

SUPPLEMENTARY MATERIAL S5

# 24-Month Implementation Roadmap

## Detailed Timeline, Milestones, and Phase Gates

### 1. Overview

Preparedness Intelligence Unit (PIU) implementation follows a structured 24-month pathway proceeding through four distinct phases: Foundation (Months 1–6), Pilot (Months 7–12), Scale-Up (Months 13–18), and Full Operations (Months 19–24). Each phase culminates in a formal phase gate review with explicit go/no-go decision criteria.

This roadmap is designed for countries with existing Public Health Emergency Operations Centres (PHEOCs) and functional District Health Information Software 2 (DHIS2) platforms. Countries starting from lower baselines should extend timelines by 6–12 months and complete prerequisite infrastructure before commencing this roadmap.

### 2. Phase Gates and Decision Criteria

Phase gates prevent premature advancement when foundational elements are incomplete. Table 1 defines the four critical phase gates, timing, go criteria, and actions if criteria are not met.

**Table 1. PIU Implementation Phase Gates**

| Phase Gate                | Timing       | Go Criteria  | No-Go Decision  |
|---------------------------|--------------|--|---|
| Gate 1: Foundation        | End Month 6  | MOU signed by all agencies; Legislation/regulation approved; Data Governance Committee established; PIU Lead recruited; Budget committed for 24 months   | Pause implementation for 3 months to resolve legal/political barriers. Do NOT proceed to pilot without governance foundation.       |
| Gate 2: Pilot Readiness   | End Month 12 | All 4 PIU staff recruited; Dashboard operational in 2–3 districts; First quarterly simulation completed; Data quality ≥80% completeness; At least 1 successful forecast validated                | Extend pilot phase 3 months. If still not meeting criteria at Month 15, conduct lessons-learned review before deciding on scale-up. |
| Gate 3: Scale-Up Decision | End Month 18 | Alert-to-response time (ART) ≤48 hours in pilot districts; Dashboard expanded to 50% of country; Domestic budget line secured for Year 3; Stakeholder satisfaction ≥70%; No major data breaches  | Maintain pilot at current scale for additional 6 months. Commission external evaluation to identify barriers to scale-up.           |
| Gate 4: Full Operations   | End Month 24 | National dashboard operational; 7-1-7 target met for ≥70% of priority diseases; After-Action Review (AAR) closure rate ≥70%; Published annual performance report; Donor transition plan approved | PIU continues operations but classified as 'maturing' rather than 'operational'. Intensive technical support for 12 months.         |

### 3. Phase 1: Foundation (Months 1–6)

**Objective: Establish legal, governance, and financing foundations enabling lawful PIU operations. Recruit PIU Lead and prepare for operational launch.**

#### Month 1: Mobilization

### Key Activities

- Ministerial directive launching PIU establishment process
- Appoint PIU Implementation Task Force (PHEOC Director as chair; representatives from IT, legal, Human Resources (HR), finance)
- Convene inter-ministerial stakeholder meeting with all data-sharing agencies
- Present PIU concept and operational requirements to stakeholders
- Establish technical working group for Memorandum of Understanding (MOU) drafting (see Supplementary Material S3)

### Deliverables

- ✓ Ministerial directive approved and communicated
- ✓ Implementation Task Force established with Terms of Reference
- ✓ Stakeholder meeting minutes documenting agency commitments
- ✓ MOU drafting timeline agreed

### Responsible Party

PHEOC Director (overall); Ministry of Health Legal Department (MOU drafting)

### Risks and Mitigation

**RISK:** Agencies reluctant to commit to data sharing

**MITIGATION:** Emphasize mutual benefits; start with 2–3 committed agencies and expand later

**RISK:** Competing priorities delay stakeholder engagement

**MITIGATION:** Secure ministerial directive with specific timeline expectations

## Month 2: Legal Foundation

### Key Activities

- Draft inter-ministerial MOU using template (Supplementary Material S3, Table 1)
- Conduct legal analysis: Is legislation required or is MOU sufficient?
- If legislation needed, draft amendment to Public Health Act or ministerial regulation
- Circulate MOU draft to all agencies for legal review
- Begin recruitment process for PIU Lead (advertise position)

### Deliverables

- ✓ MOU first draft completed
- ✓ Legal opinion on legislative requirements
- ✓ If legislation required: draft amendment prepared
- ✓ PIU Lead job advertisement published

### Risks and Mitigation

**RISK:** Legal review identifies barriers in data protection law

**MITIGATION:** Engage Data Protection Authority early; seek public health exemptions

**RISK:** Slow legislative process

**MITIGATION:** Explore ministerial regulation option to avoid parliamentary delays

## Month 3: Governance Establishment

### Key Activities

- Finalize MOU incorporating feedback from all agencies

- Submit legislation/regulation for approval (if required)
- Establish Data Governance Committee with Terms of Reference (Supplementary Material S3, Section 6)
- Recruit PIU Lead: shortlist candidates, conduct interviews
- Develop Data Protection Impact Assessment (DPIA) for PIU operations

### Deliverables

- ✓ MOU final version ready for signature
- ✓ Legislation/regulation submitted to Cabinet or Minister
- ✓ Data Governance Committee established; first meeting scheduled
- ✓ PIU Lead selected (pending final approvals)
- ✓ DPIA first draft completed

## Month 4: Legal Approvals and Budgeting

### Key Activities

- MOU signature ceremony with ministers/agency heads
- Legislation/regulation approved by Cabinet or Minister
- PIU Lead formally appointed and onboarded
- Ministry of Finance (MoF) budget allocation request submitted for PIU Year 1–2 costs
- DPIA finalized and approved by Data Protection Authority

### Deliverables

- ✓ MOU signed by all parties
- ✓ Legal framework for data sharing established
- ✓ PIU Lead onboarded
- ✓ Budget request submitted
- ✓ DPIA approved

## Month 5: Technical Infrastructure

### Key Activities

- PIU Lead oversees procurement of IT hardware (computers, servers, connectivity equipment)
- Information Technology (IT) team installs and configures DHIS2 analytics environment
- Role-based access controls (see Supplementary Material S3, Table 2) implemented in DHIS2
- Secure data-sharing pipelines established with meteorological service and laboratory networks
- PIU workspace within PHEOC prepared

### Deliverables

- ✓ Hardware procured and installed
- ✓ DHIS2 analytics environment configured
- ✓ Role-based access controls implemented
- ✓ At least 2 data-sharing pipelines operational (eIDSR + 1 other source)
- ✓ PIU workspace ready


## Month 6: Team Completion and Pre-Launch

### Key Activities

- Recruit remaining 3 PIU staff (Data Scientist, Operations Planner, Communications Officer) — see Supplementary Material S1
- All staff complete onboarding and security training
- PIU standard operating procedures (SOPs) drafted and approved
- First pilot district identified and district health team briefed
- Phase Gate 1 formal review conducted

### Phase Gate 1 Review (Go/No-Go)

- ✓ MOU signed by all agencies
- ✓ Legislation/regulation approved
- ✓ Data Governance Committee established
- ✓ PIU Lead recruited
- ✓ Budget committed for 24 months

 **GO/NO-GO DECISION:** If all criteria met, proceed to Phase 2 Pilot. If not, pause implementation for up to 3 months to resolve barriers. Do NOT proceed to pilot without legal and governance foundation in place.

## 4. Phase 2: Pilot (Months 7–12)

**Objective:** Launch PIU operations in 2–3 pilot districts; demonstrate technical feasibility; produce first routine intelligence products; complete first quarterly simulation and AAR.

### Month 7: Operational Launch

#### Key Activities

- All 4 PIU staff operational; daily schedule begins (see Supplementary Material S1, Section 6)
- First integrated daily dashboard operational in pilot districts
- Daily electronic Integrated Disease Surveillance and Response (eIDSR) on DHIS2 data pulls configured and tested
- Weekly decision meeting schedule established with PHEOC Director
- Begin 7-1-7 performance tracking across priority diseases

#### Deliverables

- ✓ Daily dashboards operational (≥80% of working days in first month)
- ✓ Weekly decision meeting instituted
- ✓ 7-1-7 tracking initiated for ≥2 priority diseases

### Months 8–9: Forecasting Development

#### Key Activities

- Data Scientist builds first probabilistic forecast models for priority diseases (cholera, measles)
- Climate data integration with meteorological service operationalized
- First weekly risk briefs produced using Supplementary Box S1 template
- Forecast performance tracking initiated (Brier score calculation)
- Data quality improvement plan developed based on completeness metrics

#### Deliverables

- ✓ At least 1 probabilistic forecast model operational
- ✓ Climate data integrated into dashboard

- ✓ Weekly risk briefs produced on schedule
- ✓ Brier score baseline established

## Month 10: First Simulation Exercise

### Key Activities

- Plan and conduct first quarterly simulation exercise
- Scenario development: test PHEOC activation using PIU forecast as trigger
- Debrief and complete first formal AAR within 14 days
- Identify and log corrective actions with owners and deadlines
- Present AAR findings to PHEOC Director and Data Governance Committee

### Deliverables

- ✓ Simulation exercise completed
- ✓ AAR written and approved within 14 days
- ✓ Corrective action log established
- ✓ AAR presented to Data Governance Committee

## Months 11–12: Pilot Evaluation

### Key Activities

- Conduct formal pilot evaluation: collect ART data, forecast accuracy, stakeholder satisfaction
- Compare ART against pre-pilot baseline (if available) and ≤48-hour target
- Survey district health officers and PHEOC leadership on product utility
- Document lessons learned; update SOPs based on experience
- Phase Gate 2 formal review conducted

### Phase Gate 2 Review (Go/No-Go)

- ✓ All 4 PIU staff recruited and operational
- ✓ Dashboard operational in 2–3 districts
- ✓ First quarterly simulation completed with documented AAR
- ✓ Data quality ≥80% completeness in pilot districts
- ✓ At least 1 successful forecast validated

**GO/NO-GO DECISION:** If criteria met, proceed to Phase 3 Scale-Up. If not, extend pilot phase by 3 months. If still not meeting criteria at Month 15, conduct comprehensive lessons-learned review before deciding on scale-up.

## 5. Phase 3: Scale-Up (Months 13–18)

**Objective:** Expand PIU operations to 50% of the country; institutionalize domestic financing; achieve ≤48-hour ART target in pilot districts.

### Months 13–15: Geographic Expansion

- Expand dashboard to additional districts based on priority (burden, connectivity, political support)
- Hire additional analysts or district-level data officers to support expanded coverage
- Adapt PIU products to district-specific priority hazards
- Conduct second quarterly simulation exercise; improve on first AAR corrective actions
- Submit Year 3 domestic budget request to Ministry of Finance (MoF)

## Deliverables


- ✓ Dashboard coverage expanded to  $\geq 30\%$  of districts
- ✓ Second simulation and AAR completed
- ✓ AAR closure rate from Simulation 1 documented
- ✓ Year 3 budget request submitted

## Months 16–18: Institutionalization

- Secure domestic budget line for PIU in Year 3 national budget
- Integrate PIU performance metrics into PHEOC annual reporting framework
- Conduct knowledge exchange visit with PIUs from other countries (Africa CDC and WHO facilitation)
- Develop PIU sustainability plan: workforce development, equipment replacement cycles, system upgrades
- Present scale-up results to Data Governance Committee and request approval for national expansion

## Phase Gate 3 Review (Go/No-Go)

- ✓ ART  $\leq 48$  hours in pilot districts
- ✓ Dashboard operational in 50% of country
- ✓ Domestic budget line secured for Year 3
- ✓ Stakeholder satisfaction  $\geq 70\%$
- ✓ No major data breaches or governance failures

 **GO/NO-GO DECISION: If criteria met, approve national expansion. If not, maintain current scale and intensify support for 6 months.**

## 6. Phase 4: Full Operations (Months 19–24)

**Objective: Achieve national PIU coverage; meet 7-1-7 targets for priority diseases; demonstrate full operational capability; transition to routine PHEOC function.**

### Months 19–20: National Expansion

- Expand dashboard to 100% of districts
- Establish PIU as permanent function within PHEOC organizational structure
- Recruit permanent replacement staff for any positions with high turnover risk
- Integrate PIU training into national Field Epidemiology Training Programme (FETP) curriculum
- Launch public-facing annual performance report with 7-1-7 metrics

## Deliverables

- ✓ National dashboard coverage
- ✓ PIU institutionalized in PHEOC
- ✓ Annual performance report published

### Months 21–22: Optimization and Innovation

- Introduce advanced analytics: machine learning models for outbreak prediction, geospatial risk mapping
- Expand to additional data sources: social media signals, pharmacy sales, school absenteeism
- Develop mobile application for district health officers to receive PIU alerts
- Conduct retrospective analysis: outbreak responses with versus without PIU intelligence
- Document PIU model for replication by other countries

### Deliverables

- ✓ Advanced analytics operational
- ✓ Mobile alert system launched
- ✓ Impact evaluation completed
- ✓ Replication guide published

### Months 23–24: Transition and Evaluation

- Complete final third-party evaluation of 24-month implementation
- Publish peer-reviewed article on PIU implementation experience
- Transition from project management to routine operations
- Donor exit: complete handover of all financing to domestic budget
- Develop 5-year PIU strategic plan aligned with national PHEOC strategy
- Host regional workshop sharing PIU lessons learned

### Phase Gate 4 Review (Go/No-Go)

- ✓ National dashboard operational
- ✓ 7-1-7 target met for ≥70% of priority disease outbreaks
- ✓ AAR closure rate ≥70%
- ✓ Annual performance report published
- ✓ Donor transition complete

**FINAL DECISION:** PIU classified as 'operational' if all criteria met, or 'maturing' if performance close but not fully meeting targets. Continue operations regardless, with intensity of support adjusted to classification.

## 7. Risk Mitigation Strategies by Implementation Phase

| Phase                          | High-Risk Areas  | Mitigation   |
|--------------------------------|--|--|
| Foundation (Months 1–6)        | Legal approvals; recruitment; budget                               | Secure ministerial directive early; offer competitive salaries; develop contingency budget         |
| Pilot (Months 7–12)            | Data quality; forecast accuracy; stakeholder buy-in                | Intensive district support; transparent communication about developmental nature; regular feedback |
| Scale-Up (Months 13–18)        | Geographic expansion overwhelming capacity; performance regression | Phase expansion carefully; hire additional analysts; automate processes                            |
| Full Operations (Months 19–24) | Donor exit; workforce retention; sustainability                    | Secure domestic budget early; competitive civil service salaries; career progression pathways      |

## 8. Conclusion

This 24-month roadmap provides a structured pathway from concept to full operational PIU. The phase gate approach ensures that implementation proceeds systematically, with formal reviews preventing premature advancement when foundational elements are incomplete.

Countries should adapt timelines to national context while maintaining the overall sequencing: governance before operations, pilot before scale-up, evidence before full expansion. Rigorous adherence to phase gate criteria creates accountability and builds stakeholder confidence that PIU implementation is proceeding soundly.

This document should be read alongside Supplementary Material S1 (staffing and SOPs), S3 (governance and legal frameworks), S4 (budget templates and financing), and S6 (performance monitoring and evaluation framework).

### List of Abbreviations

| Abbreviation | Full Term  |
|--------------|--|
| AAR          | After-Action Review  |
| Africa CDC   | Africa Centres for Disease Control and Prevention                                |
| ART          | Alert-to-Response Time   |
| DHIS2        | District Health Information Software 2   |
| DPIA         | Data Protection Impact Assessment  |
| eIDSR        | Electronic Integrated Disease Surveillance and Response                          |
| FETP         | Field Epidemiology Training Programme  |
| HR           | Human Resources  |
| IT           | Information Technology   |
| KPI          | Key Performance Indicator  |
| MoF          | Ministry of Finance  |
| MoH          | Ministry of Health   |
| MOU          | Memorandum of Understanding  |
| PHEOC        | Public Health Emergency Operations Centre  |
| PHEM         | Public Health Emergency Management   |
| PIU          | Preparedness Intelligence Unit   |
| RRT          | Rapid Response Team  |
| SOP          | Standard Operating Procedure   |
| USD          | United States Dollars  |
| WHO          | World Health Organization  |
| 7-1-7        | Detect within 7 days, notify within 1 day, initiate early response within 7 days |