International Journal of Management and Economics
www.managementjournals.net
Online ISSN: 2664-7079, Print ISSN: 2664-7060
Received: 02-03-2024, Accepted: 25-03-2024, Published: 16-04-2024
Volume 6, Issue 1, 2024, Page No. 65-71

Assessment of the implementation process of the electronic health commodity management information system in Lusaka district health facilities

Gamariel James Simpungwe*, Attridge Mwelwa
Department of Business Administration, University of Zambia, Zambia

Abstract
The implementation of the Electronic Logistics Management Information System (eLMIS) in Zambia was envisaged to ease data management, improve data quality, visibility, and access, and promote data-based supply chain decisions with the goal of improving access and availability of health commodities. Using a descriptive cross-sectional qualitative approach, the study obtained informed opinions and perspectives from supply chain players who are either involved in the end-use or management of the eLMIS implementation process in Lusaka District. Key findings were a lack of demonstrable MOH leadership and ownership, weak policy implementation, a lack of resource mobilisation, limited stakeholder active involvement, heavy donor reliance, inadequate human resources, a lack of technical and management skills, inadequate ICT infrastructure, and a lack of a data analytics skillset among users. The study conclusively demonstrated that the lack of MOH leadership and ownership has significantly impacted the execution of key prerequisite interventions to facilitate the system transition to MOH and sustainability through regularisation of eLMIS activities in the supply chain operations. Further research in rural areas is recommended to appreciate the diversity of challenges that may require unique interventions. This would increase the knowledge and understanding of the political, economic, social, technological, environmental, and legal factors needed to develop comprehensive policy frameworks to guide governance mechanisms that will ensure the sustainability of current and future donor-supported activities.

Keywords: Sustainability, eLMIS, transition, implementation process, leadership, governance, MOH, donor

Introduction

This chapter of the paper presents the problem and its setting. It introduces the background of the study, the aim and statement of the problem, the objectives and research questions, the significance, and the scope of the study.

Medical and healthcare product supply networks start and finish with patients. Patient-centered supply chains ensure timely and fair access to high-quality pharmaceuticals. Supply chain operations must comprehend consumption, sickness, and patient healthcare access. Due to the worldwide illness burden, pharmaceutical product demand has expanded in range and volume during the past decade (GBD worldwide Risk Factors Collaborators, 2020). Supply chain users may better target investments, avoid waste, and assist patients and consumers by knowing market expectations. A reliable health commodity supply requires an efficient supply chain (SC). This requires an efficient Logistics Management Information System to maintain and coordinate funding, forecasting, procurement, warehousing, and delivery. Well-designed LMISs gather and report logistical data at multiple supply chain levels into a central repository and process and show data according to supply chain management levels (Yadav *et al*., 2014) [46].

The conventional approach to designing and implementing health commodity management information systems involves the utilisation of paper forms and tools. Handwork is arduous with paper LMIS. Supply chain-skilled workers must understand and apply, which compounds this. The paper-based LMIS is being automated to solve this problem (Lessa *et al*., 2015 (UNCTAD, 2021). An electronic Logistics Management Information System (eLMIS) tracks supply chain items to clients using computers, the internet, and barcodes. The system efficiently and rapidly manages the health supply chain to guarantee service delivery sites have essential health commodities. An eLMIS enhances data-driven decision-making and evidence-based policy by properly and quickly providing health commodities. Based on international research, eLMIS may enhance health outcomes, reduce stockouts and waste, and boost healthcare system efficiency.

eLMIS implementation is difficult and risky. Implementation methods must be managed to properly realise digitization benefits including greater efficiency in huge data volume management, data quality, and visibility. In general, automated system deployment begins with software development including the end user to incorporate all their requested changes to make their work easier (Fritz *et al*., 2021) [14]. The investment needed to bring the software deployment facility up to a minimal level depends on the infrastructure. Countries using these tools have had successes and failures with useful learning. Low-income countries face poor implementation strategies, skilled human resource challenges, high attrition rates resulting in knowledge gaps, inadequate funding rollout and maintenance, poor ICT infrastructure, a lack of political will, weak leadership and governance mechanisms, and end-user buy-in.

Background

The Ministry of Health (MOH) and collaborating partners in Zambia's health sector made substantial efforts and material investments, but health facilities continued to experience difficulties accessing health consumables leading to inability to provide comprehensive healthcare services due to stockouts, and expirations of medicines and medical supplies. This motivated the MOH and cooperating partners to redesign and roll out the national logistics system in 2006, starting with anti-retroviral drug logistics.

The standardised paper-based logistics system is managed manually and heavily relies on the staff's ability to capture and report accurate data monthly for supply chain decisions to ensure commodity availability. The system required health facility staff to calculate reorder quantities using logistic data, print and mail hard-copy reports to the Zambia Medicines and Medical Supplies Agency (ZAMMSA) for resupply.

The Ministry of Health (MOH) with support from the implementing partner commenced eLMIS deployment 2014. The eLMIS was envisaged to reduce human error and free up personnel from manual labour, and improve supply chain efficiency. Increased data visibility across the supply chain, high reporting rates, strong data quality, and high order processing rates were found during the system evaluation (AIDSFree Project, 2018). As of September 2023, 1,643 facilities (51% of nationwide coverage) had deployed eLMIS. All level 1 to 3 hospitals and big health centres with substantial patient volumes are deployed. The remaining 1,500 health facilities do not have committed funding for the system to be deployed

MOH used the established and mature paper-based LMIS to construct eLMIS. This was crucial because minor user disruptions of the paper-based business process reduce operational training and orientation costs (Mabirizi *et al*., 2018) [29]. An integrated algorithm calculates facility re-order quantities from centrally deposited electronic health facility reports in the eLMIS.

The integration of the various critical supply chain elements into the logistics management information system to facilitate decision-making. MOH senior management is accountable for providing leadership through a policy framework and expected to take the initiative in mobilising central government and partner resources to support eLMIS implementation. However, since the commencement of the eLMIS implementation in 2014, donors and implementing partners have been responsible for funding and the provision of health commodities. The implementing partner has rendered technical support in the areas of hardware procurement and installation, software enhancement and programming, and supply chain management in addition to after-service assistance via a helpdesk. The project staff conducts regular assessments of the data quality on the system in order to verify adherence to established standards and implement necessary interventions to rectify any data quality concerns. MOH's involvement has been by providing stuff to participate in the deployment of eLMIS in healthcare facilities.

The system considered the country's funding constraints, compounded by donor funding declines over time and designed that eLMIS on an open-source platform that may not have as many cutting-edge features as the proprietary version but can be enhanced using local expertise to meet user needs and more was chosen.

The effectiveness of an automated system is contingent upon the proficiency of its users. The consideration of possible constraints and obstacles associated with an automated system has significant importance. The presence of proficient human resources in ICT is crucial for the implementation, upkeep, and regular enhancements to stay at the forefront. In order to effectively use the system, resolve Tier-1 problems, and minimise operational downtime, it is essential for end-users to possess fundamental IT skills. The level of user interface with the system has a direct influence on user perception and happiness, which in turn affects the overall performance of the supply chain. If consumers see the system as complex, hostile to the user, and deficient in assistance, it is probable that they will return to the paper-based system.

The logistics management information system incorporates many supply chain components to facilitate decision-making, as shown in Figure 4. This conceptual framework illustrates healthcare eLMIS deployment's complex relationships. Government support, stakeholder participation, technology infrastructure, training, data quality, change management, resource availability, and regulation are essential to eLMIS deployment. To understand their relationships, many essential eLMIS deployment factors must be conceptualised. The eLMIS programme should be easy to use. This helps system users manage logistics and make informed decisions.

The eLMIS system requires internet access. impair or unreliable internet can impair system performance and create data collection and reporting issues. Smooth data transfer from previous systems to eLMIS is expected. Transfer data must be confirmed, integrity checked, and loss reduced. The eLMIS system should generate high-quality decision-making reports and graphs. System data accuracy and completeness determine output quality. The eLMIS system should provide data to health institution personnel, district and provincial officials, and central supervisors. This requires a straightforward interface and dependable data storage and retrieval. Health institutions, districts, provinces, and central data should be visible through eLMIS. This increases health commodity management supervision and decision-making. For reliable decision-making, eLMIS needs high-quality data. Validation criteria, transaction audit trails, and data duplication reduction. The eLMIS system should help with forecasting, quantification, procurement, supply planning, inventory management, budgeting, finance, and supervisory decisions through data analysis, visualisation, and user training and support (Lagarde & Palmer, 2018 [26]; Kayikci, 2018) [23].

Zambia's post-eLMIS deployment activities include supportive supervision, staff training, routine maintenance, upgrades, and software and hardware maintenance as recurring expenditures. High attrition rates hinder eLMIS end-user training, even though MOH provides deployment and technical support staff. African countries implementing eLMIS have high attrition rates, resulting in underutilization, reduced on-the-job training, poor data-driven decision-making, and investment loss (Abrar, 2018). According to Lamers *et al*. (2017) [27], some donor-funded projects are initially implemented by highly skilled individuals from developed countries who meet deliverables with or without local participation. This threatens sustainability and necessitates urgent knowledge transfer with local staff. Unfortunately, most donor-funded projects start transition conversations as the funding agency or partner nears its end (Olsson *et al*., 2017) [36].

Research Aim

The aim of this research is to look into the challenges of implementing and maintaining an electronic logistics information system in Zambia. The study scrutinizes the obstacles and prospects that arise during the system's implementation, along with the strategies for its upkeep. The study is timely and relevant given the growing interest

in e-governance in developing countries, including Zambia. One of the primary motivations for the study is that, while many developing countries have launched e-government initiatives, the majority of these have not been as successful as hoped. One major reason for this is the lack of attention given to the implementation challenges and strategies for sustaining such systems.

Problem Statement

The eLMIS implementation has been rolled out to 51% of health facilities country wide since 2014. Overtime, MOH has generated vast amounts of logistics data in eLMIS, which users can process tailored to be consumer for an enriched supply chain decision-making in quantification, supply planning, and inventory management. eLMIS data quality come into question, cited as poor quality or incomplete. While these can generally be attributed to end-user-related lack of adherence to standard operating procedures as a result of inadequate training, increased workload, inadequate human resources, or staff attitude, other system-related factors could also contribute to this outcome, such as governance, financing, ICT infrastructure, human resources, etc. By undertaking this assessment, the study established a more comprehensive understanding of the challenges leading to the unoptimized use of the system that will inform necessary interventions to support sustainable implementation processes.

Research Objectives

a. To assess the efficiency and effectiveness of the basic requirements for eLMIS implementation and sustainability
b. To assess system technology and how it impacts the implementation process
c. To assess how end-user characteristics, technical support, and supervisory support affect optimal system utilisation and output

Research Questions

The study will address the following specific research questions:

1. What factors impact MOH's ability to roll out eLMIS with a sustained approach countrywide?
2. Is the eLMIS design and implementation process sufficient to meet facility-level staff inventory management training and information needs?
3. What challenges limit the optimised use of the system and access to technical and management support?

Significance of the study

This study will highlight the key factors critical for the successful implementation of a sustainable eLMIS in a resource-limited environment. It will elucidate the impact of stakeholder involvement or lack thereof in eLMIS implementation, policy development around resource mobilisation, infrastructural development, strategic human resource planning, and skills developed in alignment with new technological development and the integration of feasible commercial supply chain principles into the public sector.

Scope of the study

The research examined the adoption of the eLMIS in Lusaka District public health facilities. Military installations were exempt owing to security concerns. The research did not assess eLMIS architecture. The research assessed the system's implementation process, identifying accomplishments, obstacles, and providing insights for improved implementation. At the national level, the assessment included MOH and ZAMMSA senior management, donors and partners, province, district, and health facility staff involved in day-to-day supply chain management using eLMIS or supporting its implementation. District and facility data consumers were the main informants, according to observations and interviews. This enables supply chain and health eLMIS component evaluation. The evaluation included site visits, interviews, documentation examination, and data analysis. We objectively assessed eLMIS implementation using data from several health institutions at different levels. We collected qualitative data on user satisfaction and eLMIS influence on supply chain operations. The evaluation used data analysis to identify system trends, issues, and improvement opportunities. To better understand the eLMIS implementation, its strengths and flaws, and the evaluation results, we spoke with national, provincial, and district stakeholders.

Research methodology

This study adhered to the Epistemology philosophy, which pertains to the theoretical framework of knowing. It focuses on the process of acquiring knowledge or the methods by which we gain our knowledge. The study employed a qualitative approach, which aims to comprehend the significance, interpretations, and encounters of the participants. This study employed objectivism, a philosophical perspective that posits the existence of knowledge separately from any specific awareness and aims to reduce the researcher's impact on the study.

The study obtained in-depth information from stakeholder experiences and perceptions of the eLMIS using semi-structured interviews. This study was undertaken in Lusaka District. The study also included key supply chain stakeholders involved in public sector health commodity supply chain management based in Lusaka.

The targeted population for this study was public health facility staff and key supply chain stakeholders involved in the implementation of the eLMIS in Lusaka district or public sector supply chain management. The population of health facilities excluded military sites due to the security-sensitive nature of their operations.

Supply chain key stakeholders supporting eLMIS included directorate of Clinical Care and Diagnostic Services, directorate of Information Communication and Technology, directorate of Logistics, ZAMMSA, directorate of Policy and Planning, MOH, USAID GHSC PSM, USAID eSCMIS Project, Churches Health Association of Zambia, USAID, US Center for Disease Control (CDC),, Lusaka Provincial Health Office, MOH, and Lusaka

District Health Office, MOH.

Sample size for health facilities in Lusaka district was calculated using Taro Yamane formula with 5% error of margin (Yamane, 1967).

Selection of Health Facilities

The systematic sampling technique was used in the selection of health facilities included for this study. The selection interval was determined using the following formula:

$$k = N/n$$

$$n = \frac{N}{K+N(e)^2} = \frac{16}{(1+28(0.05)^2} = \frac{16}{15}$$

Where
n = sample size
N = population size (28)
K = constant (1)
e = level of significance (0.05)

$$k = 28/15 = 1.87 \approx 2$$

Where:
n = sample size
N = population size
k = size of selection interval

Staff at each health facility sampled are directly involved with the day-to-day use of the system. These were either pharmacy or laboratory staff.
Selection of other supply chain stakeholders for inclusion in the study:

a. All 11 targeted key stakeholder organisations involved in the use or implementation of the eLMIS were purposefully selected for inclusion in the study.
b. Interviews were administered to the highest-ranking manager available, whose role involves supply chain activities supporting MOH.

Data collection instruments
Semi-structured questionnaires were used to collect detailed information from stakeholders about their experiences and perceptions of the eLMIS and its use. Data collection period lasted 2 months to complete due to the unavailability of key informants owing to their busy schedules. The study also employed the use of Stata/MP 14.2, Version 29, for analysis graphical representation of the findings.

Piloting the instruments
A preliminary interview to ensure that the questions were asked in the correct context, responses were transcribed as provided by respondents, and any vagueness in pre-determined questions or sequences was addressed before the final data collection process commenced.

Validating and Reliability
The data collector's health professional background enabled them to better clarify understand and clarify technical questions and responses owing to their knowledge of the supply chain. To safeguard against professional bias and inaccuracies, the researcher undertook respondent validation by returning analysed data for the respondent to verify that the output accurately captured what was said initially. Any anomalies identified were corrected accordingly. This research was done in person as opposed to giving the respondent the questionnaire to complete in their own time. This ensured grounded data by spending more time in the field asking questions, following up on vague responses, or providing additional clarification when the respondent did not understand the question. The data collectors also requested to see copies of official documentation discussed in the interview, such as SOPs, policy documents, and training certificates. The collected data was checked for dependability by making sure there were no errors or changes in the meaning of the responses. The standardised coding by theme developed at the outset were checked at the end of each day to ensure conformity to the themes among data collectors.

Data collection procedure
Research authorisation was obtained from the University of Zambia Ethics Committee, Ministry of Health, Permanent Secretary, Lusaka Provincial Health Office, MOH and Lusaka District Health Office, MOH
The research team consisted of the principal investigator and two data collectors. Prior to data collection, the data collectors were oriented on the questionnaires and test data collection exercise undertaken. The semi-structured questionnaire was administered to pharmacy and laboratory staff at health facilities using the eLMIS for day-to-day management of pharmaceutical and laboratory supplies respectively. The questionnaire was also administered to MOH supervisors from central, provincial, and district levels as donors and partners involved in public sector health commodity supply chain management. The data collectors were sure to probe further to ensure that the open ended questions were fully answered accurately. The responses received were transcribed on the spaces provided in the questionnaire form. The information was then organised by theme and entered into the STATA software for graphical representation.

Data analysis and procedures
The study used thematic analysis as a qualitative method to analyse the data. The transcribed data was immediately reviewed at the end of each day for grammatical errors, making sure the information is clearly written by removing ambiguities and ensuring not to lose the meaning of the responses given. The data was then categorised by establishing emanating themes. The categories were then coded and summarised.
The findings were then presented using tables, diagrams and narratives. Diagrammatic representation of findings was done using STAT/MP 14.2, Version 29. These outputs were then synthesized by drawing parallels and disparities to derive interpretation for conclusions and recommendations.

Conclusion
Objective 1: To assess the efficiency and effectiveness of the basic requirements for eLMIS implementation and sustainability
The effective execution of eLMIS necessitates the presence of strong governance frameworks, proactive leadership, and initiatives aimed at enhancing capabilities. While some countries showed substantial progress, none has completed the process, highlighting persistent challenges (Zahid *et al*., 2023). The eLMIS rollout in Zambia has plateaued due to ineffective implementation of basic requirements, hindering data accuracy, accessibility, and functionality in supply chain management. The lack of a well-defined leadership, governance framework and strong policy implementation has been noted as a significant obstacle to the successful deployment of eLMIS, buy-in from the Ministry of Health (MOH) and stakeholders, and clearly defined roles, duties, and accountability (Zahid *et al*., 2023). The absence of

MOH leadership and policy implementation also contributes to the view of eLMIS as an activity primarily sponsored by donors, rather than a viable and enduring healthcare solution.

The sustainability issues faced by Zambia are mostly attributed to its significant dependence on donor financing for eLMIS operations. Although the MOH acknowledges the significance of eLMIS and has formulated a comprehensive sustainability plan, there is still a lack of effective implementation. The utilisation of predictive financing models resulting from the implementation of partner data can offer a more sustainable approach to resource mobilisation.

Ensuring the sustainability of eLMIS necessitates the resolution of capacity-building deficiencies and human resource obstacles. According to Ferrinho *et al*. (2011) [16], the absence of supply chain human resource assessments and insufficient training impede the optimisation and performance of the system. It is crucial to provide capacity-building programmes for personnel and ensure that eLMIS activities are in line with regular MOH operations.

To ensure the success of eLMIS in Zambia's healthcare system, it is crucial to enhance governance, leadership, capacity-building, and sustainable finance methods.

Objective 2: To assess system technology and how it impacts the implementation process

The study shows improved efficiency, accuracy, and reliability of data management by integrating and optimising supply chain attributed to eLMIS implementation in Zambia. This technology has enhanced decision-making by offering close to real time information on medicines and medical supplies inventory levels, consumption trends, and distribution requirements. As a result, the implementation of eLMIS has resulted in enhanced accessibility to medications and healthcare resources, minimising instances of stock shortages and guaranteeing that vital medications are delivered to the patients.

Furthermore, the implementation of eLMIS has provided health professionals with up-to-date information, facilitating proactive inventory management and enhanced service provision. The implementation of automated inventory and distribution systems has resulted in a decrease in the burden of healthcare personnel, so enabling them to allocate greater attention towards patient care. Additionally, the system's influence encompasses financial management, since it facilitates the effective distribution of resources and mitigates wastage resulting from expired or underused pharmaceuticals. Effective execution of eLMIS in Zambia requires increased efforts from government in addressing challenges of infrastructure development, end-user training, skills development, and provision of technical support. The sustainability of the technology relies on the continuous dedication of the government, assistance from donors, and the capacity to adapt the system to the changing requirements of the healthcare industry.

eLMIS technology has brought about a substantial transformation in the realm of health logistics in Zambia, resulting in notable advancements in the enhancement of healthcare delivery's efficacy and efficiency.

Objective 3: To assess how end-user characteristics, technical support, and supervisory support affect optimal system utilisation and output

The success of eLMIS is significantly influenced by end-user characteristics, technical support, and supervisory assistance. End-users' technology literacy, attitude towards eLMIS, and willingness to embrace new technologies are crucial for its efficient functioning. Technical support, including infrastructure preparation, maintenance, and resolving issues, is essential for the efficient functioning of eLMIS. Supervisory assistance, including leadership, training, and monitoring, ensures the efficient use of the system and maintains data quality. The level of satisfaction experienced by end-users and the overall success of a system is significantly influenced by the sufficiency and accessibility of technical and supervisory assistance. A comprehensive training program can increase proficiency and self-assurance in eLMIS, resulting in enhanced precision of data and decision-making. More effort from the MOH is expected to ensure sustainability through building capacity and transitioning technical skills to MOH staff. The provision of appropriate supervisory assistance plays a crucial role in cultivating a culture of responsibility and ongoing enhancement, ensuring the enduring sustainability of eLMIS. Implementing key initiatives such as continuous end-user training, dependable technical support, and strong supervisory backing can facilitate the effective adoption and ongoing usage of eLMIS.

References

1. Ahmed T, Rizvi SJR, Rasheed S, Iqbal M, Bhuiya A, Standing H, *et al* L. Digital Health and Inequalities in Access to Health Services in Bangladesh: Mixed Methods Study. JMIR mHealth uHealth, 2020, 8(7).
2. Ahmat A, *et al*. The Health Workforce status in the WHO African Region: Findings of a cross-sectional study. BMJ Global Health, 2022, 7(1).
3. AIDSFree Project. Electronic Logistics Management Information System. Evaluation Report. Arlington: AIDSFree Project, 2018.
4. Asante A, Wasike WSK, Ataguba JE. Health Financing in Sub-Saharan Africa: From Analytical Frameworks to Empirical Evaluation. Appl Health Econ Health Policy,2020:18(6):743-746.
5. Asamani JA, *et al*. The cost of health workforce gaps and inequitable distribution in the Ghana Health Service: an analysis towards evidence-based health workforce planning and management. Hum Resour Health,2021:19(43).
6. Assefa Y. The Expansion of the Health Management Information System (HMIS) in Ethiopia. J Public Health Policy,2019:40(1):30-42.
7. Basajja M, Nambobi M, Wolstencroft K. Possibility of Enhancing Digital Health Interoperability in Uganda through FAIR Data. Data Intelligence,2022:4(4):899-916.
8. Biru A, *et al*. Pathways to improve health information systems in Ethiopia: current maturity status and implications. Health Res Policy Syst,2022:20:78.
9. Chowdhury MH, *et al*. Digital health inclusion towards achieving universal health coverage for Bangladesh utilizing general practitioner model. Health Policy Technol, 2023.

10. Dlodlo N, Hamunyela S. The Status of Integration of Health Information Systems in Namibia. The Electronic Journal Information Systems Evaluation,2017:20(2):61-75.
11. Dukuly IB. Implementing supply chain management information system in Liberia: How is logistics information used for decision making to manage HIV, Tuberculosis and Malaria commodities in Liberia? Amsterdam: The University of Amsterdam, 2020.
12. Egwar PO, *et al*. Strengthening Digital Health Training in Uganda: Current Initiatives and Future Directions. Int J Health Inform,2020:25(3):45-57.
13. Esmaeilzadeh P, Sambasivan M. Health Information Exchange (HIE): A literature review, assimilation pattern and a proposed classification for a new policy approach. J Biomed Inform,2016:64:74-86.
14. Fritz J, Herrick T, Gilbert SS. Estimation of health impact from digitalizing last-mile Logistics Management Information Systems (LMIS) in Ethiopia, Tanzania, and Mozambique: A Lives Saved Tool (LiST) model analysis. PLoS ONE, 2021.
15. Fryatt R, Bennett S, Soucat A. Health Sector Governance: Should we be investing more? BMJ Global Health, 2017, 2(2).
16. Ferrinho P, *et al*. The human resource for health situation in Zambia: deficit and maldistribution. Hum Resour Health, 2011, 9(30).
17. GBD Global Risk Factors Collaborators. Global burden of 87 risk factors in 204 countries and territories, 1990-2019: a systematic analysis for the Global Burden of Disease Study. Lancet,2020:396:1223-1249.
18. Gilbert SS, *et al*. The impact of an integrated electronic immunization registry and logistics management information system (EIR-eLMIS) on vaccine availability in three regions in Tanzania: A pre-post and time-series analysis. Vaccine,2020:38(3):562-569.
19. Global Digital Health Monitor. The State of Global Digital Health, 2023.
20. Hossain MS, Syeed MMM, Fatema K, Uddin MF. The Perception of Health Professionals in Bangladesh toward the Digitalization of the Health Sector. Int J Environ Res Public Health, 2022, 19(20).
21. Holmgren AJ, Esdar M, Hüsers J, Coutinho-Almeida J. Health Information Exchange: Understanding the Policy Landscape and Future of Data Interoperability. Yearb Med Inform,2023:32(1):184-194.
22. Hossain MS, Syeed MMM, Fatema K, Uddin MF. The Perception of Health Professionals in Bangladesh toward the Digitalization of the Health Sector. Int J Environ Res Public Health, 2022, 19(20).
23. Kayikci Y. Sustainability impact of digitization in logistics. Elsevier, 2018, 82-789.
24. Khan A, *et al*. Improving the performance of public sector infrastructure projects: Role of project governance and stakeholder management. J Manage Eng, 2021, 37(2).
25. Kohler JC, Mackey TK, Ovtcharenko N. Why the MDGs need good governance in pharmaceutical systems to promote global health. Biomed Public Health, 2014, 14(63).
26. Lagarde M, Palmer N. The impact of health financing strategies on access to health services in low and middle income countries. Cochrane Database Syst Rev, 2018.
27. Lamers D, Schut M, Klerkx L, van Asten P. Compositional dynamics of multilevel innovation platforms in agricultural research for development. Sci Public Policy,2017:44(6):739-752.
28. Lugada E, *et al*. Health Supply Chain system in Uganda: Current issues, structure, performance, and implications for systems strengthening. J Pharm Policy Pract,2022:15(14).
29. Mabirizi D, *et al*. Implementing an integrated pharmaceutical management information system for antiretrovirals and other medicines: Lessons from Namibia. Glob Health Sci Pract,2018:6(4):723-735.
30. Ministry of Health - Ethiopia. Ethiopian National eHealth Strategy,2014. Available from: https://cdn.who.int/media/docs/default-source/digital-health-documents/global-observatory-on-digital-health/ethiopian_ehealth_strategy2014.pdf?sfvrsn=c379c33c_3
31. Ministry of Health. The Zambia National Health Strategic Plan 2022-2026,2023. Available from: https://www.moh.gov.zm/wp-content/uploads/2023/02/National-Health-Stratergic-Plan-for-Zambia-2022-to-2026-revised-February-2023-lower-resolution.pdf
32. Moucheraud C, *et al*. Sustainability of health information systems: a three-country qualitative study in southern africa. BMC Health Serv Res, 2017, 17(23).
33. Mwencha M, *et al*. Upgrading Supply Chain Management Systems to Improve Availability of Medicines in Tanzania: Evaluation of Performance and Cost Effects. Glob Health Sci Pract,2017:5(3):399-411.
34. Nsaghurwe A, *et al*. Tanzania's experience developing and implementing a national health information exchange. BMC Med Inform Decis Mak,2021:21(139).
35. Nyangena J, *et al*. Maturity assessment of Kenya's health information system interoperability readiness. BMJ Health Care Inform, 2020, 28.
36. Olsson P, Moore ML, Westley FR, McCarthy DD. The concept of Anthropocene as a game-changer: A new context for social innovation and transformations to sustainability. Scopus Preview, 2017, 22(2c).
37. Omary ZD, Kalinga EA. Assessing User's Satisfaction with Tanzania's Public Health Supply Chain Electronic Logistics Management Information System. J Health Inform Dev Ctries,2017:11(2):2017.
38. Stefanovic N. Proactive Supply Chain performance Management with Predictive Analytics. The Scientific World Journal,2014.
39. Tamirat D. Diagnosing the level of Supply Chain Automation at Pharmaceutical Fund and Supply Chain Agency Central Office. Addis Ababa: Addis Ababa, 2018.
40. Tewfik S. The Assessment of e-LMIS Implementation and User Satisfaction for Pharmaceutical Management in Public Health Facilities of the Addis Ababa Regional Health Bureau. Addis Ababa: Addis Ababa University, 2018.
41. ul Musawir A, Abd-Karim SB, Mohd-Danuri MS. Project governance and its role in enabling organizational strategy implementation: A systematic literature review. Int J Project Manage,2020:38(1):1-16.
42. United Nations Conference on Trade and Development. Technology and Innovation Report. New York: United Nations Publications, 2021.

43. Varma TN, Khan DA. Information Technology in Supply Chain Management. J Supply Chain Manage,2014:3(3):35-46.
44. Vledder M, *et al*. Improving Supply Chain for Essential Drugs in Low-Income Countries: Results from a Large Scale Randomized Experiment in Zambia. Health Syst Reform, 2019, 5(2).
45. Woltering L, *et al*. Scaling from reaching many to sustainable systems change at scale: A critical shift in mindset. ELSEVIER, 2019, 176.
46. Yadav P, *et al*. Integration of vaccine supply chains with other health commodity supply chains: A framework for decision making. Vaccine,2014:32(50):6725-6732.