Digital Health Assessment Toolkit Guide

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Digital Health Assessment Toolkit Guide

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Disclaimer:

The guide and the scoring tool are both living documents and will be revised accordingly in future versions.

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Health, Nutrition & Population

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Section 1
Introduction

The advancement of technology and the exponential growth of data are providing the opportunity to Low Income Countries and Lower Middle-Income Countries to leapfrog and improve quality of care, decision making, the efficient use of resources, while reducing costs and burden of diseases.

Recognizing the promise and potential of digital systems, technologies, and data to support the redesign of PHC and solve pernicious healthcare challenges in countries, digital health assessments intend to be an input and the first step towards the digital journey and to plan and prioritize what a country's health system of the future would look like. As expressed in the WHO's Global Digital Health Strategy—approved by WHO member states in 2021—"Digital health should be an integral part of health priorities and benefit people in a way that is ethical, safe, secure, reliable, equitable and sustainable. It should be developed with principles of transparency, accessibility, scalability, replicability, interoperability, privacy, security and confidentiality."

> *Digital health should be an integral part of health priorities and benefit people in a way that is ethical, safe, secure, reliable, equitable and sustainable.*

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Section 2
What is a Digital Health Assessment?

Understanding the ecosystem, infrastructure, resources and current state of digital health is important to make a successful digital health investment such as digital health strategies or disruptive technologies.

When conducting assessments, a general practice is to use a maturity model methodology. "A maturity model describes the process components that are believed to lead to better outputs and better outcomes.". In general maturity models focus on people, processes, technology, and organizational capabilities and help understanding the current state of things and determine a future goal. Low maturity levels show an opportunity for investment and leapfrogging while higher maturity levels illustrate a higher probability of success for disruptive interventions. [1]

Figure 2.1   Reasons for conducting digital assessments

THEORY OF CHANGE

If countries are able to measure and monitor their progress and maturity in digital health,

⬇

... then they can identify key gaps to inform the development of policies, scale up and integration of systems, and investment in human and financial capital.

⬇

This contributes to a supportive enabling environment and the availability, quality, and use of data to measure and track the strength of the health system and the ability for countries to achieve Universal Health Coverage and improved health outcomes.

GDHI USE CASES

USE CASES	EXAMPLES OF USERS
Benchmark a country on a spectrum of adoption of digital technologies for health, and help countries track progress and maturity over time.	• Governments • International Organizations and NGOs • Donors
Advocate for resources to be allocated for digital health at a country and international level to promote donor, public, and private sector investments.	• Governments • Private companies • Donors • International Organizations and NGOs
Create an avenue to find countries performing well or with key lessons learned to facilitate cross-country learning.	• Governments
Support private sector entrepreneurs and investors to strategically prioritize new market entry and strategies.	• Private companies

Source: Global Digital Health Index

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[1]   Digital Health Investment Review Tool (USAID) and HIS Interoperability maturity toolkit (MEASURE Evaluation)

Conducting an assessment is an opportunity for a country/organization to benefit for several relevant insights that will allow better planning and strategy, as well to get various gains as shown in figure 2.2 below[2]:

Figure 2.2   Gains from conducting digital assessments

| Measure the ability of an organization to continuously improve in a specific discipline | It helps to understand the current status and how was achieved, to set new paths | The greater the **maturity level**, the stronger the system **and its capability to withstand interruptions** | It identifies strengths, weaknesses, opportunities and threats | Can be used for benchmarking with the own country, with other systems, or with a defined standard |

Currently, there are various digital health assessments tools created by different donors and organizations that help countries/organizations to assess and evaluate their digital maturity, from a more macro perspective to a more specific one such as data, AI, interoperability, infrastructure and information systems.[3] While in the past these assessments were generally focused on one of the areas of digital health, mainly technology and architecture, with the latest developments in software, applications and the recognized value of data, an overall approach is needed. Figure 2.3 shows the several components of digital health, and what should look like the evolution in each one of them.

Figure 2.3   Components of a comprehensive digital health system

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[3]   For an inventory of the different assessments, see Appendix

The results and outcomes of the assessment can then be analyzed by using graphs or visualization tools such as dashboards. These tools facilitate the understanding of results and help to focus on the needs and gaps for policy making.

Figure 2.4   Different outputs from digital assessments

The Global Digital Health Index world map shows the maturity levels of each country where the GDHI has been done and allows to download the results for comparisons

Source: Global Digital Health Index.

The HIS Interoperability kit uses a spider-web graph to analyze in which areas the country/organization is lacking or showing high maturity

Source: MEASURE Evaluation HIS Interoperability.

The WHO Digital Health Atlas shows the different digital health interventions across countries.

Source: WHO Digital Health Atlas.

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Section 3
The Digital Health Assessment Toolkit

The World Bank Group is a signatory of The Principles of Donor Alignment for Digital Health[4] in which it committed to not finance digital health investments unless an assessment has been done.

To collaborate with other donors and organizations and reduce fragmentation, The World Bank Group has integrated and combined from different digital health assessment tools in one large digital health assessment toolkit. In this sense, the present toolkit takes a hybrid approach that can be used to fill in other tools or get input from those.

3.1 Assessment tools

The toolkit is composed by three assessment mechanisms which are briefly explained as follow:

1. **Digital Health Landscape profile**: A set of quantitative indicators including basic sociodemographic information, Information & Communication Technologies coverage, type of digital health interventions and quantitative information on exposure of digital health within workforce.

2. **Digital Health Maturity scoring tool:** A maturity score framework was built that analyzes the maturity of digital health across 4 areas: Digital Ecosystem and Governance, Architecture & Data, Applications and Analytics. Within each area several indicators are presented (74 in total) that explore various topics such as: Leadership and Governance, Strategy and Investment, Legislation, Policy & Compliance, Workforce, Standards and Interoperability, Infrastructure, Services and Applications.

3. **In-depth interviews and workshops:** The purpose is to collect primary and secondary source information to understand in more depth some of the topics covered. In addition, this mechanism will be used to discuss the results, establish the maturity level and generate the input for a future digital health roadmap strategy and interventions.

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[4]   https://digitalinvestmentprinciples.org/

Figure 3.1   Assessment tools

Literature review and databases: Secondary source. Mainly used for Digital Health Landscape profile and validation of answers

Online form: Used for collecting answers to build a maturity score.

Online interviews: In-depth interviews to expand relevant topics or results of preliminary results from the online form

Virtual Workshops and discussions: Used to validate, discuss and reach consensus on the digital health assessment and maturity. Create an input for future digital health interventions and or strategies.

3.2 Assessment process

i. **Determine the need for an assessment:** The Principles of Donor Alignment for Digital Health indicate that not finance digital health investments should be provided unless an assessment has been done. In this step, it is relevant to agree with the country/organization what is the objective of the assessment, i.e., benchmarking, review progress, determine baseline

ii. **Determine the scope:** In this stage, the country/organization should decide based on the need the scope of the assessment. Assessments can be conducted at the national or sub-national level, can be focused on a specific area (infrastructure, AI, data, etc.) or provide a general picture.

Figure 3.2   Assessment workflow

Source: MEASURE Evaluation HIS Interoperability toolkit.

iii. Establish an oversight team: For an assessment to be successful, it is important to get the buy in from the different stakeholders. An oversight team can fulfil this duty and should oversee the coordination of logistics, deadlines, review progress.

iv.   **Conduct a desk review:** In this step, secondary sources should be reviewed as well to understand the ecosystem and stakeholders that should be included in the assessment.

v.   **Assemble the assessment team:** This include both the team that will conduct the assessment but also the list of stakeholders to be interviewed.

vi.   **Collect data:** It is important to define the methodology, logistics, tools to collect the necessary data that will allow to answer all the relevant questions.

vii.   **Analyze data:** Once data is collected; it needs to be grouped and analyzed to get preliminary results. This process can occur a couple of times depending on inputs from discussions and validation.

viii.   **Action planning:** Once data is collected and outcomes and maturity is agreed, the assessment should be the input for the next phase, depending on the need and scope agreed at the beginning.

For an assessment to be successful is important to:

- Engage leadership: Select a point person who will work with the technical & advisory team

- Choose an objective team to conduct it

- Scope should be well defined (national, subnational, general, specific, topic)

- Team should be as much diverse as possible, including experts

- Repeat assessments in the future

3.3 Digital Health Landscape profile

The Digital Health Landscape profile is a summary of 50 quantitative indicators grouped under 5 domains that provide a comprehensive snapshot of the current situation of a country and the enablers for digital health. The indicators help to build a background for the maturity scoring tool answers.[5]

1	**Socio-demographics and healthcare system basic information**	– Population Size – Population Density – Population growth – Rural population – Life Expectancy at birth – GDP per capita – Income Level – # of total operational health facilities	– # of hospitals – Physician density (number per 10,000) – Nurse density (number per 10,000) – # of national hospitals – Health Expenditure as % of GDP – Public Expenditure as % of GDP – Digital Health Budget
2	**Digital Environment**	– eGovernment development index – # of startups	– Number of technology companies
3	**Infrastructure and Communications**	– ICT dvelopment index – Access to electricity – Mobile – Mobile-cellular subscriptions (per 100 inhabitants) – Fixed-broadband subscriptions (per 100 inhabitants) – Active mobile-broadband subscriptions (per 100 inhabitants) – Fixed-broadband prices (%GNI pc) – Mobile-broadband prices 500 MB (%GNI pc) – Type of coverage and % of population – LTE/WiMAX coverage (% population) – Mobile coverage gap – Mobile utilization gap	– Individuals using internet (%population) – Percentage of households with a mobile phone – Percentage of households with computers – Percentage of households with internet access – Number of existing submarine fibre-optic cables – Number of planned submarine fibre-optic cables – Number of cellular service providers – Number of internet service providers Secure internet servers

4	**Interventions and Applications**	– # or % of population registered in the national EMR
		– # of health facilities using EHR
		– # of health facilities using national EMR
		– % of health facilities connected to the internet
		– Is the national EMR integrated with
		  - *Laboratory info*
		  - *Radiology/PACS*
		  - *pharmacy info*
		  - *drug procurement*
		  - *Electronomical medical billing*
		  - *HR*
			– What kind of DHI exists in the country?
			– What type of telemedicine services exist?

5	**Workforce**	– Number of ICT/STEM specialists – % population (15 yrs+) with secondary education – % population (15 yrs+) with tertiary education	– % population with vocational/professional qualification

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5 Siaw-Teng Liaw, Rui Zhou, Sameera Ansari, Jun Gao, A digital health profile & maturity assessment toolkit: cocreation and testing in the Pacific Islands, Journal of the American Medical Informatics Association, 2020;, ocaa255, https://doi.org/10.1093/jamia/ocaa255

3.4 Digital Health Landscape Profile In-depth interview

Digital Health Landscape assessment – in depth interview/questionnaire

The purpose of this questionnaire is to collect primary source information to understand in more depth the maturity of digital health. In addition, this mechanism will be used to discuss the results, establish the maturity level and generate the input for a future digital health roadmap strategy and interventions.

Table 3.1 General information of the interview and interviewee

Date of interview:	
Place of interview:	
Total time of interview:	
Language:	
Interviewer:	
Interviewee's name:	
Interviewee's position:	
Interviewee's organization:	

Ecosystem, strategy and investment, leadership

a.   How would you describe the current digital health ecosystem/landscape?

b.   What are enablers and barriers for implementing digital health interventions in your opinion?

c.   How is digital health supporting the Sustainable Development Goals?

d.   Specifically, how is supporting digital health leading to Universal Health Coverage?

e.   In your opinion, what was the role of the government in the implementation? In which ways did the government support the implementation of the system?

f.   If you need to map the different stakeholders in the implementation of digital health interventions, which one would you include?

Policy and Legislation

a.   What can you tell me about any national eHealth strategy in the country?

b.   Are there any measures to prevent a "digital divide" (e.g., lack of digital literacy of some groups of population/medical workers) from leading to increased inequality? If yes, what are these measures?

Digital Health Interventions/applications

a.   What are the current digital health interventions in Lesotho?

b.   What do you think will be the future digital health interventions in Lesotho?

c.   What do you think are the reasons that motivate the implementation of these tools?

d.   Are Digital Health Intervention evaluations conducted before implementation?

e.   In your opinion, what are the advantages and disadvantages of the digital health interventions currently implemented? Please mention in terms of patient empowerment, acceptability of users, monitoring and decision and other relevant aspects. How is, in general, the level of acceptance by physicians, patients, government?

f.   What is the degree/capacity to scale-up current interventions?

g.   What are the future trends?

Workforce

a.   There are identified responsible staff for:

    i.   Data Collection
    ii.   Standards and interoperability issues
    iii.   Data preservation
    iv.   Data analysis
    v.   Reporting information related to data collected and analyzed
    vi.   Data quality
    vii.   Maintaining and updating the database of health facilities and services
    viii.   Maintaining and updating maps of health facilities and services
    ix.   Knowledge Management

b.   Have special trainings in digital health been conducted? What is a scope of training activities? Who is responsible for conducting trainings?

3.5 Digital Health Maturity scoring tool[6]

The Digital Health Maturity scoring tool assess the complete digital health ecosystem, using different indicators and resulting in a score that then can be explained using any gap analysis such as SWOT analysis (Strengths, Weaknesses, Opportunities and Threats).

The indicators are extracted from various digital health assessment tools, maintaining the indicator structure and the maturity levels7. There are 74 indicators in total. The digital health assessment tools used currently are:

- Global Digital Health Index
- University of Chicago Data Framework
- Measure Evaluation HIS Framework
- USAID Digital Health Investment Review Tool
- Global Observatory of eHealth
- Broadband Commission
- WHO/ITU eHealth Strategy Toolkit
- IS4H Maturity Assessment tool
- University of Oxford Cybersecurity Capacity Maturity Model

The indicators are grouped covering the 4 focus areas:

1. **Digital Environment:** The indicators assess digital health from a macro perspective and national approach and strategies.

2. **Architecture & Data:** The indicators assess topics related with infrastructure, IT enterprise, health information system, interoperability, data quality, privacy, standards, data architecture, use of data.

3. **Applications:** The indicators assess digital health from a digital health intervention perspective, including also AI when applicable. In addition, it reviews acceptability and satisfaction of clients.

4. **Analytics:** The indicators assess data analysis, the utilization of advanced analytical techniques, AI and business intelligence methods, data science curriculum and workforce

Each focus area assesses 7 domains (as defined by the WHO/ITU eHealth Strategy Toolkit) that matches those of the Global Digital Health Index.

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[6] Disclaimer: The current scoring tool is limited to several digital health assessment tools and indicators that can provide a rapid indication of the digital health maturity in all areas. However, it is important to mention that there are other multiple tools that can provide additional information and with the advancement of technologies such as Artificial Intelligence, and the new challenges presented by them, new additions to the current scoring tool may needed in the future.

[7] For some of the indicators, the categories were adapted to make the scoring coherent across the questionnaire.

Figure 3.3   WHO/ITU eHealth Strategy Toolkit components

Component	Role	Description
Leadership, governance and multi-sector engagement	Enabling environment	• Direct and coordinate eHealth at the national level; ensure alignment with health goals and political support; promote awareness and engage stakeholders. • Use mechanisms, expertise, coordination and partnerships to develop or adopt eHealth components (e.g. standards). • Support and empower required change, implementation of recommendations and monitoring results for delivery of expected benefits.
Strategy and investment	Enabling environment	• Ensure a responsive strategy and plan for the national eHealth environment. Lead planning, with involvement of major stakeholders and sectors. • Align financing with priorities; donor, government and private-sector funding identified for medium term.
Legislation, policy and compliance	Enabling environment	• Adopt national policies and legislation in priority areas; review sectoral policies for alignment and comprehensiveness; establish regular policy reviews. • Create a legal and enforcement environment to establish trust and protection for consumers and industry in eHealth practice and systems.
Workforce	Enabling environment	• Make eHealth knowledge and skills available through internal expertise, technical cooperation or the private sector. • Build national, regional and specialized networks for eHealth implementation. • Establish eHealth education and training programmes for health workforce capacity building.
Standards and interoperability	Enabling environment	• Introduce standards that enable consistent and accurate collection and exchange of health information across health systems and services.
Infrastructure	ICT environment	• Form the foundations for electronic information exchange across geographical and health-sector boundaries. This includes the physical infrastructure (e.g. networks), core services and applications that underpin a national eHealth environment.
Services and applications	ICT environment	• Provide tangible means for enabling services and systems; access to, and exchange and management of information and content. Users include the general public, patients, providers, insurance, and others. The means may be supplied by government or commercially.

Source: WHO/ITU eHealth toolkit.

In this way, by mapping all the indicators to the source, the assessment team can extract information from the other tools if an assessment was already done in the past, and it can be an input for those tools in the future, collaborating with the other initiatives.8

Once each focus area is completed and all the assessment is finished, a final score showing a maturity level is presented.

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8   For a complete list of the indicators mapped, see Appendix

Figure 3.4   Web graph showing the different maturity levels at the digital health areas

Scoring	Level
1	Nascent
2	Emerging
3	Established
4	Institutionalized
5	Optimized

How to use the maturity scoring tool

1. Select a Country in the menu below and click on "Start". This will bring you to the first focus area of the questionnaire ("Digital Environment")

Focus Area

Country

B. Architecture & Data   Afghanistan

The following indicators refer to topics such as interoperability, data govenance, health information system infrastructure, knowledge in health information systems.

Completed   0%
Total Score
Phase

Reset Score

Domain

Focus Area score and completeness of area

1. Leadership and Governance

Source
University of Chicago

23   How does leadership value data? Do they require data to be presented in order to make decisions?   Select

Indicator

Digital assessment source tool

Leaders at this level fundamentally don't know how data can help advance the organization's mission.	1
Leadership... have a clear path forward to use data	2
	3
Leadership has a clear idea of how data can be used to drive business decisions beyond justification of funding	4
Leadership builds a culture of data within the organization and demands data to justify all programmatic decisions	5

Governance Structure for HIS
24   Definition: The exercise of technical, political, and administrative authority to manage national HIS affairs at all levels of a country's health system   Select

HIS Framework

Maturity level for the indicator

Evolving governing body for health information systems (HIS) is constituted on a case-by-case basis OR no governing body exists	1
An HIS governing body is formally constituted. The governing body has a scope of work that includes the people responsible for data governance oversight. The governing body oversees interoperability directly or through a separate technical working group (TWG)	2
The HIS governing body conducts regular meetings with stakeholder participation.	3
The HIS governing body uses a work plan (or another tool) to monitor the implementation of HIS interoperability. . The HIS governing body is government-led. The HIS governing body mobilizes resources (financial, human resources, and political) to accomplish its goals.	4
The HIS governing body is legally protected from interference or organizational changes. The HIS governing body and its TWGs are nationally recognized as the lead for HIS interoperability. The governing body works in liaison with other similar working groups regionally and/or around the world.	5

Maturity level categories for the indicator

Categories

2.   For each indicator, please select the relevant options (1 to 5) based on the information you have. In general, 1 indicates a low maturity and 5 a high maturity.

A. Digital Environment   Afghanistan

The following indicators focus at the macro level of digital health in terms of strategy, guidelines, curriculum and prioritization

Completed   0%
Total Score
Phase

Reset Score

1. Leadership and Governance

Source

1   1. Digital health prioritized at the national level through dedicated bodies / mechanisms for governance
Does the country have a separate department / agency / national working group for digital health?   Select

Global Digital Health Index

Select
1
2
3
4
5

No coordinating body exists and/or nascent governance structure for digital health is constituted on a case-by-case basis.	
Governance structure is formally constituted though not fully-functional or meeting regularly.	
Governance structure and any related working groups have a scope of work (SOW) and conduct regular meetings with stakeholder participation and/or consultation.	3
Governance structure is fully-functional, government-led, consults with other ministries, and monitors implementation of digital health based on a work plan.	4
The digital health governance structure is institutionalized, consults with other ministries, and monitors implementation of digital health. It is relatively protected from interference or organizational changes. It is nationally recognized as the lead for digital health.The governance structure and its technical working groups emphasize gender balance in membership.	5

3. The tool will calculate, using a simple average, the score for the domain and then for the area. A percentage shows the completeness of the focus area.

A. Digital Environment

The following indicators focus at the macro level of digital health in terms of strategy, guidelines, curriculum and prioritization

	Afghanistan
Completed	9%
Total Score	3
Phase	Established

1. Leadership and Governance — 3

1	1. Digital health prioritized at the national level through dedicated bodies / mechanisms for governance Does the country have a separate department / agency / national working group for digital health?	2

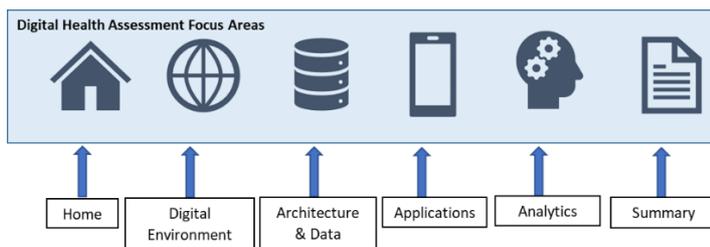|	
No coordinating body exists and/or nascent governance structure for digital health is constituted on a case-by-case basis.	1
Governance structure is formally constituted though not fully-functional or meeting regularly.	2
Governance structure and any related working groups have a scope of work (SOW) and conduct regular meetings with stakeholder participation and/or consultation.	3
Governance structure is fully-functional, government-led, consults with other ministries, and monitors implementation of digital health based on a work plan.	4
The digital health governance structure is institutionalized, consults with other ministries, and monitors implementation of digital health. It is relatively protected from interference or organizational changes. It is nationally recognized as the lead for digital health.The governance structure and its technical working groups emphasize gender balance in membership.	5

2	2. Digital Health prioritized at the national level through planning Is digital health included and budgeted for in national health or relevant national strategies and/or plan(s)? The focus of this indicator is on the inclusion of digital health or eHealth in the national health strategy.	3

4. To go to the next indicator, please **press Tab or Enter**.

5. To move along the different focus areas, click on the relevant icon.

Digital Health Assessment Focus Areas

| Home | Digital Environment | Architecture & Data | Applications | Analytics | Summary |

6. Once the questionnaire is finished, the results are displayed in the Summary tab

Areas	Completed	Score
Digital Environment	100%	1.5
Architecture & Data	100%	2.0
Applications	100%	1.1
Analytics	100%	1.6
Assessment Score		1.5
Assessment Phase Category		Nascent

Maturity level by area and final score

	Digital Environment	Architecture & Data	Applications	Analytics
Leadership and governance	1.7	0.7	0	1.4
Strategy and Investment	1	0	2	1
Legislation, policy and compliance	1	2	1	1.5
Workforce	1	2	1	1.3
Standars and Interoperability	0	1.5	1	0
Infrastructure	2.5	1.6	0	3
Services and Applications	2	3.2		2.4

Maturity level by area and

Maturity score by Digital Health Area

Spider-web gap analysis

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7. After the results are obtained, the assessment team can interpret them using different gap analysis methodologies such as SWOT (**S**trengths, **W**eaknesses, **O**pportunities and **T**hreats). The strengths are weaknesses are those characteristics that position the country in its current maturity model. The opportunities will define the possibility to move to the next level while the threats may jeopardize the level-up.

8. Once the assessment and the gap analysis is conducted, depending on the country objectives, it is suggested to use the findings to provide recommendations and support the design and implementation of digital health strategies and digital health interventions to improve healthcare delivery and healthcare outcomes.

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Appendices

Appendix 1   Inventory of Digital Health Assessments[9]

Resource	Purpose	Method	Use of results	HIS Level
Working Group on Digital and AI in Health Reimagining Global Health through Artificial Intelligence: The Roadmap to AI Maturity. (https://broadbandcommission.org/workinggroups/Pages/WG3-2019.aspx) Broadband Commission for Sustainable Development.	The maturity roadmap builds on and benefits from the robust foundations of existing initiatives and maturity frameworks, Taking the six areas for AI maturity in health as its canvas to highlight benchmarks, milestones, and enablers, the roadmap maps the progressive path towards maturity in 6 areas	Guide including 6 areas (People & workforce, Data & technology, Governance & regulatory, Design & processes, Partnerships & stakeholders, Business models) and 3 and maturity levels that assess stepwise progression for AI maturity in health	Maturity roadmaps allow stakeholders to: – Better understand the critical enablers for AI in health – Learn from insights on best practices and lessons learned – Define opportunities to leapfrog and cultivate equitable AI in health progress and fairer benefit distribution – Prioritize areas for strategic investments and collaboration – Better understand where they are placed in the AI maturity journey – Understand how to track their AI maturity progress by selecting the relevant benchmarks, priorities, and milestones	Artificial Intelligence assessment at national and sub-national level
Global Digital Health Index (GDHI) and Maturity Model (https://www.digitalhealthindex.org/) Developed as a multistakeholder initiative led by the Global Development Incubator and HealthEnabled	An interactive digital resource to assess, monitor, and improve the environment for effective use of digital health technology, to strengthen health systems and improve health outcomes Provides a maturity model with five levels to set a baseline, generate a scorecard and a benchmark against global averages, and learn from other countries to inform and target investments in digital health at the country, regional, and global levels	Data collection through a web-based survey, in collaboration with the ministry of health or country digital health agency. Results are validated through document review and expert consultation, and then shared, once approved by the health ministry or other authorized government agency.	Three objectives: – Empower health ministries, funders, policymakers, and industry to make informed, strategic decisions on resource allocation – Evaluate countries against standard digital health criteria and provide a roadmap for maturing – Motivate and track progress in national digital health systems and targeted national and global investments	Maturity of systems at national and global levels

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[9]   Source: MEASURE Evaluation and other (See reference).

Appendix 1   Inventory of Digital Health Assessments (continued)

Resource	Purpose	Method	Use of results	HIS Level
Information Systems for Health (IS4H) Toolkit – IS4H Maturity Assessment Tool (https://www.paho.org/ish/images/docs/about-IS4H-mm.pdf?ua=1) PAHO/WHO	The IS4H- Maturity Model (IS4H-MM) is a reference framework guiding Information Systems for Health to keep walking through the changing path of information and knowledge revolution, and how organizations might grow in capabilities to operate, interact and benefit from them.	Assessment of the five progressive levels of IS4H-MM provides the awareness for planning where to go by Information Systems Maturity Plans (IMPs), which include information and knowledge management processes, information governance readiness and open government initiatives. Levels of IS4H-MM are Public Health Information Organized (L1), Public Health Information Managed (L2), Public Health Decisions Based on Information (L3), Information Governance and KM Implemented (L4) and Information Systems for Health Implemented (L5).		
HIS Interoperability Maturity Toolkit (https://www.measureevaluation.org/resources/tools/health-information-systems-interoperability-toolkit) Developed by MEASURE Evaluation with HDC	Comprises a maturity model, HIS interoperability assessment tool, and a user guide. This toolkit identifies major components of interoperability for HIS and lays out a path to meet goals in leadership and governance, human resources, and information technology to support digital health.	A two- to three-day workshop for stakeholders in the domains of digital health and interoperability to assess HIS interoperability capabilities, review the assessment results, and reach a consensus on the system's maturity level	Develop a roadmap to strengthen interoperability of health information systems, identify resources to support the process, and set timelines to achieve a strong, interoperable HIS that produces high-quality data and promotes their use	National and subnational

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Appendix 1 Inventory of Digital Health Assessments (continued)

Resource	Purpose	Method	Use of results	HIS Level
Data Framework (http://www.datasciencepublicpolicy.org/home/resources/datamaturity/) University of Chicago	This tool is a questionnaire that will help people at non-profits, government agencies, and other groups take the most important first steps towards a successful data-driven social impact project. The Data Maturity Framework has three content areas: – Problem Definition – Data and Technology Readiness – Organizational Readiness	The Data Maturity Framework consists of: A questionnaire and survey to assess readiness Data and Technology Readiness Matrix Organizational Readiness Matrix	Help governments and organizations evaluate data maturity and what they need to move forward in data driven projects. It will also aggregate the results to create a benchmarking report around the state of data in non-profits and government organizations	Organizational, tech, and data readiness for analytical and data driven solutions and projects
Cybersecurity Maturity Model https://gcscc.ox.ac.uk/the-cmm University of Oxford	The Cybersecurity Capacity Maturity Model for Nations (CMM) is a methodical framework designed to review the maturity of a country's cybersecurity capacity. It was developed by the Global Cyber Security Capacity Centre through a global collaborative exercise started in 2014. This one-of-its-kind effort involved over two hundred experts from academia, international and regional organisations and the private sector. To date, the CMM has been deployed to over 80 nations worldwide and its reach has significantly impacted the global cybersecurity capacity building landscape. The CMM is premised on five Dimensions, which cover the broad expanse of areas that ought to be considered when seeking to enhance cybersecurity capacity: Cybersecurity Policy and Strategy; Cyber Culture and Society; Cybersecurity Education, Training and Skills; Legal and Regulatory Frameworks; and Standards, Organisations and Technologies.		The deployment of the CMM is a multi-faceted, multi-stepped and multi-stakeholder process. The goal of the deployment is to gather data about the country's cybersecurity capacity landscape, which is used to produce an evidence-based report that is submitted to the government with recommendations to: – benchmark the maturity of a country's cybersecurity capacity; – detail a pragmatic set of actions to contribute to the advancement of cybersecurity capacity maturity gaps; and – identify priorities for investment and future capacity-building.	National level

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Appendix 1   Inventory of Digital Health Assessments (continued)

Resource	Purpose	Method	Use of results	HIS Level
Digital Health Investment Review Tool (https://www.mcsprogram.org/resource/digital-health-investment-review-tool/) Developed by USAID and Maternal Child Survival Program (MCSP), with the Health Data Collaborative (HDC)	Provides guidance for strategic investments in digital technologies to support public health, based on best practice,	Uses quantitative scoring based on a review of a proposal or workplan.	The tool helps: Structure requests for proposals or procurements Inform the language of grants and contracts Support procurement officers' decisions on digital health proposals or proposals with a digital health component	National or subnational, depending on the level of the system or project being evaluated
Digital Health Atlas www.digitalhealthatlas.org	The Digital Health Atlas (DHA) is a WHO global technology registry platform aiming to strengthen the value and impact of digital health investments, improve coordination, and facilitate institutionalization and scale.	Stakeholders, including ministries of health, investors, and implementing partners, register their projects in the DHA. For each project, information is recorded in relation to its health focus area, geographic scope, and the details of the software system(s) deployed.	The DHA is an open-source web platform designed to help governments, technologists, implementers, and donors coordinate digital health activities globally. This platform offers users the information needed to improve the planning, coordination, and use of digital health information systems. In addition, the DHA helps implementers to assess the maturity of their digital health projects and gain access to global resources on current best practices in digital health.	National and subnational levels
Global Obseratory of eHealth (https://www.who.int/observatories/global-observatory-for-ehealth) Developed by WHO	Global survey on eHealth to determine a series of benchmarks at national, regional, and global levels in the adoption of the necessary foundation actions to support the growth of eHealth. The aim was to provide governments with data that could be used as benchmarks for their own development as well as a way to compare their own progress with that of other Member States	Country level survey based on self-reporting by a selected group of eHealth expert informants for each participating country. External sources of information were used for validation of the data and to resolve inconsistencies. In addition secondary was used to complete country profile	Monitor and analyze the evolution of eHealth in countries and to support national planning through the provision of strategic information. Policy issues and legal frameworks	Specific types of eHealth initiatives being conducted. (Applications)

Appendix 2 List of Possible Stakeholders to Interview

PUBLIC SECTOR

- Ministry of Health
- IT
- HR
- Supply Chain
- Ministry of Justice
- Ministry of Communication
- Ministry of Education
- Central Bureau of Statistics

DEVELOPMENT ORGANIZATIONS

- WHO
- UN agencies
- MCC
- GF
- PEPFAR
- EU Donors

PRIVATE SECTOR

- Chamber of commerce
- ICT companies
- Patient representatives

ACADEMY

- University
- Think tank

Appendix 3 Indicators Matrix

LEGEND

Global Digital Health Index	University of Chicago Data Framework	Measure HIS Framework	USAID Digital Health Investment Review Tool	University of Oxford - Cyber Maturity Model
Global Observatory of eHealth	Broadband Commission - AI		World Bank	IS4H Maturity Assessment tool

WHO/ITU EHEALTH STRATEGY TOOLKIT DOMAINS (also in Global Digital Health Index)	DIGITAL ENVIRONMENT	ARCHITECTURE & DATA	APPLICATIONS	ANALYTICS
LEADERSHIP AND GOVERNANCE	1. Digital health prioritized at the national level through dedicated bodies / mechanisms for governance Does the country have a separate department / agency / national working group for digital health?	Governance Structure for HIS Definition: *The exercise of technical, political, and administrative authority to manage national HIS affairs at all levels of a country's health system*		**Leadership:** Creating an integrated AI for health ecosystem across the full application spectrum is a top priority at the highest levels of government and for industry leaders
	2. Digital Health prioritized at the national level through planning Is digital health included and budgeted for in national health or relevant national strategies and/or plan(s)? The focus of this indicator is on the inclusion of digital health or eHealth in the national health strategy.	Are there policies in place around governance of Big Data in healthcare?		**AI Governance and Stewardship:** Data, algorithm, model, digital technology, ethical and workforce policies, are sufficiently robust to achieve the strategic national transformation for a data-driven health future.

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APPENDIX 3   INDICATORS MATRIX (continued)

WHO/ITU EHEALTH STRATEGY TOOLKIT DOMAINS (also in Global Digital Health Index)	DIGITAL ENVIRONMENT	ARCHITECTURE & DATA	APPLICATIONS	ANALYTICS
LEADERSHIP AND GOVERNANCE	D.3.1 Awareness rising of cybersecurity			How does leadership value data? Do they require data to be presented in order to make decisions?
STRATEGY AND INVESTMENT	3. National eHealth/ Digital Health Strategy or Framework Does the country have an eHealth or digital health strategy or framework and a costed digital health plan?		**Structured pilotism to counter fragmentation:** The umbrella structure for coordinated piloting is integrated into the larger ecosystem of scaled and operational AI in health solutions as well as into cross-sectoral working groups. Funding opportunities can be managed through a centralized platform designed for funders and donors	**Strategy & Budget:** AI strategy fully budgeted
	4. Public funding for digital health What is the estimated percent (%) of the annual public spending on health committed to digital health?			Business models: Health system players are scaling product and business models to target large NGO, commercial, or government adoption of AI solutions
	Health system players are making use of incentive structures, beyond tax benefits to also include innovation parks, grand challenges, and other initiatives, while systematically incorporating them into business models			

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APPENDIX | DIGITAL HEALTH ASSESSMENT TOOLKIT GUIDE V1

APPENDIX 3   INDICATORS MATRIX (continued)

WHO/ITU EHEALTH STRATEGY TOOLKIT DOMAINS (also in Global Digital Health Index)	DIGITAL ENVIRONMENT	ARCHITECTURE & DATA	APPLICATIONS	ANALYTICS
LEGISLATION, POLICY AND COMPLIANCE	5. Legal Framework for Data Protection (Security) Is there a law on data security (storage, transmission, use) that is relevant to digital health?	Are there policies in place around who can use data, how they can use data, which parts can they use, and for what purposes?	7. Protocol for regulating or certifying devices and/or digital health services Are there protocols, policies, frameworks or accepted processes governing the clinical and patient care use of connected medical devices and digital health services (e.g. telemedicine, applications), particularly in relation to safety, data integrity and quality of care?	Are there policies in place around the need for explain ability/fairness/transparency in AI models?
	6. Laws or Regulations for privacy, confidentiality and access to health information (Privacy) Is there a law to protect individual privacy, governing ownership, access and sharing of individually identifiable digital health data ?	Digital health projects may deal with sensitive medical information and clients have a right to have their information managed responsibly. Fear of loss of privacy may be a barrier to use of a system or accessing services. Security breaches can be damaging for governments and negatively impact the public's confidence. Describe how privacy and data security will be addressed	Does the government have a policy on utilization of social media for healthcare communication, prevention, information?	There is a written set of procedures for data analysis?

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WHO/ITU EHEALTH STRATEGY TOOLKIT DOMAINS (also in Global Digital Health Index)	DIGITAL ENVIRONMENT	ARCHITECTURE & DATA	APPLICATIONS	ANALYTICS
	8. Cross-border data security and sharing Are there protocols, policies, frameworks or accepted processes in place to support secure cross-border data exchange and storage? This includes health-related data coming into a country, going out of a country, and/or being used in a country related to an individual from another country.	Are there policies on data management, quality of data assessment, curation, validation, synthetic data? Data management includes procedures on how data are captured, stored, analyzed, transmitted, and packaged for use across the data supply chain.		
LEGISLATION, POLICY AND COMPLIANCE	Does the country have a regulation on data monetization?	Data ethics: The country has a recognized mechanism (e.g., committee or working group) for reviewing data ethics issues in the national HIS, and for updating policies, procedures, and laws, as needed. This mechanism reflects industry best practices.		
	D.2.2 Trust and Confidence on the Internet - User trust and confidence on the Internet			
	D.2.2 Trust and Confidence on the Internet - User trust in e-Government services			

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LEGISLATION, POLICY AND COMPLIANCE	D.2.2 Trust and Confidence on the Internet - User Understanding of Personal Information Protection Online			
WORKFORCE	9. Digital health integrated in health and related professional pre-service training (prior to deployment) Is digital health part of curriculum for health and health-related support professionals in training, in *general*?	11. Training of digital health workforce In general, is training in digital health / health informatics / health information systems / biomedical informatics degree programs (in either public or private institutions) producing trained digital health workers?	10. Digital health integrated in health and related professional in-service training (after deployment) Specifically, is digital health part of curriculum for health and health-related support professionals in the workforce in general? [Defined as community health workers, nurses, doctors, allied health, health managers / administrators, and technologists]	How bought in are staff throughout the organization? What percentage of the staff are involved in data collection? Data analysis?
	9a. Digital health integrated in health and related professional pre-service training (prior to deployment) Specifically, is digital health part of curriculum for doctors/physicians in medical training?	11a. Training of digital health workforce Specifically, is training in health and/or biomedical informatics (in either public or private institutions) producing trained informaticists or health information systems specialists?	10a. Digital health integrated in health and related professional in-service training (after deployment) Specifically, is digital health part of curriculum for doctors/physicians in the workforce?	National curricula and education institutions (Data Science and AI)

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WHO/ITU EHEALTH STRATEGY TOOLKIT DOMAINS (also in Global Digital Health Index)	DIGITAL ENVIRONMENT	ARCHITECTURE & DATA	APPLICATIONS	ANALYTICS
WORKFORCE	9b. Digital health integrated in health and related professional pre-service training (prior to deployment) Specifically, is digital health part of curriculum for nurses in pre-service training?		10b. Digital health integrated in health and related professional in-service training (after deployment) Specifically, is digital health part of curriculum for nurses in the workforce?	Professional and on-the-job training (Data Science & AI)
	9c. Digital health integrated in health and related professional pre-service training (prior to deployment) Specifically, is digital health part of curriculum for health and health-related support professionals in training for community health workers?		10c. Digital health integrated in health and related professional in-service training (after deployment) Specifically, is digital health part of curriculum for community health workers in the workforce?	Talent acquisition (Data Science & AI)
	12. Maturity of public sector digital health professional careers Are there public sector professional titles and career paths in digital health?			

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WHO/ITU EHEALTH STRATEGY TOOLKIT DOMAINS (also in Global Digital Health Index)	DIGITAL ENVIRONMENT	ARCHITECTURE & DATA	APPLICATIONS	ANALYTICS
STANDARDS AND INTEROPERABILITY		13. National digital health architecture and/or health information exchange Is there a national digital health (eHealth) architectural framework and/or health information exchange (HIE) established?	**Health system and workflow integration:** AI solutions are an essential and integrated component of the health system, with outcome reviews built into regular cost-benefit analyses. Integration into the health system is streamlined and follows clearly outlined processes, and can be completed with relative ease thanks to robust guidelines, agile health organizations, and predefined workflows	
		14. Health information standards Are there digital health / health information standards for data exchange, transmission, messaging, security, privacy, and hardware?		

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WHO/ITU EHEALTH STRATEGY TOOLKIT DOMAINS (also in Global Digital Health Index)	DIGITAL ENVIRONMENT	ARCHITECTURE & DATA	APPLICATIONS	ANALYTICS
INFRASTRUCTURE	15. Network readiness Extract the WEF Network Readiness Index score	16. Planning and support for ongoing digital health infrastructure maintenance Is there an articulated plan for supporting digital health infrastructure (including equipment-computers/ tablets/ phones, supplies, software, devices, etc.) provision and maintenance?		Online tools and platforms for data dissemination and analysis are available:
		Do you have Health Information Systems Monitoring and Evaluation in plan?		
		Are there plans related with Business continuity if a disruptive incident happen?		
		How accessible is the data that's required?		
		How is the data stored?		
		How integrated are the different data sources?		
		How much history is stored and how are updates handled?		
		How much is data fragmented in silos?		

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INFRASTRUCTURE		Would you define the current systems in the country as "legacy systems" (In computing, a legacy system is an old method, technology, computer system, or application program, "of, relating to, or being a previous or outdated computer system," yet still in use. Often referencing a system as "legacy" means that it paved the way for the standards that would follow it. Wikipedia)		
		D 1.2: Incident Response - Identification of Incidents		
		D 1.2: Incident Response - Mode of Operation		
		D 1.3: Critical Infrastructure protection - Risk Management and Response		
SERVICES AND APPLICATIONS	17. Nationally scaled digital health systems Public sector priorities (e.g., 14 domains included in ISO TR 14639) are supported by nationally-scaled digital health systems.	19 Digital identity management of individuals for health Are secure registries or a master patient index of uniquely identifiable individuals available, accessible and current for use for health-related purposes?	Are there any decision support systems implemented in any healthcare workflow?	Does the healthcare sector use Data consumption and business intelligence services?

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SERVICES AND APPLICATIONS		19a. Digital identity management of individuals for health Specifically, is there a secure master patient index of uniquely identifiable individuals available, accessible and current for use for health-related purposes?	Amount of services that can be provided digitally	Advanced analytical techniques (e.g., AI, predictive analysis, natural language processing, etc.) are applied to support real-time and routine clinical, management and policy decision-making.
		19b. Digital identity management of individuals for health Specifically, is there a secure birth registry of uniquely identifiable individuals available, accessible and current for use for health-related purposes?		Tools used to support health analysis:
		19c. Digital identity management of individuals for health Specifically, is there a secure death registry of uniquely identifiable individuals available, accessible and current for use for health-related purposes?	18. Digital identity management of service providers, administrators, and facilities for digital health, including location data for GIS mapping Are health system registries of uniquely identifiable providers, administrators, and public facilities (and private if applicable) available, accessible and current? Is the data geotagged to enable GIS mapping?	

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WHO/ITU EHEALTH STRATEGY TOOLKIT DOMAINS (also in Global Digital Health Index)	DIGITAL ENVIRONMENT	ARCHITECTURE & DATA	APPLICATIONS	ANALYTICS
SERVICES AND APPLICATIONS		19d. Digital identity management of individuals for health Specifically, is there a secure immunization registry of uniquely identifiable individuals available, accessible and current for use for health-related purposes?		
		Are there any healthcare services using cloud computing?		

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