



Mission Report

THE PROVISION OF TECHNICAL ASSISTANCE GDDS MODULE ON HEALTH: REPORT ON FIRST EXPERT VISIT TO SUDAN

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Prepared for:

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Information Center and The World Bank, General Data
Dissemination System, Socio-Demographic Statistics
Project for Anglophone Africa**

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1. INTRODUCTION

The Sudanese Federal Ministry of Health and National Health Information Center (NHIC) are under constant pressure to produce relevant up to date Health Statistics. They have identified a fully functional and operational Health Data warehouse as a requirement in order to capture, store and retrieve relevant Health data necessary for data analysis and dissemination.

To this end the Federal Ministry of Health requested Technical Assistance for the creation of a data warehouse.

The specific objectives and deliverables for this mission were detailed in the Terms of Reference (refer to Annexure 2: Terms of Reference).

The basic objectives and deliverables for this mission are however stated below.

Specific issues to be covered during the consultancy were the following:

Objectives / activities of mission

- Perform an analysis on the current situation and requirements regarding the data warehouse
- To produce a functional specification required for the design of a data warehouse

Based on this assessment future actions can be agreed during the visit to:

- Implement a data warehouse that will contain data from all data sources to facilitate data sharing and easy retrieval of data by users from all corners
- To agree on future in-depth discussions with relevant institutions if needed.
- To advise and assist in the design and the implementation of a state data warehouse

Specific outputs for the consultancy were the following

- Report in detail on all relevant conditions identified.
- Report on feasibility of data warehousing for health statistics in Sudan.
- Functional Specification

This mission is meant to prepare for the future deliverables, like:

- Implement the data warehouse, including a list of next steps, together with time scales and work needed to be done
- A situational analysis report and fine-tuning of objectives
- Report on any training requirements needed for statistical staff in the Health Statistics system
- Draft a mission report for the file of the country on the discussions held in the appropriate format.
- Draft a mission report for the World Bank according to the format provided

2. IMPLEMENTATION OF THE CONSULTANCY

The mission was implemented by Mr. Gareth Daniell from **GeoSpace International**. Thirteen work days were allocated for the assessment mission, and ran from the 15th January 2009 to 2nd February 2009.

3. ACKNOWLEDGEMENTS

The consultant would like to thank the Sudanese GDDS Coordinator, Mr. Elamin Adam AbeulGasim and the Director of NHIC, Mr. Elsheikh Yousif Mohammad for their time and support during the consultancy.

Special thanks to Mr. Elsheikh Eltijani Elsheikh, Mr. Mohammad Abdalghani Omar and Mr. Osama Alzubair for their enthusiasm, assistance and positive attitude during the consultancy as well as arranging the meetings and all necessary documentation.

The consultant would also like to thank the General Data Dissemination Project of the World Bank for sponsoring the consultancy.

4. PROGRAM CONTEXT

With financial support from the Department for International Development (DFID) of the United Kingdom, the World Bank is implementing a project to assist 21 Anglophone Africa countries to participate in the General Data Dissemination System (GDDS). Participating countries are being assisted to participate in the GDDS through two separate, but linked projects both financed by DFID. The IMF is providing project management and technical support in the area of economic and financial statistics. The World Bank is providing technical support in the area of socio-demographic statistics.

Technical assistance is being provided through the World Bank to help countries implement plans for improvement in population, health, agriculture, labor market, justice and security, management of statistical systems, GIS and small area statistics. The GDDS framework developed by the IMF provides the framework for the detailed elaboration of long-term statistical development strategies. Participating countries have already expressed their requests for technical assistance and both the IMF and the World Bank have developed their assistance strategies.

Sudan was one of the countries which asked for technical assistance in the field of Health Statistics.

5. NATIONAL HEALTH INFORMATION CENTER (NHIC) DATA WAREHOUSE NEEDS

Information Technology is currently playing a crucial role in the creation of Statistical Health data in Sudan. Information technology is used as a data capturing and analysis tool. The use of Information Technology as a data capturing and data creation tool means that a vast amount of data is created over a very short space of time. The NHIC has been utilizing the current data capturing tools for some time now and a lot of relevant data has therefore been created on monthly and quarterly basis. The data is stored and analyzed in separate database files and/or excel worksheets. A fully functional data warehouse is therefore a necessity for the NHIC to successfully store and retrieve the data.

The current data collection and analysis process is focused on the 15 Northern Sudanese states and 3 regions in the South. The data warehouse will focus on these 18 areas as well.

6. CHALLENGES FACING THE NATIONAL HEALTH INFORMATION CENTER (NHIC)

The department faces the following challenges regarding Health Statistics.

- The design and creation of an integrated and properly designed data warehouse and database
- Creation of pre-determined data Analysis structure
- Creation of data communication protocol

The department is aware of these challenges and the request for technical assistance was the first step in addressing them.

7. OVERVIEW OF MEETINGS AND DISCUSSIONS

Please refer to Annexure 1: Overview of Meetings Held for the meetings and discussions that took place.

8. ASSESSMENT OF CURRENT SITUATION / FEASIBILITY STUDY

A successful operational data warehouse consists of the following components:

- Data
- IT Infrastructure
 - Hardware
 - Software
 - Communication
- People
- Method

During this mission an assessment was done based on the above mentioned components.

Data

Relevant Statistical Health data is captured on a daily, weekly and monthly basis. Data is manually collected and collated at different levels using various paper based methods.

The following data is received from the states on a quarterly basis.

Excel Worksheet 1

- Births / Maternity
- BloodBank
- Deaths
- Dentistry
- Diseases
- Eyes
- Lab Work
- Surgery
- X-Rays

Excel Worksheet 2

- Inpatient data
- OutPatient data

Further Excel reports are received from the states on an annual basis. These reports contain data pertaining to "Other Services", Ward occupancy/Bed distribution etc.

The data is captured at facility and hospital level on a daily basis on a tally-sheet by hospital staff. A monthly summary sheet is collated using the daily tally-sheets and submitted to the locality-level information officer. The localities pass this information on to the State Information Officers (Statisticians) on a monthly basis.

Some states, such as Khartoum State for example, currently have their own programs for collecting and storing the data in MS Access and MS SQL Server databases. Other states use the Excel sheets directly and some states simply pass the raw data sheets through to the NHIC (whose job it is then to create the appropriate Excel worksheets).

A front-end application has been developed, using MS Access forms and MS SQL 2000, by the NHIC that will be rolled out to all the states (and localities where possible). This will ensure that all states collect and store similar data and pass this data to the NHIC in a uniform layout. The program has been completed and is currently being piloted in 3 states and undergoing testing and final changes. It is estimated that the rest of the states will start using this program in March 2009.

IT Infrastructure

Adequate hardware and software is in place for the data capturing process at State Level as well as at the NHIC. As mentioned earlier in this report, a common front-end application will soon be rolled out to all the states.

All the state-level officers have a workable computer and all the required software. All the states have access to Email and Internet and the data is transferred to NHIC through these means.

The data warehouse will be implemented using Microsoft SQL Express.

People

An assessment of the current staff component could only be made at the head-office and state level. The State Health Officers that capture the data have been trained and are given additional training and updates on their performance when they deliver the data to the NHIC. The current IT specialists have an abundance of skills. The existing Excel worksheets were developed and are currently being updated and maintained by them. The new front-end application was also developed by these IT specialists, and the application will be maintained by them as well.

The capturing of new data, maintenance of the data as well as the analysis of the data does not seem to be a problem at either the State Level or at the NHIC.

Method

Method requires that once the people, hardware, software and data is in place, the following must be implemented or should exist for the warehouse to achieve its full potential and provide relevant deliverables:

- In the short term, method will imply the specific data creation, collection and warehousing strategy
- In the long term, method will also include the specific data analysis, data dissemination and data access strategies and protocols

As the purpose of this and following missions is to implement a data warehouse, very little of the method is currently in place.

9. FUNCTIONAL SPECIFICATION

Please refer to *Annexure 3: Functional Specification* for the full specification

9.1 Introduction

The current data and workflow processes do not allow for an efficient and effective data warehouse to be implemented at the NHIC. The NHIC identified this problem some time ago, and has developed a front-end application that will be rolled out to all states. The new application also allows some localities with sufficient IT infrastructure to make use of this application directly.

The various states each collect their own data, and the main objective of the data warehouse is to collate and store this data in a central repository at the NHIC.

A successful implementation of a data warehouse will result in the following goals being achieved:

- Improve quality of data across all states
- Eliminate inconsistent reports and reporting methods between states.
- Provide capability for data sharing.
 - Make aggregated data available in report format to interested parties for further analysis and/or integration.

9.2 Solution Overview

The front-end application will be installed at all state-level offices. In some cases the localities will also have access to IT infrastructure and in these cases the data flow and data capturing processes will be slightly different.

9.2.1 Scenario 1: Front-End application deployed at localities and states

The diagrams and tables below detail the proposed data flow and workflow processes for localities and states when the new front-end data capturing application is deployed at both locality and state levels.

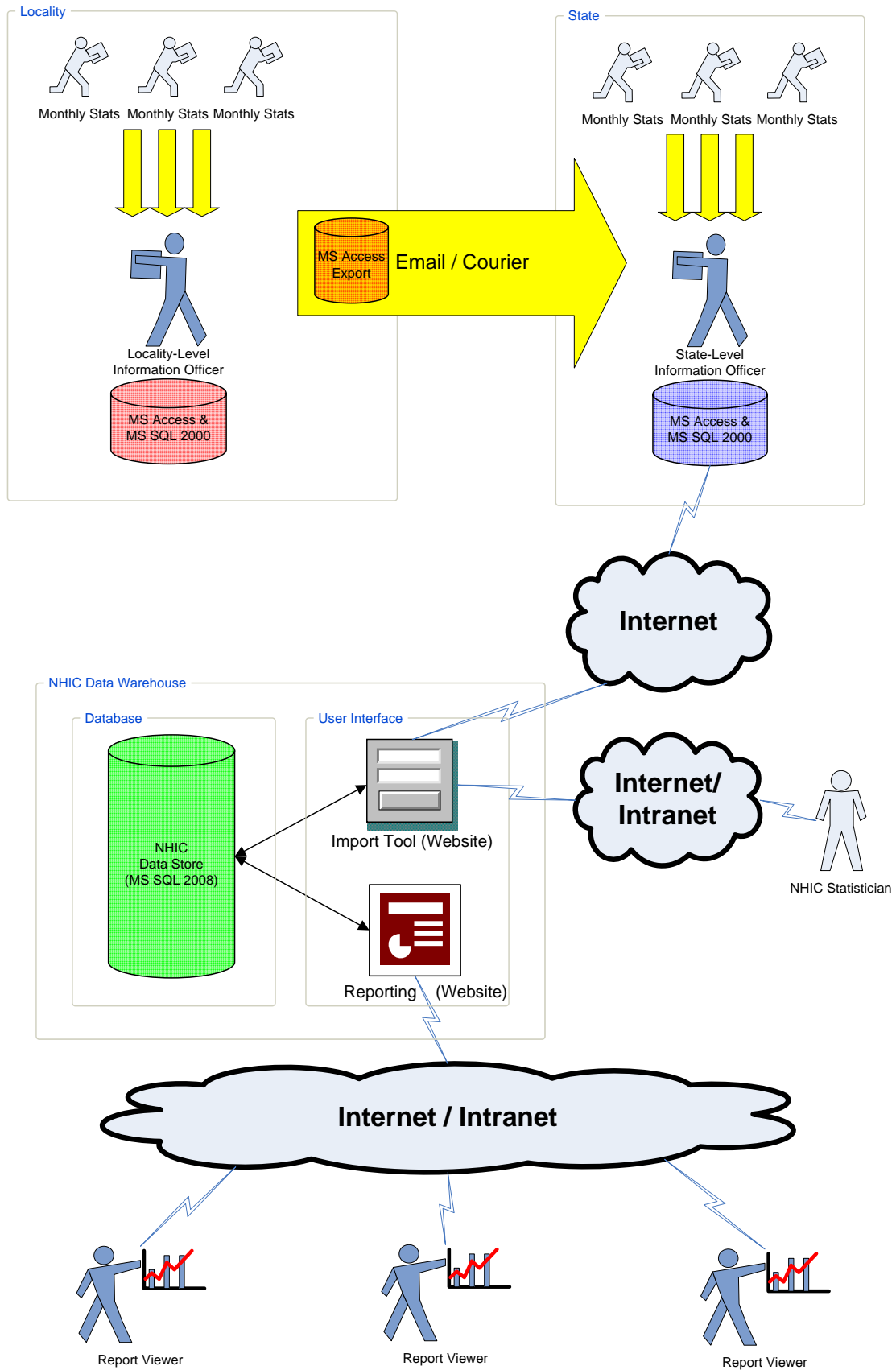


Figure 1 - Data Flow and Workflow Processes (Sufficient IT Infrastructure at locality level)

User / Role Player	Description
Locality-Level Information Officer	<p>The locality-level information officers receive raw data on hand written forms. This data is captured into the relevant MS SQL database by means of an MS Access front-end application.</p> <p>Once completed the locality-level information officer exports the data to an MS Access database and sends it to the relevant state office via email. Sometimes the locality may export the data file to a flash disk or CD and courier it to their state office.</p>
State-Level Information Officer	<p>The state-level information officers receive raw data on hand written forms. This data is captured into the relevant MS SQL database by means of an MS Access front-end application.</p> <p>They also receive files via email and/or courier from localities with sufficient IT infrastructure and the state-level information officer imports these files into their own state-level database via the same front-end application.</p> <p>Once completed the state-level information officer exports the data to an MS Access database and uploads it to the NHIC.</p>
NHIC User (Statistician)	<p>An NHIC user responsible for compiling reports accesses the Import Tool and selects which states' data files are imported into the NHIC data warehouse.</p>
Report Viewer / End User	<p>Anybody with access to the reports, including other role players. State-level users will only be able to view reports relevant to their respective state. NHIC users are able to generate reports for the entire Sudan.</p>

Table 1 – Data warehouse users (Sufficient IT Infrastructure at locality level)

9.2.2 Scenario 2: Front-End application deployed at states only

The diagrams and tables below detail the proposed data flow and workflow processes when the new front-end data capturing application is deployed at state levels only.

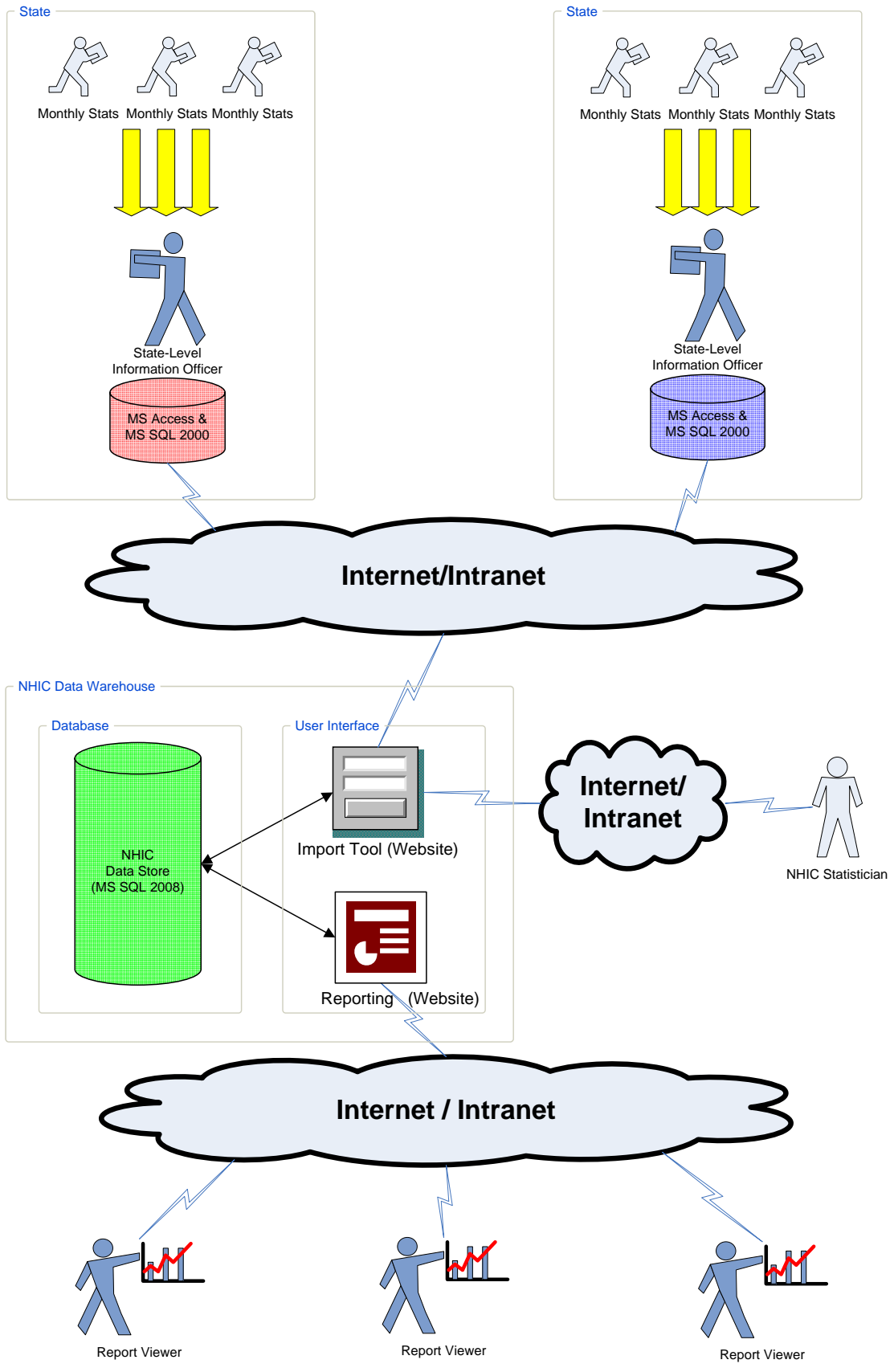


Figure 2 - Data Flow and Workflow Processes (Insufficient IT Infrastructure at locality level)

User / Role Player	Description
State-Level Information Officer	The state-level information officers receive raw data on hand written forms. This data is captured into the relevant MS SQL database by means of an MS Access front-end application. Once completed the state-level information officer exports the data to an MS Access database and uploads it to the NHIC.
NHIC User (Statistician)	An NHIC user responsible for compiling reports accesses the Import Tool and selects which states' data files are imported into the NHIC data warehouse.
Report Viewer / End User	Anybody with access to the reports, including other role players. State-level users will only be able to view reports relevant to their respective state. NHIC users are able to generate reports for the entire Sudan.

Table 2 – Data warehouse users (Insufficient IT Infrastructure at locality level)

9.3 User Interface

9.3.1 Overview

Data warehouse users interact with the data warehouse by means of a website that is hosted at the NHIC. This website may be on the same server as the data warehouse itself or on a separate web server.

The web site prompts the user for a username and password, which will be used to identify if the user is a state-level user or NHIC user.

9.3.2 Import Tool

The state-level data is uploaded to the NHIC via a web site.

State level users are only able to see the data files they have already submitted to the NHIC and upload new ones. If a file has not yet been imported into the data warehouse, the state-level user is allowed to delete it and replace it with another file.

Statistics Data Files

File Description	Date Uploaded	Delete
January 2009	2 Feb, 2009 09h34	Data Already Imported
April 2009	3 May, 2009 08h12	Data Already Imported
July 2009	1 Aug, 2009 09h31	<input type="button" value="delete"/>
Oct 2009	6 Nov, 2009 08h12	<input type="button" value="delete"/>

Upload New File	
File Description	File
<input type="text"/>	<input type="text"/> <input type="button" value="Browse..."/> <input type="button" value="Upload"/>

Figure 3 – Import Tool user interface for state-level users

NHIC users are able to see all states' uploads as well as action the import. Once a data file has been imported into the NHIC data warehouse, the state user will no longer be able to delete it.

Statistics Data Files

State	File Description	Date Uploaded	Delete	Import
Khartoum	January 2009	2 Feb, 2009 09h34	Data Already Imported	Data Already Imported
Khartoum	April 2009	3 May, 2009 08h12	Data Already Imported	Data Already Imported
Khartoum	July 2009	1 Aug, 2009 09h31	<input type="button" value="delete"/>	<input type="checkbox"/>
Khartoum	Oct 2009	6 Nov, 2009 08h12	<input type="button" value="delete"/>	<input type="checkbox"/>
Gazera	January 2009	2 Feb, 2009 09h34	Data Already Imported	Data Already Imported
Gazera	April 2009	3 May, 2009 08h12	Data Already Imported	Data Already Imported
Gazera	July 2009	1 Aug, 2009 09h31	<input type="button" value="delete"/>	<input type="checkbox"/>
Gazera	Oct 2009	6 Nov, 2009 08h12	<input type="button" value="delete"/>	<input type="checkbox"/>
				<input type="button" value="Import"/>
Upload New File				
State	File Description	File		
Khartoum <input type="button" value="v"/>	<input type="text"/>	<input type="text"/>	<input type="button" value="Browse..."/>	<input type="button" value="Upload"/>

Figure 4 – Import Tool user interface for NHIC users

9.3.3 Reporting

Along with uploading/importing data files, users are also able to generate and view reports from the data warehouse user interface.

State-level users are only able to view reports that relate to their data, while NHIC users are able to view reports for the entire Sudan.

10. RECOMMENDATIONS

It is evident from the above assessment that the NHIC is equipped with the necessary tools and skills required to successfully implement, operate and maintain a data warehouse.

It is therefore recommended that the Federal Ministry of Health continue with the implementation of a data warehouse.

The components necessary for the creation and operation of a data warehouse are either already in place, must be fine tuned or must still be created

The following short term and long term activities are recommended for the completion of a data warehouse.

10.1 Short term activities

The main goal for all the short term activities is the establishment of a data warehouse at the NHIC to enable the center to store, update, query, retrieve and disseminate the data. The establishment of the data warehouse consists of the following activities:

- Project management
- User Analysis or Scoping of requirements
- Functional Specification
- System Design
- Implementation
- Installation
- Testing
- Training

Project Management

As with the roll-out of any project it is important to specify the deliverables, dependencies, milestones and responsibilities from the start. A project plan must be developed in conjunction with the user analysis and functional specification. The project plan must be a living document and updated according to the changing environment and subsequent activities. The project plan for the actual implementation of the data warehouse can only be finalized once the functional specification document has been created.

Estimate Duration: ***1 day per week***

User Analysis

Completed

Functional specification

Completed

System Design, Implementation, Installation, Testing and Delivery

Once the Functional Specification has been clearly defined and documented the actual design of the data warehouse and the creation of the tools used to import the data as well as the tools used to export the data for analysis and dissemination can commence. The system design must take into account any future plans specified in the functional specification.

Once the data warehouse and structure has been designed it will be populated with the existing data using the import-tools. The database serves as a repository for all the information. Once all the data has been populated the database can be tested for retrieval, updating, importing of new data and exporting of data for analysis and dissemination purposes. The data warehouse should now be ready for final delivery, testing and training. The NHIC must ensure that all the phases are completed satisfactory. All amendments to the database during the implementation, installation and testing phases should be well

documented. A final document specifying the database design should be delivered as part of the final database.

Estimated Duration: **25 days**

Specific short term recommendations

The Central data warehouse should be implemented using MSQ SQL 2008. The licensing of Microsoft products in Sudan may prove problematic. Should the NHIC not be able to obtain a license for MS SQL 2008, the data warehouse should be implemented using MS SQL 2008 Express which is freely distributable.

The NHIC's IT staff must be involved with all facets of the data warehouse creation as they will be responsible for the data warehouse maintenance and upkeep.

10.2 Long term activities

Front end data capturing application

The existing front end application based on MS SQL 2000 should be changed so that the data is stored using MS SQL 2008 Express.

The design of the front end application should allow for future updates like data capturing via intra and internet, allowing locality and state level users to capture data directly to the NHIC data warehouse.

Estimated duration for front end application amendment: **10 days**.

Data Analysis

The creation of central and state data warehouses will provide the NHIC Statisticians with extra capability regarding data analysis. The current methodology where the data is exported to Microsoft Excel for data analysis should therefore be revised so that the data can be analyzed or queried using software that is directly linked to the data warehouse. The data will therefore be analyzed and queried "live" and no data export will take place. Simple, easy to use data analysis software packages such as Crystal Reports or Reporting Services can be used to analyze the data and produce reports. Pre-defined analysis and reports can be setup and saved in order to produce uniform reports. The type of analysis and reports that will be required must be well documented.

Estimated duration for Data Analysis development: **25 days (continuous process)**.

Training

Extra training in the new data warehouse, front end data capturing application and data analysis at both central and state levels are essential.

The NHIC IT personnel together with the relevant personnel from the Federal Ministry of Health must ensure that all state-level users are well versed in the use of the new data warehouse, front end data capturing application and data analysis software.

Estimated duration for Training: **5 days (continuous process)**.

Protocols

As with any data set, pre-determined protocols regarding data access need to be established.

Estimated duration for Protocol Setup: **5 days (continuous process)**.

updated accordingly. A training program should be developed as part of the data warehouse roll-out.

13. TRAVEL AND ACCOMMODATION ARRANGEMENTS

There were no problems regarding the travel and accommodation arrangements.

14. FOLLOW-UP ACTIONS

14.1 Requirements before commencing

The design of the data warehouse relies on the data coming from all the states being in a standardized layout as exported by the new front-end application. Before any future actions can be undertaken, this application needs to complete its testing phase and be rolled out to all the relevant states.

14.2 Objectives & Deliverables for near Future

1) Verification of Functional Specification

The new front-end application was still in development at the time the first mission was performed. A number of assumptions were therefore made during the specification of the data warehouse and these assumptions are to be confirmed and verified.

2) System Design

Finalize the functional specification and data warehouse layouts.

Design the import tools and relationships required to import the transactional data into the warehouse data.

Design the reports that are required from the data warehouse.

14.3 Further Follow-Up Actions

Implementation and Installation

- Implement Data warehouse
- Implement Reports
- Training

15. FINAL REFLECTIONS

The NHIC made sure that, through all their efforts, the consultancy could be completed as effectively as possible. The professionalism in all aspects of their work is noteworthy and the future of the Sudanese Health Data Warehouse is in very capable hands. The challenge is to ensure that the short and long term plans for the NHIC data warehouse are set in motion.

16. ANNEXURES

16.1 Annexure 1: Overview of Meetings Held

When	19 Jan
Attendees	Mr. Elsheikh Yousif Mohammad – Director NHIC Mr. Elsheikh Eltijani Elsheikh – Deputy Director NHIC Dr. Amal Elamin Mohammad – Community Doctor NHIC Mr. Mohammad Abdalghani Omar – Statistician/IT NHIC
Overview	Introduction and discuss general mission objectives

When	19 Jan
Attendees	Mr. Elsheikh Eltijani Elsheikh – Deputy Director NHIC Dr. Amal Elamin Mohammad – Community Doctor NHIC Mr. Osama Alzubair – IT Manager Mr. Mahmoud Abdelhadi Hassan – IT Specialist
Overview	

When	20 Jan
Attendees	Director Khartoum State Mr. Elsheikh Eltijani Elsheikh – Deputy Director NHIC
Overview	State-level User Analysis

When	20 Jan
Attendees	Mr. Elamin Adam Abuelgasim – GDDS Coordinator Mr. Elsheikh Eltijani Elsheikh – Deputy Director NHIC Mr. Mohammad Abdalghani Omar – Statistician/IT NHIC
Overview	GDDS introduction and discuss work plan

When	21 Jan
Attendees	
Mr. Mohammad Abdalghani Omar – Statistician/IT NHIC	
Overview	
User Analysis - NHIC	

When	21 Jan
Attendees	
Director Khartoum State Mr. Elsheikh Eltijani Elsheikh – Deputy Director NHIC Mr. Mohammad Abdalghani Omar – IT NHIC Dr. Amal Elamin Mohammad – Community Doctor NHIC	
Overview	
User Analysis - Khartoum State: Application Demo	

When	22 Jan
Attendees	
Mr. Mahmoud Abdelhadi Hassan – IT Specialist	
Overview	
Review new application being developed	

When	26 Jan
Attendees	
Mr. Mahmoud Abdelhadi Hassan – IT Specialist	
Overview	
.Net training	

When	27 Jan
Attendees	
Mr. Mahmoud Abdelhadi Hassan – IT Specialist Mr. Osama Alzubair – IT Manager	
Overview	
Functional Specification Review	

When	28 Jan
Attendees	
Mr. Mahmoud Abdelhadi Hassan – IT Specialist	
Overview	
Functional Specification Review	

When	29 Jan
Attendees	
Dr. Mustafa Salih Mustafa – IT Head of Department Mr. Osama Alzubair – IT Manager Mr. Mahmoud Abdelhadi Hassan – IT Specialist	
Overview	
Debriefing	

When	29 Jan
Attendees	
Dr. Amal Elamin Mohammad – Community Doctor NHIC	
Overview	
Debriefing	

16.2 Annexure 2: Terms of Reference

Refer to "*TOR_Sudan_Geospace_Health_DWS1.doc*"

16.3 Annexure 3: Functional Specification

Refer To "*Sudan_Health_Data_Warehouse_Functional_Specification.doc*"