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Healthcare Information Systems Dimensions and the Implementation of the Social Health Authority in Lamu County, Kenya

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Abstract: **Kenya replaced the National Hospital Insurance Fund with the Social Health Authority (SHA) in October 2024, and the new authority depends on digital platforms for member registration, eligibility verification, provider management and claims processing. Whether those platforms work in remote counties is central to whether the reform delivers. This study examined the influence of four healthcare information systems dimensions, namely technological infrastructure, data security, systems expertise and systems integration, on the implementation of SHA in Lamu County, drawing on the resource-based view, the unified theory of acceptance and use of technology, and diffusion of innovations theory. A descriptive design was adopted. From a population of 344 comprising SHA management, supervisors, civil-servant beneficiaries and hospital representatives, a stratified sample of 185 was drawn and 167 usable questionnaires were returned (90.3 per cent). Data were analysed using descriptive statistics and multiple linear regression. Respondents agreed, on balance, with all four dimensions, rating systems integration highest (M = 4.32) and technological infrastructure lowest (M = 4.01), and the weakest items concerned access to patient data when needed and safeguards against data loss. The regression model was significant ($F(4, 162) = 348.92$, $p < .001$), and all four dimensions had positive and significant effects on SHA implementation, with technological infrastructure the most precisely estimated ($B = 0.751$, $t = 6.47$, $p < .001$), followed by data security ($B = 0.793$, $t = 3.49$, $p < .001$), systems integration ($B = 0.799$, $t = 2.75$, $p = .007$) and systems expertise ($B = 0.708$, $t = 2.31$, $p = .022$). The results point to reliable infrastructure and access to patient records as the first conditions for SHA implementation in a remote county, and the study recommends investment in connectivity and power, data-loss safeguards and continuous user training.**

Keywords: **healthcare information systems; Social Health Authority; universal health coverage; interoperability; data security; digital health; Kenya.**

1. INTRODUCTION

The Social Health Insurance Act, 2023 established the Social Health Authority (SHA) to replace the National Hospital Insurance Fund and to move Kenya towards universal health coverage through three funds: the Primary Healthcare Fund, the Social Health Insurance Fund, and the Emergency, Chronic and Critical Illness Fund (Republic of Kenya, 2023). SHA began operating in October 2024. Unlike its predecessor, it was designed around digital platforms from the outset, so registration, means assessment, eligibility checks at the point of care, provider contracting and claims processing all run through information systems. The reform therefore depends on those systems working in every county, including those where connectivity, power and technical support are weakest.

Lamu County is one such county. Its population is spread across the mainland and an archipelago of islands, many facilities are reached by boat or by long road journeys, and public health services depend heavily on a small number of facilities with limited technical staff. In such a setting a system that works well in Nairobi may stall at the point of care because a connection drops, a record cannot be retrieved, or no one on site can resolve a fault.

Kenyan evidence on electronic health records gives reason for caution. In a national analysis of 213 facilities using the KenyaEMR system for HIV care, Ngugi, Babic and Were (2021) found that, on average, only 18.1 per cent of authorised users actively used the system. In focus groups across Kenyan facilities, users credited the same system with better data management and reporting but identified frequent power outages, inadequate computers, retrospective data entry, staff turnover and gaps in training on upgrades as barriers, with infrastructure seen as the greatest obstacle (Ngugi, Were, & Babic, 2021). Experience in a well-resourced private hospital is more positive: in a survey of 471 end users at a tertiary hospital in Nairobi, 89.9 per cent reported that the electronic health record had improved their work compared with paper (Shrestha et al., 2025). What has not been examined is how the dimensions of healthcare information systems relate to the implementation of SHA itself, in a remote county, in the first years after the reform.

The study's specific objectives were to establish the effect of technological infrastructure, data security, systems expertise and systems integration on the implementation of the Social Health Authority in Lamu County, Kenya.

2. LITERATURE REVIEW

2.1 Theoretical Literature

Three theories anchor the study. The first is the resource-based view, in which Barney (1991) argues that performance derives from resources that are valuable, rare, difficult to imitate and difficult to substitute, and from the organisation's capacity to deploy them. Applied to a public health financing agency, the view directs attention less to competitive advantage than to whether the resources on which digital service delivery depends, namely connectivity, power, hardware, data protection and skilled people, are present and usable where services are delivered. Technological infrastructure and systems expertise are, in this framing, the resources that convert an information system from a design into a working service.

Where the resource-based view looks at the organisation, the unified theory of acceptance and use of technology turns attention to the user. Venkatesh, Morris, Davis and Davis (2003) integrate earlier acceptance models into four determinants of technology use: performance expectancy, effort expectancy, social influence and facilitating conditions. The theory explains why expertise and integration should matter for implementation. Staff who are trained and supported find a system easier to use, and a system that exchanges information with others delivers more of the benefit users expect from it. Facilitating conditions, which include infrastructure and technical support, link the theory directly to the resource-based view.

The third perspective, diffusion of innovations theory, explains how such systems spread through a health system once they are in place. Rogers (2003) accounts for the rate at which innovations are adopted through their relative advantage, compatibility, complexity, trialability and observability, and by the social system through which they are communicated. Greenhalgh, Robert, Macfarlane, Bate and Kyriakidou (2004), in a systematic review of innovation in health service organisations, add that adoption depends on organisational readiness, system antecedents and the linkage between those who design an innovation and those who use it. For SHA, the theory frames data security and integration as attributes that determine whether health workers and members trust the system and find it compatible with existing practice.

Drawing these perspectives together, the study modelled the implementation of SHA as a function of four healthcare information systems dimensions. Technological infrastructure was measured through regular system updates, prompt implementation of updates, accessibility of patient data, seamless retrieval of patient records, capacity to accommodate growing data volumes and scalability. Data security was measured through encryption, confidence in encryption, access controls, role-based access, mechanisms to prevent data loss, and backup and recovery. Systems expertise was measured through low error rates in processing, training to reduce user errors, evaluation against efficiency metrics, feedback to users, and the role of quality certification. Systems integration was measured through data flow across departments, reduction of barriers between units, interoperability with external systems, the effect of interoperability on information exchange, and the contribution of information systems to the precision and accuracy of treatment.

2.2 Empirical Literature

Turning to the empirical evidence, technological infrastructure is the most consistently reported constraint on health information systems in Kenya. Ngugi, Were and Babic (2021) found that power blackouts and inadequate computers were the leading barriers to use of electronic medical records, and Ngugi, Babic and Were (2021) found that actual use of KenyaEMR remained low across the facilities in which it had been implemented. The pattern is not confined to health.

Mutiso and Mutuku (2022), studying information systems implementation in the County Government of Machakos, found that implementation improved user performance, which in turn strengthened organisational performance, and recommended that county governments invest in information systems to improve employee performance and service delivery. Outside Kenya, Adedeji, Fraser and Scott (2022) found in a pilot of electronic health records at a primary health centre in Lagos that high initial costs and sustainability were the principal challenges.

A second strand of evidence concerns data security. Health and insurance data are among the most sensitive personal information a public body holds, and trust in their protection shapes whether users adopt digital services. Mutuku (2020a), reviewing evidence on Kenya's e-Citizen platform, found that users' perceptions of security, privacy, usefulness, ease of use, speed and cost shaped adoption and continued use, and that rising cybercrime and misuse of personal data had weakened public trust. Mutuku (2020b), examining enterprise resource planning implementations, identified the consolidation of user access, internal controls, data handling, reporting and threat protection into a single system as one of the most difficult aspects of implementing integrated systems. Both studies suggest that security is a condition of adoption rather than a technical afterthought, which is directly relevant to a platform that links members' identity, income and health records.

Closely linked to security is the expertise of the people who operate the systems, and here the Kenyan evidence identifies training and support as facilitators of system use and their absence as a barrier. Users in the focus groups reported by Ngugi, Were and Babic (2021) credited training, responsive IT support and help from colleagues with making the system usable, and identified staff turnover and missing training on system upgrades as reasons for decline in use. Mutuku (2020b) likewise identifies adequate training and change management among the key success factors in implementing large integrated systems.

The fourth dimension, systems integration, determines whether information entered once can be used across facilities, departments and payers. Schmitt (2023), reviewing Germany's national rollout of electronic health records, attributes slow progress to the difficulty of aligning stakeholder interests and decision-making across a fragmented system, a finding relevant to a Kenyan reform that links county facilities, faith-based and private providers and a national payer. Shrestha et al. (2025) report that, in an integrated hospital system in Nairobi, most users judged that the electronic health record had improved the quality of care and interactions within healthcare teams.

Across this literature, infrastructure, security, expertise and integration are each associated with the use and effectiveness of health and public-sector information systems, but the Kenyan evidence concerns electronic medical records in HIV programmes, private hospitals and county administration. None of the reviewed studies examines the information systems on which SHA depends, or a remote county in the period immediately after the reform.

3. RESEARCH METHODOLOGY

A descriptive research design was adopted. The target population comprised 344 individuals involved in SHA operations in Lamu County: four members of top management, ten supervisors, 300 civil-servant beneficiaries and 30 hospital representatives. Sample size was determined with Yamane's (1967) formula at a 5 per cent margin of error, giving 185, and stratified random sampling allocated the sample across the four groups: two top managers, six supervisors, 157 beneficiaries and 20 hospital representatives.

Primary data were collected with a structured questionnaire, distributed and collected by research assistants with three days allowed for completion. The instrument comprised items on education and work experience and six five-point Likert items for each of the four information systems dimensions, scored from 1 (strongly disagree) to 5 (strongly agree). The instrument was piloted on 18 respondents, about 10 per cent of the sample, and reviewed by experienced researchers for validity. Cronbach's (1951) alpha exceeded the 0.70 threshold for every construct: 0.784 for technological infrastructure, 0.709 for data security, 0.726 for systems expertise, 0.802 for systems integration and 0.788 for SHA implementation.

Data were analysed in SPSS version 28 using descriptive statistics and multiple linear regression in the form $Y = \alpha + \beta_1X_1 + \beta_2X_2 + \beta_3X_3 + \beta_4X_4 + \varepsilon$, where Y is SHA implementation and X_1 to X_4 are technological infrastructure, data security, systems expertise and systems integration. Normality was tested with the Shapiro–Wilk test, multicollinearity with tolerance and variance inflation factors, and heteroscedasticity with the Breusch–Pagan test. Authorisation was obtained from Kenyatta University and a research licence from the National Commission for Science, Technology and Innovation, and participation was voluntary, informed and confidential.

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4. RESEARCH FINDINGS AND DISCUSSIONS

4.1 Response rate and respondent profile

Of the 185 questionnaires distributed, 167 were returned complete, a response rate of 90.3 per cent, well above the average response rates that Holtom, Baruch, Aguinis and Ballinger (2022) report for organisational survey research. Most respondents held a bachelor's degree (61.7 per cent), followed by a diploma (24.6 per cent) and a certificate (11.4 per cent), while 2.4 per cent held a doctorate. Experience was substantial: 38.3 per cent had worked for eight years or more and 33.5 per cent for five to seven years. The composition of the sample matters for interpretation. Beneficiaries made up 157 of the 185 places in the sample design, about 85 per cent, so most responses come from civil servants who use SHA as members rather than from the staff who operate or maintain its systems.

4.2 Descriptive statistics

Table 1. Mean ratings of healthcare information systems dimensions (n = 167)

Statement	Mean
Technological infrastructure	
The healthcare system is regularly updated with the latest technological advancements	3.95
System updates are promptly implemented to enhance efficiency	4.19
Patient data is easily accessible to authorised professionals when needed	3.61
The systems allow seamless retrieval of patient records	4.53
The systems can accommodate a growing volume of patient data	4.01
The system's ability to scale contributes to long-term sustainability	3.79
Overall	**4.01**
Data security	
Patient data is adequately protected through encryption	4.57
Encryption instils confidence in the security of patient data	4.09
Access controls restrict unauthorised access to patient records	4.41
Professionals access only the information their roles require	4.23
The systems have robust mechanisms to prevent data loss	3.58
Adequate measures back up and recover data after system failures	4.16
Overall	**4.17**
Systems expertise	
The systems exhibit low error rates in processing patient data	4.59
Training is provided to reduce errors in system usage	4.18
The systems are evaluated against efficiency metrics	4.02
Professionals receive feedback on efficiency metrics	4.43
Quality certifications are essential for reliability and security	3.94
Compliance with quality certifications instils confidence in the systems	4.10
Overall	**4.21**
Systems integration	
Healthcare data flows seamlessly across departments	4.21
Barriers to data flow between units are minimised	4.56
The systems are highly interoperable with external healthcare systems	4.37
Interoperability improves exchange of critical health information	4.08
The systems enhance the precision and effectiveness of interventions	4.63
The systems contribute to treatment accuracy	4.05
Overall	**4.32**

Source: Survey data (2026). Items scored 1 (strongly disagree) to 5 (strongly agree).

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Respondents agreed, on balance, with every statement, and the four dimensions are rated within a narrow band, from 4.01 for technological infrastructure to 4.32 for systems integration. The ratings describe SHA's information systems in Lamu County as secure, well integrated and operated by competent staff, with infrastructure the least satisfactory dimension.

The weakest items in each dimension are more informative than the averages. In technological infrastructure, the accessibility of patient data when needed is rated lowest (M = 3.61), well below the seamless retrieval of records (M = 4.53), a gap that suggests records can be retrieved when the system is available but are not reliably available when care is being given. That reading is consistent with the intermittent power and connectivity that Ngugi, Were and Babic (2021) identify as the leading barrier to electronic record use in Kenya. In data security, the item on mechanisms to prevent data loss is rated lowest (M = 3.58), against high ratings for encryption (M = 4.57) and access controls (M = 4.41): respondents appear more confident that data are protected from unauthorised access than that they will survive a system failure. Scalability and long-term sustainability (M = 3.79) is the other low infrastructure item. Taken together, these items identify reliability and resilience, rather than security or integration, as the dimensions respondents regard as least assured.

The high rating for interoperability with external healthcare systems (M = 4.37) should be read with caution. National evidence points to low actual use of facility electronic record systems in Kenya (Ngugi, Babic, & Were, 2021), and Schmitt (2023) documents how difficult interoperability has proved even in Germany's better-resourced health system. Because most respondents were beneficiaries, who experience SHA through registration and eligibility checks rather than through data exchange between facility systems, their ratings of interoperability and processing error rates are likely to reflect their experience of service rather than direct knowledge of system performance.

4.3 Regression results

Table 2. Multiple regression of SHA implementation on information systems dimensions (n = 167)

Predictor	B	Std. error	Beta	t	p
(Constant)	0.693	0.218	—	3.18	.002
Technological infrastructure	0.751	0.116	.702	6.47	< .001
Data security	0.793	0.227	.775	3.49	< .001
Systems integration	0.799	0.291	.757	2.75	.007
Systems expertise	0.708	0.306	.796	2.31	.022

Source: Survey data (2026). Dependent variable: SHA implementation. $F(4, 162) = 348.92$, $p < .001$.

The regression model is significant ($F(4, 162) = 348.92$, $p < .001$), and all four dimensions have positive coefficients that are significant at the 5 per cent level. The precision of the estimates differs considerably. Technological infrastructure is the most precisely estimated predictor ($t = 6.47$), followed by data security ($t = 3.49$), whereas systems integration ($t = 2.75$) and systems expertise ($t = 2.31$) have large standard errors relative to their coefficients. The evidence for expertise and integration is therefore weaker than for infrastructure and data security.

The most robust result is the one the national evidence would lead us to expect. Technological infrastructure is both the lowest-rated dimension and the most precisely estimated predictor of implementation, which is consistent with the resource-based view's emphasis on the resources that make a system usable where services are delivered (Barney, 1991) and with Kenyan evidence that power, connectivity and hardware are the main barriers to electronic record use (Ngugi, Were, & Babic, 2021). Data security is the second most precise estimate, consistent with Mutuku's (2020a) finding that users' trust in the security and privacy of a public digital platform shapes whether they continue to use it. The weaker estimates for expertise and integration are not evidence that these dimensions matter less, since Mutiso and Mutuku (2022) and Mutuku (2020b) identify user capability and integration as central to information systems performance, but in these data their independent contribution cannot be estimated with confidence.

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Respondents in Lamu County rate the information systems on which SHA depends favourably across all four dimensions, with infrastructure the least satisfactory. The weakest elements are the availability of patient data when it is needed, the protection of data against loss and the scalability of the systems, which together point to reliability and resilience rather

than security or integration as the areas of greatest concern. Technological infrastructure is also the dimension most robustly associated with implementation, followed by data security, while the independent contributions of expertise and integration cannot be established with confidence from these data.

Read through the resource-based view and the unified theory of acceptance and use of technology, these results suggest that the first condition for SHA implementation in a remote county is the facilitating infrastructure that makes a digital system available at the point of care. Security and trust come next. Expertise and integration build on these conditions but cannot substitute for them.

5.2 Recommendations

In light of these conclusions, the Social Health Authority and the Lamu County Department of Health should first treat reliable power and connectivity at facilities as a precondition of SHA implementation rather than a supporting investment. Backup power, redundant connectivity through more than one network or satellite link for island and remote facilities, and offline capability that allows registration and eligibility checks to continue when the network fails would address the weakest infrastructure item directly, namely the availability of patient data when it is needed.

Beyond infrastructure, SHA should strengthen resilience against data loss as deliberately as it protects data against unauthorised access. Routine tested backups, documented recovery procedures and monitoring of system availability at county level would address the lowest-rated security item, and regular security assessments and staff sensitisation on privacy would sustain the trust on which continued use depends.

Equally, training for health workers and SHA staff should be continuous and tied to system changes, with refresher training whenever platforms are upgraded and accessible technical support in the county, since Kenyan evidence identifies gaps in training on upgrades and staff turnover as leading causes of declining system use. SHA should also publish common data standards for facility systems and monitor the actual exchange of data between them, so that interoperability is assessed from system records rather than from perception.

Finally, further research should combine survey data from SHA and facility staff with objective system data, such as uptime, transaction completion, claims processing times and the volume of data exchanged between systems, and should report results separately for staff and beneficiaries. Comparative studies across remote and urban counties would establish whether infrastructure is the binding constraint everywhere or mainly where connectivity is weakest.

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