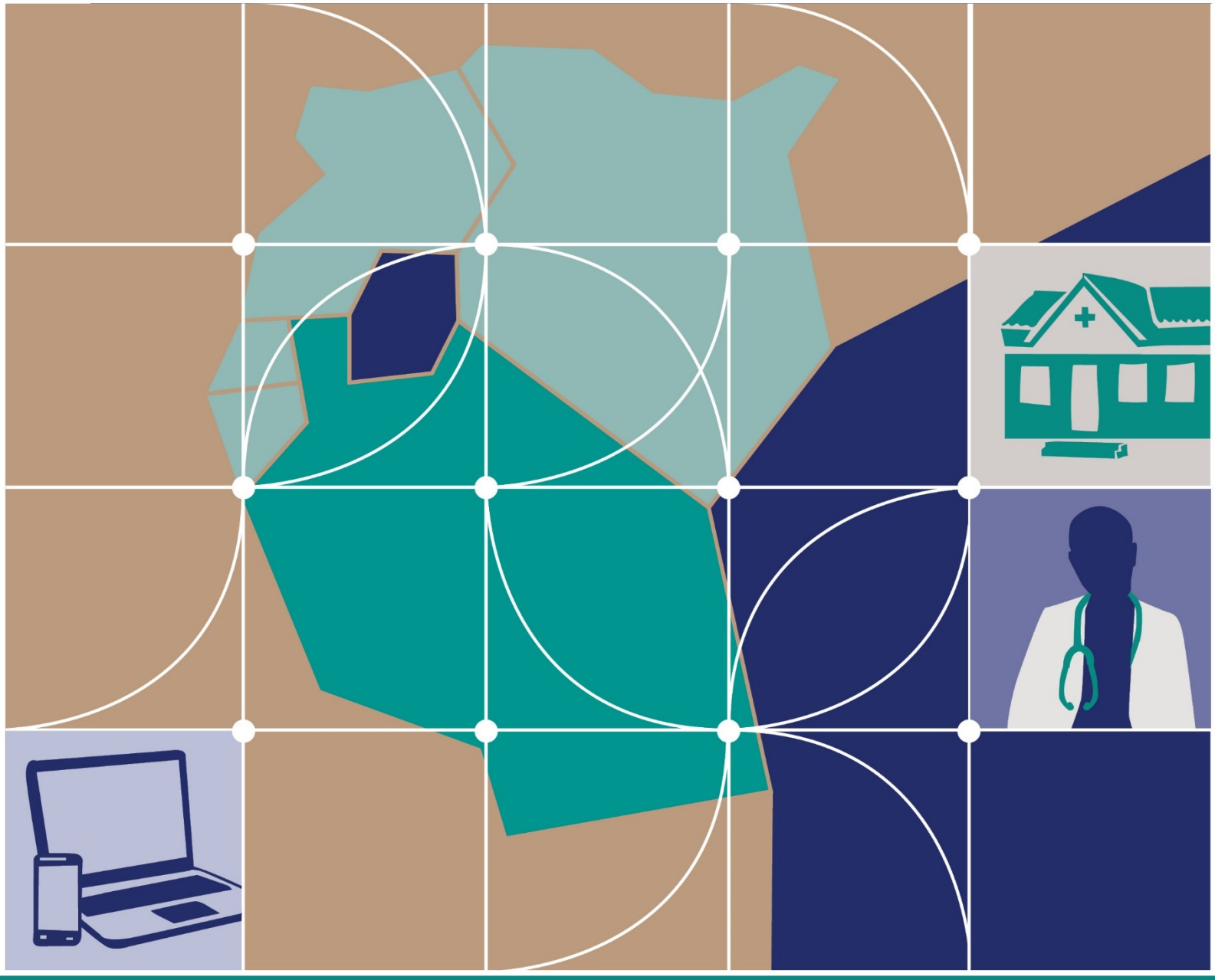


East African Community Digital Health and Interoperability Assessments

The United Republic of Tanzania

March 2020

USAID FROM THE AMERICAN PEOPLE

PEPFAR

JUMUIYA YA AFRIKA MASHARIKI

MEASURE Evaluation

East African Community Digital Health and Interoperability Assessments

The United Republic of Tanzania

March 2020

MEASURE Evaluation
University of North Carolina at Chapel Hill
123 West Franklin Street, Suite 330
Chapel Hill, NC 27516 USA
Phone: +1 919-445-9350
measure@unc.edu
www.measureevaluation.org

This publication was produced with the support of the United States Agency for International Development (USAID) under the terms of the MEASURE Evaluation cooperative agreement AID-OAA-L-14-00004. MEASURE Evaluation is implemented by the Carolina Population Center, University of North Carolina at Chapel Hill in partnership with ICF International; John Snow, Inc.; Management Sciences for Health; Palladium; and Tulane University. Views expressed are not necessarily those of USAID or the United States government. TR-19-385

ISBN: 978-1-64232-207-1

USAID FROM THE AMERICAN PEOPLE

PEPFAR

JUMUIYA YA AFRIKA MASHARIKI

MEASURE Evaluation

ACKNOWLEDGMENTS

We thank the United States Agency for International Development (USAID) for its support of this work.

We thank our colleagues, Haji Bamsi at the Ministry of Health, Community Development, Gender, Elderly, and Children (MOHCDGEC) of Tanzania, and Abdulhalim Mzale and Mohamed Al-Mafazy, at the Ministry of Health of Zanzibar, for their hard work in planning and leading this assessment with the team of the USAID-funded MEASURE Evaluation project. We also thank the other members of the assessment oversight teams for their contributions to planning and conducting this assessment (Appendix A, Table A1 and Appendix D, Table D1). We especially thank the stakeholders who took time to meet with the assessment team and to attend the assessment workshops (Appendix A, Tables A2 and A3, and Appendix D, Table D2).

We recognize the oversight and coordination conducted for this overall regional initiative led by Moses Ndahiro of the East African Science and Technology Commission, and Daniel Murenzi of the East African Community Secretariat. We acknowledge the USAID mission in Tanzania, especially Aurora Amoah and Todd Koppenhaver, for its support of this assessment. The USAID East Africa mission provided funding and managerial oversight for this activity through the leadership of Peter Arimi and Wairimu Gakuo.

We acknowledge the MEASURE Evaluation assessment team that conducted the assessment and wrote this report: Christina Villella, Olivia Velez, Alpha Nsaghurwe, Edwin Nyella, and Manyobvo Machipanda. We thank Sam Wambugu and Kathleen Tedford (MEASURE Evaluation) for their overall coordination of this activity, and the MEASURE Evaluation knowledge management team for editorial, design, and production services.

Suggested citation

MEASURE Evaluation. (2020). East African Community Digital Health and Interoperability Assessments: The United Republic of Tanzania. Chapel Hill, NC, USA: MEASURE Evaluation, University of North Carolina.

CONTENTS

FIGURES

TABLES

ABBREVIATIONS

AOT	Assessment Oversight Team
BCP	business continuity plan
CDC	Centers for Disease Control and Prevention
CMS	Central Medical Store
Digital REACH	Digital Regional East African Community Health
DHIS2	District Health Information Software, version 2
EA	enterprise architecture
EAC	East African Community
EASTECO	East African Science and Technology Commission
eGA	eGovernment Agency
EHR	electronic health record
GDHI	Global Digital Health Index
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH
HIE	health information exchange
HIM	health information mediator
HIS	health information system(s)
HMIS	health management information system(s)
HR	human resources
ICT	information and communications technology
ISL	interoperability service layer
ITU	International Telecommunications Union
JSI	John Snow Inc.
M&E	monitoring and evaluation
MOH	Ministry of Health
MOHCDGEC	Ministry of Health, Community Development, Gender, Elderly, and Children
NIDC	National Internet Data Center
PORALG	President's Office of Regional Administration and Local Government
SOP	standard operating procedure
TWG	technical working group
USAID	United States Agency for International Development
WAN	wide area network
WHO	World Health Organization

EXECUTIVE SUMMARY

Over the past decade, the East African Community (EAC) has prioritized digital health by hosting several regional conferences and committing to regional actions to strengthen the enabling environment for it. One such commitment was to conduct a regional readiness assessment for eHealth and interoperability in which Member States committed to country-based assessments that would then be compiled across the countries to form regional recommendations for moving the needle forward on eHealth and interoperability. Similarly, The United Republic of Tanzania has taken steps to strengthen the enabling environment for digital health and health information systems (HIS) interoperability. In recent years, the Mainland of Tanzania has published its eHealth strategy and policy. It also has a functional governance structure for eHealth, consisting of a steering committee and a technical working group.

In 2019, the Ministry of Health, Community Development, Gender, Elderly, and Children (MOHCDGEC) of Tanzania and the Ministry of Health (MOH) of Zanzibar partnered with MEASURE Evaluation—a project funded by the United States Agency for International Development (USAID)—to conduct an HIS interoperability readiness assessment as part of the broader EAC-commissioned regional assessment. The assessment was conducted separately in the Mainland of Tanzania and Zanzibar because each has its own ministry of health. The ministries and MEASURE Evaluation used the HIS Interoperability Maturity Assessment Toolkit to gather information on the status of the three key domains of leadership and governance, human resources (HR), and technology. The assessment method consisted of three activities: a desk review of existing literature and policies on digital health; in-country meetings with HIS and digital health stakeholders; and in-country workshops with HIS and digital health stakeholders.

The Mainland of Tanzania had strong government buy-in from two ministries, the MOHCDGEC and the President's Office of Regional Administration and Local Government (PORALG), which supported the development of a national health information exchange (HIE). There were also plans to revive the National Digital Health Steering Committee to bolster HIS governance and stakeholder coordination. There were several key documents in place to guide the implementation of the HIE and digital health, including the eHealth Strategy (2013–2018), Digital Health Investment Roadmap, Guidelines and Standards for Integrated Health Facility Electronic Management Systems, and the draft digital health strategy 2019–2024 (in draft at the time of the assessment). Progress in implementation of the HIE was seen in the development of several HIS subsystems, whose interoperability was facilitated by the country's health information mediator (HIM), although there was further work to be done in continuing to develop key HIE components and adopt technical standards to support interoperability across the health sector. Moreover, partners were being brought together by the government to develop GoTHOMIS, previously a patient registration and billing system, into a national electronic health record (EHR) to operate at all levels of the health system. The Mainland had growing capacity to train professionals in health informatics and interoperability; however, there was a need for additional training institutions and programs to build the capacity of those already working in HIS. Adding cadres of health workers to support HIS, digital health, and interoperability to the Human Resources for Health Strategic Plan will assist the MOHCDGEC and PORALG to advocate for the HR and training needed to support the robust digital health plans for the country.

Zanzibar had made progress in the last few years to develop documents outlining the goals and vision for its HIS. However, its vision did not include formal documentation or plans for digital health and interoperability in the health sector. There was no formal governing structure overseeing HIS

implementation or the deployment of digital information systems, which meant that MOH departments decided which systems to deploy, leading to silos and duplication. Although there had been an assessment that identified the HIS HR needed for the health sector, there were few training programs in Zanzibar to support capacity development in HIS and interoperability. To lay a foundation for HIS interoperability, it will be important for the MOH in Zanzibar to consider restructuring how information and communications technology (ICT), HIS, and health management information systems (HMIS) work together to define discrete roles and responsibilities for the HIS in Zanzibar. Zanzibar should also develop key documents to develop a vision and guiding principles for the implementation of its digital health activities so that the MOH can coordinate investments around a shared vision.

INTRODUCTION

This report is a summary of the East African Community (EAC) Digital Health and Interoperability Assessment that was conducted in The United Republic of Tanzania. The assessment was implemented separately in the Mainland of Tanzania (hereafter referred to as "Tanzania") and the semi-autonomous state of Zanzibar (hereafter referred to as "Zanzibar"). After a background section about the EAC and the Digital Regional East African Community Health (Digital REACH) Initiative, the report is divided into two chapters that further describe the background, methods, results, and recommendations for Tanzania and Zanzibar.

Regional Background

East African Community and Digital Regional East African Community Health Initiative

There has been a lot of momentum recently in the digital health field in the East African region. The EAC has been engaged in leading several regional initiatives in digital health. In 2010, the EAC convened a Regional eHealth Workshop and Ministerial Conference for member countries to share experiences and insights on how to move eHealth forward in the region. Following this meeting, and as a follow-up to the inaugural conference held in 2010, the East African Science and Technology Commission (EASTECO), in collaboration with the EAC Secretariat and partner states, convened the 2nd EAC Regional eHealth and Telemedicine Workshop, Ministerial Conference and International Trade Exhibition, in Kigali, Rwanda, in May 2018 (EASTECO & University of Rwanda, 2018). At the close of this two-day conference, it was agreed that the EASTECO, in collaboration with the EAC Secretariat, the East African Health Research Commission, Member States' national science and technology commissions, sectoral councils, and partners, would take the following steps:

1. Conduct an EAC regional eHealth readiness assessment that would incorporate aspects of systems interoperability, costs, and benefits of eHealth investment, by December 30, 2019.
2. Promote the incubation of local digital health solutions and submit progress reports to relevant sectoral and ministerial councils every two years.
3. Coordinate the development of regional policies, laws, regulations, guidelines, standards on health facility and patient safety, data sharing, data security, and privacy to facilitate eHealth in country and cross-border patient referrals in the EAC Member States, by June 2020.
4. Take leadership in convening the biannual EAC Regional eHealth and Telemedicine Ministerial Conferences, and their associated workshops and international exhibitions, on a rotational basis among the Member States in the last week of October as part of the meetings of the EAC Sectoral Council of Ministers, who are responsible for health, in collaboration with the EAC Secretariat, the East African Health Research Commission, and the EAC Regional Center of Excellence in Biomedical Engineering and eHealth.

In 2018, the EAC launched the Digital REACH Initiative, whose mission is to "Maximise the power of digital health in East Africa by ensuring an enabling environment and by implementing scaled, coordinated, transformational, and innovative approaches" through a shared roadmap for creating a regional enabling environment for digital health (The Digital REACH Initiative, n.d.). The roadmap consists of nine workstreams in which responsibilities are divided for the region and the Member States. The workstreams are: organization formation and management; health programs; infrastructure; services

and applications; leadership and governance; strategy and investment; legislation, policy, and compliance; workforce; and harmonization, standards, and interoperability (East African Health Research Commission, 2017). The premise of the regional initiative is that regional ownership and development of some key components of the enabling environment for digital health will help partner states reduce costs by sharing services; for example, hosting common technology components on a shared cloud, standardizing digital health training, and aggregating demand for certain services, such as telemedicine. The Initiative will also develop the enabling environment, including policies, to facilitate cross-border data and information sharing.

TANZANIA

Country Background

The health sector in Tanzania launched its eHealth strategy in 2013. Its vision was to enable a safe, high-quality, equitable, efficient, and sustainable health system for all citizens by using digital health to enhance planning, managing, and delivering health services (The United Republic of Tanzania, Ministry of Health and Social Welfare, n.d.). The strategy drew on an enterprise architecture (EA) approach to establish digital standards, rules, and protocols for information exchange and protection, and put comprehensive registries (health facility, provider, and client) and an interoperability layer in place; they are important components that support information exchange across the health sector. Implementation of the strategy was aligned with the broader eGovernment policy and guidelines for defining health application EA, for guiding selection and deployment of systems and applications, and for identifying critical technical standards that should be in place for key systems to interoperate across applications and across sectors.

Implementation of the 2013–2018 eHealth strategy led to some improvements in essential aspects of the health system, such as the quality of health service delivery, patient experiences, health promotion, disease surveillance, revenue collection and management, human resource (HR) management, supply chain management of health commodities, health information management, and planning and decision making at different levels of the health system (MOHCDGEC & PORALG, 2019).

Despite these achievements, several challenges affected the implementation of the strategy, including inadequate ICT infrastructure; unreliable electric power supply; limited financial resources; inadequate ICT personnel; user-unfriendliness of some digital solutions; inadequate digital literacy among health workers and managers; resistance to adopt digital health solutions; and the existence of multiple HIS that were not interoperable and/or not well aligned with the workflow in the health sector. It was further observed that there was an unclear governance structure, and weak coordination and engagement of stakeholders in the implementation of the digital health strategy at different levels of the health system.

The digital health and interoperability assessment in Tanzania occurred at the right time to determine the high-level status of the HIS and its domains, allowing the assessment results to contribute to the new 2019–2024 digital health strategy. The new strategy intends to address the gaps and strengthen weak areas of the digital health ecosystem by focusing on the strategic goals and priorities listed below.

Strategic Goals

1. Strengthened governance and leadership.
2. Improved client experience.
3. Healthcare providers and managers empowered to take evidence-based actions.
4. Sustained availability of health resources.
5. Standardized information exchange.

Strategic Priorities

1. Strengthen digital health governance and leadership to facilitate better coordination and implementation of digital health initiatives.
2. Improve efficiency, patient safety, quality, and continuity of care through digitalization of health service delivery in a holistic manner.
3. Improve health workforce competency and equitable access to specialized care using telehealth.
4. Promote healthy behavior through access to relevant health education, information, and communication.
5. Enhance seamless and secure information exchange.
6. Improve data use for evidence-based actions.
7. Improve supply chain management of health commodities.
8. Improve management of HR.
9. Improve management of financial resources.
10. Strengthen disease prevention, surveillance, detection, reporting, response, and control.

Objectives of the Assessment

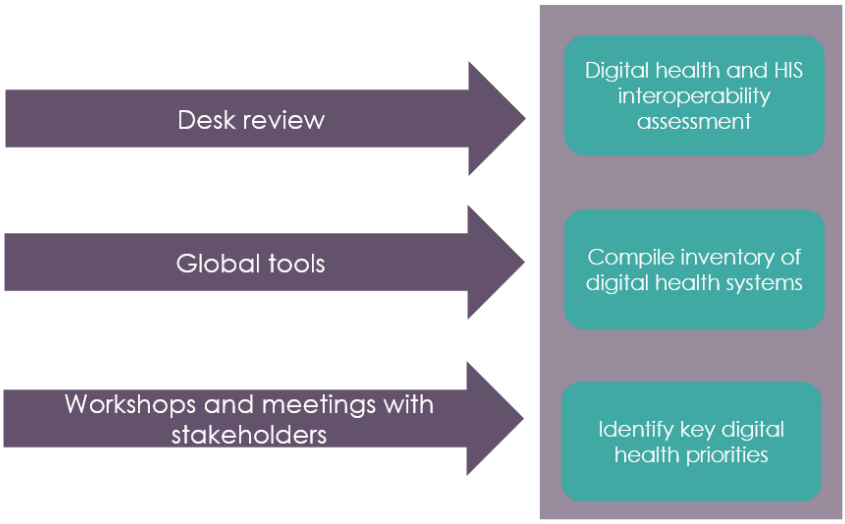
MEASURE Evaluation was engaged by the regional health program of USAID/Kenya and the USAID East Africa mission, in coordination with the USAID Global Health Bureau, U.S. Global Development Lab, and USAID Bureau for Africa, to provide technical support for EASTECO to conduct an EAC regional digital health readiness assessment. The assessment incorporated aspects of systems interoperability and the cost of investing in digital health in the EAC region. The assessment was conducted in four EAC Member States (Kenya, Rwanda, The United Republic of Tanzania, and Uganda). This chapter presents the results of the assessment conducted in the Mainland of Tanzania. The assessment had two objectives:

1. Determine the status of HIS interoperability in Tanzania by assessing the processes, structures, and capacities needed to support the enabling environment for digital health and interoperability in Tanzania.
2. Using the Tanzanian assessment results, contribute to the regional landscape assessment of digital health and interoperability in the EAC to inform regional analyses and recommendations for moving digital health forward in the EAC.

Methods

The general method for EAC Member States consisted of triangulating data from the following tools: the HIS Interoperability Maturity Toolkit, Global Digital Health Index (GDHI), and Digital Health Atlas. However, each assessment was customized to the country's needs and preferences. Figure 1 provides a graphical overview of the assessment methodology.

Figure 1. Method overview



The methods used in this assessment consisted of three components: a desk review of existing literature and policies on digital health in Tanzania; review of information systems and their implementation in the country; and workshops and meetings with stakeholders. These component processes were performed between July and October 2019. The initial desk review was conducted before the assessment trip, with additional documents added at the recommendation of key stakeholders. Upon arrival in the country, the assessment team collaborated with the MOHCDGEC and PORALG to form a local digital health advisory team, also known as the Assessment Oversight Team (AOT). The AOT's responsibilities were to review the assessment plan; review the list of key HIS and digital health stakeholders in the country who would contribute to the assessment; and plan the co-facilitation of the assessment workshop. The team conducted one, two-part workshop over the course of two days:

1. During day one, data for the HIS Interoperability Maturity Toolkit were collected and consensus on answers for the leadership and governance portion were obtained from the digital health key stakeholders.
2. During day two, consensus activities were conducted for the human resources and technology portions of the HIS Interoperability Maturity Toolkit. It was decided during this part of the workshop not to proceed with the GDHI assessment because of time limitations, and to send the GDHI assessment tool to the workshop participants via email to complete, with the results to be analyzed by the MEASURE Evaluation team.

While planning the Tanzania assessment, the AOT decided to focus on the HIS Interoperability Maturity Toolkit and the GDHI because a digital health inventory was already under development by PATH in Tanzania. (This is further discussed below.) The MEASURE Evaluation team also conducted one-on-one meetings with key stakeholders and digital health system owners (Appendix A, Table A2).

Assessment Oversight Team

As noted above, while planning the assessment, the MEASURE Evaluation assessment team formed the AOT, made up of members of the MOHCDGEC and PORALG. The AOT provided guidance on in-country HIS and digital health activities. The AOT worked with the MEASURE Evaluation team to select seven AOT participants from the ministries and government agencies. The specific mandate for the AOT (and four MEASURE Evaluation team members) was to determine the scope and overall direction of the assessment; identify key digital health stakeholders in the country; select the people who would be

invited to participate in the assessment and consensus workshop; identify additional key documents for the desk review, and facilitate implementation of the assessment. The MEASURE Evaluation team oriented the AOT to the assessment tools and assessment processes envisioned. Appendix A, Table A1 lists the composition of the AOT.

Meetings with Stakeholders

In preparation for the assessment, the MEASURE Evaluation team met with key stakeholders on a one-on-one basis to understand the landscape of digital health and interoperability in the country before conducting the assessment workshops. Stakeholders included staff from key ministries, departments, and agencies, such as the MOHCDGEC and PORALG; nongovernmental organizations and implementing partners working in digital health and HIS; academic institutions; and donors, among others. (Appendix A, Table A2 provides the list of stakeholders interviewed.)

Desk Review

The assessment team initially conducted the desk review in July 2019, using documents sourced online and with guidance from contacts at the ministries and our partners in Tanzania. To obtain documents containing strategies for HIS, it collected literature through the web libraries of key implementers of digital health, including Digital REACH, and government websites. The assessment team obtained policy and legislative documents from relevant government digital libraries and contacts in national health networks. The literature search identified reports from various national and regional projects, government policy and legislative documents, strategic documents from implemented projects, and scoping reports from different public and private initiatives. Insights from the desk review are incorporated in the Background section above and the Results section below.

HIS Interoperability Maturity Assessment

Tool Description

The MEASURE Evaluation project, funded by USAID, and in collaboration with the Digital Health and Interoperability Technical Working Group of the Health Data Collaborative, developed a toolkit of guiding documents and tools for countries to use to assess their capacity to implement interoperable systems. The toolkit (available here: https://www.measureevaluation.org/resources/tools/health-information-systems-interoperability-toolkit) contains three main components: a maturity model, an assessment tool, and a users' guide. It also offers a complete list of the references consulted in a literature review conducted as part of the toolkit's development.

The HIS Interoperability Maturity Model outlines the major components of HIS interoperability and lays out a country's growth pathway by using these components. Countries can apply the assessment tool to systematically determine their HIS maturity level on the interoperability continuum. Using the assessment results, countries can create a path for strengthening their HIS subsystems, improve their ability to interoperate, and build a resilient electronic HIS.

Assessment and Consensus Workshop

During the assessment and consensus workshop, stakeholders identified by the AOT worked in small groups to complete the assessment tool. Stakeholders and the facilitators then met in plenary to come to consensus on the assessment results over the course of the two days. Appendix A, Table A3 provides the list of workshop attendees. The workshop agenda is given in Appendix B.

Global Digital Health Index

Tool Description

The GDHI is an interactive digital resource (available here: https://www.digitalhealthindex.org/) that enables countries to assess their maturity in digital health and benchmark themselves against other countries. It uses the World Health Organization (WHO)/International Telecommunications Union (ITU) eHealth Strategy Toolkit (WHO & ITU, 2012) as the underlying framework and aligns with the WHO Digital Health Resolution. The GDHI can serve as a baseline to inform the development of a global digital health strategy and a tool to monitor progress against the objectives set forth in the resolution.

The GDHI offers an interactive database that shows the status and historical progression of key digital health performance indicators at national and global levels. It empowers health ministries, funders, policymakers, and industry to make intelligent and informed strategic decisions about how and where to allocate resources as they strive to build sustainable digital health solutions at scale.

The GDHI benchmarks countries along a maturity model against standard digital health indicators. It uses 19 core indicators to measure a country's progress in digital health across the seven categories of the WHO/ITU eHealth Strategy Framework, thereby helping countries track their progress and identify weaknesses. The GDHI creates incentives for improvements in national digital health systems and more targeted global digital health investments that can benefit multiple countries. It also facilitates learning and sharing of resources from countries that are more advanced in specific areas.

Data Collection Methods

Because of time constraints, after a presentation and overview on the GDHI, it was decided that the participants in the Assessment and Consensus Workshop would receive a copy of the tool to complete on their own and return via email within four weeks for the MEASURE Evaluation team to compile the results.

Results

Summary Themes from Key Informant Interviews

Stakeholder interviews were critical. They helped contextualize the results of the application of the assessment tools and identify additional key stakeholders with whom to meet and documents to be included in the desk review. Key themes from stakeholder meetings were as follows.

Leadership and Governance

- **Governance:** From the beginning of the assessment, the team was told that you cannot work in the health sector without involving both the MOHCDGEC and the PORALG. The synergy of these two ministries was evident in many stakeholder conversations. Implementing partners and donors are working with both ministries on their respective activities. Interviewees commented that governance has improved, mentioning that activities are more coordinated and that the government requires more documentation to approve a project. However, stakeholders also noted that the eHealth Steering Committee had not met in several years and that there will be a need to revive the governance structure and include more technical capacity in it to oversee larger projects, such as GoTHOMIS.
- **Coordination:** Implementing partners and donors were working on distinct tasks to support various aspects of the HIE, including the HIM, e-Logistics Management Information System,

mHealth platform, integrated Health Facility Electronic Management Information System, health facility registry, client registry, and the digital solutions inventory. This demonstrated coordination among donors, implementing partners, and the government to coordinate, not duplicate, efforts to implement the country's eHealth strategy.

- **GoTHOMIS:** Partners were being brought together by the government to support GoTHOMIS, which was previously a patient registration and billing system. GoTHOMIS will be a national EHR operating at all levels of the health system. Although partners and donors were willing to support this initiative, some expressed concern that the project had ambitious timelines, did not have a sustainability plan, and lacked sufficient detail for the vision to be clear, such as shared requirements, data dictionary, and design documents.
- **Value proposition:** There has been growing buy-in from MOHCDGEC and PORALG leadership for digital health. One example was that each ministry had an interoperability service layer (ISL), and they were starting to share information with each other. The MOHCDGEC had a health-specific information mediator. The Muungano Gateway was an ISL in the PORALG that was responsible for transmitting and exchanging messages across the local government administration systems, including systems in other sectors, such as the health sector. However, there was still work to be done in gaining buy-in for foundational architecture components, such as the mHealth Public-Private Partnership platform, which provided an interoperability layer between network operators and mHealth SMS (Short Message Service) and USSD (Unstructured Supplementary Service Data) apps. The platform was struggling to justify its continued support because it could not show the impact of an interoperable mHealth platform as part of the HIE. This platform supported several SMS programs, such as the electronic Integrated Disease Surveillance and Response system, antiretroviral medication refills, and a maternal health program, among others.

Human Resources

- **Capacity gap**: The GoTHOMIS project is quite ambitious, with an aggressive timeline for implementation. Several stakeholders indicated that there were large capacity gaps in both skills and personnel needed to successfully implement the project, especially skills to implement and maintain interoperability with new and existing systems. It was not clear to many stakeholders whether a long-term HR plan was included in the overall planning for sustainability of the GoTHOMIS project. The lack of local software development skills to maintain a system of this scale and magnitude was a concern, especially because it is a custom design, making both building internal capacity or hiring external support challenging.

  A capacity gap also existed for other projects. Several stakeholders noted that the full value of the District Health Information Software, version 2 (DHIS2), a critical component of Tanzania's overall HIS, was not being realized because of the lack of capacity to support the system. Interviewees noted that a crucial capacity challenge was the number of staff in the public sector supporting such projects, mentioning that many staff were overstretched.
- **Mentorship program:** Stakeholders, especially those from the two ministries, indicated that there were several mentorship programs between the government and implementing partners to build the capacity of HIS professionals. Implementing partners were also hiring and training staff, which were then seconded to the ministries, and can share their knowledge with other ministry HIS and ICT staff.

- **Champions**: At the subnational level, PORALG has adopted the champion method of having trained experts at regional and district levels. This ensured that experts were available locally to assist with systems. PORALG indicated that this was more effective than typical cascade training, which has led to diluted information at the local levels. Overall, they noted that their ICT staff had very low turnover so they could maintain skills and institutional knowledge and expertise.

Technology

- **HIS subsystems:** As mentioned above, various components of the HIE were at different stages of development. An important part of the HIE, the HIM, was functional and supported 14 use cases and more than five standards to facilitate data exchange across different HIS in Tanzania. Moreover, through the Muungano Gateway, the HIS can communicate with other important planning tools, such as PlanRep and Facility Financial Accountability and Reporting System, which enabled direct health facility financing and aided decision makers by having a more holistic view of the health system when planning for resources and programming.
- **Opportunities for sharing best practices:** Amidst the growth and development of so many different systems, there were some units and institutions in the health sector that were further along in their maturity, most notably: the Medical Stores Department, Logistics Management Unit, and the National Health Insurance Fund. There were therefore opportunities to share lessons learned about requirements gathering, testing, deployment, and maintenance that can be shared by these units with others in the health sector working on other components of the HIS.
- **Infrastructure:** Tanzania had some strong infrastructure inputs, including a growing wide area network (WAN) that connected 26 regions and 186 districts, and a National Internet Data Center (NIDC) that had several sources of power backup, and housed many health sector data servers. Some interviewees mentioned concerns about how servers that were planned to be installed in rural facilities will be functional without stable sources of power. Moreover, the NIDC was still in the process of building its backup data storage facility.

HIS Interoperability Assessment

This section describes the results of the HIS interoperability assessment, which were obtained by using the HIS interoperability assessment tool and mapping the results to the HIS Interoperability Maturity Model. The raw results of the assessment mapped to the maturity model are in Appendix C. The findings are presented in this section by the three domains in the Maturity Model: leadership and governance, HR, and technology. Each section includes a figure with a bar graph showing the scores for the individual subdomain levels in that domain.

Leadership and Governance

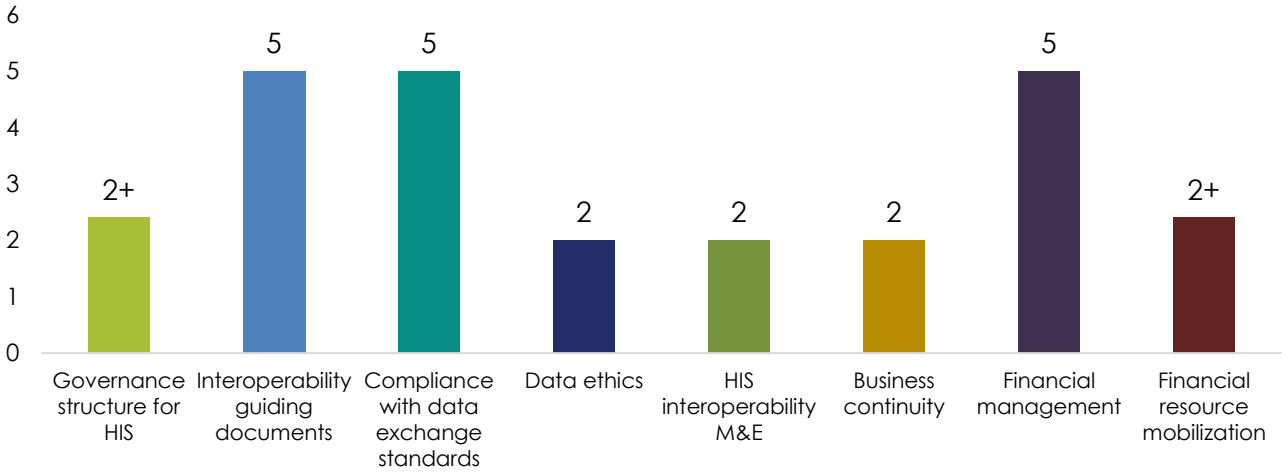
At the time of the assessment, Tanzania had an eHealth Steering Committee that was formed under the 2013–2018 eHealth Strategy, and it had a sub-working group on architecture that oversaw interoperability. The Steering Committee was led by the Permanent Secretary for Health at the MOHCDGEC, giving the committee national authority to mobilize resources. However, workshop participants acknowledged that the group had not met in more than two years and, therefore, was not functional. The vision for interoperability through the HIE was documented in many documents, including but not limited to, the 2013–2018 eHealth Strategy (The United Republic of Tanzania, Ministry of Health and Social Welfare, n.d.), Digital Health Investment Roadmap (Government of Tanzania, n.d.), Guidelines and Standards for Integrated Health Facility Electronic Management Systems (The United Republic of Tanzania, MOHCDGEC, 2016), the draft digital health strategy 2019–2024 (The United

Republic of Tanzania, MOHCDGEC, n.d.), and the Tanzania health EA that was under development at the time of the assessment. The Project Management Office of the eHealth Steering Committee used the Guidelines and Standards for Integrated Health Facility Electronic Management Systems and guidance from the eGovernment Agency (eGA) to verify that HIS subsystems met compliance and certification criteria. The MOHCDGEC had strong financial management structures in place to budget for and track expenditures for HIS activities at the national level, which were part of its overall financial management structures. The MOHCDGEC and PORALG had a costed Tanzania Digital Health Investment Roadmap (Government of Tanzania, n.d.) guiding digital health investments, but did not have sufficient funding to implement the roadmap.

Tanzania had a national data protection law; however, it was not specific to health. HIS interoperability activities were not being formally tracked using a monitoring and evaluation (M&E) framework; however, the eHealth strategy had some indicators to track its implementation. Although a disaster recovery plan existed in the MOHCDGEC, there had not been an audit to determine the extent of its implementation. The MEASURE Evaluation team learned about the thorough back-up procedures in place for the NIDC, where some of the health sector data were stored.

Figure 2 summarizes the results of the assessment of the leadership and governance domain.

Figure 2. Leadership and governance subdomain maturity levels as of 2019



Human Resources

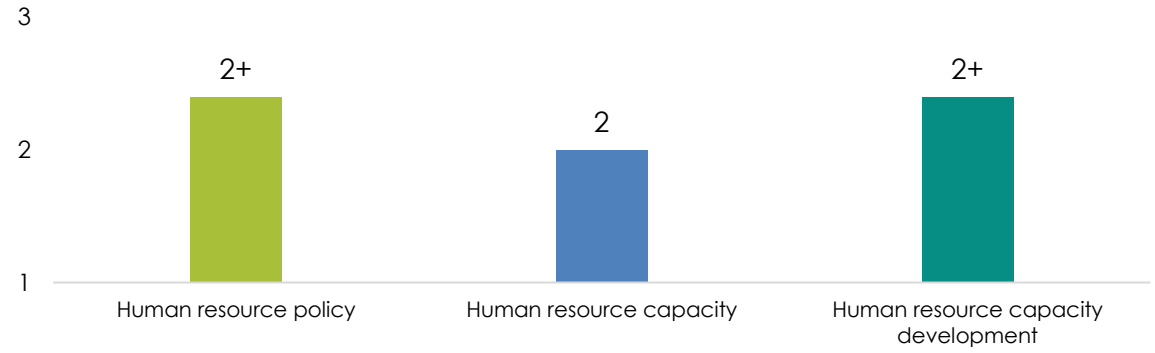
Tanzania completed an assessment of the implementation of the 2013–2018 eHealth Strategy and HR in the public sector that included the staffing and skills needed for HIS and HIS interoperability. Overall, there were strong HR management systems in place, including performance management and opportunities for growth, although HIS was not included as a specific cadre in the healthcare workforce, categorized instead under ICT.

There was growing capacity in the public sector to support digital HIS, with a bachelor's degree program in HIS at the University of Dodoma and a master's degree program in health informatics at the University of Dar Es Salaam. The country also received technical assistance and support from donors and implementing partners. The overall rapid growth of the ICT sector, in health and in other areas, had built great demand for people with ICT skills and significant gaps. Training and capacity specific to health informatics were also limited.

The Tanzania Commission for Universities had entry level requirements for ICT positions. There were also training programs, training courses, and continuing education available. There was in-service training available; however, resources to provide the training were not available. Advancement opportunities existed to encourage HIS staff to seek continuing education opportunities and to maintain and update skill sets.

Figure 3 summarizes the results of the assessment of the HR domain.

Figure 3. Human resources subdomain maturity levels as of 2019



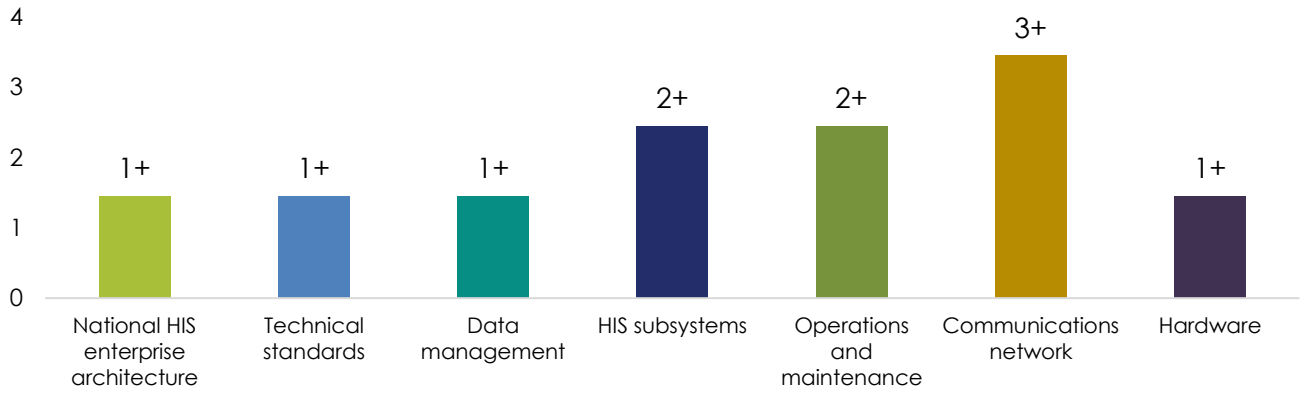
Technology

The MOHCDGEC and PORALG were working with the eGA to draft the HIS EA blueprint for the country, which will include technical standards for health data exchange, messaging, and security. However, in the absence of a final blueprint, there had been some systematic implementation of the architecture already, including the development and deployment of the HIM and its use cases. Tanzania had a virtual instance for testing each subsystem individually but did not have a testing environment that included the entire architecture to test the effect of changes on all connected systems at once. Data management systems were in place for many services, such as commodities, but most patient-level data were still collected on paper. The DHIS2 served as the national data warehouse. The MOHCDGEC had a data demand and use toolkit guiding data use, and plans to develop a data use plan.

Tanzania had capacity for strong in-country computer technology maintenance, with back-ups, redundancy, and a disaster recovery plan. The Ministry of Education, Science and Technology conducted a national infrastructure assessment to determine the hardware needs across the health sector. More than 50 percent of the MOHCDGEC's national and subnational offices had the required hardware to support the HIS. However, a plan did not exist to keep hardware up-to-date. The MOHCDGEC and PORALG had a plan to implement permanent network connectivity across all levels of the health system to support the HIS. At the time of the assessment, all national offices of the MOHCDGEC had a strong and reliable network connection to access the various HIS network services, but there was still substantial work to be done to connect subnational offices and health facilities.

Figure 4 summarizes the results of the assessment of the technology domain.

Figure 4. Technology subdomain maturity levels as of 2019



Digital Health Inventory

A digital health inventory was being developed and completed by PATH, with funding from the Gates Foundation. It will be an online platform moderated by the government and is being tailored to meet the specific requirements of the Government of Tanzania. The entries can be submitted by government or nongovernment stakeholders, but only the government can endorse a platform, meaning that the platform fits into the government's eHealth strategy and EA. The inventory was available in Microsoft Excel. There were plans to make the system integrate with the Digital Health Atlas, but it was not a priority. Because PATH and the government were developing this digital health inventory, MEASURE Evaluation decided not to include a digital health inventory as part of the assessment so as not to duplicate efforts.

Global Digital Health Index

Although the minimum required number of completed GDHI surveys were received, there were wide variations in the data and little consensus on most answers. The results were therefore considered inconclusive. The MEASURE Evaluation team recommended reconvening stakeholders to complete the GDHI in a workshop format, which will help gain consensus among stakeholders.

Discussion

Leadership and Governance

During the assessment, it was clear that the MOHCDGEC and PORALG have taken the lead on the digital health vision and its implementation, and that they are recognized as the lead government agencies by other stakeholders in the country. However, when discussing what governance structure in the country is responsible for HIS and interoperability, the assessment participants were less clear about what body is making decisions on a regular basis about HIS requirements and systems. It is important that there is an established, well-known body and a process for managing requirements for health information and supporting systems, including GoTHOMIS. Ensuring that people with the right skills and understanding of HIS and interoperability, and the appropriate authority to mobilize resources, are part of this governance structure will be essential. Moreover, stakeholders did not seem as familiar with the processes and requirements for certifying systems in the HIS, meaning that the MOHCDGEC and PORALG should further document and raise awareness about this topic. The governance structure should continue

to coordinate internal and external investments around the digital health strategy so that there continues to be widespread momentum toward the shared vision.

Human Resources

Although there is significant support for ICT cadres working in the healthcare sector, there is a lack of HR policy, capacity, and capacity development activities specific to HIS and health informatics. Given the rapid maturity and complexity of Tanzania's HIS, it is critical that skills and competencies specific to this domain are planned for and built. Although some ICT skills are transferable across different sectors, the health sector requires additional competencies in basic health and biomedical concepts, information about health diseases and domains, and knowledge of the overall healthcare delivery system. This type of knowledge is critical to building systems that can provide data for decision making, improve healthcare quality, and enhance patient safety. For example, the GoTHOMIS plan does not mention developing HR capacity to manage the system. This presents two critical issues: (1) GoTHOMIS is a large point-of-care system that will need significant support in a country that is already experiencing capacity gaps in the necessary skills areas; and (2) as a point-of-care system, the ability to leverage data for clinical and public health decision making will require personnel with advanced training in health informatics. A reassessment of Tanzania's capacity needs that reflects the growing complexity and sophistication of the systems to be integrated and implemented is needed.

Technology

Tanzania has achieved some major milestones in implementing HIS interoperability, including having a functional HIM, e-Logistics Management Information System, and health facility registry; and having a large proportion of subnational health offices connected via a WAN. There are also specific initiatives underway for other key components of the HIS, including the client registry, GoTHOMIS, terminology service, and a shared health record. As the country works on its EA, it should continue to define and adopt standards to facilitate data exchange and interoperability, including adopting a unique patient ID, diagnosis and procedure codes, and a product registry. Tanzania also has a strong infrastructure backbone on which to continue building its HIS, including the NIDC, a growing WAN, and strong computer maintenance capability.

Limitations of the Assessment

There were some limitations to this assessment and its results. First, the assessment was conducted at the national level of the health sector. There may, therefore, be differences across the regions and districts regarding the status of digital health and interoperability. For example, some subnational units may have variations in the strength of their capacity or governance structures. The data received from the completed GDHI surveys had significant variance and were therefore not reliable for analysis. As a consequence, the results of this assessment are skewed toward the use of digital health for HIS interoperability because that is what was covered in the HIS interoperability assessment.

Recommendations

Short-Term Recommendations

- **Revive the digital health governance structure:** The revised National Digital Health Strategy (2019–2024) (The United Republic of Tanzania, MOHCDGEC, n.d.) provides a detailed description of a re-envisioned governance framework for digital health in Tanzania. The MOHCDEGC should ensure that this governance framework is properly implemented after the

launch of the National Digital Health Strategy. Moreover, to enable success and accountability of the National Digital Health Steering Committee, it should ensure that meetings occur regularly, record and share attendance and minutes, and ensure that membership is transparent and represents a diverse array of stakeholders. The National Digital Health Steering Committee can also serve as a point of contact for communication and partnership with the Health Data Collaborative.

- **Develop a health data security regulatory framework:** The MOHCDEGC should finish the draft HIS policy guidelines and ensure that they include provisions for health data security and privacy for both paper and digital systems. In addition, during the assessment, the eGA referenced some documents that it produces and makes available for other ministries, departments, and agencies in Tanzania to use, including materials and checklists to sensitize information system users about security and privacy policies. The MOHCDEG should adapt these checklists to the information systems in the health sector and train users on how to implement them.
- **Finalize development of the Enterprise Architecture:** This architecture should serve as a blueprint to properly guide the implementation of digital health initiatives, serving the information needs of the health sector. Changes made to the HIS should be carefully evaluated for their impact on business, information, technology, and data architectures.
- **Add HIS, digital health, and interoperability cadres to the Human Resources for Health Strategic Plan:** To support activities under the national digital health strategy and to manage and sustain the GoTHOMIS project, the Human Resources Department for the health sector should add specific cadres and skillsets needed for HIS, digital health, and interoperability to the Human Resources for Health Strategic Plan. This will assist the MOHCDGEC and PORALG to advocate for the HR and training needed to support the robust digital health plans for the country.
- **Ensure clinical subject matter experts are included in the design of GoTHOMIS:** The MOHCDGEC and PORALG should identify clinical experts who can help guide the design of GoTHOMIS and ensure that more information is captured and available for decision making at the point-of-care, rather than simply focusing on compliance reporting. (Previous EHRs have been designed for compliance reporting).
- **Ensure the implementation of M&E for the digital health strategy:** The draft version of the revised national digital health strategy (2019–2024) included an M&E roadmap for the strategy's implementation. It will be important for the accountability of all stakeholders involved in the strategy's implementation that this M&E roadmap is continuously reviewed for progress.
- **Integrate HIS training courses in local universities:** To reduce dependence on HIS projects for training, the MOHCDGEC should work with local universities to integrate HIS and data use training courses in university offerings. This could include the integration of short courses, courses in degree programs, or another mode of instruction and delivery.

Long-Term Recommendations

- **Develop a strategic plan for mHealth technologies:** This strategic plan should be developed by MOHCDGEC and include a strategy and oversight mechanism for mHealth implementation to enhance better long-term coordination and overall alignment with health system goals.
- **Develop and implement a strategy for increasing power (electricity) infrastructure:** With the pending implementation of a countrywide EHR and the requisite plan to extend WAN penetration

to facilities, it will be important for the MOHCDGEC to advocate for the development of a strategy to increase the power supply in remote areas.

- **Implement strategies for the sustainability of the HIS:** Generate and implement strategies to ensure the sustainability of the HIS and gradually reduce dependence on external support (financial, technical, and HR). This could include collaborating with other sectors to share expertise and experiences.

ZANZIBAR

Country Background

Zanzibar conducted an HIS assessment in 2009, which found an overall low performance of various HIS subsystems, low availability of data, and poor data quality in existing systems. In response, Zanzibar developed an HIS Strategic Plan for 2012–2020 (The Revolutionary Government of Zanzibar, 2012) to implement HIS policies outlined in 2011. The strategy covers six key components: resources, indicators, data sources, data quality, data management, and data dissemination and use. The findings, progress, and plans in the response are summarized below.

- **Resources**: This section looks at the HIS resources needed for policy and planning, such as HIS institutions, HR, HIS infrastructure, and financing. Although some systems were in place, most were considered inadequate because of limited data use and an inability to share data in a meaningful way. These systems were also considered to be underfunded. Since the 2009 HIS assessment, fiber optic cable was lain throughout Unguja and Pemba Islands, allowing for wider and higher speed network connectivity. A data center for Zanzibar was also implemented by the government. The plan identified the need to build HIS HR, reduce dependency on donor and implementer subsystems, and the need to build a culture of data use among health policy developers. The plan also outlined goals for tracking the status of information infrastructure and standardizing processes for preventive maintenance.
- **Indicators:** The assessment found that data needed to monitor indicators for national and global health goals were found to be somewhat standardized and sufficient, but the regularity of reporting was inconsistent, in part because of the lack of harmonization in HIS subsystems. The plan called for a consensus on standard definitions of health indicators, collection methodologies, and reporting cycles.
- **Data sources:** Data sets, such as census, population-based surveys, vital statistics, disease surveillance, health records, and health administrative data were found to be available but not adequate. In response, a functional birth registry was implemented. The HIS plan called for the improvement of population-based data sources and those at lower level facilities, which were primarily paper-based.
- **Data management:** Overall, data management was assessed as the weakest component of the HIS. Standard operating procedures (SOPs) for data management were found to be lacking or non-existent. No national data warehouse existed, and the components needed to implement such a system, like a standard metadata dictionary, were incomplete and not used. To improve the situation, Zanzibar moved from DHIS1 to DHIS2 in 2010, making the data more accessible and improving the potential for integration. A human resources for health database and a disease surveillance tool integrated with the DHIS2 were also implemented. The plan called for the formalization of data management procedures, the establishment of a data warehouse supported by a metadata dictionary, the adoption of unique identifiers, and the improved collection and sharing of vital registration data. The plan also called for increased emphasis on improving overall infrastructure by adopting standards to support data warehouse integration.
- **Data quality:** Data quality was found to be average, although overall limited amounts of data were being collected. An MOH Epidemiology Unit was established, which included both an

epidemiologist and health informatics expertise. The plan identified goals for better adoption of data standards, verification procedures, and collection methods to improve data quality.

- **Dissemination and use**: The HIS assessment found that population data for health planning were adequately shared whereas patient-specific data were less accessible, making continuity of care difficult. Capacity building for the Office of the Chief Government Statistician was completed, with equipment provided to support data use. The plan emphasized the need to establish and enforce a policy for required data-based decision making and increased data dissemination and data use capacity.

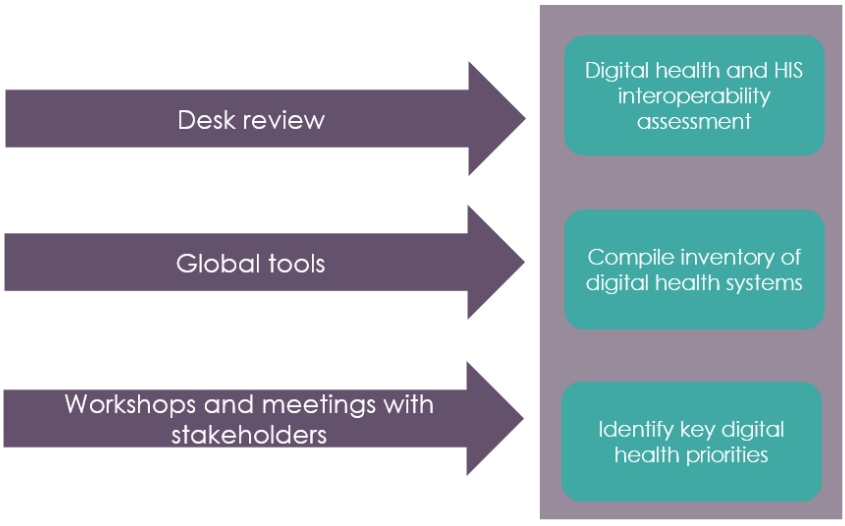
Objectives of the Assessment

MEASURE Evaluation was engaged by the regional health program of USAID/Kenya and the USAID East Africa mission, in coordination with the USAID Global Health Bureau, U.S. Global Development Lab, and USAID Bureau for Africa, to provide technical support for EASTECO to conduct an EAC regional digital health readiness assessment. The assessment incorporated aspects of systems interoperability and the cost of investing in digital health in the EAC region. The assessment was conducted in four EAC Member States (Kenya, Rwanda, The United Republic of Tanzania, and Uganda). This chapter presents the results of the assessment conducted in Zanzibar, which had two objectives:

1. Determine the status of HIS interoperability in Zanzibar by assessing the processes, structures, and capacities needed to support the enabling environment for digital health and interoperability in Zanzibar.
2. Using the Zanzibarian assessment results, contribute to the regional landscape assessment of digital health and interoperability in the EAC to inform regional analyses and recommendations for moving digital health forward in the EAC.

Methods

Figure 5. Methods overview



For an overview of the methods for the EAC digital health assessment, refer to the Methods section in the Tanzania chapter. This section discusses how the data collection methods were tailored to and implemented in Zanzibar.

As shown in Figure 5, the methods used in this assessment consisted of three components: a desk review of existing literature and policies on digital health in Zanzibar and a workshop and meetings with stakeholders. These component processes were performed between July and October 2019. The initial desk review was conducted before the assessment trip, with additional documents added at the recommendation of key stakeholders throughout the assessment process. Upon arrival in Zanzibar, the assessment team met the local advisory team, also known as the AOT (Appendix D, Table D1), to review the assessment plan, review the list of key digital health and HIS stakeholders in the country who would contribute to the assessment, and plan the co-facilitation of the assessment and consensus workshop. The team conducted one, two-part workshop over the course of two days:

1. During day one of the workshop, data for the HIS Interoperability Maturity Toolkit were collected and consensus on answers were obtained from the key HIS and digital health stakeholders.
2. During day two, the assessment team presented the results mapped to the maturity model and the assessment participants developed action items based on the results. It was decided during this portion of the workshop not to proceed with the GDHI assessment.

The MEASURE Evaluation team also conducted one-on-one meetings with key stakeholders and digital health system owners (see Appendix D for the list of assessment participants) to get more details on Zanzibar's recent digital health activities.

Assessment Oversight Team and Meetings with Stakeholders

While planning the assessment, the MOH formed the AOT, made up of local ministry members involved in digital health activities. The AOT provided guidance on activities in Zanzibar about HIS and digital health. The MOH worked with the MEASURE Evaluation team to select six AOT participants from the ministry and related agencies. This team helped determine the scope and overall direction of the assessment; identified key HIS and digital health stakeholders in Zanzibar; selected the people invited to participate in the assessment and consensus workshop; identified key documents for the desk review; and facilitated implementation of the assessment. The MEASURE Evaluation team oriented the AOT to the assessment tools and planned assessment processes. Appendix D, Table D1 lists the composition of the AOT. Table D2 provides the full list of key HIS and digital health stakeholders identified by the AOT who attended the workshop, including those who were available for one-on-one meetings. Because of the limited time in Zanzibar, individual meetings with stakeholders took place during breaks in the workshop schedule.

Desk Review

The assessment team conducted the desk review in July 2019, using documents sourced online and with additional items added later with AOT guidance. To obtain documents containing strategies for HIS, it collected literature through the web libraries of key implementers of digital health, including Digital REACH and local contacts. It obtained policy and legislative documents from relevant government digital libraries and contacts in the Zanzibar health networks. The literature search produced reports from various projects, government policy and legislative documents, and reports from different public and private initiatives. Insights from the desk review were used to conduct the assessment and preparation of this report.

HIS Interoperability Maturity Assessment

Tool Description

The MEASURE Evaluation project, funded by USAID, and in collaboration with the Digital Health and Interoperability Technical Working Group of the Health Data Collaborative, developed a toolkit of guiding documents and tools for countries to use in assessing their capacity to implement interoperable systems. The toolkit contains three main components: a maturity model, an assessment tool, and a users' guide. It also offers a complete list of the references consulted in a literature review conducted as part of the toolkit's development.

The HIS Interoperability Maturity Model outlines the major components of HIS interoperability and lays out a country's growth pathway by using these components. Countries can apply the assessment tool to systematically determine their HIS maturity level on the interoperability continuum. Using the assessment results, countries can create a path for strengthening their HIS subsystems, improve their ability to interoperate, and build resilient electronic HIS overall.

Assessment and Consensus Workshop

During the assessment and consensus workshop, the stakeholders identified by the AOT worked in small groups to complete the assessment tool. The stakeholders and facilitators then met in plenary to come to consensus on the assessment results over the course of the two days.

Results

Summary Themes from Key Informant Interviews

The stakeholder interviews were critical in helping contextualize the results of the assessment tool application and identifying documents to be included in the desk review. Unfortunately, because of limited time in Zanzibar, the stakeholder interviews were held during workshop breaks and, therefore, may not have achieved adequate representation. Key themes from stakeholder meetings are described below.

Leadership and Governance

Zanzibar did not have a governing structure overseeing HIS plans. As a result, there was no coordinating body providing a vision, guidance, and structure for HIS interoperability. Moreover, the ICT unit did not have the authority to oversee the ICT systems chosen throughout the MOH, making it difficult to govern digital health systems. Interviewees expressed a willingness and commitment to foster collaboration and eliminate silos. They provided an example of preventing an implementing partner from employing a duplicative application; however, this was done by stalling approvals rather than through a formal governance process.

Although there were some financial management structures and processes in place to support HIS activities, there was no business continuity plan (BCP) for HIS activities or an M&E structure for interoperability.

Human Resources

Interviewees reported that there was no path for HIS or digital health professionals in the public sector. Those working on HIS activities were often overstretched and lacked role clarity. Training for HIS and digital health staff in Zanzibar was limited, and most staff needed to travel to the Mainland for further

education. Some interviewees reported that this resulted in the loss of trained professionals to Mainland organizations.

Technology

Backbone infrastructure existed to support Internet connectivity throughout Unguja and Pemba Islands, although full connectivity to facilities can be unstable. There was sufficient capacity to support ICT maintenance; however, without a defined EA, plans for expansion and ongoing maintenance were not strategic. Interviewees stated that data management and equipment purchasing procedures were siloed and inconsistent, making it difficult to develop SOPs and protocols.

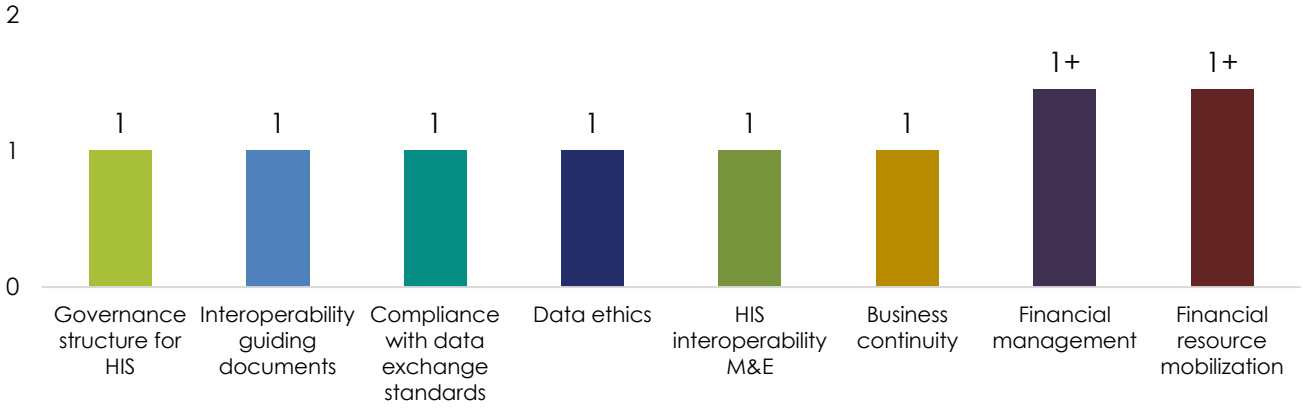
HIS Interoperability Assessment

This section describes the results of the HIS interoperability assessment, which were obtained by using the HIS interoperability assessment tool and mapping the results to the HIS Interoperability Maturity Model. The raw results of the assessment mapped to the maturity model are in Appendix F. The findings are presented by the three domains in the Maturity Model: leadership and governance, HR, and technology. Each section includes a figure with a bar graph showing the scores for the individual subdomain levels in that domain.

Leadership and Governance

As shown in Figure 6, Zanzibar was at a level 1 for all subdomains of leadership and governance, except for financial resource mobilization and financial management, which received scores of 1+. The plus was added because of the existence of some budgeting and a mechanism for financial management in the MOH. There was an HIS Unit in the MOH that, in a broad sense, had a budget for HIS, but it was not specifically for interoperability activities. The assessment participants also noted that the HIS Unit did not have the authority to convene groups across the MOH.

Figure 6. Leadership and governance subdomain maturity levels as of 2019

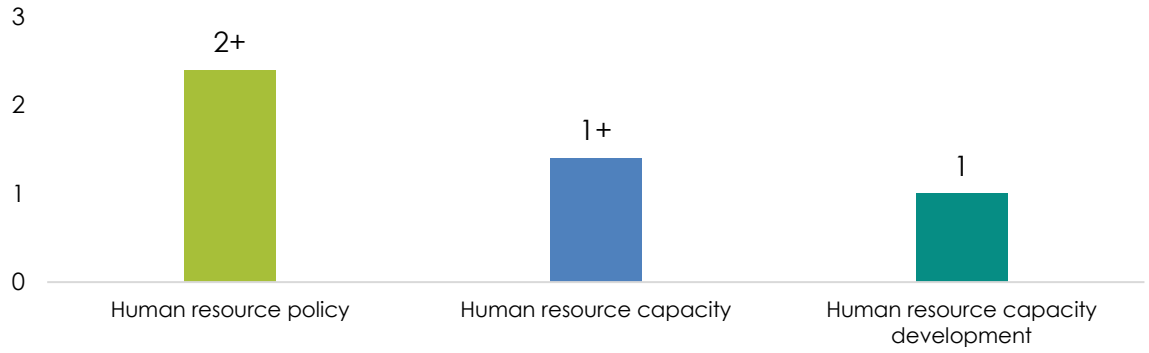


Human Resources

The subdomain scores under human resources varied from nascent (level 1) to emerging (level 2), as shown in Figure 7. An assessment of the HR needs for HIS was completed before the establishment of the HIS Unit in the MOH. The resulting documents from the assessment were completed in 2018 and described the HIS staffing needs (The Revolutionary Government of Zanzibar, MOH, Human Resource Directorate, 2018; The Revolutionary Government of Zanzibar, MOH, 2019a; The Revolutionary Government of Zanzibar, MOH, 2019b). There were implementation plans for meeting staffing needs,

including a long-term plan to address the skills needed to sustain HIS and digital health interoperability. There was growing capacity in the public sector to support digital HIS. Zanzibar also received technical assistance from donors and implementing partners. However, overall capacity development was a challenge because the relevant training programs were on the Mainland, and there was no recognized pre-service training available in Zanzibar to address HIS needs and capacity.

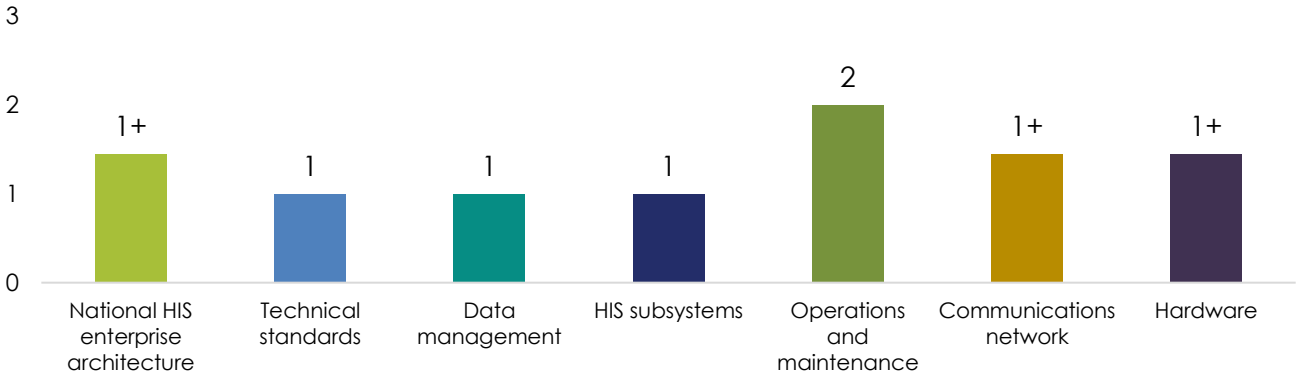
Figure 7. Human resources subdomain maturity levels as of 2019



Technology

Similar to the HR domain, the scores in the technology subdomains ranged from nascent to emerging, as shown in Figure 8. Although there was some point-to-point data exchange to support activities, such as in supply chain and malaria surveillance, there was no existing HIS EA plan. There was an HFR, but it was neither recognized as authoritative nor available in a digital format. Similarly, there is no standardized patient ID type across facilities. There were no defined technical standards in Zanzibar to operationalize critical HIS components. Although some data management practices were in place, they were not fully institutionalized. Operations and maintenance for information technology were ad hoc and unstructured. However, the HIS Unit in the MOH had a team that was dedicated to providing ICT and network support. There were limited hardware and software in place to support Zanzibar's HIS; less than 50 percent of the MOH's national and subnational offices had the needed hardware.

Figure 8. Technology subdomain maturity levels as of 2019



Description of the Action Items Generated During the Workshop

At the end of the two-day workshop, after validating the results of the assessment, participants worked in groups to brainstorm next steps and recommendations based on the assessment results. Table 1 shows the action items and recommendations developed by the participants to address the gaps identified during consensus building.

Table 1. Zanzibar consensus meeting action items and recommendations

Action/recommendation	Related subdomain(s)
Establishment of an HIS governing body that incorporates all subsystems and components of the HIS and has a full mandate (laws and regulations)	Government structure for HIS
Ensure that HIS policy, strategies, and a framework are in place and practiced	Interoperability guidance document
Data laws, regulations, and procedures should be defined and practiced	Compliance with data exchange standards, data management
Approved BCPs that address all risk and include the establishment of a disaster recovery mechanism for the HIS	Business continuity
Preserve a special budget to support capacity building of all HIS staff	Financial management, HR capacity
Availability of branded equipment and tools to sustain the HIS	Operations and maintenance, communication networks, hardware
Program for awareness about HIS	HIS interoperability M & E
Capacity building for new technology, especially for local area network and WAN Infrastructure	Communication networks
Establishment of training programs to build HR capacity in digital HIS	HR capacity development
Establish a national HIS EA that defines data exchange standards to improve interoperability	National HIS EA, technical standards
Develop a Strengthening Preventive Maintenance Plan	Operations and maintenance
Conduct an ICT infrastructure assessment on hardware requirements	Hardware
Procurement of hardware resources to support HIS	Hardware
Develop a national eHealth strategy and policy, including interoperability guidelines, HIS EA, technical standard procedures, and data management documents	Interoperability guidance documents, national HIS EA, technical standards
Incorporate HIS-specific training in the general HR strategic plan of the MOH	HR capacity

Discussion

Across the three domains, the majority of Zanzibar's scores are at the nascent level, with a few at the emerging level. The formalization of the HIS Unit in the MOH is a first step toward establishing the necessary leadership and governance for strengthening overall HIS. At first glance, the scores indicate a lot of weaknesses in the HIS; however, Zanzibar has the advantage of being able to work closely with the

Mainland, taking advantage of the lessons learned and best practices that have already been achieved there, and leveraging capacity building resources. If Zanzibar can foster closer relationships with the Mainland MOHCDGEC and eGA, it has the potential to leapfrog its progress in HIS.

Limitations of the Assessment

There were some limitations to this assessment and its results. First, the assessment was conducted at the national level of the health sector. Although Zanzibar is a small archipelago, there was no representation from Pemba Island. It was therefore unclear whether its issues were accurately represented. The assessment team had limited time in Zanzibar; therefore, all one-on-one meetings took place during breaks at the workshop. There were also no on-site visits to implementing partners or facilities. Zanzibar chose not to complete the GDHI after it was clear that the HIS Interoperability Maturity Toolkit scores were quite low. Additional lessons that could be useful from a second assessment were therefore not expected. The results of this assessment are skewed toward the use of digital health for HIS because that is what is covered in the HIS interoperability assessment.

Recommendations

By triangulating the assessment results and through an action items brainstorming session, the MEASURE Evaluation assessment team recommends the following actions for continuing to strengthen HIS interoperability and digital health in Zanzibar.

Short-Term Recommendations

- **Consider restructuring the MOH to clarify HIS-related roles and responsibilities:** During the assessment, there was confusion about which units and departments were responsible for the items in the assessment tool. To lay a foundation for HIS interoperability, it will be important for the MOH to consider restructuring how ICT, HIS, and HMIS work together and to develop discrete roles and responsibilities for each group for the HIS in Zanzibar. The MOH should consider using the structure from the Mainland or other East African countries as an example on how to restructure.
- **Coordinate procurement:** Procurement of hardware and software needs to be more formalized and coordinated in the MOH. The lack of HIS capacity is exacerbated by the strain of having to learn the technical specifications of multiple brands of hardware and the associated software and SOPs. Coordinated purchasing of hardware and software may also help reduce costs through bulk purchasing.
- **Establish an HIS governance structure for the MOH:** There is no functioning governance structure to oversee implementation of the HIS in the MOH. The governance structure should have the authority to convene HIS and digital health stakeholders, advocate for resources, draft a digital health strategy, and oversee implementation of the digital health strategy and the HIS Strategic Plan. In some countries, the HIS governance structure is a Steering Committee or a department or a combination of departments, steering committees, and technical working groups.
- **Develop a digital health strategy:** There is no plan or framework for using digital technologies in the health sector in Zanzibar. There is a lack of guidance on how to choose systems or how they should be implemented to support the overarching goals of the health sector. This digital health strategy should be developed by the MOH and cover all functions as defined by WHO eHealth Strategy Toolkit (WHO & ITU, 2012). As part of the strategy, or in a separate policy document, there should be guidelines for the implementation of new and ongoing digital health activities that

limit the ability of implementing partners to establish new systems without buy-in from the MOH. This strategy should also address the need to build HR capacity for digital health and interoperability in the health sector in Zanzibar.

Long-Term Recommendations

- **Define and design an enterprise architecture for the HIS in Zanzibar:** The EA will serve as a blueprint for the health information system in Zanzibar, and should seek to harmonize health information needs, clinical and patient workflows, and technology solutions.
- **Increase transparency and the availability of documents and policies on HIS:** The MOH should ensure that as documents and strategies on digital health and HIS are published, they are shared with all relevant stakeholders, including partners of the MOH.
- **Establish channels of communication and cooperative agreements to work better with the Mainland government** to share experiences, learn from policy and strategy implementation, and leverage purchasing power of HIS equipment and health commodities.
- **Collaborate with the Mainland to introduce in-service and pre-service training programs on eHealth:** There are already accepted digital health and HIS curricula on the Mainland that can be adapted to Zanzibar to improve the availability of health workers with the appropriate skills.
- **Develop a health data security, confidentiality, and privacy regulatory framework:** As more and more data in the health sector become digitized, it is increasingly important that the Zanzibar MOH develop a security, confidentiality, and privacy regulatory framework that can be operationalized by system administrators and users to protect health data.
- **Develop a BCP for all digital health solutions**: As more and more facilities and hospitals begin to rely on digital health solutions in their healthcare delivery, it is important that the MOH and eGovernment ensure the continuous availability of critical business processes.

REFERENCES

The Digital REACH Initiative. (n.d.). The Digital REACH Initiative. Retrieved from https://drive.google.com/file/d/1tESKmA1NJcx1jjDlP3o_c2XRU-tfRReR/view.

East African Health Research Commission. (2017). Digital REACH Initiative Roadmap. Retrieved from https://www.eahealth.org/sites/www.eahealth.org/files/content/attachments/2019-02-06/Digital-REACH-Initiative-Roadmap_20171205_custom_size_0.pdf.

East African Science and Technology Commission (EASTECO) & University of Rwanda. (2018). *2nd EAC regional eHealth and telemedicine workshop, ministerial conference and international trade exhibition: Conference report*. Kigali, Rwanda: EASTECO. Retrieved from https://easteco.org/wp-content/uploads/2018/08/Report-2ndEhealth.pdf.

Government of Tanzania. (n.d.) Tanzania digital health investment road map 2017. Retrieved from http://moh.go.tz/images/eHealth_Initiatives/TZ_Investment_Recommendations_Roadmap.pdf.

Ministry of Health, Community Development, Gender, Elderly, and Children (MOHCDGEC) & President's Office of Regional Administration and Local Government (PORALG). (2019). Assessment report for the national ehealth strategy (2013 – 2018) implementation. Final draft. Dar es Salaam, Tanzania: MOHCDGEC.

The Revolutionary Government of Zanzibar. (2012). HIS strategic plan 2012–2020. Retrieved from https://www.mohz.go.tz/pdfs/ZANZIBAR_HIS_STRATEGIC_PLAN_2012_to_2020.pdf.

The Revolutionary Government of Zanzibar, Ministry of Health (MOH). (2019a). *Human resources for health norms and standards guidelines for the health sector, Towards universal Health coverage, 2019–2023*. Mnazi Mmoja, Zanzibar Tanzania: MOH.

The Revolutionary Government of Zanzibar, Ministry of Health (MOH). (2019b). *Health workforce requirement and recruitment plan for the public health sectors, 2019/2020–2023/2024*. Mnazi Mmoja, Zanzibar Tanzania: MOH.

The Revolutionary Government of Zanzibar, Ministry of Health (MOH), Human Resource Directorate. (2018). *Job descriptions for health cadres, other non-health cadres and support staff*. Mnazi Mmoja, Zanzibar Tanzania: MOH.

The United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children. (n.d.). Digital Health Strategy, July 2019–June 2024. Retrieved from http://moh.go.tz/en/ehealth-initiative.

The United Republic of Tanzania, Ministry of Health, Community Development, Gender, Elderly and Children. (2016). Guidelines and Standards for Integrated Health Facility Electronic Management Systems. Retrieved from http://moh.go.tz/images/eHealth_Initiatives/Guidelines_and_Standards_for_Integrated_Health_Facility_MoH.pdf.

The United Republic of Tanzania, Ministry of Health and Social Welfare. (n.d.). Tanzania National eHealth Strategy 2013–2018. Retrieved from http://moh.go.tz/images/eHealth_Initiatives/Tanzania-eHealth-Strategy-2013-18.pdf.

World Health Organization & International Telecommunication Union (ITU). (2012). *National eHealth strategy toolkit*. Geneva, Switzerland: ITU. Retrieved from https://apps.who.int/iris/handle/10665/75211.

APPENDIX A. ASSESSMENT PARTICIPANTS: TANZANIA

Table A1. Tanzania assessment oversight team

Name	Organization
Haji Bamsi	MOHCDGEC
Jubilate Bernard	MOHCDGEC
Erick Kitali	PORALG
Walter Ndesanjo	MOHCDGEC
Fidelis Ronjino	MOHCDGEC

Table A2. Stakeholder interviewees

Name	Organization
Bakari	Jhpiego
Elaine Baker	PATH
Haji Bamsi	MOHCDGEC
Paul Philip Bwathondi	Management Sciences for Health
Karin Kallander	UNICEF
Zaharani Kalungwa	Centers for Disease Control and Prevention (CDC)
Said Karume	mHealth Tanzania Public Private Partnership
Makunda Kasongo	FHI360
Erick Kitali	PORALG
Dr. Kenneth Lema	Management Sciences for Health
Denis Alan Mkwati	CDC
Dr. Elias Mturi	University Computing Center
Irene Mwoga	WHO
Stefano Ningato	PATH
Alpha Nsaghurwe	John Snow Inc. (JSI) Tanzania
Edwin Nyella	JSI Tanzania
Pascal Pastory	Medical Stores Department
Sri Perera	CDC
Naomi Printz	JSI
Daniel Sanga	Management and Development for Health
Yu Shibui	UNICEF
Desderi Wengaa	Public Sector Systems Strengthening

Table A3. Workshop attendees

Name	Organization
Aurora Amoah	USAID
Haji Bamsi	MOHCDGEC
Elaine Baker	PATH
Melchiory Baltazary	PORALG
Jubilate Bernard	MOHCDGEC
Gosbeut Chobya	Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ)
Said Karume	mHealth Tanzania Public Private Partnership
Milly Kayonyo	USAID
Bernard Mussa	University of Dar es Salaam
Irene Mwoga	WHO
Dr. John Mwombela	MOHCDGEC
Moses Ndahiro	EASTECO
Walter Ndesanjo	MOHCDGEC
Baltazar Ngoli	GIZ
Ssanga Nynad	RTI
Sri Perera	CDC
Neema Ringo	PATH
Fidelis Ronjino	MOHCDGEC
Sultana Seiff	eGovernment Agency
Desderi Wenga	Public Sector Systems Strengthening

APPENDIX B. WORKSHOP AGENDA: TANZANIA

Tanzania Health Information Systems Interoperability Assessment Workshop

Sea Cliff Hotel, Dar es Salaam

Day 1: Wednesday, September 25

Session topic	Time	Facilitator(s)
Registration	8:30-9:00	All
Opening remarks	9:00-9:10	MOHCDGEC
Opening EAC remarks	9:10-9:15	EAC/EASTECO
Introduction to digital health and interoperability in Tanzania	9:15-9:30	MOHCDGEC
Overview of the Assessment	9:30-10:00	MEASURE Evaluation
Coffee break	10:00-10:15	All
HIS Interoperability Maturity Toolkit	10:15-11:00	MEASURE Evaluation
Small groups assessment	11:00-12:30	All
Consensus on assessment answers	12:30-13:00	MEASURE Evaluation
Lunch	13:00-14:00	All
Consensus on assessment answers	14:00-16:00	MEASURE Evaluation
Next steps & Closing remarks	16:00-16:30	MOHCDGEC MEASURE Evaluation
Coffee break and departure	16:30-17:00	All

Day 2: Thursday, September 26

Session topic	Time	Facilitator(s)
Registration	8:30-9:00	All
Introductions and Day 1 recap	9:00-9:15	MOHCDGEC
Assessment results review and validation	9:15-10:00	MEASURE Evaluation
Global Digital Health Index introduction	10:00-10:30	MEASURE Evaluation
Tea break	10:30-10:45	
Global Digital Health Assessment	10:45-12:15	MEASURE Evaluation
Reflection on results in plenary	12:15-13:00	MEASURE Evaluation
Lunch	13:00-14:00	
Breakout groups to determine action plans	14:00-15:30	All
Plenary sharing	15:30-16:30	All
Next steps and wrap up	16:30-16:45	MOHCDGEC/ MEASURE Evaluation
Tea break and departure	16:45-17:00	

APPENDIX C. HEAT MAP OF INTEROPERABILITY ASSESSMENT RESULTS: TANZANIA

HEALTH INFORMATION SYSTEMS INTEROPERABILITY MATURITY MODEL WORKSHEET							
Domain	**Subdomain**	**Level 1: Nascent** The country lacks HIS capacity or does not follow processes systematically. HIS activities happen by chance or represent isolated, ad hoc efforts.	**Level 2: Emerging** The country has defined HIS processes and structures, but they are not systematically documented. No formal or ongoing monitoring or measurement protocol exists.	**Level 3: Established** The country has documented HIS processes and structures. The structures are functional. Metrics for performance monitoring, quality improvement, and evaluation are systematically used.	**Level 4: Institutionalized** Government and stakeholders use the national HIS systems and follow standard practices.	**Level 5: Optimized** The government and stakeholders routinely review interoperability activities and modify them to adapt to changing conditions.	**Subdomain Level**
Leadership and Governance	**Governance structure for HIS**	Evolving governing body for health information systems (HIS) is constituted on a case-by-case basis OR no governing body exists.	An HIS governing body is formally constituted and has a scope of work that includes the people responsible for data governance oversight. The governing body oversees interoperability directly or through a separate technical working group (TWG).	The HIS governing body conducts regular meetings with stakeholder participation.	The HIS governing body is government-led, consults with other ministries, and monitors implementation of HIS interoperability using a work plan. It mobilizes resources—financial, human resources (HR), and political—to accomplish its goals.	The HIS governing body is legally protected from interference or organizational changes. The HIS governing body and its TWGs are nationally recognized as the lead for HIS interoperability. The governing body works in liaison with other similar working groups regionally and/or around the world.	2+
	Interoperability guidance documents[1]	HIS interoperability guidance documents are absent, and HIS interoperability is implemented on a case- by-case basis.	The governing body for HIS interoperability has drafted the necessary HIS interoperability guidance documents.	Interoperability guidance documents developed, tested, and adopted, and include reference terminologies and technical standards for data exchange.	The interoperability guidance documents are government-owned. They are consistently used and referenced in efforts to guide implementation of HIS interoperability.	Processes are in place to regularly monitor the implementation of the interoperability guidance documents. The interoperability guidance documents are regularly reviewed and updated based on lessons learned from implementation. These documents reflect international best practices.	5

[1] The approved documents (policies, strategies, and frameworks) that guide HIS and digital health/eHealth work in a country.

Current subdomain level: The level at which all the attributes at that level and the levels below have been achieved

Level with some attributes achieved: Level above current subdomain level with some attributes of that level achieved

Level with all attributes achieved: Level above the current subdomain level with all attributes in that level achieved

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Leadership and Governance	**Compliance with data exchange standards**	No structure, processes, and procedures (e.g., working groups, steering committees, or units) are in place to guide or enforce compliance with data exchange, messaging, and data security standards. No criteria for certification and compliance exist. No regulatory framework for compliance exists.	Structures (working groups, steering committees, or units) are in place to guide or enforce compliance.	The HIS has developed or adopted and implemented a regulatory framework for compliance.	The government enforces the regulatory framework for compliance. The subsystems in the national HIS are required to meet compliance and certification criteria.	Compliance with standards for data exchange, messaging, and security is regularly reviewed. The regulatory framework is reviewed and updated to reflect best practices for data exchange, messaging, and systems security.	5
	Data ethics	The country has no healthcare-specific data laws, regulatory frameworks, or ethics provisions to guide data security, privacy, and confidentiality.	The country has drafted laws, policies, or a regulatory framework for data security and privacy that address issues related to health data.	The country has an approved health data regulatory framework.	The health data security and privacy laws have been implemented, and there are guidelines on how to operationalize the laws in the HIS. HIS users have been sensitized on the data security and privacy laws. The government and stakeholders consistently enforce the data security and privacy laws.	The country has a recognized mechanism (e.g., committee or working group) for reviewing data ethics issues in the national HIS, and for updating policies, procedures, and laws, as needed. This mechanism reflects industry best practices.	2
	HIS interoperability monitoring and evaluation	No tracking, or ad hoc tracking, is done of HIS interoperability activities related to plans, resources, and budgets for the national HIS.	The methods and tools to report on HIS interoperability implementation are defined and documented.	HIS interoperability activities are regularly monitored and reviewed accordingly. Regular reports on HIS interoperability performance are generated and disseminated to stakeholders.	Mechanisms to track and measure performance of HIS interoperability work are government-approved and government-led.	Results from monitoring of HIS interoperability are used for planning. Decisions about future activities take this analysis into consideration.	2
	Business continuity	No government-approved business continuity plan (BCP) is in place at the national or subnational levels of the HIS.	The HIS has developed a BCP that outlines the processes needed to ensure continuity of critical business processes.	The BCP has been audited. Audit results show that at least 50% of the BCP has been implemented.	The BCP has been audited. Audit results show that at least 75% of the BCP has been implemented.	The BCP has been audited. Audit results show that all or most of the BCP has been implemented.	2

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Leadership and Governance	**Financial management**	No clear plan exists for financial management of HIS, including interoperability activities.	High-level financial management structures, including budgets, are developed for the national HIS, including interoperability in the country based on HIS work plans.	Detailed financial management structures, including budgets for HIS interoperability at the national and subnational levels, are developed based on the HIS work plan. HIS expenditures are monitored against HIS budgets.	The HIS budget is part of the Ministry of Health's budgeting process. Financial audit processes are in place and are carried out regularly to promote accountability in HIS spending.	An established, long-term HIS financial management system is owned, reviewed, tracked, and updated by the government, and is supported by stakeholders.	5
	Financial resource mobilization	There is no documented plan for financial resources for HIS strengthening, including HIS interoperability.	Financial resources for HIS strengthening, including HIS interoperability, are mostly donor driven.	A costed work plan at national and subnational levels is in place that covers both the information and communications technology (ICT) infrastructure (network, hardware, and software), and personnel for HIS needed for HIS strengthening, including HIS interoperability. At a minimum, this work plan identifies the activities, timeframe, costs, and sources of funding for HIS interoperability.	Government and implementing partners have sufficient funding to implement the costed work plan. The government owns the costed work plan.	A government-owned, costed, long-term work plan (five years or more) is in place to support ICT and human resources for HIS strengthening, including HIS interoperability. A mechanism is in place to regularly review and update the work plan.	2+
						Maturity level of Leadership and Governance domain:	2

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Human Resources	**Human resources policy**	There is no human resources (HR) policy that recognizes HIS-related cadres. Distribution of HIS human resources is ad hoc.	A national needs assessment has been completed showing the number of staff and types of skills needed to support HIS, including digital HIS and interoperability. HIS-related cadre roles and responsibilities are mapped to the government's workforce and schemes of work.	An HR policy and/or strategic plan exists that identifies the HIS, digital HIS, and interoperability skills and functions needed to support the national HIS and its digital HIS and interoperability.	Implementation plans are in place for growing a cadre of staff at national and subnational levels for digital HIS and interoperability.	A long-term plan is in place to grow and sustain staff with the skills needed to sustain HIS and digital HIS and interoperability. Performance management systems are in place to monitor growth and sustainability of the HIS workforce.	2+
	Human resources capacity (skills and numbers)	The country has no dedicated cadre of staff for maintaining the digital HIS and interoperability. Responsibility for the HIS is added to existing positions.	There is growing capacity within the public sector to support digital HIS. The country also receives technical assistance from external stakeholders to support the national and subnational digital HIS and interoperability.	The country has a growing staff with skills in governance and leadership, data collection, data management, data sources, health information technology (IT), and managing information products. The staff are sufficient in numbers and skills at the national level, but inadequate at subnational levels.	The country has staff in sufficient numbers with relevant skills to support the digital HIS and interoperability at national and subnational levels.	The country has a sufficient and sustainable number of staff with an appropriate mix of skill sets to support the digital HIS and interoperability at national and subnational levels, and the interoperability of key systems. A human resources for health strategic plan is in place to continuously upgrade staff skills to reflect international best practices in digital HIS and interoperability, preferably with locally generated funds.	2
	Human resource capacity development	The country has no national training programs to build human resource capacity on digital HIS, including interoperability.	A nationally recognized pre- service training curriculum exists that outlines needed competencies for human resources for digital HIS and the interoperability of the HIS.	A plan exists for in-service training of HIS staff to build skills around digital HIS and interoperability based on a nationally or internationally recognized HIS curriculum.	The country has the capacity to train enough staff to support digital HIS and interoperability, through in-country pre-service and in-service training institutions or partnerships with other training institutions. Government and stakeholders provide sustainable resources for health ministry staff to receive training on HIS, including digital HIS and interoperability.	Opportunities and incentives are in place for continuing education in digital HIS and interoperability for HIS-related cadre staff, to keep them up-to-date as the HIS field evolves.	2+
						Maturity level of Human Resources domain:	2

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Technology	**National HIS enterprise architecture**	A national HIS enterprise architecture document defining technology requirements and data exchange formats for interoperability does not exist OR there is a draft document, but it has not been validated or shared with the country's HIS community.	A validated national HIS enterprise architecture exists that defines technology requirements and exchange formats for interoperability. It is validated, but not widely shared or systematically applied by the HIS community. Point to point data exchange between some HIS applications exists, but there is no systematic implementation of the agreed-upon architecture.	Foundational tools and rules for HIS interoperability exist. They include a health information management system for routine and surveillance data, and core authoritative registries (Facility Registry, Metadata Dictionary, Master Patient index, and Health Worker registry). The Interoperability Service Layer (ISL) for the HIS is operational and provides core functions, such as data authentication, translation, and interpretation.	The government owns, enforces, and leads implementation of the national HIS enterprise architecture, including the ISL and core authoritative registries (Facility Registry, Metadata Dictionary, Master Patient index, and Health Worker registry).	The national HIS enterprise architecture and its ISL are fully implemented using industry standards. The ISL provides core data exchange functions and is periodically reviewed and updated to meet the changing country data needs. There is continuous learning, innovation, and quality control in the work on HIS interoperability.	1+
	Technical standards[2]	No defined technical standards exist for use in the country's HIS data exchange. Applications are hosted by the providers without any control from the government or Ministry of Health.	An HIS ICT infrastructure assessment has been conducted and the needs for a coherent HIS ICT infrastructure architecture have been documented. The country has adopted or developed technical standards for health data exchange, messaging, and security.	An interoperability lab exists for new partners to test technical standards or for onboarding new HIS subsystems, and a certification mechanism exists for new HIS subsystems to be integrated in the national HIS.	Technical standards for national data exchange have been published and disseminated in the country under the government's leadership. The ISL is orchestrating data exchange between existing HIS applications hosted by the integrated ICT infrastructure supporting the national HIS.	A routine review of standards and requirements compliance is conducted to ensure continuous integration of the various subsystems.	1+

[2] Including standards for data exchange, transmission, messaging, security, privacy, and hardware.

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Technology	**Data management**[3]	No national document for data management procedures exists for the national HIS.	Electronic data management procedures for the HIS are clearly developed and documented in a nationally recognized document.	A roadmap is in place to migrate data collection and reporting from a paper system to an electronic system, complete with necessary data security safeguards. A documented mechanism is in place for maintaining data quality throughout the data supply chain.	National electronic data management processes are published and disseminated for the HIS. A standard operating procedure and/or data use plan is in place to facilitate data use by the country and its stakeholders. A data warehouse, integrating data from all HIS subsystems and allowing for data triangulation and quality control, is fully functional and in use.	Data access and use are constantly monitored, and data management systems are updated accordingly. Electronic data transmission is the default method to move data among information systems. Dashboards displaying information from multiple sources are available to decision makers.	1+
	HIS subsystems	The country's HIS mainly consists of stand-alone program- specific subsystems working in silos, and addressing only the basic information needs (routine HIS, surveillance system, and human resources). Program- specific parallel systems exist.	HIS data exchange is mainly facilitated by a single subsystem directly linked to other subsystems to enable basic data exchange.	Guidelines for compliance with technical standards for HIS subsystem interoperability with the national HIS have been disseminated. An increasing number of HIS subsystems are web- based and integrated with the ISL following the national standards requirements.	The government requires all HIS subsystems to comply with the country's interoperability plan, including use of technical standards.	Most HIS subsystems are exchanging data electronically, according to industry standards/best practices.	2+
	Operations and maintenance (for computer technology)	Operations and maintenance services for electronic systems are ad hoc or non-existent.	Maintenance for network and hardware is a mix of reactive and evolving preventive procedures.	The country is receiving technical support to build a strong in-country capacity for computer technology maintenance. Standard operating procedures exist that detail protocols for routine network and hardware maintenance.	The country has the capacity for strong in-country technical maintenance. Computer operations and maintenance services are part of the HIS plan or the country's strategic plan for health. A disaster recovery plan for digital HIS is in place, and it meets best practices.	The operations and maintenance services plan is continuously reviewed and adapted to evolving HIS interoperability requirements, and follows industry-based standards. Regular simulations are undertaken to increase the ability of technology staff to respond to a disaster.	2+

[3] Procedures on how data are captured, stored, analyzed, transmitted, and packaged for use across the data supply chain.

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Technology	**Communication network: local area network (LAN) and wide area network (WAN)**	The country has no reliable network connection to support a national HIS.	An ICT infrastructure assessment has been conducted to determine LAN and WAN requirements for the country's HIS. The country is using mainly unreliable wireless (2G, 3G or 4G) modems to connect to the HIS services.	A national implementation plan to meet the LAN and WAN requirements in the country exists. A national network maintenance plan exists to ensure high uptime, including procedures to recover from network failure. The country has started to implement a technical solution to ensure permanent connectivity to the HIS services.	All national offices and at least 50% of the subnational offices of the Ministry of Health and health service providers have a strong and reliable network connection to the various HIS network services. An HIS-dedicated ICT and network support team is in place.	All or almost (>75%) all the Ministry of Health's national and subnational offices and health service providers have a reliable and robust network connection. A team dedicated to support connectivity exists and has adequate financial, human, and technology resources. Industry-based standards are followed.	3+
	Hardware	The country has limited/ inadequate hardware (servers, user computers, printers, and supportive accessories) to support a national HIS.	An ICT infrastructure assessment has been done to identify the hardware required at national and subnational levels. Less than 50% of the Ministry of Health's national and subnational offices have the required hardware (computers, printers, connecting devices, etc.).	50% or more of the Ministry of Health's national and subnational offices have the required hardware, including back-up hardware.	Seventy-five percent (75%) of the Ministry of Health's national and subnational offices have the required hardware. There is a back-up and recovery plan for the national HIS.	The hardware meets national and/or international specifications, and a long-term plan (five years or more) is in place that details how to keep hardware up-to-date.	1+
						Maturity level of Technology domain:	1+

APPENDIX D. ASSESSMENT PARTICIPANTS: ZANZIBAR

Table D1. Zanzibar assessment oversight team

Name	Organization
Al-Mafazy Abdul Wahid Habib	MOH-HMIS
Al-Mafazy Mohamed Habib	MOH-ICT
Mzale Abdulhalim	MOH-Logistics Management Unit
Khamis Ramadhan Juma	MOH-Human resources and administration
Haji Shaban Chum	eGovernment
Hamad Zahran Ali	MOH-Central Medical Store (CMS)

Table D2. Assessment workshop participants

Name	Organization
Zungufya Lydia Joseph	MOH-CMS
Iddi Fahmi Asaa	MOH-Logistics Management Unit
Makame Abdulrahman Taha	MOH-ICT
Omar Salma Khamis	MOH-ICT
Hurnung Heiko	D Tree
Ally Rajab Shabani	eGovernment
Ali Abdalla Juma	eGovernment
Rava Matteo Santangalo	MOH-M&E
Makanyaa Fredrik John	MOH-HMIS
Khamis Asha Ussi	MOH-ZIHHTLB
Hemed Suleiman Saleh	MOH-HMIS
Ali Ahlam Saeed	MOH-HMIS
Nsaghurwe Alpha	MEASURE Evaluation
Juma Amini Ali	MOH-CMS
Mussa Khamis Haji	MOH-CMS
Omar Fatma Said	MOH-Logistics Management Unit
Haji Amour Ramadhan	MOH-ICT
Rashid Khamis Ali	MOH-ZAHRI
Ndahiro Moses	EASTECO
Nyella Edwin	MEASURE Evaluation
Ali Munira Lillah	MOH-MMH
Velez Olivia	MEASURE Evaluation
Villella Christina	MEASURE Evaluation
Yahya Sheikh Hamad	SUZA
Mzale Abdulhalim	MOH-Logistics Management Unit
Chum Shaaban Haji	eGovernment
Machipanda Manyobvo	MEASURE Evaluation

APPENDIX E. WORKSHOP AGENDA: ZANZIBAR

Zanzibar Health Information Systems Interoperability and Digital Health Assessment Workshop

Zanzibar Ocean View Hotel and Conference Center

Day 1: October 2, 2019

Session topic	Time	Facilitator(s)
Registration	8:00-8:30	Ministry of Health
Opening remarks and introductions	8:30-9:00	Ministry of Health
Opening EAC remarks	9:00-9:10	EAC/EASTECO
Introduction to digital health in Zanzibar	9:10-9:45	Ministry of Health
Overview of the Assessment	9:45-10:15	MEASURE Evaluation
Coffee break	10:15-10:30	Hotel
HIS Interoperability Maturity Toolkit	10:30-11:00	Ministry of Health
Small groups assessment	11:00-13:00	MEASURE Evaluation
Lunch	13:00-14:00	Venue
Consensus on assessment answers	14:00-16:00	MEASURE Evaluation/Ministry of Health
Next steps & Closing remarks	16:00-16:30	Ministry of Health MEASURE Evaluation
Coffee break and departure	16:30-17:00	

Day 2: October 3, 2019

Session topic	Time	Facilitator(s)
Registration	8:00-8:30	MOH
Introductions and finish Consensus	8:30-10:00	MOH
Tea break	10:00-10:15	
Assessment results review and validation	10:15-10:45	MEASURE Evaluation
Global Digital Health Index introduction	10:45-11:00	MEASURE Evaluation
Global Digital Health Assessment	11:00-12:00	MEASURE Evaluation/MOH
Reflection on results in plenary	12:00-13:00	MOH
Lunch	12:45-13:45	
Breakout groups to determine action plans	13:45-14:30	All
Plenary sharing	14:30-16:00	All
Next steps and wrap up	16:00-16:30	MOH
Tea break and departure	16:30-17:00	

APPENDIX F. HEAT MAP OF INTEROPERABILITY ASSESSMENT RESULTS: ZANZIBAR

HEALTH INFORMATION SYSTEMS INTEROPERABILITY MATURITY MODEL WORKSHEET							
Domain	**Subdomain**	**Level 1: Nascent** The country lacks HIS capacity or does not follow processes systematically. HIS activities happen by chance or represent isolated, ad hoc efforts.	**Level 2: Emerging** The country has defined HIS processes and structures, but they are not systematically documented. No formal or ongoing monitoring or measurement protocol exists.	**Level 3: Established** The country has documented HIS processes and structures. The structures are functional. Metrics for performance monitoring, quality improvement, and evaluation are systematically used.	**Level 4: Institutionalized** Government and stakeholders use the national HIS systems and follow standard practices.	**Level 5: Optimized** The government and stakeholders routinely review interoperability activities and modify them to adapt to changing conditions.	**Subdomain Level**
Leadership and Governance	**Governance structure for HIS**	Evolving governing body for health information systems (HIS) is constituted on a case-by-case basis OR no governing body exists.	An HIS governing body is formally constituted and has a scope of work that includes the people responsible for data governance oversight. The governing body oversees interoperability directly or through a separate technical working group (TWG).	The HIS governing body conducts regular meetings with stakeholder participation.	The HIS governing body is government-led, consults with other ministries, and monitors implementation of HIS interoperability using a work plan. It mobilizes resources—financial, human resources (HR), and political—to accomplish its goals.	The HIS governing body is legally protected from interference or organizational changes. The HIS governing body and its TWGs are nationally recognized as the lead for HIS interoperability. The governing body works in liaison with other similar working groups regionally and/or around the world.	1
	Interoperability guidance documents[1]	HIS interoperability guidance documents are absent, and HIS interoperability is implemented on a case- by-case basis.	The governing body for HIS interoperability has drafted the necessary HIS interoperability guidance documents.	Interoperability guidance documents developed, tested, and adopted, and include reference terminologies and technical standards for data exchange.	The interoperability guidance documents are government-owned. They are consistently used and referenced in efforts to guide implementation of HIS interoperability.	Processes are in place to regularly monitor the implementation of the interoperability guidance documents. The interoperability guidance documents are regularly reviewed and updated based on lessons learned from implementation. These documents reflect international best practices.	1

[1] The approved documents (policies, strategies, and frameworks) that guide HIS and digital health/eHealth work in a country.

Current subdomain level: The level at which all the attributes at that level and the levels below have been achieved

Level with some attributes achieved: Level above current subdomain level with some attributes of that level

Level with all attributes achieved: Level above the current subdomain level with all attributes in that level achieved

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Leadership and Governance	**Compliance with data exchange standards**	No structure, processes, and procedures (e.g., working groups, steering committees, or units) are in place to guide or enforce compliance with data exchange, messaging, and data security standards. No criteria for certification and compliance exist. No regulatory framework for compliance exists.	Structures (working groups, steering committees, or units) are in place to guide or enforce compliance.	The HIS has developed or adopted and implemented a regulatory framework for compliance.	The government enforces the regulatory framework for compliance. The subsystems in the national HIS are required to meet compliance and certification criteria.	Compliance with standards for data exchange, messaging, and security is regularly reviewed. The regulatory framework is reviewed and updated to reflect best practices for data exchange, messaging, and systems security.	1
	Data ethics	The country has no healthcare-specific data laws, regulatory frameworks, or ethics provisions to guide data security, privacy, and confidentiality.	The country has drafted laws, policies, or a regulatory framework for data security and privacy that address issues related to health data.	The country has an approved health data regulatory framework.	The health data security and privacy laws have been implemented, and there are guidelines on how to operationalize the laws in the HIS. HIS users have been sensitized on the data security and privacy laws. The government and stakeholders consistently enforce the data security and privacy laws.	The country has a recognized mechanism (e.g., committee or working group) for reviewing data ethics issues in the national HIS, and for updating policies, procedures, and laws, as needed. This mechanism reflects industry best practices.	1
	HIS interoperability monitoring and evaluation	No tracking, or ad hoc tracking, is done of HIS interoperability activities related to plans, resources, and budgets for the national HIS.	The methods and tools to report on HIS interoperability implementation are defined and documented.	HIS interoperability activities are regularly monitored and reviewed accordingly. Regular reports on HIS interoperability performance are generated and disseminated to stakeholders.	Mechanisms to track and measure performance of HIS interoperability work are government-approved and government-led.	Results from monitoring of HIS interoperability are used for planning. Decisions about future activities take this analysis into consideration.	1
	Business continuity	No government-approved business continuity plan (BCP) is in place at the national or subnational levels of the HIS.	The HIS has developed a BCP that outlines the processes needed to ensure continuity of critical business processes.	The BCP has been audited. Audit results show that at least 50% of the BCP has been implemented.	The BCP has been audited. Audit results show that at least 75% of the BCP has been implemented.	The BCP has been audited. Audit results show that all or most of the BCP has been implemented.	1

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Leadership and Governance	**Financial management**	No clear plan exists for financial management of HIS, including interoperability activities.	High-level financial management structures, including budgets, are developed for the national HIS, including interoperability in the country based on HIS work plans.	Detailed financial management structures, including budgets for HIS interoperability at the national and subnational levels, are developed based on the HIS work plan. HIS expenditures are monitored against HIS budgets.	The HIS budget is part of the Ministry of Health's budgeting process. Financial audit processes are in place and are carried out regularly to promote accountability in HIS spending.	An established, long-term HIS financial management system is owned, reviewed, tracked, and updated by the government, and is supported by stakeholders.	1+
	Financial resource mobilization	There is no documented plan for financial resources for HIS strengthening, including HIS interoperability.	Financial resources for HIS strengthening, including HIS interoperability, are mostly donor supported.	A costed work plan at national and subnational levels is in place that covers both the information and communications technology (ICT) infrastructure (network, hardware, and software), and personnel for HIS needed for HIS strengthening, including HIS interoperability. At a minimum, this work plan identifies the activities, timeframe, costs, and sources of funding for HIS interoperability.	Government and implementing partners have sufficient funding to implement the costed work plan. The government owns the costed work plan.	A government-owned, costed, long-term work plan (five years or more) is in place to support ICT and human resources for HIS strengthening, including HIS interoperability. A mechanism is in place to regularly review and update the work plan.	1+
						Maturity level of Leadership and Governance domain:	1

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Human Resources	**Human resources policy**	There is no human resources (HR) policy that recognizes HIS-related cadres. Distribution of HIS human resources is ad hoc.	A national needs assessment has been completed showing the number of staff and types of skills needed to support HIS, including digital HIS and interoperability. HIS-related cadre roles and responsibilities are mapped to the government's workforce and schemes of work.	An HR policy and/or strategic plan exists that identifies the HIS, digital HIS, and interoperability skills and functions needed to support the national HIS and its digital HIS and interoperability.	Implementation plans are in place for growing a cadre of staff at national and subnational levels for digital HIS and interoperability.	A long-term plan is in place to grow and sustain staff with the skills needed to sustain HIS and digital HIS and interoperability. Performance management systems are in place to monitor growth and sustainability of the HIS workforce.	2+
	Human resources capacity (skills and numbers)	The country has no dedicated cadre of staff for maintaining the digital HIS and interoperability. Responsibility for the HIS is added to existing positions.	There is growing capacity within the public sector to support digital HIS. The country also receives technical assistance from external stakeholders to support the national and subnational digital HIS and interoperability.	The country has a growing staff with skills in governance and leadership, data collection, data management, data sources, health information technology (IT), and managing information products. The staff are sufficient in numbers and skills at the national level, but inadequate at subnational levels.	The country has staff in sufficient numbers with relevant skills to support the digital HIS and interoperability at national and subnational levels.	The country has a sufficient and sustainable number of staff with an appropriate mix of skill sets to support the digital HIS and interoperability at national and subnational levels, and the interoperability of key systems. A human resources for health strategic plan is in place to continuously upgrade staff skills to reflect international best practices in digital HIS and interoperability, preferably with locally generated funds.	1+
	Human resource capacity development	The country has no national training programs to build human resource capacity on digital HIS, including interoperability.	A nationally recognized pre- service training curriculum exists that outlines needed competencies for human resources for digital HIS and the interoperability of the HIS.	A plan exists for in-service training of HIS staff to build skills around digital HIS and interoperability based on a nationally or internationally recognized HIS curriculum.	The country has the capacity to train enough staff to support digital HIS and interoperability, through in-country pre-service and in-service training institutions or partnerships with other training institutions. Government and stakeholders provide sustainable resources for health ministry staff to receive training on HIS, including digital HIS and interoperability.	Opportunities and incentives are in place for continuing education in digital HIS and interoperability for HIS-related cadre staff, to keep them up-to-date as the HIS field evolves.	1
						Maturity level of Human Resources domain:	1

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Technology	**National HIS enterprise architecture**	A national HIS enterprise architecture document defining technology requirements and data exchange formats for interoperability does not exist OR there is a draft document, but it has not been validated or shared with the country's HIS community.	A validated national HIS enterprise architecture exists that defines technology requirements and exchange formats for interoperability. It is validated, but not widely shared or systematically applied by the HIS community. Point to point data exchange between some HIS applications exists, but there is no systematic implementation of the agreed-upon architecture.	Foundational tools and rules for HIS interoperability exist. They include a health information management system for routine and surveillance data, and core authoritative registries (Facility Registry, Metadata Dictionary, Master Patient index, and Health Worker registry). The Interoperability Service Layer (ISL) for the HIS is operational and provides core functions, such as data authentication, translation, and interpretation.	The government owns, enforces, and leads implementation of the national HIS enterprise architecture, including the ISL and core authoritative registries (Facility Registry, Metadata Dictionary, Master Patient index, and Health Worker registry).	The national HIS enterprise architecture and its ISL are fully implemented using industry standards. The ISL provides core data exchange functions and is periodically reviewed and updated to meet the changing country data needs. There is continuous learning, innovation, and quality control in the work on HIS interoperability.	1+
	Technical standards[2]	No defined technical standards exist for use in the country's HIS data exchange. Applications are hosted by the providers without any control from the government or Ministry of Health.	An HIS ICT infrastructure assessment has been conducted and the needs for a coherent HIS ICT infrastructure architecture have been documented. The country has adopted or developed technical standards for health data exchange, messaging, and security.	An interoperability lab exists for new partners to test technical standards or for onboarding new HIS subsystems, and a certification mechanism exists for new HIS subsystems to be integrated in the national HIS.	Technical standards for national data exchange have been published and disseminated in the country under the government's leadership. The ISL is orchestrating data exchange between existing HIS applications hosted by the integrated ICT infrastructure supporting the national HIS.	A routine review of standards and requirements compliance is conducted to ensure continuous integration of the various subsystems.	1

[2] Including standards for data exchange, transmission, messaging, security, privacy, and hardware.

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Technology	**Data management[3]**	No national document for data management procedures exists for the national HIS.	Electronic data management procedures for the HIS are clearly developed and documented in a nationally recognized document.	A roadmap is in place to migrate data collection and reporting from a paper system to an electronic system, complete with necessary data security safeguards. A documented mechanism is in place for maintaining data quality throughout the data supply chain.	National electronic data management processes are published and disseminated for the HIS. A standard operating procedure and/or data use plan is in place to facilitate data use by the country and its stakeholders. A data warehouse, integrating data from all HIS subsystems and allowing for data triangulation and quality control, is fully functional and in use.	Data access and use are constantly monitored, and data management systems are updated accordingly. Electronic data transmission is the default method to move data among information systems. Dashboards displaying information from multiple sources are available to decision makers.	1
	HIS subsystems	The country's HIS mainly consists of stand-alone program- specific subsystems working in silos, and addressing only the basic information needs (routine HIS, surveillance system, and human resources). Program- specific parallel systems exist.	HIS data exchange is mainly facilitated by a single subsystem directly linked to other subsystems to enable basic data exchange.	Guidelines for compliance with technical standards for HIS subsystem interoperability with the national HIS have been disseminated. An increasing number of HIS subsystems are web- based and integrated with the ISL following the national standards requirements.	The government requires all HIS subsystems to comply with the country's interoperability plan, including use of technical standards.	Most HIS subsystems are exchanging data electronically, according to industry standards/best practices.	1
	Operations and maintenance (for computer technology)	Operations and maintenance services for electronic systems are ad hoc or non-existent.	Maintenance for network and hardware is a mix of reactive and evolving preventive procedures.	The country is receiving technical support to build a strong in-country capacity for computer technology maintenance. Standard operating procedures exist that detail protocols for routine network and hardware maintenance.	The country has the capacity for strong in-country technical maintenance. Computer operations and maintenance services are part of the HIS plan or the country's strategic plan for health. A disaster recovery plan for digital HIS is in place, and it meets best practices.	The operations and maintenance services plan is continuously reviewed and adapted to evolving HIS interoperability requirements, and follows industry-based standards. Regular simulations are undertaken to increase the ability of technology staff to respond to a disaster.	2

[3] Procedures on how data are captured, stored, analyzed, transmitted, and packaged for use across the data supply chain.

Domain	Subdomain	Level 1: Nascent	Level 2: Emerging	Level 3: Established	Level 4: Institutionalized	Level 5: Optimized	Subdomain Level
Technology	**Communication network: local area network (LAN) and wide area network (WAN)**	The country has no reliable network connection to support a national HIS.	An ICT infrastructure assessment has been conducted to determine LAN and WAN requirements for the country's HIS. The country is using mainly unreliable wireless (2G, 3G or 4G) modems to connect to the HIS services.	A national implementation plan to meet the LAN and WAN requirements in the country exists. A national network maintenance plan exists to ensure high uptime, including procedures to recover from network failure. The country has started to implement a technical solution to ensure permanent connectivity to the HIS services.	All national offices and at least 50% of the subnational offices of the Ministry of Health and health service providers have a strong and reliable network connection to the various HIS network services. An HIS-dedicated ICT and network support team is in place.	All or almost (>75%) all the Ministry of Health's national and subnational offices and health service providers have a reliable and robust network connection. A team dedicated to support connectivity exists and has adequate financial, human, and technology resources. Industry-based standards are followed.	1+
	Hardware	The country has limited/ inadequate hardware (servers, user computers, printers, and supportive accessories) to support a national HIS.	An ICT infrastructure assessment has been done to identify the hardware required at national and subnational levels. Less than 50% of the Ministry of Health's national and subnational offices have the required hardware (computers, printers, connecting devices, etc.).	50% or more of the Ministry of Health's national and subnational offices have the required hardware, including back-up hardware.	Seventy-five percent (75%) of the Ministry of Health's national and subnational offices have the required hardware. There is a back-up and recovery plan for the national HIS.	The hardware meets national and/or international specifications, and a long-term plan (five years or more) is in place that details how to keep hardware up-to-date.	1+
						Maturity level of Technology domain:	1

MEASURE Evaluation
University of North Carolina at Chapel Hill
123 West Franklin Street, Suite 330
Chapel Hill, NC 27516 USA
Phone: +1 919-445-9350
measure@unc.edu
www.measureevaluation.org

This publication was produced with the support of the United States Agency for International Development (USAID) under the terms of the MEASURE Evaluation cooperative agreement AID-OAA-L-14-00004. MEASURE Evaluation is implemented by the Carolina Population Center, University of North Carolina at Chapel Hill in partnership with ICF International; John Snow, Inc.; Management Sciences for Health; Palladium; and Tulane University. Views expressed are not necessarily those of USAID or the United States government. TR-19-385

ISBN: 978-1-64232-207-1

USAID FROM THE AMERICAN PEOPLE

PEPFAR

JUMUIYA YA AFRIKA MASHARIKI

MEASURE Evaluation