

# Better Health

Human, technical and political factors for better coordination and support of e-health in Africa

Deliverable title: Best practices and lessons learned in e-health (Task 2.5)

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## Abbreviations

BeH	BETTEReHEALTH
LLMICs	Low and Lower Middle-Income Countries
WP	Work Package
MoH	MoH
GDHI	Global Digital Health Index

## 1 Introduction

### 1.1 Structure of the document

The present report is structured as follows:

- Section 1 - presents the main purpose of best practices and lessons learned document and the general objectives of the project.
- Section 2 - describes the objectives of Task 2.5 best practices and lessons learned, the relationship with other project deliverables and its role in achieving the expected outcomes.
- Section 3 explains the adopted methodology, mainly the design and evaluation criteria, qualitative data collection methods and practices classification.
- Section 4 – presents the findings; best practices and lessons learned are provided for the four African partner countries: Ethiopia, Ghana, Malawi and Tunisia.
- Section 5 – presents conclusions.
- Section 6 – presents some sources and references used in the Task preparation.
- Section 7 – presents some documents and forms used for data collection and analysis.

### 1.2 Purpose of the document

The purpose of this document is to describe Task 2.5 activities related to best practices and lessons learned in health and care services and health infrastructures. It explains how Task 2.5 contributes to BETTEReHEALTH objectives and connects to the other deliverables. The document also discusses the approaches used to collect and evaluate best practices and lessons learned in ehealth. Finally, it describes best practices, lessons learned relative to ehealth interventions in Ethiopia, Ghana, Malawi, and Tunisia.

The main objectives of Task 2.5 are to identify and analyze both best practices and lessons learned in ehealth, including interventions, health and care services and health infrastructures. Reporting best practices in ehealth enhances their replication in other similar contexts, whereas documenting lessons learned from past projects helps build skills and experience of involved organizations from partner African countries.

## 1.3 General project Objectives

BETTEReHEALTH (BeH) stands for "Better ehealth for better health" and studies the human, technical and political factors for better coordination and support of ehealth in low and lower middle-income countries (LLMICs) and regions in Africa. The project activities include the coordination and implementation of registries for ehealth solutions and ehealth policies while in parallel supporting and organizing activities and workshops that will address the human, technical and public policy factors that are related to the successful implementation of ehealth in LLMICs in Africa.

The overall objective of BeH project is to contribute to better, more accessible, and more efficient health and care services by coordinating and supporting the deployment of ehealth. The specific objectives are:

- To collect evidence and map existing resources to inform the successful deployment of ehealth in LLMICs in Africa
- To address the human factors that are related to successful ehealth technologies in African LLMICs
- To address the technical factors that are related to successful ehealth technologies in African LLMICs
- To address the public policy factors that are related to successful ehealth technologies
- To facilitate national initiatives by authorities for the successful deployment of ehealth in LLMICs in Africa
- To disseminate the actions and the results of the project so all relevant stakeholders get informed

Task 2.5 best practices and lessons learned takes part of WP2 Research, existing resources and evidence. This WP highlights the importance of existing resources and evidence to inform policymaking related to ehealth in low and lower middle-income countries (LLMICs) in Africa, particularly in the 4 partner countries, Ethiopia, Ghana, Malawi and Tunisia. This is ensured by the different academic and research partners of the project, and the strong local involvement ensured by the four regional hubs

## 2 Best practices and lessons learned under BeH project

### 2.1 Objectives of best practices and lessons learned

Task 2.5 best practices and lessons learned is included in WP2 research, existing resources and evidence. This WP consists in collecting evidence and mapping existing resources to inform the successful deployment of ehealth in LLMICs in Africa by:

- Creating open, free and easy to access registries of relevant existing ehealth solutions and policies ([registry.betterehealth.eu/](http://registry.betterehealth.eu/)).
- Mapping and support of existing strategic partnerships in ehealth and
- Extraction of best practices and lessons learned related to ehealth interventions

Task 2.5 activities consider national and regional policies and practices regarding health and care services and health infrastructures to:

- Include best practices and lessons-learned from health and care services and health infrastructures in the solutions and policies registries.
- Extract lessons learned from existing eHealth policies and programs at all levels of the health system.

### 2.2 Relationship with other project deliverables

Best practices and lessons learned task requires input from Tasks 2.2, Solutions registry development and implementation, and 2.3 Policies registry development and implementation, since the registries contain relevant information about ehealth solutions and policies in the four partner countries. Outputs from this Task will be useful for Task 2.6 Strengthen research capacity as results can be communicated to research groups and networks working on ehealth (see **Figure 1**).

### 2.3 Role of Task 2.5 in achieving the project's outcomes

BeH project relates to the topic SC1-HCC-09-2020: Supporting deployment of eHealth in low and lower middle-income countries in Africa for better health outcomes. The specific challenge of this topic has several dimensions, but in general refers to the importance of governmental support and coordination for the success of ehealth. In particular, Task 2.5 contributes to the achievement of the following scope: 'The action should take into account

national and regional policies and (best) practices regarding health and care services and health infrastructures and also include lessons learned from existing eHealth policies and programmes at all levels of the health system.’

The best practices and lessons learned report presents a synthesized and evidence-based study from previous projects and interventions related to ehealth. The ‘Knowledge management for policy’ approach is used to maximize the value and impact of knowledge in policy making<sup>1</sup>. This approach is based on eight key skills, two of which are needed to accomplish the Task 2.5: *synthesizing research* and *monitoring and evaluation* (Table 1).

Table 1 : Knowledge management for impact and its implementation in T2.5

Skills	Implementation in T2.5
<b>Synthesising research:</b> There is an over-supply of information to policymakers, compared to the limited ‘bandwidth’ of policymakers, producing the need to synthesise and prioritise the most robust and relevant knowledge	Data from different documents, reports and surveys with key actors will be analysed and synthesized to extract relevant information from BPLL in ehealth.
<b>Monitoring and evaluation:</b> Monitoring and evaluating the impact of research evidence on policymaking helps improve the influence of evidence on policymaking	The registry of ehealth policies that is developed in T 2.3, will also collect data that are relevant for monitoring and evaluating the ehealth policies. These data will be further evaluated to extract BPLL.

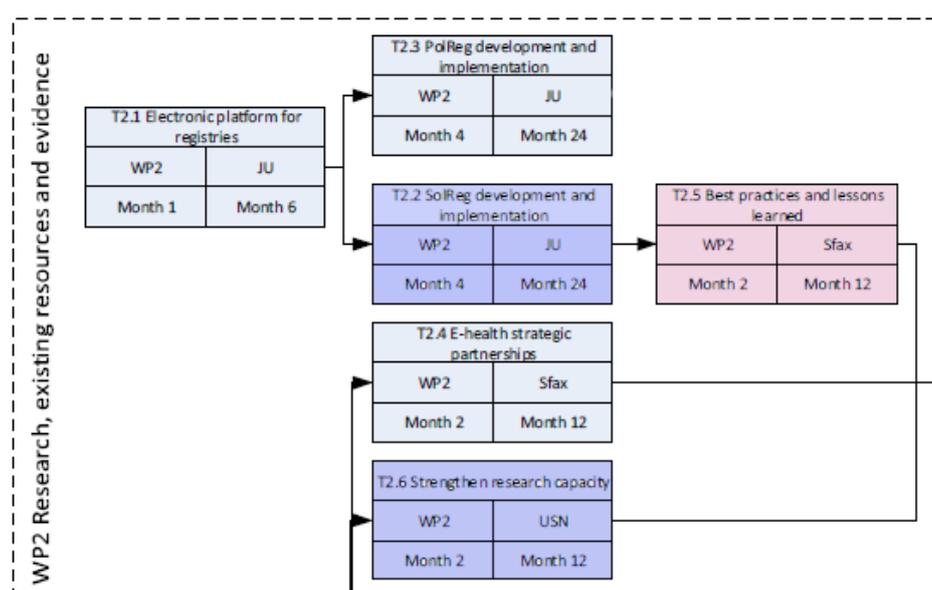


Figure 1 Relationship of Task 2.5 with other project deliverables

## 3 Methodology

### 3.1 Overall methodology

In order to extract best practices and lessons learned in ehealth in the four African countries, a methodology tailored for the countries' context has been developed. A working group including researchers, officers and IT professionals from partner organizations, namely, Ghana Health Services (Ghana), Jimma University and University of Gondar (Ethiopia) and Health Information Systems Programmes organization (Malawi) has been created. HealthTECH Cluster (Tunisia), as the leader of the Task, was in charge of study design, methodology definition, results analysis and monitoring of the different Task's activities. A biweekly meeting was scheduled by the HealthTECH Cluster to present the general guidelines of the proposed methodology and follow-up the progress of each country team.

The first activity in Task 2.5 is the design and data collection. A set of criteria to select best practices in ehealth was developed to evaluate practices and select the 'good' and 'best' ones. Likewise, assessment questions and guidelines were given to collect lessons learned from past experiences and projects related to ehealth. Received data from African countries is analyzed through a defined evaluation method to finally report best practices and lessons learned.

### 3.2 Design and evaluation criteria

#### 3.2.1. Best practices in ehealth

##### 3.2.1.1. Definition of best practices

With reference to article<sup>2</sup>, the term 'best practice' was first used by businesses, in the 1960s, looking to improve performance and maintain competitive advantage. There is no particular definition of best practice, but it is generally given to solutions, policies, interventions, actions, or procedures that are deemed successful and may assist other parties with a similar context. The approach has been applied in many disciplines; examples of best practices are published in policy documents.

For the scope of our study, we will adopt the following definition of a best practice<sup>3</sup>:

*“A best practice is a relevant intervention implemented in a real life setting and which has been favorably assessed in terms of adequacy (relevance, ethics, and evidence) and equity as well as effectiveness and efficiency related to process and/or outcomes. Other important criteria are transferability, sustainability, intersectorality and participation of stakeholders.”*

### 3.2.1.2. Primary evaluation: Global Digital health Index

In order to facilitate and accelerate the search process, available data from the Global Digital Health Index (GDHI) platform are exploited. The GDHI is based on the WHO/ITU 2012 National eHealth Strategy Toolkit<sup>4</sup> and on digital health experts to develop relevant indicators that can help countries track, monitor, assess and benchmark the use of digital health. The GDHI tracks the progress of ehealth interventions according to seven key aspects<sup>5</sup>:

- Leadership and Governance
- Strategy and Investment
- Legislation, Policy and Compliance
- Workforce
- Standards and Interoperability
- Infrastructure
- Services and Applications

Each aspect is assessed according to a number of defined indicators that allow its evaluation on a scale from 1 to 5, where 1 indicates a very low level and 5 indicates a very high level. Among the available projects on the GDHI platform, partners will further analyse aspects that achieved a score equal or superior to 3/5 to extract potential good/best practices.

The platform already includes data from Ethiopia and Ghana as shown in **(Figure 2)**<sup>6</sup>. A guidance note prepared by the thematic group ‘Digital health development in Tunisia’ of the societal dialogue that took place in 2018 adopted the same evaluation methodology of the GDHI and assigned a grade for each ehealth aspect in Tunisia<sup>7</sup>. No existing information are found for assessing ehealth aspects in Malawi.

### 3.2.1.3. Secondary evaluation: Set of criteria to select best practices

To select best practices in ehealth, certain evaluation criteria are defined at the first place. For the scope of the study, assessment criteria are classified into exclusion, core, and qualifier

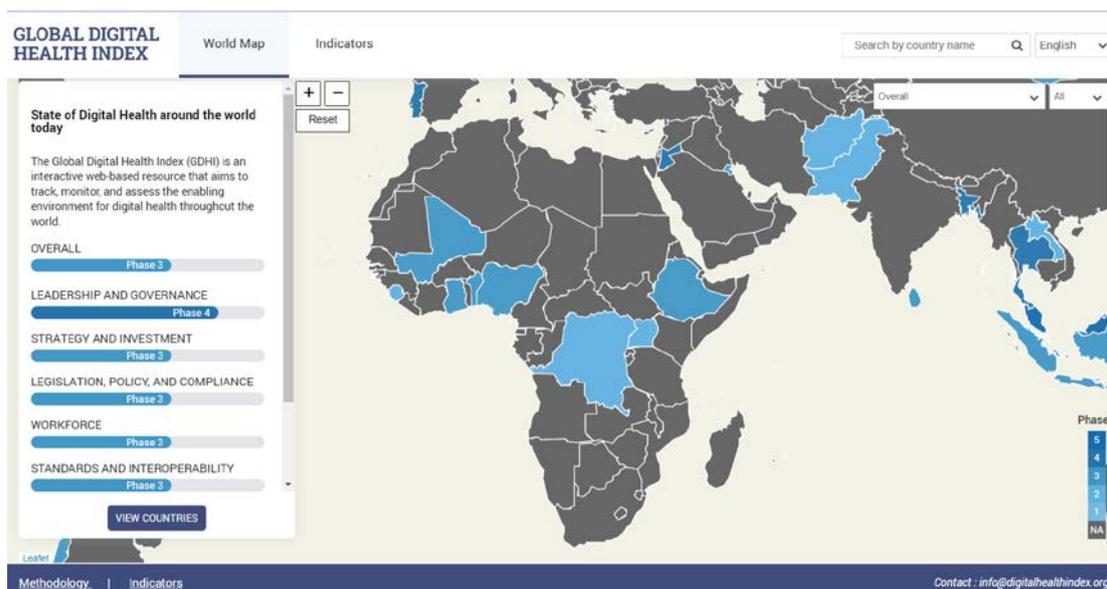


Figure 2 Global Digital Health Index: World Map

criteria<sup>3</sup> (see **Figure 2**). Explanations and guiding notes for each assessment criterion are given in **table 1**.

**Exclusion criteria** are designed to assess the adequacy of the studied practice. In case exclusion criteria are not fulfilled, other criteria will not be checked, and the studied intervention will be excluded. The Exclusion criteria includes the following aspects:

- *Relevance*
- *Intervention characteristics*
- *Evidence and theory based*
- *Ethical aspects*

**Core criteria** will entail the assessment of the effectiveness and efficiency of the practice as well as how the practice has addressed equity issues:

- *Effectiveness and efficiency of the intervention*
- *Equity*



Figure 3 Hierarchy of criteria

**Qualifier criteria** will assess the quality of the intervention in terms of its implementation and transferability. In particular, qualifier criteria will assess the following aspects:

- *Transferability*
- *Sustainability*
- *Participation*
- *Intersectoral collaboration*

Table 2 Best practices evaluation: Criteria and guiding notes

Criteria	Guiding notes
<b><i>Exclusion criteria</i></b>	
<i>Relevance</i>	Relevance is the extent to which the intervention/solution design and objectives respond to end-users needs. Evaluation of relevance can be done regarding the process and/or outcomes. Regarding solutions, we will adopt patients' outcomes evaluation.
<i>Evidence and theory based</i>	Scientific or other evidence, including from grey literature, situation analyses or anecdotal evidence was used to develop the practice/solution
<i>Ethical aspects</i>	To be respectful with ethic values, the practice/solution should ensure the privacy and confidentiality of patients' personal data
<i>Intervention characteristics</i>	This criterion assesses the existence of a situation analysis of the intervention/solution. A thorough description would include the context, the objective and target group
<b><i>Core criteria</i></b>	
<i>Effectiveness and efficiency</i>	Effectiveness evaluates the extent to which the intervention/solution achieved or is expected to achieve its objectives.

	Efficiency evaluates the extent to which the intervention/solution delivers, or is likely to deliver, results in an economic and timely way.
<i>Equity</i>	This criterion considers that the intervention/solution should take into account the needs of the population when allocating the resources, identify and reduce health inequalities.
<b><i>Qualifier criteria</i></b>	
<i>Transferability</i>	The extent to which the implementation outcomes of the intervention/solution are systematized and documented, making it possible to transfer it to other contexts/settings/countries or to scale it up to a broader target population/geographic context.
<i>Sustainability</i>	the intervention/solution's ability to be maintained in the long-term with the available resources, adapting to social, economic, and environmental requirements of the context in which it is developed.
<i>Participation</i>	The inclusion of stakeholders especially end-users throughout the whole life cycle of the intervention/solution
<i>Intersectoral collaboration</i>	This criterion considers whether the intervention/solution considers collaboration among the different sectors is fostered, e.g., health, social and education sectors.

### 3.2.2. Lessons learned in ehealth

Lessons learned are the documented information that reflects both the positive and negative experiences and the learning gained from the process of performing a project<sup>8</sup>. The principal goal of lessons learned is to improve the planned outcomes by identifying opportunities for improvement and the wider adoption of successful practices in future actions.

Under the context of BeH project, building on previous experiences will enhance the capacity and skills of partner organizations for a continuously improved performance. The present report will also serve as an advisory document for health policymakers in the four African countries. This will be ensured through WP5 public policy factors that is based on synthesizing evidence and findings of the different work packages.

### 3.3 Qualitative Data collection

Data collection methods are classified into quantitative and qualitative approaches. Quantitative data are used when a researcher is trying to quantify a problem, where data can either be counted or compared on a numeric scale. Qualitative data describes qualities or

characteristics, it frequently appears in narrative form. There are a variety of methods of data collection in qualitative research, including observations, textual or visual analysis (e.g. from books or videos) and interviews (individual or group)<sup>9</sup>.

In this study the following methods were adopted in a progressive manner starting with the most basic tool (desk research) and progressing with the other methods if required information were not available:

- Desk research / documents review (GDHI website, official reports from ministries...)
- Surveys (Online, Closed VS Open-ended questions)
- Interviews
- Focus groups discussions (Online/Offline with eHealth experts and users)

### 3.4 Practices classification

Practices can either be at an early stage of development ‘developing/promising’, fully mature ‘best’, or somewhere in-between ‘good’<sup>10</sup>. In this context, practices can be classified against the following evolutionary scale:

**Developing/Promising:** A program, activity or strategy that is in development and shows potential to become a best practice, or that has worked within one organization and shows promise for becoming a best practice with long term sustainable impact. Its relevancy, effectiveness and potential for replication is not yet proven, however shows potential for replication among other organizations.

**Good:** A program, activity or strategy that meets most of the criteria, leads to an actual change, has an impact on the policy environment, demonstrates an innovative or replicable approach, and demonstrates sustainability.

**Best:** Those strategies or techniques that have consistently shown results superior to those achieved with other means in a given situation and that could be adapted for other situations. This must be shown to work effectively and produce successful outcomes by the evidence provided by subjective and objective data sources.

By synthesizing the selected criteria with the three-level evaluation methodology:

- ✓ A developing/promising practice should comply with the exclusion criteria and some of the core criteria.
- ✓ A good practice should comply with the exclusion and most/all the core criteria and
- ✓ A best practice should comply with the exclusion, the core and most of the qualifier criteria

In many studies, the term '*good practice*' is used interchangeably with '*best practice*' since defining a 'best' cannot be generalized and depends strongly on the context, the period and many other factors. For the sake of our study and considering the African context, the present report will present information of both best and good practices in ehealth in the considered countries.

### 3.5 Data collection tool

Along with the guiding notes, key evaluation questions were developed for each criterion to guide the search and collection of best practices. Evaluation questions are given in Appendix 1. Key questions to extract lessons learned are also given in Appendix 2. A final template that summarizes all the characteristics of best practices and lessons learned related to an ehealth intervention is also provided to the partners (see Appendix 3). Addressed characteristics include aspect of the intervention, its name, context, description assessment (according to the predefined criteria), innovation/outcomes/impact, lessons learned and finally details about the contact person from the intervention.

## 4 Findings

Data search and collection have been performed by partners in their respective countries Ethiopia, Ghana, Malawi, and Tunisia. Developing/promising practices are excluded from the study. Relevant information about good and best practices are presented according to the template given in Appendix 3.

### 4.1 Best practices and lessons learned in Ethiopia

Table 3 Intervention 1 in Ethiopia ‘ET1’

<b>Aspect (s) of the ehealth intervention</b>	Services and Applications
<b>Name of the intervention</b>	District Health Information System 2 (DHIS-2)
<b>Context</b>	This DHIS-2 software is used for the Ethiopian Health centers, Hospitals, Woreda Health Office, Zonal Health Department, Regional Health Bureau and the Federal MoH and private health facilities to improve data quality by improving report completeness and timeliness.
<b>Description</b>	<p><b>Objectives</b></p> <p><b>General Objectives</b></p> <p>To improve the monthly reporting system of the country between the Public and Private Health facilities and Federal MoH.</p> <p><b>Specific Objectives</b></p> <ul style="list-style-type: none"> <li>▪ To assist the reporting system of Routine Health Information system in Ethiopia from Health Centers to Woreda Health Office, Zonal Health Department, Regional Health Bureau and then to the Federal MoH.</li> <li>▪ To assist the feedback system downwards from Federal MoH to Regional Health Bureau, from Regional Health Bureau to Zonal Health Department, from Zonal Health Department to Woreda Health Office and from Woreda Health Office to health facilities (Health centers and Hospitals).</li> </ul> <p><b>Activities</b></p> <ul style="list-style-type: none"> <li>- Data collection and reporting</li> <li>- Data validation</li> <li>- Data analysis</li> <li>- Data visualization</li> <li>- Decision Support System in terms of dashboard</li> </ul>

	<p><b>Beneficiaries</b></p> <ul style="list-style-type: none"> <li>▪ Public           <ul style="list-style-type: none"> <li>- Health centers</li> <li>- Hospitals</li> <li>- Woreda Health office</li> <li>- Zonal Health Department</li> <li>- Regional Health Bureau</li> <li>- Federal MoH</li> </ul> </li> <li>▪ Private           <ul style="list-style-type: none"> <li>- Private clinics</li> <li>- Private hospitals</li> <li>- Private specialty centers</li> </ul> </li> </ul> <p><b>Budget</b></p> <p>The budget source is secured by the Federal MoH, the Regional Health Bureau, and local and international donors. Yet, there is no exact information about the amount of funding.</p> <p><b>Duration</b></p> <p>From 2017 to date</p>
<p><b>Assessment</b></p>	<p><b>Exclusion criteria</b></p> <p><b>Relevance</b></p> <p>This District Health Information system (DHIS-2) has been applied since 2017 through the country Ethiopia to report all disease and service both in private and public facilities.</p> <p>Even though it has been applied throughout the country Ethiopia, some features were being incorporated by collecting feedback from the end-users like data validation and some features like integrating the previous e-HMIS database into the DHIS-2 software is under development.</p>

	<p><b>Evidence and theory based</b></p> <p>This District Health Information system (DHIS-2) initiated by taking lessons from the previous e-HMIS software that was developed by Tulane University. Currently DHIS-2 is used all over the country by taking open-source codes and managed by the programmers working at Ethiopian Federal MoH.</p> <p><b>Ethical aspects</b></p> <p>The Ethical aspect is insured by the guidelines and data validation feature. The Ethiopian MoH gave training and had follow up to assure the Ethical aspects like confidentiality, security and privacy when applying DHIS 2 Software.</p> <p><b>Intervention characteristics</b></p> <p>This intervention is applied both for the private and public facilities and administrative structures of the health sector and the application is both offline and online.</p>
	<p><b>Core criteria</b></p> <p><b>Effectiveness and efficiency</b></p> <p>This DHIS-2 software is expected to ensure data quality in the health sector and used to check whether we achieve the prioritized 131 Ethiopian Health care indicators. Evidence based decision making indicators are set by the Federal MoH of Ethiopia.</p> <p>The effectiveness and efficiency indicators are assessed every year based on the data received from the DHIS-2 and based on the objectives and prioritized set of activities.</p> <p><b>Equity</b></p> <p>The DHIS-2 is equally applied for both men and women  It is applied for public and private sectors to ensure its equity  It is applied for urban and rural areas.</p>
	<p><b>Qualifier criteria</b></p> <p><b>Transferability</b></p> <p>The DHIS-2 software can be transferable to other sectors like agriculture, education etc. by measuring the effectiveness and efficiency of its objectives. Also, the data collected by DHIS-2 can be used for planning in healthcare.</p>

	<p><b>Sustainability</b> The sustainability is guaranteed since the codes are customized by the professional team in the Federal MoH. It is also insured due to training of users, and it is open-source software.</p> <p><b>Participation</b> All government and private facility health professionals are participating Administrative levels starting from Woreda health office to Federal MoH are participating NGOs participated in different support activities (technical and financial)</p> <p><b>Intersectoral collaboration</b> The DHIS-2 is conducted by the MoH in collaboration with</p> <ul style="list-style-type: none"> <li>- Partners by giving training to professionals and offering system maintenance</li> <li>- Ethio-Telecom by providing network connection to the system</li> </ul>
<p><b>Innovation, outcomes, and impact</b></p>	<p>Open-source and easily customized. Will improve data quality and use. Increase effectiveness, efficiency, and responsiveness of the health system.</p>
<p><b>Lessons learned</b></p>	<p><b>What went well and what can we learn from that?</b></p> <ul style="list-style-type: none"> <li>• It is developed step by step based on the feedback given by end-users.</li> <li>• DHIS-2 is applied in all public facilities and some private facilities. The introduction of DHIS-2 to private facilities is in progress now.</li> <li>• System developers from the MoH try to incorporate comments based on end users' needs. They learned from the experience of the eHMIS that was developed by Tulane University even though the source codes were not delivered. The current DHIS-2 Software has been developed by the MoH professionals by customizing the free source code developed by University of Oslo.</li> </ul> <p><b>What didn't go so well and what can we learn from that?</b></p> <ul style="list-style-type: none"> <li>• Incorporation of GIS coordinate system were not done until now below the woreda administrative level but that might have been done if the MoH coordinated with the Ministry of Agriculture.</li> </ul>

	<ul style="list-style-type: none"> <li>The second task which remained undone until now is the use of DHIS-2 in mobile devices (android version).</li> </ul> <p><b>What advantages does the solution have?</b></p> <ul style="list-style-type: none"> <li>It can be applied both offline and online</li> <li>The Dashboard is used to frequently monitor the progress towards achieving the target</li> <li>The smart display feature in the DHIS-2 is used to disseminate information to the public.</li> </ul> <p><b>What challenges came up during the solution implementation?</b></p> <ul style="list-style-type: none"> <li>Some features of DHIS-2 are still not functional</li> <li>There has been a difficulty in migrating data from the previous eHMIS Software to the DHIS-2 software.</li> <li>Lack of adequate technical skills in the facilities to troubleshoot and maintain when the system needs maintenance.</li> </ul> <p><b>What should be done to improve the solution?</b></p> <ul style="list-style-type: none"> <li>The MoH needs to use maximum effort to fully functionalize the whole features.</li> <li>Capacity building of health professionals working in the facilities on computer hardware and software maintenance through need-based training and mentorship.</li> <li>Recruiting trained IT expert for each district to support DHIS-2</li> </ul>
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Table 4 Intervention 2 in Ethiopia ‘ET2’

<b>Aspect (s) of the ehealth intervention</b>	Services and Applications
<b>Name of the intervention</b>	Electronic Community Health Information System (eCHIS)
<b>Context</b>	The Electronic Community Health Information System (eCHIS) is a suite of mobile applications with a web-based monitoring portal. It intends to capture electronic data on the Health Extension Program (HEP) and other community-level services, as well as utilize this data to improve HEP performance and community health outcomes. Its main purpose is to serve as a job aid to Health Extension Workers (HEW). It is also intended to improve data quality and assist the limited human resource

	<p>(HEW) capacity to collect, analyze, and use data, thus promoting a culture of data use at the community level. In addition, the system is deployed at the Ministry data center, where health extension workers access it by using tablet computers. For this, the ministry provided a Tablet computer for HEWs and deployed a high-end server at the Federal Minister of Health (FMoH) data center. Also, the tablets use the Ethio-telecom subscriber identity module (SIM) card, and the ministry procured the SIM cards and covered the airtime for the HEWs. The HEWs are trained both on how to use the application and the tablet computer. The capacity of the HEWs in manipulating the tablet computer is still low and needs continuous training. The system is now being used at Amhara and Oromia regions.</p>
<p><b>Description</b></p>	<p><b>Objectives</b></p> <ul style="list-style-type: none"> <li>▪ Ensure that the neediest segment of the population is not left behind in accessing essential health care</li> <li>▪ Introduce a family health team approach at the primary health care unit level</li> <li>▪ Strengthen the Automation of the record-keeping and reporting at the health center and health extension workers' level</li> <li>▪ Build the capacity of the health center governance and management</li> <li>▪ Strengthen referral system (including consultation) between health centers and hospitals (bidirectional)</li> <li>▪ Improve supply chain management</li> <li>▪ Ensure full community participation in all processes of the implementation</li> </ul> <p><b>Activities</b></p> <ul style="list-style-type: none"> <li>- Digitalization of community health system</li> <li>- Community health data collection</li> <li>- Data synchronization to a central server</li> <li>- Service provision</li> <li>- Referral system</li> <li>- Capture family information including but not limited to household details (family profile, house no, etc...)</li> <li>- Manage service provision – immunization, pregnant woman listing, etc...</li> <li>- Generate aggregated disease and service HMIS reports</li> <li>- Generate various types of reports including environmental sanitation, kebele profile, household profile etc...</li> <li>- Provide a decision support system by which data is presented in tabular, chart, maps and used for analysis</li> </ul>

	<ul style="list-style-type: none"> <li>- Offer options to generate reports in various file formats such as Excel, PDF, CSV, etc...</li> <li>- Link with other already existing electronic systems</li> <li>- Improve data quality through tracking report timeliness, calculating data completeness and accuracy</li> </ul> <p><b>Beneficiaries</b></p> <ul style="list-style-type: none"> <li>- Community</li> <li>- Health extension workers</li> <li>- Health posts and health centers</li> <li>- Program managers</li> <li>- Policymakers and planners</li> </ul> <p><b>Budget</b></p> <p>The main budget sources are from the federal government and partner organizations</p> <p><b>Duration</b></p> <p>From 2019 to date</p>
<p><b>Assessment</b></p>	<p><b>Exclusion criteria</b></p> <p><b>Relevance</b></p> <p>eCHIS is being implemented at health posts and health centers with the objective of automating all the health extension packages of the country. The solution addresses the efficiency and effectiveness of the health extension program by improving the timeliness, completeness, and system integration with other systems like District Health Information Software (DHIS-2). The end users have been facing challenges in providing services by using the manual process and now they can easily perform their Tasks by using the application like household registration, client follow up, referral linkage etc.</p> <p><b>Evidence and theory-based</b></p> <p>The government of Ethiopia has developed and implemented Urban Health Extension Program (UHEP), one of the strategies to access primary health care (PHC) services. However due to the manual process of the system, it was exposed to data quality, efficiency, and effectiveness issues. This motivated the design and implementation of the eCHIS.</p>

	<p><b>Ethical aspects</b></p> <p>The eCHIS implementation guideline which is developed by involving all the relevant stakeholders guides the ethical issues. There is a clear guideline every stakeholder is governed about data capture, processing and sharing.</p> <p><b>Intervention characteristics</b></p> <p>All the objectives are set by the project document of the eCHIS and they are Specific, Measurable, Achievable, Realistic, and Timely (SMART) objectives and they are regularly measured against the set targets. During the system design and implementation, a human centered design approach is adopted, and the target population needs, and contributions are clearly elicited.</p>
	<p><b>Core criteria</b></p> <p><b>Effectiveness and efficiency</b></p> <p>The eCHIS digitizes family folder and CHIS content into a mobile platform for use by Health Extension Workers (HEW) around the country. The system intends to capture data on the Health Extension Program (HEP) and other community-level services, as well as utilize this data to improve HEP performance, community health outcomes, and Health Extension Workers (HEW) support across Ethiopia.</p> <p><b>Equity</b></p> <p>It is highly intended to benefit men and women          It is applied for public and private sectors to ensure its equity          It is applied for urban, rural and agrarian areas.</p>
	<p><b>Qualifier criteria</b></p> <p><b>Transferability</b></p> <p>An eCHIS implementation study was done, and the results were identified and documented as Consolidated Framework for Implementation Research (CFIR) - barriers and facilitators. The framework analyzed intervention characteristics, outer &amp; inner settings, characteristics of individuals, and processes. The documentation made it easy to scale up the implementation of the system and share experience with other implementors of the system with similar contexts. The technical</p>

	<p>experts/programmers trained on the system can transfer their skills to other organization experts who wish to use the tool from their perspective.</p> <p><b>Sustainability</b></p> <p>In order to ensure the sustainability of the system, the following actions were taken:</p> <ul style="list-style-type: none"> <li>▪ Knowledge transfer to local IT experts on how to customize and maintain the system has been done by providing technical training by experts coming from the DIMAGI company</li> <li>▪ A university (Jimma University) has been selected as an excellence center for the system and it leads the development, training, capacity building, and mentorship in the country</li> <li>▪ Different donor and implementing partners have been identified with roles and responsibilities to support the system implementation. There are many NGOs now involved in the system implementation and if one NGO goes out the others can ensure its sustainability</li> <li>▪ The ministry received all the source codes, design documents, SRS documents, and other relevant project documents to ensure institutionalization</li> <li>▪ End-user training and ICT training were provided to health extension workers to make the capable use and manage the system and the device.</li> </ul> <p><b>Participation</b></p> <p>All the relevant stakeholders have participated starting from the requirement gathering of the application up to implementation. The regions have been involved throughout the whole process. And, implementing and donor partners participated in the process</p> <p><b>Intersectoral collaboration</b></p> <p>Telecom providers participated in the network connectivity process Donor and implementing partners participated in the design, development and implementation of the application</p>
<p><b>Innovation, outcomes, and impact</b></p>	<p><b>Innovation</b></p> <p>The use of technology and data to improve service delivery starts at the community level. The eCHIS digitizes the family folder and CHIS content into a mobile platform for use by Health Extension Workers (HEW) around the country. The other innovative aspect is the interoperability work performed to integrate the eCHIS with DHIS-2. This is part of the Ethiopian eHealth architecture (eHA). The OpenHIM interoperability tool is being used as the integration tool and master facility</p>

	<p>registry (MFR) as a shared service. This is key in realizing the eHA objectives of having interoperable health systems in the sector.</p> <p><b>Outcomes</b></p> <p>The major outcomes of implementing eCHIS in the country are that health extension workers can now digitally register households with their members, follow ANC appointments automatically, and can trace dropouts, they can also link health post data with health centers. Everyone in the health hierarchy starting from the health post ( the lowest health care unit) up to the ministry can now see reports of the household registration process, RMNCH activities in real-time. A total of 457,285 households are registered on the electronic system by now. The Family Folder is the centerpiece of the Community Health Information System (CHIS). The eCHIS also automated the existing manual reporting processes by reducing time, resources, and potential reporting errors as well as presenting collected and aggregated data in a useful and meaningful format to allow for better-informed decision making. Besides it also enabled tracking and monitoring activities of HEWs. As part of the Identification, the eCHIS created a digital link between unique identifiers and health information about households and individuals as well as preventing the creation of duplicate records.</p> <p><b>Impact</b></p> <p>It is now impossible to assess the impact of the eCHIS because it is still in its early stages of implementation, both in terms of application development and geographic coverage. Its implementation, on the other hand, is projected to promote high-quality data in order to progress Ethiopia's health system and increase the coverage and quality of primary health care services, resulting in better health outcomes for mothers, children, and adolescents.</p>
<p><b>Lessons learned</b></p>	<ul style="list-style-type: none"> <li>• <b>What went well and what can we learn (lessons learned) from implementing this solution?</b> <ul style="list-style-type: none"> <li>- eCHIS has been configured and set up with Comcare HQ for local hosting.</li> <li>- Overall system design, deployment architecture, and a technology review was conducted based on the new requirements</li> <li>- Over 4,000 rural health posts in six regions (Tigray, Amhara, Oromia, Sidama, Benishangul Gumuz, and SNNPR) are using the eCHIS.</li> <li>- Progress toward an eventual country-wide implementation has been made</li> <li>- The Household registration process using the eCHIS application went very well and the success rate is more than 85 % by now.</li> </ul> </li> </ul>

- The steps taken to develop and implement eCHIS have been instructive and key to demonstrating the importance of developing a mobile tool for health service delivery.
- **What didn't go so well and what can we learn from that?**
  - A comprehensive program strategy's core components have yet to be determined. These will necessitate exploration of the development and implementation approach to rethink the overall programmatic goals of eCHIS.
- **What advantages does the solution have?**
  - eCHIS digitizes the family folder and CHIS content into a mobile platform for use by Health Extension Workers (HEW) at the service delivery point
  - The mobile platform and corresponding clinical, reporting, and system management tools promote access to the use of data about community service, support HEW and health decision-makers with relevant data
- **What challenges came up during the solution implementation?**
  - Even if eCHIS is advantageous, like another electronic system, it needs centralized devices: Servers machines and end devices like Tablets and the 3G network, which necessitate the need to collaborate between the MoH, EthioTelecom, and other relevant stakeholders.
- **What should be done to improve the solution?**
  - There should be capacity building of health extension workers in using the technology and managing the tablet computers.
  - Stakeholders at all levels should take ownership of the system and include it in their annual work plans.
  - Customize and scale up eCHIS for urban settings
  - Ensure ongoing system usage through mentorship and supportive supervision
  - Ensure the uninterrupted availability of tablets and 3G internet connectivity

## 4.2 Best practices and lessons learned in Ghana

Table 5 Intervention 1 in Ghana ‘GH1’

<b>Aspect (s) of the ehealth intervention</b>	Strategy and Investment
<b>Name of the intervention</b>	National eHealth/ Digital Health Strategy or Framework
<b>Context</b>	The MoH developed a national eHealth Policy and Strategy in 2010 to support the digital transformation in the Health Sector. The development of a national ehealth strategy constitutes the first stage of a long-term undertaking aimed at raising the levels of performance of the health sector in all areas of service delivery. It constitutes a framework for engaging recipients of health services and ensuring that they contribute effectively towards raising the overall health status of the population. It is a tool that is placed in the hands of health care providers to enable them to overcome existing barriers, and to access quality care for most consumers who live in places far from the city.
<b>Description</b>	<p><b>Objectives</b></p> <ul style="list-style-type: none"> <li>▪ Streamlining the regulatory framework for health data and information management</li> <li>▪ Building sector capacity for wider application of ehealth solutions in the health sector.</li> <li>▪ Increasing access and bridging equity gap in the health sector through the use of Information and Communication Technology</li> <li>▪ Towards a paperless records and reporting system</li> </ul> <p><b>Activities</b></p> <ul style="list-style-type: none"> <li>- Set up an ehealth committee for the health sector and define terms of reference.</li> <li>- Develop data handling protocol for the health sector covering all levels of service.</li> <li>- Develop scheme of service for ehealth workforce.</li> <li>- Set up a Task force to develop ehealth training needs for health professionals and Civil Society Organizations in health.</li> </ul>

	<ul style="list-style-type: none"> <li>- Ensure that provisions are made within the budget for ehealth at all levels</li> <li>- Develop framework for collaboration with mobile phone service providers</li> <li>- Develop pilot programs for m-health and telemedicine.</li> <li>- Develop public health information plan for incorporation in annual program of work</li> <li>- Develop framework for modernizing ICT infrastructure</li> <li>- Revamp the Center for Health Information Management</li> <li>- Set up National data repository</li> <li>- Pilot Patient record and service management system</li> </ul> <p><b>Beneficiaries</b> Health Institutions, eHealth Practitioners and stakeholders, development partners and financiers of health Care.</p> <p><b>Budget</b> Not Available</p> <p><b>Duration</b> 5 Years</p>
<p><b>Assessment</b></p>	<p><b>Exclusion criteria</b></p> <p><b>Relevance</b> The demand for ehealth solutions is amply demonstrated by the number of initiatives being undertaken in several areas of health care delivery. There is therefore the need to develop policies and legal frameworks for its roll out in the health sector and to minimize the frequent failures usually encountered in the adoption of new technology in the health sector. The strategy seeks to align all ehealth solutions to the outlined standards but will not limit the development of local ehealth initiatives. Also, the Strategy helps align Healthcare programs with the use of technology.</p> <p><b>Evidence and theory based</b> The Strategic document is evidence based and it seeks to harness the potential of information and Communication technology to improve the health status of all citizens. The Government of Ghana’s blueprint on digitalization in the country, referred to as the ICT4AD, identifies the enormous potential technology offered in the clinical and digital transformation of the healthcare</p>

	<p>delivery system. The Ministry’s eHealth Strategy sought to provide the building blocks for the realization of the national digitalization agenda. It also sought to ensure a strategic alignment with the ICT4AD and address interoperability issues. The strategy document also provided a roadmap for the implementation of the policy document.</p> <p><b>Ethical aspects</b> Not Applicable</p> <p><b>Intervention characteristics</b> The strategy document clearly describes the objectives and activities and how best to achieve them.</p>
	<p><b>Core criteria</b></p> <p><b>Effectiveness and efficiency</b> It is difficult to evaluate the effectiveness and efficiency of the strategy at the moment since no indicators have been established to measure them. However, the WHO ATLAS represents evidence that the intervention is successful.</p> <p><b>Equity</b> There is equitable allocation of resources. The document was accomplished in a transparent way and is available to the public on the internet. When it comes to the use of the strategic plan, there is no distinction between genders.</p>
	<p><b>Qualifier criteria</b></p> <p><b>Transferability</b> Not Applicable</p> <p><b>Sustainability</b> Aspects of sustainability were considered while developing the strategy. Also, in order to ensure sustainability of the strategy, the MOH implemented IT Government structures for the technical and financial sustainability of the eHealth interventions and initiatives. The IT Governance structures comprised of managerial and technical sub committees with members being key stakeholders in the health sector. The IT Governance team members addressed technical and financial sustainability by ensuring that eHealth interventions were strategically aligned with business plans and were designed to provide optimal IT</p>

	<p>value delivery. Selected eHealth interventions were subjected to risk assessment too. Resources were allocated based on the interventions identified as well as performance benchmarks that provided improved health outcomes. Sustainability was therefore achieved by institutionalizing IT Governance.</p> <p><b>Participation</b> There was limited stakeholders’ involvement and lack of effective dissemination of the document.</p> <p><b>Intersectoral collaboration</b> Stakeholders from several sectors, including communication, education, and health, were involved in the strategy's development. The eHealth strategy development involved several stakeholders. The collaborators involved the MoH, Ghana Health Service, Teaching Hospital and Private Sector healthcare providers. There was also representation from the National Information Technology Agency (NITA), National Telecommunication Chambers, Academia such as the University of Ghana School of Public Health, Development Partners in the preparation of the strategy development and review. There was however inadequate participation by end-users during the strategy development process. The coverage of the dissemination was limited due to lack of adequate funding. This made it impossible for all stakeholders to obtain copies of the strategy documents and also benefit from the awareness creation sessions.</p>
<p><b>Innovation, outcomes, and impact</b></p>	<p><b>Innovation</b> The complexity of the health care ecosystem makes it imperative for the adoption of innovative strategies and eHealth interventions to be adopted in the rollout of digital health initiatives. The innovations focused on the people, process, and technology triad. The creation of establishment post for Health IT professional and the recruitment of persons with high skill sets and competencies was completed at the Headquarters, Regional Level and for Hospital operations. A matrix of training and capacity building sessions were organized by management. The matrix of competencies required for the supporting eHealth interventions were defined.</p> <p><b>Results</b> As a result of the implementation activities, there has been an increase in the employment of Health IT professionals with eHealth specific competencies. Persons with competencies like Systems Administration, Network Engineers, Database Administrators, Cybersecurity Professionals, Health Informaticians, Big Data Analytics, Biomedical IT Professionals etc. were</p>

	<p>engaged and posted to the Teaching Hospitals. The HR operationalize the establishment post for these professionals. Training programmes and other capacity building sessions has been rolled out at the various health facilities.</p> <p><b>Impact</b></p> <p>The eHealth policy established the pathway for the digital transformation journey in healthcare. The process has had significant impact in the ecosystem. The underlisted are some of the impacts made:</p> <ul style="list-style-type: none"> <li>• Increase in the adoption of eHealth interventions among stakeholders</li> <li>• Reduction of failed eHealth Projects due to the availability of skilled IT Professionals.</li> <li>• Increase in the adoption of best practices and standards in the implementation of eHealth interventions</li> <li>• Recognition of the need to comply with legal and regulatory frameworks relating to the privacy, confidentiality and integrity of health data</li> <li>• Increase in capacity building and awareness creation of health care providers.</li> <li>• Recognition of the responsibility and accountability implication of using technology in healthcare</li> <li>• Increase in the understanding of the technology related patient safety implications of using technology in care delivery.</li> </ul>
<p><b>Lessons learned</b></p>	<ul style="list-style-type: none"> <li>• <b>What went well (advantages)?</b></li> </ul> <p>The national ehealth strategy helped align healthcare programs with the use of technology and increase in the adoption of eHealth Solution.</p> <p>It also provided a framework or context for the adoption of technology among the healthcare institutions. The national eHealth also showed the importance of implementing eHealth Interventions based on a strategic relation and alignment. The eHealth Strategy also showed the importance of making provision for adequate resources for the purpose of technical and financial sustainability.</p> <p>It also offered the opportunity for awareness creation on the eHealth Strategy.</p> <ul style="list-style-type: none"> <li>• <b>What didn't go so well (challenges)?</b></li> </ul> <p>The rapid technological advancement rendered it not so relevant.</p> <p>The unavailability of operational document/plans to implement identified projects.</p>

	<p>The lack of effective and functional IT Governance affected the full rollout of the eHealth Strategy.</p> <p>The life cycle of the implementation of the strategy was reduced.</p> <p>The budgetary allocation of funds was a major constraint</p> <p>The planned infrastructural deployment was not possible.</p>
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### 4.3 Best practices and lessons learned in Malawi

Table 6 Intervention 1 in Malawi ‘MW1’

<b>Aspect (s) of the ehealth intervention</b>	Services and Applications
<b>Name of the intervention</b>	Integrated community health information system (iCHIS) <sup>11,12</sup>
<b>Context</b>	iCHIS is being implemented in Malawi at community level. The Malawi MoH through the Community Health Services Section (CHSS) in collaboration with the Quality Management Department (QMD), Digital Health Department (DHD), and the Central Monitoring and Evaluation Division (CMED) developed a five-year National Community Health Strategy (2017-2022) and the iCHIS is a result of what was articulated in the strategy.
<b>Description</b>	<p><b>General objective</b></p> <p>The integrated community health information system (iCHIS) is an initiative to provide accessible, affordable and context aware community healthcare, through an integrated and configurable digital platform which builds on DHIS-2.</p> <p><b>Activities</b></p> <p>Implementation of this initiative is split into six phases. Starting with phase I where a situation assessment was done, followed by phase 2 for system requirements analysis and workflow specifications. Phase 3 is currently being implemented</p>

	<p>which is design and development. This activity will be followed by phase 4, the initial rollout; phase 5 the national rollout and finally phase 6 ongoing systems support.</p> <p><b>Beneficiaries</b> Health professionals Patients</p> <p><b>Budget</b> Information not available</p> <p><b>Duration</b> Information not available</p>
<p><b>Assessment</b></p>	<p><b>Exclusion criteria</b></p> <p><b>Relevance</b> iCHIS is implementing what was stated in the national community health strategy of 2017-2022 and is based on the findings of iCHIS Phase I Situation Analysis and iCHIS Phase II System Requirements and Workflow Specifications reports.</p> <p><b>Evidence and theory based</b> In addition to the situation analysis findings from iCHIS Phase I, a technological gap assessment was also conducted.</p> <p><b>Ethical aspects</b></p> <ul style="list-style-type: none"> <li>- Ethical aspects are indicated by the existing manual system. The manual system uses registers and there are existing guidelines on how data should be collected, processed and reported.</li> <li>- There is continued engagement with frontline workers to identify ethical grey areas, through the use of pre-field tests and periodic system presentation</li> </ul> <p><b>Intervention characteristics</b></p> <ul style="list-style-type: none"> <li>- Delivered through program implementation departments and units within the MoHP, coordinated by the Community Health Services Section (CHSS) and the Digital Health Division.</li> </ul>

	<ul style="list-style-type: none"> <li>- Used participatory, inclusive Human-Centered Design (HCD) approach in the situation assessment phase and user-centeredness approach was used in the design and development phase through consultative workshops, field visits, stakeholder interviews and engaging users in co-creative methods.</li> </ul>
	<p><b>Core criteria</b></p> <p><b>Effectiveness and efficiency</b> iCHIS is able to perform the functionalities of the paper-based registers Coordination is easy because all the relevant program departments were part of the process</p> <p><b>Equity</b> Equality between men and women is ensured All users have the same tools and will attend similar training sessions All interested sponsors have the same chance of joining the basket</p>
	<p><b>Qualifier criteria</b></p> <p><b>Transferability</b> iCHIS App can be used in any setting which has similar context. For instance, this system can be used for the Waredas (Ethiopia). The data collected is transferable to other health information systems that use DHIS-2 as their base (i.e., HMIS and EMRs at health facility level) and others non-DHIS-2 applications through APIs.</p> <p><b>Sustainability</b> Political will from the highest office to ensure long term activities. Each user is responsible for their data collection tools (tablet and power bank). Joint funding model makes it more sustainable and trustable.</p> <p><b>Participation</b> User involvement to try, test and provide feedback on the system Participation of stakeholders at different levels during pre-testing and piloting</p> <p><b>Intersectoral collaboration</b></p>

	There are several intersectoral collaborations within this initiative – MoH (the owner of iCHIS) with the academics-University of Malawi (the technologists) and the different development partners (the investors/sponsors)
<b>Innovation, outcomes, and impact</b>	<p><b>Results</b></p> <ul style="list-style-type: none"> <li>▪ Initial modules have been developed and are being used</li> <li>▪ Funds drawn from different sponsors who have an interest to fulfill the community health strategy by advancing the development of iCHIS</li> <li>▪ User-involvement is ensured</li> </ul> <p><b>Impact</b></p> <p>As the project is still in progress, this far, the milestones that were set have been achieved i.e. Alpha pretesting and piloting has been done and feedback from users has been incorporated</p>
<b>Lessons learned</b>	<ul style="list-style-type: none"> <li>• <b>What went well and what can we learn from implementing this program/using the solution?</b> Not all prospective users are digital literate</li> <li>• <b>What didn't go so well and what can we learn from that?</b> There is a need to ensure that the users get a chance to undergo a digital skills training</li> </ul>

Table 7 Intervention 2 in Malawi 'MW2'

<b>Aspect (s) of the ehealth intervention</b>	Services and Application
<b>Name of the intervention</b>	OpenLMIS and DHIS-2 Integration
<b>Context</b>	The Malawi Health Management Information System (HMIS) is operating on a DHIS-2 platform, and they migrated from the standalone based DHIS1 to the web-based DHIS-2 in 2012 and the system is currently covering the following program areas: Reproductive, Maternal, Newborn, Child, and Adolescent Health (RMNCAH), Malaria, Nutrition, Tuberculosis (TB), HIV, Non-

	<p>Communicable Diseases (NCDs). The health information system landscape in Malawi has experienced exponential growth in recent years, seeing the introduction of various tools and solutions for the collection of health data. Despite this being the case, fragmentation and lack of data exchange have been a long-standing challenge. The Malawi MoH (MoH) highlighted its commitment to improving the management of health data as outlined in objective 6 of the Health Sector Strategic Plan II 2017 – 2022. The lack of adequate supply chain data to inform supply chain planning and operations management decisions was identified as a major risk to achieving the impact of Global Fund-supported programs. At the same time an opportunity was recognized to use the existing DHIS-2 system to support supply chain data analysis and visualization and therefore, HMIS integration with the Logistics Management Information System (LMIS), operating on an OpenLMIS platform, was identified as the solution to the problem. The MoH received support from Global Fund integrated logistics data, the University of Oslo, Kuunika Data for Action project, USAID Procurement and Supply Chain Management - Chemonics.</p>
<p><b>Description</b></p>	<p><b>General objective</b></p> <p>The overall goal of this initiative was to strengthen existing electronic Logistics Management Information System solutions and facilitate integration with the HMIS (DHIS-2), to support analysis and data visualization in Malawi.</p> <p><b>Specific objectives</b></p> <ul style="list-style-type: none"> <li>▪ Develop capacity for HMIS/LMIS data integration</li> <li>▪ Develop HIV/TB/Malaria-related LMIS/HMIS indicator dashboards</li> <li>▪ Build country DHIS-2/LMIS team capacity, train key Supply Chain data users</li> <li>▪ Facilitate effective change management in LMIS/HMIS data use</li> </ul> <p><b>Activities</b></p> <p>The following activities were undertaken during the implementation of this project:</p> <ul style="list-style-type: none"> <li>- Readiness Assessment – October 2018</li> <li>- Stakeholder Meeting – March 2019</li> <li>- Development of KPI’s (Malaria, TB, HIV, Reproductive Health) – March-April 2019</li> <li>- Indicator Mapping and Documentation– May 2019</li> <li>- Development of Interoperability Layer (IL) and Master Health Facility Registry (MHFR) - June 2019</li> </ul>

- Stakeholder meeting to review indicators – July 2019
- The final list of indicators –September 2019
- Test Server Upgrade – September 2019
- Documentation- October 2019
- Development of the OpenLMIS API for LMIS/DHIS Integration –October 2019
- User Acceptance testing for Integration – October 2019
- Configuration of Indicators -November 2019
- DHIS2/LMIS Integration complete – December 2019
- Developing Change Management and Communication Strategy – December 2019
- Migration of LMIS data to test instance and configuration – January and February 2020
- Malaria, HIV, and TB dashboards configured in test instance – February 2020 17
- Developing training material – February 2020
- LMIS/DHIS-2 Integration/Stakeholder Meeting – February 2020
- LMIS ToT- March 2020
- Upgrade of production instance –March 2020
- Replication of work done of test instance – April – December 2020

**Beneficiaries**

The Malawi Government, MoH

Main Implementor

University of Oslo/HISP Malawi

Key Stakeholders

- MoH – The Project Owner
- MoH – Central Monitoring and Evaluation Division- HMIS Management and Implementation Coordinating Unit
- MoH – Digital Health Division -Interoperability System Custodian
- MoH– HTSS- Management of logistics data
- Global Fund -PIU-Implementation support
- Technical Partners:

	<ul style="list-style-type: none"> <li>• University of Oslo/Health Information Systems Program (HISP) Malawi -Facilitate and support technical requirements on DHIS-2</li> <li>• GHSC -PSM -Facilitate and support technical requirements on the Open LMIS</li> <li>• Kuunika Data for Action -Bill and Melinda Gates Foundation (BMGF)- Facilitate interoperability of the two systems through the development of the architecture (IL and MHFR)</li> </ul> <p><b>Budget</b> \$220,000</p> <p><b>Duration</b> From October 2018 to December 2020</p>
<p><b>Assessment</b></p>	<p><b>Exclusion criteria</b></p> <p><b>Relevance</b> The MoH has prioritized the interoperability of systems to promote health information exchange. This project was initiated to address the issue of fragmented systems and to provide a solution that allows data triangulation for service delivery data and supply chain data. This was based on both program needs and user needs i.e, to provide data that will ease stock management as well as comparison of issuance and consumption.</p> <p><b>Evidence and theory based</b> The Standard Operating Procedures (SOP) on Interoperability were developed to guide the implementation of interoperability across health information systems in Malawi. This SOP is intended to guide service providers, contractors, consultants, employees, temporary staff, and all other stakeholders of MoHP, including all personnel affiliated with third parties. The procedures also apply to all systems accessing MoHP health information. In this context, interoperability is meant to achieve reliable and secure sharing of information between all sub-systems of the MoH and Population (MoHP) and other related systems to facilitate access and retrieval of information.</p> <p><b>Ethical aspects</b> Both the LMIS and HMIS systems are only handling aggregate data. Additionally, ethical considerations are taken into consideration during the data collection processes, such as primary data collection through registers.</p>

	<p><b>Intervention characteristics</b></p> <p>The implementation was supported by the Global Fund and was initially designed to cover the Global Fund Programs; Malaria, Tuberculosis (TB), and HIV, however, there was a demand to include the Reproductive Health program. The objectives were clearly defined. Regarding the integration of OpenLMIS and DHIS-2, all reporting attributes on the OpenLMIS were adopted in consideration of future data analysis needs. The interoperability services layer manages the authentication processes, entity mapping, routing requests to target systems and an audit trail is also available detailing successful and failed requests (which can then be rerun). Documentation is also available regarding the processes undertaken on the OpenLMIS, IL, and HMIS, including indicators definitions.</p>
	<p><b>Core criteria</b></p> <p><b>Effectiveness and efficiency</b></p> <p>During the implementation, several evaluations were conducted by the Global Fund headquarters through country mission visits. At the end of the project, a closeout report was prepared which was deemed satisfactory. Feedback from the users during the capacity-building activities conducted during the implementation indicates that the dashboards would assist users in evidence-based decision-making concerning stock management.</p> <p><b>Equity</b></p> <p>The configured dashboards and indicators that are designed to facilitate data use for decision-making are available to all system users. However, to access the HMIS system, a user requires login credentials which can be requested through CMED.</p>
	<p><b>Qualifier criteria</b></p> <p><b>Transferability</b></p> <p>There is adequate documentation available to guide the implementation of a similar intervention.</p> <p><b>Sustainability</b></p> <p>Sustainability factors were put into consideration. The middle ware that facilitated interoperability is considered at the MoH architecture. Documentation is available for the processes undertaken for the integration work, in case the ministry opts to scale up to incorporate more program areas.</p>

	<p><b>Participation</b> Stakeholder consultations were conducted during various stages of the implementation and across various levels of the healthcare system. A variety of users were consulted, including but not limited to technical experts, program managers, data managers, officers, and data users.</p> <p><b>Intersectoral collaboration</b> There was no intersectoral collaboration on this project since the project was implemented under the MoH, however, the implementation involved collaboration with multiple departments and programs within the MoH.</p>
<p><b>Innovation, outcomes, and impact</b></p>	<p><b>Results</b></p> <ul style="list-style-type: none"> <li>▪ The interoperability layer provides a single point of access that will act as a mediator for communication between Health Information Systems, ensuring secure and accurate data exchange</li> <li>▪ Key performance indicators and dashboards development for TB, HIV, Malaria, and RHD.</li> </ul> <p><b>Impact</b></p> <ul style="list-style-type: none"> <li>▪ Improved supply chain data access and validation of HMIS/SC data since both sets of data were now available within the HMIS.</li> <li>▪ Improved supply chain performance monitoring through visibility and analysis of key indicators on dashboards. Users can identify understocked, overstocked, and adequately stocked facilities and effectively arrange for stock transfers</li> <li>▪ Improved monitoring of program interventions such as changes in treatment options through harmonized KPIs. Easier to track commodities used and compare with service utilization</li> </ul>
<p><b>Lessons learned</b></p>	<p>Lessons learned reported by partners involved in implementation</p> <ul style="list-style-type: none"> <li>• <b>What went well and what can we learn from implementing this program/using the solution?</b> <ul style="list-style-type: none"> <li>- There is a need to understand the ecosystem. The infrastructure and dashboards were developed according to global standards whilst considering factors presented in the local context.</li> <li>- The gaps in the health information system landscape were understood, and therefore the development of the interoperability layer focused on addressing the identified gaps.</li> </ul> </li> </ul>

	<ul style="list-style-type: none"> <li>- It is important to understand the solution and envision the result in the development process since different methods can be implemented to achieve the same result.</li> <li>- Stakeholder management is important for implementations involving multiple stakeholders with varying interests.</li> <li>• <b>What didn't go so well and what can we learn from that?</b></li> <li>- The interoperability concept is a new concept that involves a lot of learning and requires continuous development of specific skills i.e software engineering.</li> <li>- The development of the interoperability infrastructure that enables data exchange requires a lot of time</li> <li>- Lack of coordination on reporting form updates affected progress and resulted in the need of constantly update indicators. Form revisions on the OpenLMIS reporting also necessitated re-mapping and updating data elements both in DHIS-2 and the interoperability middleware. Partial data import is one of the challenges experienced as a result of revisions.</li> <li>- The product registry was in development during the project implementation period and therefore mapping of data elements and or updating the data element mapping files remained a significantly manual process.</li> <li>- The process of agreeing on the final list of indicators consumed a significant amount of time.</li> </ul>
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#### 4.4 Best practices and lessons learned in Tunisia

Table 8 Intervention 1 in Tunisia 'TN1'

<b>Aspect(s) of the ehealth intervention</b>	Services and Applications
<b>Name of the intervention</b>	Set up of a medico-economic information system in a pilot sector <sup>13</sup>
<b>Context</b>	Tunisia has been going through a period of political transition since January 2011 which could lead to changes in some of the policies, strategies and action plans which are supported through this twinning. Certain adjustments may be made with respect to certain activities and results stated in the twinning sheet.

	<p>The Tunisian public health system, faced with internal inefficiencies and inadequate funding, was reformed targeting university hospitals and then extended to regional hospitals. Its objectives are to establish management autonomy and operate an integrated information system which will enable the government to review the financing methods of the sector.</p> <p>The main achievements of the hospital reform in terms of the information system are the establishment of a management information system, the creation of the Computer Center of the MoH, cost calculation by hospital specialty using data provided by partially integrated computer applications</p> <p><b>Institutional framework</b></p> <p>This twinning project is carried out within the framework of the Support Program for the Association Agreement and the Neighborhood Action Plan (P3AII) agreed between the Tunisian Government and the European Union. The P3AII aims to support the efforts of the Tunisian administration and public institutions in the concretization and implementation of the economic, social, commercial and service components of the Association Agreement and the Neighborhood Action Plan.</p> <p>The supervisory authorities of the program are the European Commission and the Ministry of Development and International Cooperation, the national coordinator of this project. The program is managed by a management unit placed under the supervision of the ministry through the national program manager and headed by a Director General.</p>
<p><b>Description</b></p>	<p><b>General objectives</b></p> <ul style="list-style-type: none"> <li>▪ Strengthen public health governance capacities: resource allocation and performance evaluation</li> <li>▪ Improve the quality and efficiency of services provided by health facilities and contribution to the achievement of national health objectives</li> </ul> <p><b>Specific objectives</b></p> <ul style="list-style-type: none"> <li>▪ Development of a medico-economic evaluation model for hospital services by clinical stays</li> <li>▪ Implementation of the developed medico-economic model in pilot hospital sites</li> </ul> <p><b>Activities</b></p>

The twinning project provides technical and organizational support to beneficiary institutions and contributes to the creation of a unit / department dedicated to processing medico-economic information within each beneficiary hospital structure.

This project consists of setting up an integrated system for medico-economic evaluation and calculation of hospital services costs in a pilot sector. It aims more specifically to strengthen the management capacities and technical skills of the public health administration to support the design, implementation, start-up and operation of the medico-economic evaluation system of public hospital services.

#### A. Inventory and diagnosis

A1. Assessment of the existing situation and identification of the project:

A2. Definition of the organization and the support information system

A3. Development of an action plan allowing the duplication of the Medico-economic information system adopted at the level of hospital structures at the national level

#### B. Medical information

B1. Update of reference medical nomenclatures and codifications

B2. Development and implementation of a methodological guide for the production of stay summaries

#### C. Financial and medico-administrative information

C1. Preparation for the implementation of cost accounting

C2. Development and implementation of a guide for calculating the costs of stays

C3. Standardization of medico-administrative and patient identification information

C4. Improving the collection of information at the level of medico-technical services and administrative support services

#### D. Data processing

	<p>D1. Design of a structure dedicated to the processing of medico-economic information</p> <p>D2. Production of tools and instruments for classifying hospital stays in homogeneous groups of patients</p> <p>D3. Implementation of the classification of stays and the processing of medico-economic data</p> <p>D4. Strengthening the regulatory capacity of public health financing</p> <p><b>Beneficiaries</b></p> <p>The direct beneficiary institutions are:</p> <p>The General Directorate of Public Health Structures of the MoH</p> <p>The computer center of the MoH</p> <p>5 pilot hospital sites: Habib Thameur hospital, Sahloul hospital, the maternity and neonatal center of Tunis, regional hospital of Bizerte, Ras Jbel hospital.</p> <p>In addition, the national health insurance fund is an indirect beneficiary of this twinning project given the exchange of information between the MoH and this structure in terms of the costs of hospital services financed by the fund.</p> <p><b>Budget</b></p> <p>The twinning budget is estimated as € 1,300,000</p> <p><b>Duration</b></p> <p>24 months from January 2012 to January 2014</p>
<p><b>Assessment</b></p>	<p><b>Exclusion criteria</b></p> <p><b>Relevance</b></p> <p>The health sector, in particular the public hospital system, is called upon to respond effectively to new requirements for improving its performance in terms of quality, responsiveness, and efficiency. Areas for improvement in the public health sector include the support of the health system through an effective patient-centered national health information system,</p>

	<p>and the enhancement of good governance and responsiveness of the public health sector. In order to overcome the limits of the existing process, a double medico-economic approach, centered on the patient's medical file, constitutes the best means for a more rational allocation of resources and allows to create a common language between professionals and managers and help them put a coherent policy for the future of the hospital. On the other hand, the project specifically aims to strengthen the management capacities and technical skills of the public health administration to support the design, implementation, start-up, and operation of the medico-economic evaluation system for hospital services.</p> <p><b>Evidence and theory based</b></p> <p>The objectives and activities programmed in this initiative are based on a situation analysis of the Tunisian hospital information system. The study includes the following aspects: current status, limitations, infrastructure and development perspectives of the current information system.</p> <p>Good practices from different EU (Spain, Belgium...) countries are considered as references for capacity building activities offered to the Tunisian health professionals of the selected pilot sites with respect to the context.</p> <p>The documentation of the project illustrates well the adopted methods and approaches for implementing the different activities and sub-activities of the project.</p> <p><b>Ethical aspects</b></p> <p>Under the activity 'identification data and medico-administrative information', study visits were organized to relevant medical structures in EU countries implementing ethical and effective methods for the identification and administrative management of the patient. The activity made it possible to become acquainted with these methods and to verify their suitability for the Tunisian context.</p> <p><b>Intervention characteristics</b></p> <p>The documentation of this project specifies the general and specific objectives, activities to achieve them, beneficiaries, expected results and objectively verifiable performance indicators. Intervention context, other related projects that are being implemented and situation diagnosis are also stated.</p>
	<p><b>Core criteria</b></p> <p><b>Effectiveness and efficiency</b></p>

	<p>The developed medico-economic information system is able to achieve the expected results and impact through a predefined set of performance indicators. These performance indicators are defined for the general and specific objectives and expected results. Expert report and other documents are used as monitoring tools.</p> <p>There is no clear information about the efficiency of the intervention in terms of how well the resources being used, or to what extent is the relationship between inputs and results are timely and cost effective. However, an implementing agency responsible for procurement and financial management was in charge of supporting the project and ensuring the conditions allowing the achievement of the planned results. A set of institutional and organizational mechanisms are provided to ensure the necessary coordination, monitoring and steering.</p> <p><b>Equity</b>          Opportunities equality was considered in the implementation of the intervention. In its development, implementation and execution phase, project managers ensured respect for the principle of equality between women and men, combat all forms of discrimination and inequality based on gender and to develop instruments and strategies based on an integrated approach of the human dimension and skills.</p>
	<p><b>Qualifier criteria</b></p> <p><b>Transferability</b>          The intervention uses previous experiences and good practices from EU countries and other countries having the same context as Tunisia. Furthermore, the report of the twinning project comprises the description of the organizational elements, identifies the hypothesis related to each activity following a diagnosis of the existing setting.</p> <p><b>Sustainability</b>          The twinning project aimed the design and development of a medico-economic assessment system taking into account technical and infrastructure constraints and, on the other hand, its implementation at the level of a number of pilot hospital structures by supporting the medical and administrative staff concerned.</p> <p>At the strategic level, the model chosen and tested can be generalized to all hospitals, thus offering a tool for public health governance by regulating funding and evaluating performance.</p>

	<p>On the operational level, the majority of the project activities will make it possible to capitalize on the know-how of its staff through training and the transfer of European expertise in the area of medico-economic evaluation of hospital activity which ensures the durability of the project impact.</p> <p><b>Participation</b> The inclusion of users of the developed medico-economic information system is well ensured during the various phases of design and implementation. Capacity building sessions related to different activities of the project were programmed, where the objective was to train 80-100% of the total number of actors in each hospital pilot site. Intermediate seminars were also organized to present the experiences and the possible framework to be applied in Tunisia and collect the opinions of the various actors.</p> <p><b>Intersectoral collaboration</b> There is no explicit collaboration among different sectors, however, the national health insurance fund (CNAM) which is an organization under the Ministry of Social Affairs is an indirect beneficiary of the developed information system.</p>
<p><b>Innovation, outcomes, and impact</b></p>	<p><b>Results</b></p> <p>A. Inventory and diagnosis: The design and approval of a project to set up a medico-economic evaluation model</p> <p>B. Medical information: The update and implementation of references and methods of classification and coding of medical data</p> <p>C. Financial and administrative information: The establishment of a national cost accounting based on the costs of stays. And the collection of relevant medico-economic information throughout the patient's journey</p> <p>D. Data processing: The establishment of a functional device for processing medico-economic data at the pilot sites and at the Ministry</p> <p><b>Impact</b></p> <p>The adopted dual medico-economic approach, centered on the patient's medical record, constitutes the best means for a more rational allocation of resources on the one hand and makes it possible to create a common language between</p>

	<p>professionals (doctor, nursing staff, technicians, etc.) and managers and help them put a coherent policy for the future of the hospital.</p> <p>Better manage hospital care and improve its efficiency and quality by covering the functions specific to each care unit while also offering a good level of integration, to meet the basic needs of the hospital establishment thanks to the combined medical and care information as well as economic and management information.</p> <p>Allow the management of the hospital activity at three levels: medical and care, management and performance evaluation.</p> <p>Constitute a decision support tool at the level of the care unit, the hospital, the region and at the national level.</p>
<b>Lessons learned</b>	Please look to 'Lessons learned' from the following project which represents the second phase of this project

Table 9 Intervention 2 in Tunisia 'TN2'

<b>Aspect of the ehealth intervention</b>	Services and Applications <sup>14</sup>
<b>Name of the intervention</b>	Consolidation of a new medico-economic device and its generalization to all public hospital structures, in particular, those that will be supported for accreditation under the Competitiveness of Services Support Program (PACS) <sup>2</sup>
<b>Context</b>	The aging of the population, the change in its health profile with the emergence of chronic diseases and problems related to lifestyle and the new socio-economic challenges, the health care sector and particularly the public hospital system is called upon to respond effectively to the new requirements for improving its performance in terms of quality, responsiveness and efficiency. These changes have exposed the inefficiencies of the health system, including the strong centralization of management, the great disparities between the regions of the country and a significant health expenditure assumed directly by households.

	<p>In this context, a vast program to upgrade the public health sector was initiated. General orientations for improvement in ehealth revolve around the support for the health system through a national health information and effective patient-centered knowledge management.</p> <p>A first twinning project between Tunisia and Spain funded by the EU, implemented from 2012 to 2014, made it possible to start the development of a medico-economic information system that would serve as a basis for decision-making in health management with the aim of strengthening the capacities of governance of public health and improve the quality of services provided by health facilities.</p> <p>The project aimed to launch an information system developed on a network of total 6 pilot sites including the establishment of a central unit within the General Directorate of Structures Public Sanitary (DGSSP) within the MoH. Thus, this first twinning project was a pilot experience for the establishment of an efficient and effective information system that would allow the capacity building of governance in public health and the improvement of the care offered by health facilities. The implementation of such a system will fulfill this functionality, but it will be necessary to consolidate and launch a strategic and manageable extension in order to guarantee its sustainability and final extension to all hospital structures in the country.</p> <p><b>Institutional framework</b></p> <p>This twinning project is to be carried out under the Association Agreement and Transition Support Program (P3AT) agreed between the Tunisian Government and the EU to strengthen the partnership between Tunisia and the EU and contribute to the success of the democratic transition.</p>
<p><b>Description</b></p>	<p>This project consists of the establishment of an integrated system of a medico-economic evaluation and costing of hospital services. The project aims more specifically the strengthening of management capacities and technical skills of the public health administration to support the design, the implementation, the start-up and the operation of the medico-economic evaluation system of public hospitals services.</p> <p><b>General objectives</b></p> <ul style="list-style-type: none"> <li>▪ Improve the quality of services provided by health establishments and contribute to the achievement of national health objectives.</li> <li>▪ Strengthen public health governance capacities (resource allocation and performance evaluation).</li> </ul>

	<p><b>Specific objectives</b></p> <ul style="list-style-type: none"> <li>▪ Consolidate the already developed medico-economic information system</li> <li>▪ Extend its implementation to all public hospital structures (EPS and HR), especially those that will be supported for accreditation under the Competitiveness of Services Support Program (PACS).</li> </ul> <p><b>Activities</b></p> <p>A. Inventory and diagnosis</p> <p>A1. Take note, for all the structures concerned by the project, of the experiments carried out in terms of classification of medical acts, cost calculation and pricing, shared computerized medical records, networking of health facilities public, cost accounting</p> <p>A2. Define for each structure concerned by the project, the appropriate organization and support information system required.</p> <p>A3. Identify the prerequisites for the establishment of a medico-economic evaluation system in information system, organization, infrastructure and personnel.</p> <p>A4. Develop an action plan allowing the extension of the medico-economic information system to the structures concerned by the project. (This plan could be based on the identification of 6 relay regions for the dissemination of information and know-how to other regions).</p> <p>A5. Establishment of an action plan for the development of a central unit within the MoH (DGSSP) for the management of the device as well as the processing and operation information provided by hospital structures.</p> <p>B. Medical information</p> <p>B1. Train the executives concerned in the use of medical nomenclatures and codifications of appropriate reference</p> <p>B2. Apply the methodological guide for the production of summaries of the stay (this guide was designed during the previous pairing).</p> <p>C. Financial and administrative information</p>
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	<p>C1. Provide specific support for 12 hospital teams and a team from the central unit (3 executives from each unit: i.e. 39 executives in total)</p> <p>D. Data processing</p> <p>D1. Provide specific support for 12 hospital teams and the central unit (3 executives per site, i.e. 39 people in total)</p> <p>D2. Train a team of trainers in coding and coding techniques and methods for the classification of stays and the processing of medico-economic data among executives from the central unit and executives from the 12 hospital structures. (3 executives from each unit, i.e. 39 people).</p> <p>D3. Support the central unit and hospital teams for data processing (classification of stays, calculation of the real cost; etc.) and reinforcement of their capacities in matters development of decision support tools.</p> <p>E. Legal and organizational framework</p> <p>E1. Propose a bill, inspires European and international best practices to ensure the good governance of medico-economic information systems at all levels</p> <p><b>Beneficiaries</b></p> <p>The primary beneficiary institutions are:</p> <p>The General Directorate of Public Health Structures of the MoH and 10 hospital structures under its supervision.</p> <p>Other structures and organizations involved in the implementation of certain activities of this twinning will be closely associated such as the national health insurance fund and the computer center of the Ministry of Public Health.</p> <p><b>Budget</b></p> <p>The twinning budget is limited to € 1,000,000</p> <p><b>Duration</b></p> <p>24 months from June 2015 to June 2017</p>
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<b>Assessment</b>	<p><b>Exclusion criteria</b></p> <p><b>Relevance</b>          The present project represents the second stage of the ‘Set up of a medico-economic information system in a pilot sector’ intervention. The first project enabled the conception and development of a medico-economic information system in a pilot within 6 pilot sites, yet, this project has to consolidate it and launch a strategic and manageable extension in order to guarantee its sustainability and its final extension to all hospital structures in the country. This twinning project consolidates and generalizes the medico-economic information system across all hospital structures in the country, in particular, those who will be supported for accreditation under the Competitiveness of Services Support Program (PACS). On the other hand, the specified objectives are aligned with the 2013-2017 Action Plan for a privileged Tunisia-EU partnership that relates to the support of the computerization of the medicalized hospital information system and the generalization of the medico-economic evaluation system of hospital stays</p> <p><b>Evidence and theory based</b>          Similarly to the first twinning project, the objectives and activities programmed in this initiative are based on a situation analysis of the Tunisian hospital information system. The study includes the following aspects: current status, limitations, infrastructure and development perspectives of the current information system.</p> <p>The documentation of the project illustrates well the adopted methods and approaches for implementing the different activities and sub-activities of the project.</p> <p><b>Ethical aspects</b>          The ethical aspect was considered in the first twinning project.</p> <p><b>Intervention characteristics</b>          The documentation of this project specifies the general and specific objectives, activities to achieve them, beneficiaries, expected results and objectively verifiable performance indicators. Intervention context, other related projects that are being implemented and situation diagnosis are also stated.</p>
	<p><b>Core criteria</b></p> <p><b>Effectiveness and efficiency</b></p>

	<p>The intervention activities are able to achieve the expected results and impact through a predefined set of performance indicators. These performance indicators are defined for the general and specific objectives and expected results. Expert report and other documents are used as monitoring tools.</p> <p>There is no clear information about the efficiency of the intervention in terms of how well the resources being used, or to what extent is the relationship between inputs and results are timely and cost effective. However, an implementing agency responsible for procurement and financial management was in charge of supporting the project and ensuring the conditions allowing the achievement of the planned results. A set of institutional and organizational mechanisms are provided to ensure the necessary coordination, monitoring and steering.</p> <p><b>Equity</b>          Opportunities equality was considered in the implementation of the intervention. In its development, implementation and execution phase, project managers ensured respect for the principle of equality between women and men, combat all forms of discrimination and inequality based on gender and to develop instruments and strategies based on an integrated approach of the human dimension and skills.</p>
	<p><b>Qualifier criteria</b></p> <p><b>Transferability</b>          The report of the twinning project comprises the description of the organizational elements, identifies the hypothesis related to each activity following a diagnosis of the existing setting, which shows adaptability and makes it possible to transfer the experiences to other setting or countries with similar contexts.</p> <p><b>Sustainability</b>          The twinning project makes it possible to consolidate and generalize the medico-economic information system on all of the country's hospital structures, thus offering a tool for public health governance through the regulation of funding and the evaluation of performance.          On the operational level, the majority of the project activities will make it possible to capitalize on the know-how of its staff through training and the transfer of European expertise in the area of medico-economic evaluation of hospital activity.</p> <p><b>Participation</b>          The inclusion of users of the developed medico-economic information system is well ensured during the various phases of design and implementation. Capacity building sessions related to different activities of the project were programmed, where</p>

	<p>the objective was to train 80-100% of the total number of actors in each hospital pilot site. Intermediate seminars were also organized to present the experiences and the possible framework to be applied in Tunisia and collect the opinions of the various actors.</p> <p><b>Intersectoral collaboration</b> There is no explicit collaboration among different sectors, however, the national health insurance fund (CNAM) which is an organization under the Ministry of Social Affairs is an indirect beneficiary of the developed information system.</p>
<p><b>Innovation, outcomes, and impact</b></p>	<p><b>Results</b></p> <p>A. Inventory and diagnosis: Diagnosis of the situation in hospital structures affected by the project</p> <p>B. Medical information: Update and implementation of references and methods of classification and coding of medical data.</p> <p>C. Financial and administrative information: Establishment of national cost accounting based on stay costs</p> <p>D. Data processing: Set up of a functional device of processing of medico-economic data at the level of all public hospital structures (EPS and HR), especially those that will be accompanied for an accreditation under the Support Program Competitiveness of Services (PACS) and at the central unit level located at the MoH, Directorate General of Public health structures (Direction Générale des Structures Sanitaires publiques)</p> <p>E. Legal and organizational framework: Establishment of a medico-economic information system supported by an appropriate legislative and institutional framework</p> <p><b>Impact</b></p> <p>Improved coverage rate of the medico-economic evaluation model which is generalized to public hospital structures</p> <p>Real and optimum national costs of stays that will benefit both health establishments and patients</p> <p>Improved support of the exchange and communication of information related to the hospital services costs thanks to a functional interface between the MoH and the national health insurance fund</p>
<p><b>Lessons learned</b></p>	<p>Lessons learned reported by Mrs Sonya Khayat</p> <ul style="list-style-type: none"> <li>• <b>What went well and what can we learn from implementing this program/using the solution?</b> The information system related to the activities and costs of public hospital structures has made it possible to:</li> </ul>

- Measure hospital performance indicators linked to productivity and efficiency with the development of morbidity and mortality register,
- Establish tariffs reflecting the real costs per pathology and serving as a basis for invoicing the services provided by public health structures and the rational allocation of budgetary resources.

- **What didn't go so well and what can we learn from that?**

The challenges encountered can be summarized as follows:

- No legislation governing the issues of the unification of the medical record, the management of clinical documentation, the preparation and composition of the discharge report has been approved. The lack of a legal framework is a major obstacle to the smooth running of the project.
- Insufficient human and structural resources in hospitals in codification, accounting and IT units.
- Lack of interface between the Codefinder and the medical data at level of the MoH, which requires manual data entry, with loss of time and risk of errors.
- Lack of collaboration of certain medical services in the preparation of discharge summaries

- **What should be done to improve the program/solution?**

- Approve the legal framework to ensure the collaboration of medical, administrative and financial hospital services.
- Provide the centers and the Central Unit of the Ministry with the necessary human and material resources.
- Resolve the technical aspects that allow the proper automation of data collection.

## 5 Data analysis

A thorough examination of the data received by the team members of each partner country enables the extraction of critical elements related to best practices and lessons learned in ehealth deployment. Following a summary of the collected good/best practices, the next paragraphs will draw attention to the key findings specific to each country.

### 5.1 Summary of Good/Best Practices

The data collection and assessment activities in the partner countries provide insight into 7 good/best practices distributed as follows: 2 solutions from Ethiopia 'ET1' and 'ET2', 1 policy from Ghana 'GH1', 2 solutions from Malawi 'MW1' and 'MW2' and 2 interventions (with the same applied solution) from Tunisia 'TN1' and 'TN2'.

Best practice ET1 'District Health Information System 2' is an ehealth solution that aims to improve the monthly reporting system of the country between the public and private health facilities and the MoH. The DHIS-2 benefits public and private health facilities and is implemented at the national level. It is funded by the MoH with the contribution of local and international donors. Best practice ET2 'Electronic Community Health Information System' is a community level ehealth solution that benefits essentially the community citizens and health professionals. The eCHIS received governmental funding.

Best practice GH1 is a national ehealth strategy implemented over 5 years that primarily streamlines the regulatory framework for health data and information management in Ghana. The strategy also seeks to build the health workers capacity and increase access to health services.

Best practice MW1 'Integrated community health information system' is an ehealth solution that is being implemented at community level. The iCHIS provides accessible, affordable and context aware community healthcare that would benefit health professionals and patients. Best practice MW2 'OpenLMIS and DHIS-2 Integration' is an initiative to strengthen existing electronic Logistics Management Information System solutions and facilitate integration with the DHIS-2 at the MoH. The initiative involves international collaborators, mainly, the University of Oslo and is being implemented at the national level.

Best practice TN1 ‘Set up of a medico-economic information system in a pilot sector’ is a twinning project (Tunisia-Spain) that aims to strengthen public health governance capacities and to improve the quality and efficiency of services provided by health facilities. The intervention was implemented in 5 hospital pilot sites and received funding from the EU. Best practice TN2 represents the second stage of the first twinning project TN1. The intervention consolidates the already developed medico-economic information system and extend its implementation to public hospital structures that will be supported for accreditation under the PACS. Likewise, the project received funding from the EU and benefited 10 additional hospital sites.

By studying/comparing these initiatives, some general characteristics can be extracted (see Table 1). In fact, the interventions present different scales of implementation; policy GH1 and solutions ET1 and MW2 are implemented at the national level, solutions ET2 and MW1 are implemented at the local level, whereas interventions TN1 and TN2 are executed only at some pilot sites. In terms of type of collaboration/funding, ET2 and GH1 are established based on national partnerships and governmental funding. ET1 is based on national collaboration but also involves international funding, MW2 includes national and international collaborators (University of Oslo) whereas interventions TN1 and TN2 received funding from the EU and no national contributors are involved. Regarding the target group of these interventions, policy GH1 and solutions ET2 and MW1 benefit patients and health workers of the granted health facilities, while ehealth solutions ET1, MW2, TN1 and TN2 assist mainly MoH staff and health workers. Patients are considered as indirect beneficiaries as the quality of health and care services are improved.

Table 10 General characteristics of good/best practices

	<i><b>Policy/ solution</b></i>	<i><b>Level of implementation</b></i>	<i><b>Duration date</b></i>	<i><b>Established collaboration</b></i>	<i><b>Target group</b></i>
<b>ET1</b>	Solution	National	2017- continuing	National collaboration, international funding	Public and private health facilities
<b>ET2</b>	Solution	Community	2019-date	Governmental funding	Patients and health workers

<b>GH1</b>	Strategy	National	5 years	National	Patients, health workers, health institutions
<b>MW1</b>	Solution	Community	-	-	Patients, health workers
<b>MW2</b>	Solution	National	2018-2020	The Malawi MoH, University of Oslo, HISP Malawi	The Malawi Government, the MoH
<b>TN1</b>	Solution	Pilot sites	2012-2014	MoH, funded by the EU	The General Directorate of Public Health Structures of the MoH 5 pilot hospital sites
<b>TN2</b>	Solution	Pilot sites	2015-2017	MoH, funded by the EU	The General Directorate of Public Health Structures of the MoH 10 hospital sites

## 5.2 Key findings in Ethiopia

- Collecting feedback from end-users is crucial when incorporating certain features within a health information system.
- Working with open-source codes allow organizations to continue developing better health IT applications. This reduces the cost and avoids vendor lock-up. It may also help avoid many of the data interoperability issues that have made it difficult to exchange health information between electronic health records and other health IT systems.
- In order to ensure the required data quality, evidence-based performance indicators have to be used by the implementing body. Regular assessment of these indicators is made based on the defined objectives.
- Participation and inclusion of all categories of stakeholders, mainly end user (patients, health workers), the public sector and the civil society play a key role in the successful implementation of an ehealth solution and limit the resistance of change.
- Learning from both achievements and failures of previously developed solutions a better understanding of the healthcare system and thus more user-centred solutions.
- A successful ehealth intervention is characterized by a human centred design approach, where target population needs and contributions are clearly elicited.

- A renowned IT infrastructure represents the foundation for a successful deployment of ehealth solutions. Geographic coverage and interoperability are crucial components in facilitating ehealth infrastructure.
- There should be capacity building of health professionals in using the technology and managing the IT system.
- Within the developing ehealth context, starting small and scaling up based on the lessons learned during each phase is crucial to the smooth running of the projects.
- Institutionalization of ehealth systems is crucial for the sustainability of IT projects.
- Conducting review and implementing research enables identifying barriers & facilitators of ehealth implementation
- The development of terminology/data standards in order to adopt them during the development phase is required to have interoperable eHealth systems
- It is crucial to develop implementation guidelines which guide the eHealth implementation at the national level

### 5.3 Key findings in Ghana

- There is a need to develop policies and legal frameworks to minimize the frequent failures usually encountered in the adoption of new technologies in the health sector.
- The strategy document must be accomplished in a transparent way and must be available to the public, in particular, for investors and innovators.
- The unavailability of operational documents/plans disrupt the implement of identified ehealth projects and initiatives.

### 5.4 Key findings in Malawi

- In addition to legislative texts, continued engagement with frontline technical staff enables identifying ethical grey areas through the use of periodic pre-field tests.
- Participatory and Human-Centered Design (HCD) approach in the situation assessment and development phases of ehealth interventions have to be ensured through consultative workshops, field visits, stakeholder interviews and engaging users in co-creative methods.

- There is a need to ensure that the users get a chance to undergo a digital skills training
- Lack of coordination on reporting the updates taking place in either system affects the progress of the project and results in the need of constantly updated indicators.
- The infrastructure and dashboards have to be developed according to global standards whilst considering factors presented in the local context.
- When considering interoperability, it is important to agree beforehand, the key performance indicators that necessitate the integration of two systems.
- The interoperability concept is a new concept that involves a lot of learning activities and requires continuous development of specific technical skills.

## 5.5 Key findings in Tunisia

- Areas for improvement in the public health sector has to include the support of the health system through an effective patient-centred health information system, and the enhancement of good governance and responsiveness of the public health sector
- An ehealth intervention has to be preceded by a situation analysis that includes the following aspects: current status, limitations, infrastructure and development perspectives of the current information system.
- Good practices from successful experiences are considered as references for capacity building activities with respect to the actual context.
- Performance indicators and monitoring tools ensure the achievement of the required objectives and impact in an effective and efficient way.
- The lack of a legal framework is a major obstacle to the smooth running of ehealth interventions.

## 5.6 Findings' synthesis

The extracted key findings from the partner countries cover different areas, e.g., the IT infrastructure, capacity building and legislations, yet they can be classified under common categories: human, technical and public policy. This classification is compliant with the general framework of the BETTEReHEALTH project. According to the project's concept, the factors that challenge the successful deployment of ehealth can be divided into human,

technical and public policy. This adopted classification inspired by several theoretical approaches<sup>15-17</sup> ensures a holistic interpretation of all the factors influencing the outcomes and impact of ehealth interventions.

Table 10 presents the synthesis of the best practices and lessons learned from the reported ehealth interventions. Based on data analysis, these key elements are critical to the success of ehealth interventions.

Table 11 Critical elements to the success of ehealth

Category	Synthesis of Best practices and lessons learned
<b>Human factors</b>	<ul style="list-style-type: none"> <li>• Stakeholders' involvement and ownership during the different intervention phases</li> <li>• Need-based capacity building activities for health workers and patients and learning from the lessons learned of previous experiences</li> <li>• Participatory and user-centred design and process</li> </ul>
<b>Technical factors</b>	<ul style="list-style-type: none"> <li>• Working with open-source codes to foster innovation</li> <li>• Enhanced coordination, the use and continuous adjustment of evidence-based performance indicators and monitoring tools</li> <li>• Renewal of IT infrastructure considering geographic coverage and interoperability</li> <li>• Adopting global standards while considering the local context when developing the infrastructure</li> </ul>
<b>Policy factors</b>	<ul style="list-style-type: none"> <li>• Developing policies and legal frameworks which is the foundation of ehealth support</li> <li>• Transparency of legislative and strategy documents and availability of operational plans</li> <li>• The importance of a prior holistic situation analysis</li> </ul>

Although that the studied interventions represent successful initiatives, the analysis indicates that certain aspects represent challenges to their success in the African countries, namely, sustainability, transferability, innovation and impact. Explicit sustainability strategies that reflect contextual factors like health policies and availability of funding are not developed in most of the studied interventions. Yet, considering sustainability early during the design process can lead to the development of more innovative services. Likewise, the collected data related to the transferability aspect do not present relevant information. Certain interventions indicate the possibility to transfer the technology to similar contexts, however

no evidence has been provided. Innovation and impact also represent challenges to the successful deployment of ehealth in the studied countries. While several problems related to paper-based procedures have been solved through the adoption of ehealth solutions, issues related to standardization and interoperability challenge their advancement and innovation. A legal framework and a renowned infrastructure that considers interoperability prove to be the catalyst of innovation in ehealth in these countries.

## 5.7 Challenges and weaknesses of the study

Access to information and documentation were the major difficulties faced by data collectors in all partner countries. Due to the lack of information sources, the data collectors were based on interviews with contact persons from related institutions and ministries to generate primary data. Reported answers from interviewees can be influenced by their subjective opinions, thus, the interpretation and generalization of such information must be done thoroughly.

## 6 Conclusion

This report focused on identifying and collecting relevant information about best practices and lessons learned in ehealth interventions in the participating African countries Ethiopia, Ghana, Malawi and Tunisia. An evaluation methodology has been developed to assess several aspects of ehealth interventions and to identify good/best practices and lessons learned from solutions, policies, health and care services and health infrastructures. Reporting best practices in ehealth enhances their replication in other similar contexts, whereas documenting lessons learned from past projects helps build skills and experience of involved organizations from partner African countries.

A total number of 7 good/best practices and associated lessons learned have been reported in the present study and distributed as:

Two solutions from Ethiopia: 'District Health Information System 2 (DHIS-2)' and 'Electronic Community Health Information System (eCHIS)'

One policy from Ghana: 'National eHealth/ Digital Health Strategy or Framework'

Two solutions from Malawi: 'Integrated community health information system (iCHIS)' and 'OpenLMIS and DHIS2 Integration'

And two interventions from Tunisia: 'Set up of a medico-economic information system in a pilot sector' and 'Consolidation of a new medico-economic device and its generalization to all public hospital structures, in particular, those that will be supported for accreditation under the Competitiveness of Services Support Program (PACS)'.

According to the collected data, most of good/best practices in the considered countries are totally or partially funded by international donor organizations. This reflects the lack of governmental and local support of ehealth initiatives in these countries. In this regard, the next project activities included in the public policy work package will provide evidence-based advice to policy makers to prepare a strategic roadmap for successful ehealth deployment.

## 7 Acknowledgment

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## 9 Appendices

### 9.1 Appendix 1: Key evaluation questions to extract best practices

Criteria	Guiding notes
<b>Exclusion criteria</b>	
<b>Relevance</b>	<ul style="list-style-type: none"> <li>To what extent does the intervention/solution address the identified needs?</li> <li>How well do the objectives of the intervention/solution correspond to the needs of end-users?</li> <li>How well does the intervention align with the economic and social/capacity conditions in which it takes place?</li> </ul>
<b>Evidence and theory based</b>	<ul style="list-style-type: none"> <li>Is the intervention /solution built on a well-founded theory? Is it evidence-based?</li> <li>Does the implementation of the intervention follow good design practices?</li> <li>Are the adopted approaches stated and well documented?</li> </ul>
<b>Ethical aspects</b>	<ul style="list-style-type: none"> <li>Does the intervention respect the ethical values?</li> <li>Does it ensure the privacy and confidentiality of patients' personal data?</li> </ul>
<b>Intervention characteristics</b>	<ul style="list-style-type: none"> <li>Is the choice of the target population clearly described (scope, inclusion and exclusion group, underlying risk factors, etc.)?</li> <li>Are the objectives clearly defined and actions to reach them are clearly specified and easily measurable?</li> <li>Is the contribution of the target population appropriately planned?</li> <li>Does the documentation (guidelines, protocols, etc.) supporting the intervention/solution presented properly?</li> </ul>
<b>Core criteria</b>	
<b>Effectiveness and efficiency</b>	<p><b>Effectiveness</b></p> <ul style="list-style-type: none"> <li>To what extent is the intervention/solution achieving the intended outcomes (in the short, medium and long term)?</li> <li>To what extent is the intervention/solution producing worthwhile results (outputs, outcomes) and/or meeting each of its objectives?</li> </ul> <p><b>Efficiency</b></p> <ul style="list-style-type: none"> <li>To what extent is the relationship between inputs and outputs timely and cost-effective?</li> </ul>
<b>Equity</b>	<ul style="list-style-type: none"> <li>Are equity dimensions considered throughout the process of implementing the intervention/solution (e.g. age, gender, socioeconomic status, rural and/or urban area, vulnerable groups)?</li> </ul>

	<ul style="list-style-type: none"> <li>• Is material (equipment) and training affordability of ehealth accessibility equally secured?</li> </ul>
<b>Qualifier criteria</b>	
<b>Transferability</b>	<ul style="list-style-type: none"> <li>• Is the description of the intervention/solution includes all organizational elements, identifies the limits and the necessary actions that were taken to overcome technical, legal or skill-related barriers?</li> <li>• Does the intervention/solution show adaptability to different contexts and challenges encountered during its implementation?</li> </ul>
<b>Sustainability</b>	<ul style="list-style-type: none"> <li>• Does the intervention/solution use a user-friendly technology and adapts sustainable economic (availability of funds) and/or environmental (if applicable) models?</li> <li>• Does the intervention/solution associated with training and capacity building of users in order to sustain it?</li> <li>• Does a sustainability strategy that considers a range of contextual factors (e.g. health and social policies, innovation, cultural trends and general economy, epidemiological trends, environmental impact...) has been developed?</li> </ul>
<b>Participation</b>	<ul style="list-style-type: none"> <li>• Does involvement of patients, health providers, other relevant stakeholders and civil society ensured?</li> <li>• Are there any elements to promote empowerment of end-users (e.g. strengthen their ehealth literacy, ensuring their skills....)?</li> </ul>
<b>Intersectoral collaboration</b>	<ul style="list-style-type: none"> <li>• Do relevant stakeholders support a multidisciplinary approach (e.g. health and social care professionals at all levels, civil society, public institutions from education, employment and digital services)?</li> <li>• Does the intervention create ownership among the target population and several stakeholders considering multidisciplinary, multi-/inter-sectoral, partnerships and alliances?</li> </ul>

## 9.2 Appendix 2: Key questions to extract lessons learned

- What went well (advantages) and what can we learn (lessons learned) from implementing this program/using the solution?
- What didn't go so well (challenges) and what can we learn from that?
- What should be done to improve the program/solution?

### 9.3 Appendix 3: Best practices and lessons learned table template

#### Intervention X

<b>Aspect (s) of the ehealth intervention</b>	Ex: Leadership and Governance, Infrastructure, Services and Applications.....
<b>Name of the intervention</b>	
<b>Context</b>	<p><i>Describe the context of the ehealth intervention</i></p> <p>In this study we are using evidence from different countries, so context is an essential means to help us explain that what can work in one context does not necessarily work in others.</p> <p>Context represents the environment or setting in which the intervention is being implemented, the setting/regulatory context, the set of characteristics and circumstances for implementation, i.e. existing infrastructure, capacity of health professionals, the place in which it takes place...</p>
<b>Description (objectives, activities, beneficiaries, budget, duration)</b>	<i>Describe the methodology/process of the practice, the funding mechanism, involved stakeholders, deployed ehealth solution(s)</i>
<b>Assessment</b>	<p><i>Assess the intervention to extract best/good practices</i></p> <p>Make a quick primary evaluation of the ehealth intervention based on the indicators of the Global Digital Health Index. Aspects that achieve a score equal or superior to 3/5 will be further analyzed to extract potential best/good practices.</p> <p>Describe how well/to what extent the practice meets the evaluation criteria. If you are unable to extract a best practice in your country, please provide description of a good practice.</p>
	<b>Exclusion criteria</b>
	<b>Relevance</b>

	Evidence and theory based
	Ethical aspects
	Intervention characteristics
	<b>Core criteria</b>
	Effectiveness and efficiency
	Equity
	<b>Qualifier criteria</b>
	Transferability
	Sustainability
	Participation
	Intersectoral collaboration
<b>Innovation, outcomes, and impact</b>	
<b>Lessons learned</b>	