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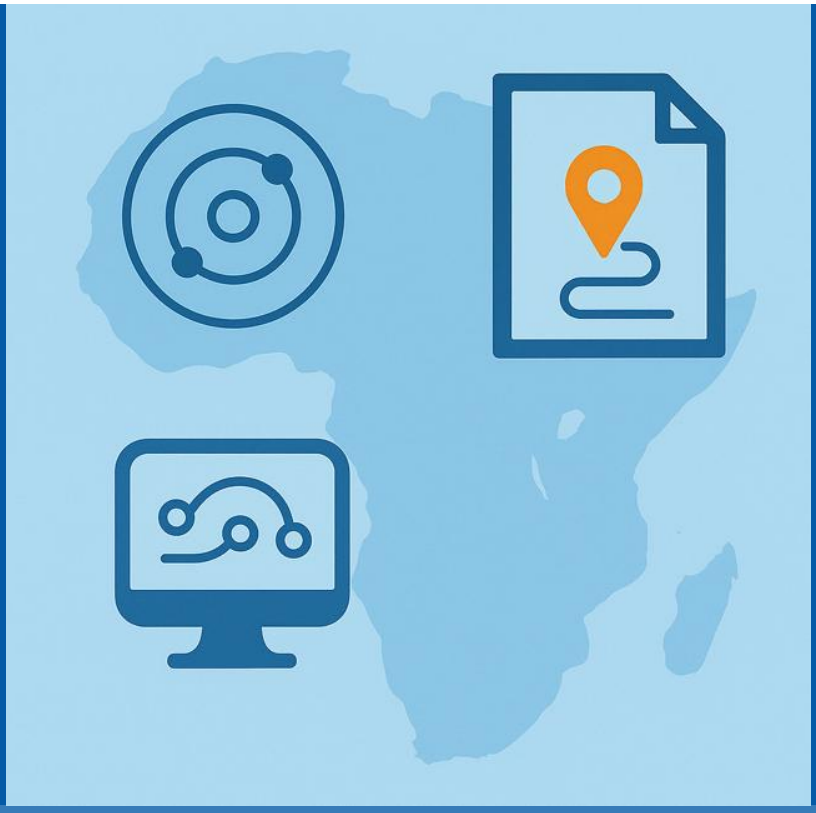

Process Evaluation of the Digital Innovation in Pandemic Control Initiative (DIPC)

Report #1: Digital Ecosystem Assessments & National Digital Health Roadmap Development

Evidence-Based Public Health| Centre for International Health Protection

Robert Koch Institute, October 2025

Process Evaluation of the Digital Innovation in Pandemic Control (DIPC) Initiative – *Report 1: Digital Ecosystem Assessments & National Digital Health Roadmap Development*

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OpenAI. (2025). *Image generated using ChatGPT image generator 40*. Retrieved from OpenAI.

Disclaimer

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List of Acronyms

BMZ	Bundesministerin für Wirtschaftliche Zusammenarbeit und Entwicklung
DAK	Digital Adaptation Kit
DH	Digital Health
DIPC	Digital Innovation in Pandemic Control
DEA	Digital Ecosystem Assessment
DPPI	Department for Policy, Planning and Innovation
GHS	Ghana Health Service
DPPA	Digital Pandemic Preparedness Assessment Tool
EDIT	Early Stage Digital Investment Tool
EPI	Expanded Program on Immunisation
FHIR	Fast Healthcare Interoperability Resource
GIZ	Gesellschaft für Internationale Zusammenarbeit
HIC	High Income Country
HIS	Health Information System
HL7	Health Level Seven International
HCW	Healthcare Worker
ICT	Information and Communication Technology
IT	Information Technology
KI	Key Informant
KII	Key Informant Interview
LMICs	Low-and Middle-Income Countries
M&E	Monitor & Evaluation
MoH	Ministry of Health
NDHRM	National Digital Health Roadmap
PAHO	Panamerican Health Organization
PATH	Program for Appropriate Technology in Health
PPME	Policy, Planning, Monitoring & Evaluation
SDGs	Sustainable Development Goals
SMART	Standards-based, machine-readable, adaptive, requirements-based, and testable
SURD	Systems and Users Requirements Document
UHC	Universal Health Coverage
WHO	World Health Organization

Executive Summary

Background and Purpose

Digital Ecosystem Assessments (DEAs) and National Digital Health Roadmaps (NDHRMs) have emerged as critical planning instruments to address fragmented digital health investments in Low- and Middle-Income Countries (LMICs), where vertical, partner-driven initiatives often operate independently, preventing data exchange and constraining governments' strategic oversight.

Within the Digital Innovation in Pandemic Control (DIPC) initiative, the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) supported Ghana and Malawi to conduct DEAs and Sierra Leone to develop a comprehensive NDHRM. These instruments aimed to systematically map digital health ecosystems, identify interoperability gaps, consolidate strategic priorities into actionable plans, and establish governance frameworks enabling coordinated partner investments aligned with national digital health strategies.

This report presents findings from the independent process evaluation of DIPC's support to these planning processes, examining three dimensions: (1) relevance to country priorities, responsiveness to target-group needs, and stakeholder engagement; (2) implementation processes, fidelity, and factors enabling or constraining execution; and (3) sustainability potential, including integration into national systems and capacity for independent continuation. Primary evidence is strongest for Ghana and Sierra Leone; Malawi interview data on the DEA were limited, hence the report focuses on the two countries with adequate key-informant material.

Key Findings

Relevance

Across both countries, the DEA/NDHRM processes were found to be policy-anchored instruments rather than parallel planning frameworks. They translated pre-existing national strategies into actionable directions. In Ghana, the DEA underpinned the ministry-endorsed System User Requirements Document (SURD) and supported the decision to enhance the DHIS2 eTracker instead of creating new systems. In Sierra Leone, the NDHRM consolidated strategy and prior ecosystem mapping into a costed, prioritised plan of more than 50 actions that DPPI uses to align partners and reduce fragmentation.

The instruments primarily addressed institutional needs (ministries, programme managers, ICT units). Frontline and sub-national perspectives featured mainly in validation rather than in earlier design stages, so responsiveness to day-to-day workflow issues is less directly evidenced. Context shaped appropriateness: Ghana's relatively higher capacity enabled quicker translation of findings into decisions; Sierra Leone's thinner capacity limited execution speed despite strong planning.

Implementation Processes

Both Ghana's DEA and Sierra Leone's NDHRM were delivered with high process fidelity: activities followed the intended sequence, were completed on time, and produced validated outputs. Enablers included clear government leadership, defined partner roles, structured and time-bound methods, and inclusive validation that surfaced missing information and built consensus.

A cross-cutting "follow-through gap" emerged between validated plans and operational delivery. In Ghana, agreed system integration work did not move beyond requirements, which is reflecting

coordination and stewardship constraints rather than technical infeasibility. In Sierra Leone, fewer than half of roadmap activities had been delivered at the time of data collection, reportedly due to financing gaps, lean staffing, and monitoring arrangements that had not yet been routinised. Common constraints included limited infrastructure, weak mechanisms for cross-institutional action, and the absence of simple, country-owned arrangements for designated ownership, routine review cycles and accountability.

Sustainability Potential

Sustainability prospects varied with custodianship and resourcing. Sierra Leone's NDHRM shows stronger institutional anchoring (DPPI stewardship, core team, community of practice, review/M&E/software-fit procedures) and is used as the governing blueprint for partner alignment. However, sustained financing and added capacity are required to accelerate the execution of the NDHRM. Ghana's DEA shows partial sustainability: it informed the EPI SURD, based on the WHO SMART Guidelines Digital Adaptation Kit framework, and aligns with tightening ICT governance, but lacks a named custodian, routine update processes and a clear handover. As such, evidence suggest that it currently functions as a valuable reference rather than a "living" asset. Two cross-cutting risks are prominent: keeping digital health ecosystem intelligence current (the "living registry" problem) and the governance-to-execution gap where policy integration is not yet matched by delivery capacity and resources.

Recommendations

On Relevance:

R1: Clarify pathways from strategic planning to operational design, with proportionate end-user integration

- Add a short "translation plan" to DEA/NDHRM outputs specifying the next forum, decision rights and when sub-national/frontline engagement intensifies.
- Use light feasibility checks (e.g., targeted workflow spot-checks) during the strategic phase; reserve deeper usability work for the subsequent operational design led by programme owners.
- Provide an "operational design starter pack" template for implementers to pick up post-validation.

R2: Differentiate assessment and planning pathways by country readiness

- Apply a simple readiness rubric (governance, technical capacity, resourcing, infrastructure) to select one of three tracks: Foundation, Consolidation or Optimisation.
- Tailor scope, outputs and success criteria accordingly; publish short exemplars for each track.

On Implementation:

R3: Build follow-through architecture into the core methodology

- Include in final reports a named stewarding unit, first three review dates, convening forum and a handful of progress indicators.
- Endorse a one-page country charter (roles, cadence, escalation).
- Offer time-bound accompaniment for the first two review cycles, then taper.

R4: Support practical coordination for cross-institutional delivery

- Use existing national forums to maintain a standing "implementation docket" of integration tasks, leads and dates, with quarterly status updates.
- Where helpful, align partner workplans and small envelopes to shared integration tasks and clarify decision rights and standards compliance with model terms of reference.

On Sustainability:

R5: Make custodianship and light maintenance cycles a requirement

- Name the owner unit, contact role and an annual/semi-annual update cadence aligned to existing ministry cycles; provide a minimal maintenance checklist and cost only incremental, routine effort.

R6: Address the "living registry" problem with lightweight trigger-and-submit rules

- Define simple triggers (new deployment, major change, retirement) and a one-page submission routed via the digital-health forum secretariat; include update reminders in quarterly agendas and add basic clauses to partner MOUs/grants; use low-effort validation.

Conclusion

Overall, DIPC's achievements confirm that evidence-driven, country-owned governance instruments are a viable pathway toward more coherent, sustainable digital health systems in LMIC settings. The DIPC-supported DEA and NDHRM instruments provide genuine governance value, which clarify priorities, rationalise investments, align partners and create institutional memory. Planning success, however, does not automatically yield operational change. As such, maximising DEA and NDHRM impacts will depend on building in modest but deliberate "follow-through architecture" (clear ownership, predictable review cadence, basic monitoring and agreed escalation options) and using existing forums to coordinate cross-institutional tasks. It also requires that expectations of what these instruments can deliver are explicitly calibrated to country readiness and resourcing, so that their success is judged against realistic, context-appropriate objectives rather than assumed to drive transformation on their own.

Whether national and global digital health community translates these insights into reformed practice, which means methodologies that integrate follow-through architecture, support models that extend through implementation phases, financing that covers maintenance alongside planning, and partnership approaches that prioritise autonomous sustainability, will determine these instruments' ultimate contribution to strengthening digital health governance in LMIC contexts.

1 Introduction

1.1 Background

Global Immunisation Landscape

Vaccine-preventable diseases remain a significant cause of mortality among children under five years of age, claiming approximately 1.5 million lives annually, predominantly in Low- and Middle-Income Countries (LMICs) (Dimitrova et al., 2023). The World Health Organisation's (WHO) Expanded Programme on Immunisation (EPI), established in 1974, marked the commencement of a coordinated international effort to utilise immunisation as a critical public health intervention (Keja et al., 1988). Over the past five decades, the EPI has been instrumental in reducing child mortality and morbidity from diseases such as measles, polio, and diphtheria, preventing an estimated 2.5 million deaths annually (Oyo-Ita et al., 2011) and modelling studies project that vaccinations against ten critical pathogens could prevent approximately 69 million deaths between 2000 and 2030 (Li et al., 2021).

Despite these achievements and ongoing global efforts to expand immunisation coverage, significant challenges persist. In 2022, approximately 20.5 million children globally remained either unvaccinated or under-vaccinated (WHO, 2020). Alarmingly, the number of children receiving no immunisation doses increased from 12.9 million to 18.2 million between 2019 and 2021, with 97% of this increase occurring in LMICs (Rachlin et al., 2022; WHO/UNICEF, 2020). These statistics underscore persistent and widening inequities in healthcare access within and between countries. For instance, vaccination coverage in Ethiopia has been documented to vary dramatically from 20.6% to 91.7% across different regions, reflecting substantial disparities in socio-economic status and healthcare accessibility (Asmare et al., 2022).

The COVID-19 pandemic further exacerbated these disparities, disrupting vaccine supply chains and intensifying the divide between high-income countries and LMICs (Basu et al., 2023; Shet et al., 2022). The pandemic's impact on routine immunisation services resulted in widespread disruptions across 170 countries and territories, setting back decades of progress in global vaccination coverage (Shet et al., 2022). This crisis highlighted the fragility of immunisation systems in resource-constrained settings and underscored the urgent need for innovative approaches to strengthen vaccine delivery mechanisms.

Digital Health Solutions for Immunisation

In response to persistent coverage gaps and emerging challenges, WHO and global partners have increasingly advocated for the integration of information and communication technologies (ICT) into immunisation programmes (WHO, 2020). During the COVID-19 pandemic, high-income countries successfully implemented various digital health solutions to monitor immunisations, create vaccination records, issue digital certificates, and report adverse effects (Mc Kenna et al., 2023). These experiences demonstrated the potential of digital technologies to enhance the efficiency, accuracy, and reach of vaccination programmes.

In LMICs, digital health technologies are expected to play a key role in reaching underserved populations, particularly through 'last mile' efforts, thereby supporting progress towards the Sustainable Development Goals and Universal Health Coverage (WHO/UNICEF, 2020). The Global Alliance for Vaccines and Immunisation (GAVI) has similarly championed the use of ICT in its Digital Health Information Strategy 2022-2025, capitalising on the widespread adoption of mobile phones in

LMICs (GAVI, 2021). Currently, 70% of the world's seven billion mobile phone users reside in LMICs (WHO, 2022), and mobile broadband connections in Sub-Saharan Africa were projected to increase from 38% to 87% by 2025 (Radcliffe, 2018), creating unprecedented opportunities for mobile health (mHealth) interventions.

The digitalisation of healthcare processes, particularly in vaccination delivery, encompasses various tools including electronic health records (EHRs), mobile health applications, and data management systems. These technologies offer numerous potential benefits: increasing immunisation coverage, addressing logistical challenges, enabling effective tracking of patients' immunisation status, improving data accuracy for public health planning, and reducing administrative burden for healthcare and public health personnel (WHO, 2019). Whilst the benefits of digital technologies in clinical medicine are well established (Nafees et al., 2023; Tanhapour et al., 2023), their application in public health programmes within LMICs, particularly for disease prevention, remains less comprehensively understood. WHO has thus called for additional research and guidance to reduce vaccine-preventable diseases and improve access to new vaccines by 2030 (WHO, 2020).

The Digital Innovation in Pandemic Control Initiative

Against this backdrop, the German Federal Ministry for Economic Cooperation and Development (BMZ), through the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ), launched the Digital Innovation in Pandemic Control (DIPC) initiative. Originally positioned under a COVID-19 emergency funding stream, and nested within GIZ's Digital Cluster, this five-country programme aimed to strengthen digital vaccine delivery systems in Ghana, Sierra Leone, Malawi, Tanzania, and Peru. The initiative focused on four key implementation components: (1) Digital Ecosystem Assessments to understand existing digital health infrastructure and capacity; (2) piloting of WHO's Standards-based, Machine-readable, Adaptive, Requirements-based, and Testable (SMART) Guidelines Approach for immunisation; (3) Capacity Strengthening activities at multiple levels of the health system; and (4) integration of Gender, Equity, and Inclusion considerations into programme design and implementation.

Implementation Challenges and the Know-Do Gap

Despite the promise of digital health technologies, their implementation at national scale in LMICs entails substantial challenges. Multiple factors can impede the adoption and effective integration of digital solutions, including limited infrastructure, low levels of digital literacy, inadequate training of healthcare workers, and insufficient engagement with key stakeholders at all levels of the health system (World Bank, 2023), to only name a few.

In implementation science, the 'know-do' gap highlights the disparity between research-based knowledge and its real-world application (Skolarus & Williams, 2024). This gap is particularly significant in digital health, which emphasises the need for identifying barriers and facilitators for effective translation of evidence into practice. Whilst numerous normative resources for digital health programming exist (Dörner et al (2025), sharing evidence between stakeholders remains essential to inform and optimise current and future programmes. Process evaluations conducted alongside ongoing programmes can generate real-time evidence to inform programme adjustments and improvements, ensuring that digital health interventions remain relevant to country contexts, effective, and sustainable.

1.2 Rationale

Given the significant challenges and disparities highlighted in the current state of vaccination programmes in LMICs, there was a pressing need for rigorous implementation research and comprehensive process evaluations of digital health initiatives. The Robert Koch Institute (RKI) was contracted by GIZ to conduct an independent external process evaluation of the DIPC initiative in three countries: Ghana, Malawi, and Sierra Leone. Process evaluations examine the internal processes and implementation aspects of an initiative whilst placing the project into the wider context of ongoing national efforts. They focus e.g. on whether activities are being carried out as planned, the quality of work performed, and how internal management and resources impact programme execution.

The conduct of this process evaluation in accompaniment to the ongoing DIPC programme was important to generate evidence not only to inform the DIPC initiative itself, but also to contribute evidence on digital health programme implementation in Ghana, Malawi, Sierra Leone, and other LMICs more broadly. The implementation research approach adopted here, can provide important insights into the factors that facilitate or hinder the adoption and integration of digital solutions and supporting activities, allowing for refinement and optimisation of strategies to ultimately enhance vaccination coverage. Furthermore, disseminating evaluation findings is important for identifying effective practices and informing future rounds of digital health funding. Ultimately, this research aimed to bridge the 'know-do' gap, translating knowledge into actionable strategies that can be implemented in real-world settings, thereby advancing the global agenda for Universal Health Coverage and the Sustainable Development Goals.

DIPC-supported Digital Ecosystem Assessments and the Development of a National Digital Health Roadmap

Within the DIPC framework, particular attention was directed toward evaluating the DEA and NDHRM development processes, as these planning instruments represent foundational components intended to inform all subsequent implementation activities. The evaluation examined Ghana's immunisation-specific DEA conducted in June-July 2023, and Sierra Leone's comprehensive NDHRM development process during 2022-2023.

DEAs and NDHRMs have emerged as critical planning instruments intended to address what Karuri et al. (2022) characterise as 'vertical, partner-driven, programme-specific investments' that operate independently, preventing effective data exchange and constraining governments' strategic oversight. The WHO and International Telecommunication Union's National eHealth Strategy Toolkit (2012) established that ecosystem assessments serve as foundational evidence for strategy development, requiring explicit connection to national health priorities and health system strengthening objectives. Subsequently, methodologies such as USAID's Digital Ecosystem Country Assessment (DECA) and the World Bank's Digital Health Readiness Assessment and Blueprint Toolkit have emphasised context-sensitive approaches, recognising that digital health maturity varies substantially across countries and requires differentiated support aligned with contextual preconditions (Kiberu et al., 2019; World Bank, 2023). However, whilst normative guidance on ecosystem assessment and roadmap development has proliferated, empirical evidence on how these planning processes function in practice, what implementation challenges arise, and whether they yield sustainable strengthening of digital health governance remains limited (Dehnavieh et al., 2019).

This evaluation addressed some of the critical evidence gaps by assessing how DEAs and NDHRM processes aligned with country priorities and responded to stakeholder needs (relevance), examining

implementation fidelity and factors facilitating or constraining execution (implementation processes), and evaluating integration into national systems and prospects for independent continuation (sustainability). Understanding whether these planning instruments yield durable contributions to digital health governance or remain dependent on sustained external facilitation constitutes a critical question for optimising future ecosystem assessment and roadmap development support in resource-constrained settings.

1.3 Evaluation Objectives

The evaluation was designed around three primary objectives, each addressing critical dimensions of the DIPC initiative's implementation and potential for sustained impact:

1. **Relevance:** To examine the extent to which DIPC programme activities align with partner countries policies and priorities, meet target groups needs and were planned and implemented with relevant stakeholder engagement.

1. **Project Implementation:** To establish how the DIPC initiative evolved over time in each country relative to initial project plans, identifying aspects of implementation that worked well and those that did not, and identifying barriers and facilitators to implementation.

2. **Project Sustainability:** To examine the extent to which the DIPC initiative had the potential to yield sustainable results in participating countries, including an analysis of the DIPC component's integration into the national systems and the partner countries' capacity for independent continuation after the project ends.

1.4 Purpose of the Report

This report presents findings from the independent process evaluation of the DIPC initiative's DEA and NDHRM development components in Ghana and Sierra Leone. The evaluation examines how these planning instruments aligned with country priorities (relevance), the factors that facilitated or constrained their development (implementation processes), and their potential for sustained contribution to national digital health governance (sustainability). Drawing on qualitative data from key informant interviews and document review, the report synthesises empirical evidence on the functioning of ecosystem assessments and roadmap development processes in diverse country contexts. The findings and recommendations aim to inform future digital health planning support, contributing to the evidence base on effective approaches for strengthening digital health systems in low- and middle-income countries.

2 Methodology

This section summarises the methods used for the DEA and NDHRM component of the DIPC evaluation.

2.1 Study Design

The evaluation employed a qualitative process evaluation design grounded in the Consolidated Framework for Implementation Research (CFIR) (Damschroder et al., 2009) to assess barriers and facilitators to the successful implementation of the Digital Innovation in Pandemic Control (DIPC) initiative across three countries: Ghana, Malawi, and Sierra Leone.

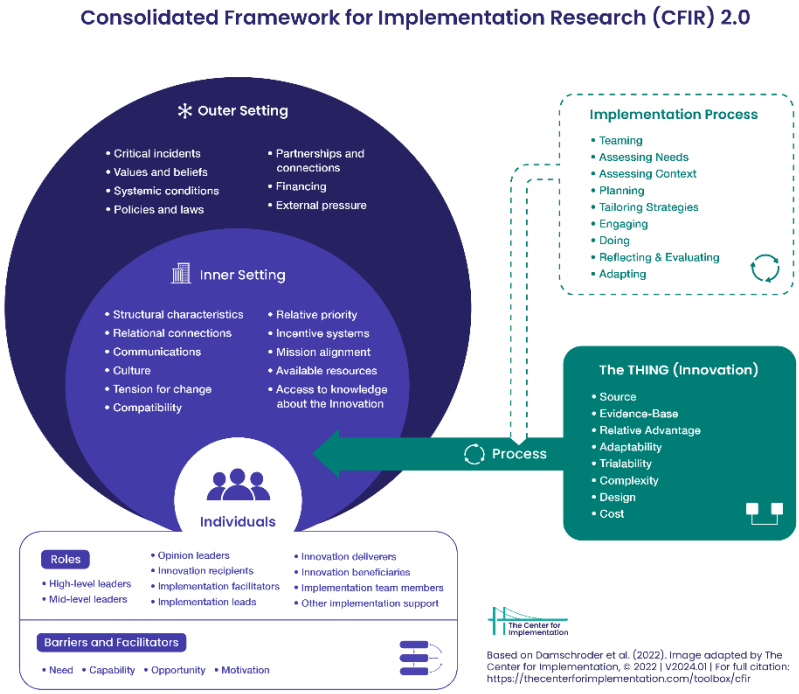

Figure 1. Consolidated Framework for Implementation Research (CFIR) 2.0 (based on Damschroder et al. (2022, adopted from The Centre for Implementation, 2022).

The evaluation framework integrated OECD Development Assistance Committee (DAC) criteria, including relevance and sustainability (OECD, 2021), to guide the formulation of evaluation questions. The focus of enquiry was structured according to the DIPC logic model, and four key implementation components were identify for detailed assessment:

1. Digital Ecosystem Assessments and the Development of a National Digital Health Road Map
2. Piloting of WHO's SMART Guidelines,
3. The implementation of DIPC-supported digital tools for immunisation,
4. Capacity Strengthening activities for digital literacy, and
5. The DIPC Initiative's Gender, Equity, and Inclusion efforts.

The evaluation utilised two primary data collection methods: comprehensive document reviews and semi-structured key informant interviews (KIIs). This mixed-method approach enabled triangulation of data sources to enhance the validity and depth of findings (Patton, 2015). Data collection was contextualised through direct observations during site visits to implementation locations.

2.2 Study Setting

We focused on three of the five DIPC partner countries and the findings presented here have their attention on Ghana and Sierra Leone where most key informant (KI) data on the present topic were available.

KIIs took place in the countries' capitals Accra, Freetown and Lilongwe. It should be notes that despite the DEA being included in the interview topic guide for national level stakeholders and implementation partners in Malawi, the available data on the topic was too sparse to draw meaningful analysis. Digital Square at PATH as the DIPC implementation partner in Malawi and Ghana adopted similar methodologies for the conduct of the DEA in the two countries. Therefore, information available from Malawi was used mainly for contextual triangulation and to understand transferability of the Ghana methodology.

2.3 Study Population and Sampling

The DIPC-supported DEAs and the NDHRM development engaged mostly national level stakeholders, as well as implementation partners and representatives from GIZ as the funding agency, therefore only this sub-sample of KIs were asked to respond to interview questions that pertained to the DEAs and the NDHRM development. As such, the analysis presented in this report is based on nine national level key informants, five of whom from Ghana and four from Sierra Leone, plus the perspective of two global level stakeholders on the topic.

2.4 Data Collection Methods

2.4.1 Document Review

The document review examined scientific literature, grey literature (including programme documents, and government policy papers), and project-specific materials (work plans, progress reports and stakeholder maps). This review provided contextual background on digital health landscapes, national immunisation programmes, and DIPC implementation processes in each country. Documents were obtained from publicly available sources or directly from implementing organisations and GIZ teams.

2.4.2 Interview Topic Guide

The overarching key informant topic guide consisted of five modules aligned with the main evaluation foci: 1. "Digital Ecosystem Assessments (DEAs) and National Digital Health Roadmap (NDHRM) Development", 2. "Piloting of WHO's SMART Guidelines", 3. "Digital Tool Development, Roll-out and Training", 4. "Digital Literacy Training and eLearning Resources", and 5. "The Women in Digital Health Event in Ghana". Each module followed a common structure and question sequence, beginning with questions on the key informant's professional background and role in relation to the DIPC initiative, followed by topic-specific questions, and sub-questions and prompts addressing the evaluation criteria of "Relevance", "Implementation Processes" and "Potential for Sustainability", adapted to the respective module. Questions were partly taken and adapted from the CFIR topic guide repositories (CFIR, 2024) to capture key CFIR domains and constructs relevant to the evaluation criteria and overarching evaluation questions.

The topic guides were further refined into four tailored versions with adapted wording for different stakeholder groups: 1. programme implementers and funders, 2. national government officials, 3.

regional and district public health officials, and 4. facility-level staff. During each interview, only the modules and questions relevant to the respondent's role were used. For example, the module on "DEA & NDHRM Development" was administered exclusively to implementers, funders and national-level stakeholders.

2.4.3 Key Informant Interviews

The semi-structured key informant interviews (KIIs) were conducted face-to-face at locations convenient to participants (offices, health facilities, or university campuses) or remotely via the RKI-approved secure videoconferencing platform (Cisco Webex) when in-person meetings were not feasible. The majority of interviews lasted approximately 45-90 minutes and were conducted by trained members of the evaluation team. All in-country interviews were conducted by the national researchers from Ghana, Malawi and Sierra Leone. Global level interviews were conducted by the RKI team in Germany.

Prior to each interview, participants provided written informed consent (for in-person interviews). Participants were informed of their right to withdraw at any time and to choose how they wished to be cited in reports. Demographic information collected in form of a demographic questionnaire included e.g., gender, organisational affiliation, professional role, years of experience, and geographic location.

All interviews were audio-recorded with participants' consent and supplemented with field notes. Recordings were transcribed verbatim and anonymised as possible. Transcripts and consent forms were stored separately to maintain confidentiality.

2.5 Data Analysis

Qualitative data analysis followed a thematic approach guided by the CFIR framework and OECD DAC evaluation criteria (Braun & Clarke, 2006). Transcripts were coded using predominantly deductive codes derived from the evaluation framework and a minimal level of inductive codes which emerged from the data. The analysis process involved: (1) familiarization with data through repeated reading of transcripts, (2) generation of codebook closely aligned to the evaluation questions (3) coding of transcripts (4) data extractions and review of coded segments by evaluation topic (5) synthesis of text segments and development of themes according to evaluation questions (6) interpretation of themes in relation to evaluation objectives.

Data from document reviews were synthesised to provide context for interview findings and to triangulate information across sources. Country-specific analyses were conducted first, followed by cross-country synthesis to identify common implementation barriers and facilitators, as well as context-specific factors influencing DIPC implementation.

Quality assurance measures included regular debriefing sessions among team members, joint codebook development with national researchers and the RKI team, peer review of coding and themes, and member checking where feasible. Reflexivity was maintained throughout the analysis process, with researchers explicitly considering how their positions and perspectives might influence interpretations.

2.6 Ethical Considerations

The evaluation received ethical clearance from review boards in all participating countries: Ghana Health Service Ethics Review Committee (GHS-ERC-025/08/24), Sierra Leone Ethics and Scientific

Review Committee (020/10/2024), and Kamuzu University of Health Sciences COMREC, Malawi (P.05/25-1585). Additional permissions were obtained from relevant health authorities including the Ghana Health Service Directorate, Malawi's District Health and Social Service offices, and Sierra Leone's Ministry of Health Directorate of Policy, Planning, and Information.

Informed consent was obtained from all participants prior to data collection, with comprehensive information sheets provided in advance. Participation was voluntary, and participants were informed of their right to withdraw at any time without consequences. Confidentiality was maintained through secure data storage practices, anonymisation of transcripts (as much as possible), and separation of identifying information from study data. Audio recordings and transcripts were stored on password-protected, encrypted servers compliant with European data protection regulations. Only members of the evaluation team had access to identifiable data, and findings are reported in aggregate form or with participant-chosen descriptors to prevent identification.

The evaluation adhered to principles of beneficence and non-maleficence, ensuring that data collection did not interfere with routine health service delivery and that findings would be used to improve DIPC implementation for the benefit of participating health systems.

2.7 Thematic Evaluation Focus of this Report

- DIPC's Digital Ecosystem Assessments (DEA) in Malawi and Ghana and the development of the National Digital Health Roadmap in Sierra Leone

Links to the end products:

Ghana - ENGREPORTGhanaecosystemmapping-.pdf

Malawi - MALAWIREPORTecosystemmapping-.pdf

Sierra Leone – no link found/available

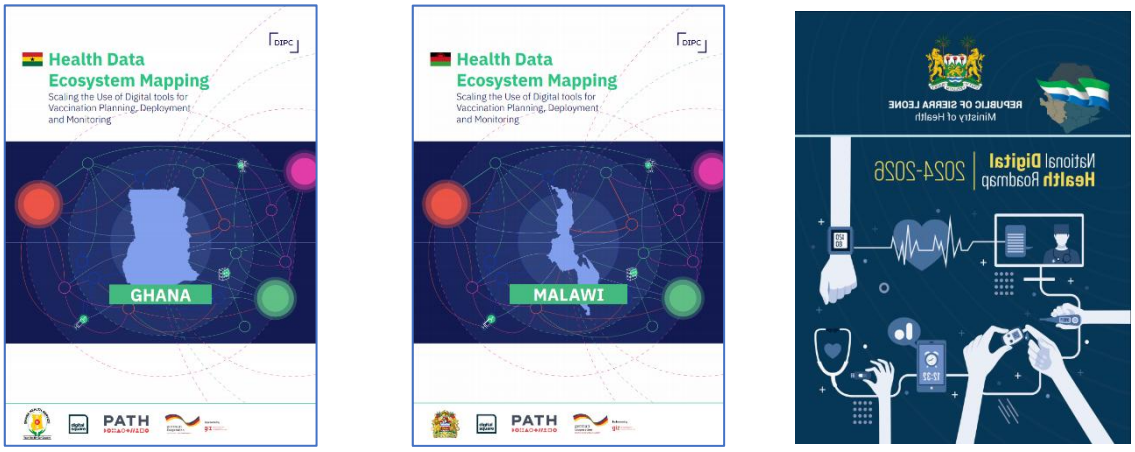

Figure 2. Ghana & Malawi DEAs & Sierra Leone's NDHRM

3 Sample Description

Overall Evaluation Sample

In total, we conducted 72 key informant interviews across Ghana (n=24), Malawi (n=22), Sierra Leone (n=21) and a small global cohort of funders/implementers (n=3). The overall sample was intentionally weighted towards health workers at the health facility level, complemented by national decision-makers and global actors to capture planning and governance perspectives. A full demographic overview has been included in Annex 1 and more detail on the sample has been provided in the Methods Report (ref).

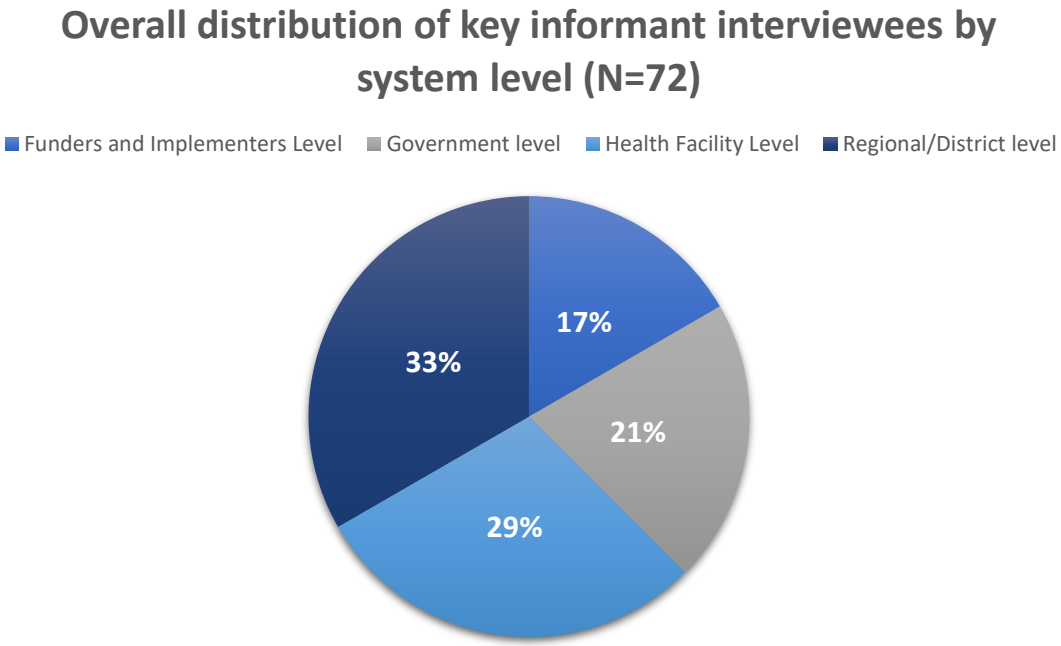

Figure 3. Proportion of Key Informants by "Role in relation to DIPC"

Evaluation Sample for the Component on DEAs and NDHRM Development

Findings of the present evaluation component (DEAs & NDHRM Development) are based on responses from 11 stakeholders in total. This includes five KIs from Ghana (three implementation partners/funders; two national level stakeholders), four KIs from Sierra Leone (two implementation partners/funders; two national level stakeholders) and two global level stakeholders (both belonging to the group of implementation partners/funders). The main limitation is the lack of responses from Malawian respondents on the topic.

4 Findings

EVALUATION QUESTION

1. **RELEVANCE:**
TO WHAT EXTENT DID THE CONDUCT OF THE DIGITAL ECOSYSTEM ASSESSMENTS AND THE DEVELOPMENT OF THE NATIONAL DIGITAL HEALTH ROADMAP RESPOND TO TARGET GROUP NEEDS, ALIGN WITH POLICIES, AND PRIORITIES AND ENGAGE THE RELEVANT STAKEHOLDERS?

2. **IMPLEMENTATION PROCESSES:**
HOW DID THE DIPC INITIATIVE AND ITS COUNTRY PROJECTS EVOLVE RELATIVE TO THE INITIAL PROJECT PLANS?

WHICH ASPECTS OF THE IMPLEMENTATION WORKED WELL/DID NOT WORK WELL IN PARTNER COUNTRIES, INCLUDING ENABLING AND HINDERING FACTORS TO THE IMPLEMENTATION?

3. **POTENTIAL FOR SUSTAINABILITY:**
TO WHAT EXTENT DOES THE DIPC INITIATIVE HAVE POTENTIAL FOR SUSTAINABILITY?
TO WHAT EXTENT HAS THE DIPC INITIATIVE BEEN DESIGNED FOR CONTINUATION OF EFFORTS ONCE ASSISTANCE THROUGH THE PROJECT CEASES IN THE PARTNER COUNTRIES?

4.1 Relevance

KEY TAKE-AWAYS ON "RELEVANCE" OF THE DEA & NDHRM

- ✓ **POLICY-ANCHORED, NOT PARALLEL:** BOTH INSTRUMENTS TRANSLATED EXISTING NATIONAL STRATEGIES INTO ACTIONABLE PLANS RATHER THAN CREATING NEW FRAMEWORKS.
  - **GHANA:** THE DEA DIRECTLY PRODUCED A MINISTRY-ENDORSED SURD AND A DECISION TO ENHANCE ETRACKER (NOT BUILD ANEW), WITH CLEAR INTEROPERABILITY PRIORITIES.
  - **SIERRA LEONE:** THE NDHRM IS A COSTED, PRIORITISED ROADMAP (50+ ACTIONS) NOW USED BY DPPI TO ALIGN PARTNERS, REDUCE FRAGMENTATION AND MOBILISE FUNDS.
- ✓ **BIGGEST VALUE ADD:** GOVERNANCE LEVERAGE THROUGH CLEARER "WHO DOES WHAT, WITH WHICH SYSTEM," ENABLING RATIONALISATION OF OVERLAPPING TOOLS AND INVESTMENTS.
- ✓ **TARGET GROUPS SERVED MOST:** MINISTRIES, PROGRAMME MANAGERS AND ICT UNITS; FRONTLINE USABILITY/CLIENT EXPERIENCE WERE SECONDARY AND REMAIN UNDER-SPECIFIED.
- ✓ **ENGAGEMENT BREADTH BUT UNEVEN DEPTH:** GHANA'S PROCESS WAS PARTNER-DRIVEN WITH COUNTRY INVOLVEMENT DURING VALIDATION; SIERRA LEONE'S WAS MORE GOVERNMENT-LED BUT OUTPUT REMAINS CAPACITY-CONSTRAINED.

Figure 4. Key Take-Aways on "Relevance" of the DEA & NDHRM

This section synthesises findings on how the DEA in Ghana (GIZ & Digital Square, 2023) and the National Digital Health NDHRM (Ministry of Health, Sierra Leone, 2023) development processes in Sierra Leone under DIPC aligned with country priorities, responded to target-group needs and involved stakeholders in planning and decision-making.

Overall, the conduct of the DEA and the development of the NDHRM experiences under DIPC show a high degree of relevance to country context. Both were firmly grounded in existing policies and strategies, offered practical tools for rationalising fragmented investments, and gave governments clearer leverage over partner activities. Their strongest contribution was at the *systems and governance* level and helped to clarify "*what should be done, by whom, and with which systems*" rather than directly transforming frontline practice during the evaluation period.

Alignment with national policies and priorities

Across countries, the DEA/roadmap instruments were broadly consistent with national digital health and UHC agendas rather than introducing parallel planning frameworks.

In Ghana**,** the DEA was explicitly commissioned to support the Ghana Health Service (GHS) and Ministry of Health directive to *improve existing systems rather than create new ones*. By mapping all major

digital applications and highlighting duplication, interoperability gaps and areas with no tools, the assessment operationalised the country's digital health strategy, which emphasises system rationalisation and data exchange. Outputs such as the immunisation System and User Requirements Document (SURD) (Digital Square, 2023), developed from the DEA, were endorsed by GHS and used as "foundation documents" for eTracker enhancement and broader interoperability planning.

In Sierra Leone, the NDHRM translated the National Digital Health Strategy 2018 – 2023 (Ministry of Health and Sanitation, 2017) and a prior ecosystem mapping exercise into a costed, prioritised roadmap with more than 50 actions. Interviewees consistently described it as a central governance instrument under the Directorate of Policy, Planning and Information (DPPI), used to attract partner funding, reduce fragmentation and steer investments toward nationally defined priorities such as transitioning from paper to digital, improving data accuracy and strengthening supply-chain and coverage monitoring.

Taken together, the evidence suggests that DEA and roadmap processes were strongly policy anchored. They helped consolidate existing strategic intentions into concrete, sequenced actions, and signalled to partners that alignment with government-defined directions, not stand-alone pilots, was expected.

Response to target group needs

The relevance of these instruments to target-group needs was clearest at institutional and programme level (MoH directorates, programme managers, ICT units).

In Ghana, the DEA was repeatedly described as a *demand-driven* exercise initiated by the Ghana Health Service (GHS)/ Department for Policy, Planning, Monitoring & Evaluation (PPME) to solve practical problems: proliferating, unapproved tools; fragmented data; and poor visibility of system performance. By systematically mapping systems, data flows and infrastructure gaps, the DEA reportedly provided the evidence needed to rationalise tools, strengthen governance of new applications and prioritise upgrades to the eTracker (a DHIS2-platform based digital tool for childhood immunisation that was later supported through DIPC in Ghana), which programme teams viewed as central for immunisation tracking, stock management and reporting. Respondents emphasised that the findings reflected their operational priorities. However, sub-national and end-user perspectives were less visible in the documentation, meaning responsiveness is strongest for organisational needs rather than for day-to-day workflow pain points.

Similarly, in Sierra Leone, target group needs were addressed as such that the NDHRM development process provided national stakeholders with a structured way to catalogue and prioritise system-level challenges, such as fragmented digital platforms, reliance on paper-based reporting, limited digital literacy and the lack of a coherent governance mechanism, so that these could then be addressed in a coordinated manner through the roadmap. By assigning activities, costs and responsible actors across WHO's seven digital health pillars, the roadmap created a registry of national priorities and a practical reference for partners. Stakeholders credited it with facilitating resource mobilisation and clarifying responsibilities for strengthening data systems, vaccine logistics and digital skills. Yet, as in Ghana, consultation at sub-national level appears limited, and the roadmap's attention to client experience or frontline usability is largely indirect, as may be expected.

Overall, the instruments clearly addressed the needs of *institutional target groups*, those planning, governing and integrating digital health systems. Evidence that they directly surfaced and addressed the needs of facility staff, community health workers or service users is weaker and will depend on

how subsequent implementation processes, following on from the development of these policy level instruments are managed.

Stakeholder engagement in planning and decision-making

Both Digital Square in Ghana Ghana and Unicef in Sierra Leone demonstrate relatively broad stakeholder involvement, but with differences in leadership, depth of engagement and reliance on external facilitation.

In Ghana, the DEA was technically country-anchored but partner-driven. Implementing partners (primarily Digital Square/PATH through DIPC, with GIZ support) supplied the analytical framework, tools and financing, while GHS departments contributed contextual information and participated in validation workshops. These workshops, bringing together the department EPI, PPME, Public Health, WHO and UNICEF, were key decision points, for example when stakeholders jointly agreed to upgrade the eTracker rather than build a new system. However, some respondents highlighted limited involvement of the DHIS2 technical team and other directorates, and several felt they entered the process mainly at interview or validation stage. This points to a consultative yet somewhat externally steered process with uneven internal ownership.

In Sierra Leone, by contrast, accounts emphasise a more visibly government-led and broadly participatory process. The Ministry of Health (MoH) Department for Planning, Policy and Innovation (DPPI) and other MoH directorates reportedly “fully participated” in technical reviews, workshops and validation, supported by a digital health core team. UNICEF, the DIPC implementation partner in Sierra Leone, acted and was fully recognised as the primary external facilitator, with GIZ, WHO, CDC, USAID and others contributing technical and financial support. A formal working group structure delineated partner roles, and the roadmap underwent pre- and post-validation. At the same time, attendance and depth of engagement varied; some areas such as surveillance were only indirectly involved, and not all invitees could attend all sessions, reflecting real-world capacity constraints.

Taken together, stakeholder engagement across the two cases can be characterised as broad but uneven. Central programme and planning units were consistently involved and exercised real influence over prioritisation. Development partners played crucial convening and technical roles. However, engagement of technical implementers and sub-national actors was patchier, which may limit long-term ownership and the translation of high-level plans into workable solutions at facility level.

4.2 Implementation Processes

KEY TAKE-AWAYS ON "IMPLIMATION PROCESSES" OF THE DEA & NDHRM

- ✓ **GHANA'S DEA** WAS CONDUCTED ACCORDING TO PROJECT PLANS (JUNE–JULY 2023) AND DIRECTLY TRIGGERED THE DECISION TO ENHANCE THE DHIS2 ETRACKER AND TO DRAFT A MINISTRY-ENDORSED SURD, EVIDENCE OF RAPID TRANSLATION FROM MAPPING TO ACTION.
- ✓ **SIERRA LEONE'S NDHRM** FOLLOWED A DISCIPLINED, MINISTRY-LED, PILLAR-BASED WORKFLOW (PRE-VALIDATION → VALIDATION → POST-VALIDATION), YIELDING A COSTED, TIME-BOUND ROADMAP USED FOR NATIONAL SENSITISATION.

- ✓ **WHAT ENABLED PROGRESS:**
  - CLEAR GOVERNMENT STEWARDSHIP, DEFINED PARTNER ROLES (PATH ANALYSIS; GIZ/UNICEF/WHO REVIEW), SMART-ALIGNED METHOD, AND TIME-BOXED MULTI-STAKEHOLDER VALIDATION.

- ✓ **IMPLEMENTATION CONSTRAINTS AND CHALLENGES:**
  - GHANA'S PRIORITY INTEGRATIONS (DHIS–DHIMS; ETRACKER–GHLIMS) STALLED AT "REQUIREMENTS ONLY" DUE TO UNCLEAR CUSTODIANSHIP AND NO ROUTINE UPDATE CYCLE.
  - SIERRA LEONE'S EARLY GAPS: SMALL CENTRAL TEAM, UNFUNDED ACTIVITIES, AND MONITORING ARRANGEMENTS NOT FULLY OPERATIONALISED AT LAUNCH; COP MEETINGS REPORTEDLY SKEWED TO UPDATES RATHER THAN MILESTONE TRACKING.

Figure 5. Key Take-Aways on "Implementation Processes" of the DEA & NDHRM

Evidence is drawn primarily from Ghana's DEA and Sierra Leone's NDHRM development, with a lighter perspective from global level stakeholders; where data are sparse (notably for Sierra Leone's development stage), findings are presented as cautious inferences. The analysis moves from implementation fidelity to what worked well and why, and finally to what did not work well, to explain the factors that shaped speed, quality, uptake and prospects for sustained use. Similarly to the previous evaluation question on "Relevance", stakeholders in Malawi did not speak about the DEA that was conducted in-country; hence we did not examine the processes there. However, the methodology was aligned with that adopted in Ghana by the same implementation partner, Digital Square.

Implementation relative to project plans

Ghana. According to our findings, the DEA was delivered essentially as planned. It was the first DIPC activity and ran to the intended sequence and timeline (June–July 2023): landscape of existing tools in close collaboration with EPI's ICT unit, analytical synthesis with Digital Square/PATH, and a multi-stakeholder validation with relevant stakeholder including GIZ, UNICEF and WHO. The immunisation-specific scope, building on earlier DPPA work, produced a clearer picture of what systems existed and which were functioning. Validation confirmed the findings and triggered an agreed decision to prioritise enhancement of the DHIS2 eTracker and to develop the SURD for immunisation.

Sierra Leone. The NDHRM, 2023–2026 also progressed broadly to plan through a structured, ministry-led process. A technical working-group model aligned to seven health-system pillars coordinated partners, with ministry staff leading to ensure national priorities prevailed. Each pillar underwent pre-validation, validation and post-validation (roughly two months per step) before launch. Subsequent sensitisation in all provinces supported adoption. The previously conducted DEA supplied situational context and helped translate the 2018–2023 strategy and DPPA recommendations into an actionable, time-bound roadmap. While one informant was unaware of the prior strategy, most accounts describe strong continuity and timely delivery.

Global perspective. One global informant judged the DEA/NDHRM approach to have worked as intended: substantial desk research paired with in-country validation, structured by WHO system classifications. As this is a single perspective and not country-specific, it should be treated as indicative only.

Aspects of implementation that went well, including facilitators and enablers

Ghana. Four factors underpinned smooth delivery of the DEA and a rapid translation to action: government ownership and legitimacy (EPI ICT strongly involved); embedded partner roles (Digital Square/PATH analysis, GHS/GIZ/UNICEF/WHO review and validation); a structured, SMART-aligned method linking ecosystem findings → CRD/ WHO SMART Guidelines framework functions → validation → requirements; and time-bound, inclusive validation that surfaced previously unknown systems in the ecosystem and closed evidence gaps.

Sierra Leone. What worked well centred on progressing from political intent to systematic tools for execution: participatory development with ministerial leadership; a costed, time-bound plan with indicators and M&E that corrected weaknesses of the earlier strategy; nationwide sensitisation and coordination; political will and leadership continuity; and a capacity foundation by naming digital literacy as a prerequisite for future digital tool-rollouts.

Aspects of implementation that did not go well, including challenges and barriers

Ghana. The main weaknesses relate to follow-through rather than the assessment methodology. Interoperability needs identified by the DEA (DHIS–DHIMS and eTracker–GhLIMS) stalled at the requirements stage. Governance for sustaining the outputs was reportedly not strong, with no designated owner of DEA at the time of data collection, routine update cycle or clear handover arrangements. Timelines were tight, and limited involvement of the DHIS technical team in the desk review likely constrained translation of findings into robust SURD specifications.

Sierra Leone. Evidence specific to the DIPC-supported development phase is limited; conclusions are cautious. Design-stage gaps reportedly included incomplete resourcing (small central team, unfunded activities), monitoring arrangements that were not operationalised from the outset, and the absence of finalised costed implementation plans and funding visibility at launch. Community-of-practice meetings tended to share partner updates rather than review progress against roadmap milestones.

Synthesis across the two processes

Both processes benefitted from clear public-sector stewardship, disciplined methods that convert mapping into validated evidence, and deliberate pathways from findings to decisions. Ghana exemplified rapid, problem-solving use of the DEA to prioritise a concrete system upgrade; Sierra Leone exemplified institutionalisation of direction through a costed roadmap and M&E framework to enable resource mobilisation. The principal risks lie in the follow-through architecture: delivering priority integrations and instituting ownership and update cycles in Ghana; and, for Sierra Leone's development phase, pairing the roadmap with phased financing, staffing, and a simple monitoring cadence used in routine coordination. The implementation fidelity appears to benefit when ministries lead, partners provide defined technical functions, validation is broad-based and time-bound, and outputs are immediately tied to either actionable system requirements or a costed, monitorable plan.

4.3 Sustainability Potential

KEY TAKE-AWAYS FOR "SUSTAINABILITY POTENTIAL" OF THE DEA & NDHRM

- ✓ EVIDENCE INDICATES HIGHER SUSTAINABILITY WHERE THE DEAS/NDHRM OPERATES AS A BINDING GOVERNANCE INSTRUMENT WITH NAMED OWNERSHIP, EARMARKED BUDGETS AND ROUTINE REVIEW CYCLES; LOWER WHERE IT REMAINS A STATIC ASSESSMENT.
  - **SIERRA LEONE'S NDHRM** SHOWS STRONG PROSPECTS BY DESIGN (COSTED ACTIONS, M&E CADENCE, SOFTWARE-FIT CHECKS), YET PROGRESS TO SCALE IS CONDITIONAL ON PREDICTABLE FINANCING AND ADDITIONAL STAFFING.
  - **GHANA'S DEA** DEMONSTRATES MEDIUM POTENTIAL: IT INFORMED A SURD AND TIGHTER ICT GUARDRAILS, BUT LACKS A DESIGNATED CUSTODIAN, SCHEDULED UPDATES (INCLUDING ATLAS CURATION) AND A FORMAL HANDOVER PLAN.

- ✓ STEWARDSHIP OF 'LIVING' REGISTRIES IS THE SYSTEMIC CONSTRAINT:
  - DISPERSED CATALOGUES, UNCLEAR CUSTODIANSHIP AND UNFUNDED MAINTENANCE RAPIDLY DEGRADE DATA CURRENCY AND POLICY UTILITY.
  - INTEGRATION IS MATERIALLY STRENGTHENED WHEN UPDATE OBLIGATIONS ARE EMBEDDED IN PARTNER AGREEMENTS AND TIED TO ROUTINE COORDINATION FORA; IN THEIR ABSENCE, INSTITUTIONAL UPTAKE PLATEAUS.

- ✓ CROSS-CUTTING RISKS INCLUDE LEADERSHIP TURNOVER, LEAN CENTRAL TEAMS AND UNFUNDED OPERATIONAL COSTS FOR MAINTENANCE, CURATION AND MONITORING.

Figure 6. Key Take-Aways for "Sustainability Potential" of the DEAs & NDHRM

Across the two countries, the DEA/NDHRM components show credible but uneven sustainability. The integration is strongest where the outputs functions as a binding governance tools: in Sierra Leone, the NDHRM anchors partner alignment to costed plans, M&E cycles and software-fit checks, though execution was reportedly slowed by financing and staffing gaps. Ghana's DEA is partially embedded at the national level, its SURD was endorsed and ICT guardrails are were strengthened. However, the absence of a named custodian, routine updates (incl. e.g., registration of findings on the Digital Health Atlas) and a robust handover appears to weaken system-wide uptake. National capacity mirrors this pattern: Sierra Leone has clear ownership structures (DPPI, core team, Community of Practice), while Ghana's operational routines remain thin despite positive policy direction. Overall, our findings show that the DIPC-supported DEA/NDHRM sustainability potential benefitted from national ownership,

budgets and review cycles; common risks that were identified include leadership turnover, understaffed teams and "living registry" maintenance.

Sustainability potential of DIPC component

Across the two countries, the DIPC activities show uneven but credible sustainability potential. Ghana's DEA is considered by stakeholders a valuable, reusable map that has already informed a SURD for immunisation, but without named custodianship, scheduled update cycles and Digital Health Atlas reporting, it risks becoming a one-off snapshot.

Findings showed that Sierra Leone's as NDHRM as a policy instrument has strong potential by design: it is considered by stakeholders as the governing blueprint linked to strategy and ecosystem mapping, with costed activities, and M&E cycles. However, stakeholders consistently highlighted that the its full realisation will depend on predictable financing, which was currently not in place or likely to become available and adequate staffing to accelerate the implementation of the NDHRM.

Overall, the findings showed that sustainability was reliant on clear custodianship and governance strategies for the instruments, including funded maintenance and update cycles.

Integration into the National System

Across the two countries, integration of DIPC's DEA/NDHRM into national systems is credible but uneven. Sierra Leone shows high institutional anchoring: the NDHRM operates as the governing blueprint, aligning partners to costed plans, and M&E cycles, supported by a core team and a community of practice. Delivery, however, lags the plan (under half of activities completed) due to financing and staffing gaps. Ghana's DEA is partially integrated: it generated a programme-level SURD and sits within tightening ICT governance and an emerging digital health strategy, but lacks a designated custodian, routine update processes (including DHA/Atlas curation) and robust handover, limiting system-wide adoption.

National Capacity for Independent Continuation

National capacity for independent continuation is mixed. According to stakeholder's perspectives, Ghana shows partial capacity: policy guardrails are strengthening (ICT controls, emerging digital health strategy) and programme intent is visible via the SURD, yet the essentials for a self-sustaining DEA are missing, which include a designated custodian, routine updates and thin handover and risk to leadership turnover. By contrast, Sierra Leone demonstrates stronger institutional ownership: DPPI with Unicef support was highlighted unanimously to have steered all actors through the NDHRM, with a core team, Community of Practice and defined review, costing and software-governance procedures. However, key informants also reflected that the operational independence was constrained by financing and workforce limits; fewer than half of roadmap activities are delivered and device/training gaps persist. Overall, Ghana requires named ownership and resourced maintenance routines; Sierra Leone needs predictable funding and targeted staffing to execute at scale. With these conditions met, both countries could sustain and evolve the assets beyond external support.

5 Discussion

5.1 Relevance

This evaluation examined the DIPC-supported DEA development in Ghana and the NDHRM development in Sierra Leone across three dimensions: relevance, implementation processes, and

sustainability potential. The findings show a consistent pattern: whilst these instruments demonstrate strong strategic relevance and successfully engage stakeholders in systematic planning, some gaps persist between planning outputs and operational follow-through, creating variable and context-dependent sustainability prospects.

Strong Policy Coherence with limited End-User Integration

The evaluation findings demonstrate that the DEA and NDHRM achieved strong policy alignment and strategic anchoring. Ghana's DEA operationalised the country's digital health strategy by systematically mapping immunisation systems, identifying duplication and interoperability gaps, and generating validated outputs that directly informed eTracker enhancement decisions. Sierra Leone's NDHRM translated prior strategy and ecosystem mapping into a comprehensive, costed plan with over 50 prioritised actions, providing the governance instrument stakeholders consistently describe as guiding partner investments.

This policy coherence aligns with the WHO/ITU National eHealth Strategy Toolkit (2012) emphasis that ecosystem assessments must connect to "national health and development policies" rather than introducing parallel structures. Recent frameworks for digital health maturity assessment similarly emphasise policy coherence as fundamental, with Karuri et al. (2022) noting that "most investments are vertical, partner-driven and program-specific," creating fragmentation that effective governance instruments should address.

The evaluation also finds that the DIPC-supported DEA implemented in Ghana guided by Digital Square and the NDHRM development facilitated by Unicef appropriately focused on institutional-level governance and strategic coordination. As high-level planning instruments designed to map ecosystems, identify governance gaps, and set strategic direction, their primary engagement with ministries, programmes, and ICT units aligns with their purpose. Strategic planning naturally centres on those responsible for governance decisions and resource allocation. The digital health maturity assessment literature confirms that "multi-stakeholder collaborative engagement" is crucial when planning assessments, with engagement needed" to ensure that all parties understand and agree on the objectives and methodology" whilst recognising that "stakeholders hold different powers and expertise" relevant to planning processes (Dörner et al., 2025).

However, the evaluation also identifies an important gap in the planning-to-implementation pathway. In both Ghana and Sierra Leone, limited end-user consultation during strategic planning, with sub-national and frontline perspectives appearing primarily during validation rather than throughout design, combined with unclear linkages from planning to operational implementation, creates risk that subsequent system design may not adequately address workflow realities and usability concerns. Whilst DEAs and roadmaps appropriately prioritise governance-level stakeholders during strategic planning, some end-user input remains valuable in our view for reality-checking feasibility, identifying major operational constraints, and ensuring priorities reflect ground-level realities that might otherwise not be visible to institutional planners.

This pattern reflects broader HIS strengthening challenges. Braa et al. (2012) documented that whilst DHIS2 implementations successfully engaged national management, the health facility level reportedly remained a weak link. The implication is not that strategic planning instruments should be redesigned to privilege operational perspectives, but rather that the overall planning ecosystem requires clearer pathways from institutional planning (where governance focus is appropriate) to operational implementation (where end-user engagement becomes critical), ensuring that high-level strategic decisions ultimately translate into contextually-appropriate, usable solutions at point of care.

Broad but Uneven Stakeholder Engagement

The evaluation findings suggest that the DIPC-implementation partner-driven stakeholder engagement demonstrated breadth through inclusive validation processes but unevenness in depth and influence. Ghana's DEA was technically country-anchored but reportedly perceived as partner-driven by some stakeholders, with PATH/Digital Square supplying analytical frameworks whilst GHS departments participated primarily in validation workshops. These workshops functioned as key decision points, for example, jointly agreeing to prioritise the eTracker upgrade, but several respondents noted limited involvement of technical implementers like the DHIS2 team during desk review, suggesting consultative but somewhat externally-steered processes.

Sierra Leone demonstrated a Unicef-supported, but more visibly government-led participation, with DPPI "fully participating" in technical reviews supported by a core team and structured working groups. However, attendance varied, with some areas only indirectly involved, reflecting real-world capacity constraints limiting consistent and comprehensive participation of all key stakeholders even in well-designed processes.

The evaluation identifies three engagement patterns warranting attention for future support, recognising that strategic planning appropriately centres on governance-level stakeholders whilst operational implementation requires different engagement approaches.

1. Technical implementers who translate specifications into operational systems participated inconsistently during requirements definition, likely contributing to specifications requiring substantial interpretation later.
2. Whilst it is appropriate for strategic planning to focus on institutional stakeholders, establishing clearer pathways into subsequent operational planning phases, where sub-national and end-user engagement is intensified, would improve the translation of strategic priorities into implementable solutions.
3. The balance between government leadership and partner facilitation varied: Ghana was described as “partner-driven with government validation”, whereas Sierra Leone was characterised as “government-led with partner facilitation”. These differences reflect broader patterns of country ownership that shape stakeholder engagement dynamics.

Context-Dependent Appropriateness and Variable Country Readiness

The evaluation demonstrates that whilst standardised methodologies were applied across the two countries, relevance and sustainability potential varied by context. Ghana exhibited high readiness through established infrastructure, sophisticated governance structures, and strong technical capacity, enabling stakeholders to translate DEA findings into actionable decisions. However, even Ghana’s follow-up on the DEA faced governance coordination and budgetary challenges, preventing the intended implementation of specified interoperability despite technical feasibility.

Sierra Leone represented substantially different preconditions, comparatively thin specialist capacity, unfunded infrastructure prerequisites, and fragmented governance. Whilst the NDHRM development succeeded through strong facilitation, fewer than 45% of activities had been delivered at the time of data collection, with delays attributed to "financing gaps, lean teams, and infrastructure deficits" rather than planning inadequacy. This suggests that whilst roadmap development proved feasible and successful, the instrument's relevance for driving operational change depends critically on concurrent investments in capacity and infrastructure that roadmap developments themselves cannot generate.

This variation aligns with recent literature recognising context-dependent digital health strengthening pathways. Krishnan et al. (2023) propose differentiated approaches for "foundation," "emerging," and "mature" countries, with assessment and planning approaches tailored accordingly. The implication is that whilst standardised methodologies provide process consistency, maximising relevance requires explicit readiness assessment informing tailored application, varying scope and depth by ecosystem maturity, adjusting roadmap granularity by governance capacity, and scaling follow-on support intensity to match readiness.

5.2 Implementation Processes

Methodological Fidelity with Follow-Through Gaps

Both Ghana's DEA and Sierra Leone's NDHRM largely proceeded according to planned methodologies, achieving strong implementation fidelity. Ghana's DEA ran to intended sequence and timeline, completing landscape mapping, analytical synthesis, and multi-stakeholder validation that triggered agreed decisions. Sierra Leone's NDHRM progressed through structured, ministry-led processes with technical working groups coordinating partners and each pillar undergoing iterative validation before launch.

This process fidelity aligns with literature documenting successful participatory planning in LMICs. Akanbi et al. (2012) reported Nigeria's systematic HIS assessment followed WHO methodology, completing activities within planned timeframes. LaFond et al. (2017) documented that whilst strategic planning quality varied across African countries, process fidelity generally succeeded when adequately resourced and technically supported.

However, the evaluation reveals that process fidelity does not in itself guarantee follow-through, particularly where downstream implementation was not funded under DIPC. In both countries, DIPC-supported activities demonstrated strong process compliance, with planned steps completed and documentation produced to specification, yet gaps emerged between planning outputs and operational implementation that required mandates and resources beyond the initiative's remit. For example, Ghana's validated interoperability specifications stalled at the requirements stage without progressing to implementation. Sierra Leone's comprehensively planned NDHRM saw fewer than 45% of activities delivered, with implementation slowed by financing gaps and staffing constraints that the planning processes alone could not overcome.

This finding emphasises that whilst implementation fidelity provides evidence of methodological feasibility, it constitutes necessary but insufficient condition for operational follow-though. The critical question is not whether planning can be done well, but whether planning instruments generate operational change.

Enabling Factors and Implementation Facilitators

The evaluation identified four clusters of enabling factors.

1. Decisive government ownership and leadership anchored legitimacy and accelerated decision-making. Ghana's EPI ICT unit leadership ensured the DEA reflected programme priorities and enabled swift consensus during validation; Sierra Leone's DPPI stewardship positioned the NDHRM as the governing blueprint for all digital health investments.
2. Embedded partner collaboration provided technical depth whilst respecting government leadership. Clear role delineation—PATH/Digital Square supplying methodology, GIZ providing

resources, WHO/UNICEF contributing technical review, prevented coordination friction whilst ensuring government retained decision-making authority.

3. Structured, time-bound methodologies helped maintain momentum and avoid open-ended consultation processes. In Ghana, Digital Square's disciplined, stepwise approach, implemented within compressed timelines, compelled stakeholders to prioritise and make timely decisions. In Sierra Leone, the seven-pillar framework aligned with the WHO health system building blocks, combined with staged validation (approximately two months per step), created clear "quality gates" that supported rigor while preserving schedule discipline.
4. Inclusive validation mechanisms created shared ownership and surfaced unknown information. Digital Square's validation processes in Ghana revealed previously unknown systems, which closed evidence gaps; Sierra Leone's Unicef-facilitated multi-stakeholder validation enabled stakeholders to ensure national priorities prevailed and balance clinical comprehensiveness against implementation feasibility.

Follow-Through Challenges

The most significant implementation weakness identified is the "follow-through gap". Whilst DIPC funding was largely confined to upstream planning and selected follow-on activities (e.g. SURD development, enhancement of the eTracker and the interoperability requirements assessment in Ghana, and digital literacy core competency courses and eSMT tool roll-out and training in Sierra Leone), many downstream implementation steps depended on domestic and other partner resources. As a result, validated planning instruments were produced, but mechanisms to ensure their systematic translation into implementation remained underdeveloped, limiting operational impact.

In Ghana, three specific gaps emerged: the absence of a clearly designated institutional owner created ambiguity around stewardship and DEA updating responsibilities; interoperability requirements largely stalled at the specification stage beyond the DIPC-supported assessment, without secured implementation resources; and limited governance capacity to enforce system consolidation meant that parallel platforms could continue despite DEA recommendations. Respondents linked the lack of progress on DEA-identified integrations more to "governance inability to mandate coordination" than to technical barriers.

In Sierra Leone, the weaknesses manifested differently. Comprehensive M&E frameworks were developed, yet monitoring processes were reportedly not systematically operationalised, with coordination meetings functioning more as information-sharing fora than structured roadmap progress reviews. Financing constraints left several roadmap activities unfunded, and phased implementation planning was not consistently applied, contributing to "roadmap–implementation drift" as actions proceeded opportunistically through available partner funding rather than through a sequenced, government-led plan.

These findings echo recent literature on health sector strategic plan implementation, which highlights weak accountability and resourcing as key reasons why plans often remain only partially executed (Maluka et al., 2018). The implication is that whilst DEAs and roadmaps are valuable planning tools, their ultimate contribution depends on the presence of a robust follow-through architecture: clearly mandated owners with adequate resources, regular review cycles, monitoring that generates accountability, enforcement mechanisms that promote alignment, and sustained commitment over multiple years.

5.3 Sustainability

Differentiated Integration and Institutional Anchoring

Sierra Leone demonstrates strongest institutional integration. The NDHRM functions as the country's single governing blueprint, with DPPI directing all partner activities to align with roadmap priorities. Practical governance instruments, i.e., costed activities with assigned responsibilities, M&E frameworks, regular review cycles, software assessment processes, create operational capacity. Multiple respondents independently described the NDHRM as "the reference document guiding all investments."

However, whilst institutional integration is strong, operational execution lags substantially. Fewer than 45% of roadmap activities were implemented at the time of data collection, with delays attributed to financing gaps and staffing constraints. Several respondents characterised the roadmap as "guiding what should happen but not determining what does happen," reflecting the gap between governance integration and operational delivery. This suggests institutional anchoring provides necessary but not quite sufficient conditions for sustainability. That said, the NDHRM survives as governing framework even when execution underperforms, but its ultimate value depends on translating governance authority into delivered interventions.

Ghana's DEA demonstrates more partial integration. The SURD, which was developed from the DEA, serves as "foundation document" guiding the eTracker enhancement and broader interoperability planning, aligning with tightening ICT governance and an emerging digital health strategy. However, significant integration gaps exist: no designated custodian, no routine update processes, unclear handover arrangements, and limited system-wide institutionalisation beyond the immunisation programme. Leadership turnover reportedly represents a recognised vulnerability where ownership remains informal.

This differentiated pattern aligns with Braa et al. (2012) findings that DHIS2 institutionalisation varied substantially, with "policy adoption" proving easier than "operational embedding." The implication is that institutionalisation requires multi-level integration: policy frameworks legitimating instruments, organisational structures stewarding them, operational procedures referencing them during decision-making, and accountability mechanisms generating consequences for non-compliance.

Custodianship and the Living Registry Challenge

Clear custodianship arrangements fundamentally shape sustainability prospects. Sierra Leone demonstrates explicit ownership, with DPPI holding clear responsibility and formal governance processes requiring DPPI approval. However, operational capacity remains thin, with the small coordination hub managing 68 interventions across seven pillars, creating bandwidth constraints limiting proactive stewardship.

Ghana demonstrates somewhat weaker custodianship with regards to their DEA. Whilst DEA outputs are valued, no designated owner reportedly exists with explicit mandate and resources for maintenance. Respondents highlighted unclear handover arrangements, no routine update processes, and no designated responsibility for Global Digital Health Atlas currency. This ambiguity creates vulnerability, in that whilst the DEA persists through institutional memory, it lacks organisational infrastructure ensuring it functions as living asset.

The evaluation identifies a specific sustainability challenge: maintaining DEAs and ecosystem registries as "living" resources rather than static snapshots rapidly obsoleted by system changes. Ghana's June-

July 2023 DEA provided comprehensive mapping, but by evaluation (12-18 months later), several changes to the ecosystem had occurred, e.g., eTracker enhancements (at the pilot stage in DIPC-supported districts) or legacy tool retirements, with no systematic process for capturing updates. The Global Digital Health Atlas requires manual updates often falling to individual initiative rather than institutional routine, which creates predictable obsolescence.

This "living registry" challenge has received limited attention in digital health literature but emerged as critical constraint. Without designated ownership, funded maintenance, and clear update obligations embedded in partner agreements or national procedures, registries inevitably deteriorate, reducing utility for planning, coordination, and governance functions they were designed to serve.

Conditional Capacity for Autonomous Continuation

Both countries exhibit partial but incomplete capacity for independent continuation. Sierra Leone demonstrates strong institutional capacity through clear ownership structures, established coordination mechanisms, and formalised procedures, which create the foundations for autonomous continuation. However, operational independence remains constrained by lean staffing, device and training gaps, and financing uncertainty where domestic budgets remain insufficient for full roadmap execution. Most respondents characterised autonomous continuation prospects as conditional, only feasible with sustained commitment and adequate resourcing, but highly vulnerable without these pre-conditions.

Ghana exhibits different patterns, including strengthening policy guardrails, visible programme intent through SURD endorsement, technical capacity through HISP Ghana and CHIM staff presence, yet the essentials components for self-sustaining DEA functions were not observed. When personnel change, institutional memory around DEA rationale may diminish, which in turn requires effort and resources to reconstruct context. This suggests that whilst Ghana possesses broad digital health management capacity, specific capability for stewarding the DEA as living institutional asset remains underdeveloped.

Synthesis Across Dimensions

The evaluation highlights that whilst Digital Square's DEA in Ghana and the Unicef-supported NDHRM development in Sierra Loene demonstrate methodological validity and strategic relevance, their operational impact depends critically on factors extending beyond planning exercise quality. Three cross-cutting patterns emerge:

1. **The governance-to-execution gap**: Strong policy coherence and stakeholder endorsement were found to be insufficient without governance mechanisms enabling coordinated action across institutional boundaries, adequate resourcing for implementation, and accountability structures translating plans into delivered interventions.

2. **Context dependency**: Instrument utility varies substantially by national readiness. High-capacity contexts can translate assessments into operational decisions through existing governance mechanisms, though coordination gaps still constrain follow-through. Limited-capacity contexts achieve planning outputs through facilitated processes but face structural barriers requiring sustained investments operating over timescales beyond what individual planning exercises can generate or mobilise.
3. **The follow-through architecture deficit**: Current methodologies focus predominantly on assessment quality and planning rigour, seemingly treating implementation arrangements,

custodianship, monitoring, and accountability as downstream concerns rather than core methodology components. Yet these "follow-through architecture" elements fundamentally determine whether planning instruments generate operational impact or remain valuable but static documentation.

The central question that emerges is whether these insights can be translated into reformed practice adopted by funders, digital health implementation partners and national governments, e.g., through revised methodologies integrating follow-through architecture as core components, support models extending through implementation phases, financing covering maintenance alongside assessment, and partnership approaches privileging autonomous sustainability over project deliverables.

This part of the DIPC-evaluation provides evidence of strong country-relevance and successful process implementation of the DEA and NDHRM in the two DIPC-supported contexts, whilst highlighting issues around methodological incompleteness, which should be acknowledged as a foundation for iterative refinement that literature demonstrates is characteristic of successful innovation in complex health systems.

6 Recommendations

6.1 Relevance

DEAs and the NDHRM development remain fundamentally relevant to country priorities when they serve as policy-anchored governance tools for system rationalisation, partner alignment and strategic decision-making. In line with the findings, recommended refinements focus on the handover from strategic outputs to the subsequent, operational design phases.

R1: Clarify pathways from strategic planning to operational design, with proportionate end-user integration

Recommendation: Make the transition from DEA/NDHRM outputs to operational design explicit, specifying when and how sub-national managers and frontline users are brought in, while keeping the strategic phase centred on governance stakeholders.

Priority actions:

- Assign responsibility: Agree and document which MoH unit (or coordination body) is responsible for translating DEA/NDHRM findings into an operational plan, and by when.
- Define next steps in the report: Add a brief “next steps” section to DEA/NDHRM reports that lists immediate follow-up actions, responsible institutions, and indicative timelines.
- Plan a first translation workshop: Convene an initial planning workshop with selected regional/district managers and facility representatives to review priority recommendations, test their feasibility, and agree on a small set of actionable implementation steps.

R2: Differentiate assessment and planning pathways by country readiness

Recommendation: Offer tiered pathways that align depth and outputs to ecosystem maturity and capacity, so expectations and deliverables are realistic.

Priority actions:

- Introduce a simple readiness rubric (governance, technical capacity, resourcing, infrastructure) to select one of three suggested tracks: e.g., Foundation (governance

blueprint and enabling environment), Consolidation (targeted rationalisation/integration) or Optimisation (operationalisation and performance focus).
- Tailor scope and success criteria accordingly (e.g., governance milestones for Foundation; integration deliverables for Consolidation; implementation handover artefacts for Optimisation).
- Publish concise guidance and exemplars for each track.

6.2 Implementation process

Process fidelity for the DIPC-supported DEA/NDHRM development was very good, but the major weakness observed at system level was follow-through from validated plans to execution, a phase that, in most cases, lay beyond DIPC's funding scope. This recommendation therefore focuses on supporting countries to embed modest, country-owned mechanisms that help connect plans to delivery, without implying that DIPC alone should resource implementation.

R3: Build follow-through architecture into the core methodology

Recommendation: Integrate a light, standardised follow-through component into the methodology, to be agreed before sign-off.

Priority actions:

- Add a brief "follow-through" section to final DEA/NDHRM reports that identifies the institutional steward(s), planned review forum(s) and indicative review timeline
- Agree a simple, country-owned follow-through note or charter at validation (clarifying roles, review rhythm and basic accountability mechanisms).
- Where feasible, include limited, time-bound accompaniment (e.g. participation in the first one or two review meetings) by the technical partner to support the stewarding unit to operationalise the roadmap, and invite future evaluations to assess whether these arrangements were established and used.

R4: Support practical coordination for cross-institutional delivery

Recommendation: Help countries use and strengthen existing coordination structures, rather than creating new ones, so that integration decisions are taken, work is sequenced and resources are aligned.

Priority actions:

- f a national digital health coordination forum already exists, agree a standing agenda item to review a simple list of priority integration tasks, responsible leads and target dates, and use this forum to resolve bottlenecks.
- Encourage ministries to publish short integration roadmaps (derived from the NDHRM) and provide simple, quarterly progress updates.
- Where appropriate, encourage partners to align their workplans and small pooled budgets to a shared set of integration tasks, using existing MoH financial procedures and partner agreements rather than creating parallel funding mechanisms.
- Offer model terms of reference for coordination bodies that clarify decision-making roles and expectations on standards compliance, for countries to adapt and adopt as they see fit.

6.3 Sustainability

Sustainability was found to hinge on clear custodianship and keeping ecosystem intelligence current, without turning planning instruments into heavy maintenance burdens.

R5: Make custodianship and light maintenance cycles a requirement

Recommendation: Require a clearly identified institutional custodian and a proportional maintenance plan before closure.

Priority actions:

- Include a short custodianship note in final documents naming the owner unit, contact role, and an annual or semi-annual update cadence aligned to existing MoH cycles (e.g., annual sector review).
- Provide a minimal "how to maintain" checklist (what changes trigger an edit; where to file; who signs off).
- Cost only the incremental, in-house effort and any small contracted support; encourage embedding within routine budgets or multi-year partner compacts.
- Track custodianship functioning in post-planning reviews.

R6: Address the "living registry" problem with lightweight update obligations

Recommendation: Use simple trigger-and-submit rules tied to existing coordination processes so registries and inventories remain usable.

Priority actions:

- Define three triggers for updates (new deployment, major change, retirement) and a pre-designed submission template or standard operating procedure routed through the responsible national digital-health agency or unit.
- Where partner MOUs or grant agreements are refreshed, add a clause to submit or confirm registry entries at grant inception/closure.

7 Conclusion

The DIPC support for the DEAs and the NDHRM development represents a significant achievement in strengthening country-led digital health governance. This part of the RKI process evaluation, based primarily on evidence from Ghana and Sierra Leone, shows that DIPC, through its implementation partners Digital Square and UNICEF, delivered on core objectives: producing methodologically rigorous, stakeholder-endorsed planning instruments that are firmly anchored in national policy frameworks and used by governments to guide partner investments, rationalise fragmented systems, and make strategic decisions about digital health priorities. Ghana's DEA provided the evidence base enabling rapid consensus on eTracker enhancement and system consolidation, whilst Sierra Leone's NDHRM established a central governance blueprint widely referenced to direct digital health investments. In both countries, planning outputs function as genuine governance assets—creating foundations for coordinated, evidence-driven digital health strengthening that were not in place before DIPC support, even as execution has progressed at different speeds.

DIPC's approach demonstrated several important strengths. The methodologies proved replicable across diverse contexts, with structured processes enabling rapid, rigorous assessment and planning

within compressed timelines. Government ownership and leadership anchored legitimacy throughout, with the responsible government agencies retaining decision-making authority whilst partners provided technical support, which is a collaborative model that built national capacity whilst generating credible outputs. Inclusive validation mechanisms created shared ownership across stakeholders, surfaced operational realities, and built consensus on previously contentious issues. Importantly, the instruments generated tangible governance effects: tighter control over unapproved system proliferation, evidence-based frameworks for partner alignment, mobilisation of resources through costed plans, and institutional memory that survives personnel turnover. These achievements validate DIPC's theory of change that systematic, participatory ecosystem assessment and roadmap development can strengthen digital health governance in resource-constrained settings.

At the same time, translating planning success into sustained operational impact requires addressing factors beyond assessment and roadmap exercises themselves. Follow-through architecture, namely designated ownership, regular review cycles, accountability structures, and maintenance resources, ultimately determines whether planning instruments catalyse implementation or remain valuable but static documentation. Cross-institutional coordination mechanisms are essential where integrations depend on multiple actors. The evaluation found that it is the context-dependent readiness that shapes what planning instruments can realistically achieve, with thinner-capacity settings requiring concurrent investments in infrastructure, financing and capability building that roadmaps can specify but not directly deliver.

The evaluation therefore highlights opportunities to strengthen future support: clarifying the handover from strategic outputs to operational design; introducing proportionate, phase-appropriate end-user engagement (light feasibility checks during the strategic phase and deeper participation during operational design); differentiating pathways by country readiness; explicitly designing follow-through architecture as a core methodology component; and offering time-bound accompaniment through the first review cycles. These refinements would enhance operational impact while preserving the governance value and methodological rigour that DIPC established.

The central insight is that the DIPC initiative achieved what it set out to accomplish as part of its digital health system strengthening agenda, namely high-quality, country-owned planning instruments that strengthen digital health governance. At the same time, we show that maximising impact requires methodological adjustments, which means, methodologies that extend beyond planning to include implementation architecture, partnership models that provide limited but sustained accompaniment, and financing that covers maintenance alongside assessment. This evaluation therefore provides evidence of successful programmatic conduct through the DIPC implementation partners that has created important system-level foundations. The task now is to build on this success so that governance instruments translate into the sustained operational improvements that countries need.

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Annex

Tabelle 1. Demographic Sample Characteristics

Participant Characteristics	Country				Total
	Ghana n (%)	Malawi n (%)	Sierra Leone n (%)	Global n (%)	N (row)
Sex					
Male	15 (63%)	16 (73%)	18 (78%)	0 (0%)	49 (68%)
Female	9 (38%)	6 (27%)	5 (22%)	3 (100%)	23 (32%)
Sub-total, N (col)	24 (100%)	22 (100%)	23 (100%)	3 (100%)	72 (100%)
Age group					
18-24	0 (0%)	2 (9%)	0 (0%)	0 (0%)	2 (3%)
25-34	7 (29%)	4 (18%)	9 (39%)	0 (0%)	20 (28%)
35-44	11 (46%)	9 (41%)	9 (39%)	0 (0%)	29 (40%)
45-54	4 (17%)	6 (27%)	4 (17%)	1 (33%)	15 (21%)
55-64	2 (8%)	1 (5%)	1 (4%)	2 (67%)	6 (8%)
Sub-total	*24 (100%)*	*22 (100%)*	*23 (100%)*	*3 (100%)*	*72 (100%)*
Organisational Involvement					
Funders & Implementers	4 (17%)	1 (5%)	4 (17%)	3 (100%)	12 (17%)
National Level/Govt Level	5 (21%)	4 (18%)	3 (13%)	0 (0%)	12 (17%)
Regional/District Level	8 (33%)	8 (36%)	10 (43%)	0 (0%)	26 (36%)
Facility Level	7 (29%)	9 (41%)	6 (26%)	0 (0%)	22 (31%)
Sub-total	*24 (100%)*	*22 (100%)*	*23 (100%)*	*3 (100%)*	*72 (100%)*
Years of Professional Experience					
Less than 1 year	0 (0%)	2 (9%)	0 (0%)	0 (0%)	2 (3%)
1-5 years	4 (17%)	5 (23%)	6 (26%)	0 (0%)	15 (21%)
6-10 years	4 (17%)	2 (9%)	8 (35%)	0 (0%)	14 (19%)
11-15 years	5 (21%)	6 (27%)	4 (17%)	0 (0%)	15 (21%)
More than 15 years	11 (46%)	7 (32%)	5 (22%)	3 (100%)	26 (36%)
Sub-total	*24 (100%)*	*22 (100%)*	*23 (100%)*	*3 (100%)*	*72 (100%)*
Professional Role in relation to Digital Health					
Programme Manager/Coordinator	5 (21%)	3 (14%)	3 (13%)	1 (33%)	12 (17%)
Policy/Decision Maker	0 (0%)	3 (14%)	0 (0%)	0 (0%)	3 (4%)
Healthcare Provider/Clinician	3 (13%)	7 (32%)	4 (17%)	0 (0%)	14 (19%)
Public Health Professional	11 (46%)	3 (14%)	5 (22%)	0 (0%)	19 (26%)
Data Analyst/M&E Specialist	2 (8%)	1 (5%)	4 (17%)	0 (0%)	7 (10%)
Technical Specialist/IT Support/Developer	2 (8%)	2 (9%)	7 (30%)	0 (0%)	11 (15%)
Capacity Strengthening/Trainer	1 (4%)	1 (5%)	0 (0%)	1 (33%)	3 (4%)
Other	0 (0%)	2 (9%)	0 (0%)	1 (33%)	3 (4%)
Sub-total	*24 (100%)*	*22 (100%)*	*23 (100%)*	*3 (100%)*	*72 (100%)*
Experience with Information Communication technology (ICT) or Digitalization in Healthcare					
None	0 (0%)	1 (5%)	0 (0%)	0 (0%)	1 (1%)
Limited experience	1 (4%)	5 (23%)	1 (4%)	0 (0%)	7 (10%)
Moderate experience	16 (67%)	12 (55%)	18 (78%)	1 (33%)	47 (65%)
Expert level	7 (29%)	4 (18%)	4 (17%)	2 (67%)	17 (24%)
Sub-total	*24 (100%)*	*22 (100%)*	*23 (100%)*	*3 (100%)*	*72 (100%)*

Experience with Vaccine Logistics or the					
None	0 (0%)	3 (14%)	0 (0%)	0 (0%)	3 (4%)
Limited experience	2 (8%)	3 (14%)	3 (13%)	1 (33%)	9 (13%)
Moderate experience	12 (50%)	13 (59%)	14 (61%)	2 (67%)	41 (57%)
Expert level	10 (42%)	3 (14%)	6 (26%)	0 (0%)	19 (26%)
Sub-total	*24 (100%)*	*22 (100%)*	*23 (100%)*	*3 (100%)*	*72 (100%)*
Professional Role in DIPC					
Core team member, directly implementing	10 (42%)	8 (36%)	6 (26%)	3 (100%)	27 (38%)
Strategic decision-making/planning	1 (4%)	6 (27%)	4 (17%)	0 (0%)	11 (15%)
Technical/administrative support	7 (29%)	4 (18%)	12 (52%)	0 (0%)	23 (32%)
Occasional consultation or indirect role	2 (8%)	2 (9%)	1 (4%)	0 (0%)	5 (7%)
Not involved, but familiar with objectives	4 (17%)	2 (9%)	0 (0%)	0 (0%)	6 (8%)
Sub-total	*24 (100%)*	*22 (100%)*	*23 (100%)*	*3 (100%)*	*72 (100%)*