMS on optimizing healthcare workflows. Further, Doskenov and Okuyelu (2025) explored real-time optimization of healthcare systems through automation and found that digitized claims processes cut clerical work hours by nearly 50%. Their study emphasized that process optimization was not only about speed but also about freeing up human resources for patient-focused tasks, thereby enhancing hospital-wide efficiency. Additionally, Oyegoke, Ikono, and Soriyan (2017) studied Nigeria's National Health Insurance Scheme (NHIS) and reported that the adoption of integrated claims and health management systems significantly improved accuracy, responsiveness, and timeliness in healthcare administration. With over 85% satisfaction levels across utility and responsiveness, their findings highlight how electronic claims systems reduce duplication and enhance optimization across service delivery chains.

5. Conclusion, Recommendations and Contributions

Conclusion

This research employed a survey-based design to examine the empirical link between technology adoption and operational efficiency in the National Health Insurance Authority (NHIA) with a focus on Southeast Nigeria. The study considered the roles of electronic health records (EHRs) and electronic claims management systems in driving efficiency outcomes. The results proved that EHRs and electronic claims systems significantly and positively influenced patient data accuracy and process optimization. The study concluded that deployment of EHRs and adoption of electronic claims systems are critical for achieving higher levels of efficiency in NHIA operations. The study also emphasizes the need for NHIA and affiliated healthcare institutions to enhance digital capacity among staff and deepen system integration with the NHIS database to maximize efficiency gains.

Recommendations

The following recommendations are given:

i. Hospitals should promote the full adoption and integration of Electronic Health Records (EHRs) across all units. This can be achieved by phasing out manual record-keeping, ensuring that electronic systems are interoperable across departments, and aligning hospital databases with NHIS standards to improve patient data accuracy.
ii. The NHIA and hospitals should expand the use of electronic claims management systems by integrating user-friendly claims platforms that reduce paperwork, shorten reimbursement cycles, and improve transparency in financial processes. Regular upgrades and user support should also be prioritized to sustain efficiency.

Contributions to Knowledge

The study charted a new path in research by empirically examining the influence of digital health technology adoption on operational efficiency within the National Health Insurance Authority

(NHIA) in Southeast Nigeria, a context that has remained largely underexplored in extant literature. While prior research has often centered on advanced health systems in developed countries, this study extends the discourse by situating the analysis in a developing economy, thereby bridging a critical contextual gap. In addition, the study advances the understanding of how dimensions of digital health technology adoption namely, electronic health records and electronic claims management, collectively enhance operational efficiency outcomes such as patient data accuracy and process optimization. This provides a nuanced contribution to the literature on digital health transformation in the insurance sector in emerging economies.

References

Adebara, O. V., Adebara, I. O., Olaide, R., Emmanuel, G. O., & Olanrewaju, O. (2017). Knowledge, attitude and willingness to use mHealth technology among doctors at a semi urban tertiary hospital in Nigeria. *Journal of Advances in Medicine and Medical Research*, *22*(8), 1-10.

Adler-Milstein, J., & Jha, A. K. (2017). HITECH Act drove large gains in hospital electronic health record adoption. *Health Affairs, 36*(8), 1416–1422. https://doi.org/10.1377/hlthaff.2016.1651

Adzakpah, G., & Dwomoh, D. (2023). Impact of digital health technology on health insurance claims rejection rate in Ghana: a quasi-experimental study. *BMC Digital Health*, *1*(1), 5.

Albasheir, K.A.M.A. (2023). The impact of IT on insurance of the technological industry. *Journal of Advanced Zoology, 44*(5). https://jazindia.com/index.php/jaz/article/view/556

Albrecher, H., Bommier, A., Filipović, D., Koch-Medina, P., Loisel, S., & Schmeiser, H. (2019). Insurance: models, digitalization, and data science. *European Actuarial Journal, 9*, 349-360.

Al-Khasawneh, A., Abuhussein, A., AlMomani, E., & Jaradat, G. (2022). Electronic health records and patient safety: A review of empirical literature. *Health Informatics Journal, 28*(1), 1–13. https://doi.org/10.1177/14604582211056820

Alolayyan, M. N., Alyahya, M. S., Alalawin, A. H., Shoukat, A., & Nusairat, F. T. (2020). Health information technology and hospital performance the role of health information quality in teaching hospitals. *Heliyon, 6*(10)

Ayotunde, A. (2012). Changing technologies and the Nigerian mass media. *Kuwait Chapter of Arabian Journal of Business and Management Review, 2*(3). https://www.arabianjbmr.com/pdfs/KD_VOL_2_3/9.pdf

Bailey, M. D., Farge, G., Brunel, M., Mohanty, S., Roy, G., de Pouvourville, G., de Wazières, B., Janssen, C., Tauty, S., Bugnard, F., Goguillot, M., Bénard, S., & Johnson, K. (2025). Assessing the economic impact and healthcare resource utilization of inpatient pneumococcal disease among adults: a French national claims database study. *Journal of Medical Economics*, 1–14. https://doi.org/10.1080/13696998.2025.2458957

Belliger, A. and Krieger, D.J., (2018). The Digitalization of healthcare. Knowledge Management in Digital Change. *New Findings and Practical Cases*, 311-326

Bilbao-Terol, A., Arenas-Parra, M., Quiroga-García, R., & Bilbao- -Terol, C. (2022). An extended best – worst multiple reference point method: Application in the assessment of non-life insurance companies. *Operational Research, 22*(5), 5323-5362. https://doi. org/10.1007/s12351-022-00731-z

Binci, D., Palozzi, G. and Scafarto, F., (2022). Toward Digitalization in healthcare: a framework for remote monitoring adoption. *The TQM Journal, 34*(6), 1772-1799

Blaya, J. A., Fraser, H. S. F., & Holt, B. (2010). E-health technologies show promise in developing countries. *Health Affairs, 29*(2), 244–251. https://doi.org/10.1377/hlthaff.2009.0894

Channi, H.K., Shrivastava, P. and Chowdhary, C.L., (2022). Digitalization in Healthcare Industry: A Survey. *In Next Generation Healthcare Informatics* (pp.279-293). Singapore: Springer Nature Singapore.

Cohen, J. W. (1988). Statistical power analysis for behavioural sciences (2nd ed.). Hilladale, Lawrence Erlbaum Associates

Davenport, T. H., & Ronanki, R. (2018). Artificial intelligence for the real world. *Harvard Business Review*, *96*(1), 108-116.

Dionisio, M., de Souza Junior, S.J., Paula, F. and Pellanda, P.C., (2023). The role of Digitalization in improving the efficacy of healthcare: A systematic review. *The Journal of High Technology Management Research, 34*(1), 100442

Doskenov, B., & Okuyelu, O. (2025). Advancing production systems with online reinforcement learning: real-time monitoring, control, and optimization. *Current Journal of Applied Science and Technology*, *44*(2), 1-22.

Hair, J. J. F., Howard, M. C., & Nitzl, C. (2020). Assessing measurement model quality in PLS-SEM using confirmatory composite analysis. *Journal of Business Research, 109*, 101–110. https://doi.org/10.1016/j. jbusres.2019.11.069

Hanelt, A., Bohnsack, R., Marz, D., & Antunes Marante, C. (2021). A systematic review of the literature on digital transformation: Insights and implications for strategy and organizational change. *Journal of management studies*, *58*(5), 1159-1197.

Häyrinen, K., Saranto, K., & Nykänen, P. (2008). Definition, structure, content, use and impacts of electronic health records: A review of the research literature. *International Journal of Medical Informatics, 77*(5), 291–304.

Hoerbst, A., & Ammenwerth, E. (2010). Electronic health records: A systematic review on quality requirements. *Methods of Information in Medicine, 49*(4), 320–336.

Hogan, D. R., Stevens, G. A., Hosseinpoor, A. R., & Boerma, T. (2018). Monitoring universal health coverage within the Sustainable Development Goals: development and baseline data for an index of essential health services. *The Lancet Global Health, 6*(2), 152-168

Honavar, S.G., (2020). Electronic medical records–The good, the bad and the ugly. *Indian journal of ophthalmology, 68*(3), 417

Jahankhani, H. and Kendzierskyj, S., (2019). Digitalization of healthcare. Blockchain and Clinical Trial: Securing Patient Data, 31-52

Kaplan, B. (2020). Revisiting health information technology ethical, legal, and social issues and evaluation: telehealth/telemedicine and COVID-19. *International Journal of Medical Informatics, 143*, 104239

Kapoor, A. (2022). *Mobile Healthcare Apps in 2022: Top Benefits & Challenges*. Retrieved from https://medium.com/geekculture/mobile-healthcare-apps-in-2022-top-benefits-challenges-eac0f415e269

Kaydos, W. (2020). *Operational performance measurement: increasing total productivity*. CRC press.

Kieny, M. P., Evans, T. G., Scarpetta, S., Kelley, E. T., Klazinga, N., Forde, I., & Kim, S. M. (2018). Delivering quality health services: a global imperative for universal health coverage. Washington, DC: World Bank Group.

Kinley, C. A. (2012). *Healthcare Technology: A Strategic Approach to Medical Device Management* (Master's thesis, East Tennessee State University).

Kruger, S., & Ni Bhroin, N. (2020). Vital signs: Innovations in self-tracking health insurance and social change. *Journal of Media Innovations, 6*(1),6-17.

Kruse, C. S., Stein, A., Thomas, H., & Kaur, H. (2018). The use of Electronic Health Records to support population health: A systematic review of the literature. *Journal of Medical Systems, 42*(11), 214. https://doi.org/10.1007/s10916-018-1075-6

Leksono, E., & Muljono, P. (2020). Insurtech innovation in the digital era: A literature review and research agenda. *Journal of Insurance and Financial Management, 5*(16), 1-19. https://doi.org/10.3390/jifm5010016

Majumdar, A., & Prasad, S. (2021). Digital transformation of the insurance industry: A systematic review of the literature. *International Journal of Information Management, 57*, 102347. https://doi.org/10.1016/j.ijinfomgt.2021.102347

Mathews, S.C., McShea, M.J., Hanley, C.L., Ravitz, A., Labrique, A.B. and Cohen, A.B., (2019). Digital health: a path to validation. *NPJ digital medicine, 2*(1), 38.

Meske, C., Amojo, I., Poncette, A. S., & Balzer, F. (2019, July). The potential role of digital nudging in the digital transformation of the healthcare industry. In *International Conference on Human-Computer Interaction* (pp. 323-336). Cham: Springer International Publishing.

Moretto, A., & Caniato, F. (2021). Can Supply Chain Finance help mitigate the financial disruption brought by Covid-19? *Journal of Purchasing and Supply Management, 27*(4), 100713. https://doi.org/10.1016/j.pursup.2021.100713

Moshood, T. D., Sorooshian, S., Nawanir, D., & Okfalisa, S. (2022). Efficiency of medical technology in measuring service quality in the Nigerian healthcare sector. *International Journal of Africa Nursing Sciences, 16*. https://doi.org/10.1016/j.ijans.2022.100397

Musaigwa, M. and Mutula, S.M. (2022) Impact of digital transformation on strategy in the insurance sector. *International Journal of Research in Business and Social Science 11* (4), 69–76

Mwangi, G. T., Musembi, M., Kamau, J. & Obunga, F. (2024). Digital transformation strategy and performance of e-claims systems at National Health Insurance Fund, Kenya. *The Strategic Journal of Business & Change Management, 11* (2), 1616 – 1640. http://dx.doi.org/10.61426/sjbcm.v11i2.3002

Nandi, S., & Schneider, H. (2020). Using an equity-based framework for evaluating publicly funded health insurance programmes as an instrument of UHC in Chhattisgarh State, India. *Health Research Policy and Systems*, *18*, 1-14

Nguyen, L., Bellucci, E., & Nguyen, L. T. (2014). Electronic health records implementation: An evaluation of information system impact and contingency factors. *International Journal of Medical Informatics, 83*(11), 779–796. https://doi.org/10.1016/j.ijmedinf.2014.06.011

Obi, T. S., Eze, E. O., & Okeke, I. C. (2022). Assessing E-Health Infrastructure and Service Delivery in Nigeria's National Health Insurance Scheme. *Nigerian Journal of Health Policy and Management, 7*(1), 45–56

Okeke, T. C., Ezenwafor, J. I., & Azih, N. (2021). Challenges of electronic health record implementation in Nigerian hospitals: Evidence from the South East. *African Journal of Health Economics and Policy, 4*(2), 56–68.

Okolo, C. A., Ijeh, S., Arowoogun, J. O., Adeniyi, A. O., & Omotayo, O. (2024). Reviewing the impact of health information technology on healthcare management efficiency. *International Medical Science Research Journal, 4*(4), 420-440.

Okpani, A. I., & Abimbola, S. (2015). Operationalizing universal health coverage in Nigeria through social health insurance. *Nigerian Medical Journal, 56*(5), 305–310. https://doi.org/10.4103/0300-1652.170382

Okuzu, O., Malaga, R., Okereafor, K., Ujulu, A., Dosunmu, A., Oyeneyin, A., Adeoye, V., Sambo, M. N., & Ebenso, B. (2022). Role of digital health insurance management systems in scaling health insurance coverage in low- and Middle-Income Countries: A case study from Nigeria. *Front. Digit. Health, 4*. https://doi.org/10.3389/fdgth.2022.1008458

Olarinre, O. T., Sunday, S. O., & Gabriel, E. D. (2020). Effects of claims management on profitability of insurance companies in Nigeria. *British Journal of Management and Marketing Studies, 3*(4), 106-114

Olusanya, M. A., & Peter, E. B. (2024). *Analysis of the Impact of Digitalisation of Healthcare Service: An Emphasis on the Digitalisation of Clinics across Nigeria*. Degree project in Sweden. https://lnu.diva-portal.org/smash/get/diva2:1922824/FULLTEXT01.pdf

Onoka, C. A., Onwujekwe, O. E., Hanson, K., & Uzochukwu, B. S. (2013). Examining catastrophic health expenditures at variable thresholds using household consumption expenditure diaries. *Tropical Medicine & International Health, 18*(10), 1175–1181.

Onwujekwe, O., Ezumah, N., Mbachu, C., Obi, F., Ichoku, H., Uzochukwu, B., & Wang, H. (2019). Exploring effectiveness of different health financing mechanisms in Nigeria; what needs to change and how can it happen? *BMC Health Services Research, 19*, 1-13

Osazefua, I. J. (2019). Operational efficiency and financial sustainability of listed manufacturing companies in Nigeria. *Journal of Accounting and Taxation, 11*(1), 17-31. https://doi. org/10.5897/JAT2018.0329

Oyegoke, T. O., Ikono, R. N., & Soriyan, H. A. (2017). An integrated health management system for national health insurance scheme in Nigeria. *Journal of Emerging Trends in Computing and Information Sciences*, *8*(1), 30-40

Oyekale, A. S. (2017). Assessment of primary health care facilities' service readiness in Nigeria. *BMC Health Services Research*, *17*, 1-12.

Popov, V.V., Kudryavtseva, E.V., Kumar Katiyar, N., Shishkin, A., Stepanov, S.I. and Goel, S., (2022). Industry 4.0 and Digitalization in Healthcare. *Materials, 15*(6), 2140

Ringle, C. M., Wende, S., & Becker, J. M. (2015). SmartPLS 3. SmartPLS GmbH

Salleh, M.I.M., Abdullah, R. & Zakaria, N. (2021). Evaluating the effects of electronic health records system adoption on the performance of Malaysian health care providers. *BMC Medical Information Decision Making. 21*, 75

Satuluri, R. (2021). Digital transformation in Indian Insurance Industry. *Turkish Journal of Computer and Mathematics Education (TURCOMAT), 12*(4), 310-324.

Schoen, C., Osborn, R., Squires, D., & Doty, M. M. (2013). Access, affordability, and insurance complexity are often worse in the United States compared to ten other countries. *Health affairs (Project Hope)*, *32*(12), 2205–2215. https://doi.org/10.1377/hlthaff.2013.087

Schubert, T., Baier, E., & Rammer, C. (2018). Firm capabilities, technological dynamism and the internationalisation of innovation: A behavioural approach. *Journal of International Business Studies*, *49*(1), 70-95

Stoumpos, A.I., Kitsios, F. and Talias, M.A., (2023). Digitalization in healthcare: technology acceptance and its applications. *International Journal of Environmental Research and Public Health, 20*(4), 3407

Taheri, R. H., Miah, M. S., & Kamaruzzaman, M. (2020). Impact of working environment on job satisfaction. *European Journal of Business and Management Research, 5*(6). https://doi.org/10.24018/ejbmr.2020.5.6.643

Tangen, S. (2015). Demystifying productivity and performance. *International Journal of Productivity and Performance Management, 54* (1), 34-46.

Tortorella, G.L., Fogliatto, F.S., Tlapa Mendoza, D., Pepper, M. and Capurro, D., (2023). Digitalization of health services: a value stream-oriented approach. *International Journal of Production Research, 61*(6), 1814-1828

Tran, T. M. T., Yuen, K. F., Li, K. X., Balci, G., & Ma, F. (2020). A theory-driven identification and ranking of the critical success factors of sustainable shipping management. *Journal of Cleaner Production, 243*, 118401. https://doi.org/10.1016/j. jclepro.2019.118401

Uzochukwu, B. S. C., Ughasoro, M. D., Etiaba, E., Okwuosa, C., Envuladu, E., & Onwujekwe, O. E. (2015). Health care financing in Nigeria: Implications for achieving universal health coverage. *Nigerian Journal of Clinical Practice, 18*(4), 437–444.

World Health Organization (WHO). (2019). Digital Health: A Strategy for Africa 2020–2030. WHO Regional Office for Africa.

World Health Organization (WHO). (2021). Global strategy on digital health 2020–2025. https://www.who.int/publications/i/item/9789240020924

Yap, J. B. H., Abdul-Rahman, H., & Chen, W. (2017). Collaborative model: Managing design changes with reusable project experiences through project learning and effective communication. *International Journal of Project Management*, *35*(7), 1253-1271.

Yasar, K. (2023) *Wearables Devices*. Retrieved from https://www.techtarget.com/searchmobilecomputing/definition/wearable-technology

Zaoui, F., & Souissi, N. (2020). Roadmap for Digital Transformation: A Literature Review. *Procedia Computer Science, 175*, 621-628. https://doi.org/10.1016/j.procs.2020.07.090