



EAST AFRICA PUBLIC HEALTH LABORATORY
NETWORKING PROJECT (EAPHLNP) Project No:
P111556
REGIONAL IMPLEMENTATION COMPLETION AND
RESULTS FINAL REPORT

REGIONAL END TERM EVALUATION
FINAL REPORT

East Central and Southern Africa – Health Community Arusha, Tanzania Project
Website: <https://eaphln-ecsahc.org>
Date: 25th September, 2020



DISCLAIMER

The information contained in this Regional EAPHLN ICR or End-Term Evaluation Consolidated Report has been prepared from publicly available materials and from discussions and interviews held with internal and external stakeholders. ECSA-HC does not express an opinion as to the accuracy or completeness of the information provided or any conclusions reached by those parties. I have based this Report on information received or obtained, on the basis that such information is accurate and, where it is represented to implementing countries reports of Kenya, Tanzania, Burundi, Rwanda and Burundi Country Reports and ECSA-HC as such, complete.

MORE INFORMATION

*For more information, please contact us:
Prof. Yoswa Dambisya
Director General
East Central and Southern Africa – Health
Community (ECSA-HC)
Email: regsec@ecsahc.org*

Abbreviations and Acronyms

AF	Additional Financing
AFENET	Africa Field Epidemiology Network
AI	Artificial Intelligence
APHL	Association of Public Health Laboratories
ASLM	Association Society for Laboratory Medicine
AUDA	Africa Union Development Agency
AUDA	Africa Union Development Agency
BMGF	Bill and Melinda Gates Foundation
CHS	Community Health Strategy
CHV	Community Health Volunteer
CoE	Centre of Excellence
Covid-19	SARS-CoV 2
DAC	Development Assistance Committee
DOTS	Directly Observed Therapy Services
DOTs	Directly Observed Treatment Short course
EAC	East African Community
EAPHLN	East Africa Public Health Laboratory Networking
ECSA-HC	East Central and Southern Africa Health Community
ESMF	Environmental Social Management Framework
FELTP	Field Epidemiology Laboratory Training Program
FELTP	Field Epidemiology Laboratory Training Programme
FIND	Foundation for Innovation Diagnostics
GEM	Geo-Enabling Initiative for Monitoring and Supervision
GFATM	Global Fund Against AIDS, TB & Malaria
GRM	Grievance Redress Mechanism
ICR	Implementation Completion and Results Report
IDA	International Development Association
IDSR	Integrated Disease Surveillance and Response
IHR	International Health Regulations
ILI	Intensive Learning Implementation Completion and Results Report
IOI	Intermediate Outcome Indicator
ISO	international Organization for Standardization
IUATLD	International Union Against TB and Lung Diseases
KEMRI	Kenya Medical Research Institute
M&E	Monitoring and Evaluation
MDR-TB	Multi-Drug Resistance Tuberculosis
MDR-TB	Multi-Drug Resistant Tuberculosis
mRDT	malaria Rapid Diagnostic Test
MTRH	Moi Teaching and Referral Hospital
MUHAS	Muhimbili University of Health and Allied Sciences
MUHAS	Muhimbili University of Health and Allied Sciences
NIMR	National Institute of Medical Research
NPHI	National Public Health Institute
NTRL	National TB Reference Laboratory
PBF	Performance Based Financing
PDO	Project Development Objective
PoC	Point of Care

POI	Project Outcome Indicator
PPP	Public Private Partnerships
QMS	Quality Management Services
RAP	Regional Advisory Panel
SATBHSSP	Southern Africa TB Health Systems Support Project
SLIPTA	Stepwise Laboratory Improvement Process Towards Accreditation
SLMTA	Strengthening Laboratory Management Towards Accreditation
TB	Tuberculosis
TB	Tuberculosis
TTL	Task Team Leader
US-CDC	United States Centres for Disease Control
VMPPF	Vulnerable and Marginalized Peoples' Planning Framework
WB	World Bank
WHO	World Health Organization

Acknowledgements

We would like to acknowledge the Ministries of Health (MOH) of Kenya, Uganda, Rwanda, Burundi and Tanzania and in particular the EAPHLN country project teams and the East Central and Southern Africa-Health Community for their assistance, support and development of the Country ICR reports, without which this Regional Implementation Completion and Results Report (ICR) report would never have been completed. Their assistance and support were invaluable throughout this regional consolidation ICR process. The significant body of literature shared by ECSA-HC team was greatly useful in compilation of this regional report.

Appreciation is also extended to key informants at regional, national and satellite health facility and laboratory sites including both internal and external stakeholders who, despite the unprecedented Covid-19 pandemic and virtual discussions undertaken, provided their committed time by sharing valuable insights for the regional ICR and the end term evaluation through key informant interviewees. We appreciate the National Public Health Laboratory Services (NPHLS)/EAPHLN project coordination unit team at the Ministry of Health in Kenya for coordination of the field visits done in Machakos County Referral Hospital Laboratory, National Public Health Laboratory Services and Moi Teaching and Referral Hospital Laboratory and Isolation facility which were very informative and we thank the leadership and hospital teams within the visited health facilities for the great discussions. Many of the informative findings in this report are based on those inputs.

The documentation of a ten (10) year World Bank funded EAPHLN project is a tremendous achievement and credit goes to all the participating countries and regional team (ECSA-HC) who have worked tirelessly through the years and this report captured numerous inputs and contributions. We are sincerely grateful for all the contributions and extensive assistance provided and indeed this regional project leaves behind a collective legacy in diagnostics and surveillance rich investments benefiting the population for many years to come.

TABLE OF CONTENTS

ABBREVIATIONS AND ACRONYMS	2
ACKNOWLEDGEMENTS.....	4
TABLE OF CONTENTS.....	5
DATA SHEET	6
1. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES	9
1.1 CONTEXT AT APPRAISAL	9
1.2 PROJECT DEVELOPMENT OBJECTIVE (PDO).....	11
1.3 PROJECT COMPONENTS.....	11
1.4 RATIONALE FOR BANK INVOLVEMENT	12
1.5 EAPHLNP THEORY OF CHANGE (RESULTS FRAMEWORK).....	13
1.6 SIGNIFICANT CHANGES DURING IMPLEMENTATION	14
1.6.1 ADDITIONAL FINANCING FOR PHASE 2	14
1.6.2 REVISED PROJECT OUTCOME AND INTERMEDIATE INDICATORS UPDATED.....	14
1.6.3 OTHER CHANGES	15
1.7 RATIONALE FOR CHANGES	15
1.8 OUTCOME	16
2.0 ACHIEVEMENT OF PDO (EFFECTIVENESS AND EFFICIENCY ASSESSMENT).....	17
2.1 COMPONENT 1: REGIONAL DIAGNOSTIC AND SURVEILLANCE CAPACITY	17
2.2 ADDITIONAL CROSS CUTTING INTERVENTIONS ON COMPONENT 1	32
2.3 COMPONENT 2: JOINT TRAINING AND CAPACITY BUILDING.....	36
2.4 COMPONENT 3: OPERATIONAL RESEARCH AND KNOWLEDGE SHARING.....	41
3.0 ASSESSMENT OF PROJECT PARTNERSHIPS ESTABLISHED	52
4.0 ASSESSMENT OF EFFICIENCY DURING PROJECT IMPLEMENTATION.....	53
5.0 SUSTAINABILITY.....	53
6.0 CHALLENGES UNDER PROJECT IMPLEMENTATION/ WHAT DID NOT WORK WELL	55
7.0 ECSA-HC PERFORMANCE, COMPLIANCE ISSUES, AND RISK TO DEVELOPMENT OUTCOME	57
8.0 ENVIRONMENTAL, SOCIAL, AND FIDUCIARY COMPLIANCE.....	60
9.0 ECSA-HC PERFORMANCE AND SUPERVISION OF REGIONAL INITIATIVE	64
10.0 WORLD BANK PERFORMANCE	64
11.0 RISK TO DEVELOPMENT OUTCOME	65
12.0 LESSONS LEARNT AND RECOMMENDATIONS.....	65
ANNEXES.....	73

DATA SHEET

BASIC INFORMATION

Product Information

Project ID	Project Name
P111556	East Africa Public Health Laboratory Networking Project
Country	Financing Instrument
Kenya, Tanzania, Uganda, Burundi	IDA Credit
Rwanda and Burundi	IDA Grant
Original EA Category	Revised EA Category
Partial Assessment (B)	Partial Assessment (B)

Related Projects

Relationship	Project	Approval	Product Line
Parent Financing	East Africa Public Health Networking Project	May 25 th , 2010	IBRD/IDA
Additional Financing	P153665-Additional Financing to East Africa Public Health Networking Project	June 22, 2015	IBRD/IDA

Organizations

Borrower	Implementing Agency
Government of Kenya	Ministry of Health
The United Republic of Tanzania	Ministry of Health and Social Welfare
Republic of Burundi	Ministry of Public Health and Aids Control
Republic of Uganda	Ministry of Health
Republic of Rwanda	Ministry of Health

Regional Coordinating Organizations

The East Central and Southern Africa Health Community (ECSA-HC)

Collaborating with

The East African Community

Project Development Objective (PDO)

Original PDO

The Project Development Objective is to establish a network of efficient, high quality, accessible public health laboratories for the diagnosis and surveillance of TB and other communicable diseases.

The East Africa Public Health Laboratory Project included three mutually reinforcing components aimed at supporting the five EAC member states to diagnose communicable diseases of public health importance, enhance the capacity of health workers, generate evidence/knowledge and to share information about those diseases to mount an effective regional response.

Component #1- *Regional Diagnostic and Surveillance Capacity* under this component the project aimed to provide support to create and render a functional regional laboratory network which aims to enhance access to diagnostic services for vulnerable groups; improve capacity to provide specialized diagnostic services and conduct drug resistance monitoring; and strengthen laboratory based disease surveillance to provide early warning of public health events.

Component #2- *Joint Training and Capacity Building* aimed to support training and capacity building for laboratory personnel, in order to increase the pool of experts in the sub-region and to improve the effectiveness of public health laboratories.

Component #3- *Joint Operational Research and Knowledge Sharing/Regional Coordination and Program Management* supported operational research and knowledge sharing activities, which aim to evaluate the impact of the new TB diagnostic technologies, assess drug resistance patterns for endemic diseases, and ascertain feasibility of using mobile phone technologies for surveillance reporting; and support regional coordination and program management functions

FINANCING (see Annex 2 for Country Cost Breakdown)

KEY DATES

Approval (Phase 1)	Effectiveness	MTR Review	Original Closing	Actual Closing
25-May-2010 (Kenya – IDA 47320)	01-Oct-2010	03-Mar-2014	30-Mar-2016	30-Mar-2016
25-May-2010 (Uganda – IDA47330)	31-Jan-2011	03-Mar-2014	30-Mar-2016	30-Mar-2016
25-May-2010 (Tanzania -IDA 47310)	07-Sep-2010	03-Mar-2014	30-Mar-2016	30-Mar-2017
17-May-2012 (Burundi – H7740)	25-Sep-2012	03-Mar-2014	30-Sep-2017	29-Mar-2019

25-May-2010 (Rwanda – H5930)	25-Oct-2010	03-Mar-2014	30-Mar-2016	30-Dec-2016
---------------------------------	-------------	-------------	-------------	-------------

KEY DATES

Approval (Phase 2)	Effectiveness	MTR Review	Original Closing	Actual Closing
07-July-2015	17-Oct-2015	03-March-2014	30-March-2020	30-September-2020

1. PROJECT CONTEXT AND DEVELOPMENT OBJECTIVES

1.1 Context at Appraisal

Laboratories are the weakest link in health systems in the East Africa Region, seriously hindering governments' ability to confirm and respond in a coordinated manner to disease outbreaks. Analytic work conducted in the context of project preparation documented the importance of an efficient public health laboratory system for: (i) supporting integrated disease surveillance; (ii) complying with International Health Regulations (IHR); and (iii) conducting clinical diagnosis, guiding treatment, and managing the spread of drug resistance (e.g. TB, malaria). Lack of access to accurate laboratory services results in misdiagnosis, which in turn leads to higher costs and compromised patient care. In outbreak situations, delayed detection/confirmation of outbreaks resulted to increased transmission and exacerbated the impact of an epidemic/pandemic as witnessed during the recent COVID-19 pandemic. Effective laboratory networks are essential in the provision of public health goods. Networking is critical for: (i) sharing timely information across countries; and (ii) contributing to joint investigations of disease outbreaks. Networks can ensure that capacity to diagnose diseases, identify public health threats, and conduct surveillance is done in a timely and effective way. Networks also serve as effective platforms for learning and knowledge sharing. TB control programs have been pioneers in promoting tiered networks of laboratories providing a continuum of quality assured services and hence provide a good entry point for broader lab strengthening. While all participating countries have relatively good national networks of microscopy centers supported by governments and partners, regional networking remains poorly developed.

In light of the above circumstances, The East Africa Public Health Laboratory Networking Project (EAPHLNP) was developed. EAPHLNP was a regional World Bank financed operation, implemented in the five East African countries, namely Republic of Kenya, Republic of Rwanda, the United Republic of Tanzania, Republic of Uganda and Republic of Burundi (joining later after implementation) with the support of the East, Central and Southern Africa Health Community Secretariat (ECSA-HC), and in collaboration with other partners such as the East African Community (EAC). The project focused on addressing gaps in laboratories services, which were identified as the weakest link to the health systems architecture in the five East African countries during project design in 2009/2010. The project commenced as a Tuberculosis (TB) laboratory project and evolved to a broader public health laboratory initiative covering aspects of both communicable i.e. TB, Malaria, hemorrhagic fevers like Ebola and non-communicable diseases i.e. cancer screening and pathology services.

The Project was implemented for ten (10) years, since 2010. The first phase was implemented between 2010 and 2015 covering Kenya, Rwanda, Tanzania, and Uganda. Burundi received its funding approval in 2012. The Mid Term Review for Phase 1 of the project was conducted in March 2014. It demonstrated measurable success on the ground towards the project development objective. Following the successful implementation of phase 1, Burundi, Kenya, Tanzania and Uganda requested additional Financing (Phase 2). The second phase was approved and covered the period between March 2016 and March 2020. This phase continued consolidating the achievements and bolstered disease outbreak preparedness and response capacities. Rwanda opted out due to adequate financing for its Ebola national prevention and preparedness plan from other development partners and Government.

The first phase of EAPHLNP had a total financing of USD 78.66M across the five East African countries while the second financing phase was USD 50M, without Rwanda being included. Both phases were implemented over four years. The project was expected to close in March 30th, 2020 but it received a no-cost extension to September 30th 2020 due to the Covid-19 pandemic. The first phase mainly focused on laboratory systems and TB control and involved setting up of country and regional structures including recruitment, construction of laboratories and procurement of equipment, initiation of operations research and capacity building. The second phase focused on: scaling up and replication of the interventions,

revitalizing disease surveillance, improving prevention and preparedness capacities, reinforcing the existing systems set up and investing in non-communicable diseases i.e. Cancer screening and diagnosis, focusing on sustainability and replication in other countries.¹

The initial project appraisal document identified a number of underlying issues for inadequate performance of the laboratories and surveillance functions in the health sector and included: (i) inadequate human resources for laboratory services; (ii) inadequate infrastructure at national and subnational level; (iii) inadequate/inappropriate availability of both laboratory and Point of Care (PoC) tests with sub optimal test accuracy; (iv) inconsistent supply of laboratory stocks and consumables/supply chain weakness; (v) lack of trust by clinicians on laboratory results due to perceived poor quality resulting in empirical treatment and drug resistance issues; (vi) increased laboratory costs due to fragmented procurement and maintenance of laboratory equipment and supplies including market failures; (vii) late identification and response to public health outbreaks and emergencies; (viii) inadequate sharing of information between laboratories within and outside the countries; and (ix) inadequate inter-country and cross-border sharing of disease surveillance information.

The regional approach was designed around multiple factors such as:²

- i. Increase in risk of communicable disease transmission and pandemics due to global and regional trade, international travel, and refugee movements which require a harmonized approach, to mitigate negative spillover effects and maximize positive externalities.
- ii. Inherent market failures which imply that services may not otherwise be provided by countries.
- iii. Potential to reap economies of scale, lower costs, and achieve quality diagnostic services.

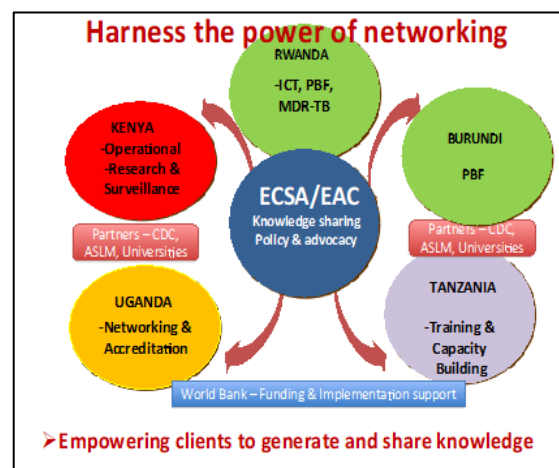
Under the regional implementation approach, each country provided technical leadership or developed a centre of excellence/technical working group in one or more thematic areas under the project based on comparative advantage over others. Each country also provided leadership to one or more technical working groups as depicted in figure 1 below. The technical working groups/centres of excellence were focused as follows:

- a) Integrated Disease Surveillance and Response & Operational Research (Kenya);
- b) Laboratory Networking and Accreditation (Uganda);
- c) Training and Capacity Building (Tanzania);
- d) Information and Communication Technologies, Multi-drug Resistant Tuberculosis (Rwanda) and
- e) Performance Based Financing (Burundi).

Figure 1: Regional technical working groups

ECSCA-HC played a coordinating role and facilitated knowledge exchange among the project countries, and other countries in the region.

Under implementation arrangements, country level activities were coordinated under the Ministry of Health led by a project coordinator/manager and a core team, within Public Health Departments. The core team was guided by National Steering Committees composed of various membership. At regional level, ECSCA-HC and EAC provided regional coordination of all these technical working groups and additional support to countries' project implementation. ECSCA-HC led this regional operation with Director General providing oversight and Regional



¹ EAPHLN Project Appraisal Document, World Bank, 2015

² EAPHLN Project Appraisal Document, World Bank, 2010

Advisory Panel (RAP) and Regional Steering Committee being the strategic oversight committees in approving regional workplans, technical advice, country experience sharing platform and reviewing opportunities for partnerships.

The Implementation Completion and Results Report (ICR) for the EAPHLN project was an independent review process for this pioneering EAPHLN diagnostics investment by the World Bank, a first for the Bank to partner with countries regionally on improving diagnostics. This ICR planned to document key lessons (what worked and what didn't), challenges in implementation required to overcome for better success and more importantly impacting public health outcomes and improving the lives of the patients and populations served. Public health leadership and structures at national and subnational levels were also assessed as well as the importance of utilizing a development investment to boost the local country capacities.

1.2 Project Development Objective (PDO)

The development objective of the project was to establish a network of efficient, high quality, accessible public health laboratories for the diagnosis and surveillance of TB and other communicable diseases. This remained unchanged through the entire project period.

Performance and Expected Outcome Indicators

The PDO was measured through these six core set of project outcome indicators and was agreed upon by the project countries at inception:

- a. **Project Outcome Indicator #1:** Average turn-around time for TB GeneXpert test (Hrs)
- b. **Project Outcome Indicator #2:** Satellite laboratories awarded three-star status under regional accreditation program based on WHO/AFRO five-step accreditation approach (cumulative number, %).
- c. **Project Outcome Indicator #3:** Number of beneficiaries (out of which x% female).
- d. **Project Outcome Indicator #4:** People receiving TB drug susceptibility tests among DOTS treated TB cases not responding to treatment (number, %).
- e. **Project Outcome Indicator #5:** Proportion of reported communicable disease outbreaks having laboratory confirmation of etiological agent (%).
- f. **Project Outcome Indicator #6:** Proportion of outbreaks in cross border areas that joint investigations were done (both in country joint investigations and inter-country joint investigations)

1.3 Project Components

The project had the following components and sub-components which remained unchanged for the two project phases measured using 12 intermediate outcome indicators to measure progress as highlighted below:

- (i) **Component I: Regional Diagnostic and Surveillance Capacity**
 - Ia. Diagnostic Services for Vulnerable Groups in Cross Border Areas
 - Ib. Disease Surveillance and Preparedness

This component provided support to create and render a functional regional laboratory network aimed to enhance access to diagnostic services for vulnerable groups; improve capacity to provide specialized diagnostic services and conduct drug resistance monitoring; and strengthen laboratory based disease surveillance to provide early warning of public health events

- (ii) **Component II: Joint training and capacity building;**

This component aimed to support training and capacity building for laboratory and other health personnel to increase the pool of experts in the sub-region and improve the effectiveness of public health laboratories

(iii) **Component III: Joint operational research and promote knowledge sharing;**

This component aimed to finance operational research and knowledge sharing activities enhance the evidence base of this investment i.e. evaluate the impact of the new TB diagnostic technologies, assess drug resistance patterns for endemic diseases, and ascertain the feasibility of using mobile phone technologies for surveillance reporting; and support regional co-ordination and program management functions.

1.4 Rationale for Bank Involvement³

In light of the institutional focus on global public goods, the Bank was well placed to tackle the regional dimensions of communicable disease prevention and control.

- a. There was an international consensus that global action is required. There was *strong demand* from countries, as reflected in the 2008 Maputo Declaration on Strengthening of Laboratory Systems and in the 59th meeting of African Ministers of Health which called for strengthening public health laboratories, and tackling the spread of drug resistance to AIDS, TB, and malaria. There was also a *call for public health action*, as TB was declared a global public health emergency in 2005. There were *international commitments* to establish integrated disease surveillance systems (IDSR) and to alert neighbouring countries of disease outbreaks (IHR).
- b. The project represented an important contribution towards meeting these commitments and building public health capacity. There were critical regional gaps that are not always adequately addressed. While the Global Fund to Fight AIDS, TB and Malaria (GFATM) and bilateral donors financed primarily disease specific and country-focused investments, the Bank was better placed to tackle regional integrated public health challenges. Despite an increase in funding, gaps persisted in many countries.

<i>Rationale for Bank Involvement</i>	
<i>Why Labs?</i>	• Critical for supporting disease surveillance and sharing information with neighboring countries. • Key to complying with IHR which aim to improve early identification of public health emergencies. • Important for accurate diagnosis, guiding treatment, and managing the growing problem of drug resistance.
<i>Why TB?</i>	• Rise in drug resistant TB, which poses major public health risks regionally and globally. • High burden of TB; highest levels of infection; disproportionate share of global burden. • High expected rate of return, highly cost-effective, strong public good nature of TB control.
<i>Why a Regional Approach?</i>	• Increase in risk of communicable disease transmission and pandemics due to global and regional trade, international travel, and refugee movements which require a harmonized approach, to mitigate negative spillover effects and maximize positive externalities. • Inherent market failures which imply that services may not otherwise be provided by countries. • Potential to reap economies of scale, lower costs, and achieve quality diagnostic services.
<i>Why Bank support?</i>	• Investments in communicable diseases are in line with the institutional commitment to global public goods. • Comparative advantage to address broader systemic health systems issues. • Bank's comparative advantages (analytic capacity, convening power, knowledge sharing, intervening regionally).

Figure 2: Source: EAPHLN Project Appraisal Document, World Bank, 2010

- c. The Bank had the capabilities and resources to be effective, as it had a growing body of experience with regional investments and with innovative reforms. The Bank's ability to broker partnerships with regional institutions had facilitated the design of this proposed project. The Bank's expertise with innovations, such as performance contracting was brought to bear to attract and retain high quality laboratory personnel.

^{3 3} EAPHLN Project Appraisal Document, World Bank, 2010

- d. The Bank provided flexible financing to tackle both health systems and communicable disease challenges, in line with the 2007 Health, Nutrition and Population Strategy. Recognizing ongoing risks of communicable disease pandemics, the Bank had a unique opportunity to assist African countries to prepare for such emergencies rather than react when outbreaks arise, and **the recent Covid-19 pandemic made this case.**

1.5 EAPHLNP Theory of Change (Results Framework)

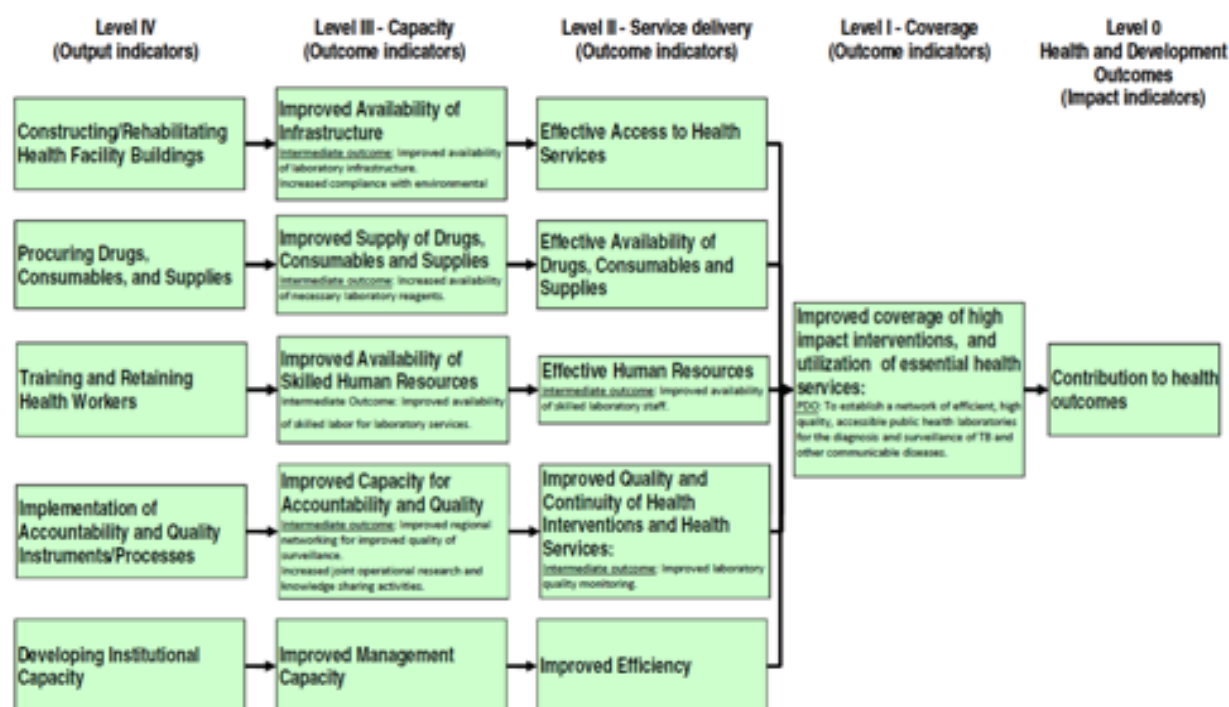
The monitoring and evaluation thinking of the EAPHLN project was an essential, integral and cross-cutting aspect for the project. A complex regional health operation such as EAPHLNP, the results framework was fundamental for providing facts and evidence backing the incremental project changes over time and best buy interventions. The primary data from the results framework was key to track quantitative achievements which was triangulated with the qualitative findings to track outcomes over the decade.

The major theory of change underpinning this regional initiative was to establish a network of efficient, high quality accessible laboratories in cross border areas in the five countries that would eventually result in stronger capacity to diagnose communicable and non-communicable diseases that are of public health importance from an infrastructure, technical capacity and overall response capabilities. Progressive learning was to be assessed and if taken up by Government, policy makers and other development partners, it would result in better diagnostics and epidemic response. The development of this Implementation Completion and Results Report (ICR) adopted an adaptive approach, in which the OECD - DAC⁴ evaluation criteria was used for accountability and learning primarily using the five elements of *relevance (plus coherence), effectiveness, efficiency, impact and sustainability* and linked to assessing the design and implementation of the project. The ICR utilized the EAPHLN results framework as a tool against which; it tracked evidence of realized progress and impact, it interrogated existing gaps at the design, implementation and results levels. Beyond the results framework, document reviews, observations, key informant interviews and general public health perspectives were examined.

COVID-19 pandemic was a crucial contextual factor in this ICR evaluation. It had potential impact on diagnostics, clinical services and health system governance. The major theory of change underpinning the regional initiative was to establish that a network of efficient, high quality accessible laboratories in cross border areas in the five countries and how this would eventually result in stronger capacity to diagnose communicable and non-communicable diseases of public health importance from an infrastructure, technical capacity and overall response capabilities. The results chain (theory of change) used to evaluate the project is shown in figure 3 below:

⁴ OECD Criteria of Evaluating Development Assistance, DAC Network of Development Evaluation, 2019

Figure 3: EAPHLNP Theory of Change/Results Framework



1.6 Significant Changes During Implementation

1.6.1 Additional Financing for Phase 2

The project received Additional Financing (AF) for the second phase, which was approved in June, 2015 of US\$ 50M consisted of International Development Association (IDA) loan to Kenya, Tanzania and Uganda and an IDA grant for Burundi. This AF focused on preparedness of health systems to deal with disease outbreaks and scale up promising regional approaches to maximize impact and development effectiveness. The first phase focused on funding of laboratory systems strengthening. This included: infrastructure, training and surveillance systems set up and operational research. The additional financing (phase 2) focused on disease surveillance, prevention, and preparedness capacities. TB control remained relevant in the countries and additional support was provided to consolidate achievements and/or expand activities to new project sites and the existing established national structures and coordinated regional platforms remain constant throughout the project.

The project begun preparing a third AF phase, however this was not successful. The priorities highlighted were shifted to the respective Countries' Covid-19 Specific Emergency Response Projects and other health systems focused Bank operations.

1.6.2 Revised Project Outcome and intermediate Indicators Updated

The results framework was amended and updated once during project's life, that is at the Mid-Term Review (MTR) in March 2014 and during the additional financing for the second phase. A total of 18 indicators monitored (6 outcome and 12 intermediate) were finally ratified by countries and the World Bank. The PDO and the project components were not revised. This is as shown in annex 1 below.

The project appraisal document for the 2nd phase provide the details on the amended results framework and included (i) dropping several indicators which were no longer relevant; (ii) added a number of new indicators; (iii) refined several indicators; and (iv) revised targets based on previous performance.

The summary of the key performance indicators with these slight modifications was as follows:

<i>Indicator</i>	<i>Action taken</i>
i. Average turn-around time for TB liquid culture tests (days)	<i>Dropped</i>
ii. Average turn-around time for GeneXpert test for tB (days)	<i>Added</i>
iii. Satellite laboratories awarded three-star status (rather than two-star) under regional accreditation program based on WHO-AFRO five-step accreditation process (cumulative number/ percent)	<i>Amended</i>
iv. Number of beneficiaries (direct; out of which x percent female)	<i>Amended</i>
v. People receiving TB drug susceptibility tests among Directly Observed Treatment Short Course (DOTS) treated TB cases not responding to treatment (number percent)	<i>Unchanged</i>
vi. Share of reported communicable disease outbreaks having laboratory confirmation of etiological agent (percent)	<i>Unchanged</i>
vii. Proportion of Cross border outbreaks for which investigations are conducted percent rather than number	<i>Amended</i>

Additional intermediate indicators included:

- i. **Intermediate Outcome Indicator #10:** Number of GeneXpert tests performed per quarter;
- ii. **Intermediate Outcome Indicator #11:** Number of laboratory tests performed
- iii. **Intermediate Outcome Indicator #12:** Laboratory Clients Satisfaction Rate

1.6.3 Other Changes

Closing date extension. During the initial phase the closing date remaining constant for the four countries i.e. on 30th March, 2016, except Burundi which joined later closing on 30th September 2017. During the AF phase from 2016 to 2020, Rwanda did not request for additional financing and only four countries were financed i.e. Kenya, Uganda, Tanzania and Burundi. For these countries, the project closing date was extended from 30th March, 2020 to 30th, September, 2020 due to the Covid-19 pandemic, however for Uganda the extension was granted up to 30th March 2021.

Reallocation of Funds: Some countries reallocated their financing due to non-implementation and shifted priorities of some sub-components i.e. Burundi reallocated the operational research funds to disease surveillance and epidemics management, Tanzania re-allocated funds for the enteric operations research towards responding to emergency outbreaks.

1.7 Rationale for Changes

Risk of Ebola Outbreak: The East African Community (EAC) member states stepped up Ebola preparedness activities and had substantial unmet needs as reflected in their Viral Haemorrhagic Fever plans. Several of the EAC countries participated in the WHO/African Union health worker deployment initiative to West Africa. They sent large contingents of medical workers which resulted to an increased level of risk and needed to be mitigated to effectively protect against any imported cases.

The AF for Burundi, Kenya, Tanzania and Uganda supported preparedness plans that were anchored on the WHO Country Epidemic Preparedness Plans. These Plans included: (a) scale up successful activities to additional facilities in cross border areas, further expanding geographic coverage; (b) broadening and deepening the range of interventions to be funded (i.e. establishing isolation units; strengthening community surveillance activities; and supported joint training in line with the One Health approach to enhance effectiveness and impact of health systems in terms of management and containment of communicable diseases; and (c) expanding the capacity to cover non-communicable diseases including enhancing pathology services utilizing the investments made during phase 1. The new interventions were aligned to the broader theory of change focused on disease surveillance and epidemic preparedness.

The AF support during the second phase has played a critical role in the Covid-19 response. Earlier investments undertaken by the project are now being utilized as Covid-19 testing facilities, trained laboratory and surveillance experts are critical role coordinating and responding to the pandemic in all the countries.

1.8 Outcome

A. Relevance and Coherence of Overall Design of the Project Development Objective (PDO)

The relevance of the PDO and overall project has been substantial from assessing the outcomes, stakeholder interviews and field visits to the funded laboratories and facilities. The EAPHLN initiative across all the countries and at regional level remained highly relevant to the National Government's priorities throughout implementation. It contributed to bolstering five countries capacities in diagnostics and disease surveillance, preparedness and outbreak timely response from infrastructure, human resources, laboratory supply chains, information systems and knowledge management. The design and implementation arrangements were aligned with the national and regional priorities and Government's led and coherent with the national priorities and strategic plans, cross-networking amongst the member states.

The design tackled the core challenges faced by countries, which from initial research showed laboratories are manned by less qualified staff, poor laboratory infrastructure (most were one room laboratories) lack of trust by clinicians and tend to have insufficient and outdated equipment thereby led to inaccurate and late results. This lengthened the time for epidemic confirmations and control. Access to reliable diagnostic testing was severely limited in the region, and misdiagnosis commonly occurs, which in turn leads to higher costs and compromised patient care (Petti C et al, 2006). Moreover, regional capacity to conduct drug susceptibility testing and drug resistance surveys was severely limited, hence undermining data capture to estimate incidence, mortality, or hospital burden for the majority of pathogenic bacterial species. Strong implementation by respective Ministries of Health and regional inter-Government Institutions has resulted in robust institutions and increased visibility on the neglected areas of the health system i.e. laboratories and surveillance. The project was aligned to building health systems through support of key pillars based on the WHO building blocks on human resource, information systems, research, governance, access to laboratory commodities. The design did not factor in health financing as a significant component of strengthening laboratory systems. The project design was flexible, Individual countries could adapt to changing contexts within the two phases of implementation. Changes from communicable to non-communicable disease, utilization of digital technology and increased focus on disease outbreaks especially after the Ebola outbreak. The flexibility was useful in enabling countries to adapt to realities of delivery such as: outbreaks, new epidemiological shift in disease burden, costs decline, antimicrobial resistance and changes to programming.

Based on the theory of change, project indicators were output-based that is, they were focused on activities, project delivery and technical milestones achieved. This resulted in improvements within the laboratories and surveillance investments from an output level. Progressively over time, outcome level effects were noted with the benefits of the project being accrued to the health system. However, the results framework was linear in design and minimally assessed multiple pathways towards achieving the output and outcomes since the achievement or non-achievement should go beyond the scoring of numerical indicators. The design was slightly limited to a smaller coverage and scale in the countries and did not address changes to the wider health context in the short term.

The design placed emphasis on partnerships with healthcare personnel, national and regional institutions. The communities were a critical component in closing the loop in the continuum of healthcare service delivery with laboratories playing a central role. From a component perspective the two components on diagnosis, surveillance and training were highly relevant and produced stellar results on the ground. The only pitfall in the design evaluated was the operational research project component. It had a flawed design and yielded low results with minimal success recorded. There were inherent challenges in research design not linked to programming, weak understanding on role of operations or implementation research in health policy, slow implementation by bureaucratic research agencies and the research products outcome not translated to practice.

Overall, the project relevance has remained consistent over the ten years with a simple, flexible and robust design with minor amendments during implementation. The design benefited from a stellar panel of technical experts ranging from public health, laboratory scientists, environmental, epidemiologists, and program managers from leading agencies. The regional design was very strategic and futuristic with cross-border aspects covered yet with obvious challenges in data sharing and movement. Participating Governments agreed to utilize regional organizations i.e. ECSA-HC and East African Community (EAC) towards more regional coordination roles which, yielded better collaboration and a stronger convening power. It facilitated knowledge and experience sharing among the countries through the Communities of Practice/Technical Working Groups.

The EAPHLN design informed development of other World Bank and partner initiatives such as the Southern Africa TB and Health System Support Project, Africa CDC, Global TB regional Laboratory initiative. Based on the above assessment, the relevance was **achieved** given the fact that the PDO remained relevant throughout the project implementation period. The ICR report sections below documented this success in the design and pointed challenges, lessons learnt and future recommendation to be tackled in future initiatives and the Governments.

2.0 Achievement of PDO (Effectiveness and Efficiency Assessment)

This ICR assessed categorized overall scoring of the various components based on the evaluation criteria and guidance from the World Bank ICR guideline:

- a. Surpassed
- b. Achieved/Substantial
- c. Partially Achieved
- d. Not Achieved

2.1 Component 1: Regional Diagnostic and Surveillance Capacity

This component was substantially achieved over the last ten years with remarkable successes and improvement from inception of laboratories and surveillance systems in terms of infrastructure, systems, human resource and many other areas. The project strengthened diagnostic and surveillance capacity in the region by providing support to create and render functional a regional laboratory network. It enhanced

access to diagnostic services for vulnerable groups; improved capacity to provide specialized diagnostic services and conducted drug resistance monitoring; and strengthened laboratory-based disease surveillance to provide an early warning of public health events.

The sub areas covered in this component evaluation include:

i. Infrastructural Improvement for Public Health Laboratories and Health Facilities Centres of Excellence

Prior to the project inception in 2010, majority of the selected project sites in the countries had: a one-roomed laboratory, mostly not equipped or lacking reagents, understaffed and the limited space was not conducive for expansion of and strengthening of laboratory services. There was an urgent need to change the narrative. The satellite laboratories were based at regional or district hospitals in strategic cross border areas and/or in densely populated peri-urban areas where poverty is rampant and slum conditions serve as a breeding ground for the spread of diseases. Each country carefully selected these sites based on the following *criteria*: (i) hospitals which are located in high transmission areas with large numbers of migrants or refugees; (ii) regional teaching hospitals which served as centers of excellence for conducting training and research; and (iii) commitment to collaborate and coordinate efforts within and across countries. The satellite sites were essential to optimize surveillance efforts by providing early detection and specialised testing and provide timely containment of spread of communicable diseases in the region.

Figure 4: EAPHLN constructed & renovated laboratories



The regional project financed new construction, renovation, and expansion of state-of-the-art public health laboratories and isolation facilities within health facilities in the five participating countries. This was a landmark investment towards adequate infrastructure meant to ensure higher standards of quality were attained. In total, the project supported **35 new and renovated laboratories**. These were fully completed and equipped over the ten year implementation period. Although this was a remarkable achievement, it had numerous challenges experienced in building the complex laboratories that were mainly biosafety level 2 and few level 3 public health laboratories. Figure 5, shows the location of the satellite laboratories across the five countries and their strategic border locations.

Kenya had, seven (7) laboratories and one (1) isolation facility constructed within the hospitals of Wajir, Kitale, Malindi, Busia, Machakos, Marsabit and Eldoret (Moi Teaching and Referral) Hospitals. This included one renovation of the National Public Health Laboratory Services building which comprised of several

reference laboratories of Microbiology, virology-National influence Centre, food and environmental laboratories, malaria laboratory based in Nairobi at Ministry of Health headquarters. In Tanzania, three (3) laboratories were constructed; St. Benedict's Referral Hospital (Ndanda), Kibongoto Infectious Diseases Hospital and the National Public Health Laboratory, a level 3 laboratory in Dares-Salaam. Three more laboratories were renovated; Ifakara laboratory (IHI) in Bagamoyo and Mbeya Regional Referral Hospital Laboratory and Ocean Road Cancer Institute. In addition, four (4) Isolation centres were constructed in Mwanza, Kilimanjaro, Temeke and at the Muhimbili National Hospital. In **Uganda, nine (9) supported satellite laboratory sites** financed included: laboratories based at the National Tuberculosis Reference Laboratory (jointly funded with other partners) and which was later designated as a Supra-National Reference Laboratory (SRL), Mbale Regional Referral Hospital, Mbarara Regional Referral Hospital, Arua Regional Referral Hospital, Lacor Hospital and Isolation centres; Moroto Regional Referral Hospital (MDR

ward remodelling) and Entebbe Isolation center and Mulago National Referral Hospital. **In Rwanda , five satellite laboratories** were financed i.e. Gihundwe, Nyagatare, Kibungo, Rubavu/Gisenyi and Byumba while **Burundi, nine laboratory satellite laboratories** were constructed over the entire project period: University Teaching Hospital of Kamenge Laboratory (CHUK), National Institute of Public Health (INSP), Kayanza, Makamba, Muyinga, Rumonge, Cibitoke, Gitega and Ruyigi.

The new infrastructure served as a strong public health platform for strengthening laboratory services for communicable and non-communicable diseases. This has been leveraged during the COVID-19 pandemic as most served as COVID-19 testing laboratory sites in Kenya, Uganda, Burundi and Tanzania. The laboratory facilities including boardrooms are a key asset for the entire hospital facilities for conducting meetings, training, and conferences. They also installed video conferencing facilities useful in communicating within and across the countries especially with limited travel during Covid-19, they have proved to be cost-effective and efficient gains. The laboratories undertook specialized testing that was traditionally done at the National Reference laboratories. These laboratories have supported their own counties and the counties in the catchment areas. These infrastructure improvements, namely the laboratories and isolation centres in some cases led to increased working space, improved safety within the laboratories, improved the quality of services and increased customer satisfaction. Picture 1 and 2 below are sample of the new laboratories in the countries:

Picture 1: New Wajir Regional Public Laboratory, Kenya

Before



After



Picture 2: National Public Health Laboratory Renovated Building, Nairobi
Before



After



Picture 3: New Cibitoke Medical Biology Laboratory, Burundi



Picture 4: Uganda National Tuberculosis Reference Laboratory



Picture 5: New Kibongoto Infectious Diseases Hospital, Tanzania
Before



After



My Government with the support of National Public Health Laboratories has put in place all the requisite kits and capacity to formally carry out testing of COVID-19 in our Regional Laboratory built by the World Bank under the East Africa Public Health Laboratory Networking Project (EAPHLNP). This is a milestone because Wajir Regional Referral laboratory will be designated a COVID-19 testing site in Kenya that will support all our neighboring counties including Mandera, Garissa, and Marsabit. We are currently able to test at least 60 to 100 samples in 24 hours."

County Governor of Wajir, Kenya during initiation of Covid-19 testing

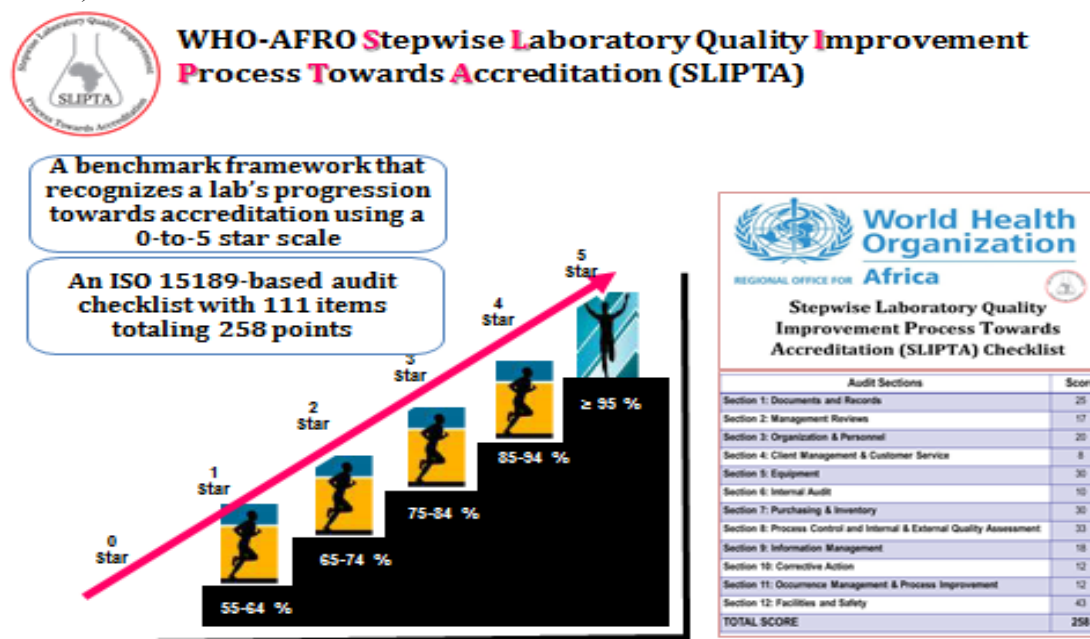
"Today I announce to the public that through our collaboration with the National Public Health laboratory, the Ministry of Health, the East Central and Southern Africa Health Community (ECSA-HC) our Kitale Hospital Regional Laboratory will start testing for Coronavirus disease. This is a facility that was built and operationalized in 2015 out of a regional East Africa public health laboratory networking project (EAPHLNP) supported by the International Development Agency/World Bank. This project has played a key role in strengthening laboratory diagnostics. It has contributed immensely in infrastructure development by constructing a new ultra-modern laboratory fully equipped with modern technology equipment for Cancer screening, TB diagnosis, microbiology assays and diagnosis of other communicable diseases of public health importance."

County Governor of Trans-Nzoia (Kitale satellite), Kenya during the initiation of testing for COVID-19 in April/May 2020

Quality assurance is the foundation of any laboratory country systems and ensures results by the laboratory are accurate, reliable, consistent and trustworthy. This was one of the hurdles at project inception in all the participating countries. Once, a neglected function, it had become a major impediment to effective health care service delivery and disease surveillance, as none of the project sites were enrolled in an elaborate Quality Management System (QMS). Over the past decade, quality performance-enablers have been developed to guide the implementation of a sustainable QMS leading to accreditation. The World Health Organization (WHO) and partners, designed one of the frameworks for improvement of Laboratory Quality Management System (QMS) to fulfill ISO 15189 standards in a stepwise process. The design was based on ISO 15189:2012 standards and the 12 quality system essentials.

Based on the principles of affordability, scalability, measurability and accessibility, the Stepwise Laboratory Quality Improvement Towards Accreditation (SLIPTA) promoted country ownership of the process and sustainability of improved quality laboratories. Uganda provided regional leadership on laboratory networking and accreditation. The project supported strengthening of laboratory quality improvement in the new laboratories through the implementation of **Quality Management Systems** at the satellite sites. This also included training and mentorship on QMS and enrolled all project laboratories in SLMTA. Regional peer assessment using the SLIPTA checklist were conducted each year and follow ups to ensure conformities identified were closed. This was implemented using the WHO- SLIPTA model which allowed for the laboratories to achieve stepwise improvement aiming for the ultimate target of ISO 15189 international accreditation.

Figure 5: WHO SLIPTA Process (An updated chart with 275 points with SLIPTA version 2.0 is currently being utilized)

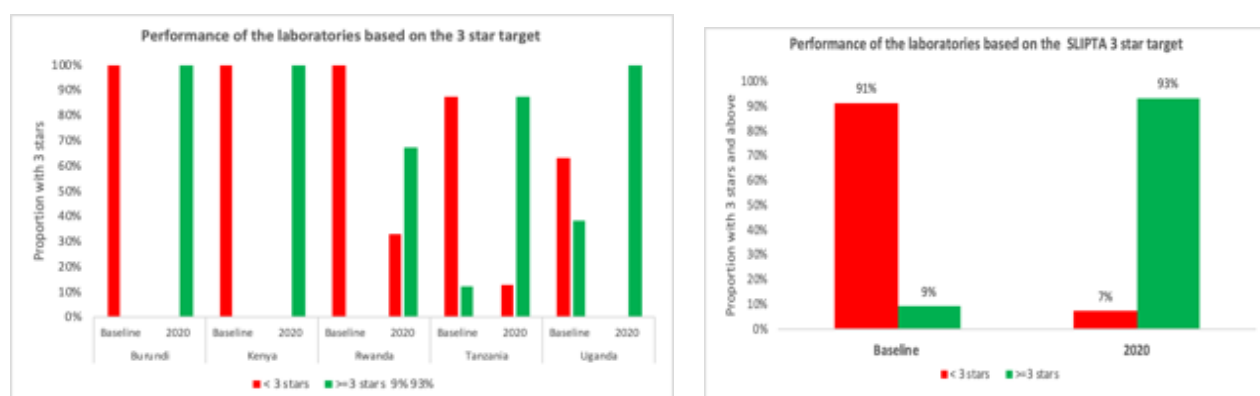


Support was mainly through key interventions shown below;

- Laboratory on-site mentorship which allowed for more experienced personnel to train, support and demonstrate to the laboratory and facility staff on improvement aspects
- Peer to peer laboratory SLIPTA assessments that allowed for measuring of the improvement efforts as well as identification of more continuous improvement opportunities.
- Performance Based Financing funds were used to incentivize improvement efforts using the SLIPTA checklist. This allowed for catalysed implementation of improvement actions through motivation of facility laboratory staff.

The project conducted annual regional peer audits of laboratory systems using SLIPTA trained and certified laboratory auditors by ASLM. They also used the same to benchmark the level of performance to meet the quality standards using the WHO/AFRO SLIPTA checklist. The peer assessment conducted in April 2020 shown in figure 12 below, found that 93% of project-supported facilities attained at least 3 stars, which was the revised target, compared with 9% at baseline (2011), an 84-percentage point's increase. The recent assessments were conducted in collaboration with the ASLM and facilities issued with official SLIPTA certification.

Figure 6: Performance of the network laboratories in the regional peer SLIPTA audits 2011 to 2020



The performance shown in figure 12 above, varied from country to country but overall improvements were recorded in performance of the laboratories over time. The SLIPTA and SLMTA process enabled the countries to identify and train mentors and auditors. It also established a network of mentors, auditors and master trainers across most of the countries. This provided a key resource in ensuring laboratory management is sustainably supported with highly trained QMS certified laboratorians and part of a regional pool of assessors and auditors in Africa. **A total of 18 laboratories received the gold ISO-15189 standard accreditation** and served as Centers of Excellence in the countries. None of laboratories had attained accreditation at the project initiation.

Table 1: Network laboratories accredited or recommended for ISO15189 accreditation

Kenya (8)	Tanzania (5)	Uganda (4)	Rwanda (1)
National Microbiology Reference Laboratory*	Mnazi (Zanzibar)** Mmoja	National TB Reference Laboratory#	National Reference Laboratory*
National TB Reference Laboratory*	Ndanda Hospital Laboratory**	Fort Portal Laboratory#	
Wajir Country Hospital Laboratory*	Kibongoto Laboratory**	Moroto Regional Hospital laboratory# ^R	
Busia Country Hospital Laboratory	Subawanga Regional Hospital Laboratory**	Mulago National Hospital laboratory# ^R	
Kitale Hospital Laboratory*	National TB Reference Laboratory (Muhumbili)**		
Machakos Country Hospital Laboratory*			
Malindi Hospital Laboratory*			
Moi Teaching and Referral Hospital Laboratory*			
*KENAS - Kenya National Accreditation services; SANAS- South African Accreditation Services#; SADCAS -Southern Africa Development Community Accreditation services**; ^R Recommended for ISO15189 accreditation			

The laboratory quality improvement has resulted in huge benefits as follows:

- i) There has been greater recognition, increased quality awareness and quality performance of testing. The countries are currently making great strides in implementing quality management systems (QMS) leading to laboratory accreditation in accordance to global standards;
- ii) Increased capacity of laboratory testing services, better turnaround times and improved surveillance data at the satellite laboratories. This has lead improved outbreak response and better patient outcomes;
- iii) Institutionalizing QMS within the laboratory department and development of QMS champions included as part of regulatory requirement.
- iv) Sustainable partnerships between countries, ECSA-HC and ASLM in jointly implementing QMS through building capacity of quality testing and peer assessment audits (TOT training done at country level)
- v) Huge impact in laboratory support to disease programmes such TB, HIV and Malaria, and
- vi) Although considerable resources were needed for quality improvement towards accreditation in the countries these costs are much less than the costs of the adverse consequences of poor quality in terms of misdiagnosis, repeating tests, lost time and ultimately poorer health outcomes.

In summary, the QMS implemented and supported by ECSA-HC was one of the regional Mega Buys, thereby making the inter-Government regional agency, a leading technical agency in SLIPTA and laboratory accreditation in the region and this has been replicated to Anti-Microbial Resistance (AMR) and beyond this buoyant laboratory accreditation efforts, ECSA-HC is well positioned to utilize this inherent capacity to leapfrog and scale this up in other countries and optimize laboratory networks .

Progress on quality management systems was steady, however occasional slippages occurred occasioned by the need for improvement in the following areas:

- (i) Internal country performance in SLIPTA Assessments where number of laboratories were not enrolled in any proficiency testing (PT) scheme.
- (ii) Management of non-conforming events and root cause analysis, which is not systematically implemented across, and
- (iii) Human resources where a number of facilities lacked replacement of separated staff. The project supported gaps in these areas to address non-conformities; conducted of root-cause analysis and additional recruitment of laboratory personnel in the satellite laboratories.

The National TB Reference Laboratory (NTRL) in Uganda was WHO designated Supranational Reference laboratory (SRL) through support by the World Bank project and continued supporting the NTRLs in 26 countries within sub-Saharan Africa through a regional global fund project being implemented jointly with ECSA-HC. These were supported to improve both their laboratory systems as well as the TB laboratory networks in their respective countries.

SRL support to countries aided key milestones comprised of;

- ✓ *International accreditation based on the ISO 15189 attained in 6 laboratories as well as its maintenance.*
- ✓ *Establishment and strengthening of TB laboratory networks in the supported countries*
- ✓ *Establishment and strengthening existing sample/results transportation mechanisms in the supported countries*
- ✓ *Improvement of testing processes to ensure they meet the WHO recommended standards*
- ✓ *Development of laboratory strategic plans, operational plans and supporting policy documents for selected supported countries*

“Uganda TB Laboratory Best Practice”

iii. Laboratory Supply Chain and Equipment Provision

A well-functioning laboratory with modern diagnostic technology is critical for timely diagnosis of diseases to aid disease management. After construction or renovating the laboratories the EAPHLN embarked on equipping the laboratories with capital-intensive equipment and reagents required. A significant part of the country budgets; over 70%, was utilized in construction, equipping and accreditation. In 2011, the EAPHLN project, rolled out the innovative and game changing diagnostics i.e. **GeneXpert TB, new molecular, Point of Care technologies to all the countries**. The GeneXpert platform revolutionized TB diagnosis and detection of TB drug resistance by significantly reducing the turnaround time. Similarly, progress was made for HIV testing under the Early Infant Diagnosis (EID) programme. Over the years, the project has made substantial financial investments in procurement of modern laboratory equipment and necessary reagents for the sites, state-of-the-art technologies such as molecular equipment (DNA/RNA extraction, Polymerase Chain Reaction (PCR) equipment, Automated Liquid Handling System, and Automated gel electrophoresis equipment), biosafety cabinet chambers) and part of these equipment is multi-disease/polyvalent diagnostic platforms which have become critical in handling the COVID-19 pandemic testing. This equipment also provides technical and financial efficiencies in disease control efforts while expanding access to care and saving lives. Other major equipment procured included the Gas Chromatograph Mass Spectrometer (GCMS) for food analysis, microbiological and chemical water testing equipment for the National Public Health Laboratory, blood culture equipment (Bactec) and Vitek for drug susceptibility testing which were non-existent in public health laboratories and were only available in private laboratories. Consumables and reagents to support testing at the project sites were procured throughout the project life included primers and kits for detection of various virus and bacteriological etiological agents, blood/sputum culture reagents, TB molecular reagents such as GeneXpert cartridges and liquid culture reagents.

The project further disbursed facility improvement funds to the satellite laboratories and utilized performance-based financing to help address specific site demands e.g. reagents to ensure services were not interrupted. In addition, the country projects procured vehicles to assist in sample transportation and supportive supervision to ensure quality laboratory services are provided.

These investments produced improved health outcomes and also led to reduced turnaround time for testing TB and detection of rifampicin and isoniazid resistance (Multi-Drug Resistant TB) to within 24 hours. This is as compared to traditional sputum smear microscopy which took at least 2 months. Liquid culture and the rapid molecular techniques have improved the sensitivity and specificity of TB diagnosis and useful in TB programme planning. The expanded test menu scope included at the satellite laboratories: molecular testing using PCR based techniques for COVID-19, dengue fever, chikungunya, Cholera, MDR-TB detection and TB testing using GeneXpert, Cancer markers screening, Biochemistry testing and Microbiology testing to confirm drug resistance (antimicrobial resistance). This has not only reduced the testing turn-around time to improve on quality of care and health outcomes and early detection of outbreaks but has also reduced expenditure on referral of samples and reduced loss of patients to care (access to services). Additionally, automation of the equipment improved efficiency within the laboratory, reduced customer complaints, increased trust by clinicians and resulted to overall improvement in patient satisfaction rates.

Beyond expenditure on the equipment, service contracts with various manufacturers was captured to address the continued servicing. To build in-house capabilities, countries trained biomedical engineers to offer this support at subnational level. The challenge of ensuring equipment maintenance was persistent. Countries, with support from ECSA-HC collaborated with the Kenya's **National Public Health Laboratory Services Center of Excellence for Equipment Calibration, Certification and Training** to conduct trainings for laboratory and biomedical engineer experts in the countries on preventive maintenance, inventory management and laboratory equipment repairs. Sixteen biomedical engineers were

trained and have been supporting the sites in the respective countries with equipment management. This has been critical in ensuring a sustainable solution towards limited equipment downtime and service interruptions over equipment management. The Kenya program was established through the support of the US- Centres for Disease Control/PEPFAR program through Association of Public Health Laboratories (APHL) that has built a pool of experts and provided the tool kits to support the maintenance and laboratory equipment calibration work.

Inconsistent supplies of the laboratory reagents was a gap beyond the World Bank financing and this has played out during this Covid-19 response. Due to project closure, counties and National Government struggled to acquire financing to conduct testing. The challenges of laboratory supply chain at national and subnational level are pretty evident with expensive equipment procurement by the project and increased service need.

Picture 6: Biomedical engineers from EAC region repairing equipment during a training session at the Kenya Equipment Maintenance and Calibration Centre of Excellence



iv. Disease Surveillance, Preparedness and Response

The disease surveillance and response sub-component was partially achieved with several achievements recorded over the project period especially in the 2nd phase, but there were weak areas especially focused on cross-border and community based disease surveillance. Kenya provided regional leadership and served as a centre of excellence in Integrated Disease Surveillance (IDSR) and coordinated at the regional level with involvement of the East African Community and ECSA-HC who hosted a senior epidemiologist to provide the technical leadership role. The countries had established protocols on IDSR and adopted the WHO IDSR strategy to their respective countries. The surveillance interventions led to: strengthened preparedness and response in the countries, development of harmonized tools to promote cross border surveillance and joint outbreak investigations. They also shared lessons from the field epidemiology and laboratory (FELTP) fellowship program and offered local training programs to build regional surveillance capacities.

a. Laboratory confirmation and early detection

The second phase of the project focused more on building the disease surveillance systems and placed a key role of laboratories role in disease surveillance. At project inception, only less than 20% of the outbreaks had laboratory confirmation. There has been a dramatic improvement over the years to 100% of disease outbreaks in the countries such as cholera, dengue fever, malaria, hemorrhagic fevers and others

having laboratory confirmation. This can be attributed to an improved laboratory capacity and increased confidence by disease detectives or epidemiologists in the laboratory system.

Under the project results framework, project outcome indicator #6, measured the role of laboratory-based surveillance in responding to the outbreaks of communicable diseases of public health importance, such as cholera, malaria, hepatitis, salmonella, typhoid, hemorrhagic fevers etc. The Regional target was to have etiological agents confirmed in 94% of all outbreaks compared to the baseline in 2009. The reports for 2017-2018 and 2019-2020 showed that etiological agents were confirmed in the laboratories for 100% of outbreaks reported in Kenya, Uganda, Burundi and Tanzania. This was a great achievement as shown in figure 12 below:

The Regional project developed a regional framework for cross-border surveillance, established cross-border committees; conducted joint simulation exercises; carried out joint disease outbreak investigations across partner states, including several Ebola and Marburg outbreaks in Uganda; and developed a mobile phone disease surveillance system to facilitate sharing of information on disease outbreaks.

b. Establishment of a framework for cross-border collaboration

To address the bureaucratic bottle-necks in facilitating joint response to disease outbreaks, the project in collaboration with EAIDSNet developed the regional Cross-border surveillance and response framework for improved and coordinated cross-border surveillance and response in the region. This included standard operating procedures for tasks to be undertaken when a health event does occur. The framework identifies the priority diseases that are of regional and international importance and provides consensus-based approaches to the surveillance of these diseases. It also supports sharing of information on the occurrence of these diseases among partner states in order to enable mounting timely joint response to disease outbreaks.

c. Cross border committees and Zoning

Cross-border committees and zones were created between countries to strengthen communication, reporting and coordination of responses at border points during public health events and outbreaks. Country borders varied in terms of stronger collaboration and joint field simulation. A table top exercise was done. These strong public health assets in cross-border collaboration have proven useful in handling COVID-19, especially at border points considered to be hot spot. The laboratories have played a major role by supporting cross-border screening and testing programs and COVID-19 testing. For example, the National Reference laboratories in the four countries became testing centres for COVID-19, further, ECSA-HC collaborated with the MoH in Kenya and trained all the satellite sites to become COVID-19 accredited testing sites using the equipment procured by the project. These sites are currently supporting the countries in the response to COVID-19.

Through the cross-border framework, nine (9) Zonal Surveillance Committees at the international borders between EAC countries were established as indicated in the table 3 below.

Table 2: The composition of Cross-Border Surveillance Committees by district/sub-county

Number	Countries sharing border	Districts/Sub-counties	Satellite Laboratories (Centers of Excellence attached to zone)
1	Rwanda	Nyagatare, Gicumbi, Musanze, Rurera	Nyagatare District hospital and Byumba district hospital, Mbarara Regional Referral Hospital
	Uganda	Kabale, Ntungamo, Kisoro	
2	Uganda	Isingiro, Rakai, Kalangala, Mbarara	Musoma Hospital Mbarara RR Hospital
	Tanzania	Mwanza, Bukoba, Karagwe, Musoma, Ukerewe, Magu, Sengerema, Geita, Biharamulo,	
3	Kenya	Machakos, Kwale, Taita, Taveta, Narok South, Loitokitok, Kibwezi, Kajiado, Kuria East, Transmara	Machakos, Musoma, Kibong'oto, Mnazi Mmoja Hospitals
	Tanzania	Longido, Rombo, Same, Lushoto, Mkinga,	

		Pemba, Siha, Tarime, Serengeti		
4	Uganda	Amudat, Napak, Kaabong, Moroto, Nakapiripirit, Kotido	Kitale Moroto RR Hospital	
	Kenya	Mt. Elgon, Kwanza, Trans Nzoia West, Turkana North, Turkana Central, Turkana South, West Pokot		
5	Uganda	Bugiri, Busia, Namayingo, Buvuma, Tororo, Mbale, Manafa, Bududa, Bukwo	Busia (K) Mbale Regional Referral Hospital	
	Kenya	Bungoma West, Teso North, Samia, Busia, Bunyala, Rarieda, Bondo, Kisumu East, Kisumu West, Homabay, Migori, Suba		
6	Rwanda	Nyagatare, Kayanza, Kirehe	Nyagatare District Hospital and Musoma Hospital	
	Tanzania	Ngara, Karagwe, Biharamulo		
7	Rwanda	Huye, Bugesera, Rusizi	Kirundo, Kayanza and Chibotoke district hospitals; Nyamata, CHUB Mibilizi District Hospital	
	Burundi	Kayanza, Kirundo, Cibitoke		
8	Rwanda	Kirehe	Ngara District Hospital, Kigoma Hospital	
	Tanzania	Ngara, Kigoma		
9	Burundi	Muyinga, Nyanza-Lac	Muyinga, Nyanz a-Lac District	
	Tanzani	Kasulu, Kibondo, Kigoma		

**Adapted from The Framework of Cross-Border Disease Surveillance in East Africa 2011*

d. Capacity Building for surveillance and response

Under disease surveillance training, the project developed a short course on IDSR laboratory specific module. It combined e-learning and face to face delivery modes and the long term training was mainly using the FELTP course which has been heralded as one of the best epidemiology trainings. The graduates occupy public health leadership positions and have been critical during the Covid-19 response managing the emergency operations centres.

Simulation exercises are seen as a way to test the level of preparedness and ability to foster a coordinated multi-sectoral response to disease outbreaks. In order to strengthen preparedness and response to disease outbreaks across districts and countries in the East African Community, the project supported the conduct of several simulation exercises—both table top (TTX) and Field (FSX).

The project developed an electronic data management system that would help to collate surveillance and laboratory data at regional level. This web-based reporting system strengthened timely sharing of disease surveillance data among partner states for mounting prompt and coordinated regional joint response to public health emergencies where necessary following consultation with the affected countries. The project has supported quarterly publication of a regional surveillance bulletin by the East Africa Integrated Disease Surveillance Network with country-specific data from 2016/2017 to-date.

A one health approach was utilized in the cross border and general surveillance interventions with animal health, environmental and experts in zoonotic diseases heavily involved in the cross border meetings, national and regional fora. The Ministries of health, research organizations and public universities formed the East Africa Integrated Disease Surveillance and Response Network (EAIDSNet) in 2000. It championed disease surveillance in the region with special attention to cross-border surveillance in a One Health Approach. EAIDSNet aimed at supporting efforts to strengthen regional capacity for disease surveillance and response and harmonization of surveillance systems and data exchange. EAPHLNP, coordinated at ECSA-HC was initiated in 2010 to strengthen the functioning of EAIDSNet by establishing high quality laboratories accessible to the vulnerable populations in cross-border regions. Through the collaboration of EAIDSNet and EAPHLNP, the framework for cross-border surveillance was developed to operationalize the existing treaty of establishment of EAC that prescribed collaboration of Partner States in disease control (Article 118).

e. Covid-19 Pandemic Preparedness and Response: EAPHLNP Contribution

WHO declared Covid-19 (SARS-CoV-2) pandemic on 11th March 2020 and this presented an unprecedented opportunity to leverage and rapidly deploy EAPHLN laboratory resources such as laboratory infrastructure, staff capacity and the latest PCR molecular equipment at strategic cross border locations within the participating countries. EAPHLN investments contributed to Covid-19 testing, surveillance and response at regional and country level aspects of laboratory testing, surveillance, disease epidemiology/case management, supply chain of covid-19 materials and preventive measures at country level.

In Kenya, initially, only two laboratories could test for COVID-19 in the country, the National Influenza Centre (NIC) at the National Public Health Laboratory and Kenya Medical Research Institute (KEMRI). The EAPHLN project sites were identified and designated as Covid-19 testing sites, given they had PCR testing equipment from the long term project investments. ECSA-HC in partnership with the Ministry of Health, in Kenya mobilized training of satellite personnel on the Covid-19 testing and the use of the PCR equipment which was earlier procured. The provision of modern equipment such as GeneXpert and other PCR platforms like Qiagen through this project has strengthened the capacity of participating facilities to perform specialized testing. Busia, Kitale, Wajir, Malindi, Machakos and National Public Health Laboratories have been designated as COVID-19 testing sites, contributing to the national COVID-19 response and supporting neighboring counties in their respective regions that do not have similar testing capacities. The surveillance team trained through this project was involved in COVID-19 preparedness, including: activation of the national Task Force; developing the national contingency plan to guide implementation of priority preparedness and response activities; ensuring enhanced screening at points of entry and implementing risk communication through various channels; training/sensitization of health and non-health workers; procurement and prepositioning of PPE and other essential supplies and establishing quarantine and isolation facilities.

In Burundi, the project played a vital role in having the nine satellite laboratory sites among the initial facilities selected by the Ministry to undertake Covid-19 testing, the vehicles procured by the project were utilized for disease surveillance and contact tracing, the isolation treatment center used for Ebola was now utilized now for Covid-19. In addition, the FELTP graduates trained under the project were involved in the frontline Covid-19 response. The GeneXpert procured machines with Xpert Express SARS-CoV 2 cartridges that were procured through this project were utilized for the Covid-19 testing satellite laboratories. In Tanzania the newly constructed National Public Health Lab, is used as the National Reference Lab for COVID 19 Testing and in Kenya the renovated National Public Health Laboratory building which hosts the National Influenza Laboratory led the Covid-19 testing efforts in the country. Uganda and Burundi are prone to Ebola outbreaks, previous efforts to build an Ebola preparedness and response unit were leveraged for preparedness and control of Covid-19.

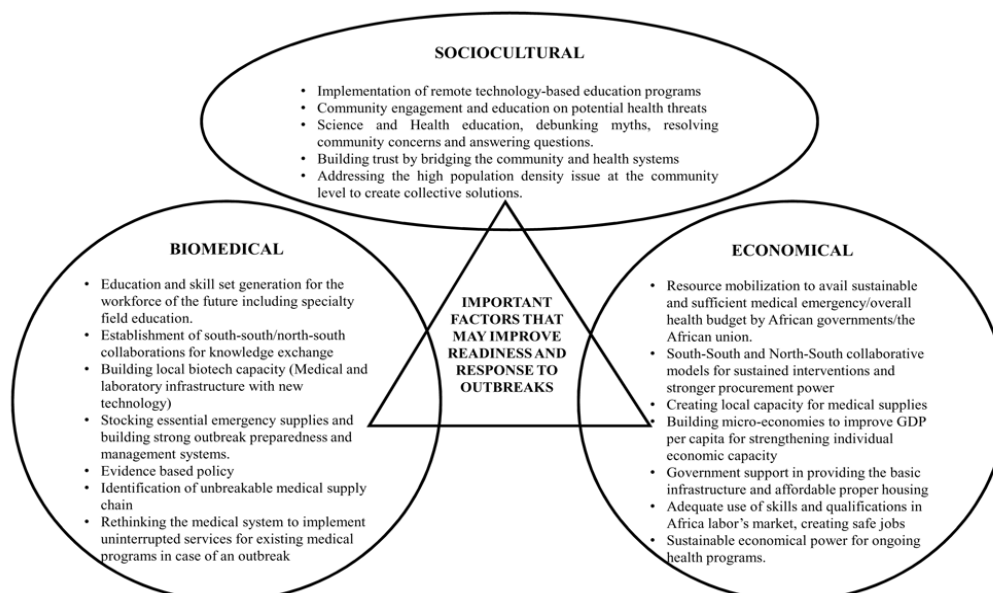
In Uganda, The project supported efforts to explore use of rapid diagnostic tests for COVID 19 screening. This could reduce the cost of the screening and testing at PoE, given the big numbers of travellers, yet very low COVID-19 positivity rates. The screening and testing at PoE was supported by laboratories available in the locality that have the requisite/appropriate biosafety and biosecurity capacity to host testing for COVID-19. Many of these were project satellite laboratories, as each PoE is part of a surveillance zone which is twinned with one or more satellite laboratories. In addition, the project provided COVID-19 electronic sample tracking (smart mobile phones and bar code labels) and COVID-19 case management (ambulance services).

Picture 7: Training of CHVs on COVID to scale up Community Health Strategy in Kenya



The impact of Covid-19 pandemic and the contribution of EAPHLN project in response in the project countries was assessed. Future programmes could explore capacity for building local manufacturing capacity of diagnostic test kits/equipment and technology transfer from innovator diagnostic companies. A recent publication by Wellcome Open Research⁵ recommended solutions to bridge Africa's gaps for improved outbreak preparedness and response.

Figure 7: Recommended solutions for improved preparedness and response to future outbreaks⁵



⁵ Umviligihozo G, Mupfumi L, Sonela N et al. Sub-Saharan Africa preparedness and response to the COVID-19 pandemic: A perspective of early career African scientists [version 1]. Wellcome Open Research 2020, 5:163 <https://wellcomeopenresearch.org/articles/5-163>

Africa CDC⁶ has stated the following are key priorities and opportunities as the Covid-19 disease spreads:

- a) Scale up testing, tracing, isolation
- b) Deploy community works and healthcare workers
- c) Expand clinical care for COVID-19 patients
- d) Protect health care workers from contracting the disease
- e) Protect existing programs for endemic diseases (TB, HIV, Malaria and others) and maintaining essential health services

Recommendations:

- a. Community based surveillance and contact tracing interventions were not implemented by the EAPHLN project and it is evident the importance beyond the core surveillance interventions by Ministries of Health to track and detect outbreaks. The involvement of community members to detect trigger events associated with specified health events, expanding the community networks for active surveillance rather than passive surveillance that will improve the sensitivity for outbreak response. This creates and improves relationships between the community and local health systems, strengthening local ownership of and buy-in to the surveillance interventions, and also help prevent infection and transmission. Community-based surveillance facilitates timely referral for testing of people who may be exposed to high risk diseases and community adherence to preventive measures
- b. The Africa CDC provided a great platform to leverage on the work done in cross-border control and using the RISLNET networks to scale this further.
- c. Future regional initiatives should involve other countries in the Eastern Africa for instance Congo DRC, Somalia, Ethiopia and South Sudan and others.
- d. Exploring sustainable models in cross-border activities and possibly partnering with private sector and other like-minded partners.

2.2 Additional Cross Cutting Interventions on Component 1/Beyond PDO

i. Anti-Microbial Resistance

Antimicrobial resistance is a global concern that may attribute to 10 million death/year by 2050, cause a reduction in GDP of up to 3% and cost the world up to \$100 trillion. The World Bank case study of “Drug Resistance Infections – Threat to our Economic future” demonstrated the need to have laboratory surveillance on antimicrobial resistance. There is also growing concerns by policy makers (GHSA) on AMR stewardship given the five EAC member states where basic yet essential and most used antibiotics are losing their effectiveness. The health systems are ill equipped to deal with the emerging Multi-Drug resistance by circulating microbes identified to even the second-generation cephalosporin (findings of the Enteric Study, Uganda, 2016). In line with the WHO five global objectives of the Global Action Plan on AMR i.e. to improve awareness and understanding of antimicrobial resistance; to strengthen knowledge through **surveillance and research**; to reduce the incidence of infection; **to optimize the use of antimicrobial agents**; and develop the economic case for sustainable investment, the project supported in two areas. AMR surveillance and research and support for optimizing use through Stewardship programs.

The investments made by the project in the physical upgrade of laboratories, improvement of quality laboratory systems, training and mentoring, have seen the laboratories being suitable candidates for early enrollment in the AMR surveillance networks. The EAPHLNP has repositioned to support AMR initiatives by mapping out sites involved in AMR surveillance and also developing a reporting tool to standardize the mode of communication. The project also sensitized hospitals management on the sustainability of the AMR program. The four countries developed AMR Action plans and rolled out AMR surveillance in the respective countries with

⁶ State of the Pandemic in Africa, Africa CDC, May 2020, J. Nkengasong

Kenya, Uganda and Tanzania enrolled in the WHO Global Anti-microbial Resistance Surveillance System (GLASS). Challenges of data transmission and quality are being addressed by the countries, but the AMR surveillance has already taken off. ECSA-HC has worked with the regional AMR teams and the Bank and developed a regional **AMR stewardship guidance document** that is assisting the countries to develop country specific stewardship program.

ECSA-HC is collaborating with other partners including Africa CDC, IQVIA, WAHO, ASLM to implement a regional Fleming Fund grant on AMR and Antimicrobial Consumption (AMC) project. This project covers selected countries across the continent. ECSA-HC is supporting countries in Eastern and Southern Africa on the project.

ii. Cancer Screening, Pathology and Registry Services Support

In the AF phase, strengthening surveillance and diagnosis of the growing burden of cancer build on existing platforms for communicable diseases that had been established under the project in the initial phase. Two initiatives were established as follows: -

a. Enhancing pathology services

With aging populations, sedentary lifestyles, improved control of communicable diseases, and rapid urbanization, developing countries are faced with the rising challenge of noncommunicable diseases (NCDs) as major contributors to death and disability. Noncommunicable diseases kill 41 million people each year, equivalent to 71 percent of all deaths globally. NCDs are projected to represent the leading cause of death in all countries irrespective of income level (WHO 2018a). Sub-Saharan Africa is among the regions projected to experience the largest increase, with NCDs expected to account for 46 percent of all deaths by 2030. NCDs affect people in their most productive years and are major contributor to premature deaths. NCDs account for over 85 percent of these premature deaths in low- and middle-income countries (LMICs) (WHO 2018b). NCDs lead to significant economic losses due to decreased productivity, lost wages, and catastrophic health spending.⁷

Cancer diagnosis is a key entry point to proper cancer care and management. Due to increasing epidemiological transition on non-communicable diseases, the project procured cancer screening equipment and reagents for various satellite laboratories sites and histology facilities to equip the histopathology sections of the laboratories.

Countries such as Kenya developed a curriculum and implementation guide for integrated cancer screening diagnosis and laboratory management, but this was not piloted or implemented. At the regional level, Bone Marrow Aspiration/Fine Needle Aspiration (FNA) training had over 20 professionals trained on sample collection, processing the specimen, reading, and interpreting the results for pathologists, clinical and laboratory teams. In Kenya, they established FNA clinics while in Uganda training was done in regional hospitals and setting up FNA/BMA clinics. In Burundi equipment for Histopathology was procured and a team trained to set up the clinics. For Tanzania, Immunochemistry equipment were procured for the Ocean Road Cancer Institute and screening commenced.

b. Building statistical capacity for cancer surveillance

The Regional Program for Cancer Registries was established through a separate but related funding from World Bank Trust fund to strengthen the capacity for collecting, analyzing and sharing data on cancers in the five East Africa member states. The project had three inter-arching components: **Component 1:** Core Capacities for Cancer registration and statistics; **Component 2:** Statistical Capacity Building and Mentorship and **Component 3:** Advocacy and knowledge exchange.

⁷ Lehmann, J, Machira, Y, Chuma ,J, Schneidman, M, Economic and Social Consequences of Cancer in Kenya; Case Studies of Selected Households, 2020

ECSA-HC worked with the International Agency for Research on Cancer (IARC), and the African Cancer Registry Network (AFCRN) to support the countries to strengthen capacity for establishment/strengthening of population-based cancer registries.

Key achievements:

iii. Established population-based cancer registry in the five countries:

The project countries established a new Population Based Cancer Registry (PBCR). Each country each increased from 6% to 18% covered by PBCR before the project implementation. Burundi, Rwanda and Tanzania did not initially have a population-based registry. The project established a registry in each country and increased the coverage in Kenya and Tanzania with additional registries. In Tanzania, another partner Bloomberg supported the establishment of additional PBCR (covering a population of 4.3M; Table 1).

Table 3: Population coverage with PBCR prior and after the project initiation

Country	Country Population	Coverage by PBCR		Population covered by PBCR (current)
		Before 2016	Current (2019)	
Tanzania	59,000,000	0%*	16%	9,600,000*
Rwanda	12,000,000	0%	13%	1,500,000
Burundi	12,000,000	0%	8%	1,000,000
Kenya	47,600,000	14%	25%	11,800,000
Uganda	42,860,000	8%	16%	6,800,000
Total 5 countries	173,460,000	6%	18%	30,400,000

* No previous population-based cancer registry; ** contribution for coverage by registries set up with funding from Bloomberg (population of 4.3M)

Countries established new or expanded the existing population based registry as seen it in the table above. These registries are continue after the end of the project as the governments owed the registries.

Table 4: Summary of the registries established by the end of the project

Country	New registries	Population covered	Registrations done	Previous PCBR
Burundi	Bujumbura population registry (1)	1M	602 cases	None
Kenya	National Cancer Registry County registries - Embu, Nyeri, Meru and Nakuru PCBR; (5) and Kakamega, Kitui, Bomet – Hospital based registries	Amalgamation of data from existing registries, New county based PCBR and cancer treatment centres – 9.3M	12,272	Nairobi, Eldoret, Kisumu
Rwanda	Kigali Population registry (1)	1.5 Million	14,124	Hospital based
Tanzania	Dar es Salaam Population registry (1)	5.3 Million	7207	Hospital based
Uganda	Mayuge Population registry (1)	2.3 Million	1070	Gulu Kampala
Total			35,275	

iv. *Established core capacities for running of the population-based cancer registries:*

ECSCA-HC in collaboration with the in-country experts (from the existing cancer registries) organized and facilitated basic training on cancer registration in Burundi, Kenya and Uganda. A total of 82 health record officers (cancer registrars) were trained on basic cancer registration; Burundi (20), Kenya (24), Rwanda (24) and Uganda (14). The training comprised of both theoretical and practical sessions on data entry/management using CanReg5 software. Tanzania cancer registrars were trained with the support from another partner. In addition, advanced level training was undertaken on data analysis on cancer registries for use in planning purposes.

The project has provided support to facilitate costs of data collection activities in established registries. The data collection was done from public and private hospitals, hospices and births & deaths registration bureaus. The infographics below depict data collected by the established cancer registries in Burundi and Kigali.

Figure 8: Top ten cancers recorded in Bujumbura cancer registry

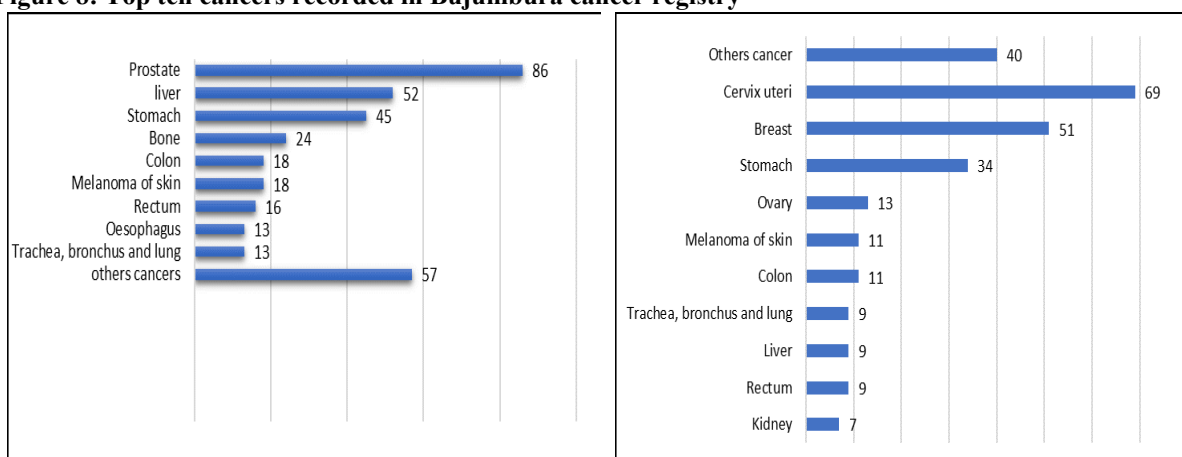
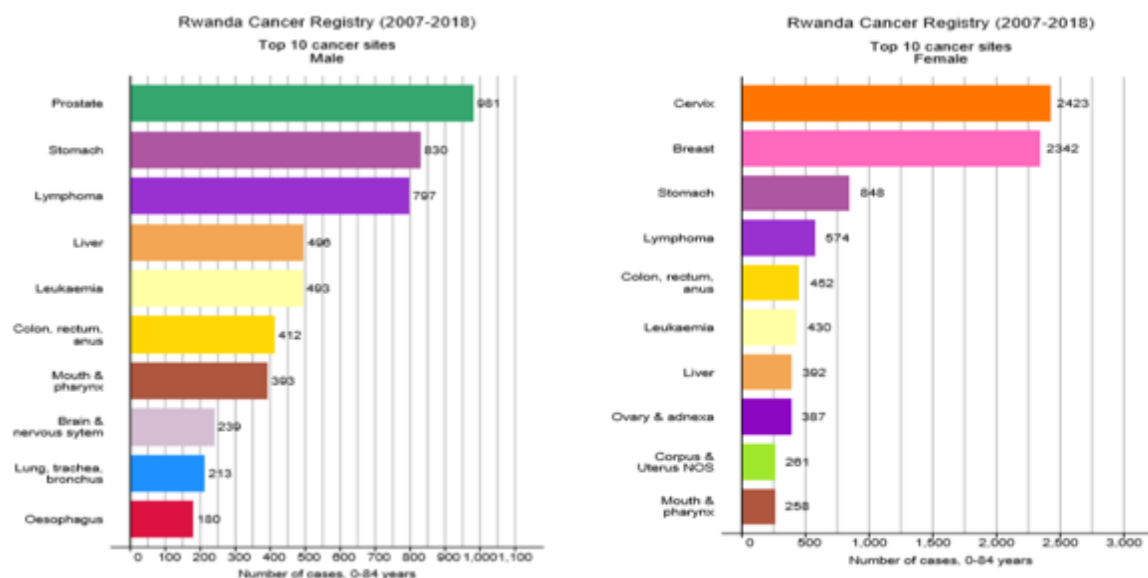


Figure 9: Top ten cancers recorded in the Kigali cancer registry



v. ***Facilitated Knowledge exchange and south to south learning:***

ECSA-HC supported the countries with regional experience sharing workshops and country benchmarking exchanges. They utilized video conferencing to enable countries review the progress jointly, share challenges and offer suggestions to improve the implementation and address the challenges experienced in the data collection process. The south to south learning also incorporated global bodies such as CDC and Africa Cancer Registry Network (AFCRN) in sharing experiences in setting up and operating cancer registries. This information was critical to enable countries with no established population-based registries to support implementing countries.

Lessons Learnt from the Cancer Registry Programme included:

- i. Cancer registration is integrated into all cancer control activities or programs within the countries. However, the coverage for the cancer surveillance that includes ***cancer registration with population-based cancer registries is still low***. The project contributed to expanding the coverage and through advocacy countries have realized the need to support cancer registration.
- ii. Data abstraction is a challenge due to ***poor documentation practices at some health facilities*** such as patient files and laboratory records with incomplete information. This was partially mitigated by onsite training/support and mentorship at the affected health facilities.
- iii. Registries that are not located within the main capital cities (Kenya treatment centres and Mayuge registry) are affected by ***limited cancer diagnostic services*** within catchment area. The registrars needed to compare the data from the capital cities in order to minimize duplicates and clean the data that is eventually logged into the respective registries for the particular population.
- iv. Cancer data quality is not a one-time event but rather a continuous process. The registry-maintained data quality by rigorously reviewing all the information abstracted and verified by the coordinator before they are entered into CANREG.
- v. The cancer registry project provided catalyst financing on establishment of cancer registries in the countries. However, the implementation period was short to have proper outcomes and impact on the ground.
- vi. Governments have not prioritized cancer registry and cancer funding beyond development of policies and guidelines.
- vii. There is limited skilled and experienced human resources with regards to cancer prevention and management i.e. medical and clinical oncologists, pathologists, cancer registry personnel and others.
- viii. There are challenge of cancer screening consumables and medicines supply chain.

2.3 Component 2: Joint Training and Capacity Building

The achievement of this component was **rated as Surpassed in achievements** from project inception. This is remarkable as it addressed a critical gap/weakness in strengthening laboratory systems, disease surveillance, preparedness and responses. Trained laboratory personnel and well-functioning laboratory systems were also important in helping countries comply with international commitments on establishing integrated disease surveillance systems and alerting neighboring countries of disease outbreaks (International Health Regulations).

Within the WHO health systems strengthening building blocks human resources for health plays a vital role in ensuring high quality and efficient health service delivery. The World Bank publication derived from the regional human resources for health for medical laboratory personnel study undertaken in all four East African Countries, highlighted the importance on human resources for laboratory professionals by stating “*since the 2008 Maputo Declaration on Strengthening of Laboratory Systems there has been recognition of the broader importance of laboratory services, and of the role of trained and qualified laboratory personnel in providing high quality, timely, reproducible results. This has*

*created a positive funding environment to reverse the previous decades of neglect of laboratory services and laboratory professionals”.*⁸

Through this project, the HR capacity development TWG was established with Tanzania providing regional leadership on the training and capacity building TWG. Muhimbili University of Health and Allied Services (MUHAS) spearheaded this initiative. The training combined face to face, mentorship type regional exchange programmes (intra districts and inter country) at centres of excellence and virtual training using e-learning platforms. The innovative and cost-effective model of trainer of trainers cascade approach for mainly short term trainings. Long term trainings (masters and doctorate programmes required careful selection, attachments and ensuring practicality of the courses undertaken.

Achievements:

All the five countries had annual training plans embedded within the annual work plans for the entire implementation period. This trainings utilised Ministry of Health training structures on selection of TOT and cascading the training to lower levels. This was done for both short and long-term trainings over the ten years. The number of trained personnel varied across countries, with some having higher training budgets. Overall, the achievement of this component lead to substantial achievements and supported human resources or human capital capacity development which has proven critical in terms of enhancing the performance of the project-supported laboratories and surveillance components. Beyond the technical and clinical inclined trainings, the project managed to focus on cross-cutting health systems training such as monitoring and evaluation, data systems, ICT, laboratory management and emerging technical areas including the current Covid-19 pandemic testing and prevention model.

A key intermediate indicator on this component was health personnel receiving training and this indicator remained unchanged throughout the project period. The project supported training of laboratory, surveillance, medical and other health personnel involved in the participating laboratories. The aggregated results framework from 2010 to 2020 showed that **cumulatively, a total of 19,239 personnel were trained compared to a regional target of 18,086. This is a substantial achievement, and it demonstrated enormous cost-efficiencies and a wide training coverage within budget.**

i. National training

a. Short Term Courses

The project supported numerous short-term trainings at country and regional level with the aim of building laboratory, surveillance and research capacity within the national and satellite health facilities. This was a major achievement for the project with huge success recorded for short term courses and efficiency gains at the regional level. The project utilized the trainers of trainers cascading model and the outcomes were easily measurable. Table 5 below highlights the key thematic areas undertaken by the project while table 6 below provides the numbers trained over ten years in the five countries.

“Overall the project achieved a lot in human resource capacity building, at national level there was good achievement with lab personnel, lab managers, disease surveillance officers, IT and others cadres and the impact could be seen from accreditation of laboratories, capacity building was a key parameter to this labs success. The Trainer of Trainers (TOT) cascading model was a key lesson learnt and should be documented as it is cost effective, efficient but needs close supervision and sensitization to health facility managers ownership on the importance of this and being part of the process and Tanzania shared this success”

Regional Training and Capacity Building TWG Member

⁸ Laboratory Professionals in Africa: The Backbone of Quality Diagnostics, Carter, J, Schneidman, M, 2014

Table 5: Long term courses implemented

Capacity Building Thematic areas covered	
• Tuberculosis and MDR-TB • Laboratory Leadership and Management • Basic and Advanced ICT • Stepwise Laboratory Management Towards Accreditation (SLMTA) • SLIPTA • Performance Based Financing • Project management • Monitoring and Evaluation • Biosafety and Biosecurity • Data management • Antimicrobial Surveillance (AMR) • ISO 15189 and Quality Management Systems • Cancer screening and Diagnosis • Environment and Social Safeguards • Web portal	• Disease Surveillance (IDSR) • Epidemiology • Laboratory Information Management Systems (LIMS) • Equipment maintenance and calibration • New rapid and innovative molecular diagnosis (GeneXpert) • Operational research and research writing • Procurement • Fine needle aspiration • Method validation and internal audits • Laboratory assessors/auditors • Mentorships • Waste management • Covid-19 PCR training • Good Clinical Laboratory Practices

Short term trainings (one months and less) within the participating countries and at the regional level registered huge numbers **with 19,239 personnel (overall 106.4% achieved)**. **Personnel** of different health and non-health cadres received various trainings from 2010 to 2020. Kenya trained total of 2,862 personell(73% achieved of target), Tanzania trained 6,990 (97% achieved), Uganda trained 3,124 (247% achieved), Burundi trained 3,526 personnel (86% achieved) and Rwanda trained 2,727 personnel (168% achieved of planned target). Table 6 below summarizes the trainings undertaken over the years.

While there was no formal evaluation that was undertaken focused on the impact of the training, these trainings ultimately resulted in better quality and efficient services for the beneficiaries, increased and improved performance leading to laboratory accreditation of several of the satellite laboratories, recognition of the importance of laboratory professionals within the Ministries of Health and career progression. However, beyond training there was need to incorporate regulatory and certification aspects especially for laboratory personnel from basic to specialized experts and development of a training database to track impact and follow up.

b. Long Term Courses

Long term capacity building was undertaken across all the countries. Personnel was required to be attached after the training period. Trainings included both masters and doctorate studies in various technical areas identified by the annual training needs assessment to boost high level technical expertise in the various thematic areas. The long-term trainees completed their training and training committees ensured posting to health facilities after completion.

One hundred and two (102) candidates benefited from training support. This included Seven (7) PhDs and seventy-three (73) masters students. Programmes included: epidemiology, microbiology, virology, public health sciences and others. Thematic area specific data is available in table 6 below. Tanzania recorded the highest level of training undertaken in both long term and short-term trainings over the project period.

Table 6: Long term courses implemented

	Course	Rw and	Tanzani a	Kenya	Burund i	Total
1	PhD	1	6	0	0	7
2	FELTP	7	16	8	3	30
3	Masters of Science (MSc.) in Virology, Microbiology & Parasitology, Pathology and Molecular Biotechnology	6	14	3	6	29
4	Master of Medicines (MMed) - Health Sciences		3	1		4
5	MSc. Health Sciences			1		1
6	MSc in Strategic management			1		1
7	Master of Public Health	1	2	1		4
8	Masters in ICT		2			2
9	Bachelor of Science (BSc.) in Laboratory Sciences		14			14
11	MSc in Monitoring and Evaluation		2			2
12	Higher Diploma (Bacteriology and Med. Microbiology)		1	2		3
13	MSc. Health Economics			1		1
TOTAL		15	60	18	9	102

The Field Epidemiology and Laboratory Training Programme was a pioneering flagship masters public health programme for infectious diseases. It was developed by the Center for Disease Control (CDC) in African countries. Africa Field Epidemiology Network (AFENET) provided technical assistance in FELTP's establishment in sub-Saharan Africa. The project trained health personnel with 30 epidemiologists (clinical and laboratory experts) undergoing this programme. The FELTP trainees were useful in leading and coordinating the Covid-19 pandemic emergency response in Burundi, Tanzania and Kenya. They provided critical technical resources for ministries of health at national and satellite health facilities towards public health leadership.

Table 3: Number of Health Personnel Trained

Countries	Cumulative target	Achieved	% achievements
	2010-2020	2010-2020	
Kenya	3909	2862	73%
Uganda	1262	3124	247%
Tanzania	7207	6990	97%
Rwanda	1620	2727	168%%
Burundi*	4088	3526	86%
ECSA-HC		10	
Total Trained	18086	19239	106.4%

Picture 8: Kenyan Training Participants on Equipment Maintenance and Calibration



ii. Development of Customized Training Technical Curriculum and Certification of Laboratory Professionals

The project combined both face to face and virtual learning methodologies to deliver the trainings. One of the best practices shared was development of a customized [e-learning platform](#) (self-learning platform similar to global online learning platforms) with five training modules developed for laboratory staff in the region. This was developed by the training and capacity building regional technical working group and accredited by the Muhimbili University of Allied Sciences (MUHAS). Each country took lead in the five thematic courses. Tanzania developed laboratory management, Uganda developed Bio-risk management, Kenya laboratory-based disease surveillance and research and Rwanda basic ICT management. The e-learning training module demonstrated partnership between the Ministries of Health and academic institutions. About 600 students were enrolled in the courses; Uganda 219, Kenya 145, Tanzania 227, Burundi 6; with 88 have been certified through this online training. Burundian registered but struggled with French to English translation and this was not resolved during the life of the programme.

iii. Analytical study on human resources for health with focus on laboratory professionals

A multi-country operational research was commissioned and undertaken in 2012 on Human Resources for Health (HRH) in relation to medical laboratory professionals in the four countries. It utilised a common regional study protocol. Individual countries hired their own consultants and the project teams provided oversight for the study. The main aim of the study was to raise awareness and improve the understanding of the role that medical laboratory personnel play in health service delivery. The study showcased general similarities and differences across the four countries with all countries having: staff shortages, limitations in capacity and competencies to produce medical laboratory personnel and a general trend to produce higher qualified laboratory professionals with preference for degree qualifications. The private health laboratories sector was growing rapidly with increase in employment and retention of medical laboratory personnel. There was a shift in specialized personnel from public to private laboratories. The study revealed major differences in the training standards, and curricula used by various training institutions within the countries and between the countries. To facilitate mutual

reciprocal recognition of laboratory professionals, it was found necessary to harmonize training curricula for various cadres of medical laboratory professionals.⁹

The project Regional Advisory Panel (RAP) recommended that the ECSA-HC secretariat through this project in collaboration with the EAC Secretariat, facilitate the process of harmonization of training standards for the medical laboratory professionals. The process commenced focused on harmonized standardized curriculum for the various levels of laboratory training from certificate, diploma and degree level. It provided guidelines for licensing and inspection. These recommendations have, however not been fully implemented.

Main outcomes of the training and capacity building Intervention:

- a. The project trained over **19,000 health workers** in short and long-term training over the project life span;
 - i. This has contributed to improved quality of laboratory services i.e. 94% of supported laboratories are at a level of three stars and above from 9% at baseline in 2011
 - ii. Improved knowledge and skills for staff from satellite sites
 - iii. Improved surveillance and response including laboratory confirmation for disease outbreaks
- b. The project developed and implemented several **tailor made training programmes** to build capacities of various health workers (Mentorship, ICT, Biorisk Management, Laboratory management, Molecular diagnostics, Laboratory based disease surveillance Monitoring and Evaluation);
- c. The project developed **five module courses for the e-learning platform** to increase access to training opportunities for laboratory staff across the region. About 600 students have been enrolled in the courses; Uganda 219, Kenya 145, Tanzania 227, Burundi 6 with 88 students received certificates of completion
- d. **The project Upgraded the curriculum** for the laboratory management training now offered at MUHAS at a certificate level
- e. **There is Ongoing harmonization of training standards and curricula** for medical laboratory Professionals in the EAC Region.

The EAPHLN strengthened public health laboratory capacities which led to dramatic improvement in the performance of these laboratories which was a major objective for the project. For the universal diagnostics care, there is need for the region to promote intentional collaboration with private and non-profit laboratories for better integration. This will enhance quality of laboratory services, effective patient management, improved patient turn-around time their geographic and financial accessibility. As a result, there will be improved quality of care received by low income populations in a cost-effective manner. This will form part of a long-term sustainability plan in building better laboratory systems across the region.

2.4 Component 3: Operational Research and Knowledge Sharing

i. Operational Research (Getting Research and Evidence Generation into Policy and Programming)

This component was rated **partially achieved** with mixed results generated. Generally, the conceptual research framework was robust. It however had a with weak implementation, monitoring and supervision framework. This is based on an evaluation of the component and stakeholder interviews. A good number of research studies were undertaken and dissemination conducted at the regional and country level. During the project inception, research was identified as a key component of the regional project. A multi-country protocol was developed by all participating countries with three generic protocols generated and agreed upon by researchers in the five countries. The research program delayed in commencement due to procurement delays on equipment and ethical review challenges.

⁹ Study on Human Resources for Health in relation to Medical Laboratory Personnel Report, 2012 (ECSA-HC)

The project established an operational research regional technical working group. This was led by Kenya under the Kenya Medical Research Institute (KEMRI). Country level research coordination was done by various Government led research institutions i.e. Tanzania; National Institute of Medical Research (NIMR) in Muhimbili Medical Research Centre, Uganda; Makerere University, Burundi – National Institute of Public Health, Research unit and CHUK university; and Rwanda; Rwanda Biomedical Centre (RBC). The research technical working group mainly comprised of experts in research and lacked deep involvement to the disease programme. It also lacked policy makers to assist in strengthening the linkages between research and policy implementation.

Further, the project supported basic training on operational research and a curriculum was jointly developed for satellite laboratory sites in all the countries. To this end, a total of fifty (50) officers were trained across all countries. The project also provided seed grants and mentorship to conduct and disseminate research findings. The first phase predominantly entailed the development and initiation of research studies while the second phase, put an emphasis on publishing and dissemination of research findings.

The EAPHLN regional project generated a significant body of research work; a total of three main multi-country research studies were undertaken in Tuberculosis (TB), Malaria and Enterics. The research was conducted in all countries Burundi which was unable to conduct any of research due to in translation of the research protocols from English to French. Burundi also had weak payment modalities to principal investigators, weak research leadership and weak implementation structures at country level. The research funds were eventually re-directed to disease surveillance, preparedness, and response. In Tanzania, the Enterics study was not undertaken as the funds were re-allocated to respond to the cholera outbreaks in the country.

Picture 9: A Laboratorian undertaken Operational Research on GeneXpert Usage



Table 7: List of Regional Operational Research Studies Implemented

Thematic Area	Title of Research Study Done	Summary of Evidence Generated	Publication and Policy Briefs Done
Tuberculosis	Evaluation of the Impact of New Tuberculosis Diagnostics on Patient Health Outcomes;	a. GeneXpert MTB/RIF is better than Microscopy at detecting TB especially in HIV positive individuals (Tanzania, Uganda, Rwanda and Kenya). b. GeneXpert is more likely than FM microscopy to detect TB in people who are not diseased (Kenya, Rwanda and Tanzania). c. In Tanzania, use of stool from children in GeneXpert produces similar results as using sputum. d. FM microscopy is better than GeneXpert in identifying people who are not infected with TB (Kenya, Rwanda and Tanzania). e. In Kenya, GeneXpert MTB/RIF is more reliable than microscopy irrespective of the facility level. f. In Kenya, LED Fluorescent microscopy is better than GeneXpert MTB/RIF in detecting TB among previously treated patients. g. When used with LED Fluorescent microscopy, GeneXpert MTB/RIF will enhance detection of TB.	a. Exploring User Acceptability on New Laboratory TB Diagnostic Tools in Kenya, EAPHLN Operational Research Project Satellite Study Sites. (Africa Journal of Health Sciences Vol 32, Issue no. 4, 2019) b. Reproducibility of Results and Performance of TB Diagnostics in East Africa Public Health Laboratories Networking Project in Kenya. (Africa Journal of Health Sciences Vol 32, Issue no. 4, 2019)
Malaria	Evaluation of the efficacy of fixed artemisinin-based combinations therapy (ACT) [(artemether-lumefantrine) CoArtem® and (Dihydroartemisinin-piperaquine) Duo-cotexin®] in patients.	a. Both Artemether-Lumefantrine (AL) and Dihydro-Artemisinin piperaquine (DHAP) are still efficacious, Kenya (64% AL ,75% DHAP, Uganda (51.3%AL , DHAP 71.2%), and Tanzania (50% AL),76.5% DHAP) although below the WHO threshold of adequate clinical and parasitological response of 95%. b. In Kenya ,cases of early treatment have been reported and there has been emerging trend of early recurrences during the study period. c. More ever, molecular information from the Ugandan study is showing some evidence of the emergence of resistance markers in circulation of 2.2% (AL) and 1.1 % (DHAP)	

		though this is still below the 5% threshold required for policy change.	
Enterics	Surveillance of common circulating enteric pathogens and their antimicrobial susceptibility patterns;	a. The main cause of bacterial diarrhea was pathogenic <i>E.coli</i> at 18% in Uganda and Kenya, followed by <i>shigella</i> at 8% in Kenya, Salmonella at 3% in Kenya. b. Ampicillin and trimethoprim showed resistance ranging (88-100%) in Uganda and Kenya. c. Emerging resistance to fluoroquinolones (Ciprofloxacin at 25%-35%) in Uganda and Kenya and third generation Cephalosporins (Cefotaxime at 15%) in Kenya was noted.	Resistance of Common Circulating Enteric Bacterial Pathogens to Prescribed Antibiotics Among under Five Years in Selected Public Hospitals in Kenya. (Africa Journal of Health Sciences Vol 32, Issue no. 4, 2019)

From the multi-country regional research studies undertaken, only research studies from Kenya were published in the African Journal of Health Sciences. The project generated policy briefs from the multi-country regional research, these were disseminated regionally but didn't inform any programmatic changes.

“First, there was need to conduct operational research priorities, which is policy relevant to disease programmes for instance examining access, mortality. Generally, there was a disconnect and weak linkages in this component leading to slow adoption. There is need to embrace global research translation practice towards embedding researchers into Ministry programmes. “

“Secondly, Researchers should engage with policy makers in defining the research problems from the onset. At the same time, policy makers should commission research from academics. EAPHLN project shared the evidence to the policy makers shareable formats, using policy briefs and other similar information products to improve intellectual access but this needs to be strengthened further”

Research Technical Experts

ii. Off-Shoot Research Studies

During project initiation phase, project staff from the study sites were trained on how to implement the research, research methodology, scientific writing and use of data collection tools based on the three protocols (TB, Enterics and Malaria). Staff who developed concepts for offshoot studies were additionally mentored in proposal development and implementation and research dissemination. Work on the off-shoot studies at the satellite laboratories was an important achievement in its own right in building capacity from bottom up and providing incentives towards developing individual research talent at participating health facilities while boosting policy- relevant research work.

Table below provides a summary of country offshoot research studies undertaken by the satellite laboratories over the years i.e. Tanzania (12 studies), Kenya (14), Burundi (2) and a complete full list is available in the specific country end term evaluation reports.

A few were published, some not yet published, but were disseminated in conferences and several scientific fora organized by ECSA-HC and countries. Table 8 below presents some of the studies undertaken in the countries.

Table 8: List of Regional Operational Research Studies Implemented

Satellite Laboratory Site	Title of Research Study Done
Kenya	
Busia County Referral Hospital	Occupational risks of Hepatitis B virus, Healthcare workers-(Busia, 2016) – not published
Wajir County Referral Hospital	Knowledge, attitude and practices of Visceral Leishmaniasis among residents and health care workers, Josephine Ihahe (Wajir) – Not published
Machakos County Referral Hospital	Blood Safety practices in Machakos Hospital (this was presented at the Infection Prevention Network (IPNET) Conference in Kenya, 2017 and awarded as the best abstract paper but has not published
Wajir County Referral Hospital	Factors that influence the knowledge, attitude and practice on utilization of TB services at Wajir TB Manyatta by Adow Aden
Kitale County Referral Hospital	Alternative sigma factor B (σ^B) and catalase enzyme contribute to <i>Staphylococcus epidermidis</i> biofilm's tolerance against physico-chemical disinfection (Kitale 2019)

	(Published on https://doi.org/10.1038/s41598-019-41797-8)
Malindi County Referral Hospital	Experience and Lessons Learnt on Health Care Personnel Participating In the Implementation of TB Operational Research at (EAPHLNP -OR) Malindi, Kenya (Published on Africa Journal of Health Sciences Vol 32, Issue no. 4, 2019)
Tanzania	
Kibong'oto Infectious Diseases Hospital	Clinical, radiological and laboratory features: comparative analysis of tuberculosis presumptive attending at Kibong'oto infectious disease hospital
National Institute For Medical Research-Muhimbili Medical Research Centre	Assessment of GeneXpert GxAlert platform for multi-drug resistant tuberculosis diagnosis and patients' linkage to care in Tanzania. Published on BioMedical Central (BMC) (2018) 11:121; https://doi.org/10.1186/s13104-018-3235-7 Assessment of sputum smear-positive but culture-negative results among newly diagnosed pulmonary tuberculosis patients in Tanzania, published by PubMed Central https://pubmed.ncbi.nlm.nih.gov/28744153/
Musoma Regional Referral Hospital	Exploration of factors associated with pre-treatment loss to follow up among tuberculosis suspects and patients in Musoma regional referral hospital In Tanzania
Kilimanjaro & Dar es Salaam health Management teams	A survey of prevalence and factors associated with transmission of tuberculosis among primary and secondary school children in North and Eastern coastal region
National Institute For Medical Research-Tanga Centre	Efficacy of artemether/lumefantrine and dihydroartemisinin/piperaquine and the effects of human gene polymorphism in the drug metabolizing enzymes on treatment outcome among patients with uncomplicated falciparum malaria in Tanzania.
National Institute For Medical Research-Muhimbili Medical Research Centre	Factors associated with low enrolment to treatment among patients with Multi Drug Resistant Tuberculosis in Tanzania
St.Benedict's Ndanda Referral Hospital,	Comparing the yield of front- Loading microscopy examination with conventional sputum microscopy examination for the diagnosis of Tuberculosis at St.Benedict's Ndanda Referral Hospital, 2015
Burundi	
CHUK (University Teaching Hospital of Kamenge)	Prevalence and microbiology of child acute urinary tract infection at university teaching hospital of Kamenge Efficacy and safety of artesunate -amodiaquine for the treatment of uncomplicated <i>Plasmodium falciparum</i> malaria in Kigobe health center, in Bujumbura Nord district in Burundi

“ A key lesson learnt was incorporating off-shoot proposals at Satellite labs, is what I like about this research project, facilities could research on local facility and community issues by developing research questions and generating local solutions from the local research so basically bottom-up research approach works great”

Operational Research Leader

Study disseminations happened in countries and at regional level. Translation of the recommendations from the studies to inform public health policy and practice in the various disease programme areas within the Ministries of health was weak. The findings, learning and evidence generated from the research in practice needed to be more widely disseminated in order to be used as a tool for advocacy to key decision makers in the public health.

iii. ICT Deployment and Innovation in Public Health Laboratories

The ICT component contributed immensely to the project development objectives and establishment of critical laboratory and surveillance data systems in the country. The regional ICT Technical Working Group (TWG) was established to provide support in expanding use of ICT innovations to improve quality of laboratory and surveillance data, provide ICT related capacity building and technical support, facilitate sharing of information and promote e-learning and web-based knowledge sharing across countries. The ICT TWG developed a five year regional ICT implementation from 2015 to 2020 to address the gaps. At the project closure, the TWG developed an sustainability plan to sustain the ICT gains in the countries.

Rwanda initially provided leadership on the ICT technical working group and was instrumental in setting the pace for the ICT investments in the countries. Four key ICT innovations were implemented by the project included: setting up of e-learning platform, IDSR knowledge exchange platform, electronic results framework and regional EAPHLN web portal <https://eaphln-ecsahc.org>. All Countries procured a new Laboratory Information Management System, computer hardware and software equipment and connectivity solutions. They also developed ICT Standard Operating Procedures (SOP's). The project procured quality video conferencing equipment which greatly enhanced communication and networking through regional and in-country video conferences and online trainings platform. ECHO for instance, linked all project sites to discuss Anti-Microbial testing and Surveillance issues. The main goal for this video conferencing investment was to connect all the satellite laboratories in the countries and allowed personnel across sites to consult each other and access information on disease outbreaks timely.

The LIMS was a critical project investment especially to the national public health laboratory network. As a result, there was improvement in sharing, interfacing of laboratory equipment outputs and use of the lab data for generating evidence and planning purposes. The project hired ICT officers within the countries who built capacity for laboratory experts at satellite laboratories in basic ICT, LIMS, data management, ICT networking and management.

The project utilized the power of digital technology as an enabler in dissemination of information with the use of web portal, social media and blogs. The various technical ICT platforms contributed in scaling up innovations and also establishment of data systems. The regional ICT technical working group developed a simple sustainability workplan on the ICT investments under the project focused on maintenance of the four ICT innovations in the countries and regional level.

The impact of deployment of ICT was enhanced capacity for populating the electronic results framework and data analytics and management function. The timeliness and completeness of the reports and improved connectivity with the satellite laboratories, has improved participation and ease of online collaboration. This also reduced the cost of travel and meetings. The challenges in utilization of the ICT resources remains a challenge in aspects related to licensing fees for the LIMS system, internet connectivity fees and limited interoperability with other information systems such as District Health Information System, Supply Chain Information Management systems and IDSR electronic system.

iv. Overall Knowledge Sharing and Translation of Research Evidence into Policy and Practice

This subcomponent was substantially achieved on the knowledge sharing; however translation of evidence to policy making was moderately achieved. More work was required to cascade the lessons learnt to policy level. Knowledge management and sharing was a key component of the project at regional and country level since project inception. It placed a strong emphasis on cross-country

learnings and building communities of practice in public health laboratory development and other shared components across the five participating countries. This learning model where each country showed leadership in specific thematic areas as seen in earlier sections, fostered south-south knowledge exchange with ECSA-HC playing an important convening role. It was strategic as an Inter-Governmental entity to facilitate exchange of information, sharing country experiences and learning at a regional level.

The studies were completed, and three policy briefs were developed to guide implementation of the recommendations of the studies. These included:-

- i. Optimal Use of Available Technologies for Improved TB Detection in the East Africa Community Region.
- ii. Emergence of Resistance to Artemisinin Combination Therapies (ACTs) Threatens Access to Safe and Efficacious Malaria Treatment in East African Community Region.
- iii. Common and Emerging Enteric Bacterial Pathogens Causing Diarrhea and their Anti-Microbial Resistance Patterns in the East African Region

The EAPHLN project utilized both traditional information sharing methods through journal publication, reports, newsletter, bulletins, policy briefs, information/ fact sheet, stakeholder workshops and web-based systems. However, today's world with the advent of technology and increasing complexity in governance and society, additional and innovative ways of dissemination information needed to be sought.

The following were achieved during the project life on knowledge management:

a. Newsletter Bulletins and EAPHLN Videos

The bulletins and video productions were very useful in dissemination of project implementation, project updates and raising awareness on the importance of investing in laboratories and disease surveillance, outbreaks, and response.

The quarterly newsletter bulletin pullouts was first initiated by the Kenya Project team in 2011 by the country editorial team working with leadership at the Ministry, project team, participating departments and satellite laboratories. This was a great avenue for public awareness, technical project update, and policy sharing on the project progress., It was a simple, very powerful creative and innovative advocacy platform useful in drumming up partnerships and raising visibility among the health community on the project and had wide stakeholder readership. Two running bulletin versions were shared, one focused on general project aspects and another one called Lab-Insight focused on laboratory issues. The bulletins eventually cascaded to all the countries with Uganda, Rwanda, Tanzania and Burundi and also at ECSA-HC commencing production. A total of over 20 bulletins were produced and this progressed from hard copies to digital email chimp sharing. Below are infographics on the various country newsletters produced.

In addition, The East African Integrated Disease Surveillance Network (EAIDSNet) Bulletin was produced and provided a platform for the East African region to share epidemiological data as well as other public health information. The EAIDSNet bulletin was a publication of the East African Community through, a regional collaboration of EAC Partner States' ministries responsible for human and animal health, wildlife and national private and public health research and academic institutions. A total of 10 issues of the bulletin were released under the support of the EAPHLNP. It is notable that staff from satellite sites has originated several articles while either FELTP residents or Alumni have written most of the articles.

Figure 10: Newsletter Bulletins produced by the project



Video Production was also produced by the project and shared on YouTube to inform stakeholders on the milestones and investments being undertaken. Some of the video produced are:

- i. https://www.youtube.com/watch?time_continue=11&v=0VE2iZ01UHw (Kenya EAPHLN Video)
- ii. https://www.youtube.com/watch?time_continue=10&v=QFHgQLh39IM (Rwanda EAPHLN Video)
- iii. <https://www.youtube.com/watch?v=FN3iiABXG7I> (Kenya EAPHLN Video)
- iv. <https://www.youtube.com/channel/UCOx1OfJ6nO0jzhza0qxCLhQ> (EAPHLN Video Channel)
- v. Stakeholder forums, regional conferences and Cross-Country Experience Sharing/benchmarking sessions
- vi. Best Practice Forums by ECSA-HC

While, the EAPHLN website and social media platforms have been actively used as channels for dissemination through the programme, EAPHLN is currently working on strengthening the visual documentation of the knowledge that the project generated by producing a documentary film to target various stakeholders. The main objective of the documentary is to create awareness and showcase EAPHLN's work over the past ten years through its interventions.

b. Web Portal

The project developed a web portal with the technical support of the Rwanda ICT team who led the regional ICT TWG of the project. This portal provided a platform for knowledge management, sharing, broadcasting, and forum for discussions among the member states and with international audience. The web portal was developed for hosting project reports, news, updates and events. This website www.eaphln-ecsahc.org. The portal was also used for posting e- learning training courses. The utility rate for the web portal was not assessed and effectiveness in utilizing the web portal by countries for within the countries. The number of references and citations when searching for public health laboratories in East Africa, EAPHLN products were increasingly appearing on google and on recognized global health development websites.

Picture 10: EAPHLN Regional Project Web Portal



c. Social Media and Blogs

The regional project utilized twitter, facebook and web blogs to share information and provided a cost-effective platform and had wide reach to stakeholders.

Examples of the blogs done included:

- Investing in medical laboratory networks: Will Covid-19 (corona virus) be a wakeup call? <https://blogs.worldbank.org/health/investing-medical-laboratory-networks-will-covid-19-coronavirus-be-wake-call>
- Allies in a battle against non-communicable diseases in Kenya - <https://blogs.worldbank.org/health/allies-battle-against-non-communicable-diseases-kenya>
- Laboratory Accreditation – Critical to Quality of Care - <https://blogs.worldbank.org/health/laboratory-accreditation-critical-to-quality-care>
- Cancer: Africa's Silent Killer <https://blogs.worldbank.org/health/cancer-africa-s-silent-killer>

d. Knowledge Translation to Policy and Practice

The translation of operational research evidence generated in the three main multi-country studies and off-shoot satellite laboratory proposals provided an opportunity to repackage the research products for the ultimate benefit of practitioners and policy makers. The key stakeholders included disease programmes i.e. Malaria, Tuberculosis, National Public Health Laboratories, development partners supporting laboratories and surveillance, counties/districts, health facilities and implementers. This component produced three policy briefs produced for the entire ten-year programme. The limited research policy outcomes utilized for policy interventions were: the TB study contributed to the recent adoption of the GeneXpert test as the primary diagnostic tool for TB diagnosis and quality of care for MDR TB patients in Kenya.

The operational research was packaged in three policy briefs listed below with various policy options provided to policy makers. However, there was generally slow adoption at the disease programme level at the Ministry of Health's in the countries. The three published policy briefs were:

- Emergence of resistance to ACTs threatens access to safe and efficacious malaria treatment in East African community region
- Common circulating and emerging enteric bacterial pathogens causing diarrhea and their antimicrobial resistance patterns in the East African Region.
- Optimal use of available technologies for improved TB detection in the East Africa Community region.

The World Bank and Countries added to the knowledge generation by producing Health Nutrition and Population learning and discussion papers to distill and provide a vehicle for publishing results and recommendations on project related component policy research. Below is a list of learning papers produced and published by the World Bank and Participating Countries:

- Opportunities Abound: Public Private Partnerships for Laboratory Services in East Africa, 2015
- Laboratory Professionals in Africa: The Backbone of Quality Diagnostics, 2014
- Performance Evaluation of Public Health Laboratories in Kenya, 2018
- Performance Evaluation of Public Health Laboratories in Rwanda, 2018
- Study on Human Resources for Health Issues in relation to Medical Laboratory Personnel in Kenya, 2012
- Evaluation of the Economic and Health Impacts of Investing in Laboratories in East Africa; Development and Application of Conceptual Framework, 2012
- Building Cross-Country Networks for Laboratory Capacity and Improvement, 2017

In summary, this sub component on evidence translation was low and future projects need to rethink on the best strategy for using research to guide the policy making process. This should involve pronouncement by senior policy makers, documentation and its implementation. Thus, in order to translate research into policy, researchers must first convince disease programme stakeholders on the need and importance of scientific evidence in decision making and present in easy to understand format such as policy briefs and if considered may lead to policy drafting and consensus building.

Across the board, it is clear that EAPHLN project needs to take its research which has been adopted into practice, to a level higher to be constitute evidence which ultimately influences policy in the laboratories and surveillance fields. The findings, learnings and evidence gathered from the research in practice needed to be more widely disseminated in order for it to be used as a tool for advocacy by key decision makers in both public and private sector.

Future Recommendations on Operational Research

- a. The multi-country studies were not effective and generally yielded low results and weak policy implementation. There is need for more effective ways on conducting national operational research studies in health projects from conceptual design, implementation, dissemination and knowledge translation. Partnerships beyond Government led research institutions to working with private sector institutions, academia and translation think tanks should be explored and possibly launching a separate research or evidence fund managed separately, but linked to routine implementation would work better.
- b. There is a need to improve research timelines (near-real time) processes to meet the demands of the policy makers in their expected times in order not be surpassed by policy making.
- c. There is need to develop a culture of evidence informed policy making. Researchers and policy makers need to partner and work together from research initiation to completion. There should be continuous engagement in defining research problems that are policy-relevant from the onset. There should be follow through for participation in technical guidelines development. The imbedding of researchers in disease programmes is a best practice that should be advocated in future programmes to enhance the operational research capacity. An example is conducting TB and Malaria prevalence surveys where researchers work hand in hand with policy managers

throughout the surveys leading to stronger translation of research outcomes to policy and strategy documents.

- d. Incorporation of Off-Shoot health facility research opportunities has been game-changing and cost-effective model, and this can be done systematically and scalable by launching research innovation calls where public, academia and possibly private sector collaborate.
- e. A more focused and well thought out pathways for better translation of research outcomes to policy relevant thematic areas is required, for instance by using advocacy groups. Knowledge brokers, intermediaries to enhance this process. There is need to build capacity at all levels on repackaging research products and linking this to policy and strategy development process and even having research-policy
- f. There is need to combine research and innovation to ensure scientists and innovators collaborate to solve the biggest challenges and offer local solutions. This is important toward product development and testing within the sites. The Covid-19 pandemic has shown this importance with local innovators producing personal preventive equipment like face masks, visors, ventilators, Covid-19 test kits, contact tracing digital applications and others.
- g. There is need to introduce and strengthen policy engagement and communication within the laboratory and surveillance as researchers and implementers play an essential role as contributors of data and evidence and having an impact on evidence-based decision making.

3.0 Assessment of Project Partnerships Established

Partnerships were instrumental at the regional level and contributed immensely to success of the three project components. At inception stage, the World Bank partnered with US-CDC, WHO and the International Union Against TB and Lung Disease (IUATLD) expert panels to design and develop the regional EAPHLN project. At country level, Ministries of Health worked with their health research institutions such as KEMRI in Kenya, NIMR in Tanzania to implement the operational research. The FELTP training which was initially set up by US-CDC and AFENET was utilized by the countries project funds to train over 30 masters graduates in the five countries.

The East, Central and Southern Africa Health Community (ECSA-HC), in collaboration with the East African Community (EAC), facilitated knowledge exchanges, promoted harmonized approaches, mobilized partners, and provided recommendations to policymakers. ECSA-HC implemented the Global Fund laboratory initiative and partnered with the Uganda Supranational Regional Laboratory (SRL) to provide technical support to other national TB reference laboratories in the region. These illustrated how the Bank operation has played a catalytic role in fostering additional partnerships.

Another key partner was Africa Society for Laboratory Medicine (ASLM), who partnered with ECSA-HC and countries to implement regional SLIPTA training and audits and participated in certification of the laboratories in the regional project. Likewise, the EAC received financial support from the German development bank (KfW) to provide complementary support to the national reference public health laboratories in the five EAC member states and to support one of them as a centre of excellence for communicable diseases. The project partnered with academic institutions such as MUHAS in Tanzania and AMREF Health Africa to develop regional training short course modules on laboratory management, laboratory disease surveillance and accreditation.

Within the World Bank, the lessons learnt from the EAPHLN project were replicated in another World Bank project in Southern Africa i.e. the Southern Africa TB and Health Systems Support (SATBHSS) Project and continued the partnership with ECSA-HC as the regional coordination entity working with AUDA, however at country level, there was limited interworking relationships and partnerships between the county based IDA health projects. This would have been encouraged to improve cross-learning with the various Bank projects. The pitfall in the partnerships was limited involvement with private sector beyond being suppliers of laboratory health products and consultancies to countries. No Public Private Partnership was implemented despite the regional study to understand the opportunities in the PPP in laboratories space.

4.0 Assessment of Efficiency During Project Implementation

The initial project appraisal document included an economic and financial analysis and no potential economic rate of return or return on investment analysis was done. However, an economic evaluation undertaken by ICF Macro¹⁰ and financed by the World Bank explored the investment of laboratories. This ICR did not assess broadly the technical (i.e. determining the right combination of least expensive inputs to achieve desired input) and allocative efficiencies (i.e. choosing between allocation alternatives to achieve best benefit for society) and implementation efficiency implication of key components.

From the three components, examples of efficiency gains included the following:

- i. Regional roll out of trainer of trainer's cascade model from regional to satellite laboratory level.
- ii. The multi-country operational research used a regional protocol and similar methodology across all the countries. This saved time and costs in having individual country protocols.
- iii. The SLIPTA peer audit assessment undertaken at the country level with oversight ECSA-HC and ASLM provided efficiency and cost gains.
- iv. The GeneXpert procured and other multi-plex PCR platforms provided technical and financial efficiencies in conducting multiple disease diagnosis to rapidly detect a wide range of viral and bacterial pathogens using the same equipment. In addition, the laboratory costs relating to service maintenance and consumables for this instrument can be apportioned across programs.
- v. Regional studies conducted by ECSA-HC on behalf of the countries like the HRH, PPP, Data Quality assessment and other monitoring and evaluation functions provided economies of scale and efficiency gains including the use of ECSA-HC as an inter-Government agency to coordinate the various regional activities instead of each individual country undertaking this.

5.0 Sustainability

Development partners should build more government, non-Governmental, private and other partners ownership. This should be designed into decision-making during implementation, especially that sustainability in many cases will depend heavily on these stakeholder groups after donor funding ends. Sustainability is closely linked to predictability of funds that allows governments to plan for when development partners' support comes to an end or changes focus. The idea is usually founded on government or other partners taking over responsibility for funding or indeed the programme beneficiaries achieving a state of financial and technical autonomy to enable sustainable continuity. The World Bank model of grant and loan financing is imbedding the budget within National treasuries and this is key not to create fiscal dependency and utilizing Government systems for implementation focused on developing institutional mechanisms and supporting management.

The ICR stakeholders' discussions highlighted sustainability as a core tenet towards ensuring maintenance of the gains and scaling up of interventions. Despite no written sustainability planning document, there has been preliminary discussions held with the Ministries of Health and Finance leadership towards sustainability of the EAPHLN investments. The EAPHLN strategic interventions build in sustainability in their design. Of note, continuation of activities under the project in three countries, has been included with new World Bank health systems and Covid-19 projects. The inclusion happened in Kenya under Kenya Covid-19 Emergency Response Project, Uganda under the Uganda Covid-19 Response and Emergency Preparedness Project & Uganda Reproductive Maternal and Child Health Services Improvement project and Burundi under the KIRA – Health Systems Support Project. The National Public Health Laboratory And surveillance strategic plans have incorporated learnings and interventions from the EAPHLN project and this will ensure sustainability through Government or partner support, however this can only be proved beyond project closure.

¹⁰ Evaluation the Economic and Health Impact of Investing in Laboratories in East Africa: Development and Application of a Conceptual Framework, ICF Macro/World Bank, 2011

On **Institutional sustainability**, the project at **Country level**, made significant sustainability milestones towards investment in laboratories. This was from a health infrastructure, human capital, laboratory equipment and timely response to outbreaks lens. Under **Human Resources for Laboratories**, The project benefited from recruitment of specialized laboratory scientists and technologists under the project. This were eventually absorbed by the participating Ministries of Health. The recruited staff built laboratories' capacity to conduct more tests, resulted in reduced waiting time for laboratory results, reduced testing backlogs, resulted to higher customer satisfaction and improved EQA and sound program management.

Under operational research component, based on the successes of the offshoot proposals , the satellite laboratory staff have capacity to undertake research to solve their local problems beyond the project life. In some cases like Tanzania, highlighted NIMR jointly partnered with the districts to develop joint grant applications as a sustainability strategy. Additionally, most of the laboratories are now accredited and have institutionalized Quality Management Systems within their laboratory departments in the hospitals. Capacity developed under this initiative will live to support the country's laboratory equipment maintenance challenges that existed for a very long time in the region.

Kenya's Laboratory Equipment Sustainability Best Practice:

"Modern equipment previously not available in Government institutions were procured for the sites. To ensure minimum downtime, the project supported training on equipment maintenance and calibration where medical engineers from all the sites participated. Each site was supplied with maintenance and calibration kits that will ensure equipment are maintained and serviced throughout internally to avoid interruptions of service delivery. Further, the project supported establishment of a Centre of Excellence on Training and equipment maintenance and calibration at the National Public Health Laboratory and equipping the maintenance center. The COE for equipment Certification and Training is ISO 17025 accredited"

At the regional level, ECSA-HC sustainability is assured using EAPHLN project learnings now replicated with the World Bank SATBHSSP. In addition, the Global Fund is another funding source for the regional TB laboratory programme which now expanded to more countries. ECSA-HC had signed agreements with Africa CDC and EAC on future collaborative efforts. Beyond ECSA-HC, the regional entity has planned to continue supporting the East Africa countries through various internal projects and working with EAC in future initiatives however this is yet to be concretized.

Role of Communities of Practice/Technical Working Groups was a best practice in, each country provided regional leadership with a comparative advantage under **five regional technical working groups focused on laboratory networking and accreditation (Uganda), IDSR and Operational Research (Kenya), ICT (Rwanda), PBF (Burundi) and Training and Capacity Building (Tanzania)**. This working groups were maintained throughout the project and served as great model on networking, cross-fertilization of experiences and lessons sharing, technical expertise and access to information support and awareness and visibility within the Government leadership. Participating countries had a shared vision to innovate, learn, and build upon existing strengths in different technical areas. This was replicated within countries with national working groups established although some were inactive due to funding constraints. Countries can, as part of sustainability plan, continue building on these TWG efforts to continue networking and support one another especially now with Covid-19 pandemic. The communities of practice established provide an effective platform for sharing information about the EAPHLN design, implementation and learning. The regional TWG knowledge gained can enhance policy and program design in their own countries and this model has been replicated and strengthened further through institutionalization within the Southern Africa Regional TB and Health System Project financed by the World Bank and other initiatives.

Financial sustainability is a perennial challenge in the health sector and this was evident from acquiring domestic financing to support post project interventions though commitments have been made. Activities bound to suffer after project exit include: procurement of laboratory consumables for the equipment purchased by the project, medical equipment maintenance (though in Kenya a centre of excellence in maintenance and calibration), cross-border meetings and joint investigations, and laboratory networking among the over 35 laboratories built over the years. The example of the performance/results based financing programme was very resourceful in the countries using the SLIPTA check list. This accelerated them towards accreditation and incentivized the staff and facilities despite focusing more on laboratories. However this could not be sustained as was wholly dependent on World Bank financing. On a positive note, countries like Rwanda and Burundi are imbedded PBF/RBF and integrated it in the Ministry of Health PBF scheme.

Generally, inadequate earmarked budgets for laboratories and surveillance activities at national or district level were noted. The upside of this is countries like Uganda had elevated the National Public Health laboratory to semi-autonomous agency with a commissioner appointed. This meant that they are able to receive funds from the treasury. For other countries, this has been a steep learning curve for instance in Kenya, devolution has seen satellite laboratories exit from the NPHLS. They are managed by counties which has its own advantages and disadvantages. Partnership with private sector through innovative public private partnerships could act as a source of revenue as the satellite laboratories which have state of the art laboratory equipment, incinerators and highly trained personnel. Exploring Memorandum of Understanding on a revenue generating model would be a self-sustainable strategy, however this requires in-house and external support of PPP and business modelling experts to work with Government to conceptualize these instruments.

In summary, sustainability of the prime investments done by the project will evolve and definitely benefit the community especially, capacity building of laboratory personnel. They are an asset for the continued implementation of the quality process including the buildings and equipment acquired. The joint networking amongst countries, medical staff and expertise boosted the team spirit and morale and will remain in place for many years to come.

6.0 Challenges under Project Implementation/ What Did Not Work Well

Component 1: Regional Diagnostics and Surveillance Capacity Challenges:

- a. There were complexities of construction of public health laboratories which saw significant delays in some countries. However, at project completion all the laboratories and isolation buildings were completed in all the countries.
- b. In addition, the new equipment procured required consistent supply of reagents and the laboratory supply chains were inadequate and need to be strengthened. This was in terms of proper forecasting and quantification, procurement demand and supply planning, inventory management and LIMS systems not integrated with the logistics management information systems. The project didn't focus on improvement of laboratory supply chains and this required careful stewardship of equipment placement and supply and beyond GeneXpert, there were many different equipment procured and this has led to large varieties of reagents and manufacturers and complicated procurement, development of specifications and the establishment of service and maintenance contracts.
- c. Environmental and social safeguards implementation was challenging across most countries including waste management leading to delays in project approvals.
- d. Country Governments are not adequately resourced for disease surveillance and preparedness. These activities are dependent on partner financing at national and lower level. This has led to limited funding for cross-border surveillance and joint investigation activities. Beyond the supply-side surveillance interventions, there was non-existent community-based disease surveillance efforts and engagement of communities. This is critical for active surveillance compared to passive surveillance and assist with community adherence to preventive measures.

- e. Regional projects are complex and require both technical and political leadership especially the disease surveillance components, cross-border surveillance interventions and sharing of information amongst countries was a challenge.

Component 2: Joint Training and Capacity Building

- a. Staff Turnover: There was attrition of healthcare workers who had being trained by the project at satellite laboratories especially for the short-term trainings. However, for the long term courses training bonds were signed by the Ministries.
- b. Long term courses including Masters and Doctorate courses were expensive compared to short term courses.
- c. The project minimally involved private sector laboratories except in Tanzania had St. Benedict's Ndanda Referral Hospital and in Uganda, Lacor hospital in Gulu. This was due to the public health focus of the project. Private clinical laboratories including faith based organizations are increasingly playing an important role in delivery of health services in the East African region especially in larger and urban areas and should be included in future capacity building and networking efforts as Covid-19 has demonstrated.

Component 3: Operational Research, Knowledge Sharing and Program Management

- i. The operational studies undertaken were not aligned and linked to disease specific programme priorities and this resulted to slow adoption of the policy relevant recommendations, this is reflected in the prevailing challenges of knowledge translation.
- ii. Delay in commencement of the multi-country operational research studies and implementation happened took long. It was therefore surpassed by policy implementation within the TB, Malaria and Enteric programmes. This was partially attributed to partnership with bureaucratic Government research institutions in some scenarios and in other cases weak leadership from the Ministry of Health on research need and importance. In addition, delays experienced in seeking ethical approvals for instance in Uganda, Kenya and generally delayed overall guidance in execution of the studies.
- iii. The regional operational research technical working group had limitations in monitoring and evaluation and overall supervision at the regional and country level in some countries and this led to delay in implementation and sometimes poor quality results generated.
- iv. Initially there were challenges in programme management in some countries due to leadership changes with project coordination, finance and procurement roles. There was a general lack of familiarity on World Bank procedures, however this stabilized over time with additional capacity built.
- v. Weak advocacy in some countries on the role of operational research in informing health programming. The research training provided an impetus and incentive but more needs to be done ensure full commitment to the entire research process especially at the health facilities leadership. An example is Burundi that never implemented the regional research studies and had very limited off-shoot proposals due to weak incentives for the principal investigator and generally weak knowledge by policy makers on the important on research.

7.0 ECSA-HC Performance, Compliance Issues, And Risk to Development Outcome

a) *Quality of Monitoring and Evaluation (M&E)*

M&E Design

The M&E focused on accountability for results and also provides a learning function facilitating collation, analysis and interpretation of data from the project countries and therefore serving as a gateway to information, knowledge management & exchange among the participating countries. In order to improve the quality of data and reduce reporting delays, the project converted the excel based reporting to an online reporting system that is accessible by the satellite facilities that upload data directly into the portal. The project M&E project development objective indicators inclined more on output and processes based and no impact indicators were captured within the results framework however despite this, being a complex regional project focused mainly on diagnostics and surveillance systems there was relatively good selection of indicators.

The original design of the results framework and M&E arrangement were generally reflective of the project design i.e. 6 project outcome indicators (POI) included measures for quality, utilization, coverage and system performance mainly on TB, diagnostics and surveillance of communicable diseases and Twelve (12) intermediate outcome indicators (IOI) were identified and mainly tracking the three project components in which the countries were accountable and report against to the regional level under ECSA-HC coordination structures. The baselines and targets were included from most of the indicators however from some this lacked and were generated during initial project implementation. To monitor progress and assess outcomes, the regional project had in place a comprehensive results framework with a routine monitoring system complemented with M&E capacity building and data quality assessments done at national and sampled health facilities.

Over the ten-year period their minimal changes to both the project outcome and intermediate indicators for the two project phases. During the mid-term review in 2014, it was noted the annual targets for four out of six POI indicators have already been achieved and for the intermediate outcome indicators, 7 out of 11 were achieved and a recommendation was made on revision of on target values upwards for certain indicators but this minimally changed the description of the indicators over the project period. In addition, the definition of some indicators slightly changed as follows and this was reflected in the project appraisal document for the additional financing phase 2015-2020.

Original Indicator (Phase 1)	Modified/Additional Indicators (Post MTR and Phase 2)
POI# 1. Average turn-around time for TB liquid culture tests (days)	POI# 1. Average turn-around time for TB GeneXpert test (hrs)
POI#6. Outbreaks for which cross border investigation under taken (number)	POI# 6. Proportion of outbreaks in cross border areas that joint investigations were done (both in country joint investigations and inter-country joint investigations)
IOI# 5. Health facilities constructed, renovated, and/or equipped (number).	IOI#5. Number of: (a) Health facilities constructed (b) Health facilities renovated (c) Health facilities equipped

IOI#10. Operational Research studies approved by the peer review panel completed (Percent).	IOI#9. Operational Research studies. a. Developed and approved by a recognized IRB b. Completed with results disseminated c. Offshoot proposals developed for short term operational studies.
	IOI#10. Number of GeneXpert tests performed per quarter.
	IOI#11. Number of laboratory tests performed per quarter.
	IOI#12. Laboratory Clients Satisfaction Rate.

b) M&E Implementation

The project emphasised on evidence and results and accuracy in the collection, recording, analysis and reporting of accurate and reliable data to inform the decision-making process in crucial. During implementation, the project indicators were closely monitored at country level and regional consolidation and verification was done. The implementation support mission aide memoires monitored progress of the results framework in addition to adhoc data quality assessments undertaken by countries and coordinated by ECSA-HC. Each country had an M&E specialist/focal person (either hired or seconded from the MOH programmes) leading coordination of the results framework and evaluation components of the project and at the regional level a seasoned M&E specialist was instrumental in ensuring consistent regional data reporting system, data quality assurance and evaluations was maintained throughout the project life and this worked well supported by an adhoc regional M&E experts group comprised of . The data was verified through periodic follow up to the countries' M&E specialists virtually or through regular supervision visits by the project implementation team at country and regional level.

Routine monitoring was done at country level using existing information management systems and additional customized project reporting template. An Electronic reporting framework was developed at regional level through an online web-based database: <http://eaphlnmne.ecsahc.org/> and the results framework was designed to build on existing Ministry of Health systems and incorporate lessons from project implementation, in addition a web portal provided additional project results including annual reports, publications, policy briefs and social media postings.

“There has been dramatic increase in data management capabilities, computer literacy and data analytics capacity for laboratory professionals as this was a major gap before the project where mainly manual data processing was done. The IDSR exchange platform/EAIDSNET, e-results framework reporting and web portal were important innovations in ensuring a strong binding foundation and implementation of the M&E system , However the e-learning systems was not cascaded well and had challenges” Overall the ICT Component played a vital role in establishment of a reliable and efficient data systems”

ICT EAPHLN Expert

A management system for populating the results framework gradually shifting from manual to digital health systems. The Laboratory Information Management System (LIMS) played an important role in data management and results reporting which the project installed in most of the satellite laboratories across the five countries and beyond the results framework the data was utilized for planning purposes at national and satellite laboratory level. The IDSR platform (EAIDNet) was also

utilized wasn't integrated with other systems such as LIMS and District Health Information System (DHIS).

c) M&E Utilization

The countries and the regional bodies (ECSA-HC & EAC), collected, synthesized and analysed data from the satellite sites, national and regional levels to contribute to the larger body of knowledge on best practices and lessons learned related to the design and implementation of innovations in improving diagnostics and surveillance capacities to control communicable disease in the region.

The country teams reported the usefulness of the results framework towards keeping track on progress of key project milestones and encourage accountability in project management. The data generated from the project was useful in providing evolving information and data to enable the various stakeholders monitor functionality and effectiveness of the project. Dissemination of the M&E outputs were shared in project steering meetings at regional and national level and from this reviews this facilitated course correction on activity implementation, knowledge management and important provided good metrics on surveillance and laboratory systems management, which before the project there a dearth of access on health laboratory services, quality, accreditation and other aspects.

In summary the solid design and implementation of the M&E systems including the DQA's and few evaluations done have been useful to provide critical lessons for Ministries of Health and at regional level informed development of new regional initiatives such as the Southern Africa TB and Health Systems Support Project (SATBHSSP) and the Africa CDC initiative in building more efficient and effective surveillance and laboratory systems.

The project generated operations research with policy briefs generated however there was general weakness or non-existent evidence towards ensuring the research findings are utilized for policy making and contribution to changes in guidelines and this would be a recommendation for future projects to address this gap by the project.

d) Performance Evaluation and Data Quality Assessments

The project supported performance evaluations of public health laboratories done in Rwanda and Kenya which were critical to document progress and lessons learned and suggest improvements for way forward on best ways to strengthen laboratory and diagnostic capacity. In Kenya the evaluation depicted a positive trend in the volume of GeneXpert tests and improved the turnaround times (TAT) for diagnosis of TB and microbiology tests, however mixed results for other test volumes. There was a strong overall improvement in the quality scores on the Stepwise Laboratory Improvement Process Towards Accreditation (SLIPTA) at all laboratories between 2011 to 2016 as depicted in table 4. In addition, the project has led to strengthen relationships and trust between the clinicians and laboratorians as a result of new equipment, joint trainings resulted in confidence in the laboratory results. Sustainability shortcomings were raised by the stakeholders in the Kenyan evaluation and key bottlenecks that were viewed as a threat to continuity and the maintenance of the gains attained were related to: (i) lack of a regular supply of reagents; (ii) lack of equipment service contracts; (iii) delays in the delivery and installation of equipment and; (iv) concerns over Staffing and devolution of health services.¹¹

¹¹ Lehmann, Joel, Muture, Bernard, Matu, Martin, Schneidman, Miriam, 2018 Performance Evaluation of Public Health Laboratories in Kenya; Main Results and Future Opportunities, Health, Nutrition, and Population (HNP) discussion paper. Washington, D.C.: World Bank Group.

Table 9: SLIPTA Stars Achieved in EAPHLN Peer Assessments

Laboratory	2011	2012	2013	2014	2016	Overall Trend
Busia	0 (36)	2 (70)	4 (89)	1 (61)	3 (77)	↗
CML	0 (49)	3 (77)		4 (85)	5 (96)	↗
Wajir	0 (13)	2 (63)	3 (75)	3 (77)	3 (77)	↗
Machakos	0 (45)	0 (44)	2 (69)	4 (88)	4 (85)	↗
NTRL	1 (55)	3 (76)	4 (85)	3 (78)	3 (77)	↗
Kitale	1 (56)	2 (70)	3 (79)	3 (81)	3 (75)	↗
Malindi	0 (28)	2 (67)	3 (76)		2 (68)	↗

The Rwanda evaluation conducted in 2015 focused on the country's experience with Performance Based Financing (PBF) tied to progress of the Stepwise Laboratory Improvement Process Towards Accreditation (SLIPTA) scores and assessed overall performance of the project supported laboratories. The evaluation generated a range of insights and lessons; observed that PBF mechanisms have a positive effect on performance for measured indicators, and that the relationship of laboratory workers with clinical Staff improved as confidence in laboratory results increased over time.¹²

The World Bank conducted a study on development of a conceptual framework for understanding the impact on investment in a network of public health laboratories on economic and health outcomes.

8.0 Environmental, Social, And Fiduciary Compliance

a) Environmental Compliance

Environmental compliance was moderate with numerous challenges in some of the countries due to the requirements as constructions or renovations of the laboratories or isolation facilities were needed. The regional project triggered OP 4.01 due to the planned construction/rehabilitation of laboratories as well as the generation of medical waste at laboratories and has been assigned the environmental category B. To ensure proper assessment and mitigation of potential adverse environmental and social impacts an Environmental and Social Management Framework (ESMF) for laboratories was elaborated. All countries developed their Health Care Waste Management Plans. The Waste Management Plans focus on existing laboratory waste generation as well as segregation, storage, collection, transport, and final disposal practices; technologies for waste disposal; public awareness programs; and relevant national legislation.

The environmental health and medical waste management plan (EMWMP) developed by the countries provided assistance in reducing the risk of infection, safety and health hazards, and guided principals for a safe and hygienic laboratory and isolation infrastructure. The EMWMP also outlined arrangements for the internal and external monitoring, capacity building needs, and budgetary arrangements for implementation. All the annual workplans included for each satellite laboratory a waste management work plan which was implemented by the public health officers however generally this component was neglected with minimal resources allocated for implementation across all the countries.

All the constructions by the laboratories in the countries prior to initiation, an Environmental and Social Impact Assessment (ESIA) was undertaken and approved by the World Bank Country Environmental Management Authority and after construction or renovation of the laboratories, an environmental and

¹² Kumar, Meghan; Lehmann, Joel Thomas; Rucogoza, Aniceth; Kayobotsi, Claver; Das, Ashis Kumar; Schneiderman, Miriam. 2016. East Africa - Public health laboratory networking project: evaluation of performance-based financing for public health laboratories in Rwanda. Health, Nutrition, and Population (HNP) discussion paper. Washington, D.C.: World Bank Group.

social audit (ESA) was conducted to ensure due diligence in the application of safeguards were followed during construction and to plan for mitigating and/or addressing any potential adverse risks during the operational phase. All countries were advised and expected to undertake a project closure Environmental, Social, Health and Safety Audit during preparation of the country implementation completion and results report (ICR's) however this was not done at the time of completion of this report.

The reports were approved by the World Bank and Environmental Management Agency and were disclosed in-country at the Ministries of Health. Most countries hired consultancy firms to undertake this before the construction and in some countries, there was huge delays in conducting and approval of this assessments by the World Bank and heavily delayed constructions.

Countries designated an ESMF officer within the Ministry's infrastructure or public health department to oversee this component during the constructions and the World Bank environmental and social country experts provided oversight to ensure compliance during the project period.

b) Waste Management

The project jointly developed a regional checklist for assessing compliance to waste management. The checklist was developed in collaboration with the World Bank, ECSA-HC and countries in 2015. The checklist focused on overall health facility waste management from collection, storage before treatment (waste holding and storage), treatment and disposal. Information from the audits assisted identify gaps in waste management practices and help determine how to improve them. Country Assessment were undertaken annually during the SLIPTA regional peer assessment. In order to guarantee safe disposal of the laboratory waste, the regional project also support construction and purchase of incinerator within the health facilities and this was utilized by all the departments within the hospitals beyond the laboratory. Within the results framework, an indicator tracking the compliance of biomedical waste management was captured and was an important indicator of laboratory safety and most countries laboratories at national and health facility level and the overall regional compliance was (Uganda 1 (12.5%), Kenya-4 (57.1%), Burundi-0 and Tanzania-0).



Muyinga District Hospital Incinerator, Burundi



Marsabit Hospital incinerator, Kenya

c) Social Safeguards

During appraisal, the delegations from the participating countries confirmed that proposed construction and renovations will be done on land owned by the respective governments and that there will be no involuntary displacement of any individuals since there are no squatters or other vendors at these sites. In cases involving construction, such as a new health laboratory or an annex to existing structures, the ESMF contains appropriate checklists and diagnostic procedures to assess risks and identify appropriate mitigation measures. Social safeguards were not triggered for the other countries, however for Kenya, OP 4.10 was triggered in Kenya especially in Kitale and Malindi laboratories since they existed indigenous communities and a separate Indigenous Peoples Policy Framework (IPPF) was prepared and disclosed to ensure that the development process of this project fully respects the dignity, rights, economies, and cultures of vulnerable indigenous communities and that the project is able to gain the broad community support of affected indigenous peoples and other marginalized groups.

In addition Kenya conducted an Vulnerable and Marginalized Peoples Planning Framework (VMPPF) with support of an external consultant for this project and two other World Bank health projects and the plan addressed issues related to gaps in health promotion/outreach activities for laboratory services, gaps in interventions addressing access, equity and utilization of laboratory services and capacity building of laboratory staff and vulnerable and marginalised peoples in Kenya. This plan was not implemented beyond the plans development in Kenya but generally the project activities included several aspects indirectly.

A Grievance Redress Mechanisms (GRM) was established within the health facilities to guide complaints management within the sites. Sensitizations and trainings were done, however towards developing a systematic and accessible grievance resolution mechanism, evidence of systematic grievance logging and resolution was not present in some countries. The Geo-Enabling initiative for Monitoring and Supervision (GEMS) and GIS monitoring tools was minimally utilized in countries, however complete information was not available to make use of this tool for this ICR report.

Client satisfaction surveys were implemented by the project utilizing a harmonized tool developed jointly by ECSA-HC and all satellite laboratories implemented this on annual basis and as part of requirement of SLIPTA process and acquiring laboratory accreditation, scored highly in ensuring customer satisfaction after the laboratories were functional and this is depicted in the results framework intermediate indicator outputs.

d) Fiduciary Compliance

i. Governance

The Paris declaration (OECD/DAC 2009), encourages donors to avoid dedicated structures for day to day management and implementation of aid-financed projects and programmes so as not to undermine national capacity building efforts and accountability systems and generally the countries worked with existing governance structures within the Ministries of Health and in some countries like Kenya and Uganda established project implementing units hosted within the specific implementing departments within the Ministries. The Project Implementation Units (PIU's) under leadership of department heads showed positive impact on project performance and maximized on existing technical staff expertise and in some cases specialized technical experts in areas of microbiology, virology, molecular scientists, construction management were hired to complement the existing capacity. Project oversight at country level was provided by MOH leadership especially the Permanent Secretaries and also economies of scale were possible for shared functions such Accounting, human resource management, planning, budgeting, supply chain operations under medical supplies agencies, compliance, and monitoring. With harmonized salaries and integrated functions, key staff including all heads of the proposed units will be MOH and not project and hence remain even after the project closes.

The governance implementation performance and capacity varied across from the Mid-term review done in 2014 but were generally adequate. This fairly worked well with project steering committees at national and regional levels for country oversight with regular meetings held and course corrections undertaken over the project implementation period.

ii. Financial Management (FM)

The project FM arrangements were adequate, and the implementing ministry had dedicated qualified project accountants with minimal outstanding audit issues. The quarterly IFR and annual audit report were submitted within the stipulated timeline majorly satisfactory to the World Bank. Financial management supervision was undertaken by the World Bank. All participating countries and ECSA-HC developed annual approved work plans for the ten years of the project and this process was successful done with procurement and budget plans incorporated in the Government financial year cycle and integrated in Government budget process and disbursement done as per the World Bank financial management standards. Capacity building was undertaken for finance and project coordinators on good financial management and ensuring proper internal controls and audit functions. The three key documents for implementation for monitoring performance and combining with the results framework was the annual work plan, procurement plan and budget spending.

At regional level, ECSA-HC was competitively selected by the World Bank and countries disbursed to ECSA-HC a total of USD 125,000 every financial year for the ten years of project implementation with subsidiary agreements signed off by each country and this ensured accountability on ECSA's part for countries with annual technical and financial reports submitted to all countries and the World Bank by ECSA-HC.

The key issues regarding the projects financial management include: (i) delayed disbursement at the initial project stages but this improved over time ii) financial accountability issues and ineligible expenditures led to refund to the World Bank by some countries (ii) Challenge in use of Government financial information management systems and delayed quarterly disbursement to satellite laboratories for facility improvements leading to delay in activities and (iii) High staff turnover in some countries for project coordinators and fiduciary teams at the Ministries of Health and this led to delays in project implementation.

iii. Procurement

Procurement under the regional project entailed procurement of various types that vary from country to country and generally comprised of: (a) works (construction and/or rehabilitation of laboratories, incinerators etc); (b) goods (computers, computer software, bio-safety equipment, protective gear, etc); (c) consulting services (i.e. technical assistance (TA), research studies, M&E, etc.); and (d) training and workshops. Procurement of the commodities was mainly done by national medical supplies procurement and warehousing entities, however for works this procurement function for acquiring contractors and works consulting firms was supported by Ministries of Public Works with some countries like Kenya seconding a construction monitoring officer/architects to manage this. Generally, the complex construction works for the laboratories and associated works lead to massive delays in procurements and actual constructions with some laboratories not completed as the project came to a close or even equipped after five-year implementation period.

Different implementation arrangements for procurement were done and assessment of procurement entities capacity were done at project appraisal stage, capacity was built in terms of procurement trainings undertaken at country level and regional level at ESAMI and World Bank however this was stifled with constant staff turnover of procurement project staff. Post procurement reviews were undertaken also. There was significant delays in procurement of commodities and delays in completion of civil works presented challenges in timely funds absorption. There was low fund absorption at the initial project implementation years but subsequent years the disbursement rates were rated well.

Overall, there was general compliance in procurement over the years with delays occasioned due to weak procurement planning and contract management

9.0 ECSA-HC Performance and Supervision of Regional Initiative

Generally, ECSA-HC performed substantial well in overall regional coordination and management of the project, initially during the project start-up they had challenges, but this eventually transition to a very efficient and effective partnership with the countries and the World Bank. ECSA-HC proved to be responsive, flexible and very committed to delivery of the project overall goals. The regional project despite being a complex operation has shown the critical role regional intergovernmental agencies role play in implementation, strategic convenorship and networking among countries.

Under the regional governance arrangements, ECSA-HC, the regional coordinating organization performed well in facilitation of knowledge sharing and learning on diagnosis and surveillance of communicable disease, great convening power of technical experts and regional steering committee and facilitated selective capacity building and training and joint analytic work and collaborating with the East African Community through a Memorandum of Understanding and web portal maintenance as a platform for sharing information and project results. The regional steering committee which was merged with the regional advisory panel consisted of both ECSA-HC, countries and external experts providing that independent oversight and approval of the regional annual work plans. The ECSA-HC regional project team hired experienced experts comprised of senior laboratory systems specialist (who doubled up as project coordinator), monitoring and evaluation expert, senior epidemiologist, finance and procurement experts and this regional team performed exceptional well from the interviews from country and partner stakeholders in ensuring coordination and consistent results across all the components.

In terms of replicability and sustainability at regional level, the EAPHLN project has bolstered and has catapulted ECSA-HC as a strong and pivotal technical especially on diagnostics, disease surveillance and overall project management capacity over the years and with this impeccable track history has enabled ECSA-HC secure more grants and contracts from the World Bank and other funders such as the Global Fund Against Aids, TB and Malaria (GFATM). ECSA-HC needs to build more competence and capacity on advocacy, communication and knowledge generation capacity and engagement with the private sector

10.0 World Bank Performance

Generally, the performance was equally satisfactory with the no changes to the Task Team Leader (TTL) throughout the project period who was based in the Headquarters but provided exceptional leadership and oversight for the whole project with regular communication and supervision missions. The EAPHLN project provided the World Bank entry into pioneering work in diagnostics and surveillance a new area of work for the Bank previously focused on health financing and health systems building.

The TTL was supported by a committed experts at country in procurement, financial management and health specialists with the co-Task Team leaders assigned and this worked well in some cases to provide on the ground support and participate in the country and regional steering committees. Despite this strengths, the regional project especially at country level did not perform well in terms of working and partnering with other World Bank Health projects especially in the health systems area with a few instances of similar PIU's for other Bank projects being used like in Rwanda, Burundi and Uganda but for Kenya and Tanzania separate PIU's were set up to manage the project.

Lessons learnt from the EAPHLN regional project were replicated and spun off in development of the Bank financed Southern Africa TB and Health Systems Support Project and the learnings and experiences were reflected in design and implementation of this regional project in the Southern African region with Malawi, Zambia, Mozambique and Lesotho with ECSA-HC competitively being selected as one of the regional organization jointly with Africa Union Development Agency (AUDA/formerly NEPAD). The World bank has supported the financing Africa CDC with a new project valued at US\$ 250 million to Ethiopia, Zambia and Africa Union towards strengthening the continental, regional and national infectious disease detection and response systems during the Covid-19 and beyond.¹³⁼

11.0 Risk to Development Outcome

The achievements under this project are expected to be continued under future initiatives and integrated in Ministries of Health strategic plans and budget making process. The World Bank conducted virtual last ICR missions with countries in Kenya, Uganda, Tanzania and Burundi and had preliminary discussions with Ministries of Health. However budgetary commitment and increased advocacy would be required and making a business/economic case using the Covid-19 can be leveraged to increase domestic health financing. The Universal Health Coverage vision in countries has accelerated with countries like Kenya, Uganda, Rwanda positioning this at the pinnacle of the political leadership, however the public health laboratories and surveillance aspects appear sparsely in this big picture proposals and more work is required by local stakeholders.

The World Bank, Countries and ECSA-HC initially prepared a project concept note as the second phase was concluding for additional financing consideration, but this was not successful mainly due to Covid-19 pandemic and Bank's policy on continuation of project over a certain period. The positive side was the concept notes developed were integrated into the Covid-19 Emergency Response national Bank projects in Burundi, Kenya, Uganda and Tanzania. The Bank supported additional operations from EAPHLN project gaps focused on cancer registries (US\$ 499,980) implemented by ECSA-HC and evaluations were undertaken to concertize the lessons in Rwanda and Kenya financed by the Bank and undertaken by consultants.

This document has been prepared in close collaboration of all Ministries of Health, partners and stakeholders including the World Bank and there is commitment from the countries, ECSA-HC and the World Bank on increased importance of investing in laboratories and disease surveillance. Focus on these issues will ensure the sustainability of investments made under this project.

12.0 Lessons Learnt and Recommendations

In summary, the last decade has seen the World Bank- invest in the East African Public Health Laboratories Network, which from 2010 focused on enhancing diagnostic services for Tuberculosis (TB) and other communicable diseases with efforts to address these weaknesses in diagnostic services. Other initiatives include the United States Centers for Disease Control and Prevention (US CDC) Field Epidemiology and Laboratory Management Program which began in 2004; the World Health Organization (WHO) Strengthening Laboratory Management Towards Accreditation (SLMTA) training program, and associated Stepwise Laboratory Quality Improvement Process Towards Accreditation (SLIPTA), launched in 2009 and now Africa Centres for Disease and Control regional initiative hosted by the African Union launched in 2017. Beyond the laboratory, progress has been made in the roll-out of rapid near point of care tests for Tuberculosis and HIV diagnosis (GeneXpert, a PCR technology has been a game changer in TB diagnostics) and Malaria (malaria Rapid Diagnostic Test- (mRDT's)).

¹³ Geli, Patricia, [Africa Centres for Disease Control and Prevention's Covid-19 Response: A United and Continental Strategy](#), World Bank Blog, 2020

Improvements in diagnostic services have been demonstrated through these initiatives, with pockets of excellence for specific diseases, and in certain facilities. However, there remains huge room for improvement especially working with researchers, translating research outputs and evidence informing policy, slow introduction of new diagnostics, standardization and regulatory challenges, budgetary support to sustain the laboratory infrastructure, sustainability of laboratory reagents supply to reduce consistent stock outs, equipment maintenance, and finally on weak engagement and contracting the private sector through effective and functional Public Private Partnerships business models. Although the needs are well understood, interventions beyond the 41 supported EAPHLN laboratories in the five countries need now to be scalable and sustained to address system-level constraints as countries pursue Universal Health Coverage (UHC) goals.

Table 10: The March 2014 Mid-Term Review (MTR): Main Achievements¹⁴

- Attained substantial quality improvements with impressive gains in the Stepwise Laboratory Quality Improvement Process towards Accreditation (SLIPTA), instilling a culture of continuous quality improvements and setting laboratories on a path towards accreditation. Seventy-three percent of facilities reached at least three stars on a scale of five, in stark contrast to less than one star at baseline for the majority.
 - Piloted the use of Performance Based Financing, linking incremental improvements in the SLIPTA composite scores to financial incentives to participating hospitals.
 - Supported the Uganda National Tuberculosis Reference Laboratory to reach the gold standard ISO accreditation, and quality to serve as a prestigious WHO SRL, the second of its kind on the continent.
 - Financed the construction and equipment of state of the art laboratories in cross border areas, bringing diagnostic services to vulnerable groups.
 - Rolled out new molecular technology for more rapid and accurate results, which implies that anti-TB drugs can be prescribed with greater accuracy, saving time and money. The GeneXpert technology has improved the turnaround time to several hours rather than waiting months for liquid culture results.
 - Introduced high-tech video conferencing and other ICT innovations to support e-learning, facilitate knowledge sharing, and strengthen communications.
 - Expanded the pool of qualified personnel by training over 7,000 professionals in both short and long term training, including fellows in the gold standard Field Epidemiology and Training Program (FETP) designed and supported by CDC.
 - Developed a regional framework for cross-border surveillance, established cross-border committees; conducted joint simulation exercises; carried out joint disease outbreak investigations across partner states, including several Ebola and Marburg outbreaks in Uganda; and developed a mobile phone disease surveillance system to facilitate sharing of information on disease outbreaks.
- Introduced a unique and cost-effective peer review mechanism by which the five EAC member states assess performance of each other's laboratories, ensuring objectivity and promoting cross-country learning.

The EAPHLN project has provided much beyond proof of concept and made a significant investment case for countries and partners to invest further on the vital role towards well performing and funded diagnostic services. These can play and enhance patient confidence in the health system, encourage appropriate care-seeking patterns at the relevant facility levels, and boost clinician morale when accreditation standards are attained and maintained. Outbreaks of Ebola and COVID-19, have highlighted the growing global threat of antimicrobial resistance, and the emerging health burdens of non-communicable and chronic diseases such as cancer and diabetes, and need for resilient systems in diagnostics for surveillance, outbreak response and effective disease management. Innovative approaches and models like the EAPHLN project are necessary achieve a step-level change in performance, by rapidly and sustainably increasing access to high quality diagnostics for the majority of African patients.

¹⁴ World Bank Mid Term Report, March, 2014

The following lessons and recommendations are derived interviews with key stakeholders, observations and EAPHLN literature repository (over 200 reports, reviews, evaluations publications, aide memoires and presentations) over the ten years of implementation period distilled at strategic level. They include:

- **Lesson 1: Regional Networking, Programming, and Cooperation is Key:** The project showcased the concept of laboratory networking and surveillance networks (both formal and informal networks) with country and regional benefits across the five countries. This saw cross border laboratories set up to monitor outbreaks, effective diagnosis conducted and information sharing across the region. This was a fundamental design thinking for the EAPHLN project. The project for instance contributed as one of the key funding partners with US-CDC and the Global Fund in establishing **Uganda National TB Reference Laboratory as a WHO Supranational premier TB reference laboratory** which is now being utilized by over 21 countries as a regional investment. The project conducted annual regional peer audits of laboratory systems using SLIPTA trained and certified laboratory auditors by Africa Society of Laboratory Medicine (ASLM) to benchmark the level of performance to meeting the quality standards and issued. with WHO/AFRO SLIPTA certification on stars attained. Regional programming was a pioneering and game-changer aspect in this World Bank operation with regional entities (ECSA-HC, EAC, ASLM and others) playing a central role and strengthened the regional capacity on cross-border and inter-country collaboration. This spilled over to Southern Africa, Africa CDC etc.. At country level, this learnings are being translated to establishment of local CDC's or public health institutes e.g. Kenya CDC/National Public Health Institute (NPHI), Uganda NPHI with public health laboratory functions included beyond epidemic preparedness and response.

Recommendation: First, WHO and global laboratory bodies and thinktanks needs to reflect on the concept of supranational accreditation as a superior global mark of quality but, as many laboratories get the ISO accreditation through the SLMTA/SLIPTA approaches we need to encourage the concept of networks and EQA processes. Secondly, aspects of strengthening regionality of project needs to be strengthened since the technical working groups and cross-border surveillance activities had challenges and need a different strategy to achieve more impact.

- **Lesson 2: Resilient and Future Investment in Laboratories and Disease Surveillance Networks¹⁵.** The Covid-19 pandemic has shown clearly the EAPHLN country investments in latest molecular equipment and Biosafety level 2 infrastructure in cross border as a necessary investment to respond to epidemic and pandemics. Both tactical and strategic resilience interventions have spruced including pivoting of local companies within countries to manufacture Preventive Protective Equipment, alcohol based sanitizers and this pandemic has shown countries need agile and flexible systems to support this rapid evolution.

Ensuring resilient public health systems and smart investment in medical laboratory networks are critical tools in responding and fighting outbreaks and building trust within the health care system this has been shown in Kenya, Uganda, Burundi and Tanzania.

- **Lesson 3: Adaptability and change of disease epidemiological profiles supported by the project shifting from communicable to non-communicable diseases over the implementation period.** The double burden in sub Saharan is changing dynamics in

¹⁵ Investing in medical laboratory networks: Will Covid-19 (corona virus) be a wakeup call? <https://blogs.worldbank.org/health/investing-medical-laboratory-networks-will-covid-19-coronavirus-be-wake-call>, Schneidman, M, World Bank Blog, 2020

health systems management and the project has progressively shifted progressed from communicable disease centric e.g. TB and Malaria towards Non-Communicable Diseases (NCD) as the mortality rises and boosting diagnostics was necessitated with setting up of cancer screening and diagnosis. An additional cancer registry initiative was conceived from the EAPHLN project learnings.

- **Lesson 4: Renewed Trust and Quality Improvement in Accurate Laboratories Due to Accreditation Enrolment:** The project has over the years increased massive trust of clinicians for lab results for effective treatment especially at the health facilities and avert increasing antimicrobial resistance. At inception most laboratories were very basic and at 0 or 1 star SLIPTA scoring level but over the years 17 laboratories across the countries have received ISO 15189 for medical laboratories accreditation. Through capacity building, participating in WHO/ASLM stepwise laboratory accreditation, audits and Quality Management Systems this has led to dramatically increased credibility of the laboratory results with expanded workload and test menus resulting in increased client satisfaction levels.

Recommendation: First, laboratories getting ISO accredited is a great step towards improving quality, however the challenge is ensuring sustainability and cost-effectiveness of the accreditation maintenance with harmonized accreditation agencies for instance, ECSA-HC is in the process of setting this up as a revenue generating model and provide more competitive accreditation fee rates as they leverage staff competency build through the EAPHLN project, members organization and certified assessors.

- **Lesson 5: Country Leadership, Ownership, good coordination, and consistent communication and engagement is penultimate to regional project success.** The implementation of regional health projects is bend on good leadership shown but at regional, country and sub national levels to ensure smooth implementation. The EAPHLN project managed to construct 40 new laboratories, equip then and train the needed personnel, this is no mean achievements considering construction projects are quite complex. The establishment of project coordination units with project coordinators leading within the Ministries of Health was vital and hiring specialised personnel for instance laboratory scientists, construction monitoring officers, epidemiologists was instrumental in success of some of the interventions.
- **Lesson 6: Adequate Implementation Time frame.** The project has been implemented over ten years and this has enabled the full cycle of interventions to be actualized. It is critical for sufficient time is provided to complex operations involving procurement of civil works and equipment's in order for learning and for the pilot interventions to reach outcome and impact level. Within the ten year period most of the components have reached maturity and generate concrete lessons and this at least should be a standard within 5-10 years for success to be actualized. Future programmes should have a longer timeframe and be designed to support promising interventions for a reasonable period.
- **Lesson 7: Use of technology and M&E systems thinking:** Effective M&E and linking to technology is critical in fast tracking implementation and outputs systematically and to measure the effectiveness of projects. The project harnessed use of technology in deploying video conferencing facilities in remote cross border in all the countries laboratories to ease communication and became handy during the Covid-19. The infusion of laboratory metrics in monitoring performance and displaying results attained is a useful asset to the laboratory staff within the health facilities.

In addition, deployment of laboratory information management systems was a crucial element in connecting data from top and down and in real time fashion, notwithstanding

deployment of multi-disease PCR platform applications with point of care resulting in more efficiencies and economies of scale.

- **Lesson 8: Opportunities for Public Private Partnerships in the laboratory/diagnostics sub sector to increase sustainability:** The EAPHLN regional project undertook a landscape analytical publication in 2015 on Opportunities on PPP's for Laboratory Services in East Africa which highlighted both challenges and opportunities on this PPP space. However, none of the EAPHLN countries tested this approach for the laboratories under the project with a few equipment placements done and working with two private/non-for profit laboratories as part of initiative, therefore an opportunity for future diagnostics initiatives to ensure full utilization of the EAPHLN investments through such partnerships or business models.

Recommendation: Private services and non-government laboratories play a significant role in the delivery of services and are becoming a major part of the network of national laboratories. Private labs are key to building national capacity, as well as public-private partnership models that increase access to diagnostic services and patient care. Countries are encouraged to think about ways to build and strengthen partnerships with private sector providers and contract out services where appropriate and should be defined in a national laboratory plan.¹⁶ There is need to build requisite capacity in this niche PPP area to enhance health service delivery and optimize private sector investments within the public health laboratories space. Indeed, it is possible to improve lab and diagnostics services for sub-Saharan Africa through PPP and private sector driven models as proven in other sectors like road and energy.

- **Lesson 9: Sustainability and Replicability is paramount:** The project partnership with Governments and ensured this is ingrained within the structures including staff hired by the project eventually being absorbed by Government and ensuring the laboratory equipment purchase have self-sustaining equipment maintenance departments. Each country selected at least 5 districts within the country and this district or county laboratories are now serving as centres of excellence at the regional level (group of districts) to access high quality and efficient diagnostic services. However, the challenge of financial sustainability in ensuring uninterrupted supply of lab reagents is still a challenge and increased advocacy would be required to ensure consistent line budget for the laboratories within the national and subnational levels. The EAPHLNP's experience has prompted the World Bank and other development partners to look differently at laboratory networks and disease surveillance and epidemic preparedness and support more programmes and has influenced this uptake and possible increased in diagnostics financing e.g. Southern Africa TB Health Systems Support regional bank project, newly launched Africa CDC multi-country initiative, Global Fund regional TB laboratory initiative and others.

Recommendation: Government needs to commit in terms of domestic financing to diagnostics and surveillance activities within their local budgets and Covid-19 pandemic has shown the critical important in this early investment. National Government working with regional bodies need to fast track adoption and standardize regulatory framework for rapid evaluation and validation of new diagnostic technologies.

- **Lesson 10: Strategic Partnerships are crucial:** The partnership between the World Bank, Ministries of Health, ECSA-HC, ASLM, EAC, CDC, IUATLD, FELTP and research and training institutions, provided a strong supportive mechanism for the EAPHLN project to strengthen the various interventions in terms of technical rigor and gain regional leadership. For instance, most laboratories have now acquired ISO Lab

¹⁶ The Global Fund, Technical Brief: Laboratory Systems Strengthening, 2019

accreditations and even The Uganda National TB Reference Laboratory is now a WHO Supranational TB reference laboratory. Joint technical missions with partners has been instrumental in ensuring the countries align to regional and global standards including participation in the regional advisory panel forums.

- **Lesson 11: Contract Management and Timely Quality Procurement:** The project has had a number of procurement related activities related to civil works majorly, lab equipment and consumables, consultancy engagements and this has led to building capacity of medical supplies agencies within countries especially on laboratory specific procurements and development of generic specifications and managing the laboratory supply chain efficiently and effectively. However, the next step would be adopting the WHO Essential Diagnostics List (EDL) in itself challenging, with rapidly evolving diagnostic innovations from point of care to benchtop equipment.
- **Lesson 12: Consistent and Dedicated World Bank and Regional Staff:** The task team leader has led the project from 2010 till closure and this has assisted in ensuring consistency and institutional memory is maintained and supported by the co-TTL based at the country Bank operations level. Similarly, ECSA-HC has maintained relatively same team over the project period with the regional project coordinator and M&E lead ensuring countries are provided technical oversight, follow ups and run parallel to each other.
- **Lesson 13: Embracing Innovations Uptake on Laboratory Services Improvement :** The project introduced innovations through introduction of new innovative molecular techniques like for Gene-Xpert® for rapid TB diagnosis within 2 hours compared to the TB microscopy and other point of care diagnostics, videoconferencing facilities based in remote cross-border areas, quarterly digital bulletins by some countries, piloting performance based financing based on the SLIPTA lab check list are some of the highlighted innovations and supporting and complementing the innovative FELTP programme towards implementing the programmes at sub national .

Recommendation: Beyond the innovation, it is imperative to design a costing model to increase uptake, improve connectivity/networking and integration with other health platforms at all levels of care. The use of Artificial Intelligence capabilities building on advanced data analytics (AI) and mathematical/prediction modelling to predict outbreaks and epidemics like Covid-19, Ebola and for instance AI could be used to predict TB defaulters or prevention of occurrence of Multi-Drug Resistance TB (MDR-TB) and strengthen data systems to be more predictive and futuristic rather than only monitoring past morbidity and consumption epidemiological data.

- **Lesson 14: Operational Research Needs to Link with Disease Programming and Implementation:** The project commissioned three multi-country research studies in TB, Malaria and Enterics implemented by Government health research agencies which had several challenges in designing and implementation (Tanzania and Kenya did fairly well but Burundi, Rwanda and Uganda were fairly weaker), eventually reports and policy briefs were generated. Relative success was achieved with offshoot satellite laboratory research with facility relevant studies undertaken. However, there was a disconnect between the health research and disease programming with some studies having no programmatic relevance with weak dissemination and policy engagement at country level.

Recommendation: Future projects need to find innovative ways to design and implementing the research with co-creation sessions done using a more bottom – up approach, in addition researchers need to be imbedded in the disease programme so that they contribute to the whole policy cycle. Countries need to use knowledge translation strategies

- **Lesson 15: Roll out of New Molecular and Diagnostic Multiplex Technologies:** The project invested and rolled out the innovative GeneXpert platform for TB rapid diagnosis which had led to increased turnaround times and better cure rates and treatment outcomes for TB programmes in the region. The project also procured other molecular equipment useful for diagnosis of both communicable (emerging/re-emerging) and non-communicable diseases such as cancer etc. This polyvalent/multiplex molecular platforms and other testing technologies were used to rapidly detect a wide range of viral and bacterial pathogens like in outbreaks in dengue, cholera, chikungunya and now SARS-CoV 2 (Covid-19) pandemic. Their strategic placement required careful planning of the anticipated numbers of different types of samples based on the testing of different patient populations and planning of procurement and supply chain system to match available machine throughput.

Recommendation: Countries in East Africa need to think about investing and partnering on manufacturing of diagnostic test kits at first and progressively in diagnostic equipment working with global diagnostic companies and research institutions. Secondly there is for proper mapping and networking of this diagnostic equipment and supported with service data gaps in service delivery as Point of care technology are adopted and rolled out, smart networking is needed to optimize rational usage of this equipment within a hub and spoke model.

Lesson 16: Strategic Resilient Laboratories Supply Chain is Important

Supply chain management in laboratories is often a weak link within laboratory network systems and the project basically equipped laboratories, however supply chain aspects were neglected. Almost 70% of the EAPHLN project's budget was spent on infrastructure and equipping laboratories with a complex combination of basic and advanced equipment, and consumables. Efficient Laboratory Health Products and Technologies which are linked to information systems is critical. The project invested in many equipment but countries as they consider the use of near-Point of care (POC) instruments, there is need to conduct laboratory network assessments and optimization activities to establish the needs in a tiered laboratory system and ensure appropriate placement of both conventional and near-POC instruments, using Public Private Partnerships models or alternative business models of laboratory delivery. The changing landscape of Universal Health Coverage in the participating countries has created a need to ensure laboratory supply chains are fully functional, standardized and have economies of scale.

Recommendation: There is need for future programme to tackle aspects of laboratories supply chain management from proper design and standardization of the laboratory equipment to quantification techniques, procurement planning, good warehousing and inventory management practices integrated to Laboratory Management Information Systems (LIMS). Laboratory experts at all levels need to be familiar with good supply chain practices and it is not only the role of supply chain or pharmaceutical experts and undertake customized laboratory supply chain management short trainings.

The Global Fund Laboratory Systems Strengthening technical brief is an important reference on laboratory supply chains not only for TB, HIV and Malaria programmes and highlights countries need to ensure oversight of supply chain operations that are informed by data systems that provide quality data at central, regional and site level facilities. Infrastructure (warehousing/storage) and distribution systems suitable for laboratory commodities need to be in place to consistently serve patients in all areas of the country. Laboratory supply chain systems should be integrated into the national health supply chain system and as earlier raised consider local manufacturing of some components of diagnostic commodities. There is need to ensure standardization and harmonization of diagnostic technologies and tests across the country to ensure consistency and use of pooled

procurement business models by the procurement entities thereby making it more efficient and effective.

Annexes

Annex 1. Consolidated Results Framework and Key Outputs

Countries participating in the EAPHLN project were committed to a common framework for monitoring performance of the project. The result framework focused on accountability for results and moves beyond the usual tracking of inputs and outputs and put more emphasis on intermediate and final outcomes. Six project outcome indicators (POI) and twelve intermediate outcome indicators (IOI) were identified in which the countries are accountable and report against for the two phases from 2010 to 2020.

Results Framework Summary 2011-2020

The EAPHLN-Project has achieved the following results on key project indicators from its initiation in 2011 to 2020 as seen in Table 4 below. The tables below summarize the results framework from 2017 to 2020 (Phase 2 of the project). Further details can be derived from the Kenya, Uganda, Tanzania, Burundi and Rwanda ICR reports.

Table 11: Regional results framework summary

Indicators	Year 2 (2011- 2012)	Year 3 (2012- 2013)	Year 4 (2013- 2014)	Year 5 (2014- 2015)	Year 6 (2015- 2016)	Year 7 (2016-2017)	Year 8 (2017- 2018)	Year 10 (2019- 2020)	Comments (Achievement Against Targets)
Project Outcome Indicators(6 POIs)	Overall Regional Achievement is 5/6 (83%)	Overall Regional Achievement is 5/6 (83%)	Overall Regional Achievement is 4/6 (66%)	Overall Regional Achievement is 5/6 (83%)	Overall Regional Achievement is 6/6 (100%)	Overall Regional Achievement is 5/6 (83%)	Overall Regional Achievement is 5/6 (83%)	Overall Regional Achievement is 5/6 (83%)	Countries performed less on POI# 4 (People receiving TB drug susceptibility tests among DOTS treated TB cases not responding to treatment)
Intermediate Outcome Indicators 12 (IOIs)	Overall Regional Achievement is 6/11 (54%)	Overall Regional Achievement is 6/11 (54%)	Overall Regional Achievement is 6/11 (54%)	Overall Regional Achievement is 7/11 (63.6%)	Overall Regional Achievement is 8/12 (66%)	Overall Regional Achievement is 11/12 (92%)	Overall Regional Achievement is 10/12 (83%)	Overall Regional Achievement is 10/12 (83%)	Countries performed less on IOI# 3 and 5 (Satellite laboratories reporting stock-outs of tracer reagent for stools culture and Share of national and satellite laboratories that comply with Biomedical Waste Management requirements)

Overall Performance	Achieved 11/17 (64%)	Achieved 11/17 (64%)	Achieved 10/17 (58.8%)	Achieved 12/17 (70.5%)	Achieved 14/18 (77.8%)	Achieved 16/18 (88.9%)	Achieved 15/18 (83%)	Achieved 15/18 (83%)	
----------------------------	----------------------	----------------------	------------------------	------------------------	------------------------	------------------------	----------------------	----------------------	--

Table 5: Results Framework for Burundi for 2017-2020¹⁷

Project Outcome Indicators	Baseline	TARGET	ACHIEVED	TARGET	ACHIEVED	TARGET	ACHIEVED	Comments (Achievement against Targets)
	2012	YR6	YR6	YR7	YR7	YR8	YR8	
		2017/18	2017/18	2018/19	2018/19	2019/20	2019/20	
//POI#1. Average turn-around time for: GeneXpert (hours)	N/A	24 hrs	12 hrs	24 hrs	10.4 hrs	24 hrs	9.3 hrs	
POI# 2. Satellite laboratories awarded three star status under regional accreditation program based on WHO/AFRO five-step accreditation approach (cumulative number, percent).	0	6(67%)	6(67%)	7(78%)	8(89%)	8(89%)	9(100%)	
POI# 3. Number of beneficiaries (out of which x% female).	195,883 (55%)	200 610	176,486 (60%)	201 413	197,802 60%	202,218	217,825 (60.4%)	
POI# 4. People receiving TB drug susceptibility tests among DOTS treated TB cases not responding to treatment (number, percent).	24 75%	36 (82%)	15 (56.5)	38 (84%)	15	40 (85%)	25%	
POI# 5. Proportion of reported communicable disease outbreaks having laboratory confirmation of etiological agent (percent).	0	100%	100%	100%	100%	100%	100%	

¹⁷ Regional results framework summary report, ECSA-HC, 2020

Project Outcome Indicators		Baseline	TARGET	ACHIEVED	TARGET	ACHIEVED	TARGET	ACHIEVED	Comments (Achievement against Targets)
		2012	YR6	YR6	YR7	YR7	YR8	YR8	
			2017/18	2017/18	2018/19	2018/19	2019/20	2019/20	
POI# 6. Proportion of outbreaks in cross border areas that joint investigations were done (both in country joint investigations and inter-country joint investigations)			75%	100%	80%	100%	85%	100%	
Intermediate Outcome Indicators		Baseline 2012	TARGET YR6	ACHIEVED YR 6	TARGET YR7	ACHIEVED YR 7			
IOI# 1. Satellite laboratories compliant with WHO SOPs (cumulative number, percent).		0	7 78%	1 11%	8 89%	1 11%	9 100%	8 (89%)	
IOI# 2. Number of days the national reference laboratory reporting stock-out of tracer reagent for TB liquid culture in past quarter (days).		<20	<5	90	<5	85	<3	NA	
IOI# 3. Satellite laboratories reporting stock-outs of tracer reagent for stools culture (percent).		80%	78%	3 (37%)	78%	64%	89%	NA	
IOI# 4. Number of Health facilities	Constructed	0	9	6	9	9	9	9	Greatly achieved
	Renovated	NA	NA	NA	NA	NA	NA	NA	
	Equipped	0	9	6	9	9	9	9	Greatly Achieved
IOI #5. Share of national and satellite laboratories that comply with Biomedical Waste Management requirements (cumulative number, percent)		0	7 67%	0	8 89%	1		0	

Project Outcome Indicators		Baseline	TARGET	ACHIEVED	TARGET	ACHIEVED	TARGET	ACHIEVED	Comments (Achievement against Targets)
		2012	YR6	YR6	YR7	YR7	YR8	YR8	
			2017/18	2017/18	2018/19	2018/19	2019/20	2019/20	
IOI# 6. Quarterly publication of a regional surveillance bulletin by East Africa integrated disease surveillance network with country-specific data (yes/no).		No	Yes	Yes	Yes	Yes	Yes	Yes	
IOI# 7. Health personnel receiving training (number).		0	450	375	520	1154	600	835	Greatly achieved
IOI# 8. Proportion of laboratory staff trained and found to be proficient (Competent) in performing assignments		0	70%	81%	72%	85%	75%	82%	
IOI#9. Operational Research studies	developed and approved by a recognized IRB	No	3	3	3	3	3	3	
	completed with results disseminated		3	0	3	0	0	0	No multi-country research implemented (Not achieved entirely)
	Offshoot proposals developed for short term		2	0	3	3	0	0	

Project Outcome Indicators	Baseline	TARGET	ACHIEVED	TARGET	ACHIEVED	TARGET	ACHIEVED	Comments (Achievement against Targets)
	2012	YR6	YR6	YR7	YR7	YR8	YR8	
		2017/18	2017/18	2018/19	2018/19	2019/20	2019/20	
operational studies.								
IOI#10. Number of GeneXpert tests performed;		3 379	719	3 457	1914	3 537	4.058	
IOI#11. Number of laboratory tests performed per quarter		474,562	504,956	485,951	631082	497,614	608,957	
IOI#12. Laboratory Clients Satisfaction Rate		75%	76.30%	80%	82%	80%	84.5%	

Table 6: Results Framework for Kenya (2017-2020)

Project Outcome Indicators	Baseline 2009	TARGET YR 8 2017-2018	ACHIEVED July-June, 2017-18	TARGET YR 9 2018-2019	ACHIEVED July-June, 2018-19	TARGET YR 10 2019-2020	PARTIAL ACHIEVED July-March, 2019-20	Comments (Achievement against Targets)
<u>POI# 1. Average turn-around time for TB GeneXpert test (Hrs)</u>		24hrs	23.4 Hrs	24hrs	21 hrs	24hrs	18.9 Hrs	

POI# 2. Satellite laboratories awarded three star status under regional accreditation program based on WHO/AFRO five-step accreditation approach (cumulative number, percent).	0(0%)	6 (60%)	8/10 (80%)	7 (100%)	9/10 (90%)	7 (100%)	10 (100%)	8 labs are ISO 15189 accredited; 2 labs are ISO 17025
POI# 3. Number of beneficiaries (out of which x% female).	81,254 (60%)	170,000	403,423 (58%)	180,000	592,277 (63%)	180,000	1,122,766 (56%)	
POI# 4. People receiving TB drug susceptibility tests among DOTS treated TB cases not responding to treatment (number, percent).	6,569 (61%)	8700	3226	8700 (82%)	16469 (100%)	8700 (82%)	4160 (100%)	
POI# 5. Proportion of reported communicable disease outbreaks having laboratory confirmation of etiological agent (percent).	20%	75%	100%	80%	100%	80%	100%	
POI# 6. Proportion of outbreaks in cross border areas that joint investigations were done (both in country joint investigations and inter-country joint investigations)		70%	0	80%	100%	80%	100%	
Intermediate Outcome Indicators	Baseline 2009	TARGET YR 8 2017-2018	ACHIEVED July-June, 2017-18	TARGET YR 9 2018-2019	ACHIEVED July-June, 2018-19	TARGET YR 10 2019-2020	TARGET YR 10 2019-2020	
IOI# 1. Satellite laboratories compliant with WHO SOPs (cumulative number, percent).	0	7 (100%)	7 (100%)	6 (66.7)	8 (100%)	6 (66.7)	10 (100%)	
IOI#2. Number of days the national reference laboratory reporting stock-out of tracer reagent for TB liquid culture in past quarter (days).	0	5	30	5	0	5	0	Wajir County had stockout in the 1 st quarter, then resolved
IOI# 3. Satellite laboratories reporting stock-outs of tracer reagent for stools culture (percent).	100%	14%	25%	0	0	0	20%	

IOI# 4. Number of Health facilities;	Constructed,	0	8 100%	5/7 62%	8 100%	8 100%	5/7 62%	7	
	Renovated		1 (100%)	1 (100%)	1 (100%)	1 (100%)	1 (100%)	1	
	Equipped		5(62%)	6/8(75%)	8(100%)	8(100%)	6/8(75%)	8	
IOI #5. Share of national and satellite laboratories that comply with Biomedical Waste Management requirements (cumulative number, percent)		0 (14%)	8 (100%)	6 (67%)	8 (100%)	0	8 (100%)	2 40%	
IOI# 6. Quarterly publication of a regional surveillance bulletin by East Africa integrated disease surveillance network with country-specific data (yes/no).		No	Yes	Yes	Yes	Yes	Yes	Yes	
IOI# 7. Health personnel receiving training (number).		0	80	127	0	151	0	161	
IOI# 8. Proportion of satellite lab staff trained and found to be proficient in performing assignments		13%	85%	94.8%	85%	98.1%	85%	100%	Greatly over achieved
IOI#9. Operational Research studies	Developed and approved by a recognized IRB	3 100%	3 100%	3 100%	2	2	3 (100%)	3 (100%)	
	Completed with results disseminated		2	3 100%			3	3 (100%)	
	Offshoot proposals developed for short-term operational studies.	7	3	2	2	2	2	14	
IOI#10. Number of GeneXpert tests performed per quarter;			720	24,340	780	26399	780	20,030	
IOI#11. Number of laboratory tests performed			510,000	1,119,642	640,000	1819754	640,000	1,529,285	Greatly achieved
IOI#12. Laboratory Clients Satisfaction Rate			80%	75.8	80%	74.5%	80%	75.10%	Dropped in client satisfaction

								over the years
--	--	--	--	--	--	--	--	----------------

Table 7: Results Framework for Tanzania (2017-2020)

PROJECT OUTCOME INDICATORS	TARGET 2017/18	ACHIEVEMENTS JULY 2017 TO JUNE 2018	TARGET YR9 2018/19	ACHIEVEMENTS JULY TO JUNE 2019	TARGET YR10 2019/20	ACHIEVEMENTS JULY 2019 TO MARCH 2020	Comments (Achievement against Targets)
POI# 1. Average turn-around time for TB GeneXpert test ¹⁸ (Hrs)	36hrs	26Hrs	24hrs	23	24hrs	12.8hrs	
POI# 2. Satellite laboratories awarded three star status under regional accreditation program based on WHO/AFRO five-step accreditation approach (cumulative number, percent).	6 (85%)	3 (60%)	7 (100%)	6 (85%)	7 (100%)	7 (87.5%)	Five labs accredited, 2 having 3 stars, and 1 two stars
POI# 3. Number of beneficiaries (out of which x% female).	160,000 (60%)	181,536 (58.0%)	170,000 (60%)	197,336 (58%)	170,000 (60%)	110,240 (53%)	
POI# 4. People receiving TB drug susceptibility tests among DOTS treated TB cases not responding to treatment (number, percent).	1600 (90%)	1570	1650 (90%)	1,112 (58%)	1650 (90%)	1,112 (58%)	
POI# 5. Proportion of reported communicable disease outbreaks having laboratory confirmation of etiological agent (percent).	100%	100%	100%	100%	100%	100%	Dengue, Cholera and Anthrax outbreaks
POI# 6. Proportion of outbreaks in cross border areas that joint investigations were done (both in country joint investigations and inter-country joint investigations)	60%	100%	60%	100%	60%	100%	
Intermediate Outcome Indicators							
IOI# 1. Satellite laboratories compliant with WHO SOPs (cumulative number, percent)	6 (100%)	6 (100%)	6 (100%)	8(100%)	6 (100%)	8 (100%)	

¹⁸ POI#1. The GeneXpert machine takes 2 hours to process the sample and give results, there are also a lot of other processes (sample preparations) that needs to be taken into account before sample is taken to the machine, in this case the we still need to measure TAT

IOI# 2. Number of days the national reference laboratory reporting stock-out of tracer reagent for TB liquid culture in past quarter (days).		0	0	0	0	0	0	
IOI# 3. Satellite laboratories reporting stock-outs of tracer reagent for stools culture (percent).		16.6%	0	0	0	0	16%	
IOI# 4. Number of Health facilities	Constructed,	0	2	0	2	0	5	
	Renovated	5	3	0	3	0	3	
	Equipped	6	8	0	8	0	8	
IOI#5. Share of national and satellite laboratories that comply with Biomedical Waste Management requirements (cumulative number, percent)		7 (100%)	7 (87.5%)	7 (100%)	0	7 (100%)	0	
IOI# 6. Quarterly publication of a regional surveillance bulletin by East Africa integrated disease surveillance network with country-specific data (yes/no).		Yes	Yes	Yes	Yes	Yes	Yes	
IOI# 7. Health personnel receiving training (number).		240	1365	23	425	23	100	
IOI# 8. Proportion of laboratory staff trained and found to be proficient (Competent) in performing assignments		100%	85%	100%	94.4%	100%	91.75%	
IOI#9. Operational Research studies	developed and approved by a recognized IRB	0	3	0	0	3	3	
	completed with results disseminated	1	3	3	3	3	3	
	Offshoot proposals developed for short term operational studies.	0	15	0	0	0	19	
IOI#10. Number of GeneXpert tests performed		24,000	12725	25,000	22,177	25,000	12,119	
IOI#11. Number of laboratory tests performed		294,494	365,924	314,464	436,280	314,464	314,319	
IOI#12. Laboratory Clients Satisfaction Rate		75%	75	80%	83.5%	80%	86%	

Table 4: Results Framework for Uganda (2017-2020)

Project Outcome Indicators	Baseline 2009	TARGET YR 8 2017/18	ACHIEVED 2017/18	TARGET YR 9 2018/19	Report July-June 2018/2019	TARGET YR 10 2019/2020	Partial Report July-March 2019/2020	Comments (Achievement against Targets)
POI# 1. Average turn-around time for TB GeneXpert test ¹⁹ (hrs)	48	24	27	24	20.8	24	19.3hrs	
POI# 2. Satellite laboratories awarded at least three star status under regional accreditation program based on WHO/AFRO accreditation approach (cumulative number, percent).	0	6 (85.7%)	3 (42.8%)	100%	7 (87.5%)	100%	8 (100%)	4 assessed laboratories scored 3 stars and above, 2 recommended for accreditation while 2 maintained their accreditation
POI# 3. Number of beneficiaries (out of which x% female).	48,000	400,000 (50)	751,313 62%	500,000 (55%)	663808 59.2%	500,000 (55%)	424,145 (53%)	
POI# 4³. People receiving TB drug susceptibility tests among DOTS treated TB cases not responding to treatment (number, percent).	800 34.7%	3,200 (90)	1,068 (57.3%)	4000 (95%)	4389 (58%)	4000 (95%)	7856 (35%)	
POI# 5.³ Proportion of reported communicable disease outbreaks ²⁰ having laboratory confirmation of etiological agent (percent).	10%	80%	12(100)	100%	100%	100%	100%	
POI# 6.³ Proportion of outbreaks in cross border areas that joint investigations were done (both in country joint investigations and inter-country joint investigations)		85%	04(100)	95%	100%	95%	100%	
Intermediate Outcome Indicators	Baseline 2009	YR6 2016/17	Q1, 2, 3 & 4 2017/18					
IOI# 1. Satellite laboratories compliant with regionally WHO SOPs (cumulative number, percent).	01(6.7)	6 (85.7%)	8 (100)	7	8 (100)	7	8 (100)	

¹⁹ POI#1. The GeneXpert machine testing time is 2 hours to process the sample and provide results, other processes (during the pre and post analytical stages) to consider when computing average Turn Around Time(TAT), are, sample referral, processing, results validation and courier services for results.

²⁰ Examples of the disease outbreaks include: cholera, malaria, hepatitis, salmonella, typhoid etc. ³POI#4,5 & 6 are reported at National level without input from the sites. N.A: Not Applicable n.a: Information not available

IOI# 2. Number of days the national reference laboratory reporting stock-out of tracer reagent for TB liquid culture in past quarter (days).		21	<5	0	<5	0	<5	0	
IOI# 3. Satellite laboratories reporting stock-outs of tracer reagent for stools culture (percent).		80%	<15	5/7 (71%)	0	3/7 (42.8%)	0	3/7 (43%)	Mbarara, Moroto and Mbale Reported Stock outs.
IOI# 4. Number of Health facilities	Constructed	Nil	3	00(Nil)	4	4	4	8	Civil works of laboratories; Mbale-90% , Mbarara-80%, Arua-70%, Remodelling of Lacor completed waiting for handover, Remodelling of Entebbe ETU – 60% completion, Mulago Isolation unit- 20%, MDR TB treatment centre at Moroto RRH –70% while NTRL completed
	Renovated	Nil	2	0(Nil)				0	Lacor-Gulu completed
	Equipped	Nil	7	6/8 (75%)	7	7		0	For this period, we are considering equipment for Histopathology which was delivered but not yet distributed to the target sites.
IOI #5. Share of national and satellite laboratories that comply with Biomedical Waste Management requirements (cumulative number, percent)		0	6 (85.7%)	4/8 (50%) (Scored 69.7%)	7 (100%)	1 (12.5%)	7 (100%)	2/6 (33%)	2 out of 6 labs assessed scored 90% and above
All IOI# 6. Quarterly publication of a regional surveillance bulletin by East Africa integrated disease surveillance network with country-specific data (yes/no).		0	Yes	Yes	Yes	Yes	Yes	Yes	

IOI# 7. Health personnel receiving training (number).		0	150	265	100	161	100	500	3 Regional 8 National rest are sub-national cascades at EAPHLNP sites
Intermediate Outcome Indicators		Baseline 2009	YR7 2017/18	ACHIEVED Q1, 2, 3& 4					
IOI# 8. Proportion of laboratory staff trained and found to be proficient (Competent) in performing assignments		0	80%	87.5%	80%	100%	80%	91%	Mulago reported 40% of the over 200 staff have evidence of passing CT on file.
IOI#9. Operational Research studies	developed and approved by a recognized IRB	0	3	3	0	0		8	1 OR Proposal pending IRB approval
	completed with results disseminated	0	3	3	0	0		3	02 completed report writing pending dissemination
	Offshoot proposals developed for short term operational studies.	0	10	10	14	14		Nil	
IOI#10. Number of GeneXpert tests performed per quarter;		0	17,280	29,904	17,280	35,773	17,280	22873	
IOI#11. Number of laboratory tests performed per quarter			280,000	1,023,260	350,000	1,276,655	350,000	1,114,626	
IOI#12. Laboratory Clients Satisfaction Rate (Percent)		0	75	62.5%	80%	82%	80%	84.3%	

Annex 2: ICR/End Term Evaluation Methodology

Overview

The EAPHLN ICR used a collaborative and participatory mixed-methods design approach in order to assess the key elements on overall relevance, coherence, effectiveness, efficiency, impact and sustainability of the programme over the implementation period. The approach was enabled capturing and documenting lessons learned, successes and challenges over time. The mixed method drew on both existing and new quantitative and qualitative data to answer the ICR questions and gain a deeper understanding of the outputs and outcomes. In addition, the method ensured programme closure activities were not interrupted during end term evaluation period.

Of note, the approach utilized the standard agreeable bank learning ICR thinking and requirements. The key project aspects reviewed were:

- i. **Project Design**
Assessed the appropriateness of the project and model design and whether or not the design was adequate to meet the project objectives and are consistent with best practices and whether the project would be more effective and efficient if the components were designed differently. In addition, if the arrangements between countries, regional organization and the World Bank were adequate for effective programme delivery.
- ii. **Project Implementation and results framework**
- iii. **Impact at all levels from regional to national level.**

The World Bank and ECSA-HC secretariat have defined this as a learning ICR different from the Core ICR, which is only prepared to satisfy accountability needs and provide lessons from completed operations. The Intensive learning ICR (ILI) is additional to core ICR elements, provides extensive analysis and lessons learning based on stakeholders and beneficiary feedback, however due to Covid-19 this was limited to virtual exchanges at regional level and travel only happened in Kenya in three major health facilities despite the travel limitations.²¹

The data collected from these different sources i.e. country and regional level would be compiled and analyzed using both methodological and data triangulation procedures to identify important relationships between the different variables on the EAPHLN project. The process to be used will ensure that data obtained from the different data collection methodologies is complementary in serving the overall aim of the project. The consolidation framework for the regional ICR report that is to be used will be guided by a clearly articulated conceptual framework described overleaf to provide comprehensive evidence on the design, implementation and performance of the regional EAPHLN project.

ICR/End-term Evaluation Conceptual Framework

The development of this ICR adopted an adaptive evaluation approach, using the OECD - DAC²² evaluation criteria for accountability and learning primarily with the five elements of *relevance (plus coherence), effectiveness, efficiency, impact and sustainability* and tied to assessing the design and implementation of the project and filtering the huge literature review repository (over 300 written documents shared to date by the client).

The evaluation methodology was riven by the need to provide timely and useful lessons based on high quality evidence to guide stakeholders in taking action and evidence relating to results achieved and

²¹ Implementation Completion and Results Updated Guidelines, 2011, World Bank

²² OECD Criteria of Evaluating Development Assistance, DAC Network of Development Evaluation, 2019

broad strategic lessons can be derived, suitable for sharing with a wider (international, regional and local) stakeholder community.

Secondly, the ICR utilized the EAPHLN results framework as a tool against which; to track evidence of realized progress and impact, and to interrogate existing gaps at the design, implementation and results levels. Beyond the results framework, organically utilizing document reviews, observations and key informant interviews, general public health perspectives were explored and how this influenced the WHO health systems building blocks will complement the consolidation of the regional data and report.

The components of the ICR evaluation criteria and guidance questions were elaborated in a questionnaire and ensured ethical guiding principles are applied to ensure integrity, systematic inquiry and promoting equity of the ICR, as per the American Evaluation Association²³ evaluation guidelines.

The following design principles were utilized i) evaluation questions have a clear logical structure distinguishing overarching questions, core evaluation judgements and sub questions included factual and exploratory questions ii) questions were clear, concise and focused.

Data Collection and Analysis Methods

a. Documents Review

In appreciation of the large body of evidence (over 200 published reports, presentation and presentations) under the EAPHLN project that's existed for the entire ten-year implementation period, for two project phases. In addition to internal project documents, the consultant scanned other regional health project initiatives.

The scope for this work was at regional level and the country ICR reports were critical in order to curate regional consolidated aspect.

Qualitative key informant interviews

Statistical assessment of complex public health projects rarely gives the complete picture, with the risk of information not measurable by numbers being missed. For this reason, a series of qualitative in-depth stakeholder and expert interviewees were mapped and undertaken through zoom virtual communication due to Covid-19 travel limitations and snowballing was used utilized to identify other important informants. The interviews were recorded on zoom virtual recording and this remained confidential with participation being voluntary.

The key informant interviews were instrumental to understand in greater depth the achievements, challenges and lessons learned and take stock of the evaluations questions. The interviews were useful to back the complementary documentary evidence on implementation, field experience and delivery, in addition information on management and oversight, coordination, partnerships, communications and financing. The consultant visited three health facilities in Kenya (National Public Health Laboratories Division, Disease Surveillance and Response Unit) at the Ministry of Health in Nairobi, Machakos and Moi Teaching and Referral Hospital, Eldoret satellite laboratories, Kenya). Due to Covid-19 limitations some stakeholders were not interviewed due to competing priorities on pandemic response, however this shortfall was covered by annual reports and country end term evaluation reports.

Final Key Informants Interviewed

Respondent Category	Actor(s)
	Project Coordinators (3) Project Implementation Units (5)

²³ American Evaluation Guidelines; Guiding Principles for Evaluation can be found here: <https://www.eval.org/p/cm/ld/fid=51>

Ministries of Health at Country Level and Project Satellite laboratories	National Cancer Control Programme Representative (1) Satellite Laboratory Manager (2) Satellite Laboratory Officers (7) Hospital Director/CEO (2) County Health Department (1) Hospital Engineer (1)
World Bank	Lead Health Specialist/Task Team Leader (1) Senior Health Specialist (1)
Regional Technical Working Groups	Regional Technical Working Groups i.e. a. IDSR (1) b. Operational Research (1) c. Training and Capacity Building (1) d. ICT (1) e. Performance Based Financing (1)
ECSCA-HC	Project Coordinator (1)
Regional Steering Committee	EAC (1)
Technical TB and Health Systems Experts/Advisors	Representative (3)
Africa CDC	Representative (1)
ASLM	Representative (1)
Private Sector	Representative (1)

Country ICR Reporting

ECSCA-HC received and reviewed the country ICR reports from Kenya, Burundi, Tanzania and Uganda and transmitted to the regional consultant towards synthesis of the regional ICR report.

Data Analysis

The quantitative and qualitative data, together with data from documents review and key informant interviews were triangulated to elicit the key findings. The findings were synthesized to reach conclusions, capture lessons learned and make recommendations. Data from the key informant interviews and documents reviews were compiled, clustered and mapped for systematic analysis.

Use of content analysis was used to identify core & emerging themes, consistent patterns and categories that emerge from the qualitative interview data. The qualitative transcripts were guided by the evaluation guidance questions and the actual questions asked, and the report does not personally identify key informants for confidentiality purposes as per global evaluation practice.

Annex 3: Implementation Support/Supervision

The project managed to bring together seasoned public health, TB, laboratory, epidemiology, programme managers and other discipline experts in development and implementation of the project at various phases of the project. This list may not be exhaustive and also included external partner organization with technical expertise and deep knowledge in areas of diagnostics and TB and non-communicable expertise. This was a pioneering programme for the World Bank, ECSA-HC and the countries involved. The list includes:

A. CORE BANK TEAM MEMBERS	
Name	Role
Preparation and Implementation	
Miriam Schneidman	Lead Health Specialist/Task Team Leader
Peter Okwero	Senior Health Specialist
Paolo Carlo Belli	Program Leader
Alaine-Desire Karibwami	Health Specialist
Joel Buku Munyori	Senior Procurement Specialist
Patrick Piker Umah Tete	Senior Financial Management Specialist
Sheila Dutta	Senior Health Specialist
Edward Felix Dwumfour	Senior Environmental Specialist
Henry Amena Amuguni	Senior Financial Management Specialist
Kelly Silva	Laboratory Consultant
B. ECSA TEAM MEMBERS	
Yoswa Dambisya	Director General
Martin Matu	Project Coordinator/Senior Laboratory Specialist
Benedict Mushi	Monitoring and Evaluation Specialist
Willy Were Abwoka	Medical Epidemiologist
Mohamed Mohamed	Public Health Specialist
Ivandra Chirime	TB Specialist
Stephen F. Biduda	Assistant Procurement Officer
C. TECHNICAL PARTNERS	
Jeremiah Chakaya	Senior Chest Physician/ Consultant
Ndhlovu Nqobile	CEO, ASLM
Talkmore Maruta	Senior Biosafety and Biosecurity Officer, Africa CDC
Chimwemwe Chamdimba	Principal Programme Officer, African Union Development Agency (AUDA)

Stanley Sonoiya	Ministry of Health/Formal EAC Health Representative
Neema Omari John	EAC Health Desk Officer
Kennedy Byoona	Technical Officer, GIZ
C. ICR/End Term Evaluation Authors (Regional and Country Teams)	
Chris Masila	Public Health Consultant/Regional ICR Author
Bernard Muture	Project Officer, Kenya
Simeon Kalyesubula-Kibuuka	Monitoring and Evaluation Specialist, Uganda
Stanislas Nyandwi	Country Focal Person, Burundi
Sindabahaye Cyrille	Monitoring and Evaluation Specialist, Burundi
Esther Ngadaya	Senior Research Officer, Tanzania
Jacqueline Mumba	Training Coordinator, Tanzania
Aziza Masoud	Monitoring and Evaluation Specialist, Tanzania
Yahya Abdallah Ipuge	Senior Health Specialist/Consultant, Tanzania

Annex 4. Project Cost by Component

Regional Project Financing Data Sheet Disbursements (Phase 1 and 2)

	Country	Loan ID	Approval	Effectiveness	MTR Review	Original Closing Date	Actual Closing Date	Total Disbursed (XDR)*	Total Disbursed (USD)*
PHASE 1	Kenya	IDA-47320	25-May-2010	01-Oct-2010	03-Mar-2014	30-Mar-2016	30-Mar-2016	15,124,563.49 (100%)	21,342,271.54 (100%)
	Uganda	IDA-47330	25-May-2010	31-Jan-2011	03-Mar-2014	30-Mar-2016	30-Mar-2016	6,410,674.37 (100%)	9,046,102.60 (100%)
	Tanzania	IDA-47310	25-May-2010	07-Sep-2010	03-Mar-2014	30-Mar-2016	30-Mar-2017	10,000,000.00 (100%)	14,111,000.00 (100%)
	Burundi	IDA-H7740	17-May-2012	25-Sep-2012	03-Mar-2014	30-Sep-2017	29-Mar-2019	9,690,471.15 (100%)	13,674,223.84 (100%)
	Rwanda	IDA-H5930	25-May-2010	25-Oct-2010	03-Mar-2014	30-Mar-2016	30-Dec-2016	9,821,959.66 (100%)	13,859,767.28 (100%)
								Subtotal	72,033,365.26
PHASE 2	Kenya	IDA-56160	07-Jul-2015	16-Feb-2016	03-Mar-2014	30-Mar-2020	30-Sep-2020	7,199,991.86 (100%)	10,159,908.51 (100%)
	Uganda	IDA-56150	07-Jul-2015	31-Mar-2016	03-Mar-2014	30-Mar-2020	30-Mar-2021	10,593,572.07 (99.01%)	14,948,589.55 (99.01%)
	Tanzania	IDA-56140	07-Jul-2015	12-Jan-2016	03-Mar-2014	30-Mar-2020	30-Sep-2020	10,699,881.32 (100%)	15,098,602.53 (100%)
	Burundi	IDA-D0470	07-Jul-2015	18-Jul-2016	03-Mar-2014	30-Mar-2020	30-Sep-2020	7,027,131.55 (97.6%)	9,915,985.33 (97.6%)
	Rwanda	NA	NA	NA	NA	NA	NA	NA	NA
								Sub Total	50,123,085.92
								Overall Total for 10 years	122,156,451.18

PHASE 1 EAPHLN Regional Project Financing Breakdown (US\$ 78.5 Million):

Component	Kenya	Uganda	Tanzania	Rwanda
1: Regional Diagnostic & Surveillance Capacity	US\$ 16.285 Million for: • Diagnostics services for vulnerable groups in cross border areas (US\$5.78) • Reference and specialized services (US\$10.063) • Disease surveillance and preparedness (US\$0.44)	US\$ 7.033 Million for: • Diagnostics services for vulnerable groups in cross border areas (US\$3.111) • Reference and specialized services (US\$3.872) • Disease surveillance and preparedness (US\$0.050)	US\$ 9.629 Million for: • Diagnostics services for vulnerable groups in cross border areas (US\$5.738) • Reference and specialized services (US\$3.353) • Disease surveillance and preparedness (US\$0.538)	US\$ 12.015 Million for: • Diagnostics services for vulnerable groups in cross border areas (US\$6.573) • Reference and specialized services (US\$5.189) • Disease surveillance and preparedness (US\$0.253)
2: Joint Training & Capacity Building	• National training (US\$3.154) • Regional training (US\$1.070)	• National training (US\$0.895) • Regional training (US\$0.298)	• National training (US\$0.875) • Regional training (US\$2.655)	• National training (US\$0.479) • Regional training (US\$0.500)
3: Joint Operational Research, Knowledge Sharing/Coordination, & Program Management	• Operational Research and knowledge sharing (US\$1.423) • Regional coordination-ECSA-HC (US\$0.625)	• Operational Research and knowledge sharing (US\$0.705) • Regional coordination-ECSA-HC (US\$0.625)	• Operational Research and knowledge sharing (US\$0.816) • Regional coordination-ECSA-HC (US\$0.625)	• Operational Research and knowledge sharing (US\$0.777) • Regional coordination-ECSA-HC (US\$0.625)

		Program management (US\$0.941)	Program management (US\$0.544)	Program management (US\$0.450)	Program management (US\$0.614)
Total Component Cost		US\$ 23.5 Million	US\$ 10.1 Million	US\$ 15.05 Million	US\$ 15.01 Million

Costs by component		This column is for Burundi's addition	
<i>Component</i>	<i>Original cost (East Africa Public Health Laboratory Networking Project)</i>	<i>Changes with Additional Financing</i>	<i>Revised cost</i>
1: Regional diagnostic & surveillance capacity	US\$ 44.9 million	US\$12.00 million	US\$ 56.9 million
2: Joint training & capacity building	US\$ 9.9 million	US\$1.60 million	US\$ 11.5 million
3: Joint operational research, knowledge sharing/coordination, & program management	US\$ 8.7 million	US\$1.40 million	US\$ 10.1 million
Unallocated			
Total	US\$ 63.5 million	US\$15 million	US\$ 78.5 million

PHASE 2 EAPHLN Regional Project Financing Breakdown (US\$ 50.0 Million):

Component	Kenya	Uganda	Tanzania	Burundi
1: Regional diagnostic & surveillance capacity	US\$7.0 Million for: 1a: Diagnostic services for vulnerable groups in cross border	US\$10.6 Million for: 1a: Diagnostic services for vulnerable groups in cross border	US\$10.0 Million for: 1a: Diagnostic services for vulnerable groups in cross border	US\$7.5 Million for: 1a: Services for vulnerable groups in cross border area (US\$3.9 million) 1b: Disease surveillance and epidemic preparedness (US\$1.2 million)

	areas (US\$6.2 million) • 1b: Disease surveillance and epidemic preparedness (US\$0.8 million)	areas (US\$7.6 million) • 1b: Disease surveillance and epidemic preparedness (US\$3.0 million)	areas (US\$4.3 million) • 1b: Disease surveillance and epidemic preparedness (US\$5.7 million)	• 1c: Reference and Specialized Services (US\$2.4 million)
2: Joint training & capacity building	US\$1.0 Million	US\$1.6 Million	US\$2.3 Million	US\$1.3 Million
3: Joint operational research, knowledge sharing/coordination, & program management	US\$2.0 Million	US\$2.8 Million	US\$2.7 Million	US\$1.2 Million
Total Component Cost	US\$ 10.0 Million	US\$ 15.0 Million	US\$ 15.0 Million	US\$ 10.0 Million

Annex 5. Supporting Documents/ Bibliography

1. Accessed Africa Development Bank website news: <https://www.afdb.org/en/news-and-events/press-releases/african-development-fund-approves-952-million-enhance-coordinated-covid-19-response-east-and-horn-africa-and-comoros-36627>, July 2020
2. Accessed EAPHLN regional website, <https://eaphln-ecsahc.org>, 2020
3. Accessed Rwanda News Times news article on Digital Technology Re-opening Africa <https://www.newtimes.co.rw/opinions/digital-technology-re-opening-africa#.XxLhut5vvn9.whatsapp>, July 2020
4. Accessed World Bank Project Portal, <https://projects.worldbank.org/en/projects-operations/projects-list?searchTerm=East%20Africa%20Public%20Health%20Networking%20Project>, 2020
5. Africa Centres for Disease Control and Prevention's Covid-19 Response: A united, continental strategy <https://blogs.worldbank.org/health/africa-centres-disease-control-and-preventions-covid-19-response-united-continental-strategy>
6. Africa Journal of Health Sciences , Operational Research Publication, Volume 32, Issue No. 4, July - August 2019 <https://www.ajol.info/index.php/ajhs/issue/view/18964>
7. Burundi, Ministry of Health, Implementation Completion and Results Report/Project Achievement Draft Report, 2020
8. East Africa Public Health Laboratory Networking Project Appraisal Document, World Bank, 2010
9. East Africa Public Health Laboratory Networking Project Appraisal Document, World Bank, 2015
10. ECSA-HC, EAPHLNP Regional Project Status Report 2018-2020
11. Evaluation the Economic and Health Impact of Investing in Laboratories in East Africa: Development and Application of a Conceptual Framework, ICF Macro/World Bank, 2011
12. <https://africacdc.org/news-item/african-union-and-africa-centres-for-disease-control-and-prevention-launch-partnership-to-accelerate-covid-19-testing-trace-test-and-track/>
13. <https://blogs.worldbank.org/health/investing-medical-laboratory-networks-will-covid-19-coronavirus-be-wake-call>
14. <https://www.unicef.org/innovation/stories/ict-innovations-now-replicable>
15. Implementation Completion and Results Guidelines (Updated), World Bank 2011
16. Investing in medical laboratory networks: Will Covid-19 (corona virus) be a wakeup call, <https://blogs.worldbank.org/health/investing-medical-laboratory-networks-will-covid-19-coronavirus-be-wake-call>, Schneidman, M, World Bank Blog, 2020
17. Kenya Ministry of Health, Implementation Completion and Results Report/Project End Term Review Report, 2020
18. Schneidman, Miriam & Ma, & Matu, Martin & Nkengasong, John & Githui, Willie & Kalyesubula-Kibuuka, Simeon & Silva, Kelly. (2018). Building Cross-Country Networks for Laboratory Capacity and Improvement. Clinics in Laboratory Medicine. 10.1016/j.cll.2017.10.009.
19. Lehmann, J, Muture, B, Matu, M, Schneidman, M, Performance Evaluation of Public Health Laboratories in Kenya, (Discussion Paper), World Bank, 2018
20. Nirmala, R, Lehmann, J, Opportunities Abound: Public Private Partnerships for Laboratory Services in East Africa (Discussion Paper), World Bank, 2015
21. OECD Criteria of Evaluating Development Assistance, DAC Network of Development Evaluation, 2019
22. Regional EAPHLN Bulletin, Ministry of Health/NPHLS, 2012
23. Technical Brief, Laboratory Systems Strengthening, The Global Fund, 2019
24. Terms of Reference for Consolidated Regional ICR for the EAPHLN Project, ECSA-HC, 2020
25. Uganda, Ministry of Health, Implementation Completion and Results Report/Project Close Out Draft Report, 2020
26. United Republic of Tanzania, Ministry of Health Community Development, Gender Elderly and Children, Implementation Completion and Results Final Report, 2020