From paper to digital in a resource-limited setting: A case study of Zimbabwe's health administration system and e-health strategy

Lubinda Haabazoka[1]
Matipedza Lole[2]

[1]lhabazoka@yahoo.com
[2]lolematy@gmail.com

[1,2]The University of Zambia

https://doi.org/10.51867/scimundi.6.1.17

ABSTRACT

The implementation of the e-Health Strategy (2021–2025) for Zimbabwe has been critically reviewed and has been treated as a paradigm for transitioning from paper-based administration to digital health. This study was guided by the Technological, Organizational, and Environmental (TOE) framework and the Diffusion of Innovations (DOI) theory. This study employed a qualitative case study method, which included data collected through a documentary review of several primary resources, such as Health Management Information System (HMIS) reports (2020–2023) and official Ministry of Health and Child Care (MoHCC) publications, as well as secondary sources like peer-reviewed journals and reports from the World Health Organization (WHO) and International Telecommunication Union (ITU) (2019–2024). Thematic content analysis, based on the Technological, Organizational, and Environmental (TOE) framework, was used to identify achievements, systemic barriers, and implementation gaps. The findings indicate that Zimbabwe has made significant progress towards the centralization of health data by ensuring 95% facility reporting and reducing delays in reporting from 90 days to less than 15. Various targeted digital interventions with e-TB and FP/HIV tracking tools have enabled patient monitoring and medication adherence. For example, considering that across-the-board challenges still exist due to uneven technological infrastructure, fragmented and non-interoperable systems, poor human resource capacity, and donor funding only, one example is the cold-chain breakdown. Comparative evidence from regional and global contexts supports the notion that a sustainable scale-up of digital health may be achieved only by combining our approaches to technology, workforce development, interoperability, and domestic funding. The study concludes that while Zimbabwe has made exciting progress, systemic, organizational, and environmental barriers need to be overcome if it is ever to achieve a strongly established, sustainable, and equitable national digital health setting. Thus, the study recommends that legislators should adopt an all-encompassing approach that synthesizes technological, organizational, and environmental perspectives. From a technological perspective, the government should prioritize providing Internet and power infrastructure that is widely accessible anywhere by all, particularly in the rural districts, and also enforce the interoperability standards in order to reduce fragmentation in the system. Organizationally, there should be sustained investment in digital literacy training, mentorship programs, and the recruitment of dedicated ICT personnel for the district and provincial levels so as to bolster system adoption and promotion of seamless workflow integration. There should also be enactment of policies to either subsidize or provide completely free data services and connectivity tools to the health facilities and front-line workers. Another important recommendation is consideration of the incorporation of change management strategies, incentives for adoption, and aligning donor-supported activities with priorities on the national level so as to achieve the development of a resilient system that can be applied and scaled in a flexible way to bring equitable health outcomes simultaneously to the urban and rural populations.

Keywords: Digital Health, e-Health, Health Information Systems, Health Administration, Resource-Limited Settings, Zimbabwe

I. INTRODUCTION

The global demand for resilient, inclusive, and efficient health systems has driven an unprecedented shift towards digitization. Mentioned as a strategic priority for this transformation in the World Health Organization [WHO] Global Strategy on Digital Health 2020-2025, the journey is not about replacing technology with something better, said, though, rather it calls for a completely new perspective and solution for how healthcare, public health governance, and service delivery are managed (WHO, 2021). The strategic use of information and communication technologies (ICTs) is recognized as a means to disrupt legacy problems of data fragmentation, delayed reporting, and inefficient resource use, hence advancing responsive, evidence-based healthcare (Tahsin et al., 2023). Together, digital health stands as a critical enabler for the realization of goals of Universal Health Coverage and Sustainable Development Goals (SDGs), particularly in situations nudging against the limit of health system capacity.

The landscapes of digital health across the globe, however, are characterized by profound inequities, with the process of implementation categorically divided between high-income settings and low-resource settings. At the other end of the scale, the shift from deeply entrenched, paper-based systems to digital platforms are fraught with complex

and often contradictory challenges and opportunities. For example, they offer digital tools as a tangible means to cut through the morass of chronic administrative inefficiency such as manual data aggregation, which can hold back critical disease surveillance by weeks, even months and yet the deployment remains almost always subject to the condition of an underlying infrastructure being missing or in flux (Haleem et al., 2022). Scholarship abounds on the question, including the claim by Memari and Ruggles (2025) that digital-health progressions must be much more strategic in addressing the social determinants of health, lest they operate in an environment one would describe as "islands of innovation," only making the already weak infrastructural health care system divide in terms of haves and have-nots, urban versus rural.

The Zimbabwe health landscape offers a telling and unimpeachable informative example of a journey so delicate it could snap anytime. This is while the country is also grappling with an enormous epidemiological burden: an adult HIV prevalence of 12.9% and mounting non-communicable diseases (NCDs), with cardiovascular conditions alone contributing to nearly 25% of adult mortality (ICAP, 2022; Zimbabwe NCDI Poverty Commission, 2021). This burden mandates a health information system that can manage at full capacity both routine chronic care management and acute epidemic control. Historically, though, it has been paralyzed by a chain of fragmented paper processes. An operational review conducted in 2021 found that district hospitals' manual stock management for essential medicines caused stock-out rates of over 40% for key antiretroviral drugs at any given time, occasioned by delayed and faulty paper-based reporting (Yenet et al., 2023).

In response to some systemic weaknesses, the Government of Zimbabwe launched its National e-Health Strategy 2021-2025 through the Ministry of Health and Child Care (MoHCC). With the central primary objective being to guide the transformation of the country's health system from disconnected, bespoke vertical digital projects, donor-dependent, and non-interoperable into a government-owned ecosystem for digital health (MoHCC, 2021), the E-Health Strategy also places possessed vision on the establishment of the DHIS2 as the nationwide health data warehouse and electronic health records (EHRs) and mobile health (mHealth) solutions for the laid expanse for the community health workers with a phased-implementation approach. The policy intends to foster the use of digital tools for outcomes improvement, enhance operational efficiency, and increase health information and services' equity.

However, within an environment of serious infrastructure challenges, the implementation of this visionary strategy becomes necessary. Infrastructural needs are myriad: according to the Postal and Telecommunications Regulatory Authority of Zimbabwe (POTRAZ from 2023) there is 4G/LTE mobile network coverage reaching some 85% of the population, the figure for reliable, affordable broadband connectivity in the public health facilities, particularly in rural areas, languishes below 40%. On top of that, a human resource capacity assessment revealed that, out of mid-level health managers, less than 30% had the digital literacy necessary for using data analytics from DHIS2 for local decision-making (Chilunjika et al., 2024). These problems, indeed, underpin the critical research context: a strategic vision of digital efficiency confronting the realities of a resource-despoiled environment.

Thus, the paper puts forth an in-depth critical scrutiny of Zimbabwe's transition from paper-based to digital health administration. It delves beyond a cursory appraisal of technological uptake to probe broader implementation issues related to the National e-Health Strategy, to investigate a dynamic interplay between policy aspiration, uptake of technology, organizational capacity, and the realities of the socio-economic environment. In attempting to bring together many more-or-less transient databases, given case examples and the last documental criticisms on the topic, the study aims to ascertain the determinants of success or stagnation between transformative interventions in an environment where everything is limited. The findings made will thus provide a crucial finger on the pulse of the progression of the country's health sector. Further, they will be equally relevant to making evidence-based, transferable learning for other sub-Saharan countries traversing the winding path from analog to digital technology.

1.1 Statement of the Problem

The paper-based health management system in Zimbabwe poses as a foremost bottleneck to the healthcare delivery system as many instances have ascertained detrimental effects on data quality, timeliness, and resource management. For example, the empirical evidence suggested that manual processing resulted in significant inaccuracies and delays in information management. A study substantiating the statement, found inconsistencies between the paper registers and aggregated reports to account for a data error rate of over 25% for the key maternal health indicators at the district level (Agbedi et al., 2025). Thus, in action, delayed reporting which often takes 6-8 weeks for data to traverse and reach the provincial levels became a direct hindrance to swift disease outbreak responses like cholera (Bwire et al., 2016). With regards to provision and policy for digitalization, the launching of the National e-Health Strategy 2021-2025 provides attempting information on the subject matter with respect to transition, implementation of the process into operational reality. However, there has been a lack of study investigating the operationalization of the intent of this strategy in the context of poverty-stricken Zimbabwe. Existing literature has isolated pilot schemes, but limited systematic analysis of systemic barriers spanning financing, infrastructure, capacity of the workforce, and institutional governance driving “drag” and preventing sustainable state-wide scale-up. The

present study tries to fill this void by investigating why, after clear strategic guidance given for this activity, the changeover from paper to a seamlessly integrated digital health system is yet to mature, resulting in a series of fragmented re-implemented activities that still will fail to provide permanent solutions to the inefficiencies confronting the Ministry of Health and Child Care.

1.2 Research Objective(s)

i. Examine the key components and implementation architecture of Zimbabwe's e-Health Strategy.
ii. Assess the documented impacts and achievements of digital health tools on health administration since 2020.
iii. Identify the persistent technological, financial, and human resource challenges hindering nationwide scale-up.

II. LITERATURE REVIEW

2.1 Theoretical Review

2.1.1 The Technology-Organization-Environment (TOE) Framework

The Technology-Organization-Environment (TOE) framework established by Tornatzky and Fleischer in 1990 functions as a methodical examination framework which researchers use to study how organizations adopt and use new technological innovations. The framework establishes three separate contexts which impact how organizations adopt new technologies: the technological context which includes all internal and external technological assets of the organization; the organizational context which defines the unique attributes and capabilities of the business; and the environmental context which contains the industrial framework and regulatory system and foundational facilities (Zhang et al., 2020).

The technology framework in Zimbabwe's digital health transformation depends on three factors which include the existing digital technologies and their operational difficulty and their compatibility with digital systems. Kudyba (2020) shows that these technologies provide important benefits to users but their actual usage remains restricted because systems need to interoperate with multiple health networks which include HIV and tuberculosis and maternal health programs to create a centralized national data storage system. The organizational context includes all the fundamental elements which include both human resources and operational methods that the Ministry of Health and Child Care (MoHCC) and its partner institutions in Zimbabwe maintain. The country faces a critical shortage of trained health personnel because a recent evaluation found that only 32% of health facility managers in rural areas have the necessary digital skills to analyze data from digital systems for decision-making (Chilunjika et al., 2024). The organization faces two major challenges which include a staffing shortage and a lack of expertise which exists because the organization needs to change from its traditional paper-based system to an electronic system.

The environmental context includes external elements which consist of government policies and regulatory frameworks and infrastructure availability. The National e-Health Strategy 2021-2025 in Zimbabwe provides policy guidance but its implementation faces challenges because 42% of public health facilities lacked dependable internet access in 2023 and 65% of facilities suffered power interruptions that lasted more than six hours daily (Postal and Telecommunications Regulatory Authority of Zimbabwe [POTRAZ], 2023). The TOE framework demonstrates strength through its extensive scope which enables researchers to study how three different contexts work together to drive or limit digital transformation efforts. The TOE Framework evaluation in resource-constrained environments reveals that it tends to downplay existing power disparities which exist in global health funding since donor interests take precedence over both organizational and environmental factors which leads to unsustainable technology deployments (Assaye et al., 2024).

2.1.2 Diffusion of Innovations (DOI) Theory

The Diffusion of Innovations (DOI) theory developed by Rogers (2003) explains how new technologies and ideas move through social networks. The theory states that people will adopt an innovation based on their assessment of its five perceived attributes which include relative advantage compatibility and complexity and trialability and observability. Health workers in Zimbabwe cannot see the digital health systems' benefits because they must enter data into both digital and paper systems which create an extra workload for them, (Kiberu et al., 2017).

The systems show extremely low compatibility with current values systems and previous experiences and their existing requirements because they disrupt established paper workflows without delivering sufficient local customization. The research conducted by Kambarami et al. (2016) shows that a mobile health application developed for community health workers in Mashonaland Central Province faced initial resistance which resulted in less than 25% uptake during its first year because users believed the application did not match their local literacy abilities and existing network coverage.

Health workers who have not received proper training in technology find it difficult to adopt DHIS2 because the system requires complex implementation processes. According to DOI theory health workers can be categorized

into five groups which include innovators early adopters early majority late majority and laggards and health facilities throughout Zimbabwe have adopted digital tools at different rates based on their geographic locations (Putteeraj et al., 2022). The theory shows limitations in this context because DOI requires voluntary adoption and equal access to information and resources which do not exist in resource-restricted health systems that operate under strict hierarchical structures. The current situation in Zimbabwe requires that organizations implement new systems through executive orders which lack essential support while power outages create structural problems that make it impossible to test new systems and observe their processes which lead to restricted innovation spread across all system components (Mandowa et al., 2025).

2.2 Empirical Review

2.2.1 The Financing and Infrastructure Chasm

The digital health field faces major growth challenges because it suffers from severe funding shortages which disrupt its basic operational activities and its ability to maintain business operations. Evidence indicates that over 75% of digital health interventions in Zimbabwe subsist primarily on short-term donor funding which tends to focus on disease-specific interventions while neglecting investment in enduring systemic infrastructure (Ministry of Health and Child Care [MoHCC], 2021b). The funding model creates "projectification" problems because it enables organizations to deploy digital technologies through isolated projects that lack both local community control and permanent operational viability which researchers have documented in multiple low- and middle-income countries (LMICs) (Sahay et al., 2017). All five donor-funded mHealth projects from 2018 to 2020 ceased their operations six months after project completion because they had no plans for sustainable transition (Erku et al., 2023). The ongoing cycle of project termination which destroys health system confidence leads to funding for temporary digital projects instead of permanent digital system development.

The financial challenges facing e-Health expansion because of infrastructure deficits which include insufficient connectivity and unreliable electricity supply. National data show that mobile connectivity has increased but 60% of rural health centers still need affordable broadband access to operate their digital systems (POTRAZ 2023). Digital tools require internet access to execute their functions which include real-time data reporting and telehealth consultations and remote supervisory operations. The unstable electricity supply creates a new obstacle for rural health facilities which face monthly power outages that last 120 hours on average and this leads to system failure which compels staff to use paper records (Ministry of Energy, 2023). The combination of limited connectivity and unstable electricity supply creates disruptions to e-Health operations which result in more administrative tasks that decrease the operational benefits e-Health systems should provide (Utete & Mahlanganise, 2024).

The ongoing need for infrastructure funding appears essential according to evidence from regional comparative studies. The national digital health infrastructure of Rwanda now provides more than 80% of healthcare facilities with both broadband internet access and backup power systems which support operational electronic health records and unified health information systems (Bananeza, 2025). The infrastructure deficiencies of Zimbabwe demonstrate a major problem because the country cannot achieve its strategic goals without essential resources for expansion. The current situation shows that digital health systems will remain unworkable because organizations need to invest in both broadband internet access and reliable electrical power sources (Sangwa & Mutabazi, 2025).

2.2.2 Human Resource Capacity and Institutional Inertia

Human resources are essential for digital health implementation. The country faces serious challenges because its people lack digital skills and its institutions have insufficient technical capabilities. A training needs assessment conducted in 2022 in Manicaland Province revealed that only 28% of nurses and environmental health officers demonstrated confidence in performing basic computer functions. The existing training programs at their facilities offer training that lasts less than three days (Chilunjika et al., 2024). The brief exposure to training materials does not meet the requirements for building proficiency because users need to work with digital tools for extended periods while receiving updates. The insufficient training that results from this practice explains how organizations lose system effectiveness while their employees make more mistakes and produce inferior data which in turn decreases their trust in digital systems (Sangwa & Mutabazi, 2025). The existing skills deficit functions as a training requirement which creates a fundamental barrier that prevents organizations from maintaining their data quality and receiving user acceptance of their systems.

The existing paper-based system at Zimbabwean health facilities establishes an ongoing challenge which prevents their shift to digital health systems. The administrative operations of Zimbabwe's health system have relied on inefficient paper methods which created negative views about technology among health workers. Health workers consider digital tools to be extra tasks which create more administrative work especially when digital systems do not fit into their regular work routines (Putteeraj et al., 2022). The need to keep both electronic and paper records for compliance with regulations and donor-funded programs creates additional resistance to this practice. The

"workaround cultures" of these organizations create data errors because their digital systems show different data from what their paper records display, which reduces trust in digital solutions and stops users from fully using them (Agbeyangi & Lukose, 2025).

The research shows that human resource difficulties exist in all resource-limited environments which include Zimbabwe. Research conducted in Nigeria and Ethiopia has found that health workers' perceptions of digital tools including usability, relevance to clinical workflow, and perceived value significantly predict adoption patterns (Okele, 2026). The research demonstrates that technical training needs additional support because it requires organizations to improve their employee motivation through better workplace practices. The sustainable approach needs to provide health workers with ongoing professional development supervision support and active participation in digital health implementation training instead of using brief training sessions which do not bring about permanent changes in behavior (Kiberu et al., 2017).

2.2.3 Fragmentation, Interoperability, and the "Pilotitis" Pandemic

The ongoing separation of various systems in Zimbabwean digital health systems creates their main obstacle which needs to be solved through the development of a single digital health system. The current health information systems in Zimbabwe, which include the HIV Electronic Patient Monitoring System (ePMS) and ETR.net, and the electronic Logistics Management Information System (eLMIS), waste resources because they lack common interoperability standards (MoHCC, 2022). The system requires users to enter data multiple times across different platforms, which leads to higher administrative work and greater chances of making data entry mistakes. The 2022 interoperability audit uncovered numerous data silos that created major obstacles to developing complete system-wide understanding while they also prevented the national system from tracking patients and monitoring its operational efficiency (MoHCC, 2022).

The system suffers from fragmentation because donors establish project priorities which require immediate results through disease-specific work instead of developing sustainable project outcomes that maintain system integrity (Sahay et al., 2017). The 2021 scoping review discovered that only five out of 22 digital health pilots which operated in Zimbabwe from 2017 until 2021 achieved national scaling and interoperability with essential systems like DHIS2 (Erku et al., 2023). The funding system for global health research funds projects which produce immediate results but fails to support ongoing development of health systems (Amarakoon et al., 2020). The method creates separate data storage areas which do not enable the construction of extensive data systems.

International comparisons provide strong evidence against fragmentation. The two neighboring countries of Kenya and Rwanda established national interoperability standards which improved their healthcare delivery and national health reporting accuracy and system performance (Musabi & Kipkebut, 2024). The integrated platforms of these systems stop duplicate work while they permit sharing information between different programs. The fragmentation of Zimbabwean operations leads to a major loss of opportunity costs. The analysis shows that "pilotitis" represents a technical failure which originates from the funding system providing resources without considering the operational needs of health systems. Zimbabwe needs to establish new interoperability standards and develop a comprehensive policy framework to achieve its digital health transformation goals (Aanestad et al., 2019).

III. METHODOLOGY

This study uses a qualitative case study research design to investigate the implementation and its related systemic challenges of Zimbabwe's national e-Health strategy. Qualitative case study serves the purpose of providing an in-depth, contextually tailored insight into the complex environment prevailing in the policy stage, where infrastructure and organization issues interact with culture and deeply structure the national transition toward digital health (Yin, 2014). While quantitative approaches consistently stressed the power of numerical generalization, the qualitative case emphasizes rich description, meaning building, and pattern recognition by which the researcher can pull out the evolution of that process amid the stumbling blocks lying in the wider system, which a synthesis of data would otherwise miss (Saunders et al., 2023).

Data collection was implemented through a large-scale documentary review from both primary and secondary sources to ensure a wide and deep evidential base. The primary sources were mainly the official documents identified by the Zimbabwe National e-Health Strategy 2021–2025 and Health Management Information System (HMIS) annual reports from 2020 to 2023 together with other documentation from the Ministry of Health and Child Care (MoHCC). These policy documents provide a direct vision-meeting point for the national objective, the actual course, fading, and other official reports-a ground which is the ultimate need of any empirical inquiry. Usage of this official document follows "best practices" used in qualitative research phenomena of interest in health systems, that document data could easily disclose the conflicting confrontations between policy intentions and administrative realities (Corbin & Strauss, 2023). The secondary sources included papers in peer-reviewed or trade journals, reports of that analysis of data that

have been published online by the WHO, ITU, etc., for the period 2019-2024. These sources were carefully chosen to situate Zimbabwe's experience within a global and regional landscape of digital health uptake providing comparative insights and theoretical framing for this argument. In order to enrich the empirical analysis with the most recent statistics and contextual data, the study undertook to analyse quantitative variables extracted from the 2023 Second Quarter HMIS Report and ZIMSTAT ICT Access Survey; whilst the research remains largely qualitative, the inclusion of data in recent statistics is capable of triangulating these findings and ensuring that the credibility of the findings is maintained by showing qualifications drawn from trends, making quantitative comparisons within and between themes. Recent statistics from HMIS and ZIMSTAT scored well in monitoring how peripherals and connectivity were increasing and contributing to any up-to-date workforce distribution related to Zimbabwe's health and digital infrastructure developments (ZIMSTAT, 2023; MoHCC, 2023).

Documentary data collected was analyzed thematically; a frequently used qualitative data analysis methodology categorizing the internal patterns and themes of textual data through coding and categorizing recurrent themes. Thematic analysis seems particularly apt in policy and organizational studies because it helps to interpret latent meanings, compare perspectives, and hence create a connection between the objectives documented and the outcomes observed. Video recordings, minutes, and reports, for instance, were coded in each sixth of the above categories. The other categories are strategy implementation, systemic barriers, infrastructural challenges, and documented impacts. Codes in this category were then refined to the textual, organisational, and technological elements. This was used to discuss the technological, organisational, and environmental aspects of accessibility to gather information on cooperative behavior and the degree to which these dimensions are affected by the technological capability of agencies, other organizational readiness factors, and environmental circumstances (Jeilani & Hussein, 2025; Ali et al., 2022). It engaged in multiple rounds of review and cross validation to ensure inter-sectional and depth in theme determination. When conflicting narrative sources, for example, discrepancies between the official progress reports and scholarly analysis were discovered, the researcher diligently investigated contextual matters and referenced other sources to help resolve such discrepancies and add further interpretive validity. Drawing on documentary review and guided thematic analysis within the TOE framework, this methodology potentially furnishes a sturdy space from which to critically evaluate Zimbabwe's digital health strategy and to develop insights that root from theorizing as much as from empirical grounding.

IV. FINDINGS & DISCUSSION

4.1 Achievements and Progress

Zimbabwe has made significant strides in digital health, enabled primarily by the systematic deployment of DHIS2 as the centralized national data repository. By 2023, approximately 95% of health facilities were submitting their Health Management Information System (HMIS) data electronically, reducing data reporting delays from an average of 90 days to less than 15 (MoHCC, 2023). During the COVID-19 pandemic, this development proved instrumental in enabling near real-time case surveillance, guiding targeted interventions, and facilitating rapid resource allocation for oxygen capacity, personal protective equipment, and vaccines (Ross & Wendel, 2023). The timeliness of reporting achieved in Zimbabwe parallels experiences in Rwanda, where real-time reporting through DHIS2 reduced delays by over 50%, demonstrating the indispensable contribution of centralized digital health platforms to responsive public health management (Simbini et al., 2026).

Additional gains have been realized through disease-specific digital interventions. Tools such as e-TB for tuberculosis management and digital platforms for family planning (FP) and HIV monitoring have enhanced patient tracking and adherence monitoring. According to Timire et al., (2019), e-TB platforms implemented in pilot districts reduced treatment attrition by approximately 18%, improving outcomes for one of Zimbabwe's most challenging communicable diseases. Similarly, FP and HIV monitoring tools have enabled better longitudinal tracking of patient follow-up visits (Kruse et al., 2017). However, these achievements remain unevenly distributed, with urban districts deriving greater benefits than rural areas due to infrastructure inequalities, reinforcing the importance of targeted investments to eliminate systemic inequities (Chitungo et al., 2022).

At provincial and national levels, health management has been strengthened through access to timely, contextually informed data. Health managers can now access near real-time indicators on vaccination coverage, drug supplies, and patient admissions, enabling rapid intervention adjustments. During the 2022 cholera outbreak in Harare, DHIS2 data enabled rapid hotspot identification and resource distribution, exemplifying the broader health information system's contribution to outbreak response (MoHCC, 2023). While encouraging, this progress must be evaluated against the substantial systemic challenges that continue to constrain more equitable scaling throughout the country.

Table 1

Achievements in Zimbabwe's Digital Health Implementation (2020–2023)

Achievement	Indicator/Statistic	Impact/Insight	Source
DHIS2 adoption	95% of facilities reporting electronically	Reduced reporting delays from 90 → <15 days	MoHCC, 2023
e-TB adherence improvement	18% reduction in patient attrition	Improved TB treatment completion rates	Timire et al., 2019
FP & HIV tracking expansion	Coverage increased in 60% of pilot districts	Enhanced patient follow-up and adherence	Timire et al., 2019
Real-time outbreak surveillance	2022 cholera outbreak managed using DHIS2	Rapid hotspot identification and resource allocation	MoHCC, 2023

4.2 Persistent Challenges within the TOE Framework

4.2.1 Technological Context

The existing technology achieves its objectives, yet technological limitations still prevent complete system deployment. The existing infrastructure system has critical deficiencies because urban locations such as Harare and Bulawayo experience dependable network service while more than 35% of rural health facilities face total internet service unavailability which becomes worse due to constant power interruptions (ZIMSTAT, 2022). This situation causes data quality issues which result in reporting delays and require health workers to use both paper-based systems and electronic systems. The challenge exists throughout Sub-Saharan Africa because the region lacks uniform internet access which creates digital healthcare disparities (Utete & Mahlanganise, 2024; Musabi & Kipkebut, 2024).

The technological landscape experiences additional difficulties because digital systems experience fragmentation. The existence of non-interoperable tools for HIV and immunization and TB and supply chain management creates data silos which prevent teams from making decisions together. The 2022 interoperability audit showed that more than 70% of facilities needed to perform duplicate data entry which created additional work and increased the chance of making mistakes (MoHCC, 2022). The current state of digital health projects demonstrates that over ten years these projects have maintained their separate operations which create excessive data through multiple systems without producing better understanding. The emergence of "pilotitis" which creates multiple independent short-term pilot projects according to Amarakoon et al. (2020) occurs because donors create their own priorities which focus on program visibility instead of long-term program sustainability. The governments of Kenya and Rwanda established system integration policies which required their health systems to follow standardized interoperability protocols according to Musabi and Kipkebut (2024).

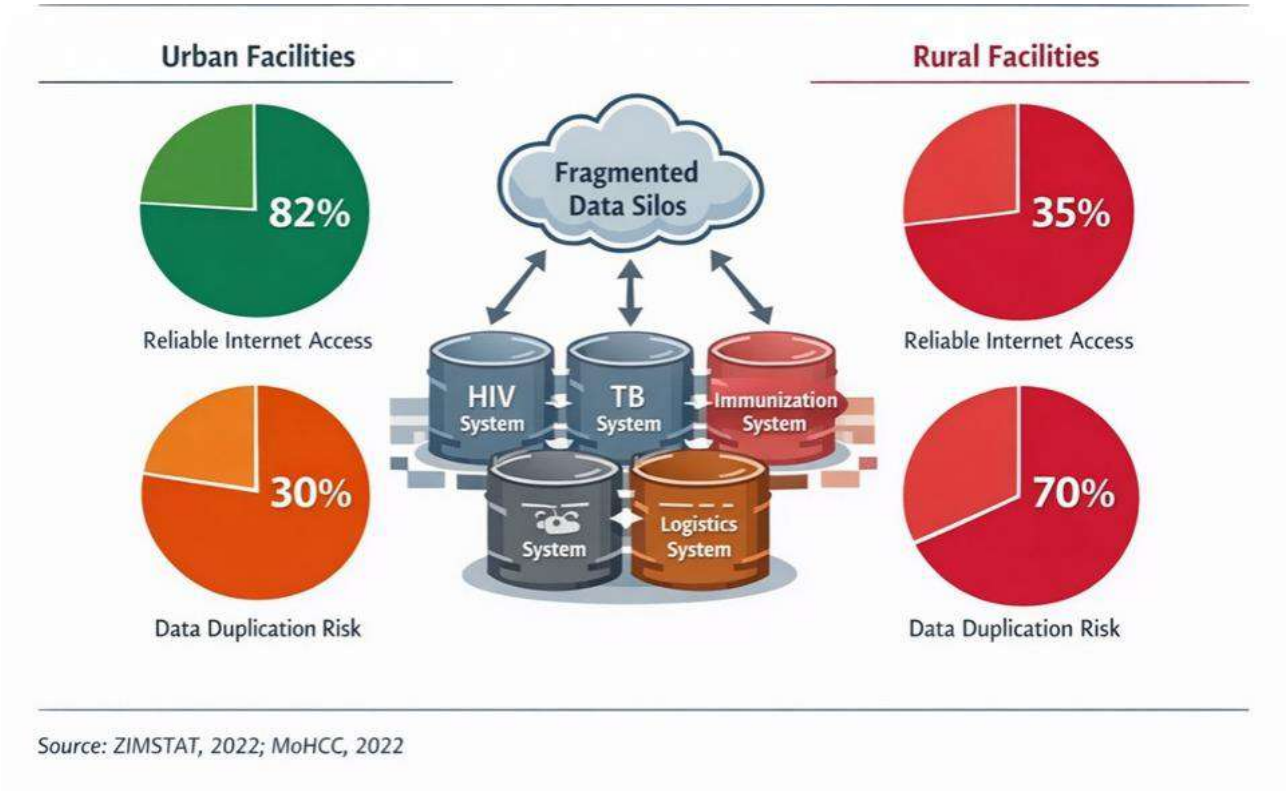

Figure 1

Distribution of Internet Connectivity and System Fragmentation in Health Facilities

The study found that 95% of urban facilities have dependable internet access while only 35% of rural facilities maintain consistent internet connectivity. The study found that more than 70% of facilities operate three or more digital systems which do not work together, resulting in major data replication issues. Source: Adapted from ZIMSTAT (2022) and MoHCC (2022).

4.2.2 Organisational Context

The organization faces human resource limitations which serve as its most critical obstacle to implementation. A study conducted across five districts found that only 40% of nurses had received adequate training in electronic health record utilization because digital literacy levels remained uneven (Chitungo et al., 2022). The understaffing of ICT personnel at district and provincial levels creates delays in both troubleshooting and user support functions. People in LMIC areas demonstrate low system adoption because they have both low digital literacy and limited confidence which causes them to use digital tools only partly according to the pattern which researchers found in their study (Sangwa & Mutabazi, 2025).

The existing practices of the organization create an unchanging operational standard which requires the organization to maintain duplicate regulatory documents for donor and auditor needs. The established work practices which the organization follows create obstacles for employees and lead to record-keeping errors between digital and physical documents (Agbeyangi & Lukose, 2025). The case studies from Rwanda Ghana and Kenya demonstrate that organizations can achieve better data quality and user acceptance through their investment in staff development and mentoring and process improvement activities which create better operational procedures (Okele, 2026).

4.2.3 Environmental Context

Environmental factors create major impacts on sustainability through their effect on economic and financing limitations. The e-Health Strategy of Zimbabwe depends on temporary donor support which hinders both local ownership of the program and its ongoing operation (MoHCC, 2021b). The operational activities of facilities and the participation of end users experience negative impacts from economic factors which include rising inflation and expensive data access. The costs of mobile data in rural areas reach up to 10% of monthly health worker salaries which creates a major obstacle to maintaining system operations (Muhonde, 2023).

International studies show that sustainable digital health programs create permanent funding support in their respective countries. Rwanda and Ghana both use government funding to develop national interoperability platforms which include workforce development programs (Sangwa & Mutabazi, 2021). The case studies demonstrate how technological systems work together with institutional capabilities and policy frameworks and governmental budget resources to achieve sustainable impacts in Zimbabwe.

Table 2

Persistent Challenges in Zimbabwe's e-Health Implementation

TOE Dimension	Key Challenge	Evidence/Statistic	Comparative Insight
Technological	Uneven connectivity & power outages	35% rural facilities reliable internet (2022)	Kenya: >70% rural facilities connected
	Non-interoperable systems	>70% facilities report duplication of data	Rwanda: Integrated DHIS2 reduces duplication
Organizational	Limited digital literacy & ICT staff	40% nurses trained adequately (Mhembere, 2019)	Rwanda: 80% staff competent with DHIS2
	Resistance to change	Parallel paper reporting persists	Ghana: Workflow redesign improves adoption
Environmental	Funding & economic constraints	>75% donor-reliant projects (2023)	Ghana & Rwanda: domestic funding enables sustainability

V. CONCLUSION & RECOMMENDATIONS

5.1 Conclusion

To sum up, the journey of digital health in Zimbabwe presents a tale of a mixed bag success and longstanding issues. The systemic provision and roll-out of DHIS2 together with digital intervention for specific diseases have increased tremendously the area of data timeliness, patient tracking, and averts of evidence-based decision-making for urban and fairly well-resourced districts; systemic challenges, including uneven technological infrastructure, inter-fragmented non-interoperable systems, limited human resource capability, and heavy dependence on donor funding, still impede state expansion and equitable adoption. While the results have not been proven to demonstrate evidence

against success in digital health, the comparative evidence from regional partners notes that equipping Zimbabwe needs more than technology; it entails such investments in the workforce, interoperability, and sustainable domestic financing methods. Zimbabwe has made outstanding progress in system governance with stricter guidance from certain development partners, but unresolved and lingering facets on the ground can hinder the full transposition of the e-Health Strategy into an integrated, robust and egalitarian national digital health system.

5.2 Recommendations

To ensure a sustainable and impartial scale-up of the Zimbabwe e-Health Strategy, legislators should adopt an all-encompassing approach that synthesizes technological, organizational, and environmental perspectives; hence, technologically, the government should prioritize providing such Internet and power infrastructure that are widely accessible anywhere at all, particularly in the rural districts, and enforcing interoperability standards may well help to reduce fragmentation in the system. Organizationally, sustained investment in digital literacy training, mentor-ship programs, and the recruitment of dedicated ICT personnel for the district and provincial levels is crucial, in terms of bolstering system adoption and promoting seamless workflow integration. In the domain of the environment, work on making property financing mechanisms stronger and less dependent on short-term funds will be a very important stride; moreover, there must be policies to either subsidize or provide completely free data services and connectivity tools to the health facilities and front-line workers. Incorporation of change management strategies, incentives for adoption, and aligning donor-supported activities with priorities on the national level are also important for developing a resilient system that can be applied and scaled in a flexible way to bring equitable health outcomes simultaneously to the urban and rural population.

REFERENCES

Agbedi, E. B., & Oweibia, M. (2025). Assessment of data quality and reporting consistency in maternal health services at rural Sub-Saharan Africa: The challenges in decision-making. *Medical and Clinical Research: Open Access, 6*, 22. https://doi.org/10.52106/2766-3213.1060.

Agbeyangi, A. O., & Lukose, J. M. (2025). Telemedicine adoption and prospects in Sub-Saharan Africa: A systematic review with a focus on South Africa, Kenya, and Nigeria. *Healthcare, 13*(7), 762. https://doi.org/10.3390/healthcare13070762

Ali, O., Murray, P. A., Muhammed, S., Dwivedi, Y. K., & Rashiti, S. (2022). Evaluating organizational level IT innovation adoption factors among global firms. *Journal of Innovation & Knowledge, 7*(3), 100213.

Amarakoon, P., Braa, J., Sahay, S., Siribaddana, P., & Hewapathirana, R. (2020). Building agility in health information systems to respond to the COVID-19 pandemic: The Sri Lankan experience. In *IFIP Joint Working Conference on the Future of Digital Work: The Challenge of Inequality* (pp. 222–236). Springer International Publishing.

Assaye, B. T., Endalew, B., Tadele, M. M., Hailiye Teferie, G., Teym, A., Melese, Y. H., Senishaw, A. F., Wubante, S. M., Ngusie, H. S., & Haimanot, A. B. (2024). Readiness of big health data analytics by technology-organization-environment (TOE) framework in Ethiopian health sectors. *Heliyon*, *10*(19), e38570. https://doi.org/10.1016/j.heliyon.2024.e38570

Bananeza, R. (2025). Revolutionizing digital health in Rwanda: Progress toward universal health coverage. *Journal of Indian Physician Associates, 1*(1), 4.

Bwire, G., Mwesawina, M., Baluku, Y., Kanyanda, S. S., & Orach, C. G. (2016). Cross-Border Cholera Outbreaks in Sub-Saharan Africa, the Mystery behind the Silent Illness: What Needs to Be Done?. *PloS One, 11*(6), e0156674. https://doi.org/10.1371/journal.pone.0156674

Chilunjika, A., Chilunjika, S., & Uwizeyimana, D. (2024). Implementing e-health initiatives in Zimbabwe's public health sector. *Journal of Economic Development, Environment and People, 13*, 55–66. https://doi.org/10.26458/jedep.v13i1.837

Chitungo, I., Dzinamarira, T., Tungwarara, N., Chimene, M., Mukwenha, S., Kunonga, E., Musuka, G., & Murewanhema, G. (2022). COVID-19 Response in Zimbabwe: The Need for a Paradigm Shift? *COVID*, *2*(7), 895-906. https://doi.org/10.3390/covid2070065

Corbin, J., & Strauss, A. (2023). *Basics of qualitative research: Techniques and procedures for developing grounded theory* (5th ed.). Sage Publications.

Erku, D., Khatri, R., Endalamaw, A., Wolka, E., Nigatu, F., Zewdie, A., & Assefa, Y. (2023). Digital health interventions to improve access to and quality of primary health care services: A scoping review. *International Journal of Environmental Research and Public Health, 20*(19), 6854. https://doi.org/10.3390/ijerph20196854

Haleem, A., Javaid, M., Singh, R. P., & Suman, R. (2021). Telemedicine for healthcare: Capabilities, features, barriers, and applications. *Sensors International, 2*, 100117. https://doi.org/10.1016/j.sintl.2021.100117

ICAP. (2022). *Zimbabwe population health survey 2022*. ICAP at Columbia University.

Jeilani, A., & Hussein, A. (2025). Impact of digital health technologies adoption on healthcare workers' performance and workload: perspective with DOI and TOE models. *BMC Health Services Research*, *25*(1), 271. https://doi.org/10.1186/s12913-025-12414-4

Kambarami, R. A., Mbuya, M. N., Pelletier, D., Fundira, D., Tavengwa, N. V., & Stoltzfus, R. J. (2016). Factors associated with community health worker performance differ by task in a multi-tasked setting in rural Zimbabwe. *Global Health: Science and Practice, 4*(2), 238–250. https://doi.org/10.9745/GHSP-D-16-00003

Kiberu, V. M., Mars, M., & Scott, R. E. (2017). Barriers and opportunities to implementation of sustainable e-Health programmes in Uganda: A literature review. *African journal of primary health care & family medicine*, *9*(1), e1–e10. https://doi.org/10.4102/phcfm.v9i1.1277

Kruse, C. S., Mileski, M., Vijaykumar, A. G., Viswanathan, S. V., Suskandla, U., & Chidambaram, Y. (2017). Impact of electronic health records on long-term care facilities: Systematic review. *JMIR Medical Informatics, 5*(4), e35. https://doi.org/10.2196/medinform.7958

Mandowa, J., Matsa, M., & Jerie, S. (2025). Challenges associated with the implementation of occupational safety and health management systems in manufacturing industry of Mutare, Zimbabwe. *Frontiers in public health*, *13*, 1587769. https://doi.org/10.3389/fpubh.2025.1587769

Memari, M., & Ruggles, K. (2025). Artificial intelligence in elementary STEM education: A systematic review of current applications and future challenges. *arXiv*. https://doi.org/10.48550/arXiv.2511.00105

Mhembere, T. B. (2019). *Lack of adoption of electronic medical records systems in developing countries: A case study of Zimbabwe*.

Ministry of Energy. (2023). *Rural power reliability report 2023*. Government of Zimbabwe.

Ministry of Health and Child Care. (2021). *National e-health strategy 2021–2025*. Ministry of Health and Child Care.

Ministry of Health and Child Care. (2022). *Interoperability audit report 2022*. Ministry of Health and Child Care.

Ministry of Health and Child Care. (2023). *Health management information system (HMIS) annual report 2023*. Ministry of Health and Child Care.

Muhonde, M. (2023). *Implementation of e-health interoperability in developing country contexts: The case of Zimbabwe* (Doctoral thesis, University of South Africa). https://hdl.handle.net/10500/30281

Musabi, A., & Kipkebut, A. (2024). Healthcare services interoperability in Kenya: Challenges and opportunities. *E-Health Telecommunication Systems and Networks, 13*(1), 1–11. https://doi.org/10.4236/etsn.2024.131001

Okele, E. B. (2026). *The use of digital tools to improve delivery of healthcare services in rural communities in Oyo State, Nigeria: Accessibility and acceptability* (Doctoral dissertation).

Postal and Telecommunications Regulatory Authority of Zimbabwe. (2023). *Telecommunication and broadband access report 2023*. POTRAZ.

Putteeraj, M., Bhungee, N., Somanah, J., & Moty, N. (2022). Assessing E-Health adoption readiness using diffusion of innovation theory and the role mediated by each adopter's category in a Mauritian context. *International health*, *14*(3), 236–249. https://doi.org/10.1093/inthealth/ihab035

Ross, M., & Wendel, S. K. (2023). Oxygen Inequity in the COVID-19 Pandemic and Beyond. *Global Health, Science and Practice*, *11*(1), e2200360. https://doi.org/10.9745/GHSP-D-22-00360

Sangwa, S., & Mutabazi, P. (2021). Assessing the effectiveness of e-governance in public service delivery: A comparative study of digitization efforts in Rwanda, Kenya, and Ghana. *Open Journal of Stewardship Economics & Ethical Innovation, 1*(1), 1–33. https://doi.org/10.5281/zenodo.16723425

Saunders, M., Lewis, P., & Thornhill, A. (2003). *Research methods for business students*. Prentice Hall.

Simbini, T., Adimado, E., Adjorlolo, S., Guerrero-Torres, L., Srinivas, P., Zizhou, S., & Zerfu, T. (2026). Digital health interventions in strengthening primary healthcare systems in Sub-Saharan Africa: Insights from Ethiopia, Ghana, and Zimbabwe. *PLOS Digital Health*, *5*(1), e0000863. https://doi.org/10.1371/journal.pdig.0000863

Tahsin, F., Armas, A., Kirakalaprathapan, A., Kadu, M., Sritharan, J., & Steele Gray, C. (2023). Information and Communications Technologies Enabling Integrated Primary Care for Patients With Complex Care Needs: Scoping Review. *Journal of Medical Internet Research*, *25*, e44035. https://doi.org/10.2196/44035

Timire, C., Sandy, C., Ngwenya, M., Woznitza, N., Kumar, A. M. V., Takarinda, K. C., Sengai, T., & Harries, A. D. (2019). Targeted active screening for tuberculosis in Zimbabwe: Are field digital chest X-ray ratings reliable? *Public Health Action, 9*(3), 96–101. https://doi.org/10.5588/pha.19.0003

Utete, E., & Mahlanganise, R. (2024). Challenges to electronic health record implementation grouped according to level of national development and stage of implementation: A scoping review. *Research Square*. https://doi.org/10.21203/rs.3.rs-4351822/v1

World Health Organization. (2021). *Global strategy on digital health 2020–2025*. World Health Organization.

Yenet, A., Nibret, G., & Tegegne, B. A. (2023). Challenges to the availability and affordability of essential medicines in African countries: A scoping review. *ClinicoEconomics and Outcomes Research, 15*, 443–458. https://doi.org/10.2147/CEOR.S413546

Yin, R. K. (2014). Case study research design and methods. *Canadian Journal of Program Evaluation, 30*(1), 108–110.

Zhang, Y., Sun, J., Yang, Z., & Wang, Y. (2020). Critical success factors of green innovation: Technology, organization and environment readiness. *Journal of Cleaner Production, 264*, 121701.

Zimbabwe National Statistics Agency. (2022). *ICT access survey 2022*. ZIMSTAT.

Zimbabwe National Statistics Agency. (2023). *ICT access survey 2023*. ZIMSTAT.

Zimbabwe NCDI Poverty Commission. (2021). *Non-communicable diseases in Zimbabwe: Burden and policy implications*. Government of Zimbabwe.