Vital Wave℠

digital square

# Development actor behavior through the lens of a value chain analysis

*Phase 1 Detailed Analysis*

July 2020

# Contents



# Project Overview

## Project Goal

- Provide Digital Square with a clear and actionable view, across countries of differing levels of digital health maturity, of what roles the private sector can and should play in LMIC digital health and where global goods will play an important role in maximizing the growth of digital health and the sustainability of country-level ecosystems.

## Project Outputs

- Creation of value-chain analytical frameworks for four digital health components critical to country HIS functioning.
- Testing and validation of these value chains through global value chain experts and in-country primary research in India, Kenya, and Mozambique.
- Development of three advocacy briefs on a functioning value chain use-case, a conceptual ROI, and an investor checklist.
- Creation of a set of clear recommendations and next steps for the Digital Square team and its community.

# Assessment Summary

Overall, digital health value chains are functioning. However, suboptimal dynamics exist within each of them, with some root causes common to all value chains and others specific to individual ones.

## *Root Causes of Common Issues Across All Value Chains*

***The primary causes of common issues across all four value chains can be summarized as:***

- Authoritative information on reasonable budgeting and cost categories for long-term solution management is lacking.
- Political pressure and organizational incentives exist to pursue implementations with insufficient investment.
- ICT oversight capacity within governments is inadequate (stemming from lack of appropriate funding for qualified headcount).
- Local ICT capacity is generally insufficient, impacting private-sector participation.
- Entrenched procurement processes discourage robust private-sector participation.

## *Root Causes of Issues in Specific Value Chains*

- ***SCIS and EMR:***
  - Donors are not incentivized to fund standards-based, interoperable solutions as interoperability is not seen as critically important to the disease-specific interventions they typically fund.
  - Governments lack the capacity to implement standards-based, interoperable solutions.
- ***LIS:*** There is not a clear and direct financial ROI for LIS, and the non-financial benefits of ROI to donors and to governments differ enough to cause a conflict between the types of LIS implementations they each need.
- ***MFR:*** There is a gap between perceived and actual value that results in limited demand for the creation of a standardized MFR solution by donors and governments.

# Private-Sector Engagement and the Role of Global Goods

- The private sector is playing an active role in delivering digital health solutions, but the nature of this participation varies based on **market maturity, value chain health, and system scope**.
- Local private-sector activity is less robust than it could be due to **procurement and program parameters** that reduce local organizations' ability to participate in software development, implementation, and maintenance and support.
- Gaps in local private-sector presence that are due to low market maturity and malfunctioning value chains indicate a **need for robust global goods** supported by strong communities of practice.
- **Packaged global goods** offer a model for delivering digital health solutions cost-effectively while increasing opportunities for local private-sector growth.

# Recommendations

## Create opportunities for greater local private-sector involvement

- Create mechanisms that overcome procurement barriers, including pooled financing vehicles and encouragement of prime/subprime relationships between established implementers and local private-sector organizations.
- Promote packaged global goods model as a new business model for the local private sector.

## Build government capacity to oversee ICT investments

- Create appropriate governance and organizational structure and roles.
- Use initial funding to second people into the governance and organizational structure.
- Build capacity within the permanent government workforce through a targeted, accelerated professional development program.

## Create an authoritative source of information on reasonable budgeting and cost categories for long-term solution development and management

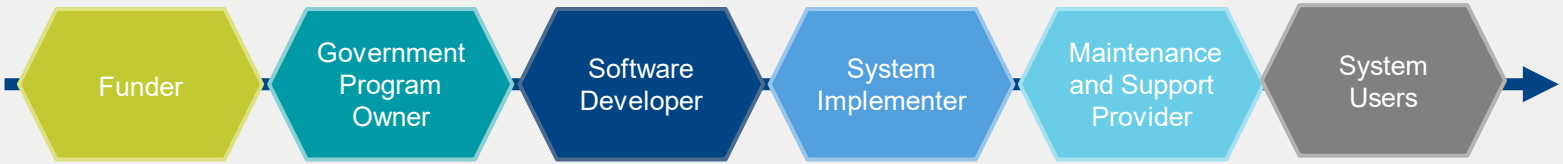
- Conduct an in-depth reference budgeting exercise.
- Bring together other organizations who have developed similar or related tools.
- Create one jointly developed, mutually endorsed budgeting reference guide.
- Socialize guide with the field, including ministries and donors, to stimulate buy in and use of the guide.

# Methodology

Vital Wave and PATH teams conducted secondary research and 73 in-depth interviews with global subject matter experts and country actors. Data were analyzed using consistent value chain frameworks.

## Value Chain Assessment

View market factors through the lens of the software value chain to determine incentives and disincentives for private-sector engagement and opportunities for global goods and develop actionable recommendations.




### Expert Interviews- 15

- Supply Chain Information Systems
- Electronic Medical Records
- Master Facility Registry
- Lab Information Systems

**Inform understanding of value chain actors, dynamics, and ecosystems at the global level**

### Country Interviews- 58

- Mozambique - 13
- Kenya – 21
- India/Uttar Pradesh - 24

**Inform contextual use and deployment of digital tools in each value chain in a variety of market maturity levels**

The three countries represent varying degrees of digital health market maturity and allow for extrapolation of conclusions from Mozambique, Kenya, and India to LMICs more broadly.

# Introducing Four Digital Health Solutions

Each value chain category includes a range of solution types that vary in terms of complexity and health system level. See slide 54 for further detail.

**SUPPLY CHAIN IS**

Manage the acquisition, distribution, and management of health commodities.

**ELECTRONIC MEDICAL RECORDS**

Collect and store individual patient data, such as diagnoses, medicines, medical tests, and treatment plans.

**LAB IS**

Record, manage and store data such as test orders, results, and interpretations for clinical laboratories and health facilities.

**MASTER FACILITY REGISTRIES**

Store list of all healthcare facilities, public and private, and may include facility attributes, e.g., number of beds, ventilators, services provided.

# Key Definitions

Terminology and definitions related to software models and sectors in digital health often lack consistency and standardization. The terms and definitions below apply to findings and analysis in this deck.

- **Private Sector**: For-profit and non-profit entities that generate revenue through the development, implementation or support of digital health software systems.
- **Open Source Software**: Source code released under a license in which the copyright holder grants users the rights to use, study, change, and distribute the software to anyone and for any purpose. Users typically do not pay licensing costs.
  - **Global Good**: Open-source digital health software intended for adaptation and reuse in LMICs settings.
  - **Packaged Global Good**: Global good customized by a private-sector firm to local needs and context and sold to both public and private buyers; implementation, maintenance, and support drive revenue rather than licensing fees.
  - **Forked/White-Label**: A bespoke workstream developed by a private-sector organization based on existing open-source code, possibly a global good, that deviates sufficiently from the original source code such that the developer can no longer benefit from improvements or changes made by the open-source community to the original source code.
- **Proprietary Software**: Closed-source software in which publisher or commissioning entity retains intellectual property rights over source code.
  - **Commercial Off-the-Shelf (COTS)**: Ready-made and available software designed for implementation without the need for extensive customization. COTS can include both enterprise-level software sold by international vendors and small locally developed and supported solutions. The revenue model typically includes licensing and support fees.
  - **Bespoke or Custom-Built**: Custom software developed for a specific organization.
- **Point-of-Service (PoS) App:** Front-end application, often on a mobile device, used to connect to a back-end system in areas such as supply chain information systems and electronic medical records.

# Key Definitions - Continued

Terminology and definitions related to software scope, scale and digital health domains. The terms and definitions below apply to findings and analysis in this deck.

- **System Scope**: There is a range of digital health solutions in the marketplace, which can be categorized by the level of functionality the system provides. This is commonly referred to as system scope.

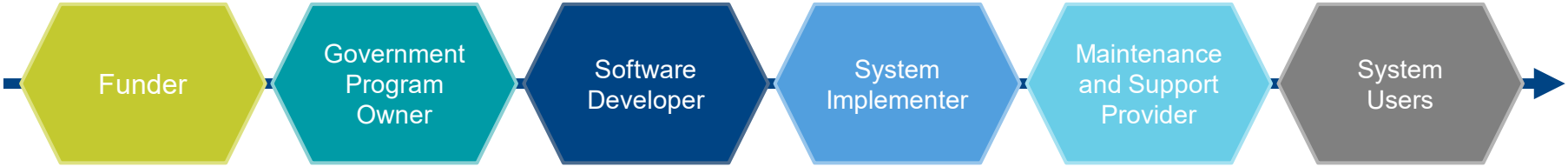
  To illustrate system scope, Bahmni, a repackaged global good, contains comprehensive EMR functionality, ranging from clinical, laboratory and inventory management along with billing functions, and is considered a broad-scope EMR. Alternatively, narrow-scope EMRs contain limited functionality, such as minimal patient health data, transactional data and administrative and billing management.

  - Broad Scope: Comprehensive, full-featured digital health system.
  - Narrow Scope: Limited functionality digital health system.
- **System Health Domain**: In high digital health market maturity countries, health systems generally encompass universal health domains. However, in LMICs, digital health systems are often implemented in the specific health domain.
  - Disease-Specific: HIV, Malaria and TB are common disease-specific health domains with discrete digital health systems.
  - Program-Specific: The Expanded Program on Immunization and Reproductive Child Health are examples of program-specific health domains with discrete digital health systems.
- **System Scale:** The scale of a system eventual implementation varies greatly, from a national-scale public health deployment to an implementation in a small network of hospitals. When a national digital health system is referenced, the rollout of the system may be in an earlier stage or fully implemented at the national scale.

# Value Chain Overview

# Value Chain Analysis Introduction

- A value chain framework provides a way to more deeply understand the market dynamics that shape opportunities, obstacles, risks for the private sector and global goods.
- Depending on the implementation, the same actor may play multiple roles (i.e., a system implementer may also provide long-term maintenance and support).
- In this assessment, a "functioning" value chain or an individual link in the value chain delivers on its basic requirements, even if suboptimally, i.e., net utility is not as high as it could be (or "healthy").




## FOUNDATIONAL CONCEPTS

**"Give"** – includes cost outlays and other value contributions (real and perceived) that an actor puts into the end solution.
**"Get"** – includes forms of value that actors in the value chain receive from their participation in solution delivery.
**"Net Utility" (ROI)** – net value (perceived or real) that an actor receives from their participation in the value chain (the Get minus the Give).

# Value Chain Roles

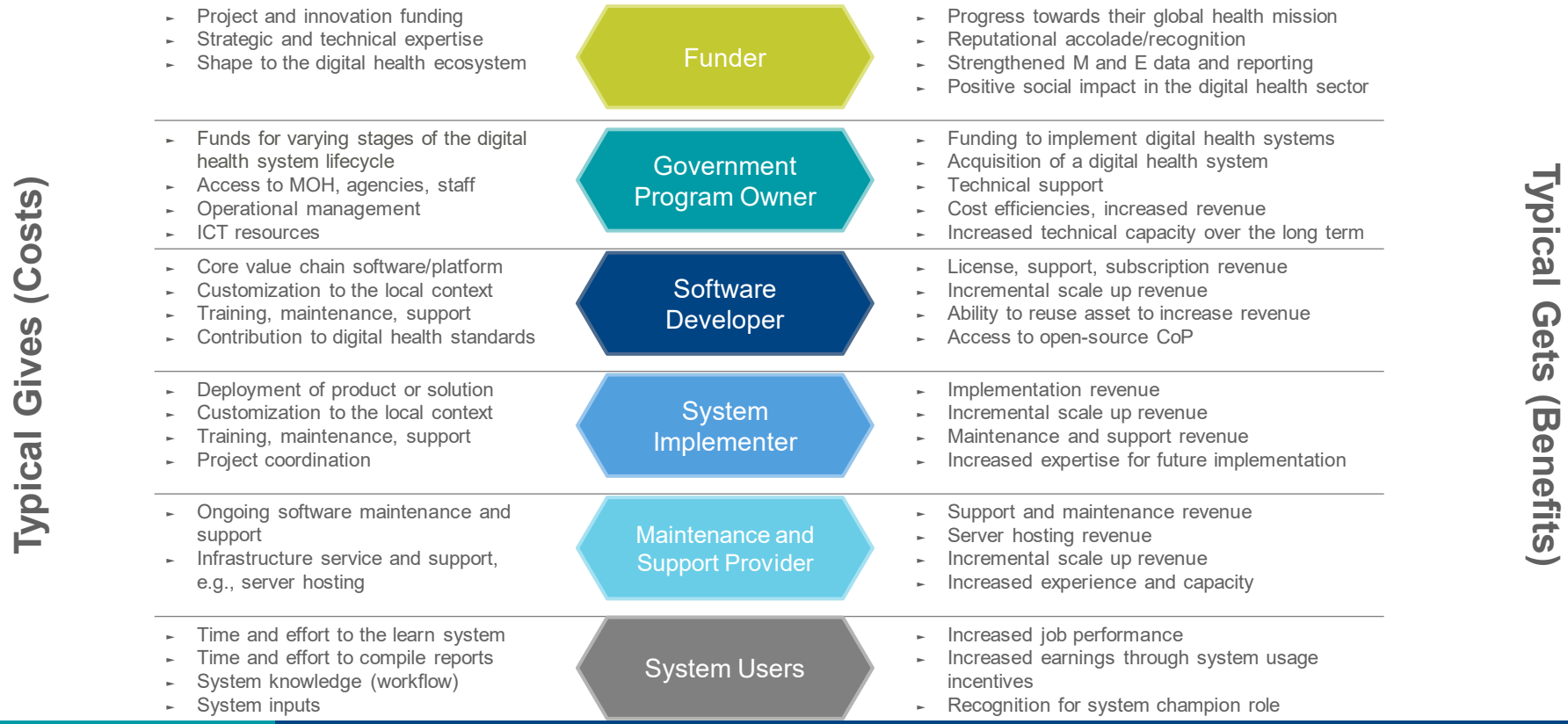
In LMICs, actors in the public, private and NGO sectors can play roles in the digital health value chain.

| Role | Overview | Examples |
|---|---|---|
| Funder | Provides short or long-term funding | ► Bilateral and multilateral aid agencies<br>► Foundations<br>► Governments |
| Government Program Owner | Represents government program needs and oversees implementation | ► Government ministries or agencies (national, subnational level) |
| Software Developer | Performs core software development and maintenance; may contribute to software customization and support | ► Global software companies<br>► Regional software companies<br>► Local software companies<br>► Government health IT staff |
| System Implementer | Manages software adaptation against program goals and initial deployment, often including training, partner management and support | ► Global software companies<br>► Regional software companies<br>► Local software companies<br>► Government health IT staff |
| Maintenance and Support Provider | Provides ongoing system maintenance and support, including system and infrastructure upgrades | ► Software/platform developer<br>► System implementer<br>► Government health IT staff |
| System Users | Utilize the solution software, often healthcare actors | ► Suppliers<br>► Government system administrators<br>► Central medical stores, laboratories<br>► Warehouses, transport/logistics<br>► Facility users, e.g., health workers |

# Value Chain Analyses

# Gives and Gets Underpinning Net Utility (ROI) for Actors

Value chain analysis looks at the balance of gives and gets for actors at a moment in time; the ability of a market to sustainably deliver a solution depends on maintaining positive net utility over the long term.



# Drivers of Net Utility (ROI) for Actors

The factors that influence whether net utility for each actor is positive or negative group into four broad categories.

## F ▸ Financial

### Financial factors impacting net utility

- Expenditures categories (CapEx vs. OpEx)
- Funding and budgeting
- Business model and financial terms
- Affordability and potential for cost savings

## T ▸ Technology

### Technology factors impacting net utility

- System technological model and requirements
- Solution design and complexity (vs. user needs)
- System standards (interoperability)
- Hardware, infrastructure and ICT skill level

## P ▸ Program

### Program factors impacting net utility

- System scope (broad vs. narrow)
- Program and customization requirements
- Governance, ownership, management
- Partnership structure and training parameter

## E ▸ Ecosystem

### Ecosystems factors impacting net utility

- Political structure (degree of centralization)
- Health system structure (public vs. private)
- Laws and policies (UHC, data hosting)
- Procurement regulations and donor influence
- ICT skill availability and competition

Definition: Broad and narrow solutions are defined by the breadth of functionality, not by the geographic scale or the number of disease domains the solution addresses.

# What We Heard

## Key quotes from interview sources illustrate the drivers of net utility.

**Disease-specific program funding**

F

*Program-focused funding is a direct threat to enterprise architecture, which aims to incorporate a holistic approach to disease surveillance and management. There are big opportunities to provide more incentives and make use of more mature products.* - Donor

**Lack of interoperability**

T

*There is a mixture of free open source and proprietary and systems are supposed to be interoperable, but there is not a lot of focus there. .* - Government Official, Kenya

**Budgeting for maintenance and support**

F

*Support and maintenance is often left out of costing… funding might be for one to three years, what do you put in year one? Not hardware refresh and training because you'd be out priced…*

- Global LIS Expert, Mozambique

**Complex governance structures**

P

*We like RFPs that you can do alone. More partners, more complicated, boils down to optimal number of partners and ones who are nearer to our core skills* - Local System Implementer, India

**Government ICT capacity**

E

*There is a need to support strong capacity for governments so they can hold partners accountable for what they say they are going to do; this is currently lacking on the government side…*

- Global SCIS System Implementer, Mozambique

**Procurement challenges**

E

*We have companies that are entrenched into the system and get all of the contracts. You may not be taken seriously (by the government) because they already have preferred vendors.*

*- Global SCIS System Implementer*, Kenya

# Supply Chain Information Systems

A well-functioning value chain overall, with significant private-sector participation but too many siloed systems.

## VALUE CHAIN HEALTH (BROAD)

MZ UP KE

**KEY RISK**

Siloed funding, fragmented system development and use

## AREAS OF DIFFERENTIATION:

**Functionality:** Varies from broad, complex to narrow PoS solutions

**Country Environment:** Level of government capacity and ownership

Legend: =Healthy =Functioning =Malfunctioning

## Supply Chain Information Systems

### Market Nature

The SCIS market encompasses a large number of categories and solutions of varying scope. Solutions range from national-level systems for logistics and inventory management of drugs and health commodities to narrower solutions for specific health or disease programs and front-end, point-of-service (PoS) solutions. Private-sector participation is robust in PoS solutions, while global goods and bespoke solutions tend to be prevalent in national-level systems.

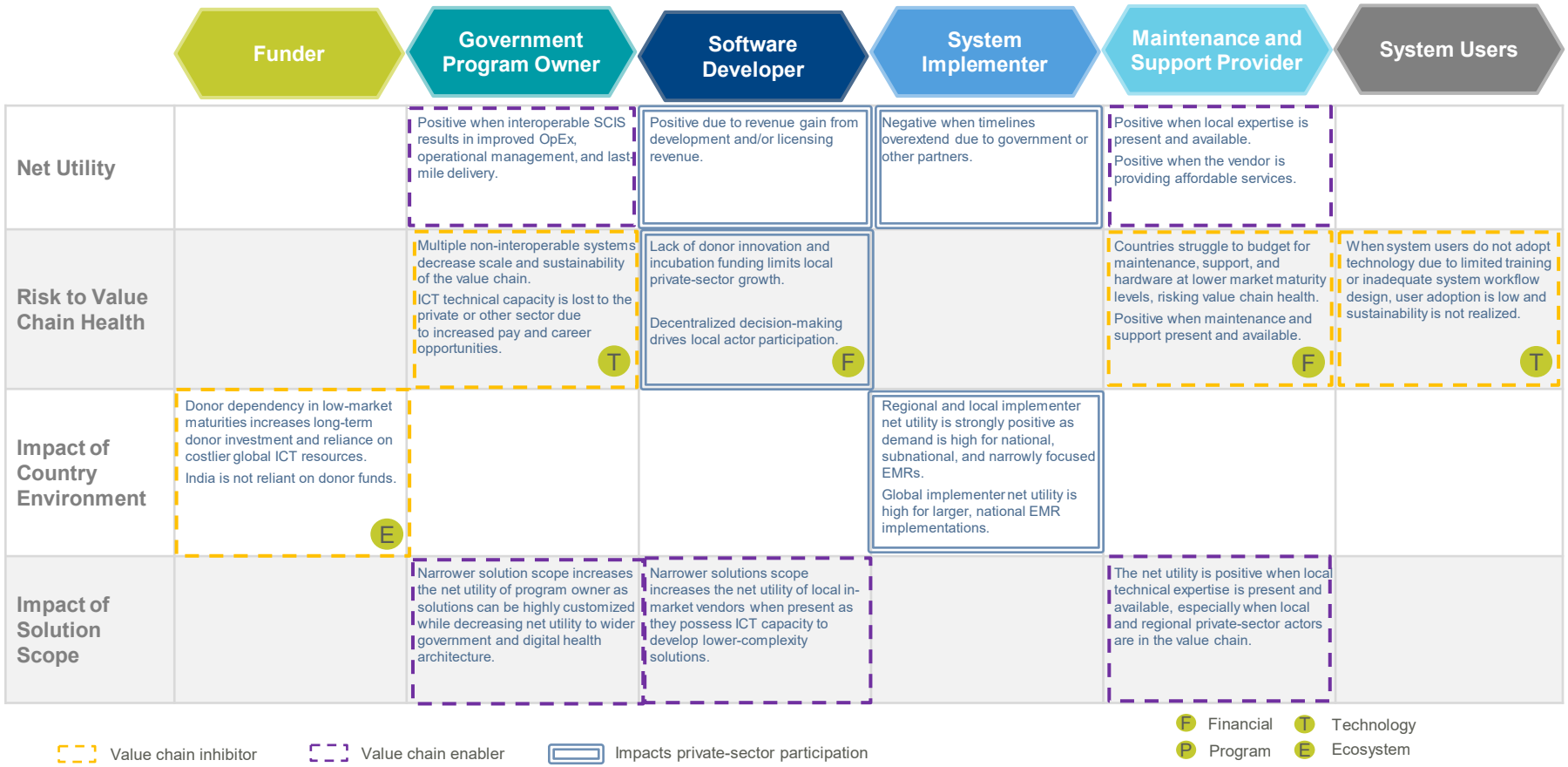
### Predominant Implementation Strategy

Donors fund either OpenLMIS-based solutions for specific programs or bespoke LMIS for more comprehensive inventory and distribution management tracking. Government-developed solutions or open-source tools may involve private-sector implementers or technology partners in addition to government and NGO resources.

**Private-Sector Participation:** Private-sector participation in SCIS is **medium.** It is most prevalent in PoS solutions (e.g., inventory management at facilities) but lacking in other areas due to donor preferences for open-source solutions and the upfront costs associated with commercial software.

# Supply Chain Information Systems Value Chain Summary

While the net utility is positive for most actors, siloed systems and inadequate budgeting pose risks.



# Supply Chain Information Systems Value Chain Drivers

Financial, technology, program, and ecosystem factors impacting the health of the value chain.

| | | |
|---|---|---|
| F | **Maintenance Costs** | Implementation budgets rarely include costs associated with user training and system maintenance and support, leading to insufficient funding for long-term support and training and decreasing user adoption and sustainability. |
| T | **Myriad Commodities** | Health program fragmentation creates differing procurement methods (e.g., WHO and PEPFAR processes and systems) and multiple ways to receive commodities (e.g., delivery to a program office) outside of the government's centralized supply chain information system. |
| P | **Total Cost of Ownership** | Donors underestimate the complexity and cost to adapt a global good or global north solution to meet local requirements, leading to insufficient project lifecycle funding, increased project timelines, and budget overruns, often leaving ill-equipped governments to manage donor investment in the long-term. |
| E | **Donor Control** | Reliance on donors to build system requirements due to lack of government technical expertise decreases system ownership as donor controls system design and value chain actors. |

**Private-sector observation:** In India, NIC systems predominate in public-sector supply chain systems (e-Aushadhi), though large private-sector vendors (Logistimo's eVin) deliver program-specific solutions at the national scale. In Kenya, private-sector vendors deliver PoS inventory systems. Mozambique has discouraged private-sector participation through the procurement process.

# Electronic Medical Records

Robust levels of activity, with many clinical and administrative systems but little interoperability.

## VALUE CHAIN HEALTH (BROAD)

MZ UP KE

**KEY RISK**

Dependency on regional or international implementers

## AREAS OF DIFFERENTIATION:

**Functionality:** Range from clinical to administrative solutions

**Country Environment:** Technical skills and demand are the biggest drivers for success

Legend: =Healthy =Functioning =Malfunctioning

## Electronic Medical Records

### Market Nature

National-level EMRs (comprehensive or program-specific) in Africa are global goods, while in India, they are bespoke government solutions. Conversely, narrow-focused EMR solutions are prevalent throughout Kenya and India and served by the local and regional private-sector actors.

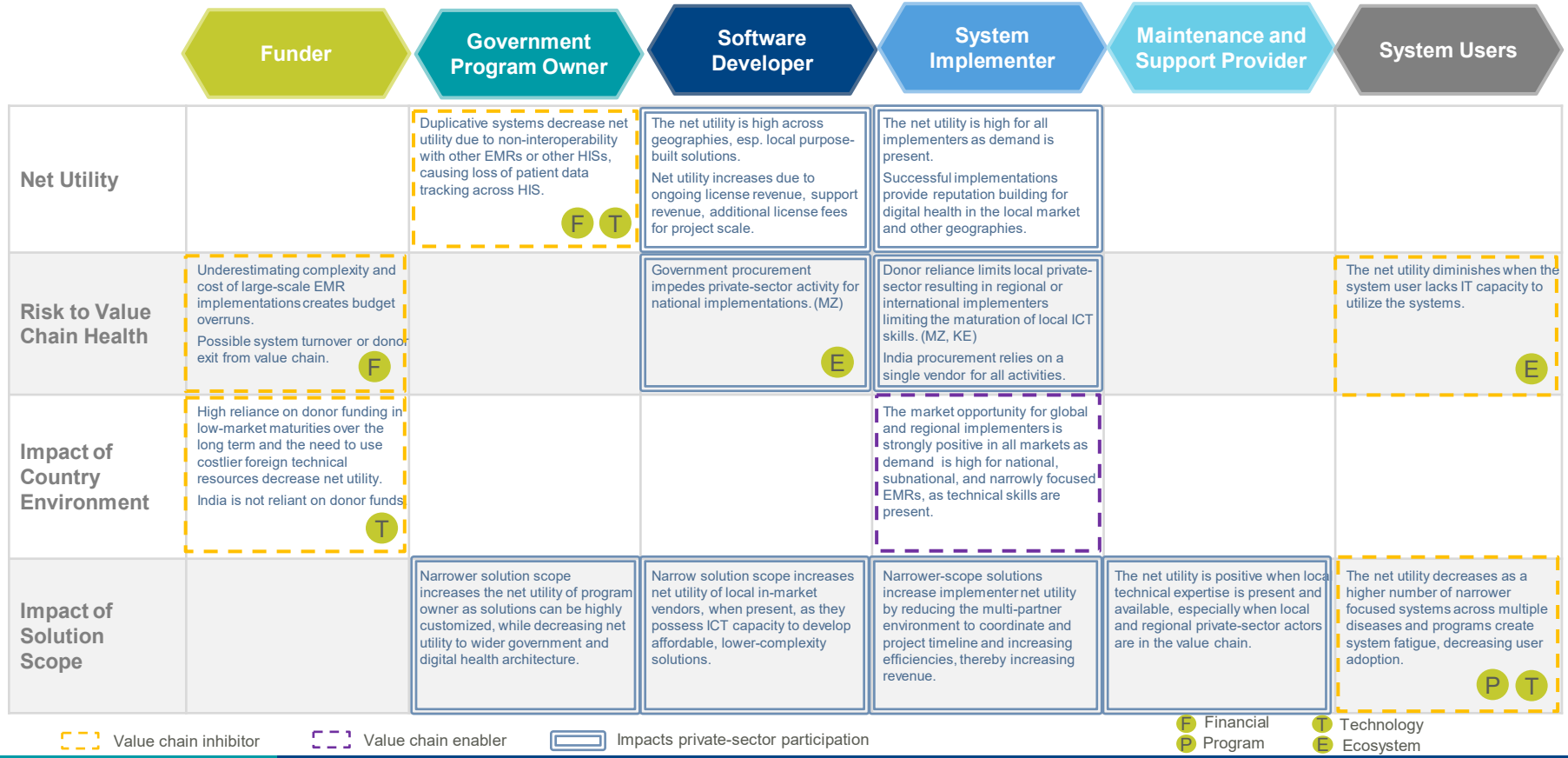
### Predominant Implementation Strategy

The strategy for national-level EMRs is to implement a donor-funded system through the use of global, regional, and local partners. National-level EMRs that exist in program-specific areas are funded by donors and government. Private-sector vendors are engaged to support efforts where needed. Subnational and hospital systems implement narrowly focused EMRs developed by the private sector, focusing on administration and billing functionality.

**Private-Sector Participation:** Local private-sector participation in EMRs is **medium**, with a focus on subnational and narrowly focused EMRs. Lack of funding can limit private-sector engagement, which is then replaced by regional or international implementers.

# Electronic Medical Records Value Chain Summary

The proliferation of non-interoperable systems funded by donors is a key inhibitor to value chain functioning.



# Electronic Medical Record Value Chain Drivers

Financial, technology, program and ecosystem factors impacting the health of the value chain.

| | | |
|---|---|---|
| F | **EMR Focus Dynamics** | Demand for broad and narrowly focused EMRs creates distinct opportunities for private-sector actors, the former being global NGO partners and the latter being local vendors. Local vendors increase the net utility for all actors. |
| T | **System Standards** | Due to the multiple actors delivering EMRs at varying levels of health in Kenya and India (public and private healthcare), the systems are built without standards: the two most critical being interoperability of EMRs to access patient data across all systems and other HIS and the lack of local actors to develop products with the required expertise. |
| P | **Understanding Requirements** | Donors and governments underestimate the complexity and cost of implementing a National EMR as high levels of customization are required for both commercial-off-the-shelf and global good products. Most often, adequate long-term is unbudgeted. |
| E | **Political Structure and UHC** | Decentralization allows states and counties the autonomy to procure digital health systems. The vendors are often local private-sector entities as they are affordable and built-for-purpose. Universal Health Care drives EMR growth at all levels of government where present. |

**Private-sector observation:** In India, the world's largest EMR (PM-JAY) was driven by the country's UHC push and implemented by the National Health Authority. The private sector in Kenya is engaged in developing administrative and billing EMRs for subnational health system levels and the private healthcare sector. Both countries have extensive private healthcare delivery systems.

# Lab Information Systems

Sub-optimal value chain functioning, with high private-sector participation but funding mismatched to needs.

## VALUE CHAIN HEALTH (BROAD)

MZ UP KE

**KEY RISK**

Departure from the value chain due to lack of incentives

## AREAS OF DIFFERENTIATION:

**Functionality:** Range from small scale to enterprise-level solutions

**Country Environment:** Technical capacity and skills are a key driver for success

Legend: =Healthy =Functioning =Malfunctioning

## Lab Information Systems

### Market Nature

LIS implementations are typically seen in national labs, reference labs, or program-specific labs. Most lab systems offered are fully-featured and multi-disciplinary. They range from easily configurable COTS solutions to enterprise-level solutions for large laboratories where customization is required. LIS products comprise both global and regional proprietary solutions and customized global goods, whereas the local private sector delivers narrow-scope LIS.

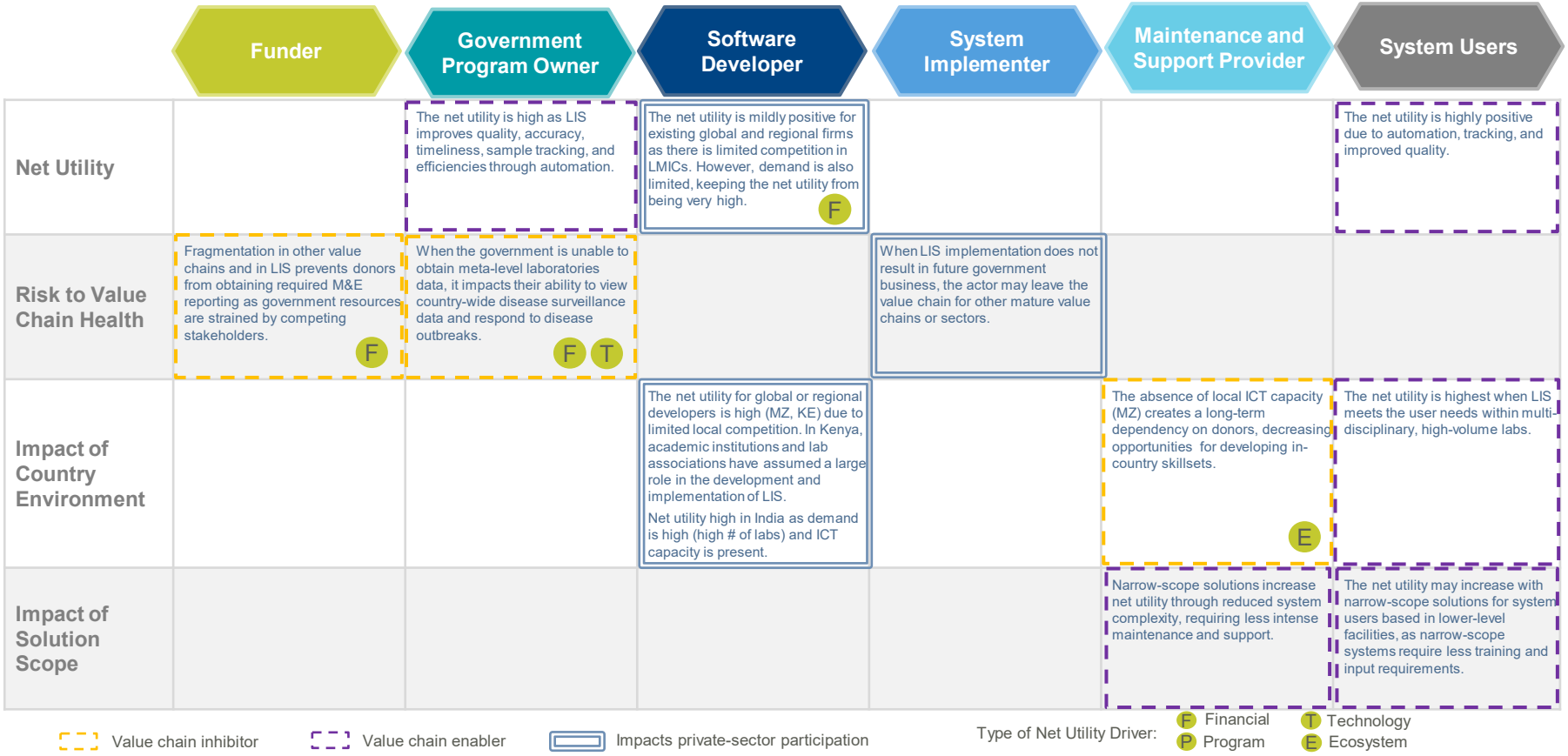
### Predominant Implementation Strategy

The current predominant strategy of meeting public LIS needs is through the end-to-end delivery of commercial systems by global and regional software providers, aside from India, where the local private sector is engaged. Global goods augment LIS systems, e.g., OpenLDR and BLIS. Donors commonly fund disease-specific systems, especially in HIV and TB.

**Private-Sector Participation:** The private-sector participation in LIS is **high**. Laboratory-focused implementers and academia influence the use of proprietary solutions. Where private-sector activity is highest, firms focus on delivering commercial products for the private healthcare sector.

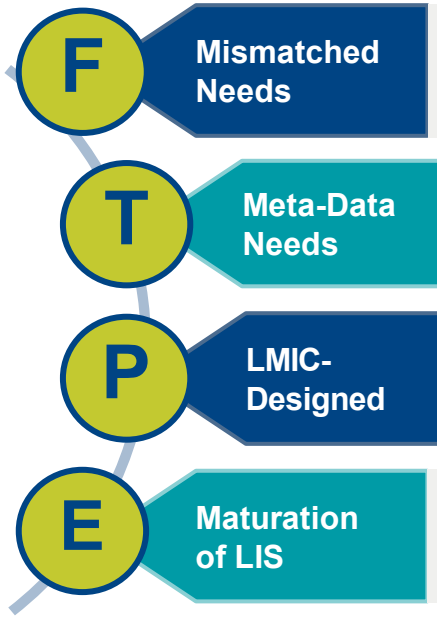
# Lab Information Systems Value Chain Summary

## The disconnect between funders and government program owners pose significant risks.



# Laboratories Information System Value Chain Drivers

Financial, technology, program and ecosystem factors impacting the health of the value chain.




LIS need in LMICs exists at the national and reference lab level, processing high-volume, multi-disciplinary samples across all diseases. Donors fund disease-specific LIS, whereas governments require a single, multi-disciplinary LIS to meet system user needs.

Global north (Labware) and regional (DisaLab) COTS vendor solutions are costly for local governments and lack interoperability across HIS. Other donor-funded, disease-specific systems deny the MoH the ability to view meta-level data, which is critical for disease surveillance, e.g., COVID-19 pandemic.

Regionally built LIS are highly configurable for narrow-focused labs and customizable for high-volume, multi-disciplinary lab environments, and affordable compared to comparable global north solutions.

The LIS market in LMICs lacks maturity compared to SCIS and EMR and will take some time before governments and the local ICT sector participate in the value chain outside of the current state. However, in India, the private sector is highly engaged in the private healthcare sector.

**Private-sector observation:** The private sector is delivering solutions in both Kenya and India due to the mix of public and private healthcare systems, albeit at a limited scale. South African firms are delivering solutions for the Africa region, while in India, private-sector providers from outside UP dominate. Global north LIS vendors are present in high-volume, complex lab environments.

# Master Facility Registries

While Kenya and UP are developing at-scale MFRs, the value chain in most LMICs is malfunctioning.

## VALUE CHAIN HEALTH (BROAD)

MZ UP KE

**KEY RISK**

Funder and government perception of low utility

## AREAS OF DIFFERENTIATION:

**Functionality:** No range

**Country Environment:** Lower-market maturity equals reliance on other members of the value chain and abroad

Legend: =Healthy =Functioning =Malfunctioning

## Master Facility Registries

### Market Nature

MFRs are built today on a custom basis, as no commercial or open-source version exists. A single implementation is meant to be an at-scale, highly integrated component in the HIS across multiple health domains; therefore, market size is low, and the current perceived value of MFR by buyer and beneficiaries is low.

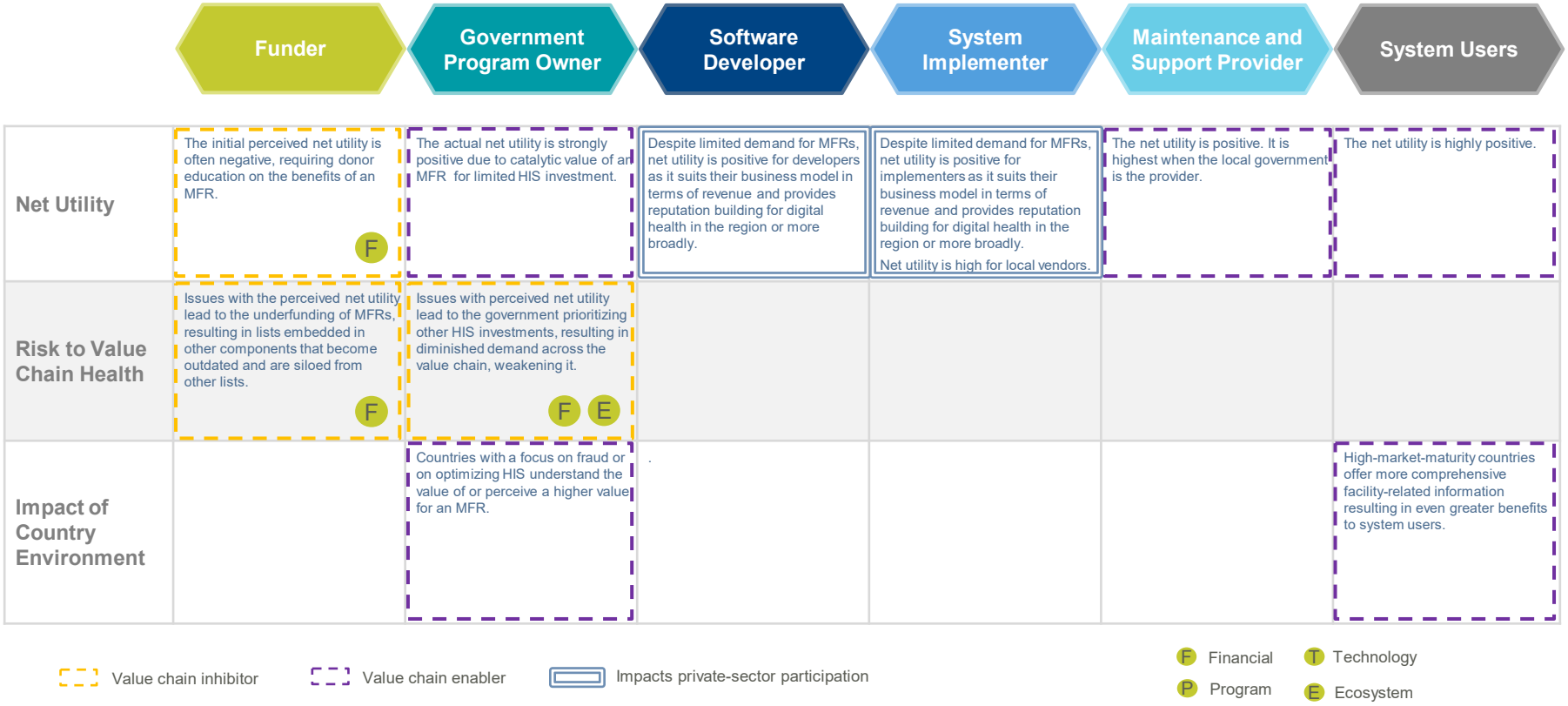
### Predominant Implementation Strategy

Integrate a facility list that is compiled by the software developer or implementer into a discrete national HIS facility list, such as EMR or SCIS. Generally, there is no standardized process for updating and managing these separate lists. As a result, they are outdated, siloed, and lack the intended purpose of a master list being a single, trusted source of truth.

**Private-Sector Participation:** Private-sector participation in MFRs is **low**, with no COTS MFR solutions in the market. This is due primarily to the low demand for MFRs by governments and donors, resulting in a market in which private-sector developers and implementers have little incentive to invest.

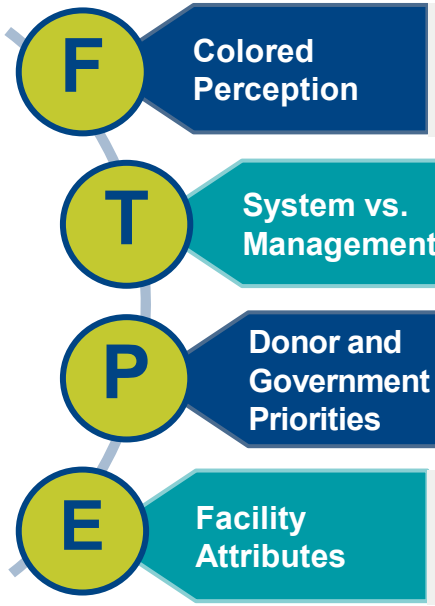
# Master Facility Registry Value Chain Summary

## Low demand from funders and government program owners are the main value chain inhibitors.



# Master Facility Registry Value Chain Drivers

Financial, technology, program, and ecosystem factors impacting the health of the value chain.




Donors do not perceive the value of an MFR, limiting funding available for them. Where investments have been made, donors recognize the benefits that an MFR delivers.

Investment in developing MFRs is low compared to other value chains, especially with the advent of tools such as GOFR. The challenge is creating and implementing the system workflow, maintenance, and management processes across all HIS and their actors.

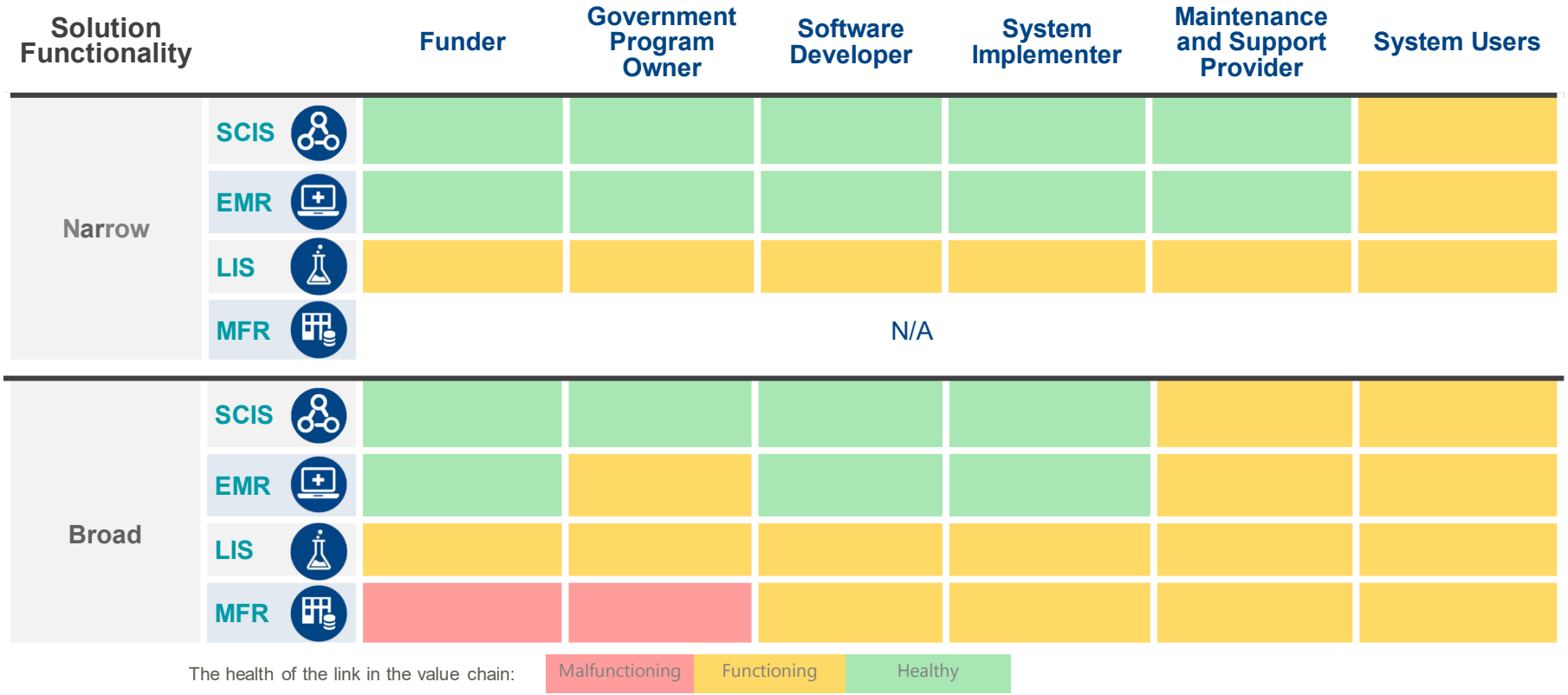
Donors do not currently fund national MFR implementations as they are focused on their own specific programmatic goals; governments do not prioritize a single MFR as the political will of each HIS owner is ambivalent since they must give up control of managing their system's facility list.

The creation of a country's MFR should include facility attributes (e.g., number of beds, equipment, facility services) as part of any mapping exercise because net utility increases exponentially.

**Private-sector observation:** Private-sector engagement in MFRs is seen only in India. In Kenya, the development and support of the national MFR are driven by the government, with no private-sector participation.

# Value Chain Health by Actor Category

Except for MFRs, value chains are functioning, if not entirely healthy.



# Common Issues Across the Four Value Chains

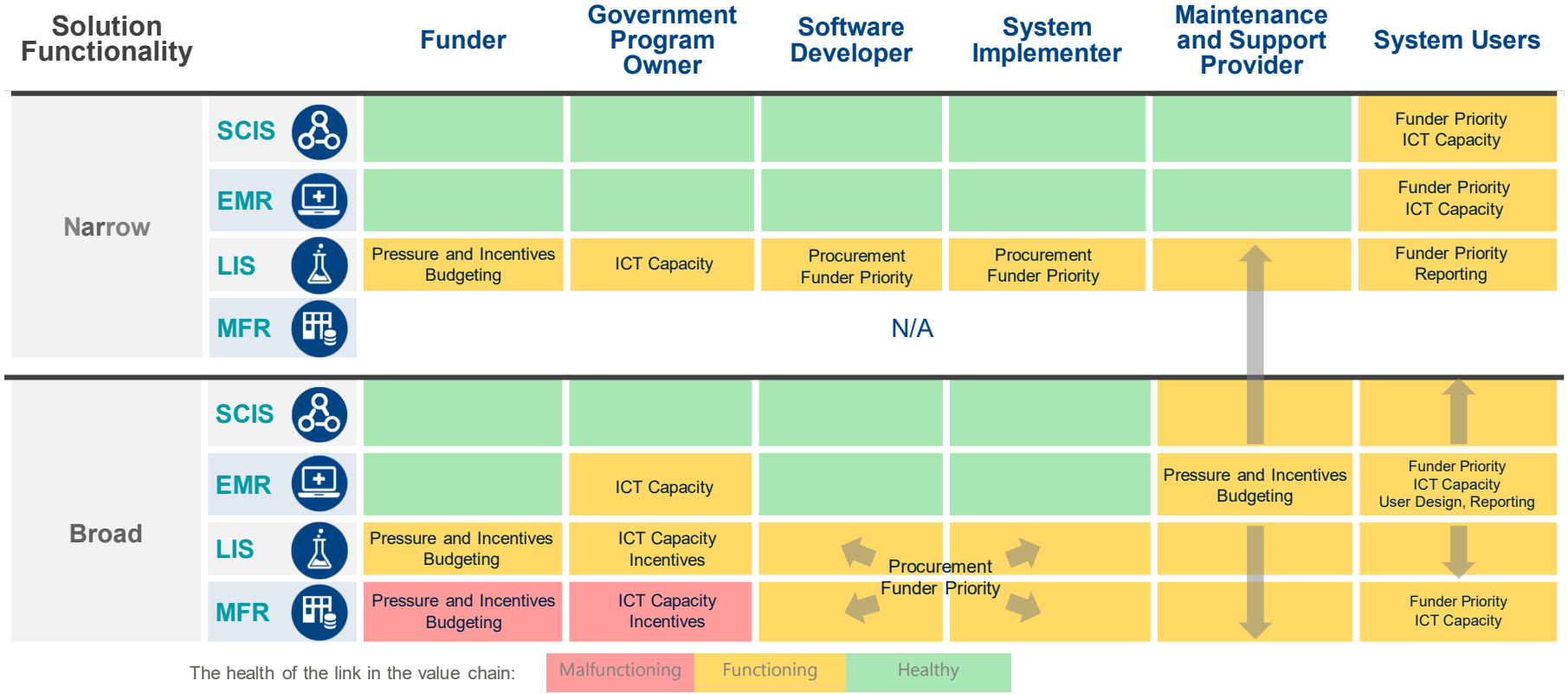
| Driver Categories | Common Issues | Root Causes |
|---|---|---|
| F | Donors and governments do not adequately budget for total cost of ownership of digital health solutions. | • Political **pressure** and organizational **incentives** exist to pursue implementations with insufficient investment, particularly for operating expenditures.<br>• Authoritative sources of information for **budgeting** appropriate amounts and cost categories do not exist for digital health solutions, especially for operating expenditures. |
| T | System standards for interoperability are not supported by most actors. | Technical exchange of system data is not a **funder** or program owner **priority**. |
| | Solutions lack user-centered design requirements from donors and governments. | Success measures for program officers focus on **reporting** and exclude system user needs; governments lack familiarity with **user-design** principles. |
| P | Lack of government capacity and, therefore, ownership of broad-functionality solutions impede solution sustainability. | • Political **pressure** and organizational **incentives** exist to pursue implementations with insufficient investment, particularly for operating expenditures. |
| | Donors and government owners underestimate complexity and extent of customization required for existing solutions (open-source or proprietary). | • Authoritative sources of information for **budgeting** appropriate amounts and cost categories do not exist for digital health solutions, especially for operating expenditures. |
| E | Data sovereignty prevents cloud hosting, except where vendors ignore policies and laws. | Lack of understating cloud security and **ICT capacity**, e.g., use of local server instance to mitigate government concerns. |
| | Procurement processes (e.g., payment terms) prevent new market entrants, thereby limiting local ICT capacity and private-sector growth. | **Procurement** functions do not have incentives to support major change for the benefit of **ICT capacity** and private-sector growth. |

# Issues Unique to Each of the Four Value Chains

| | SCIS | EMR | LIS | MFR |
|---|---|---|---|---|
| Financial | ► Donors funding disease-specific SCIS, not essential commodities. (Pressure, Incentives) | ► Government funding many program-specific EMRs. (IN) (Incentives)<br>► Interoperable systems increase donor funding requirements. | ► Lack of donor funding for national and reference systems. (Pressure, Incentives)<br>► Limited LIS implementations due to high cost of system. (Budgeting) | ► Limited funding for MFRs in low-market maturity countries. (Pressure, Incentives, Budgeting)<br>► High costs to map facilities and facility attributes. (IN) |
| Technology | ► Global goods are not interoperable across HIS. (Funder Priority)<br>► Donor supply chain processes and systems not integrated into the country's SCIS. (Funder Priority) | ► Lack of user-centric design limits user adoption. (Reporting, User-Design)<br>► Proprietary software utilized for narrow-focused EMR is not interoperable. (KE, IN) (Funder Priority) | ► COTS and global good utilization for LIS implementations. (KE)<br>► LIS requires integration with laboratory equipment, e.g., analyzers. (Funder Priority) | ► MFR requires interoperability with other HIS. (Funder Priority) |
| Program | ► Donors underestimate the complexity and cost to adapt a global good or global north solution to meet local requirements. (Budgeting) | ► Limited government ownership of large-scale, broad EMR. (Pressure, Incentives, Budgeting) | ► Limited government procurement opportunity for broad LIS. (Pressure, Incentives)<br>► LIS is not a mature digital health tool. | ► Limited procurement opportunity for MFRs. (Pressure, Incentives, Budgeting) |
| Ecosystem | ► Donors continue to fund program-specific SCIS through procurement loopholes. (IN) (ICT Capacity) | ► Solution turnover occurs at subnational level more frequently due to leadership change. (KE) (Procurement)<br>► Governments not creating standards for value chain actors preventing interoperable systems. (Procurement) | ► Limited opportunity for LIS developers and system implementers.<br>► Limited local expertise to develop country-specific LIS. (ICT Capacity) | ► Government does not perceive the value of the MFR to the country's HIS. (ICT Capacity) |

# Value Chain Health by Actor Category and Root Cause

## Root causes of sub-optimal functioning are consistent within actor categories across value chains.



# Private Sector Engagement and the Role of Global Goods

# Private Sector Engagement: Dimensions and Drivers

## *Dimensions*

Private-sector engagement in a value chain can be evaluated in several ways:

- **Location of private-sector organization**, which speaks to the degree of local vs. foreign capacity and impacts areas such as cost and sustainability.
- **Engagement by actor category,** which provides insights into private-sector ability to play different roles in software solution delivery and maintenance.
- **Engagement by country,** which provides insight into how the composition of private-sector engagement varies in countries of different market maturity levels.

## *Drivers*

The nature and level of private-sector engagement are influenced by several factors:

**Market characteristics:**

- **Market maturity**, which relates to a country's ecosystem characteristics, such as ICT capacity, infrastructure, and market and policy environment, that progresses gradually over time
- **Market/value chain functioning,** including factors such as market demand.

**Solution and program characteristics:**

- **Solution scope**, i.e., broad vs. narrow.
- **Software development model**, i.e., choice of open-source vs. proprietary digital health solutions.
- **Procurement and program parameters,** such as payment terms and governance structures.

# Dimension: Private Sector Influence by Actor Location

The geographic location of private sector actors has both direct and indirect impacts on the value chain.

| | | Local | Regional | Global |
|---|---|---|---|---|
| Direct | **Benefits of Private Sector Participation** | + Lower licensing and support costs<br>+ Greater awareness of local user needs and context<br>+ Availability of in-country maintenance and support | + Availability of regionally designed solutions where local solutions do not exist<br>+ Lower licensing and support costs compared to global competitor | + Greater reliability and performance of solution platform<br>+ Implementation efficiencies due to economies of scale |
| | **Disadvantages of Private Sector Participation** | – Lower quality solution on average compared to global competitors<br>– Vendor lock-in | – Higher licensing and support costs than local alternatives<br>– Requires some customization, increasing costs<br>– Vendor lock-in | – High licensing and support costs<br>– Requires significant customization, increasing costs<br>– Vendor lock-in |
| Indirect | **Positive Impacts of Private Sector Participation** | + Increased sustainability<br>+ Increased growth in local ICT capacity over time<br>+ Decreased government reliance on global actors | + Improved regional ICT ecosystem | + Potential for knowledge transfer and local capacity building |
| | **Negative Impacts of Private Sector Participation** | – Possible increase of proliferation of inefficient solutions | – Possible crowding out of local ICT actors | – Increases reliance on donor funding due to high costs<br>– Limits local private-sector participation and growth |

# Dimension: Private Sector Engagement by Value Chain Actor Category

When seen from the perspective of participation in the software developer and system implementer actor categories, private-sector participation is robust, with local, regional, and global organizations involved in implementations in all three countries.

| | Software Developer | System Implementer | Maintenance and Support Provider |
|---|---|---|---|
| **Local** | ► SourceCode Solutions (MZ)<br>► IntelliSOFT (KE)<br>► mHealthKenya (KE)<br>► Everwell (IN)<br>► Dhanush InfoTech (IN, KE) | ► Aura Safira (KE)<br>► IQVIA (IN)<br>► Tattva Foundation (IN)<br>► Tata Consultancy Services (IN)<br>► Saudigitus (MZ) | ► Provided by other value chain actors (software developers, system implementers, and government program owners) |
| **Regional** | ► DisaLab (MZ, KE)<br>► Mezzanine (MZ) | ► Jembi (MZ) | ► Provided by other value chain actors (software developers, system implementers, and government program owners) |
| **Global** | ► Zenysis (MZ)<br>► LabWare (KE)<br>► SolDevelo (MZ)<br>► I-TECH (MZ)<br>► HISP (KE) | ► Dimagi (MZ)<br>► Palladium Group (KE)<br>► Village Reach (MZ)<br>► Acasus (MZ)<br>► APHL (KE, MZ)<br>► AMPATH (KE)<br>► Jhpiego (IN) | ► Provided by other value chain actors (software developers, system implementers, and government program owners) |

BLUE = For-Profit GREEN = Non-Profit

# Dimension: Private-Sector Engagement by Country

When viewed by country, private-sector engagement is viewed by country, it is clear that the composition of private-sector participation varies significantly between countries of differing market maturity levels.

| | Mozambique | Kenya | Uttar Pradesh (IN) |
|---|---|---|---|
| **Local*** | ► SourceCode Solutions (sm)<br>► Saudigitus (sm) | ► Aura Safira (sm)<br>► Maisha Meds (sm)<br>► IntelliSOFT (med)<br>► mHealthKenya (lrg) | ► Dhanush InfoTech (med)<br>► IQVIA (lrg)<br>► Everwell (lrg)<br>► Tata Consultancy Services (lrg)<br>► Apollo (private health provider) (lrg)<br>► Tattva Foundation (lrg) |
| **Regional** | ► DisaLab<br>► Jembi<br>► Mezzanine | ► DisaLab | ► NA |
| **Global** | ► Zenysis<br>► SolDevelo<br>► Acasus<br>► I-TECH<br>► HISP<br>► Village Reach<br>► JSI | ► LabWare<br>► Palladium Group<br>► Seven Hills<br>► Baobab Circle (med)<br>► AMPATH<br>► I-TECH<br>► JSI | ► Google<br>► Ernst & Young<br>► Dimagi<br>► Jhpiego<br>► Dell<br>► BMGF |

* See slide 38 for more information

BLUE = For-Profit

GREEN = Non-Profit

Organization size: small (sm), medium (med), large (lrg)

# Driver: Program and Procurement Parameters

Government and donor procurement processes and program requirements often limit the ability of local private-sector organizations to participate.

## Procurement

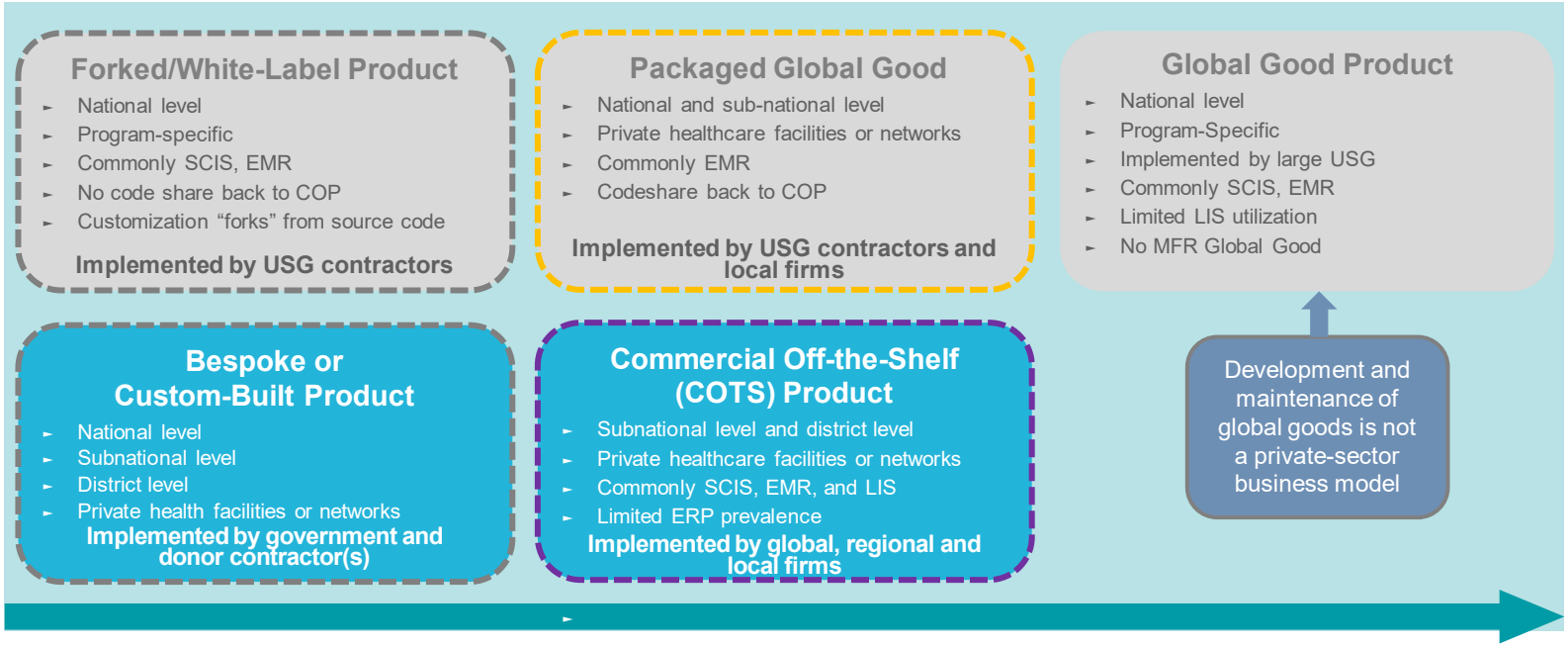
- Government payment terms require significant working capital, which local private sector may lack.
- Procurement focuses on CapEx vs. OpEx, decreasing funding for training, maintenance, and support
- Project delays impact payment when tied to deliverables, increasing local private-sector risks.
- Government policies may limit or restrict private-sector participation.
- Long procurement processes impede private-sector participation.
- No mechanism to identify existing local ICT talent for implementations.
- Lack of donor requirement for local private-sector participation.

## Program

- Complexity of the partnership structure may discourage private-sector participation in the RFP/bidding process.
- Program customization requirements increase system complexity and ICT technical skill requirements beyond the capacity of local private-sector participants.
- Local private-sector firms may lack the required digital health domain expertise (for example, laboratory system knowledge).

# Driver: Software Business Model

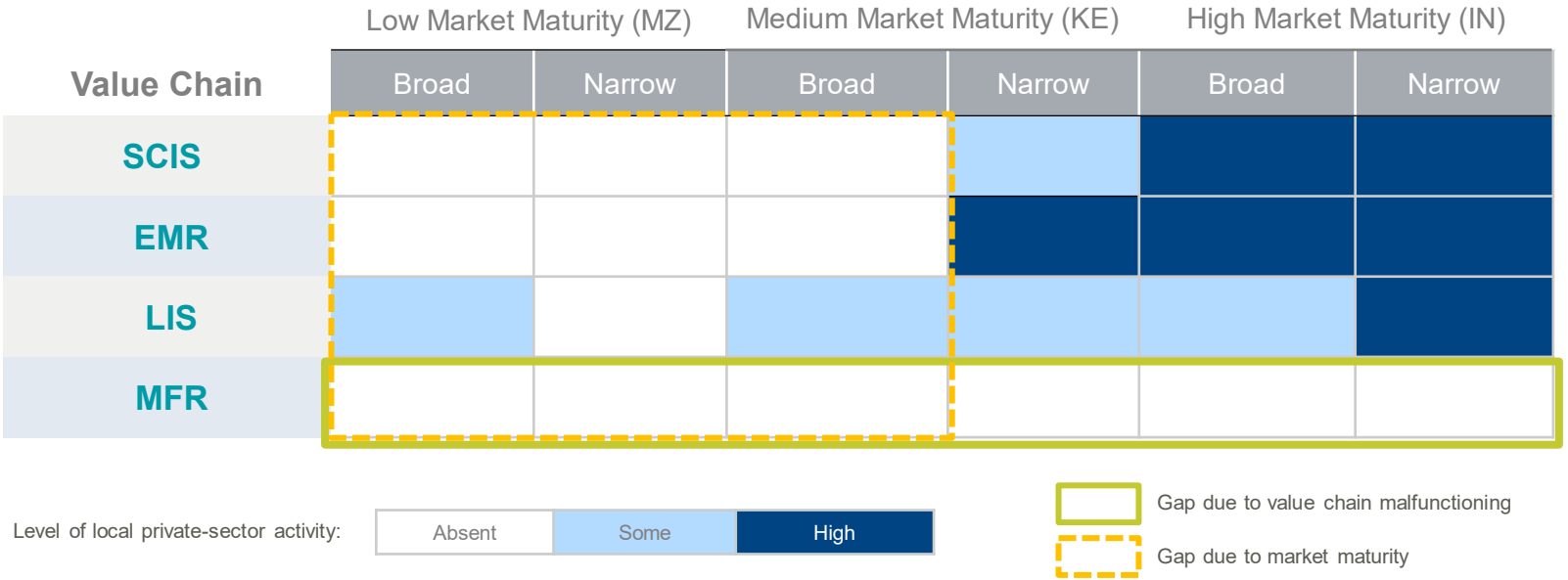
The software business model of a digital health solution impacts private-sector participation. Packaged global good and COTS solutions create the greatest opportunities for local private-sector organizations.



# Driver: Market Maturity, Functionality and Value Chain Health

## Impact of market maturity and value chain malfunctioning.

The absence of local private-sector software development activity in certain solution areas can be due to either low market maturity or a malfunctioning value chain. These gaps indicate where a global good could add value.



# Private Sector Engagement and the Role of Global Goods

- The private sector is playing an active role in delivering digital health solutions, but the nature of this participation varies based on **market maturity, value chain health, and system scope**.
- Local private-sector activity is less robust than it could be due to **procurement and program parameters** that reduce local organizations' ability to participate in software development, implementation, and maintenance and support.
- Gaps in local private-sector presence that are due to low market maturity and malfunctioning value chains indicate a **need for robust global goods** supported by strong communities of practice.
- **Packaged global goods** offer a model for delivering digital health solutions cost-effectively and while increasing opportunities for local private-sector growth.

# Assessment Summary and Recommendations

# Assessment Summary

Overall, digital health value chains are functioning. However, suboptimal dynamics exist within each of them, with some root causes common to all value chains and others that are specific to individual ones.

## *Root Causes of Common Issues Across All Value Chains*

***The primary causes of common issues across all four value chains can be summarized as:***

- Authoritative information on reasonable budgeting and cost categories for long-term solution management is lacking.
- Political pressure and organizational incentives exist to pursue implementations with insufficient investment.
- ICT oversight capacity within governments is inadequate (stemming from lack of appropriate funding for qualified headcount).
- Local ICT capacity is generally insufficient, impacting private-sector participation.
- Entrenched procurement processes discourage robust private-sector participation.

## *Root Causes of Issues in Specific Value Chains*

- ***SCIS and EMR:***
  - Donors are not incentivized to fund standards-based, interoperable solutions as interoperability is not seen as critically important to the disease-specific interventions they typically fund.
  - Governments lack the capacity to implement standards-based, interoperable solutions.
- ***LIS:*** There is not a clear and direct financial ROI for LIS, and the non-financial benefits of ROI to donors and to governments differ enough to cause a conflict between the types of LIS implementations they each need.
- ***MFR:*** There is a gap between perceived and actual value that results in limited demand for the creation of a standardized MFR solution by donors and governments.

# Recommendations

## Create opportunities for greater local private-sector involvement

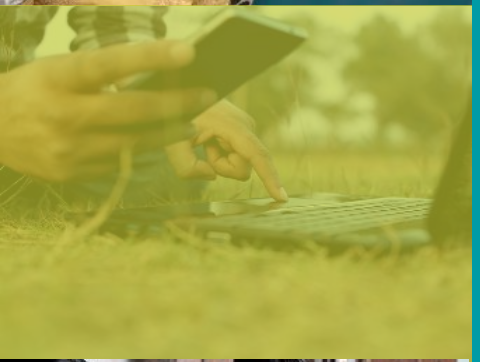
- Create mechanisms that overcome procurement barriers, including pooled financing vehicles and encouragement of prime/subprime relationships between established implementers and local private-sector organizations.
- Promote packaged global goods model as a new business model for local private sector.

## Build government capacity to oversee ICT investments

- Create appropriate governance and organizational structure and roles.
- Use initial funding to second people into the governance and organizational structure.
- Build capacity within the permanent government workforce through a targeted, accelerated professional development program.

## Create an authoritative source of information on reasonable budgeting and cost categories for long-term solution development and management

- Conduct in-depth reference budgeting exercise.
- Bring together other organizations who have developed similar or related tools.
- Create one jointly developed, mutually endorsed budgeting reference guide.
- Socialize guide with the field, including with ministries and donors, to stimulate buy in and use of the guide.



# Thank You!

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# Country-Specific Findings

# Local Private-Sector Engagement by Country

## Local private-sector participation grows as country market maturity level increases and where funders support local value chain actors.

| | Mozambique | Kenya | Uttar Pradesh (IN) |
|---|---|---|---|
| **Local Private-Sector Engagement** | ● SCIS: limited<br>● EMR: limited<br>● LIS: limited<br>● MFR: none | ● SCIS: inventory mgmt. (PoS)<br>● EMR: billing/admin systems<br>● LIS: limited, reference labs<br>● MFR: none | ● SCIS: ERP, private, pharma<br>● EMR: private healthcare<br>● LIS: private and reference labs<br>● MFR: |
| **Broad vs. Narrow*** | **Low** local private-sector presence in both broad and narrow | **Low** local private-sector activity in broad; **high** in narrow | **Medium to high** local private-sector activity in both broad and narrow |
| **Key Drivers of Private-Sector Engagement** | ▼ Government restrictions on private-sector participation<br>▼ Low ICT skill base<br>▲ NGO utilization of local private-sector firms | ▼ Procurement process stifles private-sector in MOH implementations<br>▲ Increased ICT capacity<br>▲ Innovation funding for developers<br>▲ Devolved political structure | ▼ State government reliance on NIC solutions<br>▼ Government reliance on established value chain actors<br>▲ Innovation funding<br>▲ Robust private healthcare system |

*Does not apply to MFR

● low ● emerging ● high ▼ negative impact (inhibitor) ▲ positive impact (enabler)

# Mozambique

Mozambique is characterized by low government and ICT capacity with an underdeveloped digital health ecosystem. Existing digital health activity is donor-driven and supported by USG contractors. Private-sector opportunities are limited.

- **Software ecosystem.** Donors shape digital health systems. Solutions are generally global goods with multi-partner global north implementation teams. Government-Donor tensions and problematic partner collaboration weakens the digital health environment.
- **Government processes and capacity.** Limited government capacity and ICT resources prevent government decision-making and system ownership. Procurement process bypassed due to donor decision-making power.
- **Centralized/decentralized decision making.** Centralized decision making allows government control over vendor selection; however, donors heavily influence the system and implementing partners. Inability to adequately pay for ICT resources and vendors in the value chain limit local private-sector engagement.
- **Supporting infrastructure.** Limited infrastructure and ability to support systems in-country impacting ability to scale, sustainability, and ROI.

SIGLUS (Stock Mgmt); GHSC-PSM and SELV (Vaccine Mgmt); Village Reach

OpenMRS; Jembi, eSaude
*Ntl EMR moving to Bahmni…*

DISA Link, OpenLDR; APHL

DHIS2, SCIS, EMR MFR

# Kenya

Kenya is characterized by strong national and subnational capacity and increasing ICT human capacity. Strong private-sector activity is driven by devolved government and universal health care. The country continues to struggle with scale due to high hardware costs.

- **Software ecosystem.** Characterized by a mix of private sector and global north donor-supported digital health solutions. Robust private-sector participation throughout the value chain due to presence of skilled ICT resources and universal health care.
- **Government processes and capacity**. Procurement process differences at national vs. county drives varying levels of scope, scale, standards, and vendors.
- **Centralized / decentralized decision making.** Devolution of power drives local value chain actor participation as counties possess decision-making authority. Donor involvement at the national level and program-specific level.
- **Supporting infrastructure.** Infrastructure remains nascent in rural areas, challenging the scalability of digital health systems. Availability of local capacity to support systems increasing ROI and sustainability.

KEMSA with ERP module (HR, Acct, Warehouse) eMobile, SVS, AfyaPaP, MaishaMeds, other inventory management solutions

Kenya EMR
AMRS (OpenMRS w/ Navision)
eHospital, and other EMRs w/ billing functionality

iLab (BLIS), DHIS2 Tracker
LabWare, DISA Link, mLab

Kenya MFR MOH developed

# India (Uttar Pradesh)

India is characterized by relatively strong national government capacity and ICT resources, along with a robust private sector building for public and private buyers, albeit not always with fit-for-purpose or interoperable solutions.

- **Software ecosystem.** Digital health systems grew out from MOH's NIC in-house developed solutions, utilizing empaneled software vendors where needed. Software development, implementation, maintenance and support are delivered by private-sector actors and government. A strong market exists for the private sector to meet public and private healthcare IT needs. The government is not reliant on donor funding and funds CapEx and OpEx.
- **Government processes and capacity.** Procurement process prevents unregistered foreign and small-scale private-sector involvement; however, donors are able to bypass procurement processes. ICT market capacity is strong with sporadic government capacity.
- **Centralized / decentralized decision making.** Number, size and varying levels of development across the states create unequal penetration of digital health systems and well-functioning value chains.
- **Supporting infrastructure.** High levels of infrastructure (e.g., smart-phone, mobile phone, broadband internet penetration) with high levels of local ICT skills.

eVin, E-Aushadhi, FPLMIS, many private-sector solutions across VC

PM-JAY, Apollo, ANMOL, CAS, Nikshay, eHospital, Dell's NCD App

No national LIS, 50% of labs have some type of LIS

National MFR

# Country Environment Summary

## Characteristics of the country's environment affect value chain functioning.

| | Mozambique | India (UP) | Kenya |
|---|---|---|---|
| **Software Ecosystem** | ✔ Donors shape digital health systems. Solutions are generally global goods. Government and donor tensions and problematic partner collaboration weaken the digital health environment. | ✔ Digital health systems are provided by the MOH's NIC, where in-house developed solutions and empaneled software developers are utilized.. A strong private sector exists. | ✔ Characterized by a mix of private-sector and global north donor-supported digital health solutions. Robust private-sector participation throughout the value chain. |
| **Government Processes And Capacity** | ✔ Limited government capacity and resources prevent decision-making and system ownership. Procurement process bypassed due to donor decision-making power. | ✔ Procurement process prevents foreign, small-scale private-sector involvement; however, donors able to bypass procurement processes. ICT market capacity strong with sporadic government capacity. | ✔ Procurement process differences at national versus county drives varying levels of scope, scale and standards, and vendors. |
| **Centralized/Decentralized Decision Making** | ✔ Centralized decision making allows government control over vendor selection. However, donor heavily influences the system and implementing partners. | ✔ Number, size, and varying levels of development across the states create unequal penetration of digital health systems and well-functioning value chains. | ✔ Devolution of power drives local value chain actor participation as counties possess decision-making authority. Donor involvement at the national level and program-specific level. |
| **Supporting Infrastructure** | ✔ Limited infrastructure and ability to support systems in-country impacting ability to scale, sustainability, and ROI. | ✔ High levels of infrastructure with high levels of local ICT skills. | ✔ Infrastructure remains nascent in rural areas challenging the scalability of digital health systems. Availability of local capacity to support systems increasing ROI and sustainability. |

# Additional Information

# Introducing Four Digital Health Solutions

Each value chain category includes a range of solution types that vary in terms of complexity and health system level.

| | SUPPLY CHAIN IS | ELECTRONIC MEDICAL RECORDS | LAB IS | MASTER FACILITY REGISTRIES |
|---|---|---|---|---|
| **DESCRIPTION** | A supply chain manages the acquisition, distribution, and management of health commodities. | An electronic medical record is a (digital) collection of patient data such as diagnoses, medicines, medical tests, and treatment plans. | A laboratory information system records, manages, and stores data such as test orders, results and interpretations for clinical laboratories and health facilities. | A master facility registry is a national list of all healthcare facilities, public and private, and may include facility attributes, e.g., number of beds, ventilators, services. |
| **SOLUTION TYPES** | ► National-level ERP system<br>► National logistics management<br>► National, subnational, programmatic inventory management<br>► Last-mile delivery | ► National EMR systems (disease-specific or comprehensive)<br>► Local or hospital-specific systems<br>► EMR modules in other information systems | ► National labs<br>► Reference labs<br>► Individual or network of labs<br>► Lab modules in EMR, DHIS2 | ► National MFR<br>► Facility lists in other HIS, SCIS, EMR, LIS |
| **SOFTWARE AND PLATFORM EXAMPLES** | ► SIGLUS-OpenLMIS (MZ)<br>► KEMSA (KE)<br>► eVin (IN)<br>► e-Aushadhi (IN) | ► AMRS (KE)<br>► OpenMRS (KE, MZ)<br>► eHospital (KE)<br>► Impilo (ZW)<br>► PM-JAY (IN) | ► iLabs-BLIS (KE)<br>► Labware (KE)<br>► DisaLink (MZ KE)<br>► Disease-specific systems<br>► Hospital-specific systems | ► India MFR<br>► Kenya MFR<br>► Lists/registries in other information systems |

# Illustrative Solutions by Software Development Model

SCIS and EMR implementations far outnumber those in MFR and LIS across all three geographies.

| | | Supply Chain Information Systems(SCIS) | Electronic Medical Records (EMR) | Master Facility Registry (MFR) | Lab Information Systems (LIS) |
|---|---|---|---|---|---|
| **Open Source** Implementations | Global Good | ► KEMSA***<br>► SIGLUS<br>► SELV<br>► Logistimo*** | ► KenyaEMR (OpenMRS)<br>► KenyaEMR (Bahmni)<br>► OpenMRS | | ► iLab (BLIS)***<br>► OpenLIMS |
| | Packaged Global Good | ► None Identified | ► eHospital<br>► Impilo*** | ► None Identified | ► None Identified |
| | White-Label | ► None Identified | ► AMRS (OpenMRS) | ► None Identified | ► AMPATH (BLIS) |
| **Proprietary** Implementations | Commercial Off-the-Shelf | ► Logistimo***<br>► SVS<br>► AfyaPap<br>► eMobile<br>► Maisha Meds | ► Funsoft<br>► MedBoss<br>► Fortis Innovations | ► None Identified | ► DISA Link<br>► Labware*** |
| | Bespoke Proprietary | ► E-Aushadhi***<br>► eVIN<br>► Dell NCD App | ► Apollo<br>► PM-JAY***<br>► Baobab (Malawi)*** | ► India MFR***<br>► Kenya MFR*** | ► mLab<br>► FIND TB |

**If not marked with ***, solution is narrow scope**

# Software/Platform Advantages and Disadvantages

Packaged Global Goods have the highest near-term and long-term ROI for governments, where the ROI for global goods and large-scale proprietary systems is realized in the long-term.

| | Proprietary | | Open Source | | |
|---|---|---|---|---|---|
| | **Bespoke or Custom Built** | **Commercial Off-the-Shelf (COTS)** | **White-Label Open Source** | **Packaged GG** | **Global Goods** |
| **Advantages to Government Owner** | + Tailored to program needs<br>+ GG or COTS customization costs are higher<br>+ ICT skills in-market | + Regional purpose-built COTS with the vendor providing affordable support | + No license fees coupled with regional vendor implementer, cost to scale low | + No license fees, localized, purpose-built, interoperable, standards-built, CoP with the vendor providing affordable maintenance and support | + No license fees, cost to scale low, with regards to license fees, interoperable and std-built, CoP improving for LMICs settings |
| **Disadvantages to Government Owner** | − TCO high, cost to scale if license fees present<br>− Requires ICT skills in market | − Global north COTS license cost and customization cost are high; cost to scale is high | − Reliance on the vendor for maintenance unless OpenHIE stack skills in-market | − Reliance on the vendor for maintenance unless OpenHIE stack skills in-market | − Multi-partner, complex implementation model is costly, lack of government ownership, lack in-country ability to support |

# Primary Inhibitors to Sustainable Scale of Digital Health in LMICs

| Barrier | Description |
|---|---|
| **Siloed Funding** | Focus on disease or program-specific funding |
| **Lack of Evidence** | Lack of concrete evidence that greater investment will have a significant impact |
| **Lack of Human Capacity** | Lack of leadership and ownership |
| | Lack of technical capacity |
| | Inability to retain staff |
| **Lack of Infrastructure** | Lack of reliable connectivity and power |
| **Design Issues** | Lack of focus on user |
| | Overly complex design standards |
| | Lack of process to evolve design standards to benefit from innovations |
| **Market Dynamics** | Lack of sustained, reliable, supporting market (supply and demand); informed, motivated, funded "customer" (government/donors) |
| **Insufficient Institutional or Organizational Structure at the Country Level in Governments and Between Cross-Sectoral Actors at the Country Level** | Lack of country governance and institutionalization |
| | Institutional immaturity (across sectors) with appropriate roles and organizational structure |
| | Inappropriate internal incentives |

*Note: Purple text indicates prioritized barriers, discussed on February 11, 2020.*