

USAID GLOBAL HEALTH SUPPLY CHAIN PROGRAM
PROCUREMENT AND SUPPLY MANAGEMENT

**RWANDA PUBLIC HEALTH
NATIONAL PRODUCT CATALOG
NEED ASSESSMENT REPORT**

Version I



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Acronyms

| | |
|---------------|--|
| APQC | American Productivity and Quality Center |
| EDI | Electronic Data Interchange |
| GDSN | Global Data Synchronization Network |
| GHSC | Global Health Supply Chain |
| GLN | Global Location Number |
| GSI | Global Standards Organization |
| GTIN | Global Trade Item Number |
| IT | information technology |
| MIS | Management Information System |
| MOH | Ministry of Health |
| OMS | Order Management System |
| PHSC | Public Health Supply Chain |
| PHSCIS | Public Health Supply Chain Information Systems |
| PSM | Procurement and Supply Management |
| SCOR | Supply Chain Operations Reference |
| TMS | Transportation Management System |
| UNFPA | United Nations Population Fund |
| USAID | U.S. Agency for International Development |
| WMS | Warehouse Management System |
| SCISMM | Supply Chain Information System Maturity Model |

I. EXECUTIVE SUMMARY

This report is based on a holistic assessment of public health supply chain information systems in Rwanda. The assessment was done through site visits to MPPD Warehouse and meetings with key stakeholders from MOH, RFDA, RBC, MPPD, RISA and NISR. Assessment also utilized Supply Chain Information System Maturity Model (SCISMM), developed by GHSC-PSM based on APICS' SCOR Model Framework (<http://www.apics.org/apics-for-business/frameworks/scor>) and APQC Framework (<https://www.apqc.org/about>). The maturity model helped organize the results in a holistic way and identify critical opportunities for improvement. The details of the assessment can be found in Section 3.

The assessment highlighted strengths and weaknesses across the existing public health supply chain information systems. Most importantly, the assessment identified a critical gap and improvement opportunity in master data management, specifically product master data, which is foundational for planning as well as all transactions and commodity traceability. This critical opportunity has been identified as needing immediate attention. However, this report highlights other long term opportunities for information systems' improvements.

Based on the identification of immediate term focus area a key activity to implement a system to facilitate efficient and effective management of product master data has been recommended. This activity will establish a robust process to manage product master data at a National level using a system called National Product Catalog system (NPC). NPC will store all public health commodity information and also align with Global Standards identification (GS1) to promote standardization across public health domain. NPC will become the primary source of public health commodity information and will ensure all downstream systems refer to this single version of truth.

Recommendations and next steps identified have been categorized as below to facilitate a well-orchestrated progress of implementing a robust product master data management.

- Organizational – This relates to the people related activities needed to support and sustain product master data management processes.
 - **Establish a Data Governance Group** with stakeholders from MOH, RFDA, MPPD and any other organization that might use product master data. Please refer to section 4.4 for details of this group.
 - **Establish a Catalog Manager Role** and identify resource/s that will fill this role.
 - **Identify technical resource/s** that will provide technical support for the system that will be used for NPC.
- Process – This relates to the processes needed to manage product master data.
 - **Define Standard Operating Procedures (SOPs)** for product master data management
 - **Harmonize Product Master Data** to have a single version of truth at National level.
- Technology – This relates to the systems that need to be in place to facilitate efficient and effective management & dissemination of product master data
 - **Identify and procure a system for NPC**
 - **Design, Develop and Implement NPC**

2. RWANDA PUBLIC HEALTH – SUPPLY CHAIN INFORMATION SYSTEMS

1.1 CONTEXT

Rwanda has made many gains in ICT infrastructures over the past few years. These include achievements in the automation of systems that are operational at many levels of Rwanda's Public Health Supply Chain (WMS, HMIS, SISCom, RapidSMS, e-LMIS, etc.) and incorporated an innovative mix of paper-based and technological solutions. While these health information systems have provided improvements in operational efficiencies, they are not all integrated thus limiting the ability to operate the supply chain seamlessly and in a secure way. This also limits the ability to gain end-to-end visibility of the entire public health supply chain and address supply chain issues such as stock outs, overstocking, wastage etc on a timely fashion. These open issues provide opportunities to further streamline and automate processes from planning to dispensing that will ultimately enable true end-to-end supply chain visibility as well as commodity traceability.

One major foundational opportunity is to enable all public health as well as private health supply chain systems to interoperate. In order to interoperate, the various disparate systems involved such as WMS, eLMIS, HMIS etc from the public sector as well as Ishyiga from the private sector, will need to understand each other's transactional information. A key element of that information is product details.

2.1.1 PUBLIC HEALTH SUPPLY CHAIN SYSTEMS ASSESSMENT

A Short Term Technical Assistance (STTA) was conducted in Mar-Apr 2019 for 2 weeks in Rwanda by USAID GHSC PSM team members. The STTA focused mainly on the following key areas with immediate focus on the first 3 areas.

1. Rwanda Public Health Supply Chain Information System (PH SC IS) Roadmap
2. National Product Catalog Management
3. Rwanda Public Health Data Analytics Platform
4. Synchronized Planning & Visibility through Dashboards
5. National Traceability & Verification

During the STTA, several stakeholders, including leadership teams across MOH, RBC, Rwanda FDA, MPPD and RISA highlighted key priorities for PHSCIS that includes data standardization, interoperable health information systems and end-to-end data visibility. An overall assessment of PHSCIS landscape in Rwanda was conducted through site visits, interviews and meetings with key stakeholders across various organizations such as MOH, Rwanda FDA, RBC, MPPD, RISA and NISR. The purpose of this assessment was,

- to understand current strengths & capabilities,
- to identify challenges, gaps & opportunities, and

- to provide immediately actionable short-term recommendations as well as implementation roadmaps for the long-term

The below diagram captures the key PHSCIS focus areas and their alignment towards end-to-end public health supply chain visibility in Rwanda.

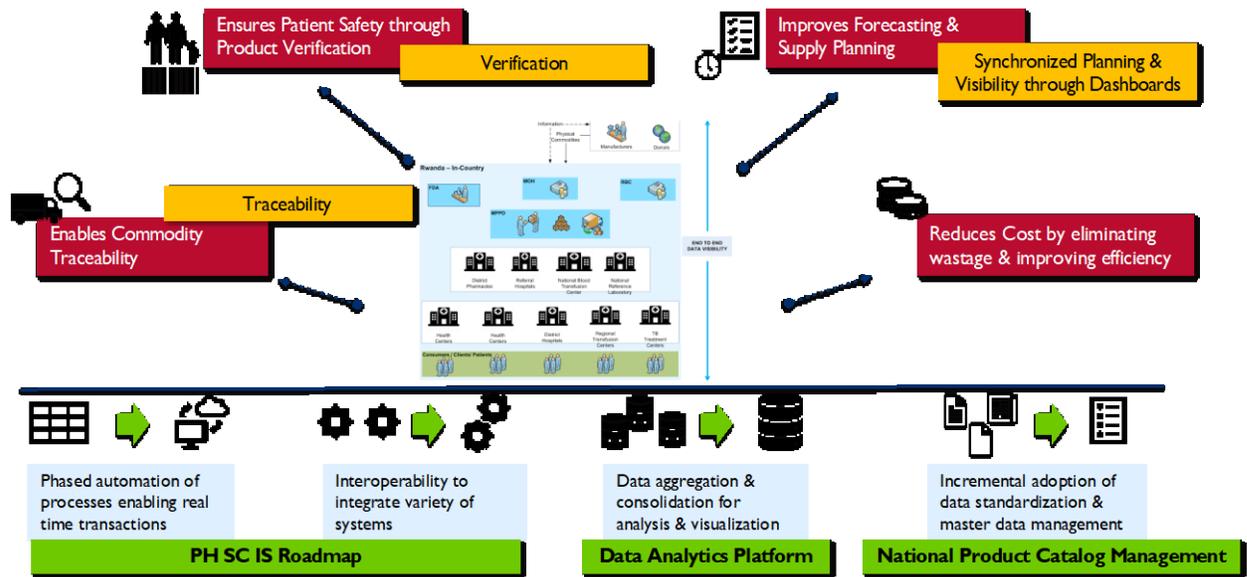


Figure 1 – Rwanda PHSCIS Focus Areas

3. RWANDA PHSCIS ASSESSMENT

As part of the STTA, the team met with key stakeholders from USAID and Government of Rwanda, including Ministry of Health, Rwanda Biomedical Centre (RBC), Medical Procurement and Production Division (MPPD), Rwanda Food & Drug Administration, Rwanda Information Society Authority (RISA) and National Institute of Statistics Rwanda (NISR).

The team visited MPPD’s warehouse, a District Pharmacy in Kicukiro and a District Hospital in Masaka to analyze supply chain operations, identify any system gaps and constraints and discuss supply chain processes and challenges with key stakeholders at those sites.

Interviews, discussions and site visits provided insights in to the following areas:

- Key supply chain processes in Warehouse Management System (WMS) and eLMIS around warehousing and distribution operations.
- Data gathering mechanism and data flow in WMS and eLMIS
- Rwanda FDA’s approach to register and license public health commodities
- Product identification and product classification methodologies used in various systems
- Information and Communications Technology approach for application systems and data analytics in health sector, as recommended by RISA and NISR

3.1.1 OVERALL FINDINGS

The various interviews, discussions and site visits during the STTA highlighted the current key Strengths, Opportunities and Constraints.

Strengths:

- Supply Chain Processes
 - Key processes such as procurement, ordering, distribution and warehousing are well organized, managed and some are well documented.
- Timely Data
 - Users aware of the importance of timely data capture through systems and enforcing the same
- System Usage
 - Most supply chain data captured through systems
- ICT initiatives
 - Key initiatives such as Data Analytics Platform are already underway
- MOH Commitment
 - MOH recognizes and is committed to the importance of key Supply Chain objectives such as End-to-End Visibility and Traceability
- Formation of Rwanda FDA
 - Provides opportunity to streamline pharmaceutical products registration and master data

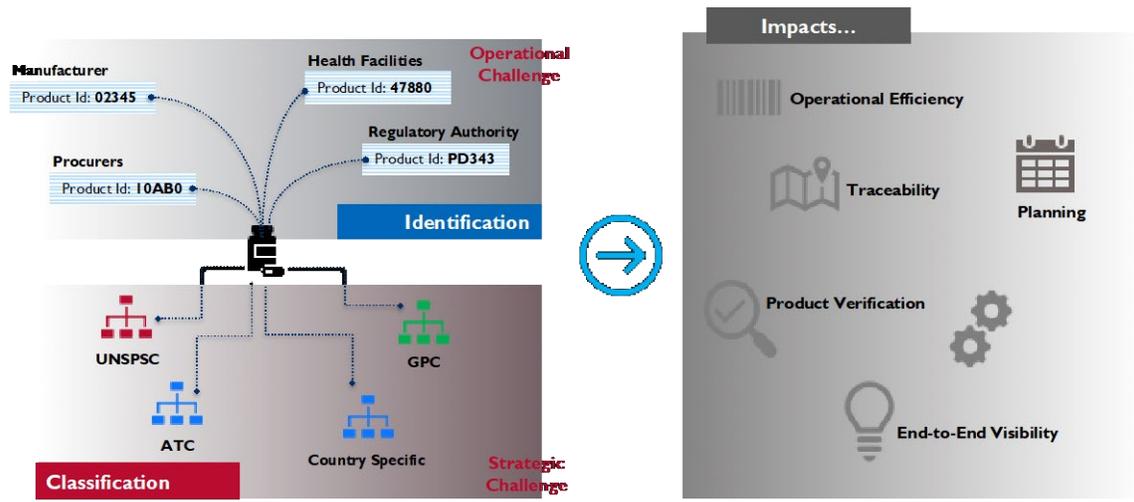
Opportunities

- WMS
 - Potential replacement of WMS provides an opportunity to adopt best practices
- Interoperability
 - Interoperability, Data availability, standardization & quality identified as key considerations by MOH, RBC, MPPD, RISA and Rwanda FDA
- ICT & Data initiatives
 - Key initiatives planned across GoR such as Big Data by NISR, Enterprise Architecture by MoH etc.
- Data & Process Standardization
 - Several manufacturers are already following global standards by shipping commodities with GSI compliant barcode/datamatrix labels. Warehouse systems can be enhanced to leverage these labels so that several processes such as receiving, putaway etc can be automated. While this can primarily improve operational efficiencies it can also enable real-time data visibility and improve data quality.

Constraints

- Supply Chain Processes
 - System processes & physical processes are not performed hand-in-hand
- **Product Data Management**
 - **Different product coding used across entities, SC levels & systems**
 - **Different product classification schemes used across GoR institutions**
 - **Products from multiple manufacturers are tracked against single product in the system**
 - **Different packaging levels of the same product maintained with different identifiers causing misrepresentation of facts**

The visual below depicts the challenges and their impacts caused by a lack of coordinated product master data management.



Below is an example of these challenges in Rwanda’s context.

PRIMS

| Product Name | INN | Dosage Form | National Regn. No. |
|--------------|-------------------------|-------------|------------------------|
| COLART | Artemether-Lumefantrine | Tablet | 20/1380/PH/REG/ZN/2013 |

WMS(Sage) / eLMIS

| #Name | Description | Drug Code |
|---------------------|--|----------------|
| PERF00010000000030C | PERFUSION SET + NEEDLE | 30450920030 |
| P02CA03020100E | ALBENDAZOLE 400MG TABLET B/100 | P02CA0302E |
| P01BE52090001E | ARTEM 20MG + LUMEF 120MG TAB (1X6) B/1 | P01BE5209E |
| P01BE52080030E | ARTE 20MG + LUME 120MG TAB (4X6) B/30 | P01BE52080030E |
| P01BE52070030E | ARTE 20MG + LUME 120MG TAB (3X6) B/30 | P01BE5207E |
| WAST00010374800100C | WASTE BAG 37X48 AUTOCLAVABLE RED | 30502750100 |

DHIS

| DHIS Item Name | Item |
|---|----------------|
| Coartem Artemether Lumefantrine tab 20 mg 120mg 6x4 | P01BE52080030E |

It can be noted above that the same product is identified different across different systems and different supply chain levels. This not only impacts interoperability of these systems and hence operational efficiencies but also limits the ability to track and trace commodities putting patients’ at risk.

3.1.2 SUPPLY CHAIN INFORMATION SYSTEM MATURITY ASSESSMENT

In addition to the findings, the feedback from discussions with stakeholders across various supply chain information system areas were used to do a preliminary assessment of PHSCIS using the Supply Chain Information System Maturity Model (SCISMM).

SCISMM provides a holistic assessment of various supply chain information systems’ capabilities. It assesses capabilities across the foundational cross-cutting areas such as Master Data Management, Interoperability and Track and Trace. It also considers capabilities across supply

chain functional areas such as Forecasting & Planning, Supplier & Contract Management, Procurement, Order Management, Warehouse Management and Transportation Management. SCISMM has been developed leveraging some of the processes and best practices from APICS' SCOR model and APQC's process frameworks.



Figure 2 – Supply Chain Information System Capabilities

The detailed assessment is attached in [Appendix](#) section of this document. The below graph represents the overall assessment.



Figure 3 – Rwanda PHSCIS Overall Assessment using SCISMM

The below graph further provides a view of various PHSCIS areas and their maturity levels in Rwanda's context.



Figure 4 – Rwanda PHSCIS Maturity Level Assessment

- These graphs indicate Rwanda has a well-established order management processes and system.
- While the warehouse management processes and system exist with a certain amount of maturity there is opportunity for improvement.
- Other areas such as procurement, forecasting & planning needs attention and a long-term roadmap to improve these.
- **However, the most important and fundamental capability that needs immediate attention is Master Data Management (MDM), especially Product Master Data Management,** which is a key element of MDM.

3.1.3 LONG TERM FOCUS

As Rwanda progresses towards a well integrated and automated supply chain, it is important to lay out a long-term roadmap with key MIS elements. This section attempts to capture an overall architectural view of Public Health Supply Chain Information Systems for the long-term to accomplish that architectural vision.

The below diagram provides a high level conceptual architecture of the various public health supply chain systems and how they interoperate.

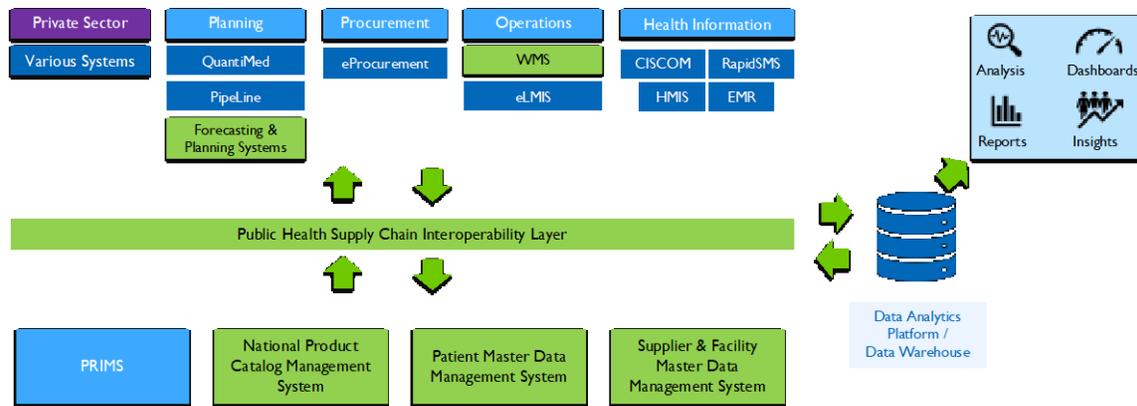


Figure 5 – PHSCIS - High Level Conceptual Architecture

The green boxes represent the potential enhancements that Rwanda should pursue to achieve a well integrated and automated MIS that utilizes standardized processes and data.

3.1.4 IMMEDIATE TERM FOCUS

Master Data Management, especially product master data management is a key foundational element of supply chain information systems. Product Master Data includes basic reference information for all public health pharmaceutical commodities. This data is elementary for all processes right from planning till consumption. All systems in the supply chain require this data in some form to process transactions. As shown in the Rwanda context in the below diagram, the importance of Product Master Data is apparent since it is central to all supply chain processes and transactions across all the various supply chain systems.

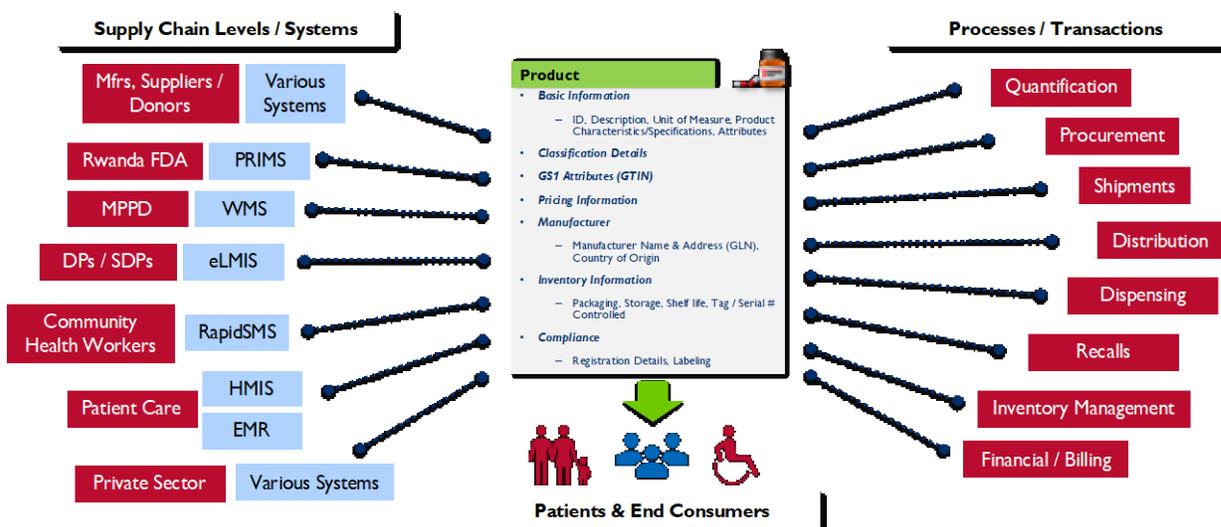


Figure 6 – Significance of Product Master Data

In view of these findings and assessments, National Product Catalog was identified as a key MIS initiative that should be targeted for implementation in the immediate future (FY 2020).

Implementation of National Product Catalog is an important first step for Rwanda Public Health Supply Chain in order to,

- Enable interoperability across various disparate public and private health supply chain systems
- Achieve operational efficiency by leveraging GS1 barcodes on packages
- Implement traceability and verification of pharmaceutical commodities
- Ensure patient safety by making sure the medicaments being dispensed is genuine
- Accomplish end-to-end supply chain visibility

The following section highlights the key aspects of Rwanda NPC.

4. RWANDA NATIONAL PRODUCT CATALOG

This section outlines the key components that need to be put in place to achieve a effective and functional National Product Catalog.

4.1 PRODUCT MASTER DATA FLOW

As can be seen from Figure 3, several systems and processes impact and are impacted by product master data. While there needs to be one central repository of product master data, this data will invariably be enriched as well as utilized in transactions by several systems across different supply chain levels. So it is important to identify the current flow of product master data across these systems in order to define an effective and scalable flow for the future.

The below diagram represents how product master data is currently used across public health information systems in Rwanda.

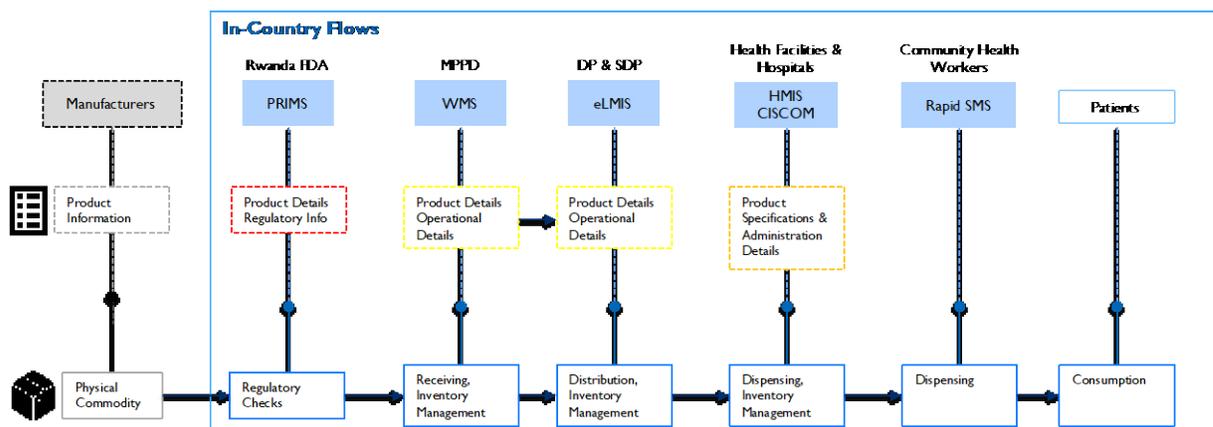


Figure 7 – As-Is Product Master Data Flow

It can be seen from Figure 4 that while physical commodities move from one supply chain level to another the product data associated with that commodity does not. While Rwanda FDA has its own set of product master data, MPPD's WMS and eLMIS that is used by District Pharmacies and SDPS maintain their own set of product master data. This creates inconsistency as well as duplication of critical master data, which should ideally be singular and accurate in nature in order to ensure commodity and patient security.

The below diagram represents an initial conceptual view of product master data flows across systems. This ensures that there is one single version of truth for product master data. It is understandable that different supply chain levels might manage different sets of product data. For instance, WMS might be central to maintaining operational data such as storage conditions, alternate units of measures etc. The below flow recognizes such collaboration challenges when multiple entities and systems are required to maintain the same set of data. On the same line, it also highlights the need for governance of product master data.

Data Governance will be further elaborated in section 3.4.

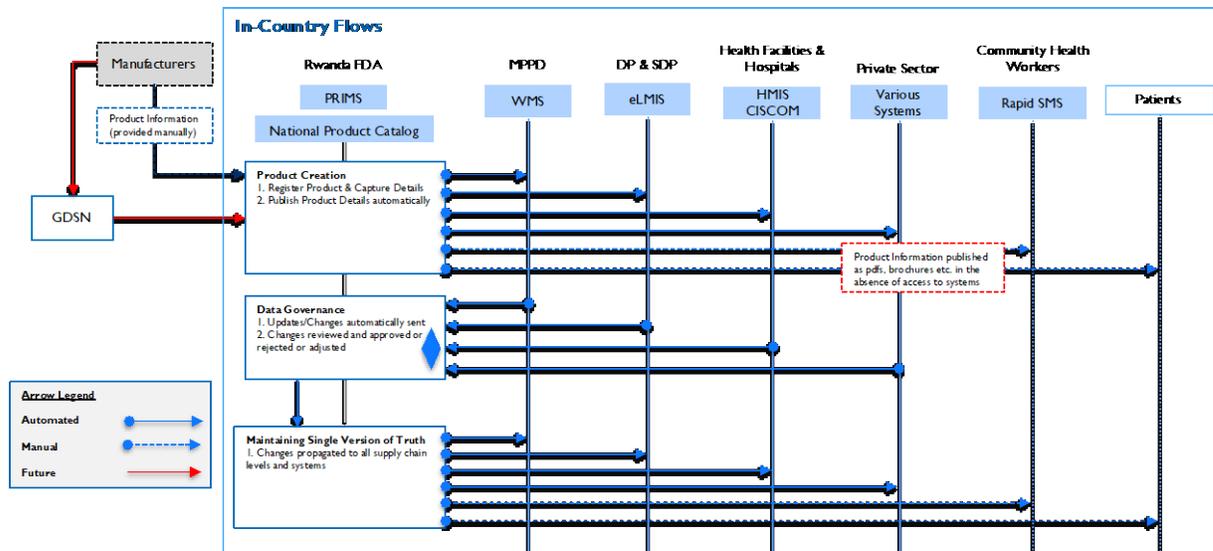


Figure 8 – To-Be Product Master Data Flow

4.2 NATIONAL PRODUCT CATALOG ARCHITECTURE

Considering the various systems in the existing landscape and considering how product master data will get used across these systems a logical architecture has been put together in the diagram below.

This shows a central repository of product master data in this national product catalog tool. The source data in this tool can be derived from initial data provided either by Manufacturers or from GDSN data providers. Data can then be enriched by other systems if required. For example WMS can add certain operational attributes.

Ideally, data in this central repository should be governed by Rwanda FDA. Relevant product data can be published publically through a web based catalog portal.

All supply chain systems, including private sector systems can leverage this repository for product master data to be used in their operations, so that all supply chain levels are referring to the same product identifier and its associated details.

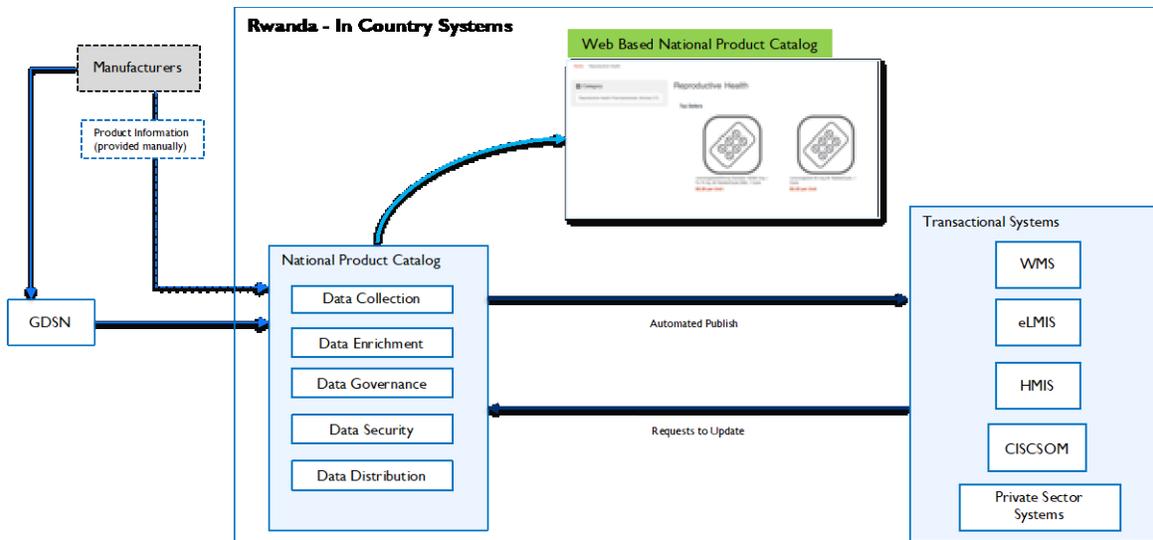


Figure 9 – Logical Architecture of National Product Catalog

4.3 PRODUCT CATALOG REQUIREMENTS

A draft list of system requirements has been put together for a product catalog management tool. Please refer to this list of requirements in [Appendix](#).

4.4 PRODUCT MASTER DATA GOVERNANCE

Product master data includes data that impacts multiple supply chain levels and systems. The stakeholders impacted by this data are diverse. For this reason it is important that any modifications to this data be managed in collaboration with all the key stakeholders. Governance thus becomes a critical process in the overall management of product master data. In this section a representative set of roles and responsibilities are outlined for a governance committee to oversee administration of and changes to product master data.

| | |
|-----------------------------|---|
| Executive Sponsor: | <ol style="list-style-type: none"> 1. Become educated in what data governance means 2. Approve policy level decisions and priorities as presented from the Data Custodians and Data Stewards 3. Communicating / advocating for data governance priorities in other settings |
| Data Owner: | <ol style="list-style-type: none"> 1. Defining product master data fields, usage of fields and allowed values for the fields 2. Reviewing Data Quality report regularly that shows where any values do not match the intended definition 3. Respond for any requests for additions, deactivations or changes to the definition/data records/values |
| Data Consumer: | <ol style="list-style-type: none"> 1. Ensure product data is sourced for transactions and operational processes from the single version of truth, which is the National Product Catalog 2. Provide recommendations on additions, deactivations, changes or the development of new standards |
| System Owner: | <ol style="list-style-type: none"> 1. Ensures the healthy functioning of the system 2. Handle requests for security changes (adding or removing users, setting permissions etc.) 3. Handle support requests for any technical issues |
| Tactical Assistance: | <ol style="list-style-type: none"> 1. Provide logistic support with handling meeting scheduling, resources, taking and publishing meeting minutes |

Figure 10 – Product Master Data Governance – Roles & Responsibilities

Product master data governance should ensure data is,

- Accurate
- Standardized (GSI compliant, preferably)
- Non-duplicative
- Comprehensive
- Consistent
- Catering to the needs of all supply chain operations

These roles and responsibilities outlined in Figure 7 can be used as an initial guide to setting up a governance committee with key stakeholders filling relevant roles.

4.5 ILLUSTRATIVE IMPLEMENTATION ROADMAP

This section provides an illustrative roadmap for implementation of National Product Catalog management tool. Depending on whether there are pre-identified options certain steps such as RFP etc might not be required.

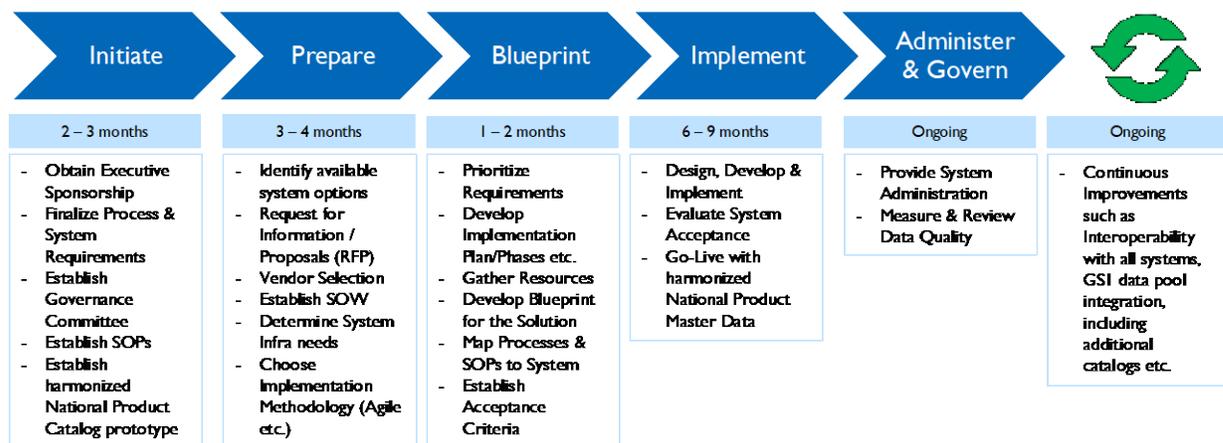


Figure 11 – Illustrative Roadmap to implement National Product Catalog management tool

4.6 KEY CONSIDERATIONS FOR DATA

The below are some of key considerations that should be kept in mind while organizing product master data.

- **Product v/s Item** – Given the way demand and supply are planned at a generic product level, it is important to differentiate, from a data perspective, between product, which is non-manufacturer specific and item, which is manufacturer specific. For instance, data should identify Nevarapine as a product where Nevarapine manufactured specifically by Aurobindo Pharma as an item and Nevarapine manufactured by Cipla as a different item. Nevarapine as a product is helpful in planning processes whereas Nevarapine item specific to a manufacturer is key while procuring and managing inventory.
- **Product Classifications** – It is important have a standardized classification in place so that like products are classified together that ultimately helps in proper planning. While defining classifications and while assigning products and items to specific classifications it should be considered that a product or an item can belong to multiple classification.

5. RECOMMENDATIONS SUMMARY & NEXT STEPS

Based on the assessment of public health supply chain information systems in Rwanda, master data management, particularly product master data management has been identified as an immediate priority. This will help solidify a strong foundation for other transactional supply chain systems as well as enable commodity traceability and verification.

Following recommendations and next steps have been categorized to facilitate a well-orchestrated progress of implementing a robust product master data management.

- **Organizational** – This relates to the people related activities needed to support and sustain product master data management processes.
 - **Establish a Data Governance Group** with stakeholders from MOH, RFDA, MPPD and any other organization that might use product master data. Please refer to section 4.4 for details of this group.
 - **Establish a Catalog Manager Role** and identify resource/s that will fill this role. The person/s in this role will be responsible to ensure National Product Catalog has all the required data for all public health products and that all changes to this data is well regulated.
 - **Identify technical resource/s** that will provide technical support for the system that will be used for NPC.
- **Process** – This relates to the processes needed to manage product master data.
 - **Define Standard Operating Procedures (SOPs)** for product master data management
 - **Harmonize Product Master Data** to have a single version of truth at National level. This will involve collecting existing product master data, analyzing data to eliminate duplicates and mapping across ids to arrive at a single set of data. This exercise will also attempt to map GS1 based GTINs where available.
- **Technology** – This relates to the systems that need to be in place to facilitate efficient and effective management & dissemination of product master data
 - **Identify and procure a system for NPC**
 - **Design, Develop and Implement NPC**
 - **Provide ongoing support for NPC**

A detailed timeline has been developed in the form of an implementation plan, as depicted in the table below. Some of the activities such as providing additional documentation for procurement plan update and defining technical requirements for NPC system are already in progress and close to be reviewed and finalized.

| # | Activity | Activity Owner | Dependency | Deliverables | Timeline | | | | | | | | | | | |
|--|--|----------------|-------------------------------------|--|----------|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|--|
| | | | | | Nov | Dec | Jan | Feb | Mar | Apr | May | Jun | Jul | Aug | Sep | |
| Tool Procurement | | | | | | | | | | | | | | | | |
| | | | | NPC Requirements Document NPC Need Assessment Document NPC Implementation Plan Product Master Data Management SOP | | | | | | | | | | | | |
| 1 | Provide supporting documentation for NPC procurement process | PSM | | | | | | | | | | | | | | |
| 2 | Review and finalize NPC supporting documentation | MOH | Supporting Documentation | | | | | | | | | | | | | |
| 3 | Update FY20 Procurement Plan | MOH | Finalized Supporting Documentation | | | | | | | | | | | | | |
| 4 | Initiate Tool Procurement Process | MOH | Procurement Plan Update | | | | | | | | | | | | | |
| 5 | Select tool & vendor for NPC implementation | MOH | Procurement Process Initiation | | | | | | | | | | | | | |
| 6 | Finalize Scope of Work | MOH | Tool & Vendor Selection | NPC Implementation SOW | | | | | | | | | | | | |
| Product Data and Process Management | | | | | | | | | | | | | | | | |
| 7 | Provide draft Product Master Data Management SOPs | PSM | | | | | | | | | | | | | | |
| 8 | Review, revise and approve Product Master Data Management SOP | MOH | Product Master Data Management SOPs | | | | | | | | | | | | | |
| 9 | Collect Product Master Data from all systems (from WMS/eUMIS, PRMS, DHS2) | MOH | | | | | | | | | | | | | | |
| 10 | Analyze Product Master Data for duplicates & cleanse data | RFDA | Product Master Data Collection | | | | | | | | | | | | | |
| 11 | Map Existing Product Identifiers to GTINs where available (sourced by PSM, GS1 etc.) | RFDA | Activity 9 | | | | | | | | | | | | | |
| 12 | Identify the list of data attributes, for configuration in NPC, based on harmonized data | RFDA | Activity 10 | | | | | | | | | | | | | |
| 13 | Review harmonized data with key stakeholders | RFDA | Activity 10 | | | | | | | | | | | | | |
| 14 | Assign relevant product classifications | RFDA | Product Master Data Harmonization | | | | | | | | | | | | | |
| 15 | Ongoing data management support | RFDA | | | | | | | | | | | | | | |
| People Management | | | | | | | | | | | | | | | | |
| 16 | Setup Master Data Governance Group | MOH | | | | | | | | | | | | | | |
| 17 | Establish & Assign Catalog Manager Role | RFDA | | | | | | | | | | | | | | |
| 18 | Identify Technical Resource to manage NPC System Administration | MOH | | | | | | | | | | | | | | |
| Tool Implementation | | | | | | | | | | | | | | | | |
| 19 | Develop detailed project plan for implementation | MOH | | | | | | | | | | | | | | |
| 20 | Develop NPC design specifications | MOH | Tool & Vendor Selection | NPC Design Specifications | | | | | | | | | | | | |
| 21 | Define system integration specifications to integrate with other systems for data exchange | MOH | NPC Design | NPC Integration Specifications | | | | | | | | | | | | |
| 22 | Configure & develop NPC (including testing support such as bug fixes) | MOH | NPC Design | NPC Tool (Available for Testing) | | | | | | | | | | | | |
| 23 | Product Master Data Migration into Test Instance | MOH | NPC Development | | | | | | | | | | | | | |
| 24 | Testing (System, Integration & User Acceptance) | MOH | NPC Development | NPC Testing Reports | | | | | | | | | | | | |
| 25 | Migrate Product Master Data into NPC Production Instance | MOH | Testing Completion | | | | | | | | | | | | | |
| 26 | User Training | MOH | Testing Completion | User Training Documents | | | | | | | | | | | | |
| 27 | NPC Roll Out | MOH | Testing Completion & User Training | NPC Operational | | | | | | | | | | | | |
| 28 | Ongoing system admin support | MOH | NPC Roll Out | | | | | | | | | | | | | |

APPENDIX

1. Rwanda PHSCIS Assessment using SCISMM



**Supply Chain
Information**

2. Rwanda National Product Catalog System Requirements



**Rwanda PH
Product Catalog**

3. Rwanda NPC Implementation Plan



**Rwanda - NPC
Implementation**

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