

# IMPLEMENTATING BUSINESS INTELLIGENCE SOLUTIONS IN THE HEALTH SECTOR: LESSONS FROM THE KENYA HMIS PROJECT

Mwenda Gitonga<sup>1</sup>, Ali Karisa<sup>1</sup>, Brian Wakhutu<sup>1</sup>, Mysha Sissine<sup>2</sup>, Joshua Oiro<sup>1</sup>, Donna Medeiros<sup>2</sup>, Bobby Jefferson<sup>2</sup>  
Futures Group<sup>1</sup>, Kenya; Futures Group, USA<sup>2</sup>  
Morningside Office Park, Ngong Road, Nairobi, Kenya<sup>1</sup>; One Thomas Circle, Washington, DC 20005 USA<sup>2</sup>  
[mgitonga@futuresgroup.com](mailto:mgitonga@futuresgroup.com)

## ABSTRACT

### Background

Futures Group through a CDC co-operative agreement has been working with the Kenya Ministry of Health (MoH) to develop a patient-level data warehouse and business intelligence (BI) solutions to ensure that electronic patient care data is used in real-time decision making.

### Challenge

While the Kenya MoH has been investing in information communication technology (ICT) implementations to improve service delivery, a number of these implementations are silos leading to multiple un-integrated systems. This has consequently deprived policy makers and the general public of a rich and centralized repository of data for country level business intelligence, analytics and reporting capabilities.

### Response

To address this challenge, the Kenya MoH and Futures Group have started development of a HIV centric data mart to further understanding requirements, design, implementation and data security needs.

### Lessons Learnt

The computerization of patient medical records together with the goodwill of stakeholders in the Kenya MoH has made it possible to consolidate patient data for decision making in a centralized data repository. There continues to be a need for rigorous processes to be undertaken in development of data governance policies around patient data security and administration.

### Next Steps

In order to develop a meaningful and sustainable data warehouse, the Kenya HMIS project aims at increasing technical capacity within the ministry through workshops and other stakeholder engagement forums. A culture of data demand and information use is also being cultivated at health facilities with an aim of not only developing analytics capacity at the health facility but also improve on the quality of data generated by these facilities.

## KEY WORDS

Public Health Informatics; Data Demand and Information Use; Evidence Based Decision Making; Data Mart; Data Warehouse; Business Intelligence;

## 1. Introduction

Computerization of health records in Kenya has been gathering momentum in the recent past. The Presidential Emergency Fund for AIDS Relief (PEPFAR) through the Centers for Disease Control (CDC) awarded Futures Group Kenya HMIS (KE HMIS) project and I-TECH grants to implement standardized Electronic Medical Records (EMR) in over 600 Government of Kenya (GoK) health facilities between the years 2010 and 2015.

In addition Futures Group KE HMIS received a mandate to develop a National Data warehouse that would integrate data from the EMRs and other Health Information Systems (HIS) in operation, allowing for easy and timely access to data for analysis and decision making.

The KE HMIS project has adopted an all-inclusive approach in developing a HIV centric patient level data-mart as a starting point to further the understanding the following:

- Requirements and Scope
- Policy and Implementation issues
- Design and Infrastructure considerations
- Data and metadata Considerations
- Data Security and privacy Considerations

We performed work with consideration to develop a fully-fledged platform for healthcare BI solutions that integrate additional data-marts including:

- HIV/AIDS case-based surveillance
- Commodities and supply chain
- Human resource and financials
- Early infant diagnosis data

- Male circumcision data
- PMTCT mother- child follow-up data

## 2. Description

The rapid uptake of EMRs and other Health Information Management Systems (HMIS) has brought about the need for Business Intelligence (BI) through which access to and analysis of data can be used to improve and optimize decision making and performance within the health sector.

Generally the development of any BI solution presents a number of challenges such as high costs of software, limited resources, infrastructure, and the requirement of highly specialized skills. In addition, unlike other off-the-shelf solutions the development of any BI solutions requires regular communication and interaction between system architects and the stakeholders. This process is highly visible and a resource intensive undertaking.

Futures Group divided the implementation process into the following 3 distinct tracks:

- Policy and Governance Track
- Data and Technology Track
- Capacity building Track

### a) Policy and Governance Track

HIV<sup>[2]</sup> patient data is highly regulated and places additional emphasis on patient privacy and confidentiality often requiring a stringent degree of data de-identification to ensure no subsequent data points can be traced back to a patient. This, for example, makes the technical task of patient consolidation across systems more difficult as it would require some patient identifiers to be maintained.

The purpose of this track is to address activities and issues related to policy and data governance where general consensus among stakeholders is crucial for the success and uptake of the solution. Some of the activities handled include:

- Formulation of a data warehouse technical working group and task force to steer the development of the data warehouse. This is a working group under the leadership of the Ministry of Health which will contribute to the following initiatives:
- Carry out Data Warehouse concepts sensitization to policy makers
- Development of standards and guidelines for data center and data warehouse operations under the leadership of the Ministry of Health ICT unit.
- Development of standards and guidelines for data access, security, privacy and ownership

- Defining of the minimum data sets
- Carrying out project management activities

### b) Data and Technology Track

Every business intelligence deployment has an underlying architecture that includes extract transform and load (ETL) tools, a data warehouse, data marts, BI front end tools, master data management (MDM) services and data governance policies.

In this track activities related to data acquisition, transmission and technology use, are addressed. These include:

- Source systems identification and prioritization
- Carrying out requirements gathering and analysis
- Carrying out data modelling based on required indicators
- Establishing data quality management protocols that would ensure quality data is extracted from the source systems

Software and tools assessment to help select and recommend the BI tools, Relation Database Management System (RDBMS) and ETL tools that will be used for the development of the solution. Figure 1, demonstrates how the BI tools selection was done using the Gartner BI magic quadrant [3]. This provided an unbiased scale that gauges BI tools on their ability to execute required functionality while giving users a deeper understanding of their data. From this analysis project settled on using the following tools:

- Microsoft SQL Server as the RDBMS
- Tableau desktop & server as the BI platform
- Microsoft analysis services and reporting services

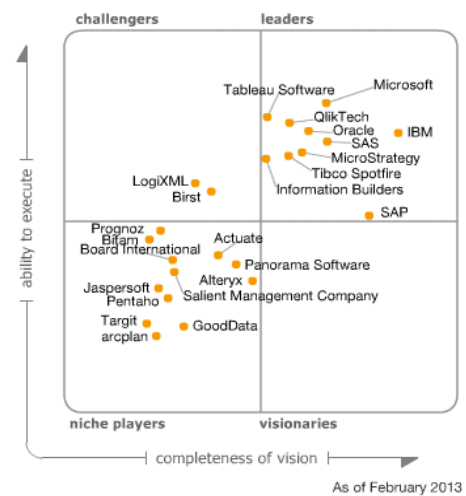


Figure 1: Gartner BI Magic Quadrant

The overall data warehouse architecture design used a [1] bottom –up approach to data warehouse design dimensional modelling and data mart development.

This would see the development of data marts aligned to the reporting requirements as determined in the requirements gathering phase. The data mart will then be integrated into a data warehouse. The advantages to this approach is that users can begin utilizing the data marts for analysis as soon as they are deployed

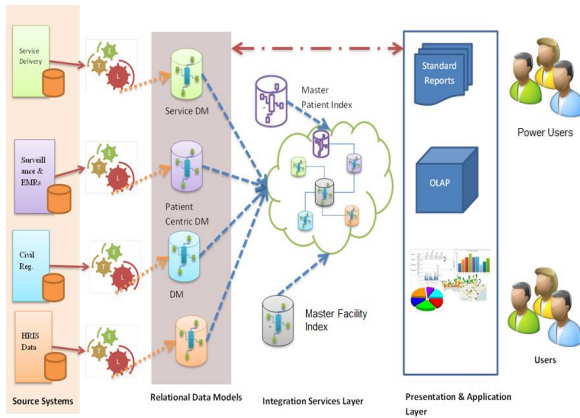


Figure 2: Data Warehouse overall Architecture

The development of extraction, transformation and loading (ETL) routines was done using SQL Server integration services.

### c) Capacity Building Track

Development of any BI solution requires that the stakeholders have a high-level understanding of the solution and the interactions of the various components. This ensures that there will be a high chance of sustainability and meaningful use of the solution. This track is purposefully designed to address activities and issues related to capacity building of stakeholders to ensure continuity. Planning and executing end user training to pass on knowledge of meaningful use of the BI solution by equipping the participants with the necessary skills to utilize the BI tools such as Tableau, Excel and Power pivot to analyze data and produce dashboards that deliver accurate information to support decision making. This will also enhance data demand and information use (DDIU).

Planning and executing technical training and workshops to impart technical knowledge on data warehouse development and maintenance, requirements gathering and dimensional modelling to the MoH ICT units and

other stakeholders. This will build capacity to ensure that there will be ownership and continuity for the solution.

Documentation on activities is also critical to ensure sustainability of BI tools and DDIU. The development of technical documentation such as:

- Data mart schemas
- Data dictionaries
- Development standards

It is also valuable to develop documentation for end-users such as:

- User manuals
- User notes

### 3. Conclusion

The computerization of patient medical records together with the goodwill of stakeholders in the Kenya MoH has made it possible to consolidate patient data for decision making in a centralized data repository. However there continues to be a need for rigorous processes to be undertaken in development of data governance policies around patient data security and administration.

In order to maintain and advance the use of BI the Ministry of Health (MoH) also should consider the investment of hiring BI analysts into their human resources plan.

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