

Institutional and user perspectives on digital supply chain transformation in Zimbabwe's public health sector: Barriers to enhanced visibility

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Background: This study examines how digital supply chain transformation can enhance public health logistics in Zimbabwe, a country facing systemic infrastructure and resource limitations. While digitalisation promises increased transparency, better inventory management and timely delivery of medical supplies, widespread adoption remains challenging. Barriers such as poor infrastructure, financial constraints and low technological literacy limit progress.

Objectives: To identify the key systemic and human factors influencing digital health supply chain adoption in Zimbabwe and to propose strategies for leveraging digital transformation to strengthen public health logistics.

Method: Employing a qualitative desk review, the study draws on Institutional Theory and the Technology Acceptance Model (TAM). It analyses literature, policy documents and reports to identify both systemic and human barriers to the adoption of digital health technologies.

Results: The findings reveal that reliance on manual processes and limited digital literacy perpetuate inefficiencies and stockouts, hampering health service delivery. Main obstacles include weak policy enforcement, fragmented systems, infrastructure gaps and low acceptance of technology. Adoption of innovations like blockchain and e-procurement could improve transparency if accompanied by institutional reforms.

Conclusion: Strategic investment in digital infrastructure, workforce training and coherent policy is crucial to the success of digital health initiatives. Integrating infrastructure, capacity building and institutional reform is essential to overcoming barriers and realising the benefits of digital transformation in Zimbabwe's public health logistics.

Contribution: This article analyses barriers to digital supply chain transformation in Zimbabwe's public health sector, emphasizing infrastructural, institutional, and human resource challenges. It highlights the importance of strategic reforms, capacity building, and policy support to enhance visibility, efficiency, and health outcomes through context-specific digital solutions.

Keywords: supply chain; digitalisation; visibility; infrastructure; challenges; healthcare.

Introduction

The effective management of public health supply chains is vital for timely access to medicines, especially in Zimbabwe (Lesego et al. 2023). Challenges such as resource constraints, foreign currency shortages and inefficiencies are worsened by global disruptions like the coronavirus disease 2019 (COVID-19) (Yemeke et al. 2023), leading to shortages of essential reagents and hindering service delivery and digital health initiatives (Chidhau, Mutizwa & Muzama 2021; Simbini et al. 2025). Fragmented supply chains cause medicine stock-outs at last-mile facilities, resulting in wastage and poor health outcomes (Bvuchete, Grobbelaar & Van Eeden 2022; Egharevba et al. 2019; Usuemerai et al. 2024). Digital supply chain transformation in Zimbabwe is often reduced to a discussion of technical barriers; however, it is fundamentally a quest for 'visibility' – the ability to track life-saving commodities from procurement to the last mile (Asamoah, Asare-Bediako & Jacqueline 2023). This study argues that the pervasive stockouts and inefficiencies in the public health sector are a direct result of 'data blindness', which can only be corrected by treating digital transformation as a strategic driver for resilience rather than a mere technological add-on (Bvuchete et al. 2022; Usuemerai et al. 2024). The article explores barriers to digital supply chain transformation in Zimbabwe's health sector (Kagande et al. 2022).

The global digital divide in supply chain transformation: A Global South perspective

This manuscript explores the global landscape of digital transformation in supply chains, emphasising disparities between the Global North and Global South. While digitalisation is recognised for enhancing efficiency, transparency and resilience (Perotti et al. 2022), most research and practical applications are concentrated in developed economies, such as Europe, North America, China and India. Conversely, regions like Africa and South America remain underrepresented, with limited scholarly focus (Malagon-Suarez & Castro 2023; Mwangakala et al. 2023; Rodrigues et al. 2022; Vaio et al. 2023). In particular, sub-Saharan Africa faces unique institutional, infrastructural and socio-economic hurdles that hinder digital adoption (Kuteyi & Winkler 2022; Makudza et al. 2023). Challenges include reliance on manual processes, low logistics efficiency, skills shortages, limited financial capacity and difficulties in information sharing (Gillpatrick, Boğa & Aldanmaz 2022; Khalifa et al. 2021; Tasnim et al. 2023). Institutional voids and regulatory uncertainties further complicate progress (Arakpogun et al. 2023; Mhlongo et al. 2024). Additionally, digital health initiatives from the Global North can unintentionally reinforce market monopolies in the Global South, underscoring the importance of context-specific evaluations (Hussain et al. 2025; Sekalala & Chatikobo 2024).

By focusing on Zimbabwe's public health sector, this study aims to address the research gap by analysing digital supply chain transformation within an African context, considering local institutional realities and organisational effectiveness (Makudza et al. 2023; Mataba and Chibaro 2024). The social motivation is significant, as inefficient health supply chains result in delayed diagnoses, inadequate treatments and preventable deaths, disproportionately affecting vulnerable populations. By identifying barriers to digital adoption, the research seeks to develop strategies that improve the availability and accessibility of medical supplies, ultimately enhancing health outcomes, disease response and system resilience. The capacity to track health products and manage inventories effectively is critical for health equity and human well-being. This study supports the argument that research in the Global South must move beyond 'mimicking' Northern research proposals (Silva et al. 2023). Instead, it should 're-imagine' supply chain visibility through local practices and informal networks that define the southern context (Park et al. 2022; Silva et al. 2023). Table 1 makes a comparative analysis of the Global North versus the Global South Perspectives.

Aim of the study

The aim of this study is to critically analyse the barriers and challenges impeding digital supply chain transformation for enhanced public health supply chain visibility in Zimbabwe.

TABLE 1: Global North versus Global South.

Dimension	Global North focus	Global South focus
Primary goal	Upgrading advanced industrial systems (Orisadare et al. 2024).	Modernising manufacturing and distribution (Orisadare et al. 2024).
Data context	Already digitised; focus on GDPR and privacy (Marrucci et al. 2022).	Transitioning from manual to digital; focus on data integrity (Tasnim et al. 2023).
Research output	99% of published SSCM literature (Amofa et al. 2023).	1% of current literature; critical gap to fill (Amofa et al. 2023).
Key barrier	Technological complexity and individualisation (Orisadare et al. 2024).	Infrastructure, skills, and 'institutional voids' (Intauno, Chilunjika & Poshai 2024; Orisadare et al. 2024).

Source: Adapted from Park, S.H., Lou, E. & Quan, N.T., 2022, 'Guest editorial: Disruptive and innovative technologies for sustainable development in the built environment', *International Journal of Building Pathology and Adaptation* 40(3), 301–304. <https://doi.org/10.1108/IJBPA-06-2022-173>

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GDPR, general data protection regulation; SSCM, sustainable supply chain management.

Objectives of the study

To review the current state of public health supply chain management in Zimbabwe, highlighting existing inefficiencies and visibility gaps through the identification of the perceived benefits of digital transformation for public health supply chain visibility among stakeholders in Zimbabwe, as well as critically assess the infrastructural, financial, human capital and regulatory barriers to digital supply chain transformation. Finally, the study proposes recommendations for policy and practice that leverage digital solutions to enhance supply chain visibility and operational efficiency in Zimbabwe's public health sector.

Scientifically, the study contributes by applying an integrated framework combining Institutional Theory and the Technology Acceptance Model (TAM) to a less-explored setting. While digital technologies hold transformative potential, their adoption in resource-constrained environments remains limited (Asamoah et al. 2023). The research empirically investigates how institutional pressures – coercive, mimetic and normative – shape or hinder digital adoption (Munyoka 2019). It also examines how perceptions of usefulness and ease-of-use are influenced by broad institutional and technological factors. The article offers nuanced, context-specific insights, highlighting actionable strategies for policymakers and practitioners. Ultimately, it sheds light on the complex barriers to digital supply chain transformation in Zimbabwe's public health sector, aiming to improve visibility and operational efficiency amid resource constraints (Kagande et al. 2022).

Literature review

This review synthesises existing literature on digital supply chain management, particularly within the context of public health in developing nations, to establish a theoretical framework for understanding the unique operational impediments faced by Zimbabwe (Kagande et al. 2022). It further explores the specific socio-economic, technological and infrastructural limitations that compromise the resilience and transparency of its public health supply chain (Kagande et al. 2022). The lack of comprehensive supply

chain visibility, often compounded by inefficiencies in data management and technological constraints, frequently results in setbacks for businesses and public health systems alike (Asamoah et al. 2023). These issues are frequently exacerbated by inadequate funding and a shortage of skilled personnel capable of managing complex digital systems, hindering the adoption of advanced technologies like artificial intelligence for supply chain optimisation (Chidhau et al. 2021; Mweha 2025).

Theoretical framework

The study employs an integrated theoretical framework combining Institutional Theory and the TAM to examine barriers to digitalising Zimbabwe's public health supply chain, particularly focusing on issues affecting supply chain visibility. Institutional Theory posits that organisations are influenced by social structures and institutional pressures – coercive, mimetic and normative – that shape their practices and strategic decisions. Coercive pressures stem from regulatory and donor mandates demanding digital reporting and transparency, emphasising the significance of policy frameworks and data governance in Zimbabwe's digital health initiatives. Mimetic pressures lead organisations to imitate successful digital practices from other nations to enhance efficiency, despite local challenges (Munyoka 2019). Normative pressures involve professional standards and the need for skilled personnel, highlighting the importance of training and capacity-building in digital system management (Alfaouri et al. 2025; Dza et al. 2013). The theory also helps elucidate how infrastructural deficiencies, funding limitations and complex regulations serve as barriers or enablers for digital transformation while explaining the persistence of manual processes and stakeholder influences (Huq & Stevenson 2018; Kabra & Ramesh 2015).

Complementing the Institutional Model, TAM explores user acceptance of digital technologies through perceived usefulness and perceived ease of use – key determinants of adoption (Herold et al. 2021). In Zimbabwe, perceived usefulness relates to the belief that digital systems can improve supply chain visibility, inventory control and timely delivery of health commodities. Perceived ease of use is hindered by low technological literacy and a scarcity of trained staff, making digital systems seem complex and discouraging adoption (Huq & Stevenson 2018). This model helps explain why, despite recognising the benefits of digitalisation, adoption remains limited because of negative perceptions of ease and utility, compounded by human capital shortages (Liu et al. 2024).

The integration of Institutional Theory and TAM offers a comprehensive perspective: the former highlights systemic factors like policies, infrastructure and institutional pressures shaping the environment, while the latter addresses individual and organisational perceptions influencing technology use (Alfaouri et al. 2025). Together, these frameworks identify not only the barriers to digital

transformation but also why these obstacles persist – such as inadequate infrastructure, low technological literacy and sustainability issues – ultimately impeding progress in Zimbabwe's public health supply chain digitalisation efforts.

Digital supply chain transformation in public health

Digital transformation in public health supply chains involves integrating advanced digital technologies to enhance efficiency, transparency and responsiveness in the procurement, storage and distribution of medical products (Mweha 2025). This transformation leverages tools such as blockchain, artificial intelligence and real-time data analytics to create a more resilient and agile supply chain capable of responding effectively to dynamic public health demands (Usuemerai et al. 2024). Such advancements are crucial for developing nations like Zimbabwe, where traditional supply chain models often struggle with inefficiencies, leading to critical shortages of essential medicines and supplies (Bolaños et al. 2024; Chilunjika & Uwizeyimana 2024). However, implementing digital health interventions in sub-Saharan Africa, including Zimbabwe, faces significant obstacles, such as inadequate infrastructure, limited technological literacy and sustainability challenges for these initiatives (Simbini et al. 2025). These challenges include resource constraints, skill gaps and security concerns, all of which hinder the widespread adoption of digital solutions crucial for supply chain optimisation (Singh 2024).

Supply chain visibility in public health

Enhanced supply chain visibility is paramount for public health systems to effectively track products, manage inventory and mitigate risks, thereby ensuring the uninterrupted flow of critical medical supplies. This visibility is often hampered by poor product visibility and significant data gaps, which are compounded by an ageing logistics fleet that further obstructs efficient supply and distribution systems (Lesego et al. 2024). Furthermore, the lack of real-time data on inventory levels, demand patterns and transportation logistics prevents healthcare providers from effectively managing their supply chains, leading to procurement and distribution inefficiencies (Usuemerai et al. 2024). This lack of real-time data is often exacerbated by manual data entry processes, which are prone to errors and limit the effective utility of advanced analytics tools like artificial intelligent (AI) and machine learning (ML) in the hospital supply chain (Angula & Dongo 2024). Without accurate and timely data, it becomes challenging to account for lead times in medicine restocking, hindering accurate modelling and comparison of supply chain performance (Angula & Dongo 2024; Elechi Ubalaeze et al. 2024).

Digitalisation in developing countries

Digitalisation efforts in developing countries, particularly in public health, aim to overcome inherent systemic

weaknesses, such as fragmented supply chains and procurement systems that frequently result in medicine stock-outs at last-mile health facilities (Bvuchete et al. 2022). These fragmented systems often arise from a lack of appropriate technology and infrastructure, making it difficult to efficiently deliver health commodities to targeted populations and leading to issues like avoidable stock-outs and wastage (Egharevba et al. 2019; Usuemera et al. 2024). Despite these challenges, innovations such as blockchain technology and mobile health applications offer promising avenues for creating more transparent and efficient public health supply chains in these regions (Oriekhoe et al. 2024a). However, their successful integration requires significant investment in infrastructure, digital literacy and regulatory frameworks to ensure interoperability and data security (Evangelista et al. 2023; Singh 2024). Furthermore, the proper implementation of these digital solutions can mitigate issues like drug shortages and enhance overall supply chain resilience by fostering better communication and predictive analytics among stakeholders (Ghannem et al. 2024). Moreover, digital tools have the potential to significantly enhance supply chain efficiency by easing procurement processes and streamlining inventory management through technologies like computer vision or radio frequency identification (Periáñez et al. 2024).

Research methods and design

This study employs a desk review approach to comprehensively analyse existing literature and reports on digital supply chain transformation, public health logistics and associated barriers in developing countries, with a specific focus on Zimbabwe. This approach allows for a synthesis of diverse perspectives, identifying common challenges and best practices pertinent to enhancing supply chain visibility in resource-constrained environments. This methodology allows for a deep dive into the theoretical underpinnings and empirical evidence surrounding digital interventions in public health supply chains, thereby identifying critical research gaps and proposing future directions (Usuemera et al. 2024).

Research design and philosophical approach

The research design for this study is primarily qualitative, drawing upon a comprehensive review of scholarly articles, institutional reports and policy documents to construct a robust understanding of the subject matter (Bolaños et al. 2024). This qualitative approach, underpinned by an *interpretivist philosophical stance*, acknowledges the subjective and context-bound nature of understanding complex social phenomena like digital transformation in public health. It facilitates the identification of recurring themes, challenges and successful strategies in the implementation of digital supply chain solutions within public health contexts (Asamoah et al. 2023). This allows for an in-depth analysis of the complex interplay between technological advancements, socio-economic factors and public health outcomes, especially in the unique context of Zimbabwe.

The study's desk review and umbrella review methodologies serve as the primary means of 'sampling' the existing body of literature for qualitative synthesis, allowing for a broad yet detailed exploration of the topic (Beaulieu & Bentahar 2021).

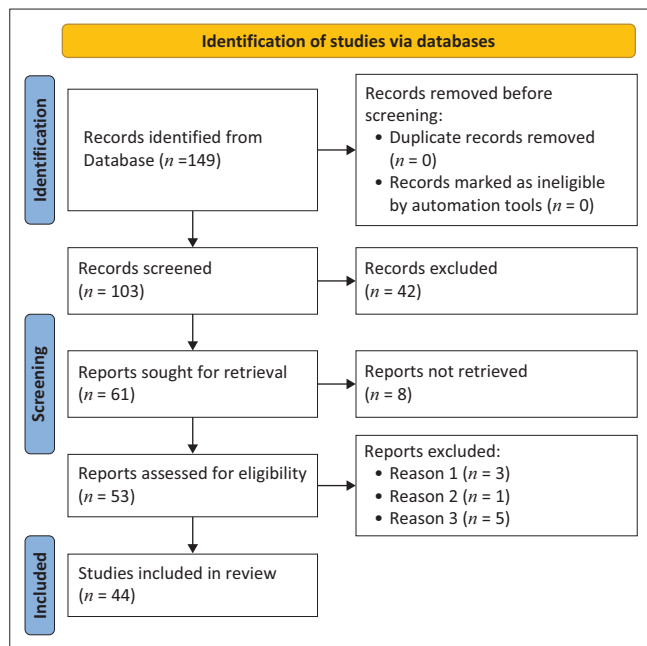
Data collection

Data collection involved systematic searches of academic databases, organisational reports from entities like the World Health Organization and the Global Fund, and relevant government publications from Zimbabwe pertaining to health infrastructure and digital policy (Lesego et al. 2023, 2024). This comprehensive data gathering focused on identifying initiatives, outcomes and challenges related to digital interventions in public health supply chains (Lesego et al. 2023). The selection of literature prioritised peer-reviewed articles, industry reports and academic conference proceedings from the last decade, with an emphasis on empirical evidence and case studies relevant to digital transformation in supply chains (Singh 2024). Databases searched included PubMed, Scopus, Web of Science and Google Scholar, utilising keywords such as 'digital supply chain', 'public health logistics', 'supply chain visibility' and 'Zimbabwe' to ensure comprehensive coverage. An umbrella review methodology was adopted to integrate findings from various existing reviews, providing a broad yet detailed synthesis of the topic (Beaulieu & Bentahar 2021). This systematic approach ensures a robust and exhaustive collection of information, allowing for the identification of critical trends, gaps and areas requiring further investigation within the Zimbabwean public health supply chain context (Jayadi 2024; Varma et al. 2024). The literature search and data collection were primarily conducted from August 2025 to November 2025, focusing on publications from the last decade up to the search date.

Study selection process

The study selection process meticulously followed the guidelines outlined in the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) protocol (Moher et al. 2009). This systematic and transparent approach ensured that the selection of relevant literature was comprehensive, unbiased and replicable (Figure 1):

- **Identification:** A comprehensive search across the specified databases initially yielded 103 records. After importing these records into reference management software, 42 duplicates were removed.
- **Screening:** The remaining 61 unique records underwent title and abstract screening by Dr P Ngarize, (the researcher's reviewer) against predefined inclusion and exclusion criteria. This stage resulted in the exclusion of 14 records that were deemed irrelevant to digital supply chain transformation in public health or not focused on developing country contexts.



Source: Adapted from Moher, D, Page, M.J., McKenzie, J.E., Bossuyt & P.M. '2021; The PRISMA 2020 Statement: An Updated Guideline for Reporting Systematic Reviews', *BMJ* 372, 71 for this article

FIGURE 1: A Preferred Reporting Items for Systematic Reviews and Meta-Analyses flow diagram visually represents the selection process.

- **Eligibility:** The full texts of 47 potentially eligible articles were retrieved and assessed in detail. Exclusion criteria were applied to filter out studies not directly addressing digital supply chain aspects in public health or those focusing solely on developed economies without transferable insights (Oriekhoe et al. 2024). Inclusion criteria included studies that specifically examined digital health interventions, supply chain visibility, or eHealth literacy within low-income or middle-income countries, particularly those providing empirical data or systematic reviews relevant to sub-Saharan Africa (Raymond & Aslan 2025; Simbini et al. 2025). During this stage, three articles were excluded for reasons such as 'not empirical evidence', 'irrelevant context' and 'full text unavailable'.
- **Included:** Ultimately, 44 articles were identified for in-depth analysis, meeting all inclusion criteria for qualitative synthesis. This total specifically focused on factors influencing digital technology adoption and use by small and medium digital enterprises in sub-Saharan Africa, given their critical role in the broader supply chain ecosystem (Achieng & Malatji 2022).

Data analysis

A rigorous thematic analysis was applied to the collected qualitative data to identify recurring themes, patterns and relationships concerning barriers and enablers of digital supply chain transformation in Zimbabwe's public health sector (Ghoubach & Amine 2025). This involved an inductive approach to coding, allowing themes to emerge directly from the data rather than imposing predetermined categories (Aspers & Corte 2019). This analytical process facilitated the categorisation of findings into distinct areas, such as

infrastructural deficits, regulatory hurdles, human resource limitations and technological adoption challenges specific to the Zimbabwean context (Medina & Rumbidzai 2025; Vu et al. 2025). Thematic analysis, a systematic approach for identifying, analysing and reporting patterns within data, was employed to synthesise findings from the selected articles (Nasereddin 2024).

Ethical considerations

This study, being a comprehensive desk review and umbrella review of existing literature and publicly available reports, did not involve direct interaction with human participants or animals. Consequently, it was determined to be non-human subjects research and, as such, did not require approval from an Institutional Review Board or an equivalent ethical review committee. All data were accessed from publicly available sources. Measures were taken to maintain confidentiality by focusing solely on aggregated and de-identified information from the reviewed sources, ensuring no individual-level data were extracted or presented. The integrity and ethical conduct of the original studies are acknowledged and respected. The research was approved by the Durban University of Technology Research Ethics Committee (Ethical Clearance number IREC 153/25).

Results

This section delineates the principal findings derived from the thematic analysis, presenting a nuanced and critical understanding of the challenges and opportunities for digital supply chain transformation in Zimbabwe's public health sector (Lesego et al. 2024; Udeh et al. 2024). The findings are categorised into key thematic areas, reflecting the multifaceted nature of enhancing supply chain visibility through digital means in a developing country context. These themes encompass infrastructural limitations, financial constraints, human capital deficiencies and regulatory complexities, alongside potential enablers such as governmental initiatives and strategic partnerships, which are critically analysed through the explicit lens of Institutional Theory and the TAM.

Current state of public health supply chain in Zimbabwe

The current state reveals a landscape heavily reliant on traditional, often manual processes, leading to significant visibility gaps and systemic inefficiencies in the distribution and management of essential health commodities (Kagande et al. 2022). This persistent reliance on conventional methods, rather than being a mere historical artefact, critically perpetuates stockouts, expirations and suboptimal resource allocation, thereby undermining the efficacy and credibility of public health interventions (Usuemerai et al. 2024). From an Institutional Theory perspective, this indicates a powerful entrenchment of existing norms and practices, where normative pressures favouring traditional, often informal, operational methods clearly outweigh the emergent pressures for digital adoption.

A critical observation is the pervasive ‘embryonic’ stage of Fourth Industrial Revolution (4IR) technology adoption among Zimbabwean small and medium enterprises, which are crucial components of any broader supply chain ecosystem (Achieng & Malatji 2022; Munongo & Pooe 2022; Mweha 2025). This is not simply a slow uptake but a critical failure in digital integration, suggesting a severe gap in the perceived ease of use of these technologies, coupled with significant institutional barriers such as high costs and a lack of digital literacy. Furthermore, the explicit finding that ‘many local businesses lack awareness of governmental information communication technology (ICT) policies’ (Makiwa & Steyn 2020) is highly critical. It highlights a profound disconnect and a failure of coercive pressures from the state to effectively translate policy intent into widespread digital engagement, leaving the sector vulnerable to inefficiencies and missed opportunities for modernisation.

Benefits of digital transformation

Digital transformation is widely regarded as a critical enabler for enhancing supply chain visibility, optimising inventory management and ensuring the timely delivery of essential health products (Lesego et al. 2023). This consensus aligns with the high perceived usefulness component of the TAM, as stakeholders recognise that digitalisation can reduce operational costs, improve data accuracy and foster accountability across the supply chain, leading to strategic benefits like better patient outcomes and system resilience (Ghoubach & Amine 2025). The integration of digital solutions is viewed as essential for addressing challenges such as stockouts and waste, thus strengthening healthcare delivery (Bolaños et al. 2024).

However, despite this widespread acknowledgement of benefits, actual adoption remains low. For instance, the slow uptake of e-commerce in supply chain management among retail and consumer goods traders in developing countries underscores a disconnect (Ngwira & Phiri 2024). Institutional barriers and low perceived ease of use hinder the translation of perceived usefulness into practice, highlighting that understanding benefits alone is insufficient without overcoming operational and infrastructural obstacles.

Barriers to digital transformation

A primary and critically limiting barrier stems from the ‘limited budgetary allocations for digital solutions within municipal clinics, alongside an acute shortage of trained staff capable of managing intricate digital systems effectively’ (Khumalo & Moloi 2025). These financial constraints and human capital deficiencies are not simply obstacles but represent fundamental structural failings that directly suppress the perceived ease of use for implementing any digital system. This consistently results in the complete prevention or severe delay of acquiring necessary hardware, software and network infrastructure, profoundly compounding the difficulties in implementing digital health interventions (Khumalo & Moloi 2025).

Moreover, the ‘high costs of internet access services and a scarcity of internet-enabled devices’ (Munongo & Pooe 2022) critically exacerbate the digital divide. This is not just an inconvenience; it acts as a pervasive institutional barrier that fundamentally undermines the potential for widespread 4IR technology adoption among Small and Medium-sized Enterprises (SMEs) in Zimbabwe. These factors demonstrate a systemic lack of an enabling environment, highlighting weak coercive pressures (in terms of investment mandates or subsidies) and a failure to overcome basic infrastructural limitations that would otherwise foster a more digitally receptive landscape. The lack of investment in these foundational elements renders many digital solutions impractical, regardless of their theoretical utility.

Challenges to enhancing visibility

The primary challenges to enhancing supply chain visibility in the public health sector of Zimbabwe are deeply rooted in pervasive ‘inadequate infrastructure, limited financial resources and a dearth of skilled human capital’ (Khumalo & Moloi 2025). These are not isolated issues but interconnected, severe institutional barriers that systematically impede the integration of modern digital solutions capable of providing real-time tracking and comprehensive data analytics for health commodities (Kagande et al. 2022; Maluleke et al. 2024). The observation that ‘many government departments lack appropriate information technology for effective supply chain management, and inconsistencies often exist between departmental supply chain structures and their information systems’ (Kagande et al. 2022) is a critical indictment of fragmented governance and a profound lack of coercive pressure to standardise and integrate. This fragmentation creates silos, making unified visibility practically impossible.

These systemic deficits are further compounded by a ‘pervasive lack of reliable internet and electricity’ (Chidhau et al. 2021; Usuemera et al. 2024), which critically constrains the deployment and effective utilisation of *any* advanced inventory tracking systems. This represents a foundational infrastructural breakdown that renders digital solutions with high perceived usefulness practically unusable because of an abysmal perceived ease of use. The persistent reliance on ‘paper-based’ tendering processes for public procurement (Sakutemba, Muvungani & Moyo 2024) is not merely inefficient; it introduces inherent vulnerabilities for corruption and critically delays processes despite the clear perceived usefulness of digital platforms in mitigating these issues (Mweha 2025). This highlights a severe institutional inertia, where established normative pressures for manual processes and a lack of effective coercive pressures for digitalisation perpetuate systemic weaknesses, fundamentally hindering progress towards enhanced supply chain visibility.

Discussion

Zimbabwe’s public health supply chain predominantly relies on manual, traditional methods, resulting in

significant inefficiencies and visibility gaps (Kagande et al. 2022). This reliance is characteristic of many developing countries, where entrenched routines and normative pressures perpetuate outdated systems, despite their association with stockouts and resource wastage (Lesego et al. 2023). Such institutional challenges transcend technical issues, reflecting a low digitalisation culture akin to what Herold et al. (2021) describe as common among traditional supply chain entities. In environments with limited resources and weak data cultures, inconsistent reporting and a lack of robust data management exacerbate these inefficiencies (Ramanujapuram & Malemarpuram 2020).

The slow adoption of 4IR technologies by Zimbabwean SMEs exemplifies a broader regional trend, where emerging economies account for only 28% of global digital technology usage, primarily because of inadequate technological infrastructure (Dza et al. 2013). Infrastructure deficiencies – such as poor roads, unreliable transport, inconsistent electricity and weak telecommunications – directly impair last-mile delivery and hinder digital system operations (Usuemerai et al. 2024). These infrastructural deficits are institutional barriers that lower the perceived ease of use of digital tools, discouraging adoption despite recognised benefits (Chidhau et al. 2021; Denhere, Zhou & Ruhode 2022). Furthermore, high costs of Internet access and digital systems, coupled with limited funding for health logistics, restrict investments necessary for digital transformation (Lesego et al. 2023; Mweha 2025). This financial strain particularly affects resource-constrained SMEs, making digital inclusion difficult.

Awareness and enforcement of government ICT policies remain weak, contributing to a persistent policy-practice gap (Dubey et al. 2023; Usuemerai et al. 2024). While stakeholders recognise the potential of digital systems to improve visibility, inventory management and delivery timeliness (Usuemerai et al. 2024), high perceived usefulness alone does not translate into swift adoption. The TAM emphasises that perceived ease of use and user attitudes are critical; low confidence and digital illiteracy among health workers hinder effective utilisation of digital tools (Kagande et al. 2022). This gap is compounded by the slow uptake of e-commerce platforms despite their proven benefits for supply chain responsiveness (Kabra & Ramesh 2015; Lesego et al. 2023).

A significant challenge is the inadequate infrastructure and human capital. Poor logistics infrastructure, such as unreliable transport and electricity, impairs the deployment of digital systems and diminishes their perceived ease of use (Tadesse et al. 2021; Usuemerai et al. 2024). Additionally, a shortage of trained personnel and widespread digital illiteracy further hinder digital adoption. The scarcity of skilled staff to manage complex systems and implement AI or data-driven solutions is a common obstacle in developing economies, affecting perceptions of usability and limiting system effectiveness (Kuteyi & Winkler 2022; Mweha 2025; Yemeke et al. 2023). Capacity-building and targeted skills

development are essential strategies to overcome these barriers.

Institutional misalignments also impede progress. Many departments continue to rely on paper-based procurement processes despite the known advantages of digital procurement systems (Lesego et al. 2023; Yemeke et al. 2023). Weak legislative frameworks, limited top management support and the absence of standardised protocols undermine institutional reforms necessary for digital integration (Intauno et al. 2024; Sakutemba et al. 2024). Limited interoperability among health information systems and weak mimetic pressures to emulate successful models further restrict progress, emphasising the need for comprehensive institutional reforms that foster a conducive regulatory environment.

The Institutional Theory's three pillars are key in addressing misalignments, with the regulative pillar creating a supportive regulatory environment and data governance to promote digital adoption, often weaker in developing economies (Herold et al., 2021). The normative pillar advocates investing in digital infrastructure and workforce development to build shared norms around digital literacy and transparency (Khumalo & Moloi 2025; Simbini et al. 2025). The cultural-cognitive pillar stresses interdisciplinary collaboration and innovative teams to challenge traditional routines and foster understanding of digital transformation (Quan et al. 2023; Sakutemba et al. 2024). Regarding the TAM, perceived usefulness and ease of use are vital, requiring tailored solutions like training and user-friendly interfaces, providing lessons for both developing and developed nations (Asah & Kaasbøll 2023; Dey et al. 2023; Ebenso et al. 2021; Edo et al. 2023; Sharma & Kshetri 2020; Tegegne et al. 2023; Uluc 2016).

Barriers like power outages and skill gaps are viewed as design parameters shaping Zimbabwe's transformation (Oriekhoe et al. 2024). These challenges hinder health practitioners' perceived ease of use and usefulness of digital tools (Dza et al. 2013; Ngwira & Phiri 2024). Instead of abandoning digital solutions as a result of Internet issues, scalable, community-centric options such as offline mobile apps are recommended (Oriekhoe et al. 2024; Usuemerai et al. 2024). The skill gap is seen as a digital literacy issue, limiting data-driven insights (Egharevba et al. 2019; Singh 2024). E-government reforms are essential before e-procurement to prevent digitising manual inefficiencies (Intauno et al. 2024; Sakutemba et al. 2024).

In conclusion, Zimbabwe's public health sector faces multifaceted barriers – technological, infrastructural, human resource and institutional – that collectively hinder digital supply chain transformation. Addressing these challenges requires a holistic approach that combines infrastructural investments, capacity building, policy enforcement and institutional reforms, aligned with insights from both international trends and local contexts to harness digital technologies for improved health outcomes.

Addressing barriers and challenges

To effectively address the identified barriers, including limited budgetary allocations and a scarcity of trained personnel, a strategic allocation of resources towards comprehensive digital infrastructure development and workforce training initiatives is paramount. These interventions directly aim to increase the perceived ease of use by making digital systems more accessible and manageable for the workforce. This includes fostering innovative conversion teams within healthcare organisations to champion patient-centred digital transformations, emphasising continuous improvement over mere financial savings (Quan et al. 2023). Furthermore, the integration of digital systems necessitates a concurrent update of operational procedures and organisational frameworks to ensure seamless adoption and avoid negative consequences associated with merely layering technology onto outdated processes (Arbia & Layeb 2024). This addresses institutional inertia and the need for normative shifts to support new digital practices. Crucially, a holistic approach involving interdisciplinary collaboration among policymakers, healthcare providers and technology experts is essential to navigate the complexities of digital integration in resource-constrained environments (Werner et al. 2023). This collaborative effort can generate new mimetic pressures as successful pilot projects inspire broader adoption and establish new normative standards for digital health.

There is a need to implement policy and regulatory changes, which should encompass both regulative and normative pillars to foster digital health adoption, creating an enabling environment and normative expectations (Kulkov 2021). Institutional barriers can impede digital projects, with institutional theory offering insights into these challenges (Kulkov 2021; Mureyi 2021). Workforce training and system design improvements enhance perceived usefulness and ease of use among healthcare professionals, crucial for adoption, especially in developing economies (Day et al. 2023; Ebenso et al. 2021; Edo et al. 2023). Investment in digital infrastructure, exemplified by Rwanda's nationwide network and mobile apps like 'electronic access to surgical events (EASE)' (Egharevba et al. 2019) and 'LoMIS Stock' (Metiboba et al. 2023), demonstrates solutions to resource limitations.

Conclusion

The journey towards a digitally transformed public health supply chain in Zimbabwe, while fraught with significant challenges including infrastructural deficits, resource limitations and human capital constraints, presents substantial opportunities for enhanced visibility, efficiency and corruption reduction (Mackey & Cuomo 2020; Obazele & Osuji 2025). This study's critical application of Institutional Theory and the TAM reveals that the slow pace of digital transformation is not simply a matter of technological availability or even awareness of benefits. Instead, it is deeply rooted in an interplay of

powerful institutional barriers (weak coercive and normative pressures, fragmented policies, inadequate infrastructure) and compromised individual-level factors (low perceived ease of use because of skill gaps and cost despite high perceived usefulness) (Sakutemba et al. 2024). Overcoming these hurdles necessitates a concerted effort towards strategic investment in digital infrastructure, comprehensive workforce development and the establishment of a supportive regulatory and policy landscape (Asah & Kaasbøll 2023). This includes a national digital health strategy emphasising continuous in-service training and computer-based systems to build capacity and ensure sustainable advancements, ultimately fostering patient-centric digital health initiatives (Rashid 2024). Addressing these interlinked challenges requires a holistic approach that simultaneously tackles institutional inertia and enhances the practical usability and accessibility of digital tools.

In conclusion, harnessing digital supply chain transformation for enhanced visibility in Zimbabwe requires moving beyond a deficit-based view of technology (Kagande et al. 2022). By integrating infrastructural constraints as core design parameters and prioritising digital literacy as a strategic asset, the public health sector can bridge the gap between fragmented data and operational transparency (Egharevba et al. 2019; Usuemera et al. 2024). Ultimately, the successful deployment of e-procurement and real-time tracking systems depends on a foundation of **regulatory resilience** and transparent governance, ensuring that digital tools serve as a catalyst for a more equitable and effective health system (Intauno et al. 2024; Mackey & Cuomo 2020; S et al. 2024).

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The authors, Takesure Kudai and Mohamed S. Bayat, declare that they have no financial or personal relationship(s) that may have inappropriately influenced them in writing this article.

CRedit authorship contribution

Takesure Kudai: Conceptualisation, Data curation, Formal analysis, Funding acquisition, Investigation, Methodology, Project administration, Resources, Software, Visualisation, Writing – original draft, Writing – review & editing. Mohamed S. Bayat: Conceptualisation, Project administration, Supervision, Validation. All authors reviewed the article, contributed to the discussion of results, approved the final version for submission and publication and take responsibility for the integrity of its findings.

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