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# Software Global Goods Valuation Framework

*User's Guide*

USAID's **Center for Innovation and Impact (CII)** takes a business-minded approach to fast-tracking the development, introduction and scale-up of health interventions that address the world's most important health challenges. CII invests seed capital in the most promising ideas and novel approaches, using forward-looking business practices to cut the time it takes to transform discoveries in the lab to impact on the ground.

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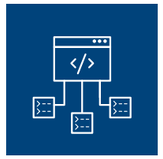
For contact information, and to download the latest version of *Software Global Goods Valuation Framework*, please visit www.usaid.gov/cii.

# Contents

# What is this Framework?

The ***Software Global Goods Valuation Framework***, or FinVal framework for short, is an Excel-based tool that enables donors, software development organizations, governments, and others to estimate the **cumulative development cost** for software global goods. This estimation is based on two key outputs:



1. The **retrospective development costs** of a software global good

2. The **ongoing costs** of maintaining or further developing the software's core functionality

Together these estimations of financial investments into software global goods provide a calculation of their valuation to-date, and can serve as a data point for consideration by decision-makers in selecting software systems to meet country public health needs. While the framework and this paper were developed in the context of global health sector opportunities and need, these tools and the findings their use enables can be more broadly relevant in other development sectors as well.



# Why is this Framework Needed?

As access to digital technologies and data services grows around the world, low and middle income countries (LMICs) are increasingly leveraging digital systems to overcome health systems bottlenecks (e.g. lack of access to high quality data and information, or insufficient availability of commodities and supplies) and improve health outcomes. To avoid fragmentation and duplication of digital systems, governments, normative bodies, and research papers are increasingly calling for national digital health strategies including the adaptation and re-use of mature, tested software global goods. In addition to promoting the use of trusted and scaled tools, the adaptation and re-use of software global goods can increase investment efficiencies, and align to the sustainability needs of developing country digital health systems.[1]

As digital global goods have grown in prominence, scale, and value in the recent years, many have become the digital health infrastructure tools of choice in developing countries. Accordingly, donors increasingly are focusing on how these tools in many LMIC health systems are adequately sustained. As a result, two key questions have emerged:

1. *What is the financial value of mature and scaled software global goods?*
2. *What are the ongoing costs required to maintain and enhance mature software global goods?*

The *Software Global Goods Valuation Framework* seeks to answer both questions by providing a framework to estimate:

**a.** the retrospective development cost of a software global good, and

**b.** the ongoing costs required to keep the core software stable, develop new features, and remain competitive.

In order to make informed decisions about digital health systems investments, stakeholders must be able to assess and understand the relative value of these global goods compared to building a new tool from scratch. Moreover, investors in software global goods need to understand what is required to keep these tools fully operational over time. By enabling a more robust view

[1] As country economies and digital health ecosystems mature, countries should assess whether software global goods are sufficient to meet their national priorities, and if global goods are sufficient or if other digital tools are preferable.

of costs, this framework aims to bring greater alignment and coherence to the way these tools are planned for by global good producers, invested in by funders, and used globally - both in terms of their initial development and installation, and their long term maintenance and improvement.

The creators of this framework conducted a landscape assessment of related cost estimator tools for global goods. At the time, no existing tool estimated both retrospective development costs and ongoing costs to provide an overall valuation of a software global good. The Excel-based framework contains an annex highlighting the purpose and scope of those landscaped digital health costing tools. [2]

[2] This framework is accessible at usaid.gov/cii



# What is a Software Global Good?

Software global goods are tools that are adaptable to different countries and contexts. A digital health software global good is a software tool that functions as a public good.[3] In practice this means they are often "free and open source,"[4] easy to implement and scale, interoperable amongst other commonly-used global goods systems, used to manage, analyze, or transmit data, and have proven utility in multiple health-related settings.

Digital Square, a partnership of a number of the world's leading digital health experts, has developed a Global Good Maturity Model to assess how advanced various digital health tools are, in order to help planners prioritize digital health investments. Digital health software global goods typically fall somewhere along a spectrum of maturity in meeting the following criteria:[5]

- Licensed as a free and open source software (FOSS)
- Support from a strong community
- A clear governance structure
- Funding from multiple sources
- Deployment at significant scale
- Use across multiple countries
- Demonstrated effectiveness
- Designed for interoperability
- Established as a pre-eminent application to achieve a given purpose

[3] Global public goods are characterized by three traits: 1) non-rivalry, meaning consumption by one party does not reduce the quantity available to others. 2) non-excludability, meaning it is impossible to prevent others from consuming the good, and 3) global availability.
[4] www.wiki.digitalsquare.io/index.php/What_are_Global_Goods
[5] www.digitalsquare.org/global-goods-guidebook

# Why Do We Need Global Goods for Digital Health?

Digital health solutions can provide tremendous value, efficiency, and visibility for governments, donors, and implementers. They can play a pivotal role in enhancing the capabilities, transparency, efficiency, and effectiveness of health services and systems, and the data they generate, in low-and-middle-income countries (LMICs). However, the rapid proliferation of digital health software in recent years has contributed to a deeply fragmented approach to the use of digital tools at a country-level as well as the under-resourcing of promising tools on a global scale. Individual, disease- or activity-focused digital systems often fail to be interoperable with one another, can be duplicative with other digital systems, and often are not integrated into the national health system infrastructure.

The global health community needs to move toward a more strategic and holistic approach to digital health. This includes better aligning with country priorities (such as a country's digital health strategy and architecture), and making more strategic investments that promote long-term sustainability of funded digital systems. This strategic shift includes sufficient consideration of software global goods as well as licensed, proprietary systems, in order to ensure that identified solutions meet user requirements, adhere to country policies and regulations, and are sustainable by in-country stakeholders over the long term.[6] Supporting the development, adoption, and scale-up of software global goods can strengthen data quality in countries around the world, enabling health workers and policymakers to make more evidence-based decisions to improve health outcomes. Streamlining and consolidating the number and types of digital health technologies used will concentrate funding in the most promising digital systems and enable these tools to consistently improve. Additionally, consolidated investment in and use of software global goods more readily enhances the transfer of ownership, capacity, and sustainability to in-country stakeholders and local private sector players. This approach is critical to promoting countries' Journey to Self-Reliance [7]. Global goods bring much-needed efficiency and value to the digital health space and reduce the overall cost and complexity for countries to implement digital health systems.

Given the value that software global goods can bring to digital health, there has been a growing call to further leverage these tools. The Principles for Digital Development, created by donors and implementing partners, aim to address issues of fragmentation and sustainability by creating a unifying set of principles for those working in digital development.[8] These principles encourage the use of open standards and open source software as well as call for the reuse of global goods software and knowledge tools in order to increase collaboration, reduce duplication, and build for sustainability and scale. The Principles of Donor Alignment for Digital Health, a set of guiding principles created by donors to align digital health investments in-country, explicitly call for the use of global goods to achieve this alignment.[9] Additionally, in 2018 the Word Health Assembly adopted a WHO digital health resolution that calls for the integration of digital technologies into national health systems by optimizing the use of existing platforms and services, a prime example being software global goods. The resolution explicitly requests WHO member states to reuse and adapt existing digital tools where relevant.[10]

## PRINCIPLES OF DONOR ALIGNMENT FOR DIGITAL HEALTH

- Collaborate
- National strategies
- Prioritise national plans
- Maturity continuum
- Quantify costs
- Country capacity
- Track & measure
- Global goods
- Strengthen donor skills
- Sharing and peer-learning

[6] www.nationalacademies.org/hmd/reports/2017/global-health-and-the-future-role-of-the-united-states.aspx
[7] www.usaid.gov/selfreliance
[8] www.digitalprinciples.org
[9] www.digitalinvestmentprinciples.org/
[10] www.apps.who.int/gb/ebwha/pdf_files/WHA71/A71_ACONF1-en.pdf

# Who Should Use this Framework?

This framework can be used by two primary groups of stakeholders to better understand the true foundational and ongoing costs of developing software global goods in order to understand their cumulative financial valuation.

## INVESTORS

- Investors in global goods platforms are a key intended audience for this framework. Country governments, external funders (e.g. donors, lenders), implementing partners and other organizations that fund, build, or launch these global goods can use this framework to better understand the cost of development of the various digital health platforms in which they invest.
- For instance, donors can use this framework to assess the comparative value of an existing global good relative to other platforms and identify the total level of funding necessary to maintain and sustain the core platform. By understanding the effort that has already been invested in these platforms, governments and their partners can use this framework to assess existing software global goods that may be suitable for adaptation and re-use in meeting countries' health sector priorities.

## PLATFORMS

- Software global goods producers can use information from this framework to inform business modeling, fundraising, and long-term sustainability planning. By enabling the calculation of the retrospective value of investments into these global goods, the use of this framework can result in a critical selling point for current and potential investors. By supporting a calculation of ongoing core support costs, the framework can provide a key data point with which to advocate for ongoing operational funding.



# How Does this Framework Work?

Cumulative development costs comprise both retrospective development costs and ongoing maintenance and product development costs of a global good. At a high level, these two cost categories can be broken down in the following way:

## RETROSPECTIVE PROJECT DEVELOPMENT COSTS:

This category refers to the costs to develop the initial global good to its current state, including gathering requirements, designing, developing, testing, and deploying the global good.

Three methodologies were used in combination to evaluate retrospective project development costs:

- **An FTE-based analysis**, which assesses staff-hours that have gone into developing a global good over time and includes a number of labor categories.
- **A revenue-based analysis**, which measures grants and other spending that has gone into building the core global good.
- **A code-based analysis** called COCOMO 81, which estimates development effort based on the number of lines of code in the product. Output from the COCOMO approach can be viewed as an approximation of the replacement cost for a global good if all effort was to be compensated at fair market value.

Three separate calculation methods were leveraged to create a range of values for any given development project in case any one method over- or underestimated costs.

## ONGOING DEVELOPMENT COSTS:

This category refers to the annual operating costs to maintain, enhance, and expand the core global good, including development work for new releases with progressive improvements, maintenance of the global good, infrastructure costs, community support costs, and overhead. This estimation included costs of keeping the software functional and operational as well as costs related to enhancing and improving the global good to keep it competitive.

The Excel-based framework contains more detailed information on the methodology behind the three retrospective cost estimation approaches and the ongoing cost estimation approach, advantages and disadvantages of each, as well as overall insights and learnings from the costing analyses of these three global goods.

# Testing the Framework

Three software global goods were selected to inform the development of this costing framework and assess cumulative development costs. The methodology for selecting the three global goods consisted of identifying a candidate list of global goods and paring down to three tools based on a set of ranked selection criteria and a desire to assess a diverse array of platforms. These criteria included enterprise-level functionality, the range of uses of the tool, applicable business models or revenue strategies, number and type of end users, level of maturity and uptake of the global good, and finally, comparability with commercial software.

For each of the three selected global goods—CommCare, OpenMRS, and iHRIS (see text box for an overview of each)—deep dive costing analyses of the cumulative development cost were performed. The three global good developers provided data such as labor hours, grant funding, and maintenance costs, which were instrumental to building, testing, and refining this framework.

**CommCare** is an open source platform for creating mobile data-entry and decision support applications for front-line health workers. The apps created by CommCare span a wide range of health interventions from childhood health to HIV care to Ebola responses. In a typical deployment, the app (running on a mobile phone or tablet) guides health workers through steps for triage or diagnosis while simultaneously asking the worker to input relevant health data. Collected data is synced to a server and viewable by analysts or managers in reports. CommCare has been solely developed by Dimagi, Inc, a mission-driven, for-profit corporation based in Cambridge, MA with satellite offices in numerous LMIC countries. CommCare has been widely deployed in over 80+ countries across more than 2,000 projects, and has an active user base of over 300,000 people. Historically, Dimagi primarily relied on implementation project funding and some targeted grants to develop CommCare.

**OpenMRS** is an open source electronic medical record platform. OpenMRS provides the core data record component, a reference front end application, and a large selection; adoption in 3,500+ locations of add-on modules to support specific health use cases (e.g. Ebola) and integrations (e.g. single sign-on). OpenMRS is not designed to be used as an out of the box solution; instead countries or implementers are expected to customize an electronic medical record by combining a selection of existing modules with other specific customizations. OpenMRS began through a partnership between Regenstrief Institute (Indiana University) and Partners in Health in 2004. Today, OpenMRS intellectual property, copyrights, and representation is represented by OpenMRS, Inc., a lightweight legal entity. While initially many of these deployments have been of limited scope, spanning a limited time period or a specific health use case, there have been increasingly a number of large-scale LMIC deployments. Kenya, Uganda, Nigeria, Mozambique, Rwanda, Bangladesh, Philippines, and Nepal are currently at various stages of national-level implementations. Additionally, OpenMRS has served as the technical foundation for a collection of secondary products such as Bahmni and OpenSRP. A majority of OpenMRS's existing code base was built by a combination of volunteers and implementing organizations.

**iHRIS** is a suite of human resources software for managing a health care workforce. The three primary tools consist of iHRIS Manage, which supports tracking of employees and positions, iHRIS Train, which tracks training progress and certifications across the entire workforce, and iHRIS Qualify, which tracks registration and licenses for health care workers to ensure quality of care. Each individual software can be deployed independently or in conjunction. iHRIS is a browser-based application and supports deployment on an isolated PC or via a remote server. iHRIS has been deployed in 24 countries, primarily in Africa but also in India, Tajikistan, and Guatemala. While the number of deployments is small relative to OpenMRS or CommCare, most deployments are large scale, covering 10,000+ health workers. The two largest deployments in Uganda and Nigeria each cover 300,000+ workers. iHRIS is developed and maintained by IntraHealth International, a Chapel Hill, North Carolina-based non-profit. Almost all implementations have been led by IntraHealth as the prime contractor. Funding has come primarily in the form of project implementation funding, with two large grants (Capacity and CapacityPlus) from USAID providing most of the funding.

# What is this Framework *not* Meant to Be?

The *Software Global Goods Valuation Framework* **is not a tool to estimate the quality of a software global good**. The overall quality, development infrastructure, functionality, and business models of these global good platforms are not being evaluated, nor are the potential applicability of these tools to different countries or health contexts.

The *Software Global Goods Valuation Framework* **is not a total cost of ownership tool**. A total cost of ownership tool would also include a standard way to calculate the country-level global good implementation costs. Although the analysis for this project did include retrospective project costs for in-country implementations of CommCare, OpenMRS, and iHRIS, it was determined that the scale and scope of the in-country digital health global good implementations were too varied to create a standard estimator of these costs.

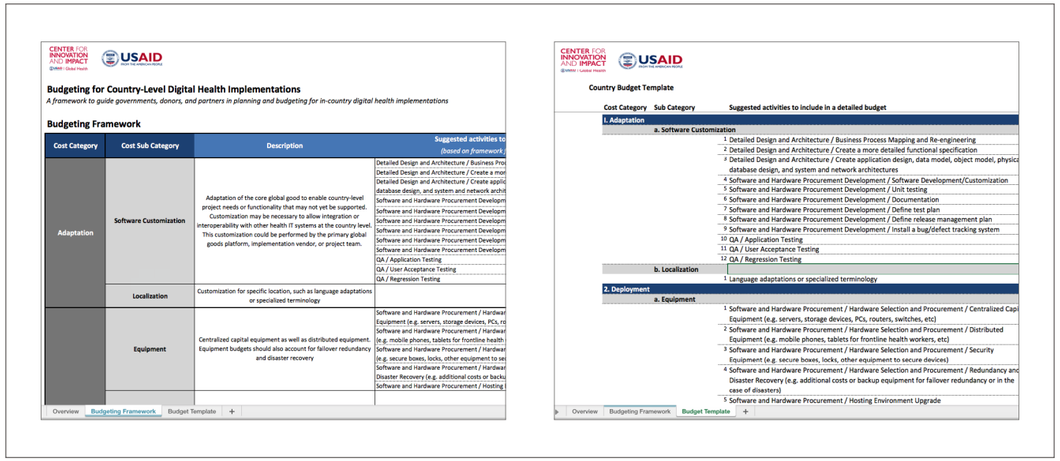
The *Software Global Goods Valuation Framework* **is not a tool to measure return on investment (ROI), cost efficiencies, or cost-effectiveness derived from platform use**. There are a number of existing initiatives exploring the ROI of shifting to digital health platforms overall, and this framework is not part of those efforts. This framework is meant to help value a core component of a digital health system, not provide commentary on the overall value or return of implementing a digital health system in a given country or context.



# What about Budgeting for Country-level Digital Health Global Goods Implementations?

The *Software Global Goods Valuation Framework* does not evaluate the cost to deploy a digital health global good to a certain country. Given the vast differences in scale and scope of country-level digital health implementations, it is not possible to equally compare digital health implementations across different contexts in order to estimate a total cost of ownership for a given global good. As mentioned, this framework is only designed to assess the retrospective cost to develop a software global good and the ongoing costs required for upkeep, maintenance, and improvement.

However, it is critical to provide governments, implementing partners, and other country stakeholders with a comprehensive framework to adequately budget and plan for country-level uses of digital health global goods. With this in mind, we have developed a supplementary framework to help countries think about what line items to consider when developing a robust budget template for a global good digital health implementation. Called ***Budgeting for Country-Level Digital Health Implementations***, this framework can help countries think more holistically about budgeting for digital health global goods and can be a helpful starting point for countries to develop detailed line-item budgets for prospective deployments. This document can be found on the CII website.[11]



**Budgeting for Country-Level Digital Health Implementations**

*A framework to guide governments, donors, and partners in planning and budgeting for in-country digital health implementations*

**Budgeting Framework**

| Cost Category | Cost Sub Category | Description | Suggested activities to (based on Framework) |
|---|---|---|---|
| Adaptation | Software Customization | Adaptation of the core global good to enable country-level project needs or functionality that may not yet be supported. Customization may be necessary to allow integration or interoperability with other health IT systems at the country level. This customization could be performed by the primary global goods platform, implementation vendor, or project team. | Detailed Design and Architecture / Business Pro<br>Detailed Design and Architecture / Create a mor<br>Detailed Design and Architecture / Create applic<br>database design, and system and network archit<br>Software and Hardware Procurement Developm<br>Software and Hardware Procurement Developm<br>Software and Hardware Procurement Developm<br>Software and Hardware Procurement Developm<br>Software and Hardware Procurement Developm<br>QA / Application Testing<br>QA / User Acceptance Testing<br>QA / Regression Testing |
| | Localization | Customization for specific location, such as language adaptations or specialized terminology | |
| | Equipment | Centralized capital equipment as well as distributed equipment. Equipment budgets should also account for failover redundancy and disaster recovery | Software and Hardware Procurement / Hardwar<br>Equipment (e.g. servers, storage devices, PCs, ro<br>Software and Hardware Procurement / Hardwar<br>(e.g. mobile phones, tablets for frontline health<br>Software and Hardware Procurement / Hardwar<br>(e.g. secure boxes, locks, other equipment to se<br>Software and Hardware Procurement / Hardwar<br>Disaster Recovery (e.g. additional costs or backu<br>Software and Hardware Procurement / Hosting |

Overview | Budgeting Framework | Budget Template | +



**Country Budget Template**

| Cost Category | Sub Category | Suggested activities to include in a detailed budget |
|---|---|---|
| 1. Adaptation | | |
| | a. Software Customization | |
| | | 1 Detailed Design and Architecture / Business Process Mapping and Re-engineering |
| | | 2 Detailed Design and Architecture / Create a more detailed functional specification |
| | | 3 Detailed Design and Architecture / Create application design, data model, object model, physica database design, and system and network architectures |
| | | 4 Software and Hardware Procurement Development / Software Development/Customization |
| | | 5 Software and Hardware Procurement Development / Unit testing |
| | | 6 Software and Hardware Procurement Development / Documentation |
| | | 7 Software and Hardware Procurement Development / Define test plan |
| | | 8 Software and Hardware Procurement Development / Define release management plan |
| | | 9 Software and Hardware Procurement Development / Install a bug/defect tracking system |
| | | 10 QA / Application Testing |
| | | 11 QA / User Acceptance Testing |
| | | 12 QA / Regression Testing |
| | b. Localization | |
| | | 1 Language adaptations or specialized terminology |
| 2. Deployment | | |
| | a. Equipment | |
| | | 1 Software and Hardware Procurement / Hardware Selection and Procurement / Centralized Capi Equipment (e.g. servers, storage devices, PCs, routers, switches, etc) |
| | | 2 Software and Hardware Procurement / Hardware Selection and Procurement / Distributed Equipment (e.g. mobile phones, tablets for frontline health workers, etc) |
| | | 3 Software and Hardware Procurement / Hardware Selection and Procurement / Security Equipment (e.g. secure boxes, locks, other equipment to secure devices) |
| | | 4 Software and Hardware Procurement / Hardware Selection and Procurement / Redundancy and Disaster Recovery (e.g. additional costs or backup equipment for failover redundancy or in the case of disasters) |
| | | 5 Software and Hardware Procurement / Hosting Environment Upgrade |

Overview | Budgeting Framework | Budget Template | +

[11] www.usaid.gov/cii

# What are the Major Takeaways from the Development of this Framework?

1. **Software global goods for digital health offer tremendous value**. The outputs of testing this framework on three diverse software global goods found that foundational investments in these global goods are significant, leading to two main conclusions:

   - *Don't build from scratch.* It would take a great deal of financial and human resources to recreate the global good from scratch, indicating a **high replacement value**. The resources needed to build the global good software alone can exceed by many times the total digital health budget for a typical country implementation.
   - *Mature global goods can reach a size and complexity comparable with enterprise proprietary solutions*. The resources, time, and labor already encapsulated in a global good can be **equivalent to or exceed that in proprietary enterprise-level tools.** Leveraging existing global good software for a given digital health deployment allows funding to be focused on developing local capacity or customizing the tool for specific project needs rather than paying for licenses.

   These conclusions speak to the importance of reusing existing global goods to support project and program implementations in order to avoid investing in duplicative tools that waste scarce development funding, contribute to fragmentation of digital and data systems in countries, increase the management and reporting burden on countries, and fail to harness the financial and other value of widely tested and scaled software global goods. Given the numerous demands on the time of many in-country stakeholders, overall declining foreign aid funding, and the need to move toward more integrated digital health infrastructure, starting with an existing global good can be extremely valuable for governments, donors, and partners alike. These findings underscore the critical need for country-level digital health implementations to consider customizing existing global goods platforms for their needs rather than building a new product from scratch.

2. **In order to reap the value that software global goods can offer, it is critical to budget for their ongoing maintenance and enhancement.** In order to take advantage of the existing investments made in these digital platforms, it is necessary to ensure sources of funding to maintain, enhance, and evolve the core global good. Understanding the costs required for upkeep of the global good can help platform developers ensure maintenance and integrity of their work, assist governments in comprehensively budgeting for in-country implementations, and enable increased and better coordinated donor investment in software global goods for digital health. Not budgeting for the ongoing cost of maintaining the global good can result in wide-reaching negative implications for the number of projects using the tool, such as security vulnerabilities or underlying system failures. Varying business models that can result in many different types of ongoing annual costs, this framework can be a helpful instrument to define, standardize, and articulate what those costs are in order to account for them more effectively. Furthermore, budgeting for funding to modify and update a tool with new features and improvements is critical to ensuring the global good remains competitive and relevant, and many modern software platforms have a steady or growing development budget year to year as opposed to large upfront costs and low ongoing maintenance costs.

3. **Objective evaluations of cumulative development costs are essential.** Self-evaluations of the retrospective software global goods' development and ongoing maintenance costs may be challenging for software organizations or result in bias in results. When possible, it is recommended to strive for a third-party evaluation of the cumulative development costs for any given software global good. It is also important to note that variations in analyses done on the same organization may also exist, depending on how labor and effort are categorized. The Excel-based framework offers recommendations and guidelines in selecting inputs to ensure as much objectivity as possible, but variance is to be expected.

4. **Governments and their partners should focus on the overall digital health ecosystem.** As countries strive to understand how different tools can be valuable for them, and the core differences between software platforms, it will be critical to keep a sharp focus on the overall architecture and digital health infrastructure across the country to ensure interoperability and linkages with other systems and country health priorities. Regardless of the type of platform used, a successful digital health implementation requires strong governance, change management processes that accompany digitization, in-depth training, ongoing supportive supervision, human resource capacity, sustainability plans, and integration with other components of the country's digital infrastructure and overall health programming.

# What are Short-term and Long-term Next Steps?

## SHORT-TERM:

1. The ***Software Global Goods Valuation Framework*** and this accompanying User's Guide seek to foster a discussion amongst developing country governments, funders, and other development partners around **whether publicly-funded investments in digital systems should leverage software global goods by default**. Further discussion is needed to socialize this concept and engage a variety of actors in debate.

2. To support development actors' understanding of and access to software global goods, a **compendium of software global goods** approaching or at high levels of maturity is needed to support digital health planning. Such a compendium could be supplemented with data produced through the use of this framework to combine visibility into the valuation of a tool alongside other descriptive aspects of a tool's functionality.[12] More broadly, a central platform is needed to provide a **one-stop shop for accessing software global goods**, understanding their key features and applicable use cases, and obtaining supporting information such as user guides and manuals.

## LONG-TERM:

1. In the longer term, this framework can be used to: **foster in-depth conversations around optimal strategic support for countries, shortlist tools for different types of digital health implementations, and consider the quickly-evolving landscape of maturity of software global goods as well as country digital health ecosystems**. Given the need to make the most strategic and cost-effective investments in digital health due to declining overall development funding, these conversations can help assess the relative valuation and merits of global health investments in software systems.

2. In the future, it would be helpful to build on this groundwork by creating a framework to **compare the economics of using software global goods for digital health implementations versus customized solutions or commercial off-the-shelf solutions**. This type of analysis can help users understand if and when global goods may be more cost effective than other software alternatives. The modeling in this framework enables analysis of a small portion of the overall body of work needed to undertake comprehensive modeling of financial and costing in the use of software in real world contexts. For much of this analysis there is not yet a clear set of literature supporting rigorous, standardized approaches to undertaking such assessments. More research and modeling frameworks like this one are needed to inform future decision-making.

3. The presence of scaled, software global goods offers a unique opportunity to **engage with and amplify growing local private sector and entrepreneurship networks in LMICs.** Customization of software global goods, country dashboards, maintenance, and deployment assistance for digital health projects can be supported by in-country and/or regional private sector firms, which in turn can promote capacity building and a country's Journey to Self-Reliance.

4. The use of this framework furthermore can help **inform efforts to identify key market gaps**, such as the development of "middleware," or software that acts as a bridge between other software, databases, or applications. In essence, middleware is the connective tissue that connects different platforms and makes them interoperable. The further development of middleware is critical to capturing value from existing digital health platforms and front-end applications by ensuring both closed- and open-source solutions are connected and interoperable. Surfacing the most prominent digital health software global goods requiring interoperability is an important step in that direction.

Finally, these discussions and activities are an opportunity to put forward a list of best practice in the adaptation and re-use of software global goods. The text box below is a start to that discussion.

### Considerations in Software Global Goods Use

- If you are considering building a new software tool, it is critical to:
  - » Undertake a thorough landscaping to ensure there are not already existing software global goods with large amounts of investment that could be modified to meet anticipated needs, and
  - » Carefully account for the considerable complexity of building a new software global good, see O'Reilly Media report *Producing Open Source Software*[13]
- Adhere to the Principles for Digital Development[14]
- Ensure appropriate overhead to enable proper documentation of code and use of use of metadata (industry standard is approximately 15-20%)

[12] For a preliminary list of digital health software global goods, refer to the Digital Square Global Goods Guidebook: www.digitalsquare.org/global-goods-guidebook

[13] www.shop.oreilly.com/product/9780596007591.do

[14] www.digitalprinciples.org

# Appendix:

Three global goods, A. CommCare, B. OpenMRS, and C. iHRIS were evaluated as part of the process of creating this tool. Here are the high level results:

## A. CommCare

**Cumulative Development cost for Core GG**

**Retrospective Development Cost**

- FTE-based method estimates **$15.6M** development cost
- Revenue-based method estimates **$11.9M** in dedicated core funding
- COCOMO methodology implies market replacement cost of **$22M**

**Onging Cost**

- Annual run rate estimated at **$4.2M**
- *Dimagi did not split out between "keep the lights on" and "continued development"*

**Country / Project Cost**

**Project Cost**

- Country / Project costs vary considerably based on size and scope of project
  - » CRS / Vatsalya ReMiND project cost **~$1M** over 3 years covering ~200 health workers
  - » TdH IeDA project much larger, costing **$7.7M** over 4 years in 606 sites in Burkina Faso

## B. OpenMRS

**Cumulative Development cost for Core GG**

**Retrospective Development Cost**

- Direct spend on development of OpenMRS estimated at **$4–5M**, though valuation of in-kind contributions suggests **~$8M** is more reflective of total cost
- COCOMO methodology implies market replacement cost of **$76M**

**Onging Cost**

- Optimal annual run rate estimated at **$2.8M**
  - » **$1.1M** predicted to keep the lights on
  - » **$1.7M** additional funding required for further development

**Country / Project Cost**

**Project Cost**

- AMPATH project in Kenya estimated to cost **$1.4M** over 5 years

## C. iHRIS

**Cumulative Development cost for Core GG**

**Retrospective Development Cost**

- Direct spend on development of iHRIS estimated at between **$1.8M** and **$2.4M** with dedicated core funding provided through Capacity and CapacityPlus projects
- COCOMO methodology implies market replacement cost of **$10.8M**

**Onging Cost**

- Optimal annual run rate estimated at **$1.25M**
  - » **$0.67M** predicted to keep the lights on
  - » **$0.58M** additional funding required for further development

**Country / Project Cost**

**Project Cost**

- Country / Project costs vary considerably based on size and scope of project
  - » Catholic, Lutheran, Anglican project in Namibia estimated to cost **< $300K** over 4 years for 6 sites
  - » Uganda nationwide rollout estimated to cost **$3.7M** over 5 years for 112 sites

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