



**República de Moçambique  
Ministério de Saúde**

# **Terms of Reference for Designing the Requirements of the Health Information System of the Maputo Central Hospital and preparation of the Tender Specifications**

Technical Report

**World Health Organisation**

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*"There is no health without management,  
there is no management without information"*

Gonzalo Vecina Neto, São Paulo, 2003

## **Presentation**

This Technical Report complements the product of the Technical Consultancy offered by the World Health Organisation to the Department of Health Information at the Ministry of Health of the Republic of Mozambique, as per obligation number AF/06/062911, for the specification of the Maputo Central Hospital (HCM) computerisation project.

## Background to this Document

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## Glossary

BES	-	Weekly Epidemiological Bulletin
BI	-	Business Intelligence
ICD	-	International Classification of Diseases
DIS	-	Department of Health Information
INE	-	National Institute of Statistics
MISAU	-	Ministry of Health
WHO	-	World Health Organisation
PAHO	-	Pan American Health Organisation
PES	-	Social and Economic Plan
PESS	-	Health Sector Strategic Plan
PMI	-	Project Management Institute
EHR	-	Electronic Health Record
AIDS	-	Acquired Immunodeficiency Syndrome
SIS	-	Health Information System
HIS	-	Hospital Information System
NHS	-	National Health Service
IT	-	Information Technologies

## Executive Summary

The products of this consultancy were divided into two documents. The first deals with the main objective of the consultancy: the elaboration of the TOR and the requirements for the bidding of Hospital Information System (HIS) for Maputo Central Hospital (HCM), the most important and referral hospital for Mozambique's Health System. The second document is a technical report that aims at helping the Ministry of Health of Mozambique (MISAU), or more precisely MISAU's Health Information and Informatics Department, to implement a National Health Informatics Infrastructure. The current policy documents and the roadmap for the area were analyzed and the need for some extensions has been identified. Such extensions include the creation and adoption of national e-health standards as well as aspects related to infrastructure, methods and human resources. These extensions are proposed in the Technical Report.

The first document details the requirements for the HIS/HCM. It proposes a four-year strategy for HIS deployment and emphasizes that besides the system itself there is the need to align HIS implementation with the National Strategy and, by doing so, to have the standards defined together with MISAU. In addition to that, it is necessary to incorporate in the TOR the revision of all management and healthcare delivery processes in order to guarantee a successful HIS implementation.

The TOR document starts with the diagnosis of the present situation of the use of IT at HCM. The lack of information for patient care, or hospital management is pointed out. Areas where the need for some automation is urgent, such as Pharmacy and Stocks, whose processes are fully on paper, or the (Nutrition) sector that has no tool to calculate the patient diets, are also singled-out. The problem of the distributed patient files and the need to reform the current patient archives are also identified. The most important issue raised in this part of the report are the standards, or the absence of them. ICD-10 is poorly used. There are no standards to describe medical procedures nor is a common content standard to describe summary discharges, encounters, or outpatient visits. Only volume indicators are calculated since there is no information about morbidities. Exception is taken for the TARV programme (Anti retro Viral Treatment for AIDS patients) for which an essential dataset based on international protocols do exist.

Based on this scenario the TOR proposes a four-year four-stage strategy to implement the HIS. In common they have the standards component that is the system's cornerstone.

1<sup>st</sup> phase (1<sup>st</sup> year): Standards (vocabulary, content, security and communication) should be defined. This first interaction must implement the healthcare vocabulary repository; face the revision of the following processes: Patient Register, Admission and Transfers, Discharge Summary, Stocks and Pharmacy, Patient Scheduling, TARV Patients Register and Follow-Up, uses of the health information (an extensive list of hospital health indicators is proposed). Those are also the functionalities that should be present in the first interaction.

2<sup>nd</sup> phase (2<sup>nd</sup> year). The second year focuses the HIS implementation to support the administrative and managerial departments. The processes revision and HIS functionalities should cover: Sterilized Supplies Centre, Procurement, Hospital Costs, Assets, Finance and Account, Laundry and Transports.

3<sup>rd</sup> phase (3<sup>rd</sup> year): The focus for the third year is to support healthcare delivery processes. Again, standards for the new functionalities need assessment. Processes and Functionalities: Encounter Registers (outpatient and emergency), Electronic Health Record (starting with ePrescribing and integration with Lab results), Medical Images, Diet and Nutrition) (partially addressed in the first interaction), Surgical Centre and Scheduling, Pathology, Blood Bank.

4<sup>th</sup> phase (4<sup>th</sup> year): This interaction focuses on the definition of the business intelligence tools to support HCM and MISAU strategic planning. The BI tool will dynamically build the health indicators using information from the different areas within the hospital. A comprehensive list of hospital indicators is proposed. It is recommended that the same BI tool used for HCM should be the one also adopted in MISAU to build all the reports from the different health information systems presently in use in Mozambique.

All the functionalities are minimally described to make sure bidders know what is expected. The document also describes the standards, concepts and methods that should be used, such as PMI, Java, open architectures, UML for use cases description, international health informatics standards, Internet architecture, total independence of software on hardware platform or database management systems, and also that bidders must create an Internet page to follow-up the project that should be updated at least each 48 hours. The TOR also proposes a Steering Committee formed by the MISAU, HCM and the hired company to coordinate the project. At least two other independent renowned organizations should appoint observers to monitor the project. Next, the document details a timetable for products delivery related payments. In section two of this first document the details of the bidding process are presented. The requirements expected from bidders are stated, and include qualification of the bidders (including consortia), of the project coordinator, of the technical proposal and of the technical team. Experience on the methodologies and technologies are required. A scoring method is also proposed. It is also suggested that the final evaluation criterion should be 70% technical and 30% commercial. (The model for these bidding details is presented and is based on bidding processes used by the Ministry of Health and UNESCO when procuring Health Information Systems in Brazil).

The second document of this consultancy is Technical Report that deals with the analysis of the Mozambique National Health Informatics infrastructure. The main objectives are to support MISAU in the construction of a national e-health effort. The report gives a brief description of national policies of health information, with emphasis in its commonalities: standards, infrastructure, organization and human resources. The WHO eHealth initiative was also discussed. The previously existing planning and roadmap defined for the development of Mozambique National Health Information System (SIS) and the planning for the Health Information Department area are analyzed. The following extensions on the current roadmap are proposed:

- to adopt a patient-centred model for the health information systems, instead of the vertical approach today in practice;
- to implement a national health informatics standards initiative, starting with unique identifiers for persons, healthcare providers and healthcare professionals and moving forward to vocabularies (diagnoses: ICD-10, procedures, treatment and so forth), essential datasets (starting with Discharge Summary and TARV to link with the HIS-HCM initiative, and security and confidentiality. The recommendation is to adopt international standards and look for available Portuguese resources for vocabularies, as may be the ones in use in Brazil.
- To define the methods to be adopted within DIS and all external projects contracted by MISAU, such as project management, software development and documentation, and open standards, in order to guarantee a scalable, robust and modular architecture.
- To establish a Human Resources development strategy for health informatics. The objective is to build some national competence in Health Informatics through short, medium and long-term efforts.

- To build a national technological infrastructure to connect healthcare providers across the country with broadband Internet services and to create the backend of servers, to support the needs of web-services, application servers, database and data mining methods.

The final part of this document discusses the following topics: the risks building the Mozambique eHealth initiative; the relationship between the MISAU-DIS Plan of Action and the HCM HIS project; the summary of the consultancies proposed and, the complexity dimension of the process in the future years outlined.

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## **1 OBJECTIVES**

The objective of this technical report is to support MISAU's Health Information and Informatics Department in building and implementing a National Health Information and Informatics strategy.

### **1.1 Specific Objectives**

The specific objectives are to:

- Present a review of national policies for the health information and informatics area and their impact on the health sector
- Analyse the proposed Health information and informatics policy for Mozambique
- Present a proposal for extending the document "SIS Reorientation and Reorganisation Plan – Roadmap" to the Health Information and Informatics area, with the objective of building a national health information and informatics infrastructure.

## **2 JUSTIFICATION**

The basic argument sustaining the planning and investment in health information and informatics is that, through appropriate, innovative and creative use of information technology, it is possible to promote a quantum leap in healthcare promotion, prevention and delivery.

In its 58<sup>th</sup> Assembly, the WHO acknowledged, through Resolution 28 (WHA 58/28), the importance of the use of IT in the health area, creating "eHealth" strategy within the scope of the WHO. In other words, an action that, through efficient use of information and communications technologies (ICTs), will support activities in the health sector and in health-related areas, including healthcare delivery, surveillance, access to educational literature, and healthcare research and development. In this resolution, the WHO strongly recommends member countries to create long-term strategies for the use of IT in the health sector. Long-term policies are important since they align the short- and medium-term initiatives, thereby avoiding a distribution of resources over fragmented projects.

In 2003, the Government of Mozambique, based on the Health Sector Strategic Plan (PESS), approved the "Health Information System Development Programme", containing the mission and action plans for its implementation. The computerisation of the quaternary sector was one of the strategies identified, which led the WHO to commission this consultancy.

During the consultant's technical visit to Mozambique, she was able to identify the characteristics necessary to prepare the TOR to engage the specialised technical services required to implement a Hospital Information System for Maputo Central Hospital – HCM (HIS-HCM). However, since the HIS-HCM is not an isolated initiative, but rather the beginning of a process to computerise the quaternary level, which will be replicated, it became necessary to analyse the national health information and informatics strategy; in other words, the above-mentioned Programme and its action plans so that the HIS-HCM may be integrated with other initiatives in the area in the near future.

Therefore, the focus of this technical report is on analysing national strategies for the Health Information and Informatics (HII) area and, whenever necessary, proposing necessary alignments.

The end objective is to support MISAU so as to ensure that its eHealth strategy is in line with the most current trends in the use of Health IT, yet adapted to the local reality. To this end, some international experiences are given, with those that already have concrete results, such as Canada or countries closer to Mozambique, like Brazil being singled-out. An effort was also made to identify experiences from the African continent.

The text is organised as follows:

- Chapter 3 – International Experiences in Building National Health Information and Informatics Policies
- Chapter 4 – Mozambique's Health Information and Informatics Strategy
- Chapter 5 – Suggested Extensions to the Action Plan Proposed for the Development of the SIS
- Chapter 6 – Alignment of the HIS-HCM Terms of Reference (TOR) with the DIS/MISAU Action Plan
- Chapter 7 – Risks
- Chapter 8 – Final Considerations

### 3 INTERNATIONAL EXPERIENCES IN BUILDING NATIONAL HEALTH INFORMATION AND INFORMATICS POLICIES

The definition of integrated Health Information and Informatics policies has been disseminated worldwide since 2000. The study of some of these policies, particularly in countries with public health systems, is of special interest to this report.

The argument that, with appropriate use of information technologies, it is possible to improve the health status of a country is present in all the experiences studied. Also common to all experiences studied is the focus on the patient, user of the healthcare system, and from there, essential datasets that are subsequently shared by the healthcare network, i.e., the building of an electronic health record. The use of unique identifiers for patients, healthcare professionals and locations of healthcare delivery is also a concern in all countries. There are different degrees of difficulty in implementing unique national identification numbers. It is evident, in all of the initiatives, that the building blocks of these policies are based on standards to represent health information (vocabularies, content, communication and security), on Internet technology based connectivity infrastructures, and on security to ensure health information privacy and confidentiality. It is not by chance that these four major categories of standards represent the first four working groups of the ISO 215 Health Information Committee:

- **WG1 Data Structure** – Developing standards that establish the structure of health information, in order to facilitate the sharing of information among institutions, organisations and information systems. These standards establish the definitions, contexts, architectures and models, and data structure requirements for health information and associated datasets. The current topics of discussion of this WG are: identification of healthcare subjects, healthcare professionals and respective roles, healthcare providers, reference models for the exchange of Information (archetypes) and the principles and practices for building a Clinical Data Warehouse. The following are highlighted from among the already approved WG1 standards: [ISO/TS 18308:2004](#) Health Informatics -- Requirements for an electronic health record architecture and [ISO/TR 20514:2005](#) Health informatics - Electronic health record -- Definition, scope and context;
- **WG2 Data Interchange** – Establishing functionalities for information exchange within the health scenario, and the circumstances in which this interchange should occur; definition of the resources to implement the data interchange in more than one syntax or communication methodology and identification of specific domains of action. The WG2 has already published a series of standards that establish the

communication (interoperability) of different equipment with the information system. The standards for the TeleHealth and TeleLearning areas are discussed in these WGs under four sub-groups: Medical Equipment, Methodologies, Architecture and DICOM Standard. Some of the documents under discussion are: TR 16056-1 – Health informatics – Interoperability of telehealth systems and networks, TR 16058 Health informatics – Interoperability of telelearning systems and CD Health informatics – Interoperability guidelines for telehealth systems and networks

- **WG3 Semantic Content** – Establishing standards to represent health concepts. These standards include formal models for representing and describing health concepts, the principles for organising terminologies and controlled vocabulary and systems, clinical terminologies and classifications, and the issues relating to the use of these concepts in EHR systems. Some of the approved standards are: ISO/TS 17117:2002 Health informatics – Controlled health terminology – Structure and high-level indicators, ISO 18104:2003 Health informatics – Integration of a reference terminology model for nursing
- **WG4 Security** – Defining standards for establishing methods and technologies to protect and ensure confidentiality, availability and integrity of health information, and also ensure audits of the use and good practices to manage the security of health information. One of the main standardising efforts of this group was the definition of the framework required to implement digital signatures based on public key infrastructures: ISO/TS 17090-1:2002 Health informatics – Public key infrastructure – Part 1: Framework and overview, ISO/TS 17090-2:2002 Health informatics – Public key infrastructure – Part 2: Certificate profile and ISO/TS 17090-3:2002 Health informatics – Public key infrastructure – Part 3: Policy management of certification authority.

Currently, the ISO 215 Committee has eight working groups, in addition to interfaces with the WHO's e-Health initiative. Only two countries on the African continent take part in the ISO 215 Committee: South Africa and Kenya.

Presented below is a brief summary of some national policies, with emphasis on their implementation and corresponding budgets.

### **3.1 Australia**

In November 1999, the Australian Government launched the first version of the Health Information and Informatics strategy to be adopted in the country. The source document providing the definition of the policy is called "[Health Online: A Health Information Action Plan](#)"

[for Australia](#)". The project was prepared by Health Information specialists from the National Health Management Advisory Council (NHIMAC) in collaboration with community and state and territory representatives. The document focuses on action plans in use at present and covers the following areas: standards and policies on health information security, infrastructure-related issues, change management and training in health informatics, and sharing information over networks.

The first outcome following the definition of this policy was the appointment, in July 2001, of a taskforce to build the EHR (the National Electronic Health Records Taskforce) in Australia. The final report prepared by this taskforce recommended the creation of a national Health Information network, which became known as HealthConnect. The National Health Information Standards Advisory Committee was also created, leading to the publication, in February 2001, of the base document on the standardisation of Health Information in Australia: Setting the Standards: A National Health Information Standards Plan for Australia. The current version is called: [National E-Health Standards Catalogue](#).

In 2005, a private non-profit organisation called [NEHTA](#) – (National E-Health Transition Authority) was created to ensure better coordination and guarantee the implementation of the HII action plans. A series of reference publications relating to health information, standards and electronic health records is available on NEHTA's Webpage. The establishment of public-private partnerships are encouraged to obtain funding for each of the initiatives. These documents will certainly be useful for DIS/MISAU.

### **3.2 Canada**

The Canadian Health Information strategy was launched in September 2000, and is called [Canada Health Infoway](#). The model adopted by Canada to implement its policy was the creation of Health Infoway Inc., a non-profit company that invests with public and private sector partners to implement a national HII policy. The company is made up by healthcare representatives from all provinces and territories. Over 100 projects are currently underway using public-private partnerships, with the focus being on building the EHR system for Canadian citizens. The goal is to implement an interoperable EHR solution across 50% of the Canadian population by 2009.

The Canadian strategy is one of the best structured strategies, with clear funding lines according to the business plan.

There are various documents available on Health Infoway's webpage that could be of interest to MISAU, such as the issue of EHR standards and architecture. The Canadian initiative

is, certainly, currently the best articulated initiative, with greater acceptance by the community and continued investments.

The figure below details the investments of the Canadian programme, according to the Business Plan available on the internet site:

[\[http://www.infoway-inforoute.ca/Admin/Upload/Dev/Document/Business Plan 06-07 EN.pdf\]](http://www.infoway-inforoute.ca/Admin/Upload/Dev/Document/Business_Plan_06-07_EN.pdf)

Investment Program	Investment Program Description	Investment Program Target
Registries \$134 M	Implement directory services that accurately identify clients (white pages) and providers (yellow pages) of health care services.	Implement client and provider registries in all jurisdictions by March 31, 2008
Diagnostic Imaging Systems \$280 M	Implement digital storage of diagnostic images that permits clinicians to access and view images regardless of where they are located or where the test was conducted.	Implement shared diagnostic image storage and retrieval services in all jurisdictions by December 31, 2009
Drug Information Systems \$185 M	Implement solutions that allow prescriptions to be sent, viewed and confirmed electronically. Drug and drug-interaction checks are performed automatically and added to the patient's drug profile.	Implement drug information systems in all jurisdictions by December 31, 2009
Laboratory Information Systems \$150 M	Implement solutions that allow clinicians to view laboratory results and reports from all hospital, community and public health laboratories.	Implement jurisdictional laboratory information systems in at least eight jurisdictions by December 31, 2009
Interoperable EHR Systems \$175 M	Implement solutions that allow clinicians to view and update an integrated patient-centric health record anywhere at anytime.	Implement interoperable electronic health record solutions across 50% of Canada by population by December 31, 2009
Telehealth \$120 M	Implement solutions that facilitate the delivery of health information and services between patients and providers over distance, with a focus on the Aboriginal, official language minority, northern and remote communities.	Implement telehealth solutions in all jurisdictions by December 31, 2009
Public Health Surveillance \$100 M	Implement solutions that support the identification, management and control of infectious disease cases and outbreaks that pose a threat to the public's health.	Implement an integrated public health surveillance system in all jurisdictions by December 31, 2009
Innovation & Adoption \$60 M	Develop projects that demonstrate rapid deployment and uptake of innovative electronic health record solutions in support of the national healthcare renewal priorities.	Complete Innovation and Adoption project approvals by March 31, 2007
Infostructure \$25 M	Develop the common solution architecture and standards to ensure interoperability of electronic health record solutions.	Complete Infostructure project approvals by March 31, 2007

Figure 1. Health Infoway Investment Programme 2006/07

The Canadian experience, however, has faced difficulties with the country's political structure, given that the provinces tend to be totally independent from each other, resulting in



treatment, healthcare records and corresponding information being tightly confined to each province.

### **3.3 Experiences on the African Continent**

Below is a brief summary of some successful experiences in IT use in the African continent. This report is not intended to cover all of the initiatives currently underway, and only those most relevant to the task presently being developed by DIS/MISAU were identified.

#### **3.3.1 South Africa**

In 1994, the Ministry of Health of South Africa formed a committee to initiate the process for the definition of a National Health Information System (NHIS/SA). Significant effort has been made over the last decade to create an integrated health information system. Advances were made in building district systems, but the desired integration has not been achieved. Each system uses a type of technology and databases that are at different stages of implementation.

After an analysis of the results over the last decade (1995-2005), the Ministry of Health of South Africa established that the priority for the 2005 to 2009 period would be the building of an EHR solution for South Africa. The bidding process for the implementation was launched in 2006, proposing the integration of the current systems, building a BI tool to obtain information and, finally, an EHR for South Africa, accessible in all provinces through pre-defined standards.

#### **3.3.2 Egypt**

The Government of Egypt, through its Ministry of Information and Communications Technology, established an e-Health strategy, rooted in standards to ensure interoperability and scalability of the integrated health system.

This documentation may be obtained from the following internet site:

[http://www.mcit.gov.eg/ICT\\_Health\\_1.aspx](http://www.mcit.gov.eg/ICT_Health_1.aspx)

The main projects in the Egyptian initiative are:

- The Tele-medicine Network Project – take healthcare to the rural areas
- Integrated Health Record System – building the EHR solution in two stages. The first phase will be put into operation very shortly, connecting 400 healthcare facilities to a central location. The second phase aims at connecting 60000 healthcare facilities, and implementation is expected to be concluded by 2010;
- Emergency Medical Service Call Centre Ambulance Project – optimising the control of patient transport (evacuation) by using a “call-centre” and geo-referencing

- National Network for Medical Assistance in the Public Health System – intends to establish processes for agreements, transmission and re-transmission to optimise resources and improve the quality of healthcare delivery.

### **3.3.3 Experiences in the use of Electronic Medical Records in Africa**

The WHO sponsored a two-day seminar, held in 2004 in Nairobi, Kenya, on the Electronic Medical Records Project underway in Africa. The objective of this seminar was to discuss the current experiences as well as information and knowledge requirements to extend the AIDS assistance programmes in the region to south of the Sahara, and to develop realistic strategies to develop electronic records systems for the region. Members from the Ministries of Health of Kenya, Uganda, Tanzania, and Zambia, as well as members from various academic institutions and organisations involved in HIV treatment, knowledge management experts and systems analysts participated in the event.

It was understood that because of the need to broaden the treatment of HIV in the African continent, a specific electronic medical record system for AIDS must be developed. Meanwhile, it was proposed that this electronic medical record system should also include other areas of healthcare, such as prenatal care, TB and malaria, both for adults and children.

During the two-day event, various experiences in the use of electronic medical records systems were presented by Uganda, Kenya, Tanzania and Zambia.

The conclusion reached at the seminar was that there is urgent need to coordinate and integrate the different demands for information collection, or rather, to do away with parallel tools for collecting information and create a single integrated system that can collect all of the necessary information for the different programmes simultaneously. It was also pointed out that since building an integrated system such as this one is a long-term project, existing systems need to be integrated through a communications standard. The consensus was to adopt the HL7 (Health Level Seven) standard to establish interoperability between the vertical systems and any other existing initiatives. The need for standard vocabularies and contents to specify a minimum dataset on healthcare was also made clear. The issue regarding infrastructure and data storage location, as well as need to ensure data privacy and confidentiality, particularly when dealing with information on HIV, was also discussed. The need to share knowledge and experiences in implementing these systems in the African continent was also identified. It was recommended that the WHO take the lead in the standardisation efforts.

The seminar resulted in an important initiative on the use of free software for building electronic records systems: the OpenMRS initiative ([www.openmrs.org](http://www.openmrs.org)).

### **3.3.4 OPENMRS – Free Software for the Electronic Medical Records Initiative**

OpenMRS is an application which enables customised medical record systems to be built with no need of knowledge on programming languages. The system is flexible, easy to use and based on a conceptual model containing health vocabularies. Currently, OpenMRS has vocabularies in English. The system is being used in several countries in Africa, namely Kenya, Ruanda and South Africa. The widest experience is in Kenya, with 100.000 medical records of 30.000 AIDS patients.

## **3.4 The Brazilian Experience**

Brazil has a long tradition in the use of health information systems. The DATASUS portal, belonging to the Ministry of Health's department of Informatics ([www.datasus.gov.br](http://www.datasus.gov.br)) was acknowledge by PAHO/WHO as one of the best health information sites in Latin America.

Recently, the Brazilian Government included a Tele-Health strategy in its Government plan for the next four years (2007 – 2010), with the objective of promoting capacity building and training programmes in healthcare for the more remote regions, and supporting healthcare delivery processes through the use of Tele-Medicine technologies, particularly in primary healthcare activities and Family Health programmes.

Several projects are underway, and some have already shown very promising results in getting second opinions and distance healthcare in basic healthcare facilities, demonstrating a reduction in cost and an increase in the effectiveness and quality of the healthcare. The purpose of the Brazilian Health Information and Informatics Policy is the following:

*"To promote innovative, creative and transformative use of information technology, to improve healthcare work processes, resulting in an articulated National Health Information System which produces information for the citizens, management, professional practice, knowledge generation and social control (social control is understood to be society's control over governmental initiatives), ensuring measurable gains in efficiency and quality by expanding the access, equity, integrity and humanisation of the services, thereby contributing to an improvement in the population's health status".*

The guidelines are aligned with the policies in other countries already mentioned: electronic records, standards, capacity building, and information dissemination. There are national standards to identify persons (the national database has 116 million records), healthcare professionals and healthcare facilities. The database of the National Healthcare Facilities Register, CNES, has 150 thousand healthcare facilities registered, with full details on the services, specialisations, types of healthcare, equipment and professional staff (1.5 million

professionals are registered). All of the information on the CNES, including the software for registration, is available on the internet site [www.datasus.gov.br/cnes](http://www.datasus.gov.br/cnes). From 2000 to 2004, the Ministry of Health implemented a pilot project in 44 municipalities with 10 million people – the national health card project, which established the standards for national registers and a set of essential data on healthcare. Today, one of the developments brought about by the pilot project is a totally integrated application ranging from basic to extremely complex healthcare, covering all of the processes for transmission, re-transmission, and management of the SUS's financial processes: the SIGA Saúde System is being used in the city of São Paulo by 600 healthcare facilities with a database of 11 million patients. SIGA Saúde has been developed using Java technology, on Internet architecture and public entities do not require user licences.

Furthermore, there are standards for the supplementary healthcare network (private) covering the exchange of information between healthcare providers and paying entities. An open-standard based public key infrastructure, ICP-Brasil, provides validation for digitally signed documents. The SBIS – *Sociedade Brasileira de Informática em Saúde* (Brazilian Health Informatics Company) and the CFM – Federal Medical Board established an electronic record system certification process.

Despite all of these innovative initiatives, there are several problems that need to be addressed. The main issue relates to the fragmentation of the systems still in use in most parts of the country for the different vertical programmes such as, for example, AIDS, hypertension, diabetes, prenatal care, children's health, uterine cancer, among others. At the last count, in 2004, there were over 200 health information applications scattered throughout the country, offered free of charge by the Ministry of Health. These systems reflect different tools for collecting information which demand reworking the backend of the system and also result in low quality information. The problem of the proliferation of vertical systems is common in several countries, including Mozambique. The lesson Brazil is learning is that although vertical systems are still useful today, they create problems in the medium- and long-term, and require strategies for integration and cultural change to be able to achieve a horizontal view focusing on the individual.

Another important issue in Brazil is the need for large-scale human resources qualification in health information. The team within the MS (Ministry of Health) responsible for IS (Health Information) needs to be updated and needs a market-adjusted salary policy in order to ensure the stability of the team in such a competitive field.

It is hoped that, with the National Tele-Health Commission and the inclusion of this issue in the Government's Programme, the actions proposed by the Policy can be implemented.

## 4 MOZAMBIQUE'S HEALTH INFORMATION AND INFORMATICS STRATEGY

The reference documents which led to the building of the national health information and informatics strategy are: **Five-Year Programme, 2000-2004** the second edition of the **Plan for the Reduction of Absolute Poverty (PARPA) 2001-2005**, Public Administration Reform and the **Health Sector Strategic Plan, 2001-2005 (2010) - PESS**. In July 2002, the Government defined the Implementation Strategy for the Informatics Policy, which defines the main objectives in five areas:

- *“Expand the availability and access to contents and applications relevant to the main National development needs,*
- *Promote the use of ICTs in governmental institutions and in civil society organisations, thereby promoting efficiency and effectiveness,*
- *Create an environment conducive to the extension of ICTs in the private sector,*
- *Accelerate the extension of the infrastructure across the entire Country and ensure its modernisation,*
- *Extend and develop the National ICT knowledgebase, a basic requirement for success.”*

The issue of a single connectivity infrastructure to support all of the Government's actions, as well as the foundation of an information system for public sector management and the e-Gov programme, have been clearly identified. The SIS project falls within the objectives of the approved Informatics policy.

The Health Information System Development Programme, 2003-2005 (2010), approved by MISAU's Enlarged Consultative Council in August 2003, defines the strategies for the development of the National Health Information System, under the leadership of MISAU's Department of Health Information.

The importance of health information is clearly identified right at the beginning of the text:

*“In this context, the Health Information System managed by MISAU's Department of Health Information at the Directorate of Planning and Cooperation plays a crucial role in stating these principles and ensuring the pursuit and measurement of the objectives, being responsible for collecting and making available objective information on the population's Health status as well as the efficiency, effectiveness and impact of the activities carried out by the National Health System”.*

The mission of the SIS is identified as follows:

*“It is the mission of the SIS to produce, prepare and disseminate information for decision-making by NHS managers at all levels, in order to effectively and efficiently plan the resources required to support research and for accountability to the National and international community.”*

In this scenario, the functions of the DIS were defined as follows:

- *“Operate and develop an Information System covering the different areas to enable surveillance of the epidemics and diseases, to measure and monitor the health status of the Mozambican population, and to pursue the development of the NHS activities, analyse trends and produce data necessary for planning activities and resources;*
- *Promote the creation, maintenance and development of complementary information subsystems in the different areas, in coordination with Central Government sector bodies, being responsible for their standardisation;*
- *Produce periodic and official statistical information on the Health Sector;*
- *Contribute to the periodic monitoring and evaluation of the annual plans, main programmes and outcomes of the PESS, PARPA and other strategic plans.”*

There are currently various tools for collecting information, with programme-specific vertical visions, which require the healthcare delivery network to fill-in data on different printed forms or in isolated district-level systems. The transfer of data to the central level is done on paper (hardcopy), or on diskette, or by email, depending on the available infrastructure.

At MISAU level, information is consolidated in a single database in MSAccess which reproduces the printed forms as relational tables, with one table for each printed form. From these data, a set of reports is issued with volume indicators on the type of healthcare provided, such as Epidemiological Bulletins, Statistics from the various vertical programmes, and health profiles, among others.

The main problems of the SIS have been identified in the **Programme Development** document, and the strategic objectives and mechanisms to correct these problems were defined according to Table 1 below, which compiles the Programme proposals.

**Table 1. Strategic Objectives of the SIS Development Programme**

Problem	Strategic Objective	Specific Objectives
1. Ineffectiveness of the SIS	1.1 To have a more effective SIS, with quality and efficiency	1.1.1 Good Quality SIS 1.1.2 Ensure Analysis, Interpretation and Dissemination of Data 1.1.3 Incorporate and complement Management Information Needs 1.1.4 Make available integrated information at all levels using an integrating system 1.1.5 Establish coordination mechanisms for non-sectorial information flow 1.1.6 Ensure good initial training in SIS for healthcare professionals, producers and users
2. Unsuitability of the SIS Tools	2.2 To have suitable SIS tools	2.2.0 Develop systems for the health facilities, districts, provinces and central level 2.2.1 Ensure commitment of top managers at each level 2.2.2 Synchronise and Standardise the SIS Tools for Levels III and IV of the NHS 2.2.3 Strengthen and Review the Tools for Levels I and II 2.2.4 Encourage Good Relations between the existing subsystems (internally and externally) 2.2.5 Ensure sufficient material resources for the SIS and that they are in place and operational
3. Weak Institutional Capacity of SIS Management	3.1. To have Greater institutional capacity and skills in management	3.1.1 Human Resources Dimensioned in Function of the Work Load and Existing Tasks 3.2.1 Achieve good capacity of information managers 3.3.3 Ensure dimensioned and skilled IS/IT Human Resources 3.3.4 Have sufficient Funds
4. Weak Practice of Internal and External Communication	4.1 To achieve Effective Communication and Information Sharing both within and outside the NHS	4.1.1 Ensure recognition of the authority of the DIS and subordinate entities both within and outside of the NHS 4.1.2 Ensure information sharing 4.1.3 Reinforce the credibility of the nuclear SIS

The Programme identifies the main problems of the HIS and proposes interesting strategies to overcome them. The issue of human resources and capacity building has been appropriately contemplated within the set of objectives in item 3, which also discusses the issue of guaranteeing funding.

The issue of standardising the health information and the need to define standardised vocabularies is also contemplated in the strategies of item 2. More specifically, the document makes proposals similar to those already described for the HIS-HCM TOR, i.e., the need to

adopt standardised vocabularies for Diagnoses (CID-10), Procedures and Drugs. The governability of the SIS is also a strong point in the Development Programme.

#### **4.1.1 Action Plan and Schedule for the Reorientation and Reorganisation of the SIS**

During the reorganisation of the SIS, an action plan (Roadmap) was prepared to operationalise the issues already identified by the Development Programme as well as any others arising. This planning was presented at the SWAP meeting in October 2006. Three working groups were established to define this action plan, and 9 areas of intervention were identified. The objectives and the results expected to be achieved with the relevant activities, per quarter, were specified as from the second quarter of 2006 until the fourth quarter of 2008.

The nine areas of intervention covered by the action plan are:

- Focus the SIS on the Health Status of the population and on the Performance of the NHS;
- Restore reliability in the System;
- Improve use at local level, as well as the Flow and Speed of circulation of the Information from the HU up to the Central level;
- Increase the SIS's coverage;
- Improve the capacity of the SIS to inform decision-makers, the Public and Cooperation Partners;
- Review, restructure and reorganise the Informatics System supporting the SIS Informatics;
- Restructure the SIS in line with its reorientation;
- Equip the SIS with the human and material resources necessary for its operation;
- Define mechanisms to monitor and evaluate the implementation of the Plan.

Below is a brief description of each intervention, with comments.

##### **4.1.1.1 Intervention 1 – Focus the SIS on the Health Status of the population and on the Performance of the NHS**

This intervention focuses on the issue of the performance indicators; the SIS must consider and propose mechanisms to define them.

To this end, it is suggested that, in addition to the proposals in the action plan, a revision be carried out on sets of indicators for basic healthcare already in use in other countries with public health systems endorsed by the PAHO/WHO. With this purpose in mind, we would like to offer the basic healthcare indicators used in Brazil, a product of extensive discussions and agreements with the different players in the healthcare field, for appreciation by the DIS/MISAU.

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The set of indicators used by Brazil resulted the Pan American Health Organisation publishing the document: “Health Indicators in Brazil: concepts and applications”, with the text being provided in an annex to this product.

In addition to this list, the SUS (the Brazilian Health System), has a set of specific indicators for basic healthcare, called the “Basic Healthcare Agreement”. The set of indicators with the respective technical notes can be found at the following internet site: <http://tabnet.datasus.gov.br/cgi/siab/pacto2006/pacdescr.htm>.

These indicators are compiled by using different data, namely healthcare, population basis, Live Births system (SINASC) and Mortality System (SIM) data. These are the two oldest systems in Brazil, and are therefore called national core systems. From what we were able to observe, in Mozambique there is no reliable system of births or deaths. Building these two systems, together with the team from the National Statistics Institute, and establishing methodologies to capture quality data on births and deaths could be included in this action plan.

#### **4.1.1.2 Restore reliability in the System**

From what has already been mentioned in the previous sections of this document and in the HIS-HCM TOR, the current trend is to build a SIS focusing on the individual, i.e., a look that “cuts across” all actions and vertical programmes and focuses on the person and his dataset. In this sense, in addition to the revisions of each of the files in the vertical programmes, which should contain the necessary information for each of the programmes, it is essential to look horizontally, focusing on the patient and a dataset which cuts across the different levels of healthcare.

Intervention 2 proposes a specific consultancy to discuss the SIS and its role. We believe that it would be interesting for this consultant to have wide experience in building and defining national Health Informatics policies and, above all, in standards to represent and share health information. This subject has not been dealt with in this action plan. The proposal for extending this plan to include these and other items is described in the chapter below.

#### **4.1.1.3 Intervention 3 - Improve use at local level, as well as the Flow and Speed of circulation of the Information from the HU up to the Central level**

The third intervention proposes a review of the different uses of information within the spheres of the healthcare facilities and district directorates. It can be aligned with specific objective 2 **To Have Suitable SIS Tools**. The idea is to integrate it, to construct a vision focusing on the patient and giving examples of the uses of this information at the different levels. Once again, the manner in which this is done in Brazil could perhaps be used as a reference, since the model in Brazil also has three levels with indicators for each level. The HR

issue proposed in this interaction requires dedicated action in accordance with the description in the chapter below.

#### **4.1.1.4 Intervention 4 - Increase the coverage of the SIS**

This intervention proposes strategies along two lines. In the first, it proposes that an inventory of the healthcare network be carried out. This proposition is very important to the SIS, since the basic questions that an integrated SIS focusing on the individual should answer are: Who was assisted? By whom? Where did this healthcare delivery take place? What happened during the healthcare delivery and what were the referrals? Now, to be able to answer these questions it is necessary to build national registers of people, healthcare facilities and healthcare professionals. It is necessary for the register of healthcare facilities to contain all of the information necessary to characterise the institution, define the type of healthcare provided and the resources available. The construction of these registers is one of the main building blocks of a National Health Information System. This initiative is detailed in the extension proposals.

In that which concerns the extensions of the SIS to level III and IV, we believe that these have been contemplated in the description of the HIS-HCM TOR which, because of how it was proposed, is totally in line with a national strategy and could be an accelerating factor in the standardisation issue.

As to the issue of notification for surveillance purposes, this is certainly a very important issue and its solution could perhaps be in resorting to international agencies for building systems, seeing as it is one of the topical subjects. It is vital to define the data standards and establish the possibility of electronic exchange of information to integrate the different systems. The question of who will be responsible for maintaining and making available information falls outside the scope of this report, however, what is important is for this information to be appropriately stored at central level, in a large database covering the entire healthcare sector, and to establish paper-based security controlled access levels for authorised personnel.

#### **4.1.1.5 Intervention 5 - Improve the capacity of the SIS to inform decision-makers, the Public and Cooperation Partners**

This intervention covers one of the fundamental issues, which is to ensure that health information is used appropriately. Today, the international trend is to make available information over the Internet and enable dynamic consultations. It is important, as is proposed, to get an impression of the consultations that reflect the most frequent indicators, agreed to by all levels from the Primary Healthcare Facilities to the Central level. It is important to discuss and identify the necessary methodologies and infrastructure to make available health information. Access

control mechanisms and policies should be widely discussed and access should be controlled by a security service. Just as an example, the SIGA Saúde system in operation in the city of São Paulo has around 70 different access profiles.

#### **4.1.1.6 Intervention 6 - Review, restructure and reorganise the Informatics System supporting the SIS Informatics**

This intervention is fundamental for the development of the SIS. The company eventually contracted to support the execution of this activity should cover the necessary aspects relating to infrastructure, human resources and methodology.

#### **4.1.1.7 Intervention 7 - Restructure the SIS in line with its reorientation**

The restructuring of the SIS based on the work to be carried out in this intervention will certainly impact on all levels of work in the other interventions, since IT will be present at the various levels of healthcare and management, supporting healthcare end activities.

#### **4.1.1.8 Intervention 8 - Equip the SIS with the Human and Material Resources necessary for its operation**

Of all the interventions, this is the most structuring since it builds local competence. Without this intervention, all others will serve no purpose. Human resources capacity building should cover specific health informatics subjects such as: health information systems, standards to represent health information, national policies, e-Health and its applications, Methodologies and Architecture of Health Information Systems, Support Systems for Decision and Clinical Protocols and Evidence-Based Medicine, Processing of Medical Signals and Images, and Uses of Health Information.

#### **4.1.1.9 Intervention 9 – Create / Define mechanisms to monitor and evaluate the implementation of the present Plan**

The evaluation processes should be rooted in methods that will be used and should contain metrics and checkpoints. The possibility of attracting institutions independent from MISAU to carry out the monitoring/ evaluation should be considered.

## **5 SUGGESTION OF EXTENSIONS TO THE ACTION PLAN PROPOSED FOR THE DEVELOPMENT OF THE SIS**

An ever-increasing number of countries at stages of development are beginning to understand the need to create policies and define strategies for the e-Health domain. The WHO publication “**Connecting for health: global vision, local insight**”, the report from World Summit on the Information Society, 2005 [11] and “**The Global eHealth Survey**” clearly show that Resolution WHA 58/28 is beginning to bear its first fruit. Research carried out on e-Health shows that countries at different stages of development understand the importance and wish to

prepare national strategies to build a National Health Information System, i.e., an e-Health strategy. E-Health was the term adopted most recently to describe all initiatives using information and communications technology in benefit of health. This is a fairly broad definition covering also all Health Informatics applications, such as: information systems for healthcare, management, promotion, prevention, long-distance education and TeleMedicine or TeleHealth. The WHO's eHealth initiative is described in (<http://www.euro.who.int/telemed>).

Over the last five years, the Mozambican government prepared a series of structuring documents for the National Health Information Policy, and these were defined and materialised in the Action Plan described above. An analysis of the Action Plan reveals that it prioritises operational issues linked to the area. Unfortunately, due to historical reasons major strategic issues - the building blocks of an e-Health Policy - are not clearly identified despite appearing in different propositions. The objective of this section is to suggest a reorganisation of the Action Plan to consider the pillars that consolidate the strategies in the e-Health domain. These pillars appear constantly in e-health policy documents available today:

**Technological Infrastructures** – this is the simplest part of the strategy, seeing as it deals with purchasable items: servers, communications networks, database management systems and automation equipment, for example;

**Standards** – definitions of the standards of vocabularies, contents, communications, transmission and security required for the development and implementation of the SIS. The standards area to represent health information is vast, with work dating back over 30 years. Building standards is a foundation for building a SIS;

**Methodological Resources** – these are the most important technical parts of an Information System and they involve Methods for managing IT Projects, Systems Development and Implementation Methodologies, Systems Specifications and Documentation. In other words, good Methodological Resources should guarantee that the different parts of the Information System are integrated naturally, that they do not require additional work, that there is a synchronization of concepts across the entire Information System and that, therefore, the Information System is ONE throughout the Organisation.

**Human Resources** – this is the most important and decisive pillar for the success of Information Systems. The issue of profiles, interdisciplinarity and the need for competence in the specific topics of Health Informatics are determining factors.

**Organisational Resources** – these have a large impact on the use of Information Technology. Singled-out from among the most important organisational resources are the Organisation of the IT Area, its internal relationship and interface with other external areas, the

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organisation's governability and management capacity, the existence of all types of policies, as well as the organisation's adoption of them. The most important organisational resource for the Information System has to do with the subordination of the IS, in other words, to whom the IS "belongs". The best Information Systems are those that are totally aligned with the Organisation's strategic planning and remain steadfast to the Organisation's needs.

Considering what has been presented, the suggestion is that the alignments and expansions described be considered in the Action Plan. From the point of view of the schedule, the actions are proposed for implementation in the short (three months), medium (three to six months) and long term (more than six months).

## **5.1 Definition of the Technological Infrastructure**

**Objectives:** to define the connectivity and equipment needs in order to be able to computerise the entire healthcare network, consider the different connectivity options for the rural areas, and carry out different pilot projects with support from the suppliers of this technology. List the priorities in order to carry out the pilot projects. Define the infrastructure for back-end datacentres required to operationalise the SIS. Currently there is no structure within MISAU and the possibility of sharing this effort with other governmental structures should be considered, given that the needs in hardware, and above all in qualified HR to operate in a regime of high availability, are demands that will be easier to consider if several Government bodies share the server side, maintaining total independence of their databases and applications.

Several projects dealing with connectivity and eGov are currently underway in Mozambique. A specialised consultancy will be required to dimension the servers and the connectivity structure. The efforts of intervention 7, on the "roadmap" and the implementation of the TOR proposed by this consultant for the HCM should offer subsidies for the needs raised here.

### **Suggested Short-Term Actions:**

- Identify the existing actions within the Government of Mozambique to build connectivity infrastructures and datacentres, as well as possible private partnerships
- Contract a consultancy to dimension the needs for the healthcare domain, beginning with a concrete project (HIS-HCM) and preparing bidding documents to procure equipment

### **Suggested Medium-Term Actions**

- Bidding Process and Appraisal of Proposals

### Suggested Long-Term Actions

- Install Equipment,
- Train Local Team
- DataCentre Assisted Operation
- Deliver to local team for operation

Actions relating to infrastructure should be continuous and scheduled, in other words, done in cycles. Planning should take into consideration a project for the next ten years to have the network totally connected.

## **5.2 Methodological Resources**

### **5.2.1 Standards**

The objective of the standardisation effort is to identify the main datasets, vocabularies, structures and national registers, as well as exchange and security standards.

To begin with, it is recommended that a Health Standardisation Committee be created under the aegis of MISAU, to lead the process and follow-up developments, including those relating to standardisation. It is also suggested that a specialised consultancy be contracted to accelerate the local process and that a detailed study be carried out on the experiences of other countries, such as Brazil, since language similarities could make it an easier starting point.

The suggestion is to begin with unambiguous identifiers for individuals and healthcare professionals and national healthcare facilities register, immediately followed by the definition of some basic vocabularies, such as procedures, drugs and strengthening the use of CID-10.

#### Suggested Short-Term Actions:

- Create the Standardisation Committee
- Contract a consultancy to assist in the process
- Training in health standards provided by the consultancy, including the review of existing standards
- Define the identification standards for individuals and healthcare professionals
- Define the identification standards for healthcare facilities

#### Suggested Medium-Term Actions:

- Define the standards to represent procedures and drugs
- Define the minimum dataset

Suggested Long-Term Actions:

- Define standardisation priorities for units, provinces and districts
- Plan next phases

### **5.2.2 Methods for Project Management**

The second component of the methodological resources concerns the definition of the project management methods that should be adopted by DIS/MISAU.

Suggested Short-Term Actions:

- Identify organisations that could offer capacity building in project management locally, in Portuguese.

Suggested Medium-Term Actions:

- Capacity building in project management – PMI (Project Management Institute)

Suggested Long-Term Actions:

- Define follow-up methodologies for IT projects to be adopted by DIS/MISAU

## **5.3 Human Resources**

This is a long-term, ongoing activity. There is urgent need to create a Health Informatics training programme. This programme should cover the short-, medium- and long-term training needs, providing capacity building from healthcare network professionals who will be using the systems up to the DIS professionals. Training in Health Informatics competences is a subject dealt with constantly by the international community. The IMIA – International Medical Informatics Association, through its Working Group 1 has, over the last twenty years, consolidated a set of recommendations and model curricula for HR capacity building in this area [13]. The map below, prepared by IMIA, shows the scope of the Health Informatics area.

**Table 1: Proposed Medical Informatics Scientific Content Map**

Applied Technology	Information Technology Infrastructure	Data-Infrastructure Related	Applications and Products	Human - Organizational	Education and Knowledge
<ul style="list-style-type: none"> <li>Algorithms</li> <li>Bioinformatics</li> <li>Biosignal processing</li> <li>Boolean logic</li> <li>Cryptography</li> <li>Human genome related</li> <li>Human interfaces</li> <li>Image Processing</li> <li>Mathematical models in medicine</li> <li>Pattern recognition</li> </ul>	<ul style="list-style-type: none"> <li>Archival-repository systems for medical records- EPR-CPR-EMR</li> <li>Authentication</li> <li>Chip cards in health care</li> <li>Distributed systems</li> <li>Health professional workstation</li> <li>Interfaces</li> <li>Knowledge based systems</li> <li>Networks</li> <li>Neural networks</li> <li>Pen based</li> <li>Security</li> <li>Speech recognition</li> <li>Standards</li> <li>Systems architecture</li> <li>Telehealth</li> <li>User interfaces</li> </ul>	<ul style="list-style-type: none"> <li>Classification</li> <li>Coding systems</li> <li>Concept representation-preservation</li> <li>Data acquisition- data capture</li> <li>Data analysis-extraction tools</li> <li>Data entry</li> <li>Data policies</li> <li>Data protection</li> <li>Database design</li> <li>Indexing</li> <li>Syntax</li> <li>Language representation</li> <li>Lexicons</li> <li>Linguistics</li> <li>Modeling</li> <li>Nomenclatures</li> <li>Standards</li> <li>Terminology-vocabulary</li> <li>Thesaurus tools</li> </ul>	<ul style="list-style-type: none"> <li>Biostatistics</li> <li>Clinical trials</li> <li>Computer-supported surgery</li> <li>Decision support</li> <li>Diagnosis related</li> <li>Disease mgt.</li> <li>EPR-CPR-EMR</li> <li>Epidemiological research Hospital IS</li> <li>Event-based systems</li> <li>Evidence based guidelines</li> <li>Expert systems</li> <li>Health services research</li> <li>HIS management</li> <li>Knowledge-based systems</li> <li>Laboratory data</li> <li>Image processing</li> <li>Operations/Resource management</li> <li>Outcomes research and measurement</li> <li>Quality management</li> </ul>	<ul style="list-style-type: none"> <li>Assessment</li> <li>Compliance</li> <li>Cognitive tasks</li> <li>Collaboration</li> <li>Communication</li> <li>Economics of IT</li> <li>Ethics</li> <li>Implementation-deployment</li> <li>Diffusion of IT</li> <li>Evaluation</li> <li>Human Factors</li> <li>Legal issues, implementing national laws</li> <li>Management</li> <li>Managing Change</li> <li>Needs assessment</li> <li>Organizational redesign processes</li> <li>Organizational transformation</li> <li>Planning</li> <li>Policy Issues</li> <li>Privacy</li> <li>Project Management</li> <li>Security</li> <li>Strategic plans</li> <li>Unique identifiers</li> <li>User-computer interface</li> </ul>	<ul style="list-style-type: none"> <li>Bibliographic</li> <li>Cognitive learning</li> <li>Computer aided instruction</li> <li>Computer-supported training</li> <li>Consumer education</li> <li>Continuing education</li> <li>Digital Libraries</li> <li>E-Business</li> <li>H/MI education</li> <li>Information management-dissemination</li> <li>Knowledge bases</li> <li>Knowledge management</li> <li>Learning models</li> <li>Online/distance education</li> </ul>

Figure 2. Source: International Medical Informatics Society - [http://www.imia.org/2002\\_scientific\\_map.html](http://www.imia.org/2002_scientific_map.html)

The skills and competencies in Health Informatics may be grouped into 5 categories:

- Specific Skills and Knowledge on Health Informatics
- Skills and Knowledge on informatics
- Organisational and Staff Management Skills and Knowledge
- Clinical and Healthcare Skills and Knowledge
- Other Skills and Knowledge

Australia and Canada are two of the countries with the greatest experience in large-scale capacity building in Health Informatics, with national programmes, including long-distance learning [13] underway. The two proposals, which are similar and include the IMIA's recommendations, developed three types of capacity building programmes, according to the learner's profile:

- Capacity building for users: targeting healthcare professionals who will have to use the different types of health information systems efficiently and responsibly. IMIA recommends that this content be present in all the course curricula in the healthcare area. At this level, it includes general knowledge on the area;
- Capacity building for professionals implementing the Health Information Systems (developers and systems implementers): targeting professionals involved with the processes for implementing the health information systems. These professionals should understand the healthcare area and its complexity, at the same time as



understanding the technology and be capable of leading the system implementation process;

- Capacity building for Health Informatics specialists and developers: these are the professionals who generate new methods for the health informatics area. They combine interdisciplinary competencies in software engineering, programming methodologies, knowledge representation and health. The success in the development of systems for the healthcare domain depends on this type of skill.

For each of these levels there are well-established content proposals that cover the proposed structure introduced by Banir and accepted internationally, of competence levels for: beginner, advanced beginner, competent, proficient and expert.

The HR capacity building programme to be adopted in Mozambique should necessarily comply with IMIA WG1's "roadmap" – Health and Medical Informatics Education and be taught in Portuguese. It is suggested that, for this, partnerships be established with institutions in Portuguese-speaking countries, such as Portugal or Brazil, that have experience in HR training in Health Informatics.

Since this competence is currently not available within the DIS, capacity building strategies for Mozambique should be multiple and done as soon as possible. Some of the actions that should be considered are:

#### Suggested Short-Term Actions:

- Hire a consultant who is an expert in Health Informatics, on a full-time basis, to coordinate the DIS team
- Identify possible support lines and external funding to create a national Health Informatics capacity building strategy;
- Hold a basic training course in Health Informatics, in Portuguese, for the MISAU and HCM teams. This course must be at least 60 hours and provide a basic overview of the area;

#### Suggested Medium-Term Actions:

- Identify international institutions providing capacity building in this area for exchange programmes in Portuguese-speaking countries;
- Include the Health Informatics subject in the curricula of the technical and higher levels of healthcare-related courses;

- Participate in e-Health experience observatory networks which link countries with similar experiences in building and implementing health information systems for managing public health systems. While it would be interesting to share the experiences on the continent, this network should not be limited to Africa;
- Establish, in partnership with the WHO, knowledge assets from Portuguese-speaking countries to share experiences and, in particular, health vocabulary standards in Portuguese. At present, the vast majority of health vocabularies, with the exception of the CID, are not translated into Portuguese. More than the vocabularies themselves, it is necessary to create a repository of software components that can be used in different types of applications in all Portuguese-speaking countries.

#### Suggested Long-Term Actions:

- Establish a national Health Informatics capacity building programme, with post-graduate courses of at least specialisation level and, if possible, Masters. Establish partnerships with international organisations to ensure that visiting teachers, with different competencies in the field, are brought in to form part of the teaching staff until local competence has been established;
- Establish a programme of technical trips and participation in international Health Informatics events. The next world congress, MEDINFO 2007, will be held in Brisbane, Australia, from 20-24 August – <http://www.medinfo2007.org>, and it is an excellent opportunity to establish contacts with other Public Health groups in other countries.

## 5.4 Organisational Resources

Organisational resources have a major impact on the success of the initiative. The suggested actions for this plan are similar to those already proposed in the Development Programme, in other words, to improve the management capacity and governability of the DIS so that this proposal may be acknowledged with authority in the area of health IT usage in the Country. Alignment with MISAU's strategies is fundamental to the success of the project.

All of the actions are ongoing and funding should be guaranteed for this area.

#### Suggested Actions:

- Identify possible sources of funding for the implementation of the SIS under DIS's coordination;

- Ensure the governability of the DIS for actions in Health IT usage. It is fundamental for the DIS to have very close ties to the Minister of Health, in order to be able to reflect the national strategies and, at the same time, contribute to the definition of these strategies, given that the use of health IT is an issue of national strategy and should therefore be reflected in MISAU's strategic planning;
- Establish mechanisms for disseminating information through the Internet portal, in a transparent manner, based on datamining tools;
- Ensure a human resources policy for this area with salaries compatible with those of the private sector market;
- Consider the creation of a private, non-profit organisation, in the medium- or long-term, to implement the SIS within the same models already adopted by several other countries. This is, without doubt, the option that provides the most flexibility and stability, and best guarantees the efficiency of the project, avoiding discontinuation and waste of resources;
- Encourage the use of free software and the creation of development communities;
- Invest continuously in capacity building for local DIS human resources, so that the technological choices are the most suitable for the scenario in Mozambique;
- Get to know the experiences of other countries, but create local intelligence in eHealth so that, instead of becoming a consumer of ready-made technologies in other places, the Country can begin to contribute to its construction through, for example, participating in free software communities.

## **6 ALIGNING THE HIS-HCM TOR WITH THE DIS/MISAU ACTION PLAN**

The activities to extend the DIS action plan proposed in this document are reflected in the HIS-HCM TOR. The technological infrastructure to house the HCM HIS should be expandable so as to include other DIS/MISAU needs. The effort in the area of standards to define vocabularies and content for HCM's documents should be considered as the first action in defining standards in the DIS's action plan. The HIS-HCM TOR proposes systems development methodologies based on the UML standard and project management based on PMI – Project Management Institute. It is essential for the Health Informatics capacity building programme to consider these methodologies and, ideally, to include them in the national strategy.

It is, therefore, essential that the HCM computerisation process be totally aligned with the National Strategy. We recommend that the HCM HIS to be the first step in implementing the extension of the roadmap proposed in this document.

## **7 RISKS**

- Failure to understand the importance of investing in Health IT, and its importance in improving the population's health conditions;
- Insufficient resources to build the necessary infrastructure, could lead to the construction of scenarios unable to meet the requirements for the operation of a National Health Information System;
- Lack of Human Resources with competence in Health Informatics
- Results expected within unreasonable timeframes, since most of the activities, as well as the building of a public health system, are long-term actions;
- Lack of articulation between the different Government departments in that which concerns infrastructure projects and information sharing requirements.

## **8 FINAL CONSIDERATIONS**

This document raises pertinent issues that were identified by us during the consultancy process. We are convinced that these subjects require in-depth attention in order to be able to create the foundations of a National Health Information System that is useful, stable and that can grow continuously without problems or breaks.

One of the major advantages of being able to initiate projects such as the SIS in Mozambique is the opportunity to take advantage of other countries' experiences. Health Information Systems in practically all countries suffered, or are still suffering from fragmentation of information, which is mainly due to the focus being on vertical and isolated systems, marked by the lack of an integrating vision. Mozambique has the opportunity to, with some effort, design its own SIS before investing heavily in its construction. This unique opportunity should not be wasted. One of the critical success factors in creating a National Health Information System for Mozambique is the need for specific consultancies in the health informatics field: it is necessary to include a Portuguese-speaking consultant, on a full-time basis and as soon as possible, in the DIS team. This consultant should support the DIS and the HCM in the extension projects for the DIS/MISAU action plan. It is proposed that this be in the form of technical assistance during at least four years to guarantee the development of local competencies. Furthermore, in the short-term it is necessary to have a consultant to accelerate the computerisation process within HCM, defining the standards and ensuring the compatibility of this project with national

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initiatives. This will be a short-term consultancy (three months) that could be done through technical visits and follow-up and orientation of the local HCM and DIS teams. It is also essential for the consultant to speak Portuguese.

If we had to summarise this Technical Report in a single paragraph, it would be: Health Information Systems are extremely complex. In order to develop them one must attempt to first observe, understand and then model, then plan and then execute. When executing the project, the previous phases must be constantly re-evaluated.

Modern management methods for organisations and complex projects presuppose a continuous cycle of “Plan, Do, Check, Act” (PDCA cycle). Planning should be done after the domain in which the project is to be implemented has been observed and understood. The command of Health Information is particularly complex, due to the complexity of the Field; proof of this is not only in the fact that Health Informatics is offered at the best universities in the world, but also in the difficulties reported by several countries, even the most developed ones, to build quality health systems at acceptable costs.

Building HCM’s Information System with a view to subsidising the construction of Mozambique’s National Health Information System is a complex and long-term project. Obviously the short- and medium-term objectives should be planned and the results achieved. However, a project like this one requires, essentially, human resources training and change management which will only occur in the long term. Mozambique should prepare for a gradual implementation of its Health Information System and for permanent change related to this process.

It appears appropriate for us to propose the use of best project management practices (using PDCA) and offer the contribution of best Health Information practices, focusing on international experience and, in particular, taking advantage of the best developments in Portuguese-speaking countries.

Therefore, we suggest that conditions be created for the PDCA cycle to be initiated. For this we propose capacity building for professionals, who will be exposed to the best international practices and will then interpret them and adapt them to the Mozambican reality. These professionals should be backed by a specialised consultancy capable of conducting the PDCA process, understanding and respecting the outline conditions defined by both the Mozambican reality and the priorities defined by Mozambique. The process is continuous and requires a constant evaluation of all of its aspects, including the objectives themselves, since these are partially determined by the reality, which is dynamic.

## 9 REFERENCES

### 9.1 Reference Documents

- [1]. Ministério da Saúde Republica de Moçambique – “Plano Estratégico do Sector Saúde – PESS 2001-2005 (2010)” – (Aprovado pelo XI sessão do Conselho de Ministros em 24 de Abril de 2001), Maputo, April, 2001;
- [2]. Ministério da Saúde, Republica de Moçambique – Depto de Informação para Saúde – “Programa de Desenvolvimento do Sistema de Informação para Saúde 2003 – 2005 (2010)”. 1ª Edição. Doc. Aprovado pelo Conselho Consultivo Alargado do MISAU em Agosto de 2003. Maputo, 2003.
- [3]. Ministério da Saúde, Republica de Moçambique – “Projeto Sistema de Informação Hospitalar Hospital Central de Maputo, Maputo, May, 2006;
- [4]. Ministério da Saúde, Republica de Moçambique – Direção Nacional de Saúde - “Relatório Resumo – Dados de Actividade Hospitalar dos Níveis Terciário e Quaternário do SNS”, Maputo 2005.
- [5]. República de Moçambique. “Plano de Ação para Redução da Proeza Absoluta 2006-2009 (Parpa II).” Versão Final Aprovada pelo Conselho de Ministros aos 02 de Maio de 2006. Maputo, May, 2006.
- [6]. República de Moçambique. “Política de Informática”. Aprovada pela Resolução N.º 28/2000, de 12 de Dezembro, do Conselho de Ministros. Maputo, 2000.
- [7]. Ministério da Saúde, Republica de Moçambique. “Classificação de Diagnósticos no Hospital de Mavalane”. Maputo, May, 2006.
- [8]. Grady Booch, James Rumbaugh and Ivar Jacobson, The Unified Modeling Language User Guide (Addison-Wesley, 1999) ISBN 0-201-57168-4
- [9]. Bakken S, Cimino JJ, Haskell R, Kukafka R, Matsumoto C, Chan GK, Huff SM. Evaluation of the clinical LOINC (Logical Observation Identifiers, Names, and Codes) semantic structure as a terminology model for standardized assessment measures. J Am Med Inform Assoc. 2000 Nov-Dec;7(6):529-38.
- [10]. HL7 Tools, Utilities and Resources. Disponível em <http://www.hl7.org.au/HL7-Tools.htm>
- [11]. Dzenowagis, Joan. Connecting for health: global vision, local insight. World Health Organization, 2005. ISBN 92 4 159390 3 (LC/NLM classification: Z699.5.M39).
- [12]. Haux R, Grant A, Hasman A, Hovenga E, Knaup P (2000) Recommendations of the International Medical Informatics Association (IMIA) on education in health and medical informatics. Methods Inf Med 39: 267-77.
- [13]. [http://achi.org.au/documents/publications/Health\\_Informatics\\_Educational\\_Framework\\_20060326.pdf](http://achi.org.au/documents/publications/Health_Informatics_Educational_Framework_20060326.pdf)

### 9.2 References of National Policies

- [14]. South Africa. <http://www.doh.gov.za/nhis/intro.html>
- [15]. Australia  
Health Online: A Health Information Action Plan for Australia, 2<sup>nd</sup> edition  
<http://www.informatics-review.com/thoughts/hlthonline.html>  
National E-Health Standards Catalogue Version 1.0-18 August 2006 -  
[http://www.nehta.gov.au/component/option,com\\_docman/task,cat\\_view/gid,133/Itemid,139/](http://www.nehta.gov.au/component/option,com_docman/task,cat_view/gid,133/Itemid,139/)  
National E-Health Transition Authority - <http://www.nehta.gov.au/>
- [16]. Canada - Canada Health Infoway  
[http://www.infoway-inforoute.ca/Admin/Upload/Dev/Document/Business\\_Plan\\_06-07\\_EN.pdf](http://www.infoway-inforoute.ca/Admin/Upload/Dev/Document/Business_Plan_06-07_EN.pdf)
- [17]. Egypt - [http://www.mcit.gov.eg/ict\\_health.aspx](http://www.mcit.gov.eg/ict_health.aspx)

- [18]. Brazil -  
<http://w3.datasus.gov.br/DATASUS/datasus.php?area=362A4B4027C4D0E0F362G3292HIJd4L54M0N&VInclude=../site/texto.php>

### 9.3 General References on Health Informatics and Electronic Health Record

- [19]. Massad E, Marin HF, Azevedo, RS. Edts O Prontuário Eletrônico do Paciente na Assistência, Informação e Conhecimento. São Paulo : H. de F. Marin, 2003. Available for download on:  
[www.med.fm.usp.br/dim/livrosdim/prontuario.pdf](http://www.med.fm.usp.br/dim/livrosdim/prontuario.pdf)
- [20]. vanBemmel JH, Musen MA. Edts. Handbook of Medical Informatics. Springer-Verlag, Heidelberg, Germany, 1997. Available for download on  
[http://www.mieur.nl/mihandbook/r\\_3\\_2/handbook/homepage\\_self.htm](http://www.mieur.nl/mihandbook/r_3_2/handbook/homepage_self.htm)
- [21]. Dick RS, Steen EB, Detmer DE. Edts. The Computer Based Patient Record – An essential Technology for Healthcare. Committee on Improving the Patient Record. Institute of Medicine. National Academy Press, Washington DC, 1997.  
<http://www.nap.edu/books/0309055326/html/index.html>
- [22]. Networking Health: Prescriptions for the Internet (2000) (ISBN 0309068436), Committee on Enhancing the Internet for Health Applications: Technical Requirements and Implementation Strategies, Computer Science and Telecommunications Board, National Research Council.  
<http://search.nap.edu/nap-cgi/getrecid.cgi?isbn=0309068436>
- [23]. Linda T. Kohn, Janet M. Corrigan, and Molla S. Donaldson, Editors. To Err Is Human: Building a Safer Health System (2000) (ISBN 0309068371), Committee on Quality of Healthcare in America, Institute of Medicine. <http://search.nap.edu/nap-cgi/getrecid.cgi?isbn=0309068371>
- [24]. Philip Aspden, Janet M. Corrigan, Julie Wolcott, Shari M. Erickson, Editors. Patient Safety: Achieving a New Standard for Care. , Committee on Data Standards for Patient Safety ISBN- 0309-09077-6. <http://www.nap.edu/catalog/10863.html>
- [25]. Key Capabilities of an Electronic Health Record System: Letter Report – IOM, 2003  
<http://www.nap.edu/catalog/10781.htm>
- [26]. The State of Healthcare Quality: 2005. National Committee for Quality Assurance. Washington DC, 2005. [http://www.ncqa.org/Docs/SOHCQ\\_2005.pdf](http://www.ncqa.org/Docs/SOHCQ_2005.pdf)
- [27]. Proctor P. Reid, W. Dale Compton, Jerome H. Grossman, and Gary Fanjiang, Editors,. Building a Better Delivery System: A New Engineering/Healthcare Partnership. Committee on Engineering and the Healthcare System, Institute of Medicine and National Academy of Engineering. ISBN: 030909643X. <http://www.nap.edu/catalog/11378.html>
- [28]. ICP-BRASIL – A Infra-estrutura Brasileira de Chaves Públicas  
<http://www.icpbrasil.gov.br/>
- [29]. SBIS. Manual de Requisitos de Segurança, Conteúdo e Funcionalidades para Sistemas de Registro Eletrônico em Saúde (RES), São Paulo, 2004.  
[http://www.sbis.org.br/GTCERT\\_20040219\\_RT\\_V2.1.pdf](http://www.sbis.org.br/GTCERT_20040219_RT_V2.1.pdf)