Mapping of the health information system in Mozambique and identification of its constraints

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September 2010

inSCALE – Innovations at Scale for Community Access and Lasting Effects

The inSCALE programme, a collaboration between Malaria Consortium, London School of Hygiene and Tropical Medicine (LSHTM) and University College of London (UCL), aims to increase coverage of integrated community case management (ICCM) of children with diarrhoea, pneumonia and malaria in Uganda and Mozambique. inSCALE is funded by Bill & Melinda Gates Foundation and sets out to better understand community based agent (CBA) motivation and attrition, and to find feasible and acceptable solutions to CBA retention and performance which are vital for successful implementation of ICCM at scale.

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Preface

This document was prepared for an internal meeting of the inSCALE project. It does not aim to be a comprehensive systematic review of the topic. Rather, it pictures the landscape based on review articles and informal discussions with expert colleagues. This document is not an official inSCALE publication but rather an internal working document.

None of this document may therefore be quoted, copied or referenced.

Discussions about the content of this document are welcomed.

1. INTRODUCTION.

At the Ministry of Health (MISAU), the Department of Health Information (DIS) is the coordinating body of all health statistics roles, responsible for the development and maintenance of the Health Information System (SIS). The provincial level coordinates SIS activities of the districts, adjusting the strategic guidelines set centrally to the real situation of each province. The District Service of Health and Social Affairs (SDSMAS) implements the guidelines, according to the priorities defined by the sector and harmonized with the provincial level.

Through the Strategic Plan of the Health Information System 2009-2014 (PE-SIS) document designed with reference to the a) Action Plan for the Reduction of Absolute Poverty 2006-2009 (PARPA II), b) Health Strategic Plan (PESS) and c) Strategic Plan of the National Statistical System 2008-2012 (SEN), it is expected that this will serve as a planning tool that allows DIS, the Provincial Departments of Planning and Cooperation (DPCC) and the District Bureaus of Statistics to operate in organized fashion along the lines defined by the Government policy regarding the area of health information. Therefore in the mentioned document are considered the assessments previously taken; the strategies are designed and the resources are identified that are necessary to achieve the objectives explained in the PESS for the referred period. This document since the development of Health Information Systems in Mozambique, must be seen as the core for the action plans of this sector until 2014. In preparing the PE SIS were taken into consideration the main problems of SIS related to the previous assessment, and has been identified that the large number of proposed strategies and the lack of trained human resources run them, at the different levels, with emphasis on the central level, prevented the implementation of all proposed solutions and some problems still remain. Although this is a known problem of SIS managers, the recommendations made therein so far have not shown the expected result for trained professionals to be provided at enough numbers to the various and complex activities.[1]

Based on the constraints and recommendations described on the PE-SIS and other complementary literature used to validate the information of the PE SIS, in this report we describe the trajectory, ambitions and challenges of SIS.

1.1. CONTEXT.

Before Independence there were several systems that worked without coordination amongst themselves, using different methods of action, reflecting a division of the Health System components entailing control by administrative bodies, trade associations, charity associations, religious associations, private companies, etc.

Between 1975 and 1979, SIS worked with typically centralised orientation and only during the early eighties started the first restructuring of the system, marked in 1983 with the arrival of the first micro-computer at the Health Sector. In 1990 was made a second complete review and, in 1991, SIS was introduced nationwide in the form that still maintains as the base of the health statistical information: framed by the various subsystems that cover specific areas such as Human Resources, Maintenance, Financial Management, Pharmacy, etc.

Since the establishment of the Development Program of Health Information 2003-2005 (PRODESI) there have been some significant progresses in search of system quality. Among them can be highlighted the development of an application that standardizes the interface for the different data collection forms, facilitating the operation of the user and providing a database which combines epidemiological information, assistance and morbidity rates, allowing the user to obtain the different panoramic looks required to manage health. This application is deployed in all provinces and districts through the electrical power from the national network.[1]

It is increasingly observed the perception that the systematic use of information in management is paramount to improve the quality of information and provides more consistent subsidies to guide on the decision-making.

1.2. OVERALL OBJECTIVE.

Document the methods of data collection and flow, identifying the strengths and weaknesses and based on these, define innovations that may offer solutions to improve data collection and flow.

1.3 SPECIFIC OBJECTIVES

This report aims at describing the SIS in the following areas:

- ✓ The SIS existing at the community, district, provincial and central levels.
- ✓ The flow between the various levels.
- ✓ The SIS constraints at the different levels including the central one where there are centralized health programs such as malaria, TB, HIV/AIDS, among others.

- ✓ SWOT analysis of Mozambique SIS.
- ✓ Possible innovations to improve data collection and flow.
- ✓ Acceptability, feasibility and expansion of innovations.

2. METHODOLOGY

The methodology for data collection will consist of interviews/informal conversations with key informants in the health sector who are active in some departments and vertical programs of MISAU, Provincial Directorate of Health (DPS), District Services of Health, Women and Social Affairs (SDSMAS). The same methodology will be followed for key informants that work in NGOs implementing activities related to the APE.

Due to geographical and labour constraints, besides face-to-face interviews, some of them were conducted through email and telephone. The following guide developed by the inscale project team was used as the basis for the interviews:

A. **Health Information System (SIS) existing at the community, district, provincial and central levels:**
   a. What systems exist (developed "locally" or by partners)?
   b. How is data colleted and summarized and how they feed the system/program?
   c. How are APE data collected, presented and used?
   d. How is the feedback done to the data provider?
   e. What are the main limitations of the current systems and potentialities?
   f. How to design a chart of data flow for the existing systems?

B. **Possible innovations to improve data collection and flow:**
   a. What are the areas of the existing system that need to be improved?
   b. How can data flow be improved and how can the feedback reach the data providers at the community, district, provincial and central levels?
   c. What is the role of ICT on data collection, sending and feedback?
   d. How can the community be involved in the process and how will the data be used to create the consciousness of the need to collect data.

C. **Observations :**
   a. Can you describe any other experience acquire from the SIS?
   b. Any recommendation(s)?

The interviews entailed 6 SIS managers where 2 came from MISAU at central and provincial level and the rest cam from partners namely:

- ✓ The person responsible for PNCM M&E.
- ✓ Provincial Head of Statistics Bureau of Zambezia Province.

- ✓ LSDI Information Officer.
- ✓ GIS Technician from the DIS.
- ✓ Person responsible for NEP at Inhambane Province.
- ✓ Epidemiological Department.

2.1 . Existing SIS at the Community, District, Provincial and Central Levels.

All interviewees had knowledge on SIS with emphasis on MB-SIS, despite the existence of other systems that also work as important sources of information. It was found out that the SIS does not include the community level. The feedback is done through monthly, quarterly, half-yearly and annual reports.

The lack of training of staff at the District and Provincial levels, the shortage of technological infrastructures that ensure the functioning of more consistent systems, the use of standalone systems, the non-standardization of data collection were identified by the interviewees as the main limitations of SIS.

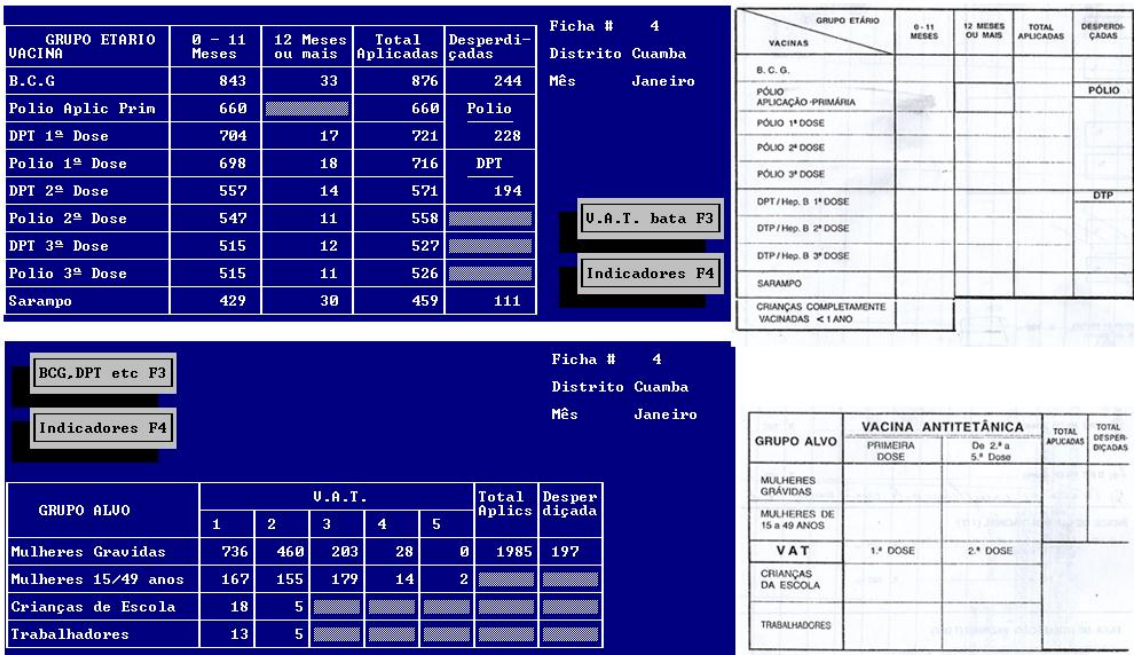
2.2 Possible innovations to improve data collection and flow.

The positioning of interviewees varied according to their individual involvement in the SIS. Generally, they suggested improvements in the areas of epidemiological diseases and HIV/AIDS, the development of a baseline plan of Monitoring and Evaluation to define the forms for data collection and improvement of some database (MB-SIS and SIS-ROH). The development of systems in real-time or online, stimulating and training of TIC providers as well and providing TIC at the Community, District and Provincial levels may improve the existing flows of data. Training and supervision from the community can have a positive impact on the involvement of community in the process of data collection.

3. Mapping of main SIS systems.

3.1. Department of Health Information.

SISPROG was the first national database developed in 1992. It was established in the provincial capitals covering PAV and SMI. The flow of data was done via diskette to the central level.



GRUPO ETARIO VACINA	0 - 11 Meses	12 Meses ou mais	Total Aplicadas	Desperdi-çadas
B.C.G	843	33	876	244
Polio Aplic Prim	660		660	Polio
DPT 1ª Dose	704	17	721	228
Polio 1ª Dose	698	18	716	DPT
DPT 2ª Dose	557	14	571	194
Polio 2ª Dose	547	11	558	
DPT 3ª Dose	515	12	527	
Polio 3ª Dose	515	11	526	
Sarampo	429	30	459	111

Ficha # 4
Distrito Cuamba
Mês Janeiro

V.A.T. bata F3

Indicadores F4

GRUPO ETÁRIO / VACINAS	0-11 MESES	12 MESES OU MAIS	TOTAL APLICADAS	DESPERDI-ÇADAS
B. C. G.				
PÓLIO APLICAÇÃO -PRIMÁRIA				PÓLIO
PÓLIO 1ª DOSE				
PÓLIO 2ª DOSE				
PÓLIO 3ª DOSE				
DPT / Hep. B 1ª DOSE				DTP
DTP / Hep. B 2ª DOSE				
DTP / Hep. B 3ª DOSE				
SARAMPO				
CRIANÇAS COMPLETAMENTE VACINADAS < 1 ANO				

BCG,DPT etc F3

Indicadores F4

Ficha # 4
Distrito Cuamba
Mês Janeiro

GRUPO ALVO	V.A.T. 1	2	3	4	5	Total Aplics	Desperdiçada
Mulheres Gravidas	736	460	203	28	0	1985	197
Mulheres 15/49 anos	167	155	179	14	2		
Crianças de Escola	18	5					
Trabalhadores	13	5					

GRUPO ALVO	VACINA ANTITETÂNICA PRIMEIRA DOSE	De 2.ª a 5.ª Dose	TOTAL APLICADAS	TOTAL DESPER-DIÇADAS
MULHERES GRÁVIDAS				
MULHERES DE 15 a 49 ANOS				
VAT	1.ª DOSE	2.ª DOSE		
CRIANÇAS DA ESCOLA				
TRABALHADORES				

Interface SISPROG data entry (entrada de dados) [2].

Nowadays this application proves to be inadequate to answer for the currents needs in terms of health information, taking into account not only the major technological developments that have occurred in the recent years, but also the need to obtain another type of systematized and integrated information.

Given the limitations, in 2002 was developed another system called SIMP (Integrated System of Monitoring and Planning), incorporating Finances, Healthcare workers (SIP), infrastructures, Epidemiological Surveillance and SISPROG. The low capacity of integration, storage and presentation of SIMP data allowed the designing of "Modulo Basico SIS" (MB-SIS) to provide a consistent, simple and compatible application with successive evolutions within the shortest space of time for the whole country.

Parallel to the development of MB-SIS, a user manual for reference was prepared by users and it is available in both hardcopy and electronic versions.

The new software also had as main characteristics:

- ✓ Data entry for monthly forms.
- ✓ Listing and printing of aggregate data (different levels and periods). All aggregate data are printed in the original format of the forms.
- ✓ Data import and export between computers to the various levels (district/provincial/central) and different periods.
- ✓ Automatic transformation of old SISPROG data into MB-SIS – which allows the usage of new MB-SIS tools to work with old data.
- ✓ Integration in the new U.S. (Health Unit) software of district and provincial codes.

- ✓ Data entry of population.
- ✓ Data export to Excel format.
- ✓ Security copy of data in the hard disk, diskette, zip disk, flash drive, etc...
- ✓ Detailed user manual including practical examples.

Interface for data export (exportação de dados) [2]

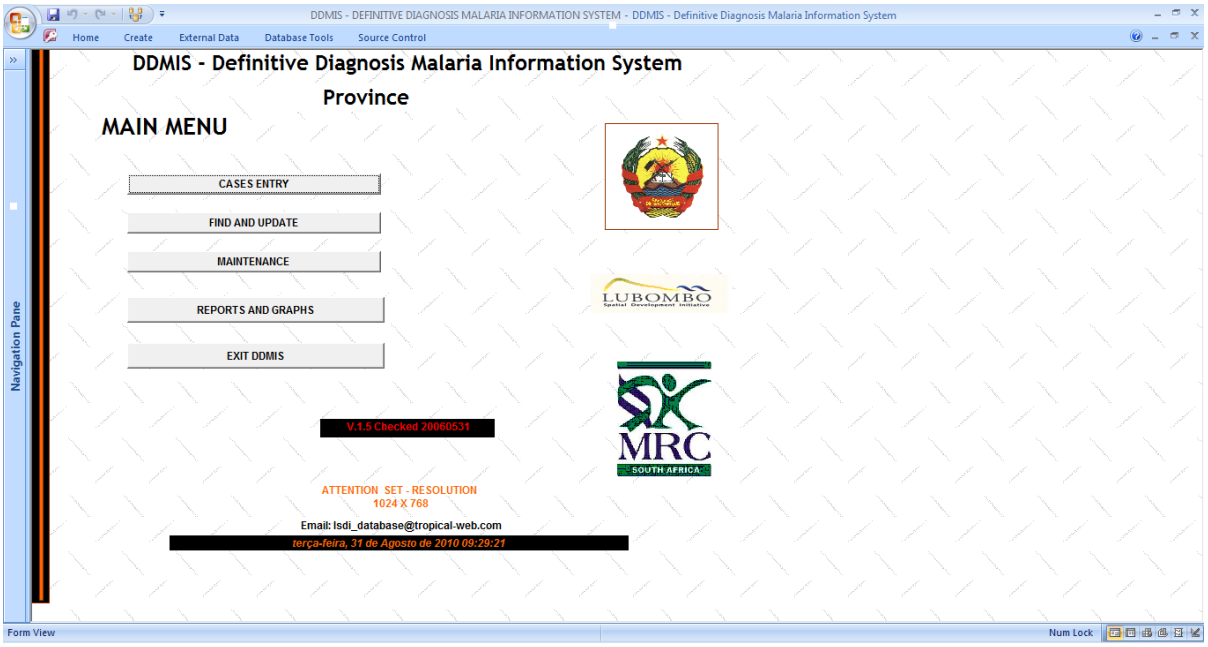
Interface for data entry (entrada de dados) [2].

Interface for report generation (geração de relatórios) [2].

3.2 Vertical and Partner Programs.

Various vertical programs have developed and managed their own information systems. Some examples of these programs include:

- ✓ LSDI is a trilateral partnership between the Governments of South Africa, Swaziland and Mozambique. The aim of this spatial development initiative is to promote the economic growth in the vicinity of the Lubombo Mountains which comprises southern Mozambique, Swaziland and parts of North-eastern of South Africa. The Malaria Information System (MIS) is a computerized system that allows the input, management and output of malaria case data used for management and research. Such includes a spatial component called Geographic Information System (GIS) that collects geographic data including administrative boundaries, population, U.S., cities and other relevant information. The MIS is continually customized to minimize the skill requirements of the end user and to optimize access to different sets of data. The MIS was developed and implemented for each of the three countries participating in the LSDI. The data collected during the routine operations are entered in the MIS and entails both outpatient and clinically confirmed and diagnosed malaria cases. The data collected during the pulverization rounds are inserted in the MIS, the data play a key role in the follow-up and planning of pulverization activities. The MIS provides managers with information on malaria cases diagnosed by U.S. and information on vector control activities.



Main interface for confirmed and diagnosed cases.

- ✓ The PNCM has some data management systems namely a database of Client/Server environment for managing data from sentinel posts (PS). It is done by exporting data at the district level and sending the file by email to the central level where it is imported to the central server. The file of Malaria Data comes in MS Excel format where data is aggregated from SIS, BES and PS in an Excel sheet, per year and partner. The Malaria Country Profile provided by WHO is still under translation and will be introduced locally at the provinces and the reporting will be at the central level. It also relies on the MB-SIS with the permission of DPC.

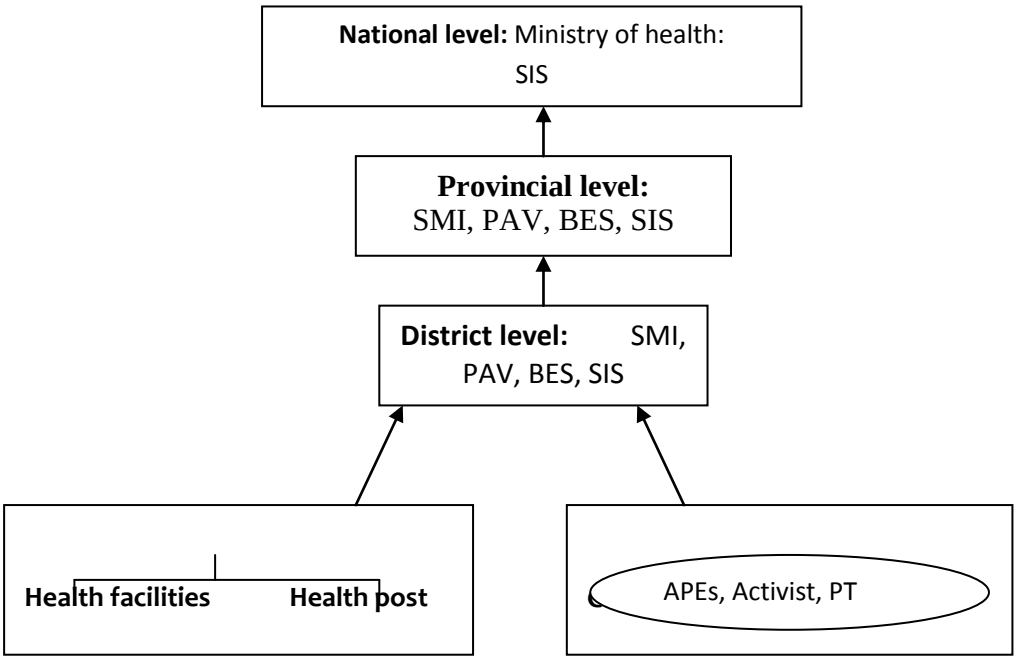
- ✓ In the Epidemiological Department, there is a database called "Resumo Diario" developed in Ms Excel where statistical data is stored on the number of cases, number deaths and relevant cumulative by Province and District on every epidemiological disease. This system is fed daily though a system called "via rapida" in which the District Heads of Epidemiology send SMS or call the person responsible at MISAU telling the number of cases and deaths, and this one inserts the data in the database which calculates the cumulative as well as generates graphical reports. The BES was designed to follow-up reported cases and deaths in each epidemiological week. In partnership with CDC, a spatial database was developed using MAPInfo, a free application developed by CDC.

- ✓ MHIN is a partnership between, AED and MISAU, AED has developed and installed across the country an online database called SIS-VE (MOZESS). In the SIS-VE, the data are introduced as soon as the district users receive the information from the U.S. These introduce in the PDAs or in the computers and data flows to the central server through the internet. The provincial users have access to information provided by the district users via internet. They may generate reports of their provinces, both for the monthly bulletin of Sentinel Post and for the Weekly Epidemiological Bulletins and "Resumo Diario".

Main interface of SIS-VE.

4. Analysis on the flows of SIS information in Mozambique.

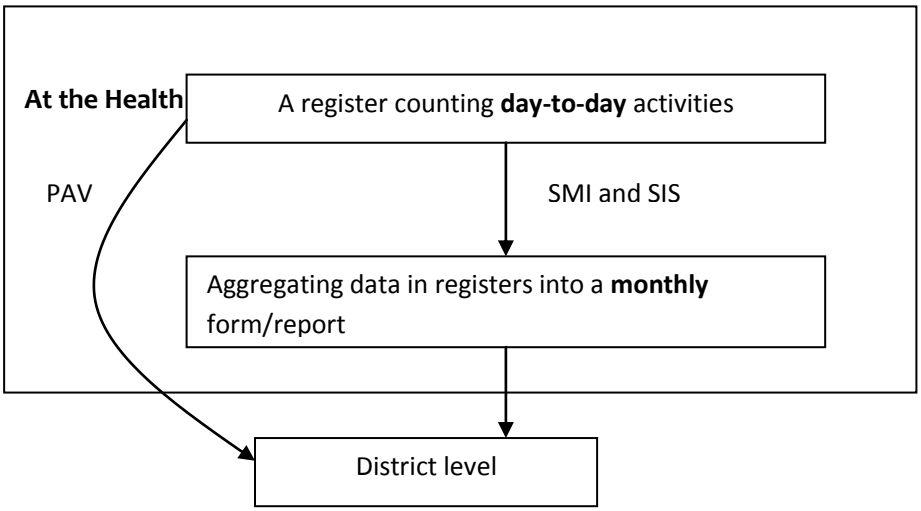
According [4] a study was done in Xai-Xai based on interviews, with the aim of analyzing the health forms, reports and existing technological infrastructure, describing SIS structure, giving an overview of the flows of information within the health system in the district. These flows of information are also a reflection of the current health system structure in the health units at the district, provincial and national levels.



Overview of SIS data flow.

4.1. Health Units (U.S.) Level.

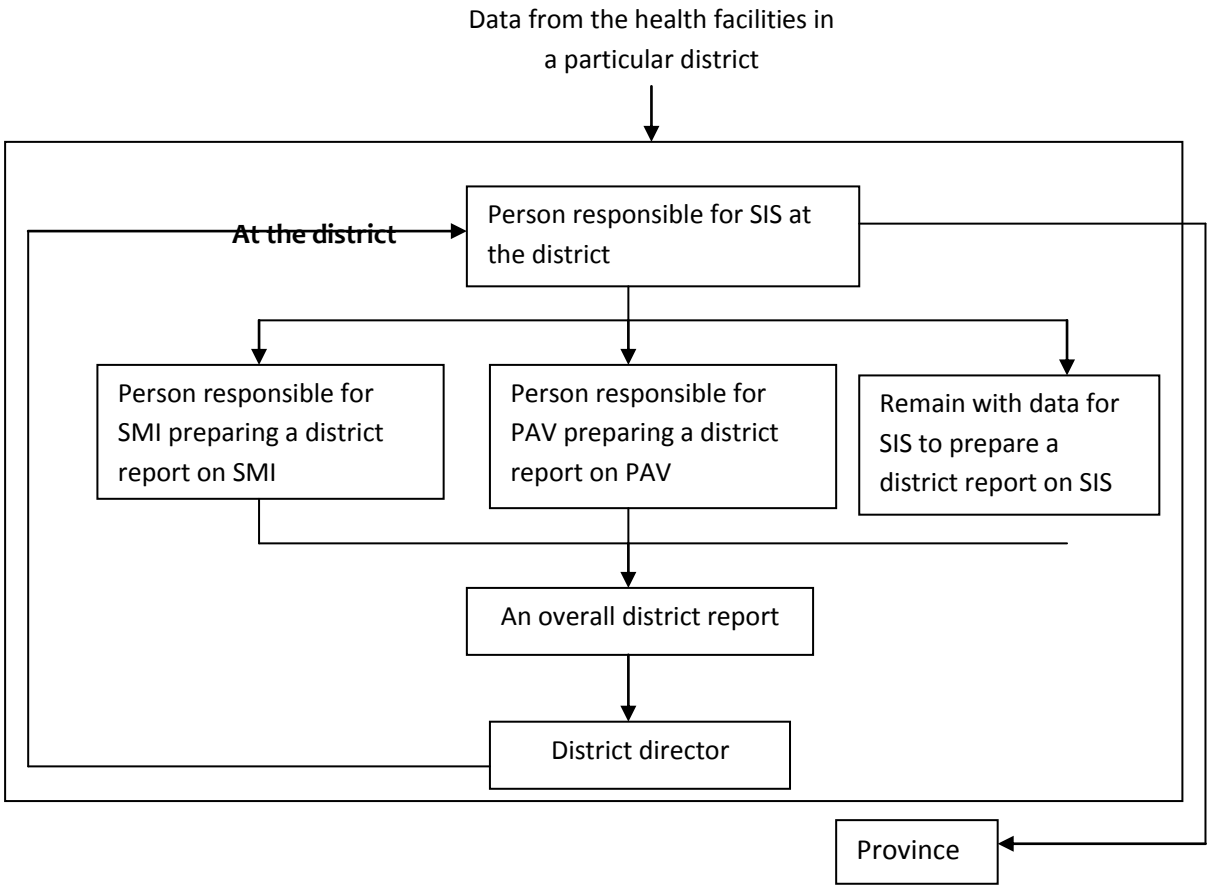
The U.S. are the source of health data and figures for the SIS. The health professionals at the U.S. as well as at the community APEs collect statistical data on immunization, maternal and child health, family planning and outpatient drugs. The aSMI and SIS data are aggregated in a monthly report and then sent to the district., While data on PAV are sent to the district on a daily bases (without being aggregated), BES data are sent to the district at a weekly basis. So there are various methods of data collection and reporting. For example for SMI there are three different ways of collecting data which are then combined in a single reporting form.



Flow of data at the U.S. levels

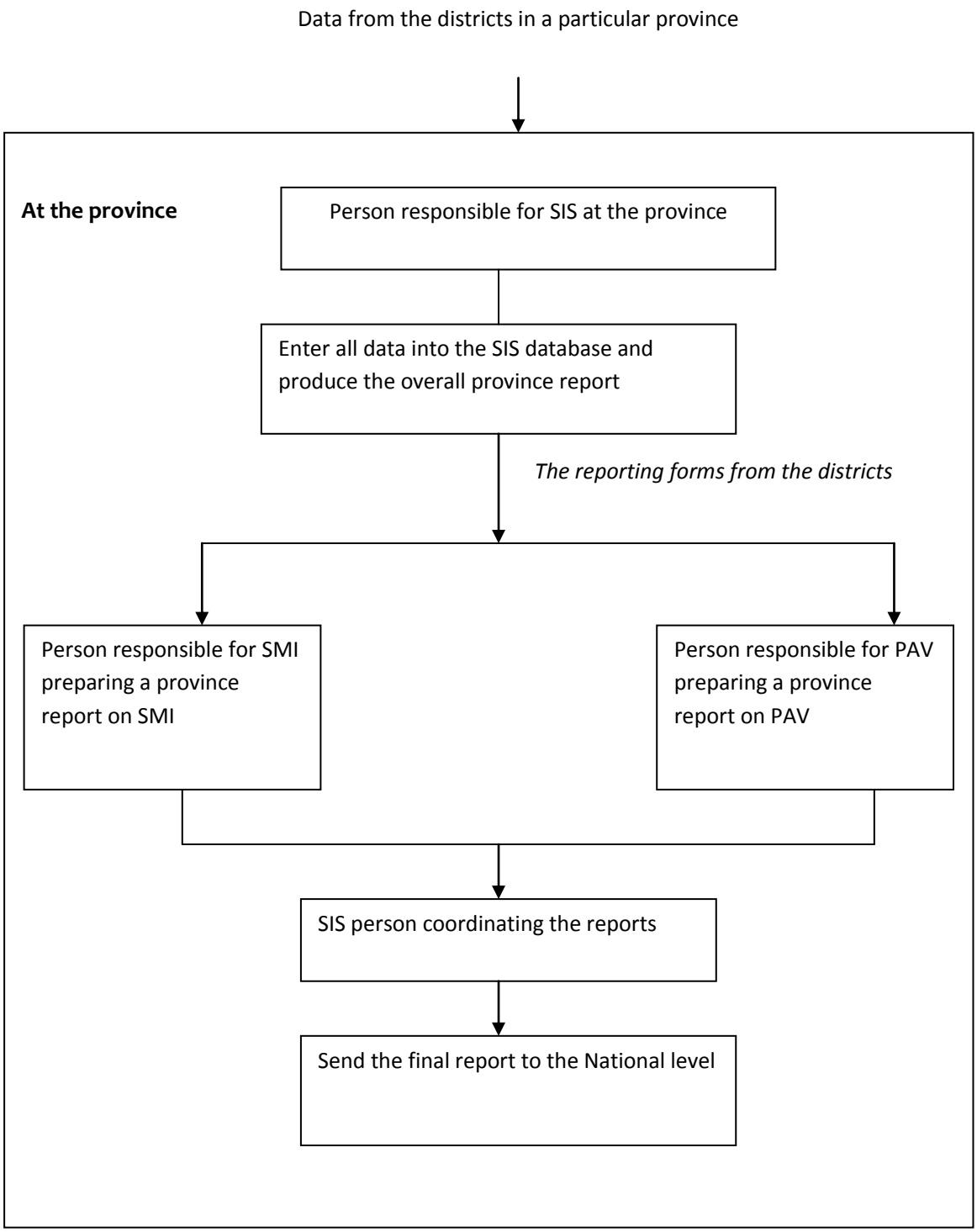
4.2 District Level.

In the District, data from U.S. facilities are aggregated into a single report and sometimes separated into different types of report. The reports on the District SMI data of the Province are done by the U.S., that is, not aggregated, while for PAV and SIS are aggregated. The person responsible for SIS receives the reports (of every program) coming from the U.S., enters data into the database and then distributes electronic SIS data for each person responsible for SMI and PAV. Each of them then prepare a program specific report and afterwards sit together to prepare the District report that must be verified by the District director before being sent to province. After the verification, the District Director returns the report to the person responsible for SIS which sends the report to the Province. The flows at the District level can be presented as follows:



4.3 Provincial Level.

At the province, district reports are aggregated every three months period, allowing for the preparation of cumulative reports of three months, six months, nine months and annual. The person responsible for SIS receives the reports (of every program) coming from the districts, enters data into the SIS electronic database and then distributes to the person in charge (of SMI and PAV). Each of them prepare a program specific report, while the person responsible for SIS also prepares the overall report of all programs (SIS, PAV and SMI). Then they give the reports to the person responsible for SIS which then coordinates the reports, comparing them with the computer output. After coordination, the person responsible for SIS sends the overall provincial report to the national level. The flows of information within the province can be presented as follows:



Data flow at the Provincial level.

4.4 Problems related to the flows of information.

- ✓ Complete information, not all Health Units can submit the reports on time to the next level.
- ✓ Data accuracy, the health professionals in the Health Units do much work but report less because during the day they work hard and in the afternoon they try to remember what they did throughout the day for information purposes. The lack of personnel is one of the issues that influences this problem because a single person develops many activities, since it is considered important to have all activities fulfilled instead of completing endless forms. Thus, the information completed in the form is what the worker sometimes thinks that was done during the day. This is also influenced by the lack of culture in terms of proper completion of data and analysis. Nobody knows why the forms must be completed but only for sending data to the higher level. The forms are mechanically completed, without knowing the meaning of the data or at least the purpose. The non-use of data collected for decision-making and feedback is one of the issues that influence health workers to be unconcerned about the truthfulness of data. Another aspect is that there is no trust in the information (data) due to the educational level of the people responsible for the health services, where some of them are servants.
- ✓ Deadline, for each level of information flows there is a deadline to send the reports to the higher level, and what happens is that sometimes these deadlines are not obeyed meaning that the reports are sent with missing data. Therefore, if any decision has to be made it will be done with data missing from the lower level. So we can say that the data collected are not used for decision-making but it is just a formality.
- ✓ Feedback, data are collected daily, weekly and monthly which are sent to the upper levels. But the opposite is very unusual. Nobody sends a well done notice, only complains are sent on errors and missing information. Such does not motivate people to collect data. There are mistakes in the collected data that are not questioned.
- ✓ Defective data analysis, data that seems to be correct are the data collected by the people responsible for NEP, from which are made some charts (local analysis and decision-making). When the person responsible at the district level finds out that there are some missing data, the calculation was improperly done, the same person starts an argument with the person that inserted the data unless the latter is a servant, in this case, the mistakes are reported to the servant to inform the person that inserted the data. There is no concrete data analysis; the person passes the information/data through the formality of receiving and sending to the person that needs the information.
- ✓ Informal system, the non-use of collected data or the information produced for decision-making lead us to say that there is an informal system of information.
- ✓ Lack of resources, the information is not coordinated so that it is not used; other Districts are more organized in data collection and sending to province because they have infrastructures and receive more resources.

5. SWOT Analysis.

The SWOT analysis is a tool for diagnosis and analysis of organizations that improve perception of managers about the type and characteristics of relationships that the organization must develop will all its stakeholders in order to achieve a good level of performance and actions that must be undertaken for the organization to function in a sustainable manner.

This analysis determines how the organization is achieving its performance targets and what actions should be developed to increase the satisfaction of needs and expectations of every stakeholder in their area of activity particularly the end users of produced goods and services.
The level of satisfaction or dissatisfaction of stakeholders can identify opportunities and threats and also the issues that the organization should perform well so that can take advantage and overcome the existing threats (key factors of success).

Seizing opportunities and overcoming threats should be the main concern of managers. To do this, the strengths and weaknesses of the organization must be identified, seeking to find out about the core competences that build and develop structures, processes, systems and mainly organization.
Thus, the essence of the SWOT analysis technique is to systematise the organizational diagnosis information and its functioning so as to meet the key factors of success and develop current and future core competences of the organization.

In the PE-SIS framework was developed a thorough diagnosis of the current situation of Information Systems and technologies. This analysis identifies opportunities, threats and key factors of success for the SIS, as well as evaluated its current functioning, identifying the strengths and weaknesses and defining its current and future competences.

The PE-SIS must have a central role in this process to seize the opportunities, overcome threats, improve the strengths and reduce the weaknesses of SIS through a clear definition of key factors of success and identification of actions that develop current and future core competence for the management of SIS as a whole.

The analysis also comprises opportunities, threats, strengths and weaknesses for internal clients, critical success factors and core competences and future roles of informatics at the health sector.
The SWOT analysis is important in defining the plans to implement the EP-SIS which is the main platform to implement, in a incremented and integrated form, a set of actions in the areas of information systems, information technology, organizational structure to manage SIS and the management of organizational change.[5]

5.1 Overall Analysis.

The objective of the analysis is to systematize the information on the opportunities and threats, strengths and weaknesses, expectations of internal clients, key factors of success and current and future competences, both for the SIS and the functional Health informatics sector.

The following table presents the variables that have direct influence on the SIS and that are opportunities or threats to its development.

VARIABLES	OPPORTUNITIES	THREATS
Participation of economic agents.	✓ Release of State Budget funds. ✓ Occupation and development of geographical spaces not occupied or improperly occupied. ✓ Establishment of new health units.	✓ Scarcity of Funds.
Role of donors.	✓ Important source of funding.	✓ Imposition on the ways of developing the IS.
Infrastructures.	✓ Project for the creation of conditions based on the development of SIS through the projects to expand energy and telecommunications to the Districts.	
High level of illiteracy/Low level of schooling		✓ Scarcity of human resources trained for Information Management.
Low purchasing power.		✓ Inability to recover investment due to lack of enough revenue.
Inexistence of a culture of Information Management.		✓ Difficulties for relations between MISAU and other national partners. ✓ Constraints of introducing the IS in the organization.
Increase of population/Pressure over the health services.	✓ Increased need of Information Management.	✓ Scarcity of resources with competence to perform the information management.
National Policy of Informatics.	✓ Trend towards a more efficient State instrument with the use of information technologies.	✓ Possibility of overlapping the policy of Organizational Development of the institution.
Government Five-Year Plan.	✓ The Health Sector is a priority for the Government.	
Reform of the Public sector.	✓ Emphasis on organizational development.	
Rapid increase of capacity for computing, storage and processing of data.	✓ More alternatives; higher capacity to deal with information; lower cost due to great supplies and economies	✓ Increased need to update human resources and related technology.

	of scale.	
Existence of internet as a means to transmit and present information.	✓ Develops and improves the communication processes and strengthen the organizational culture. ✓ Reduction of transmission costs of information.	
IT as means to make use of new management models.	✓ Management by process. ✓ Strategic management of human resources. ✓ Mechanism for control and provision of accounts based on integrated models.	
Strong development of IT related to the Health Sector at the global and regional level.	✓ Experiences can be gathered and the implementation impacts in other places can be studied.	
Final users of health services.	✓ Pressure over the increase in quantity and quality of services at affordable prices.	
SIS suppliers.	✓ Rapid evolution on the development of solutions according to the needs of information management of Public Health Services.	✓ Low supply of SIS solutions at the Mozambican market which leads to high implementation costs and difficulties in supporting the implementation maintenance.

5.2 Users expectations of SIS at the Health sector.

Hereafter are presented the main conclusions on the expectations defined by the managers that determine the performance and functioning characteristics of Health Information Systems.

- ✓ Existence of a core orientation that allows for the harmonization of criteria in parallel with SIS development, aligned to the needs of information management, facilitates and controls the implementation and control of PESS.
- ✓ Development of infrastructures to ensure quality data communications within and outside the Sector.
- ✓ Implementation of a development policy for the integration of diverse systems functioning and to be developed.

- ✓ Establishment of a structure for SIS Management capable of fulfilling the support need of internal clients.
- ✓ Analysis of processes to simplify the administrative management based on the use of SIS.
- ✓ Considerable increase of information quality and the introduction of mechanisms to support decision-making of health units and Provincial and District Directorates.
- ✓ Definition of a Human Resources policy for the recruitment and retention of SIS cadres.

Development of SIS professional management. The use of SIS as the main tool to support competence development through the training and clinical diagnosis.

5.3 SIS Strenghts

- ✓ Establishment of core mechanisms for decision-making on SIS strategies.
- ✓ Concerns by managers and cadres over the need to develop systems as well as better information management of different functional areas of the sector.
- ✓ Experience on the SIS implementation.
- ✓ Experience on the implementation of systems for information collection.
- ✓ Existence of opportunities to obtain SIS through the cooperation funds.

5.4 SIS Weaknesses

- ✓ Lack of strategic orientations and processes for information management.
- ✓ Shortage of own funds to ensure the development and funding of SIS.
- ✓ Low organizational maturity to create conditions for the development of SIS in terms of processes, systems, staff and criteria to follow-up its development.
- ✓ Lack of human resources in terms of quantity and competence to manage SIS.
- ✓ Lack of competence for the selection and choice of the acquisition process of systems.
- ✓ Shortages in the system of internal and external communication.
- ✓ Exacerbated dependence on external agents for the development and maintenance of SIS.

5.5 Key factors for the success of SIS.

- ✓ Policy of support and orientation of internal clients.
- ✓ Creation of policies and adequate environment for the admission and retention of human resources with adequate competences for the management and development of SIS.
- ✓ Stimulate and participate in the designing of a relocations management plan to ensure the establishment of proper conditions within the organization for the implementation of SIS.

- ✓ Define an adequate position of strategic importance and SIS decision-making on the implementation of PESS.

5.6 Main Competences for the success of the informatics role at the Health Sector.

- ✓ Systems Analysis.
- ✓ Technical implementation of systems.
- ✓ Organizational implementation of systems.
- ✓ Administration of hardware server.
- ✓ Administration of operative Systems.
- ✓ Administration of database.
- ✓ Administration of communications.
- ✓ Administration of micro informatics.
- ✓ Support to users.

Appendix 1 – table for the presentation of proposed interventions / innovations

Reviewer to complete						
1	2	3	4	5	6	7
Innovation[1]	**Source**	**Methodology**			**Issues which may impact feasibility, acceptability and scalability**	**Moderators of impact**
		Approach	**Tools**	**Evidence**		
PDA's for Malaria Monitoring	Lubombo Spatial Development Initiative/AED-SatelLife	Malaria is the principal cause of morbidity and mortality in Mozambique and is considered a major impediment to development. The effectiveness of any malaria control program depends on reliable data delivered in timely fashion, something that is currently lacking in the nation's health service. The	The project partners acquired, configured and distributed 20 PDAs, eight GPS units and 20 cellphones, plus data cables and a forms-creation application. Training materials designed by AED-Satellife were translated into Portuguese. Over five days, a trainer from the Uganda Health Information	Some technical difficulties were experienced. While it initially appeared that the cellphone infrastructure was sufficient for transferring data from the field to the central computer at the LSDI office, this turned out not to be the case, and the data had to be downloaded directly from the PDAs to the	If successful, the use of handheld computers would be expanded nationally and adapted to bring similar benefits to other components of the health system.	According to an independent evaluation, 100% of the respondents (technicians) found the PDA a useful tool for data collection, wished to continue using it and would recommend its use in other health applications, mainly HIV/AIDS programs.

[1] Innovation here refers to an activity, approach or underlying concept which may contribute to the performance and retention of CBAs.

		project partners introduced the use of personal digital assistants (PDAs) or handheld computers at the district level in the Lubombo Spatial Development Initiative (LSDI) Malaria Program area in Maputo and Gaza provinces.	Network trained 50 technical personnel and data collectors on the general use of PDAs, data collection using PDAs, remote synchronization of data to LSDI databases.	computer. Also, each district unit had one PDA to be shared between the spaying team and the pharmacy, and this resulted problems of availability. Perhaps the most important finding of the project was that geographic data imaging (mapping) can be a powerful tool in explaining public health priorities to community leaders and engaging them to become active advocates for their own villages.		
Empowering Health Workers to Save Lives	Mozambique Health Information Network Project/AED-SatelLife.	The Mozambique Health Information Network (MHIN) strengthens the Ministry of Health of Mozambique (Ministério de Saúde, MISAU) capacity to collect, transmit and	MHIN provides a two-way access to information utilizing the existing cellular telephone network and low-cost, simple to use, and energy efficient handheld	District Health Offices receive data from various levels of health centers using the MHIN that include immunization registers and reports, disease surveillance data,	AED and MISAU are currently working with Eduardo Mondlane University to conduct cost-benefit analysis of MHIN by comparing the data collection and report generation costs associated with MHIN and paper based approaches.	The project also started delivering health content to rural health workers pertaining to diagnosis, treatment, and prevention of major health problems such as malaria and TB. Health content is "broadcast" from the server at MISAU via the cellular network to African Access Points located at health

		report Health Management Information System (HMIS) data.	computers (also known as Personal Digital Assistant or PDA) for supporting health information dissemination, data collection and reporting, and email exchange. Data transfer from/to PDAs is facilitated using wireless access points (called African Access Points or AAP, developed by AED-SATELLIFE) and a linux server located in Maputo at MISAU.	and reports related to other health problems as required by MISAU department of Health Information System. The DHO also use the network to receive data for monitoring drug usage and stocks, which is used for ordering medicines.		facilities. Health workers download relevant health content to their PDAs and use it as a reference for treating and/or providing better care to their patients.
Africa Research Program.	ZMQ/ Freedom HIV/Aids.	Freedom HIV/AIDS comprises of four mobile games targeting different mindsets and psychology of mobile users. Learning from its experience in India, ZMQ planned to take up the mobile	The games are deployed on low-end black/white to sophisticated high-end colored devices. The project has been developed for different mobile technology platforms like	Under the programme, ZMQ developed 2 mobile games - AIDS Fighter Pilot and AIDS Penalty Shoot Out. Apart from English, the games have been developed in local languages -	On World AIDS day - 1st December 2006, Freedom HIV/AIDS not only celebrated its first anniversary in fight against HIV/AIDS using mobile phone games but also added a new chapter - 'Africa Reach Program' with Hivos, a leading Dutch development organization, and KPN, the largest Dutch telecom	The games have been made available to over 6 million handsets in the Eastern African regions. There is more demand of the games in the local languages - Kiswahili and Shen.

		games to other parts of the world specially the most affected ones in Africa and South East Asia in the local languages. The six countries covered under the Star programme in Africa are Uganda, Tanzania and Kenya in Eastern Africa, and Malawi, Mozambique and Namibia in Southern Africa, the regions of high HIV/AIDS prevalence.	Java/J2ME, C++/Brew, C++/Symbian and Macromedia Flashlite to cater to over 100 devices and handsets covering over majority of devices.	Kiswahili and Shen.	company, under the "Star Programme".	
Developing Open Architecture, Standards and Information Systems (OASIS) for Healthcare in Africa	Medical Research Council (MRC)	In Africa, the twin epidemics of HIV/AIDS and TB, and the continued high rate of morbidity of malaria, means that this continent is dealing with a triple health burden with insufficient knowledge of the	The project builds on previous successes in developing and implementing health information systems. OASIS will continue to support the development of open source	The OASIS project evolves out of several health and ICT initiatives that have built on each other like "Information and communication technology in support of antiretroviral treatment in the	OASIS will also link with already established networks and government departments. The project will investigate appropriate organizational models to sustain this activity in future. The overall aim of this project is to investigate, develop and evaluate methods, tools and techniques required to develop sustainable,	It is envisaged that OASIS will influence positive developments within and between the constituent networks, as well as amongst health informatics practitioners, academics and policy makers. A key change that OASIS is expected to influence concerns the research skills of the African researchers engaged in the project. Specifically, lead and supporting researchers will strengthen their skills in research

		scale to manage either. Progressive health ministers would like to have the data at their fingertips. An example of one such ministry is in Mozambique.	software applications and networks in sub-Saharan African countries, which collaborate in research, development, implementation and training. African junior developers will improve their skills in implementing OpenMRS and JavaROSA systems as well as other relevant health application software; and eHealth specialists who assist in the implementation and use of eHealth systems will have an increased capacity to advise policy makers.	Free State Province, South Africa"; "Open source PDA software for health data collection"; " The Open Medical Records Systems Implementers meeting in Africa .	integrated and interoperable open source health information systems in low- and medium-income developing countries to assist with the development of more effective health information systems.	design, implementation, analysis and communication; Members of OASIS have also helped lay the groundwork for an international e-Health policy by participating in the WHO-convened Consultation on e-Health Engagement Policy in Kigali, Rwanda (October 19-23, 2009). The purpose of this consultation was to identify issues that will be addressed in a revised "Guide for Acquisition of Information and Communications Technologies (ICT) and Services," which will help inform the acquisition and development of health information systems and e-health related systems and services in developing countries. The Consultation on e-Health Engagement Policy also resulted in the development of an initial draft of a Kigali declaration that specifies the actions required by key stakeholders to enable successful design and acquisition of health ICT and services.

Open Medical Record System (OpenMRS).[6]	Regenstrief Institute/ Partners In Health	OpenMRS is a software platform and a reference application which enables design of a customized medical records system with no programming knowledge (although medical and systems analysis knowledge is required). It is a common platform upon which medical informatics efforts in developing countries can be built. The system is based on a conceptual database structure which is not dependent on the actual types of medical information required to be collected or on particular data	OpenMRS is a client-server application, which means it is designed to work in an environment where many client computers access the same information on a server.	The core OpenMRS application comprises a web application, programmed in Java and JavaScript and a number of open source component applications, maintained by other open source communities, including: MySQL; Apache Tomcat ; Mozilla Firefox and Hibernate.However OpenMRS interectats with other a non-Open Source softwares.	OpenMRS is a highly configurable, scalable and extensible open source electronic medical record (EMR) application currently applied mainly to HIV/AIDS and Tuberculosis patient and treatment information management in developing countries. As Free Open Source Software (FOSS) can potentially reduce the costs of acquiring systems and also contribute to in-country capacity and economic development by re-assigning licensing costs to developing local software development and implementation skills. OpenMRS is now in use around the world, including South Africa, Kenya, Rwanda, Lesotho, Zimbabwe, Mozambique, Uganda, Tanzania, Haiti, India, China, United States, Pakistan, the Phillipines, and many other places.	Projects identified at OpenMRS implementation meeting, June 2006: Implement a desktop version of OpenMRS; Develop an open source XForms Design Application; Develop systems specific for tuberculosis and for integrating care TB HIV co-infection; Develop OpenMRS applications for handheld devices and mobile phones; Enable concept sharing; Develop OpenMRS Reporting Systems.

		collection forms and so can be customized for different uses.				

Notes

Column 1 – description of innovation including key features

Column 2 – program or theoretical source of innovation

Column 3 – the methodological approach that has been used and the type of evidence that is available

Column 4 – the specific tools used for the measurement of the innovation

Column 5 – the available evidence for the impact of the innovation

Column 6 – aspects of innovation which may impact on feasibility, acceptability and scalability. These may include but not be limited to issues of cost, political and cultural sensitivity, required resources and logistics of implementation

Column 7 – lessons from other settings that indicate factors which may moderate impact

6. Bibligraphy

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