MZ: EPTS Implementation Packet

EPTS Implementation Planning Guide

Description: Specific guide to implement OpenMRS in the Mozambique context
Audience: Moz teams
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Overview

This **Implementation Guide** is based on the general [I-TECH Implementation Framework](#) intended to be a template of steps and principles for Implementation Partners (IP) to consider in order to maximise efficiency and minimise risk of implementing, maintaining, and transitioning the OpenMRS EMR software.

This Guide is intended to be useful in developing individual IP and/or Site Implementation Plans, which contain the specific steps, timelines, contacts and metrics used to implement at a specific site. The Plans should include measures for implementing and assessing each step.

This guide has **two primary purposes**.
1.   The identification, tailoring, deployment, and support of information systems at the facility or government unit level.
2.   A guide to sequencing the transition of capabilities and software ownership from one organization to another - as a series of competencies to be sequentially acquired and mastered to build the entire chain of capacity to acquire, tailor, deploy, support, and evolve software systems.

CDC documents reference a DHHS (Department of Health and Human Services) implementation plan template, which provides a framework to describe management, implementation support, and site-specific implementation requirements, though it doesn't specify tasks to the level of detail we are trying to achieve in the I-TECH Framework.[1]

How to Use This Guide

This document contains information for two main areas of implementation,
1.   the roles and competencies needed during the implementation process, and
2.   the main components of the implementation process.

The roles and competencies associated with those roles are listed out in the first section. In the components section, the component is first described, then followed by a table outlining the following details:

Roles Involved	**Responsible**: "The Doer", The responsible person is the individual(s) who actually complete the task. This person is responsible for action/implementation. **Helpers**: "Support", The helper role is for those individuals who

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	assist the responsible individuals as needed. They don't have primary responsibility for completing a task. ● **Acceptance**: "Approver", The acceptance role is for those individuals who have final say on whether a task and/or outputs of the task are completed as needed. ● **Inform**: "Keep in the Picture", This is the individual(s) who needs to be informed after a decision or action is taken. Not involved in the planning or carrying out the activity. They may be required to take action as a result of the outcome. It is a one-way communication.
Dependencies	What tasks or components this component is relying on, and what the status of that dependency is needed to be at (Finished or Started)
Outputs and Impact	What *Actions* or *Documents* are a result of this component
Next Step(s)	What components follow the completion of this component
Resources and Tools	A list of resources and tools that could be used to complete this component

Measuring Success of the Implementation

Before an implementation begins, it should be determined what the definition of success is and how it will be evaluated. For example, is an implementation considered successful once computer equipment and the software is installed, regardless of whether a user enters data? Or is success achieved if users enter data, but there is no data quality measurements in place? If success includes how users are actually interacting with the system, then how do you measure that - by amount of time spent on the system, by number of errors or omissions, by delay in entry of data?

There are many factors to consider to success.   Using the components outlined in the guide below, success could be defined as having each of the components completed.   Or there could be defined criteria that need to be met for each component. Success can even be measured at pre-defined graduated levels of implementation, since some sites may never get to the same level as other sites due to environment, budget, skills, or other considerations. The following is a list of example factors that may be considered in measuring success of an implementation.

- Completion of components in the implementation plan (site assessment, installation, etc)
- Trainings conducted (HF Manager Orientation, System Administration, etc)
- User training evaluations (did users skills and knowledge improve?)
- Use of the system
    - Regular logins to the system
    - # of charts entered by user per time period
    - # of reports generated

- Infrastructure and system performance
    - system availability / uptime
    - power outages - duration and frequency
- User Satisfaction Surveys
- User and System Issue Response and Resolution
- Data Migration and Data Reconstruction Completion and Accuracy
- Data Quality
    - % errors
    - % missing data
    - time difference between encounter and entry of data
- Clinical Care Improvements

HIS Implementation Roles and Competencies

The following is a list of roles associated with an OpenMRS implementation. Some roles may be filled by more than one person, and some people may fill more than one role.

Role	Competencies
Implementation Manager	Acts as Champion of EMR within the organization Project Management Budgeting Communications Activity Coordinator at the organization level
Implementation Analyst	Requirements Gathering ● Workflow Assessment ● Staffing Needs ● Infrastructure Assessment Requirements Analysis and Recommendations Issue and Change Request Analysis and Prioritization Project Management at the HF level
Software Engineer	Requirements Analysis and Recommendations Java Development SQL Data Modeling
User Interface Developer	HTML and CSS Javascript, AJAX, etc. Forms Development
Reports Developer	Jasper Reports SQL Data Modeling

Systems Engineer	Linux Scripting Technologies (Perl, Python, etc) Networking
Procurement	Procurement (hardware, infrastructure) Contracting Negotiations
System Administrator	Virtual Machine and Virtual Appliances Networking
User Support	Deal with issues and requests from end users See document for specifics (Appendix when printed)
HIS Trainer	Training Planning Staff Training Needs Assessments Curriculum Development Coordination of Domain Experts for contributing to materials Training Evaluation Coordination of On-going Mentoring Resources
Health Facility (HF) Manager	Approves and coordinates activities at the HF
Health Facility (HF) Champion	Acts as Champion of EMR within the health facility being implemented See document for specifics (Appendix when printed)
Health Facility (HF) Staff	Support EMR implementation as needed
Health Facility (HF) IT	Support EMR desktop and networking equipment Support EMR server equipment and networking

Implementation Guide

Flowchart Diagram

Event Based Flowchart (Appendix when printed)

Phase 1: Planning

Project Concept (Charter)

Develop a project concept note that describes:
- any background context,
- purpose of the project,
- scope of the project,
- high-level budget,
- strategy for completing the project and the main deliverables of the project,

- governance plan and reporting of the project progress,
- risk assessment and mitigation plan, and
- a description of how the project will be measured for success.

The goal of the project concept document is to gain consensus within the organization and between any partners of the overall scope and structure of the project, along with how the project will unfold and be managed throughout. Over the course of the project, this document will serve as a reference of agreed upon terms of the project, and to help guide the project to its desired outcomes.

Roles Involved	Responsible: Implementation Manager Helpers: Implementation Analyst, Upper Management Acceptance: Governing Committee Inform: HF Managers
Dependencies	None
Outputs and Impact	Document: Implementation Project Concept Note
Next Step(s)	Project Work Plan
Resources and Tools	Implementation Planning Guide (this doc)

Project Work Plan

Develop a detailed work plan that outlines:
- Tasks of the project
- Effort needed for each task
- Dependencies of each task
- Deliverables and milestones
- Resources assigned

The team will use this work plan to track and report the progress of the project.

Roles Involved	Responsible: Implementation Manager Helpers: Implementation Analyst Acceptance: Governing Committee Inform: HF Managers
Dependencies	Project Concept
Outputs and Impact	Document: Project Work Plan
Next Step(s)	Site Selection
Resources and Tools	Implementation Planning Guide (this doc)

	[Implementation Project Plan Template](#)

System Support Strategy

Before any implementation, a system support strategy should be put into place. It is important that users at the HF have immediate access to a support person that can help identify issues and escalate those as needed.

Roles Involved	Responsible: Implementation Manager Helpers: Implementation Analyst Acceptance: Governing Committee Inform: HF Managers
Dependencies	Project Concept
Outputs and Impact	Document: System Support Structure and Workflow
Next Step(s)	
Resources and Tools	[System Support Structure Guide](#)

Site Selection

The process of selecting sites should be based on a pre-determined set of criteria that are used to evaluate whether a site is capable and ready for an EMR implementation. Ideally, sites should be evaluated on the following factors:

1. Identified champion for the implementation within the HF (typically a HF Manager)
2. Infrastructure readiness (consistent power, locations for computers, security, etc)
3. Structured processes and good management practices in place
4. Amount of clinical workflow changes needed to effectively use the system
5. Number of active patients

For implementation plans that include multiple sites, it is best to gain experience by starting with smaller, well organized sites that have good infrastructure in place and need little clinical workflow change. This will allow your team to gain experience into implementation getting the easier sites up and running quickly, showing early success, while getting some of the less ready and more complicated sites ready for implementation on a longer timeframe.

Roles Involved	Responsible: Implementation Analyst Helpers: Implementation Manager, HF Managers, HF Champions, HIS Trainer

	Acceptance: Governing Committee Inform: HF Managers
Dependencies	Project Concept
Outputs and Impact	Action: Sites are prioritized for implementation Action: HF implementation champions identified and engaged for sites
Next Step(s)	Site Assessment
Resources and Tools	Implementation Planning Guide (this document) Implementation Project Plan Template HF Champion Guide

Site Assessment

Once a site has been scheduled for implementation, a site readiness assessment can be performed. The site assessment serves to identify any needs to be addressed at the site for the implementation and to determine the site specific strategy for the implementation. A site assessment includes:
- describing current workflows and any changes needed,
- identifying existing electronic systems for potential data migration and potential dependencies and interactions,
- existing hardware that can be used,
- infrastructure assessment (i.e. power, physical security, networking capacity),
- identification of staff,
- anticipated usage of system (i.e. who, how many patients, how much data),
- historical data evaluation (i.e. paper vs. electronic, number of charts, data quality evaluation),
- planning for computer placement,
- training needs, and
- any special considerations for the HF.

Roles Involved	Responsible: Implementation Analyst Helpers: HF Manager, HF Champion, HF Staff Acceptance: HF Manager Inform: Implementation Manager
Dependencies	Site Selection - *Finished* HF Manager Orientation - *Finished*
Outputs and Impact	Document: Site Implementation Readiness Assessment
Next Step(s)	Implementation Analysis

Resources and Tools	[Site Implementation Readiness Assessment Tool](#)

Implementation Analysis

Using the completed *Site Implementation Readiness Assessment*, specify anticipated workflow(s) of the EMR (POC vs retrospective use, where will steps be done, etc). When considering the workflows, a minimum of two workflows should be anticipated: 1) normal usage, and 2) downtime usage.

In addition, the site-specific network and hardware specification should be produced, identify location and physical security for computers at the site, determine current data use or specific data requests/needs (existing or needed uses for patient care, quality assurance, site level reporting/clinic management, higher level reporting). Lastly, staff must be identified for roles within the facility and a training plan created.

Roles Involved	Responsible: Implementation Analyst Helpers: System Administrator, Procurement, HIS Trainer Acceptance: Implementation Manager Inform: HF Manager
Dependencies	Site Assessment - *Finished*
Outputs and Impact	Decision: Agreed upon site workflow Decision: Key Staff Identified for HF HIS Roles Document: Infrastructure and Equipment Specification Document: Staff Training Plans Document: Physical Security and Disaster Plan Document: Data Migration Plan Document: Data Reconstruction Plan
Next Step(s)	Software Configuration Equipment and Infrastructure Procurement
Resources and Tools	Infrastructure and Equipment Recommendations

Software Concept Dictionary

For OpenMRS, this component also includes the difficulty of defining the Concept Dictionary. There are several options for the concept dictionary within OpenMRS:
- Define local dictionary
- Collaborate with the CIEL Dictionary community

● Use a mixed model of local and CIEL dictionary

The CIEL dictionary is popular and adopted by the global community in general, but is not broadly managed enough to mitigate the risk of time-delayed response to requests for changes or error fixes. However, the advantage is that most concepts are internationally coded with SNOMED and ICD-10, mapped across organizations using it, contributed to by multiple organizations, and often times translated into multiple languages.

Defining an entire local concept dictionary has the advantage of being managed locally, solving the problem of relying on external organizations to update the dictionary. However, defining an entire database of concepts can be difficult and time consuming, and often times ends up with errors, duplicates, and mis-defined concepts that are unable to be coded properly. This results in difficulties scaling, for example, when attempting an interoperable eHealth architecture to share patient and reporting data.

To take advantage of both of these approaches, it is possible to setup a mixed model that uses the CIEL dictionary as a base, but adds/updates/deletes concepts locally for expediency, and then merges updates from CIEL as possible to take advantage of the community contributions of concepts, codings, and translations.

Regardless of the approach taken, governance will need to be planned for and setup for how the concept dictionary will be managed, including the adds/updates/deletes, coding, and translation of concepts in the future.

Roles Involved	Responsible: Software Engineer Helpers: Implementation Analyst Acceptance: Implementation Analyst Inform: Implementation Manager
Dependencies	Implementation Analysis - *Started*
Outputs and Impact	Action: Concept Dictionary configured Action: Concept Dictionary Governance determined
Next Step(s)	Data Migration Data Reconstruction Acceptance Testing
Resources and Tools	

Software Configuration

Development of new forms, new reports, and configuring a system's optional items for specific Health Facility implementations.

Roles Involved	Responsible: Software Engineer Helpers: Implementation Analyst, HF IT Acceptance: Implementation Analyst
Dependencies	Implementation Analysis - *Started*
Outputs and Impact	Action: Forms, reports, and options in software configured for HF Document: Software Release Note Document: Technical Documentation Document: User Manual
Next Step(s)	Data Migration Data Reconstruction Acceptance Testing
Resources and Tools	

Procurement of Infrastructure and Equipment

Procurement of Power systems, Network systems, and Hardware based on the Infrastructure and Equipment Specification document from the Implementation Analysis task. Contracting for any installation should be conducted in this task as well.

Roles Involved	Responsible: Procurement Helpers: Implementation Analyst, System Administrator Acceptance: Implementation Analyst, System Administrator Inform: Implementation Manager, HF Manager
Dependencies	Implementation Analysis - *Started* Infrastructure and Equipment Specification - *Finished*
Outputs and Impact	Action: Infrastructure and Equipment Procured Action: Installation contract in place
Next Step(s)	Equipment and Infrastructure Installation HF System Administration Training
Resources and Tools	

Phase 2: Installation

Installation of Infrastructure and Equipment

Deliver and Install infrastructure, including systems for reliable power   (inverters, batteries, UPS, solar, etc.) , Server and client hardware, any necessary access to offsite servers, mobile devices, site level network, internet connectivity, and any necessary security alterations.

Roles Involved	Responsible: System Administrator Helpers: Implementation Analyst, HF IT Acceptance: HF Manager, Implementation Analyst Inform: Implementation Manager
Dependencies	Procurement - *Finished*
Outputs and Impact	Action: Infrastructure and Equipment Installed Document: HF Network Diagram and System Configuration
Next Step(s)	Server Setup and Software Installation
Resources and Tools	System Networking SOP End User Desktop Setup SOP Data Security SOP

Server Setup and Software Installation

Configure server, install and configure virtual machine environment, install virtual machine appliance with OpenMRS software. The specific tasks in this component are dependent upon the hosting model that is being implemented - hosted centrally and connected to through the Internet (ASP model), or local hosted within the facility (standalone model).

Roles Involved	Responsible: System Administrator Helpers: Implementation Analyst, HF IT Acceptance: Implementation Analyst Inform: HF Manager
Dependencies	Procurement - *Finished*
Outputs and Impact	Action: Server setup and software Installed Document: HF Network Diagram and System Configuration

Next Step(s)	Data Migration Data Reconstruction System Acceptance Testing HF Mentor Training HF User Training
Resources and Tools	EMR Server Setup and Configuration SOP Data Security SOP HF Network Diagram and System Configuration Template

Data Migration

Data Migration from previous electronic health information systems involves the mapping of concepts between systems, scripting/transformation of data, and validation testing of the migrated data.

Roles Involved	Responsible: Software Engineer Helpers: HF Staff Acceptance: HF Manager Inform: Implementation Analyst
Dependencies	Software Configuration - *Started* Concept Dictionary configuration - *Finished*
Outputs and Impact	Document: Test Plan for Migrated Data Action: Relevant data from previous electronic systems migrated and validated
Next Step(s)	Acceptance Testing
Resources and Tools	Data Migration Validation Testing Methodology

Data Reconstruction

Manual entry must be done in order to transfer any historical clinical records from paper to OpenMRS. This may require transformation and "reconstruction" of a medical record. For the reconstruction of the historical record, consider focusing on the minimum key data variables, such as those needed for PEPFAR reporting, rather than all of the data. Also consider only focusing on those patients necessary for reporting, such as patients from the past year. The remainder information can be pulled from the paper chart if needed for a clinical consult.

To determine staffing, use an algorithm for the **number of records / per hour / per data entry clerk**. This number will vary depending on the number of data elements that is decided to be entered into the system, as well as, the workflow in the electronic system that must be followed to enter the system, and the expected performance / availability of the system. For example: 30 records / day / person.

Roles Involved	Responsible: Data Entry Clerk(s) Helpers: HF Staff Acceptance: HF Manager Inform: Implementation Analyst
Dependencies	Software Configuration - *Finished*
Outputs and Impact	Document: Test Plan for Reconstructed Data Action: Data from paper sources are entered and validated in system
Next Step(s)	Acceptance Testing
Resources and Tools	Data Reconstruction Validation Testing Methodology

System Acceptance Testing

This step may be performed multiple times, depending on the timeline of software configuration, data migration, and data reconstruction. This step is intended to gain buy-off on the functionality of the system by key stakeholders after every software release of the system, **before** the system is put into production at the site. However, if data migration and reconstruction are performed on other timelines, this step may be used to gain buy-off on the completion of those tasks.

Roles Involved	Responsible: Implementation Analyst Helpers: HF Manager, HF Staff Acceptance: HF Manager Inform: Implementation Manager
Dependencies	Software Installation - *Finished* Software Configuration - *Finished*
Outputs and Impact	Action: Stakeholders have approved system
Next Step(s)	Training
Resources and Tools	System Acceptance Testing Tool

Training

- managers - alert to changes capabilities (ideally after site assessment)
- mentors - mentorship, system use, and relationship building (after installation, before release to production)

- users - functional training (after installation, before release to production)
- system administrators - train in maintenance steps (before and during installation)
- managers - train in data use and reports (any time after installation)

Roles Involved	Responsible: HIS Trainer Helpers: Implementation Analyst, System Administrator, HF Manager, HF Champion, HF Staff Acceptance: HF Manager Inform: Implementation Manager
Dependencies	Software Configuration - *Finished* System Acceptance Testing - *Started*
Outputs and Impact	Documents: Training Curriculum Customized for HF Needs Action: Participants trained and evaluated
Next Step(s)	HF Pilot
Resources and Tools	HF Manager Orientation Curriculum Mentor Curriculum User Curriculum System Administration Curriculum

HF Pilot

After users have been trained, run a limited pilot of the OpenMRS system in parallel to any previous system (paper or otherwise) to allow users to test their knowledge in using the system and make sure they fully understand how to perform their job with the new system in place. At the end of the pilot period, use the "Pilot to Production Readiness Assessment Tool" to measure whether the site is ready to go to production use of the system.

Roles Involved	Responsible: Implementation Analyst Helpers: HF Manager, HF Staff Acceptance: HF Manager Inform: Implementation Manager
Dependencies	System Acceptance Testing - *Finished* Training - *Finished*
Outputs and Impact	Action: Users using system in a timely manner, consistently and accurately. Action: HF passes pilot to production readiness assessment.

Next Step(s)	HF Pilot to Production
Resources and Tools	Pilot to Production Readiness Assessment Tool

HF Pilot to Production

Once the HF has passed the readiness assessment in their pilot, the system should be moved into production.

Roles Involved	Responsible: Implementation Analyst Helpers: HF Manager, HF Staff Acceptance: HF Manager Inform: Implementation Manager
Dependencies	HF Pilot - *Finished*
Outputs and Impact	Action: New system is in use for production; previous systems are deprecated and cycled out of production
Next Step(s)	
Resources and Tools	

Phase 3: Maintenance

Data Use Support

QI, Report Generation, and Feedback.

Roles Involved	Responsible: Helpers: Acceptance: Inform:
Dependencies	HF Pilot to Production - *Finished*
Outputs and Impact	
Next Step(s)	
Resources and Tools	Data Quality SOP

System Monitoring

Perform routine monitoring of the system and maintain metrics/indicators for
- server performance (e.g. uptime/shut downs, % CPU load, memory utilization, etc)
- application usage (e.g. # logins per day per user, patient-level transactions, item level transactions such as # forms entered)
  - application independent (e.g. # logins/day)
  - application dependent (e.g. # test results transmitted/day)
- user issue monitoring (e.g. bug reporting, community engagement, suggestions, functionality issues, etc.)
- data use monitoring (e.g. # reports generated per day)
- data quality monitoring (e.g. using statistical methods to look for drop-outs and spikes in expected patterns of data that might represent interruptions in completeness. looking for delays between visit data and data entry dates that might represent interruptions in timeliness. accuracy is hard to measure, but looking for variance from expected norms might help expose significant patterns as proxies for accuracy issues. (Need to think about all three of these dimensions.)
- service delivery monitoring (e.g. regular review of dashboard including indicators such as enrollment, ART, loss-to-follow-up, PMTCT testing, malaria, quality of care exceptions, etc)

Roles Involved	Responsible: Implementation Analyst Helpers: System Administrator, Software Engineer Acceptance: Implementation Manager Inform: HF Manager, Upper Management
Dependencies	HF Pilot to Production - *Finished*
Outputs and Impact	
Next Step(s)	
Resources and Tools	User Support SOP System Monitoring SOP

System Maintenance

Network problems/troubleshooting and Hardware problems.

Roles Involved	Responsible: HF IT Helpers: System Administrator Acceptance: HF Manager Inform: Implementation Manager
Dependencies	HF Pilot to Production - *Finished*

Outputs and Impact	
Next Step(s)	
Resources and Tools	User Support SOP System Maintenance SOP

System Upgrades

Software upgrade process:
- software update
- data migration
- IT testing of new system (verification of data accuracy and basic features)
- system acceptance testing
- release for clinical use

Roles Involved	Responsible: HF IT, System Administrator Helpers: System Administrator Acceptance: HF Manager Inform: Implementation Manager
Dependencies	HF Pilot to Production - *Finished*
Outputs and Impact	
Next Step(s)	
Resources and Tools	User Support SOP System Upgrade SOP