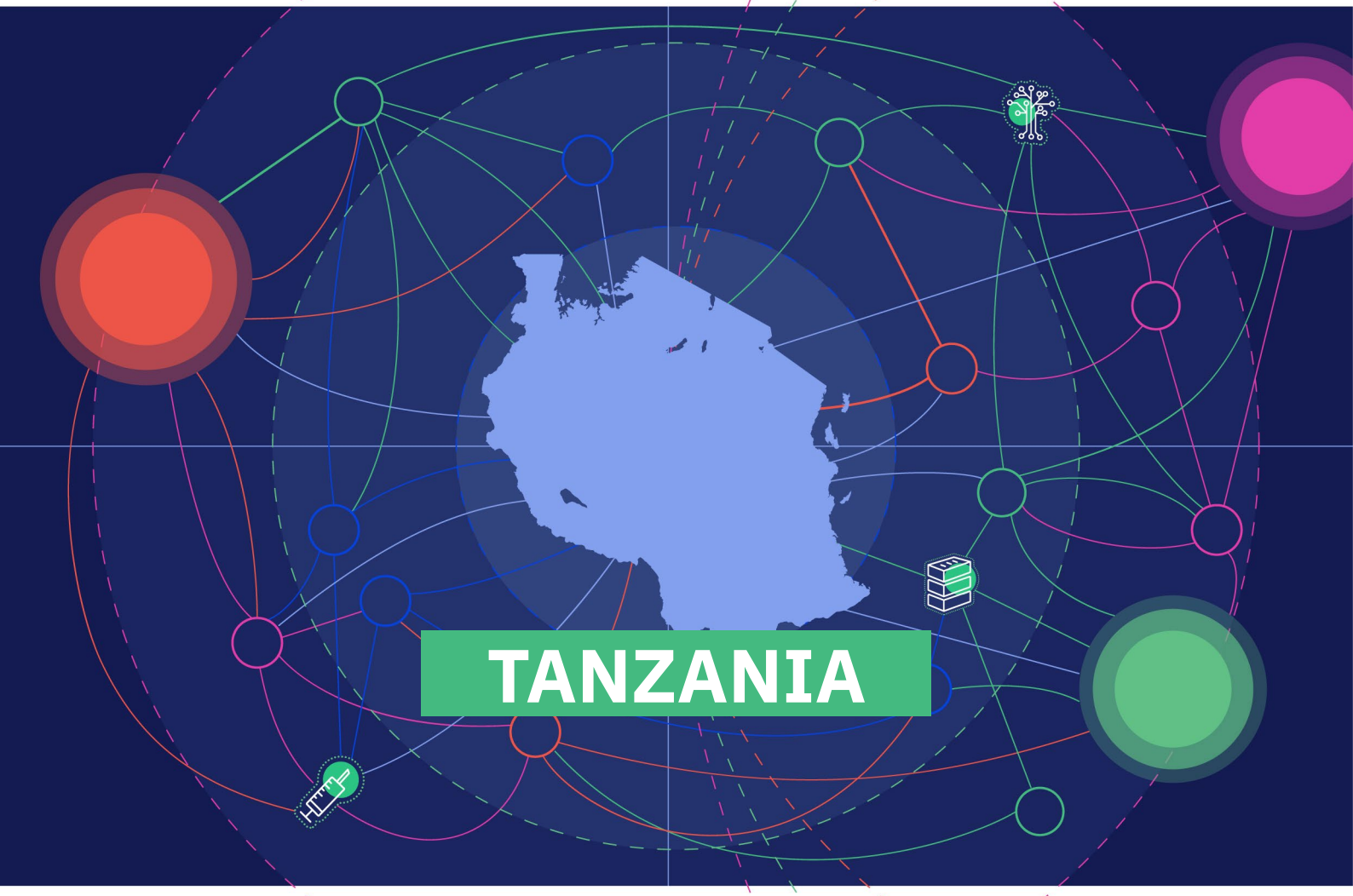
DIPC

Health Data Ecosystem Mapping



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CONTENTS

01. ACRONYMS 4

02. EXECUTIVE SUMMARY 5

03. BACKGROUND 7

04. ECOSYSTEM MAPPING SCOPE AND METHODOLOGY 9

05. FINDINGS FROM TANZANIA'S ECOSYSTEM MAPPING 10

- Enabling environment for leadership, governance, and coordination of stakeholders 10
  - Tanzania's digital health landscape 10
- Enabling environment for strategy 12

06. OVERVIEW OF TANZANIA'S DIGITAL SYSTEMS TO SUPPORT IMMUNIZATION 13

07. RESULTS OF TANZANIA'S KEY DIGITAL SOLUTIONS SUPPORTING THE IMMUNIZATION HEALTH DOMAIN 16

- Descriptions and parameters overview 16
- Priority solution 1: Chanjo COVID 18
- Priority solution 2: TImR 19
- Priority solution 3: VIMS 21
- Solution 4: HMIS (DHIS2) 23
- Solution 5: Electronic integrated disease surveillance and response (eIDSR) 24
- Solution 6: HFR 25
- Solution 7: Tanzania HIM 26
- Solution 8: Unified Community System (UCS) 27

08. CONCLUSION AND NEXT STEPS 29

01 ACRONYMS

CDH	Center for Digital Health
COVID-19	Coronavirus disease 2019
DHIS2	District Health Information System 2
DICE	Digital Health Centre of Excellence
DIPC	Digital Innovation in Pandemic Control
DIVO	District Immunization and Vaccine Officer
eIDSR	Electronic integrated disease surveillance and response
eLMIS	Electronic logistics management information system
FHIR	Fast Healthcare Interoperability Resources
GoT	Government of Tanzania
HFR	Health facility registry
HIM	Health Informaiton Mediator
HISP	Health Information Systems Program
HMIS	Health management information system
ICT	Information and communications technology
IVD	Immunization and Vaccines Development
JSI	John Snow Inc.
M&E	Monitoring and evaluation
MOH	Ministry of health
MOHC-DGEC	Ministry of Health, Community Development, Gender, Elderly and Children
OpenHIE	Open Health Information Exchange
OpenHIM	Open Health Information Mediator
OpenSRP	Open Smart Register Platform
RIVO	Regional Immunization and Vaccine Officer
TImR	Tanzania Immunization Registry
UCS	Unified Community System
USAID	United States Agency for International Development
VIMS	Vaccine Information Management System
WHO	World Health Organization

02
EXECUTIVE SUMMARY

Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation) launched the **Digital Innovation in Pandemic Control (DIPC)** project in 2021 to bring digital health technical expertise to countries to create more pandemic-prepared health systems. The DIPC project provided an award to Digital Square to partner with ministries of health and other key stakeholders from November 2022 to 2024 to scale the use of digital tools for COVID-19 and routine vaccination planning, deployment, and monitoring. **The DIPC project is creating models for improved and more sustainable pandemic-prepared health systems with a focus on immunization workflows using three exemplar countries: Ghana, Malawi, and Tanzania.**

Digital Square partnered with the Tanzania Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC) to review existing assessments and workflows to better understand the landscape of solutions currently used in Tanzania's immunization health domain. The MOHCDGEC and Digital Square used various methodologies to produce this country profile, which included a desk review and consultative sessions with MOHCDGEC officials. **This country profile provides an overview of current digital immunization solutions used in Tanzania and outlines priorities so that Tanzania—guided by the MOHCDGEC and its existing governance mechanisms and supported by other key stakeholders—can use the findings to inform its journey to develop and operationalize interoperable digital solutions that support immunization from end to end.**

Key findings from ecosystem mapping reveal that Tanzania has strong digital health governance mechanisms in place already, such as the National Digital Health Steering Committee. **Three priority digital solutions for immunization and six other integral digital system solutions are described in this report, with an overview of each solution and a discussion of its major functional features and existing challenges, as well as recommended interventions to strengthen each system.** Tanzania is experiencing rapid growth in the development and adoption of these mobile and web-based digital health solutions; however, a number of the existing systems are not integrated and/or interoperable. Although Tanzania has a strong technical capacity for working with digital solutions, there is a need for further capacity building. There is also an urgent need to address the lack of stable Internet connectivity in low-resource settings to ensure users can effectively use the solutions. Interoperability challenges and gaps in the digital systems supporting the functional components of immunization also exist (e.g., digital immunization certificates, microplanning, product catalog).

As part of the ecosystem mapping exercise, end users of the digital solutions (e.g., District and Regional Immunization and Vaccine Officers, or DIVOs/RIVOs) provided specific recommendations on features and interventions they would like to see added to the immunization registry, including incorporation of COVID-19 (and all forms of adult) immunization. Tanzania has a clear vision for its national digital health strategy and how existing tools can be adapted and scaled up to support the functional components of immunization. As part of this ecosystem mapping process, Digital Square partnered with the MOHCDGEC to determine that the DIPC project's implementation in Tanzania (2023/24) will be aimed at strengthening existing in-country digital immunization solutions by working to:

1. Update the Tanzania Immunization Registry, the country's current electronic immunization registry, so that:

(a) It is locally owned/managed.
(b) Its necessary functionalities are incorporated into the upgraded system.
(c) It is align with the localized Digital Adaptation Kit.
(d) It is standards-based (e.g., Fast Healthcare Interoperability Resources [FHIR®] compliant).
(e) It is interoperable via OpenHIM (Open Health Information Mediator).
(f) It can exchange information securely across the interoperability layer.

2. Deploy the upgraded electronic immunization registry in select facilities.

3. Create a training package for national use to strengthen health workers' capacity to use the new and improved system and conduct training of health care workers in selected facilities.

[1]FHIR is a registered trademark of Health Level Seven International.

03 BACKGROUND

Since the beginning of the COVID-19 pandemic, Digital Square has leveraged its unique role and strengths to support countries, donors, and partners in using existing digital tools in response efforts. Harnessing our technical expertise and established relationships across the global digital health ecosystem, including our engagement with and support of digital public goods for health, Digital Square is supporting countries to innovatively select and adapt digital tools to navigate the complexities of the pandemics and strengthen routine immunization systems.

Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation), together with its actors from the field of digitalization and health—including the **Digital Health Centre of Excellence (DICE)** consortium, which is co-led by the United Nations Children's Fund and the World Health Organization (WHO)—launched the **Digital Innovation in Pandemic Control (DIPC)** project in 2021 to bring digital health technical expertise to countries to create more pandemic-prepared health systems. The DIPC project provided an award to Digital Square to partner with ministries of health (MOHs) and other key stakeholders from November 2022 to 2024 to scale the use of digital tools for COVID-19 vaccination planning, deployment, and monitoring. The DIPC project is partnering with MOHs by aligning its project goals and activities with countries' national digital health strategies to strengthen health systems to better equip them to respond to COVID-19 and future pandemics.

The DIPC project is creating models for improved and more sustainable pandemic-prepared health systems with a focus on immunization workflows using three exemplar countries: **Ghana, Malawi, and Tanzania.** The project is carrying out the work by focusing on three primary workstreams (see Figure 1):

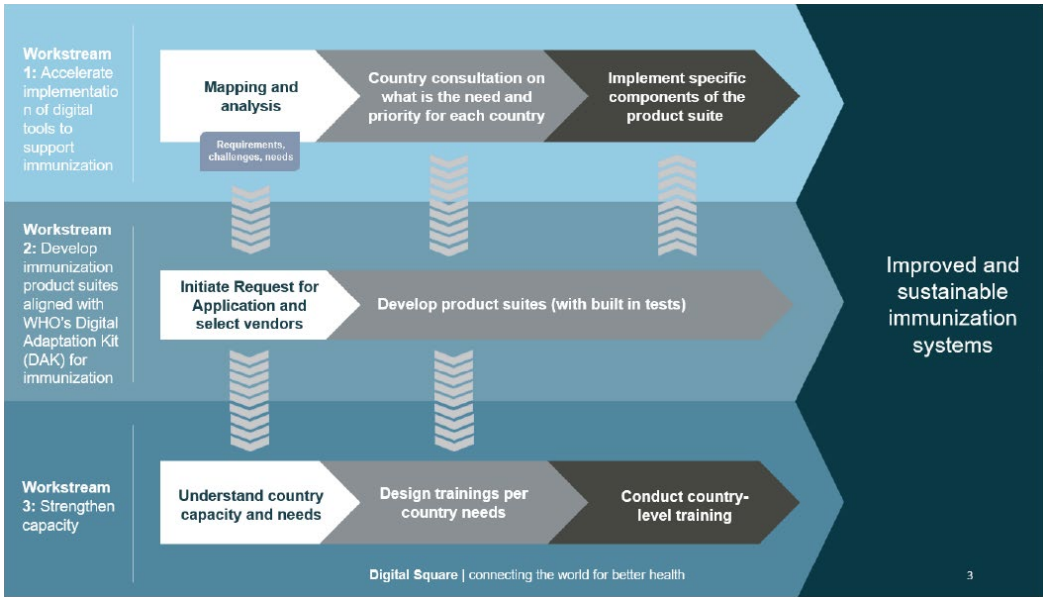

Figure 1: *The three DIPC workstreams*

WORKSTREAM 1 GOAL:

Accelerating the implementation of digital tools to support sustainable immunization systems in Ghana, Malawi, and Tanzania by:

- Building on existing investments and advancing the use of technology adopted and adapted to support COVID-19 and routine immunization to better prepare for, prevent, and respond to future pandemics.
- Leveraging existing global guidelines and recommendations and adapting to each country's context.
- Demonstrating how the use of digital tools can further support routine immunization and surveillance.
- Equipping countries with the capacity to test and validate their local infrastructure to vet how well their own digital tools meet the needs of immunization workflows.
- Generating and disseminating an evidence base that can be used to scale similar digital tools and systems in other geographies.

WORKSTREAM 2 GOAL:

Developing immunization product suite(s) aligned with WHO's Digital Adaptation Kit for immunization to:

- Promote the development, adoption, and reuse of digital public goods for health, with a particular focus on open source global goods, and support an ecosystem of interoperable standards-based technologies.
- Engage the global goods community in identifying and packaging digital public goods for health as joint products to meet immunization needs to make them "shelf ready."
- Create documentation to help countries better understand the group or suite of tools best designed for exchanging data to meet their needs in the immunization health domain.

WORKSTREAM 3 GOAL:

Implementing innovative and sustainable capacity-strengthening approaches by:

- Partnering with MOHs and the Regenstrief Institute to design and carry out an in-depth capacity assessment to identify critical technical skill gaps that need to be filled to ensure that the immunization product suite can be successfully deployed, operated, and scaled in-country.
- Partnering with the Regenstrief Institute and the OpenHIE (Open Health Information Exchange) community to support trainings in Ghana, Malawi, and Tanzania at the planner and manager level and at local and regional health facilities.
- Building from "global" training content to support training of local digital health entrepreneurs to serve as technical counterparts, advisors, and partners to MOHs in the three target countries.

04
ECOSYSTEM MAPPING SCOPE AND METHODOLOGY

Digital Square completed mapping of the digital immunization ecosystem in Tanzania as an initial activity under Workstream 1, aimed at accelerating the implementation of digital solutions to support COVID-19 and routine immunization. Digital Square worked with various departments within the Ministry of Health, Community Development, Gender, Elderly and Children (MOHCDGEC), including Immunization and Vaccines Development (IVD), Information and Communications Technology (ICT), and Monitoring and Evaluation (M&E), to review existing assessments and workflows to better understand the landscape of solutions currently used in the country's immunization health domain. The MOHCDGEC and Digital Square used the ecosystem mapping to produce this country profile, which will be shared with all project stakeholders (e.g., government stakeholders, funders, and implementing partners) so that the information is widely available.

This country profile helps define the priority needs so that Tanzania—directed by the MOHCDGEC and existing governance mechanisms—can use it as a resource on its journey to developing and operationalizing an interoperable digital solution that supports the full end-to-end immunization use case.

Digital Square employed the following methods to collect the data included in this report:

Conducted a **desk review** of Tanzania's health and digital governance documents (e.g., Digital Health Strategy: July 2019–June 2024) and previous landscaping reports (e.g., Digital Pandemic Preparedness Assessment and the Map & Match project).

Held **consultative sessions** with country leaders to validate the current state assessment of the immunization ecosystems and propose ways to strengthen relevant components of the digital health immunization ecosystem, as needed.

Consulted with additional stakeholders, including the Health Information Systems Program (HISP) Tanzania, John Snow Inc. (JSI), and the President's Office – Regional Administration and Local Government.

05
FINDINGS FROM TANZANIA'S ECOSYSTEM MAPPING

Enabling environment for leadership, governance, and coordination of stakeholders

Tanzania's digital health landscape

The government of Tanzania (GoT) prioritized digital health in its revised National Health Policy 2019 by developing the **Digital Health Strategy 2019–2024** to provide a vision for achieving better health outcomes using digital health to strengthen the health system. The strategy and the subsequent implementation plan, also known as the **Digital Health Investment Road Map 2021–2026**, provide the basis for the GoT and its partners to work together to accelerate digital transformation in the health sector.

Within the strategy, the GoT has defined governance structures which are instrumental in maintaining sector-wide coordination (Figure 2). These structures provide strategic oversight and facilitate inclusive governance for the implementation of digital health initiatives. The governance structures are integrated as part of the sector-wide approach and include the National Digital Health Steering Committee, chaired by the MOHCDGEC Permanent Secretary; the ICT/M&E Steering Technical Working Group; the National Digital Health Secretariat; and subnational, institutional, and facility digital health committees.

Recently, the GoT, through the MOHCDGEC, prioritized the establishment of the Center for Digital Health (CDH), as outlined in the **Health Sector Strategic Plan 2021–2026.** The goal of the CDH is to bring together innovators, technologists, clinicians, digital health stakeholders, and the society to provide all the elements necessary to design, build, and deploy enterprise-level digital health interventions for all levels of the health system. The CDH will streamline resources, address coordination problems, improve implementation plans and roadmaps, align programs with the national strategy, harmonize systems, remove duplication of efforts, and ensure sustainability of digital health investments in the health sector. The CDH will be established under the MOHCDGEC's ICT department and housed within the external operations section of the department.

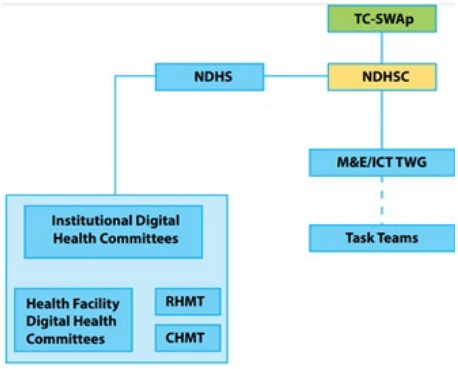

Figure 3. *Governance structure of the sector-wide approach in Tanzania.*

Abbreviations: CHMT, Council Health Management Team; ICT, information and commjnications technology; M&E, monitoring and evaluation; NDHS, National Digital Health Secretariat; NDHSC, National Digital Health Steering Committee; RHMT, Regional Health Management Team; TC-SWAP, Technical Committee Sector-Wide Approach; TWG, technical working group.

Critical to the success of the Digital Health Strategy and the Digital Health Investment Road Map is a strong and integrated health information system that supports interoperability among various clinical, logistic, and administrative systems. The GoT has developed the Tanzania Health Enterprise Architecture blueprint, which outlines application, data, and technology standards for aligning and guiding digital health solutions to support the overarching health sector's strategic goals and objectives. The blueprint also provides the architectural framework to support information exchange among disparate systems through a standards-based Health Information Mediator (HIM).

The MOHCDGEC collaborates with various stakeholders and partners in the implementation of the Digital Health Strategy and Road Map. These include development partners, implementing partners, and both local and international digital entrepreneurs.

Figure 4 provides a flow chart of the ICT Unit's internal structure.

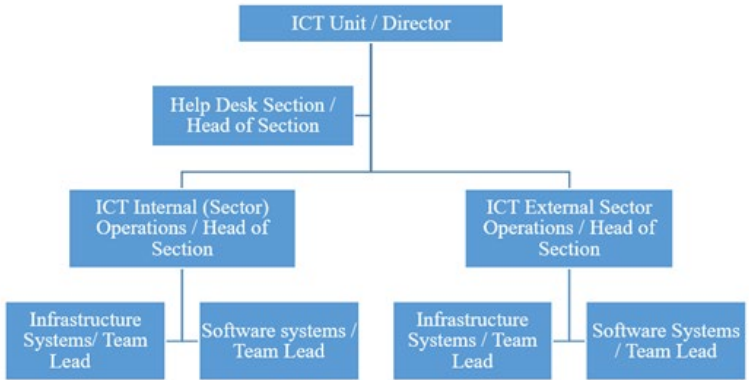

Figure 4.
Structure of the Information and Communications Technology (ICT) Unit of the Ministry of Health, Community Development, Gender, Elderly and Children.

Key stakeholders and governance mechanisms pertinent to the digital health immunization space

MOHCDGEC departments
- Epidemiology unit
- ICT unit
- IVD
- President's Office – Regional Administration and Local Government

Governance mechanisms
- National Digital Health Steering Committee
- National Digital Health Secretariat
- M&E/ICT Technical Working Group

Funders/development partners
- Bill & Melinda Gates Foundation
- Centers for Disease Control and Prevention
- Gavi, the Vaccine Alliance
- Deutsche Gesellschaft für Internationale Zusammenarbeit (German Agency for International Cooperation)
- Korea International Cooperation Agency
- Rockefeller Foundation
- Unitaid
- United States Agency for International Development (USAID)

Implementing partners
- Abt Associates
- Clinton Health Access Initiative (CHAI)
- JSI
- PATH
- VillageReach
- WHO
- United Nations Children's Fund

Enabling environment for strategy

Digital Square analyzed Tanzania's Digital Health Strategy 2019–2024 to determine where there is alignment across the DIPC project workstreams to prioritize how the project can support the MOHCDGEC in delivering on the activities named in the strategy (Table 1). Digital Square plans to partner with the MOHCDGEC to strengthen digital immunization systems while also providing technical documentation, training (e.g., on the improved digital immunization system), and mentoring to technical teams to develop, implement, and maintain the digital immunization systems.

Table 1. *Snapshot of the analysis showing alignment opportunities between national strategy activities and Digital Innovation in Pandemic Control project workstreams.*

Tanzania Digital Health Strategy strategic priority #	Initiative	DIPC project workstream
3	Implement digital platforms for health professional peer networking.	3: Implement innovative and sustainable capacity-strengthening approaches.
3	Implement eLearning and knowledge management platforms for continuous professional development.	3: Implement innovative and sustainable capacity-strengthening approaches.
5	Strengthen use of data, application, and technology standards (e.g., International Classification of Diseases, 10th Revision; Health Level 7; Digital Imaging and Communications in Medicine; Logical Observation Identifiers Names and Codes; and service codes).	1: Accelerate implementation of digital tools to support immunization systems.
5	Strengthen interoperability across different systems within health and other sectors.	1: Accelerate implementation of digital tools to support immunization systems.
9	Improve digital solutions for planning, budgeting, revenue collection, accounting, auditing, and reporting at all levels.	2: Develop immunization product suites.

06
OVERVIEW OF TANZANIA'S DIGITAL SYSTEMS TO SUPPORT IMMUNIZATION

Figure 5 defines the components, features, and requirements of a digital system. It illustrates how requirements make up a software system feature and how those features roll into a functional component. Figure 6 illustrates how a Health Information Exchange composed of various digital health systems may be implemented together to fulfill the five core immunization workflows, shown at the bottom of the diagram. It also shows how the software components supporting immunization and vaccine supply chain management are aligned with the OpenHIE Architecture domains. The point of service applications (e.g. immunization information system, notification service, microplanning tool) should be designed to exchange data with the registry service applications, and with each other, via an interoperability layer. The interoperability layer is a middleware software that enables secure, standards-based communication between software applications.

The five additional digital systems shown on the right-hand side of Figure 5 may interact with the immunization system in the future, although they are out of scope for this phase of the DIPC project because they are not directly involved in the core immunization workflows. This also emphasizes the importance of why system architecture that is interoperable is a critical part of any immunization solution.

Figure 5.
Components, features, and requirements of a digital system.

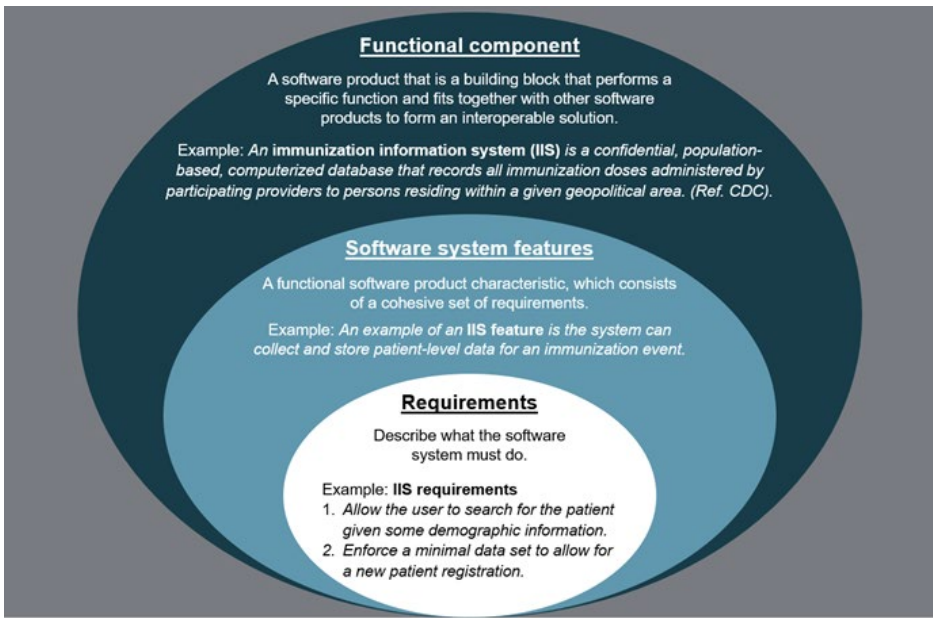

Figure 6.
Functional immunization components
Abbreviation: OpenHIE, Open Health Information Exchange.

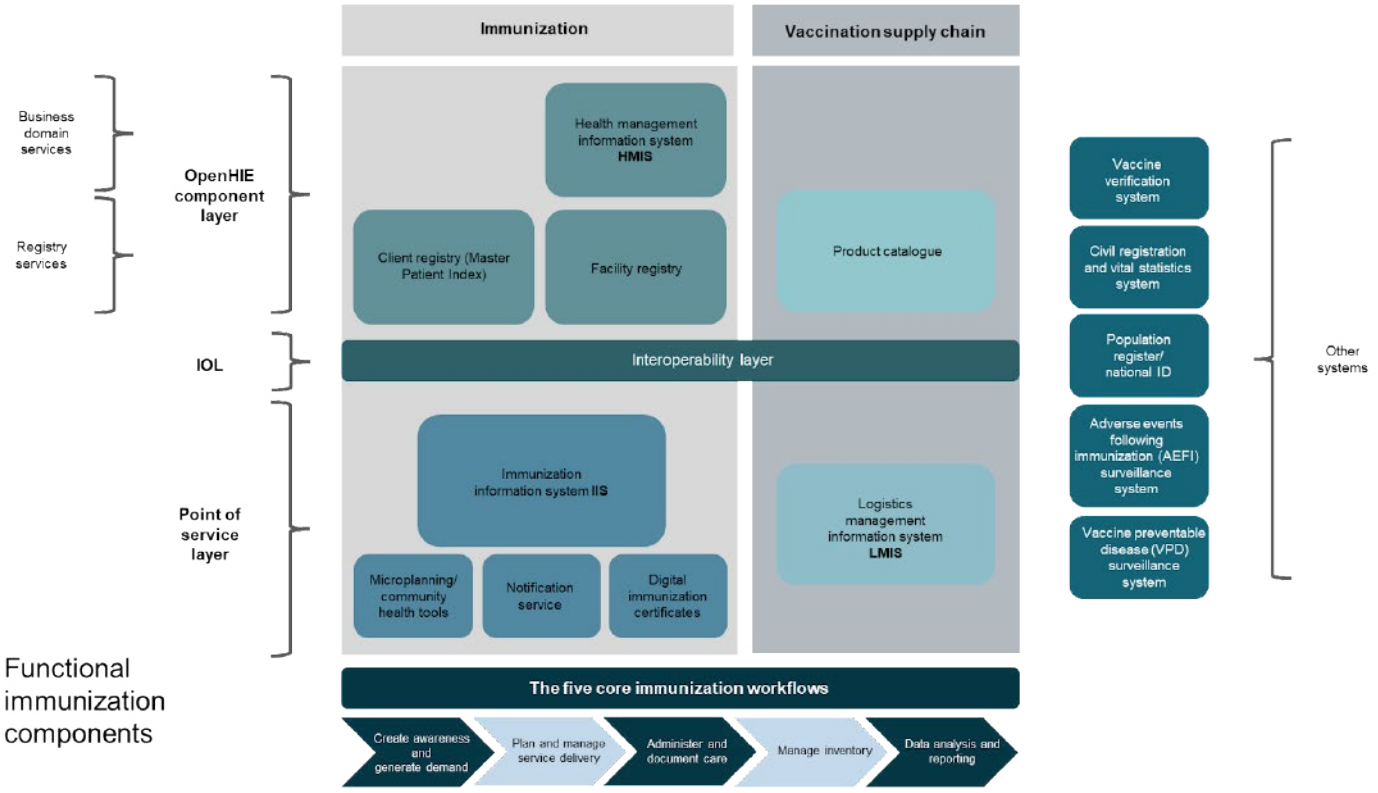

Table 2 below provides an overview of different digital systems being used for immunization across Tanzania and their current scale. A more detailed description of each system is included in the "Results" section below the table.

Components	Civil registration & national ID	Client registry	Community health	Awareness & demand generation	Digital immunization certificates	Health facility registry (HFR)	HMIS
Deployed on national scale	National Identification Authority System, RITA system				Chanjo COVID	HFR	DHIS2
Deployed on sub-national scale			UCS* (OpenSRP)	TImR			
Not yet deployed or current gap		NHCR					

Components	Immunization information system	Inter-operability layer	Learning & training system	Logistic management information system	Micro- planning	Product catalog	Surveillance
Deployed on national scale	Chanjo COVID	HIM	eLearning Platform for Health	VIMS			eIDSR
Deployed on sub-national scale	TImR				TImR		
Not yet deployed or current gap						Gap	

Gray
System is not yet deployed, out of scope for DIPC project phase 2

Blue
System is deployed, but not prioritized in DIPC project phase 2 scope

Green
System is prioritized for support as part of DIPC project phase 2 scope.

Table 2.
Overview of the current landscape of Tanzania's digital systems to support functional components of immunization

Abbreviations: DHIS2, District Health Information System 2; eIDSR, electronic integrated disease surveillance and response; HIM, Health Information Mediator; HMIS, health management information system; NHCR, National Health Client Registry; OpenSRP, Open Smart Register Platform; RITA, Registration Insolvency and Trusteeship Agency; TImR, Tanzania Immunization Registry; UCS, Unified Community System; VIMS, Vaccine Information Management System.

** Although the UCS has been piloted in some communities, it does not currently have immunization-related workflows or features, although this mapping has identified it as a potential existing digital solution that could be adapted to support immunization.*

07
RESULTS OF TANZANIA'S KEY DIGITAL SOLUTIONS SUPPORTING THE IMMUNIZATION HEALTH DOMAIN

Descriptions and parameters overview

This section describes the digital solutions Tanzania uses to support the immunization health domains. For each digital solution, the results provide a **solution overview** and details about its **major features, users, challenges, and recommendations.** The DIPC applied classifications from WHO's Classification of Digital Health Interventions v1.0 to frame the analysis by looking at the users, challenges, and recommendations to describe how the digital solutions are currently supporting the immunization health domain and where there are gaps and opportunities to improve these digital solutions.

The major features of digital solutions include functional features that describe the functional requirements the digital system must have to meet the users' needs and achieve tasks within a business process. An example of a functional feature is the ability to register a new client in the immunization registry. This also includes nonfunctional requirements that provide the general attributes and features of the digital system to ensure usability and overcome technical and physical constraints. In addition to security and privacy features that have their own section attributed to them in the analysis due to their importance, other examples of nonfunctional requirements include having the ability to work offline or having multiple language settings.

Users describe the targeted primary user of each intervention. WHO's Classification of Digital Health Interventions breaks users into the following four overarching groupings (for the analysis in this profile, the section below will only focus on the first three user groupings):

01 **Interventions for clients:** Clients are members of the public who are potential or current users of health services, including health promotion activities. Caregivers of clients receiving health services are also included in this group.

02 **Interventions for health care providers:** Health care providers are members of the health workforce who deliver health services.
Examples of job roles in Tanzania pertaining to this user grouping include community health workers, nurses, doctors, facility-level immunization providers, and pharmacists/pharmacist technicians.

03 **Interventions for health system or resource managers:** Health system and resource managers are involved in the administration and oversight of public health systems. Interventions within this category reflect managerial functions related to supply chain management, health financing, and human resource management.
Examples of job titles in Tanzania pertaining to this user grouping include supply chain managers, human resource managers, and finance officers.

04 **Interventions for data services:** This consists of crosscutting functionality to support a wide range of activities related to data collection, management, use, and exchange[iii].

Health system challenges describe issues that each system faces, categorized according to WHO's eight groupings in its Classification of Digital Health Interventions:

1. Information
2. Availability
3. Quality
4. Acceptability
5. Utilization
6. Efficiency
7. Cost
8. Accountability

[2]WHO's Classification of Digital Health Interventions is a resource document that provides a shared language to describe the uses of digital technology.
[3]This WHO classification user group is omitted from the analysis below because many of the health care providers or health system or resource managers are responsible for data services.
The four groupings were taken from: World Health Organization (WHO). Classification of Digital Health Interventions: A Shared Language to Describe the Uses of Digital Technology for Health. WHO; 2018. https://apps.who.int/iris/bitstream/handle/10665/260480/WHO-RHR-18.06-eng.pdf.

Recommendations are organized using tables and use the same four categories from the users tables to specify which user grouping the recommendation is intended to target (i.e., clients, health care providers, health system or resource managers, and/or data services).

There are three primary systems profiled in the analysis: Chanjo COVID, the Tanzania Immunization Registry (TImR), and the Vaccine Information Management System (VIMS).

Priority solution 1: Chanjo COVID

Chanjo COVID is a web-based application built on top of the District Health Information System 2 (DHIS2) platform to support COVID-19 vaccination nationwide. The application was rolled out throughout the country to enable appointment bookings, scheduling and recording of vaccinations, and issuance and verification of vaccination certificates, among other things. In 2022, the GoT developed and implemented a mobile client for the application to facilitate offline data capture and fast-track clearance of backlog data that had piled up at the health facilities.

Solution overview						
Global Goods Guidebook v.4 (pages)	**Scale**	**Primary WHO classification system**	**System owners**	**Developers**	**Funders**	**Implementers**
DHIS2 (41–42); established application	National	N: health management information system (HMIS)	MOHCDGEC	N/A	N/A	HISP, MOHCDGEC ICT

Major features of the digital solution

- Its main functional features include booking vaccinations, recording vaccinations, issuing vaccination certificates, and verifying certificates.
- It is available in all 26 regions of mainland Tanzania.

Interoperability and standards

Although Chanjo COVID is not currently integrated into other systems, there is an active initiative to integrate it with VIMS. PATH, through Digital Square (USAID), is supporting the MOHCDGEC ICT department and vertical programs to strengthen the HIM, including developing and implementing interoperability use cases. Some of the use cases include between VIMS and Chanjo COVID to improve end-to-end availability and to use supply chain data so that health workers across all levels have real-time visibility of stock data and can efficiently execute supply of vaccines.

Users
Chanjo COVID is used at the health facilities. Health workers use the system to manage vaccination appointments and fill out vaccine delivery. The system also issues digital vaccine certificate and verifies these certificates (at port of entry).

Grouping	Users	Description
1 Clients	No	N/A
2 Health care providers	Yes	Facility-level health workers
3 Health system or resource managers	Yes	District-level managers (DIVO, ICTO, HMIS focal person) / national-level MOHCDGEC

Health system challenges		
End users shared the challenges they encountered using the system, categorized according to WHO's Classifications of Digital Health Interventions.		
1	**Information**	
1.3	Lack of high-quality/reliable data	No stock management functionality
9	**Interoperability**	
		No exchange of information with other systems at the moment

Priority solution 2: TImR

Solution overview							
Global Goods Guidebook v.4 (pages)	**Scale**	**Primary WHO classification system**	**System owners**	**Data exchange standards**	**Partners**	**Licensing**	**Implementers**
N/A	National	P: ID registries and directories	N/A	FHIR® compliant†	Gavi, MOHCDGEC (ICT, M&E), PATH	N/A	PATH

† Fast Healthcare Interoperability Resources (FHIR) is a registered trademark of Health Level Seven International.

Major features of the digital solution
The TImR was implemented to improve data quality (e.g., transition regions to a paperless system) and data use for immunization (especially routine immunizations). Currently, the TImR supports client bookings, SMS notifications, vaccine scheduling, and stock management at the point of care; includes 1.9 million client records; and has been implemented in approximately 3,736 out of 6,000 facilities across 15 of the 26 regions in mainland Tanzania. With funding support from Gavi, the MOHCDGEC is planning to scale up TImR to all 26 regions starting in January 2024, supported by PATH as an implementing partner.

Interoperability and standards

Currently, TImR is not interoperable with other immunization systems like VIMS and Chanjo COVID. Mediators to support information exchange with DHIS2 and VIMS were created and tested but are not operational due to various technical challenges.

Users

TImR is used at health facilities. Health workers use the system to manage vaccination appointments and fill out vaccine delivery manage vaccination stock at the facilities.

Grouping	Users	Description
1 Clients	No	N/A
2 Health care providers	Yes	Facility-level nurses and clinicians for supporting immunization services and health care providers for scheduling vaccination appointments.
3 Health system or resource managers	Yes	DIVO portal that is accessible by users at the district level

Health system challenges

End users shared the challenges they encountered using the system, categorized according to WHO's Classifications of Digital Health Interventions.

1	Information		Priority level
1.3	Lack of high-quality/reliable data	**Report extraction:** When data are erased from the report extraction process that runs data from all tables and fresh data are reloaded, this means that any incase of failure to complete warehouse job would render reports unusable, so users will not be able to view reports, leading to a delay in making effective decisions and planning.	Low
		Unsynchronized facility data: There is still a huge amount of data in health facility tablets that have not been synced with the server, which results in data inconsistency across facilities and affects system usage and continuity of care.	High
		Stock data updates: Facilities are not receiving stock data and updates from the district due to Internet or other system-related issues (e.g., received pentavalent and pneumococcal conjugate vaccine stocks at times would not be reflected on the stock overview summary and would therefore show a facility as being out of stock during a vaccination session).	High
		New functional features: District officials must be assigned admin-level access to be able to assign villages to specific facilities, add target populations, or track zero-dose under-5 children.	N/A
6	**Efficiency**		
6.3	Poor planning and coordination	**System maintenance and support:** Users do not regularly receive notification of planned or emergency downtime resulting from changes made on the application of the hosting environment. In addition, there is high dependency/reliance on the original developers, Hamilton Health Sciences, for technical support in resolving bugs and implementing any upgrades, rendering the whole process of technical support lengthy, costly, and infective.	High
9	**Interoperability**		
		Even though the system is FHIR compliant, it is currently not exchanging information with other systems in the ecosystem (e.g., the mediators between TImR and VIMS were developed and tested but have not been operational due to various technical setbacks).	High

Recommendations		
Users made several recommendations for strengthening this digital system, categorized according to WHO's Classification of Digital Health Interventions.		
2	**Health care providers**	
2.5.3	Transmit routine news and workflow notifications to health care provider(s)	Add screen for sending system alerts when there is downtime or maintenance to all facilities or selected sites (administrator and region, district) for users to be aware of what is going on to properly allocate their time.
3	**Health system managers**	
3.1.3	Manage certification/ registration of health care provider(s)	Improve admin portal (DIVOs to have admin access specific to their roles, such as assigning village to their facilities, viewing stock and status).
3.2.1	Manage inventory and distribution of health commodities	Enable system to allow administrators/DIVOs to see status of stock (i.e., pending or accepted).
3.2.2	Notify stock levels of health commodities	Enhance admin portal to add stock visibility screen for administrators to be able to see stock sent from
		Enable system to provide a reason why stock is not saved.
4	**Data services**	
4.1.2	Improve data storage and aggregation	Enable system to allow bulk synchronization of data to be done by DIVOs or system administrators .
		Enhance ETL (extract, transform, and load) incremental data/changes will ensure data availability so even if it happens ETL failed users will still be able to access previous data with incremental load only the difference between the target and source data is loaded through the ETL process in data warehouse which saves time and other server resources.
4.4.1	Enable data exchange across systems	Enable system to make archived data available for other systems (i.e., client registry). Enable information exchange between TImR and the Civil Registration and Vital Statistics to allow sharing of birth notification data.

Priority solution 3: VIMS

Solution overview							
Global Goods Guidebook v.4 (pages)	**Scale**	**Primary WHO classification system**	**System owners**	**Data exchange standards**	**Partners**	**Licensing**	**Implementers**
Electronic logistics management information system, or eLMIS (49–50)	National	T: LMIS	N/A	Open source	MOHCDGEC IVD & ICT, JSI	N/A	N/A

Major features of the digital solution

VIMS is a web-based information management system that computerizes the then Excel-based Stock Management Tool / District Vaccination Data Management Tool and container closure integrity testing, all developed by WHO. It is used by IVD and regional/council vaccination officers to capture logistics data and cold chain inventory data.

Interoperability and standards

VIMS is not interoperable with other systems.

Users

- At the national level, there are approximately 50 users, including program managers at the MOHC-DGEC and representatives from implementing partner organizations supporting immunization and service delivery. Users at the national level use the system for end-to-end stock management, including national vaccine quantification for international procurement, access reports, data analysis, and intake and distribution. General system administration—including configuration of users, administrative areas, and health facilities data—is also done centrally by the technical team at the MOHCDGEC.
- Across all 26 regions of Tanzania's mainland, approximately 80 users, including Regional Medical Officers, RIVOs, and assistant RIVOs, use VIMS for general stocks management of vaccines, data management, analysis, and reporting. RIVOs and their assistants also use the system to enter and manage annual population targets for vaccination for councils within their regions.
- At the district level, VIMS is used by an estimated 500 users (District Medical Officers, DIVOs, and assistant DIVOs) in all 184 administrative councils (districts) in the country. Council users rely on VIMS for vaccine stock management, data analysis, monthly reporting, and management of facility vaccination population targets.

Grouping	Users	Description
1 Clients	No	N/A
2 Health care providers	No	N/A (no point of care / health facility usage)
3 Health system or resource managers	Yes	District-, regional-, and national-level use (DIVOs, RIVOs, and IVD Program Officers, respectively)

Health system challenges

End users shared the challenges they encounter using the system, categorized according to WHO's Classifications of Digital Health Interventions.

9	Interoperability	
2.5.3		It is currently not exchanging data with other systems. Interoperability with the TImR and health facility registry (HFR) through Tanzania's HIM was implemented but is not operational.

Solution 4: HMIS (DHIS2)

Solution overview							
Global Goods Guidebook v.4 (pages)	Scale	Primary WHO classification system	System owners	Data exchange standards	Funders	Licensing	Implementers
DHIS2 (41–42)	National	T: LMIS	N/A	Open source	University of Dar es Salaam / HISP Tanzania and MOHCDGEC ICT	N/A	N/A

Major features of the digital solution

DHIS2 is an open source, flexible, web-based HMIS. In Tanzania, it is used on a national scale for capturing aggregate data on vaccine stock and delivery. It has limited capacity at all levels, including data management, technical infrastructure and support, data analytics and use, skilled personnel, and funding to support digitalization of health facilities.

Interoperability and standards

DHIS2 is integrated with the HFR, eLMIS, Human Resource for Health Information System, and other systems in Tanzania. It is not, however, exchanging information with the TImR, Chanjo COVID, or VIMS.

Users

Data are manually entered at some facilities, and for the facilities that do not have access to the systems, council-level users, such as DIVOs, compile data from facilities within their geographic areas and enter them into DHIS2.

Grouping	Users	Description
1 Clients	No	N/A
2 Health care workers	Yes	Health workers (who input data and promote data use so they can visualize trends and access information to improve service delivery).
3 Health system or resource managers	Yes	Health managers at the district, regional, and national levels (to have visibility into what is happening in terms of quality of services across all levels, starting at the facility level and up to the national level).
4 Data services	N/A	Managed by the MOHCDGEC ICT and M&E Units, with tech support by the ICT Unit, supported by HISP Tanzania and the University of Dar es Salaam.

Solution 5: Electronic integrated disease surveillance and response (eIDSR)

An eIDSR system is used for reporting and tracking diseases of public health importance. It is aligned with the 3rd edition of the WHO Regional Office for Africa's guidelines for IDSR which includes surveillance and response protocols for 44 diseases and health conditions of public health importance. Following the COVID-19 outbreak and introduction of COVID-19 vaccines in Tanzania, the MOHCDGEC sought to use the eIDSR to track confirmed cases of COVID-19 and compare how many of those individuals had been vaccinated versus not vaccinated. This was achieved through implementation of peer-to-peer information exchange between the eIDSR and Chanjo COVID digital applications.

Solution overview

Global Goods Guidebook v.4 (pages)	Scale	Primary WHO classification system	System owners	Data exchange standards	Partners	Licensing	Implementers
DHIS2 (41–42); established application	National	N: HMIS	MOHCDGEC Epidemiology Unit	N/A	MOHCDGEC ICT, University of Dar es Salaam, HISP Tanzania	N/A	N/A

Major features of the digital solution

The eIDSR system is used to track both vaccinated and unvaccinated COVID-19 patients, as well as capture notifiable diseases on a national scale.

Interoperability and standards

The eIDSR has peer-to-peer integration with the Chanjo COVID system for confirmation of vaccination for patients who are diagnosed with COVID-19. The eIDSR is not integrated with the TImR for routine immunization and does not give details on the type of vaccine a patient has received.

Users

The eIDSR is used by surveillance focal persons at health facilities nationwide.

Grouping	Users	Description
1 Clients	No	N/A
2 Health care providers	Yes	Surveillance focal persons at health facilities nationwide
3 Health system or resource managers	Yes	Health system managers, who access the data after the eIDSR data are fed into the HMIS

Health system challenges		
End users shared the challenges they encounter using the system, categorized according to WHO's Classifications of Digital Health Interventions.		
1	**Information**	
1.7	Lack of unique identifier	eIDSR does not give details on the type of vaccine a patient has received.
9	**Interoperability**	
		eIDSR is not integrated with TImR for tracking routine immunization.

Solution 6: HFR

The HFR is a system for registration of both public and private health facilities in Tanzania's mainland. The system acts as a true source of health facility data for all applications within the Tanzania digital health ecosystem, including the electronic immunization systems. Housing facility information in the HFR ensures consistency in the use and reporting of facility-level data across systems and institutions, as well as across the health sector.

Solution overview							
Global Goods Guidebook v.4 (pages)	**Scale**	**Primary WHO classification system**	**System owners**	**Data exchange standards**	**Funders**	**Licensing**	**Implementers**
N/A	National level	N/A	N/A	Free and open source, Yii Framework	MOHCDGEC ICT, University of Computing Center	Free and open source	N/A

Major features of the digital solution
The HFR is a tool used to provide access to information on officially recognized public and private health facilities in Tanzania's mainland.

Interoperability and standards
Integration is done through the HIM with the following connected systems: DHIS2, eLMIS, Tanzania Health Supply Chain Portal, National Health Insurance Fund, Afya Supportive Supervision system, Human Resource for Health Information System, and Medical Store Department system.

Users		
Grouping	**Users**	**Description**
1 Clients	No	N/A
2 Health care workers	No	N/A
3 Health system or resource managers	No	N/A
4 Data services	Yes	Several systems connected to the HFR to ensure a trusted, consistent source of information and data on facilities that are being used and referenced across systems

Health system challenges		
End users shared the challenges they encounter using the system, categorized according to WHO's Classifications of Digital Health Interventions.		

The system does not restrict based on minimum facility registration requirements per facility type. The system has two menus for updating and upgrading facilities that offer similar functionalities, so they confuse users. It does not capture the inspection process at the council and regional levels.

There is no mechanism to validate services offered against available equipment (e.g., facility without radiographer and X-ray machine can offer X-ray services). Duplication of facility records can occur due to having the district focal person or facility owner creating a new application instead of upgrading/changing the name/change ownership/ change location.

Solution 7: Tanzania HIM

The Tanzania HIM is an interoperability layer within the Tanzania digital health framework that is designed and implemented to facilitate interoperability between point-of-care systems (e.g., TImR) and other digital health applications, such as those involved in managing supply chain of commodities and vaccines (VIMS), core registries (e.g., HFR), and health systems (DHIS2). The use of an interoperability layer makes it easy to reuse and share information and promote data use.

Solution overview							
Global Goods Guidebook v.4 (pages)	**Scale**	**Primary WHO classification system**	**System owners**	**Data exchange standards**	**Funders**	**Licensing**	**Implementers**
OpenHIM (27)	National	G: Data interchange interoperability and accessibility	N/A	Compliant with FHIR and Tanzania Health Enterprise Architecture blueprint standards and guidelines	MOHCDGEC ICT and Digital Square		N/A

Major features of the digital solution
The Tanzania HIM is a middleware component designed to ease interoperability between disparate systems. So far, more than 36 systems are connected and able to exchange information.

Interoperability and standards
• Even though mediators through the HIM were developed to support information exchange between VIMS and the HFR and VIMS and the TImR, they are yet to be fully operational. • 160 interoperability use cases are available at the national level. • The HIM is compliant with FHIR and Tanzania Health Enterprise Architecture blueprint standards and guidelines.

Users		
Grouping	**Users**	**Description**
1 Clients	No	N/A
2 Health care providers	No	N/A
3 Health system or resource managers	Yes	System administrators (ability to add more interoperability use cases)

Solution 8: Unified Community System (UCS)

The UCS is an application based on OpenSRP (Open Smart Register Platform) and used to support community-based services and interventions. The MOHCDGEC is envisioning an enhanced UCS, subject to availability of resources, to support community-based immunization campaigns and services. The enhancement will include implementing mediators through the HIM to facilitate exchange of immunization data between the UCS and the facility-based immunization registry for continuity of care for immunization clients.

Solution overview							
Global Goods Guidebook v.4 (pages)	**Scale**	**Primary WHO classification system**	**System owners**	**Data exchange standards**	**Funders**	**Licensing**	**Implementers**
N/A	Sub-national	N/A	MOHCDGEC's Health Promotion Services	N/A	UCS	N/A	Digital Square

Major features of the digital solution
Since 2021, Digital Square has collaborated with the GoT through the MOHCDGEC to strengthen the community health system based on the OpenSRP software. The OpenSRP platform is an open source mobile digital global good whose primary users are frontline health workers. It empowers health workers by allowing them to digitally record the services they render at community- and health-facility levels, while simultaneously providing program managers and policymakers with current data for improved decision-making. With funding support from USAID, Digital Square worked with the MOHCDGEC to strengthen the UCS's functionalities and governance structure as part of Tanzania's health information system. The system comprises three components: the WAJA application for community health care workers, the KITUONI application for facility health care workers, and the reporting application (In-App and dashboard) for the managerial level to provide insights and analytics of data to support decision-making. The UCS is currently used to support the following health domains: HIV/AIDs; reproductive, maternal, newborn, and child health; tuberculosis/leprosy; and malaria. UCS has a Health Interoperability Mediator layer, funded through the US President's Emergency Plan for AIDS Relief, which allows it to securely exchange data with other systems. Though the UCS does not currently possess immunization-related workflows or features, it could be adapted to do so.

Users		
Grouping	**Users**	**Description**
1 Clients	No	N/A
2 Health care providers	Yes	Community health workers and facility-level workers
3 Health system or resource managers	No	N/A

08 CONCLUSION AND NEXT STEPS

Digital Square, with the MOHCDGEC, mapped and analyzed the current immunization ecosystem in Tanzania to identify gaps, challenges, and opportunities for the DIPC project to support strengthening of digital health immunization systems in a coordinated effort with the government and other stakeholders.

Implementation of the DIPC project in Tanzania will focus on strengthening existing in-country digital immunization tools by:

01 Reviewing and standardizing end-to-end immunization workflows, processes, data standards, business logic, and requirements to strengthen and scale digital tools for immunization.

02 Mapping the existing digital tools for immunization (TImR, Chanjo COVID, and VIMS) to a common set of requirements and resources to understand gaps and areas of improvement.

03 Performing upgrades to digital systems and tools, including implementing information exchange between immunization systems and other digitally shared services (including DHIS2) within the Tanzania digital health architecture framework.

04 Supporting implementation of the upgrades and information exchange to strengthen data use of vaccine supply chain and delivery.

05 Building capacity of local technical teams on best practices for integrating WHO and MOHCDGEC guidelines and recommendations in digital tools using the SMART Guidelines approach (**S**tandards-based, **M**achine-readable, **A**daptive, **R**equirements-based, and **T**estable) with multiple modalities (e.g., mentoring, training).

DIPC