Technical Report No. 10

Building Health Management Information Systems in Egypt: The Role of USAID Technical Support in Program Assistance

March 1997

Prepared By:

Gordon M. Cressman
Research Triangle Institute

Partnerships for Health Reform

PHR

Abt Associates Inc. ■ 4800 Montgomery Lane, Suite 600
Bethesda, Maryland 20814 ■ Tel: 301/913-0500 ■ Fax: 301/652-3916

In collaboration with:

Development Associates, Inc. ■ Harvard School of Public Health ■
Howard University International Affairs Center ■ University Research Corporation

Abstract

In Egypt there is increasingly strong political support for health sector reform including a widespread recognition that a working information system is necessary to undertake and monitor this reform. This paper assesses the role of USAID technical support to help build health management information systems in Egypt. The major objectives of the report are to: identify constraints to building the necessary information systems, identify and describe available resources, determine the most constructive role for the technical assistance element of the initiative, recommend a development strategy, and outline necessary resources.

The study describes the history, characteristics, and status of project-based information system efforts carried out to date. It outlines guidelines that USAID program assistance should use for information systems development. Amongst others, the guidelines include: do not create a project-based information system, play a coordinating role, define and prioritize objectives, build organizational capacity, make available consolidated information at MOHP headquarters, produce information at the governorate level for local decision-making, strengthen human resources, do not introduce information technology faster than capacity is developed to use the technology, use the private sector for support, establish official standard coding systems, and develop a workplan with well defined stages and tasks.

Building Health Management Information Systems in Egypt: The Role of USAID Technical Support in Program Assistance

Technical Report No. 10

Contract No.: HRN-5974-C-00-5024-00
Project No.: 936-5974.13
Submitted to: USAID/Cairo
and Health Policy and Sector Reform Division
Office of Health and Nutrition
Center for Population, Health, and Nutrition
Bureau for Global Programs, Field Support, and Research
United States Agency for International Development

March 1997

Table of Contents

List of Tables

List of Figures

Acronyms

ADT	Admission, Discharge, Transfer
Arabsoft	Arabic Software Engineering Incorporated
ASMO	Arab Measurement and Standards Organization
BTS	Budget Tracking System (DDM)
CAPMAS	Central Authority for Public Mobilization and Statistics
CAU	Clark Atlanta University
CCC	Cambridge Consulting Corporation
CCO	Curative Care Organization
CIDSC	Cabinet Information and Decision Support Center
cps	Characters per Second
CRHP	Cost Recovery for Health Project
DOP	Directorate of Planning
DOS	IBM/Microsoft Disk Operating System
DPS	Data Processing Services
Eng.	Engineer
GIC	Governorate Information Center
GIS	Geographical Information System
HIC	Health Information Center (governorate)
HIO	Health Insurance Organization
HIS	Health Information System (Child Survival Project)
HMHC	Health Mother Healthy Child
HPSP	Health Policy Support Program
HSPH	Harvard School of Public Health
ICD	International Codes for Disease
IDDSC	Information, Documentation, and Decision Support Center (MOHP)
ISP	Internet Service Provider
IT	Information Technology
MOHP	Ministry of Health and Population
NGO	Non-Governmental Organization
NPC	National Population Council
PC	Personal Computer
PD	Project Directorate
RTI	Research Triangle Institute
URC	University Research Corporation
WHO	World Health Organization

Acknowledgments

Many people contributed to this report. As always, the staff of USAID/Cairo's Health and Population Office have been enthusiastic and supportive. Several project officers spent significant time with the author discussing problems, lessons learned, and possible solutions. Many members of the Ministry of Health and Population (MOHP) spent time helping me identify obstacles and possible solutions to their information system needs, including Dr. Nabil Nassar, Dr. Magda Sherbini, Dr. Moushira El Shafa'i, Dr. Wagida Anwar, Eng. Eman Abdel Aziz El Aasar, and Dr. Samir Guirguis. The staff of HIO/MAXIMUS were extremely helpful, all going above and beyond the call of duty. My special thanks to Felix Meyer, James F. Meere, Mohamed H. El Alfy, Maralee DeMark, and Mary Tailor Hassouna. Members of the URC team also went out of their way to help, including Dr. Thomas Hayes, Dr. Robert Snyder, Phil Schrafer, and Mark Wilcox. Eng. Mediha Abdallah was particularly generous with her time. At the Healthy Mother Healthy Child Project, Dr. Hala Safwat was helpful and dynamic as always. Several members of the Cabinet Information and Decision Support Center went out of their way to help me, including Dr. Sherif Hasham, and Dr. Tarek Kamel. Dr. Assem El Fiky at MedNet was also generous with his time. Finally, thanks to Dr. A. K. Nandakumar and the fine members of the Harvard School of Public Health/DDM team for past and continuing support. Though all of these persons contributed to this report, none are responsible for any mistakes or inaccuracies it contains.

Executive Summary

USAID program assistance takes a holistic approach to health policy reform and ties release of funds to the MOHP to measurable benchmarks. Measuring expected end-of-program status requires or implies the following information system objectives:

1. a way to routinely measure aggregate MOHP expenditures on curative services, on preventive medicine, and on primary health care;
2. a way to routinely measure aggregate MOHP expenditures on personnel;
3. a way to routinely measure aggregate MOHP expenditures on pharmaceuticals; including vaccines and contraceptives;
4. a way to determine current and appropriate staffing for each health facility;
5. use of appropriate hospital MIS systems for use by an increasing number of cost-recovery hospitals.

As the MOHP changes its role in curative care from provider to regulator, and from direct funding to indirect funding, accurate information is vital for monitoring providers, adjusting policies, and informing users. Increased focus on efficiently targeting MOHP preventive and primary care services also demands more timely and accurate information. The last objective is aimed at these general long-term needs:

6. a comprehensive national health information system (HIS) supporting an economic and policy analysis unit in the MOHP, operational in all regional offices, hospitals, and polyclinics.

The information system must be flexible enough to serve decentralized needs and centralized policy analysis.

There is increasingly strong political support for health sector reform. There is widespread recognition that a working information system is necessary to undertake and monitor this reform. Reorganization of key information system departments is underway. Despite low salaries, there are bright, capable people in the MOHP. Existing projects contain many important elements of the information system. The telecommunications environment is improving. There is serious interest in coordinating all these elements.

The technical assistance element of USAID program assistance should use the following guidelines for information systems development:

Do not create a project-based information system. Technical assistance should focus on helping the MOHP to develop its own independent capacity to design, build, and operate the needed information system.

Play a coordinating role. Help the MOHP develop its vision of an integrated information system. It should help coordinate the work of USAID, other donor projects, other agencies such as the CIDSC, and efforts of the MOHP to make this vision reality.

Think globally, act locally. Help the MOHP develop the overall architecture, defining major components, relationships between them, and exactly what data is transferred from one to

another. The technical assistance effort should help the MOHP break the problem into manageable components and make them work together.

Define and prioritize objectives. Help the MOHP complete a comprehensive analysis of information needs at key levels: facility, district, governorate, and MOHP headquarters, and prioritize these needs. System components should be built in order of priority. This should provide the most critical information first, while allowing time for organizational and human resources development.

There is no time to build systems from scratch. Existing project-based systems must be coordinated and developed. Not all of these systems are relevant, and choices must be made to strengthen support for some and drop support for others.

Build organizational capacity. More than half of technical assistance resources should go to capacity-building at governorate and MOHP headquarters levels. Technical assistance should support reorganizing the information sector at governorate and central levels, and should help to design and execute training programs.

Consolidated information must be available at the MOHP headquarters for performance monitoring, regulation, and policy analysis. MOHP headquarters should establish and maintain standards necessary for an integrated system, should provide training to personnel in governorate HICs, and should be responsible for overall quality control and operation. Clear, uniform, and widely recognized standards are necessary for consolidating and comparing data from facilities, districts, and governorates.

The MOHP must have the capacity to plan and manage MIS development. No significant investment in computer hardware and software should be made until a department with this mission formally exists.

Information must be produced at the governorate level for local decision-making. In large governorates, data entry must be decentralized to the district level. Equipment and personnel in districts must be trained, supported, and sustained by the governorate health directorate. Independent capacity at the governorate level is critical. Technical assistance should help the MOHP copy reorganization and development of the headquarters information sector to governorate health directorates.

Strengthen human resources. Help develop the necessary human resources as follows:

- design integrated training programs;
- identify and coordinate efforts with other public sector providers such as CIDSC;
- arrange appropriate training through local private sector providers;
- bring experienced international public health care specialists to provide specialized training

Sustained close contact is necessary to transfer skills efficiently and completely. Personal mentoring and on-the-job training should be emphasized.

Some permanent capacity for training data providers, processors, and quality control personnel, must be developed at the governorate level. Training in proper use and processing of forms, interpretation of results, data quality control, and other areas must be provided in the

governorates. New teams need to be created in the governorates and centrally. Compensation for trainers must be independently sustainable.

The MOHP needs to establish basic training standards, provide a uniform training framework, help governorates put this system in place, monitor governorate efforts, and provide help where necessary. Technical assistance should help the MOHP establish this system.

Do not exceed absorptive capacity. Do not introduce information technology faster than capacity is developed to use it. Development should proceed in phases. Introduction of information technology should be coordinated with human resource and general infrastructure development. Information technology depreciates rapidly. If introduced too far in advance of organizational and human resource development, its value may reach zero before it can be used. Newly automated systems should be run in parallel with manual systems while problems are resolved, and organizational and human resource capacity is strengthened.

Match operating costs to carrying capacity. Match information technology to the needs and carrying capacity of the MOHP. Carrying capacity is the organization's ability and willingness to spend its own resources to keep the system running. It is possible for operating costs to exceed an organization's willingness or ability to pay, though a less expensive design may do the same job.

Technical design and information demand both determine acceptable operating costs. The only way to find a design with sustainable operating costs is to communicate with the organization during design. The MOHP should be presented with the operating costs of various options and should understand the relationship between the two before significant quantities of hardware arrive.

Transfer operating costs in phases. Give the MOHP an immediate stake in containing operating costs. The proportion of operating costs paid by the MOHP should increase over the life of USAID program assistance so all operating costs are assumed by the MOHP before assistance ends. The only way the MOHP can agree to this is if operating costs are judged by the MOHP to be reasonable and within the means of the organization. This approach requires technical support contracts with vendors to be negotiated by the MOHP.

Define and increase information demand. Allocate significant resources to increasing the Ministry's ability to use MIS products and to defining their information needs. Work closely with MOHP decision makers to define their needs precisely and design products to meet these needs. Initial efforts should use existing data sources and include indicators listed in Objectives 1 through 5. Establish procedures to deliver these reports routinely to MOHP decision makers to establish vital information flows, refine information demand, and guide further system development. Prototype reports and presentations should guide development of the information system called for in Objective 6.

Use the private sector. An information system depending on information technology cannot be sustained without required technical support personnel. Hiring and retaining competent technical personnel is a critical problem for the Egyptian public sector. Information technology must be selected and introduced with this in mind.

The MOHP should consider contracting a private sector provider to fill two or three critical technical positions having well-defined responsibilities. Suitable technical positions deal with general information technology management and support, such as a Local Area Network

Administrator and a Network Support Technician. The terms of the Site Management Contract and its careful management are critical to success. The contract site management market in Egypt is immature. The technical assistance element should discuss this approach with the MOHP.

There are other areas where private sector working relationships are necessary to support the information system. These can be grouped into two areas: hardware and software development and maintenance, and basic skills training. The technical assistance element can help evaluate vendors, develop contract terms, evaluate offers, and monitor the work of contractors.

The following major steps should be taken to capitalize on existing information system efforts:

- converge hierarchical systems;
- commercialize facility management systems;
- establish recognized official standard coding systems

Converge hierarchical systems. The HIS provides the only reasonable foundation for merging hierarchical systems. Technical assistance should help the MOHP begin to integrate these systems at all levels, technical and organizational. At the same time, facility management systems should be coordinated so they provide data easily to an integrated HIS, eliminating unnecessary forms.

Commercialize facility management systems. USAID program assistance for health sector reform calls for increasing the number of MOHP hospitals under cost recovery to 100. This creates a significant market for hospital information management systems in Egypt. The private sector should be encouraged to provide solutions for key hospital management subsystems.

Establish recognized official standard coding systems. Even if commercialized, hospital management systems must produce comparable information for MOHP monitoring and policy analysis. This requires development and authoritative control of national coding standards for key data elements and indicators. The MOHP has the leverage necessary to require commercial providers to meet such standards.

Development should proceed in well-defined stages against a general design and general work plan. A separate work plan should be written for each stage, detailing tasks and resources for that stage. This will allow schedules and resources to be estimated with greater precision.

1.0 Introduction

The health sector reform initiative of the Ministry of Health and Population (MOHP) may be the most significant effort by any Middle Eastern country to overhaul its public health system. The supporting program assistance departs from USAID's previous portfolio of vertical projects, taking a holistic approach and tying release of funds to the MOHP to measurable benchmarks. The Health Policy Support Program (HPSP) Draft Matrix of the Projected Benchmarks for Tranche One keys reform objectives to expected end-of-program results and specific measurable benchmarks. Major objectives of the National Health Sector Reform Policy are as follows:

1. Reduce the role of the MOHP in providing and financing curative care.
2. Strengthen the role of the MOHP in the provision of and increase share of financing Preventive Medicine (PM) and Primary Health Care (PHC).
3. Reform MOHP personnel policy.
4. Develop the MOHP role in regulation and accreditation; and its capacity for national health strategic planning and policy analysis.
5. Ensure the viability of the HIO.
6. Expand social health insurance coverage coupled with adequate administrative and financing mechanisms.

Measuring of expected end-of-program status requires or implies the following information system components:

1. a way to routinely measure aggregate MOHP expenditures on curative services, on preventive medicine, and on primary health care;
2. a way to routinely measure aggregate MOHP expenditures on personnel;
3. a way to routinely measure aggregate MOHP expenditures on pharmaceuticals; including vaccines and contraceptives;
4. a way to determine current and appropriate staffing for each health facility;
5. use of appropriate hospital MIS systems for use by an increasing number of cost-recovery hospitals.

A broader goal is implied: as the MOHP changes its role in curative care from provider to regulator, and from direct funding to indirect funding, accurate information is vital for monitoring providers, adjusting policies, and informing users. At the same time, increased focus on efficiently targeting MOHP preventive and primary care services also demands more timely and accurate information. The last component included in the matrix is aimed at these general long-term needs:

6. a comprehensive national health information system (HIS) supporting an economic and policy analysis unit in the MOHP, operational in all regional offices, hospitals, and polyclinics.

The approach taken to health sector reform is likely to emphasize decentralization. The financing system is already decentralized; funds from the Ministry of Finance go directly to governorate accounts. Many significant decisions are made at the governorate level. There are indications the MOHP will increase the responsibility of the governorates, making them more autonomous managerially and more responsible for performance. The information system must

meet the needs of decentralized decision-makers, while meeting the national policy analysis, monitoring, and regulation needs of the MOHP.

The purposes of this report are as follows:

- identify constraints to building the necessary information systems;
- identify and describe available resources;
- determine the most constructive role for the technical assistance element of the program assistance initiative;
- recommend a development strategy;
- outline necessary resources

The information in this report is based on meetings the author attended in Egypt in January 1997, and on experience working with information systems projects in Egypt since 1989. A list of the principal persons contacted is included in Annex A. Documents consulted during preparation of this report are listed in Annex B.

2.0 Challenges

The challenges are immense. Several promising initiatives are underway, but the MOHP has no system regularly providing key decision-makers with vital information. Constraints include general issues challenging all information system projects in the Egyptian public sector, the magnitude of the problem, and special issues confronting the MOHP.

Budget and human resource constraints are severe. Funds for operating costs such as maintenance and supplies are severely limited. Equipment waits for repair and personnel ration paper sheet by sheet. Since the late 1960s, civil service salaries and the respectability of government service have been in steady decline. Qualified personnel in key positions must be unusually dedicated. There is little prospect of keeping persons with good, marketable technical skills. In many positions, employees are so poorly paid they merely go through the motions required to collect a check, supplementing this income as best they can. Record keeping systems in most facilities are rudimentary, consisting of ledger books and tables drawn by hand. Paper filing systems are crude and disorganized. Prescriptions are hand written on odd scraps of paper and impaled on a pin. The environment for computer equipment is hostile. Electrical systems are crude and ungrounded. Plumbing systems leak. Buildings lack environmental control and are open to weather and dust. Getting people, materials, and data from one place to another can be difficult. Travel time to some facilities makes it hard to distribute and collect forms, monitor data collection, and provide the necessary technical support. Telephone lines are increasingly limited and of poorer quality the farther a facility is from an urban center.

Table 1

Number of MOHP Facilities by Type[1]

Number	Type of Facility
220	General or District/Central Hospital
182	Specialized Hospital
172	Rural Hospital
4,409	Non-Hospital Medical
134	Education & Training
863	Administration & Other

Examining the number of facilities and offices to be automated shows the magnitude of the task. *Table 1* shows the number of MOH facilities by general type. There are 220 general or district hospitals to be automated, 182 specialized hospitals, and 172 rural hospitals. Data must

[1]Source: Child Survival Project, Health Information System.

also be collected from 4,409 non-hospital medical facilities. Of these, 2,260 are rural health units. Egypt has one of the largest rural health care networks among developing countries. There are 27 central pharmaceutical supply centers to automate. There is one health information center (HIC) in each governorate. These need strengthening and support to handle an increasing volume of data. The number of units in some governorates will require data entry at the district level. There are 232 health districts, with a third of all governorates having ten or more.

Though requirements are somewhat different, the HIO project is a benchmark for the required level of effort. It has taken four years to automate 16 hospitals, 63 polyclinics, six pharmacies, and four branch offices. This represents roughly only half of HIO operations. Not including organizational development and training, about forty percent of HIO project expenditures, $5.7 million, have gone to information technology. Several USAID project teams, as well as project evaluations, have concluded that organizational development and training efforts have been seriously underestimated.

In addition to the general environment and magnitude of the challenge, there are other special issues to deal with. These include the following:

- vaguely defined information needs
- no clearly recognized center for policy analysis and planning
- a history of uncoordinated project-based efforts
- no history of clear MIS organization and leadership
- little capacity to support information technology
- few official or common coding standards

Each of these issues is discussed in more detail in the following sections.

2.1 Define Information Needs

As commitment to health sector reform has strengthened, so has the realization that a good information system is necessary to support reform. Exactly what information is necessary is not clear. The information needs required by Objective 1 through Objective 5 of USAID's program assistance, stated at the beginning of this report, are specific but limited. Objective 6, calling for construction of a national MIS for MOHP policymakers, calls for much more, but is vague. Information needs must be defined and prioritized before development can focus on what needs to be done.

2.2 Strengthen Policy Analysis and Planning

Historically, the Directorate of Planning (DOP) has been responsible only for evaluating requests for Chapter 3 (Bab III) funds for capital investment projects. For more than two years the DOP has been expanded by DDM project activities, including National Health Accounts, Facility Costing, and development of a system for tracking expenditures by function. These activities have contributed significantly towards MOHP reform, but most DOP staff have been hired and supported through DDM activities.

Though technically part of the Central Administration of the Minister, the DOP currently reports to the Sector for Curative Care. It is not widely considered to be the central planning department in the Ministry and is not responsible for helping the Ministry analyze policy alternatives or develop a comprehensive plan for the health care sector. There is widespread recognition at top levels of the MOHP that this directorate needs strengthening.

2.3 Coordinate Project-Based Efforts

Project assistance has created an uncoordinated set of information system components. These include several facility level management systems and systems that aspire to collect and consolidate data from bottom to top of the MOHP apparatus. In many cases these efforts overlap. There has been little effort to coordinate projects by sharing components, coding systems, or data structures. Opportunities for leveraging the work of one project to benefit another have not been capitalized on. Each project has its own separate scope of work and appears self contained. There are no structures or incentives to encourage projects to integrate and share efforts. There are no regular formal meetings of contractors engaged in related or similar efforts. There is no central library of information on past and current information system activities and products. Much of the memory of what is learned by a project disappears when the project ends. The MOHP is not able provide this kind coordination, since it lacks a strong, functioning MIS organization.

2.4 Strengthen MIS Organization and Leadership

The Ministry of Health and Population (MOHP) currently has no capacity to support a coordinated, system-wide information system. Departments dealing with the collection and processing of information (IDDSC), planning (DOP), and monitoring (Monitoring and Follow-up) are shown under the Central Administration for the Minister's Office Affairs. These related departments are grouped together with other less closely related functions, such as public relations, security, legal affairs, and so on. In reality, the IDDSC currently reports to the Sector for Basic & Preventive Care, and the DOP reports to the Sector for Medical (Curative) Care. Thus the department responsible for collecting basic information from the governorates and the department responsible for planning now report to different sectors and do not work together.

The Information, Documentation, and Decision Support Center (IDDSC) of the MOHP has benefited in the past from USAID project assistance. Much of its equipment came from these projects. Currently it is the only department engaged in significant information gathering activities that are not supported by foreign projects. Information from the Health Information Center (HIC) in each governorate is sent to the IDDSC for processing. Some of this information is entered in the governorate HIC and is transferred to the IDDSC on diskette. Other information is entered directly by the IDDSC directly from paper forms.

It is difficult to determine the content and quality of IDDSC information; little is published. The department does not regularly issue reports to any undersecretary or general director. No undersecretary questioned for this report receives information from this department. The only evidence of routine reporting is a small annual statistical yearbook lacking analysis. Information collected independently from health care facilities by the Data for Decision Making (DDM) Project is often at odds with information in the IDDSC yearbook. Though the IDDSC provides information directly to the Minister, various related projects have difficulty getting

information from the IDDSC. The divide between the IDDSC and other information system efforts is significant.

Original plans for the Health Information System (HIS) developed under the Child Survival (CS) Project call for the IDDSC to be the central processing and distribution point for information coming from the governorates. The HIS team made a strong effort to integrate their efforts with the HIC/IDDSC system. This approach has been abandoned due to coordination problems. Continued HIS development by the Healthy Mother Healthy Child Project provides a separate computer in each HIC solely for HIS processing.

For many years the Cabinet Information and Decision Support Center (CIDSC) collected basic statistics from each major sector: agriculture, education, health, etc. In education, they are able to get this information directly from a functioning MIS in the Ministry of Education. In health, efforts to collect this information from IDDSC failed. Instead, they collect this information directly from the governorate HICs.

Several newer information systems initiatives are underway outside the IDDSC. The Technical Office of the Minister has been coordinating efforts with the Cabinet Information and Decision Support Center (IDSC) to assume responsibility for a public Web site to distribute information to the health sector in Egypt. The Sector for Population has started to build its own information system. The IDDSC is not in a position to lead these efforts. Under the direction of the Minister, the First Under Secretary for Basic and Preventive Care recently began meetings to coordinate these efforts and development of the Health Information System (HIS) first by the Child Survival Project, then the Healthy Mother Healthy Child Project.

2.5 Build Capacity to Support Information Technology

The IDDSC reportedly has 19 professional personnel in its main center, 10 clerks, and 50 statistical technicians at other sites for a total of roughly 79 persons. Professional personnel include physicians, statisticians, demographers, and computer specialists, all with university degrees.

Computing equipment in the IDDSC consists of roughly twenty stand-alone PCS and a variety of dot-matrix and laser printers. Outside the IDDSC, several PCS can be found in the offices of undersecretaries and some general directors and in various project offices in MOHP Headquarters. In the main MOHP building several PCS are connected in a small network through a DEChub 90. In addition, the Cabinet Information and Decision Support Center (CIDSC) recently installed an Internet gateway and Web server.

The IDDSC is not generally viewed as an Information Technology (IT) service organization supporting the general needs of the Ministry. According to some sources, IDDSC has perhaps only one or two capable computer specialists on staff. Apparently no department in the Ministry has been given the responsibly for general IT strategic planning, support, and operations. There is no written set of standards for IT platform components, no IT strategic plan, no network administrator, no network operations staff, no hardware technicians, no PC training program, and no help desk. The Ministry has no contracts with private sector companies to provide any of these services. All this must be built from scratch to support the necessary

technology. At the same time, the operating requirements of the selected IT platform must remain within the means of the Ministry.

2.6 Establish Official or Common Coding Standards

The MOHP has no known official national coding standards for basic data elements. These include governorates, districts, health facilities, professional specialties, pharmaceuticals, diseases, and so on. The Central Agency for Public Mobilization and Statistics (CAPMAS) has distinct coding standards for some general elements, but none specific to the health care sector. Existing information system projects are using a variety of different coding standards for the same key data elements. Several projects are using the International Codes for Disease (ICD), but there is no formal requirement that they do so, or that they use a specific release of the coding system. Most project coding systems are unique to that project. Widespread use of unique coding systems makes it difficult to consolidate and cross-reference data from various project information systems. As some information systems elements are consolidated to form part of an integrated MOHP information system, common standard coding systems must be defined and maintained by clearly designated authorities.

3.0 Existing Projects

Nearly all information system efforts to date have been project-based. Though overlapping, duplicative, and uncoordinated, existing project-based systems contain many useful elements. The MOHP needs to select from among them and coordinate development as it builds its information system. Following sections briefly describe the history, characteristics, and status of the various project-based efforts. Tables in Annex C list the general and technical characteristics of these efforts.

3.1 Curative Care Organization

Beginning in 1988 under Component 2 of the Cost Recovery for Health Project, Birch and Davis International was responsible for providing hospital management systems to hospitals of the Cairo Curative Care Organization (CCO). Curative Care Organizations include six autonomous organizations providing health care services. The largest are in Cairo and Alexandria. The Cairo CCO consists of twelve hospitals. CCOs are run independently, but come under the authority of the MOHP.

Facility management systems were developed for Cairo CCO hospitals by Data Processing Services (DPS), under the direction of the Birch and Davis team. Software was developed using dBASE III/IV for stand-alone PCS running DOS. User interfaces are in Arabic. Contrary to statements in the CRHP mid-term evaluation, user and technical documentation is well developed and has existed since at least September 1995.

CCO hospitals operate under fairly independent management, and do not require a beneficiaries registration and authorization system. There is no central CCO management structure; management systems in the various CCO hospitals are not interconnected. In this organizational environment, selection of a simple, low-cost, stand-alone PC database system was reasonable. However, management subsystems within CCO hospitals are also unconnected, and do not share data in any way. It would not be difficult to interconnect these subsystems within hospitals, but capacity limitations of the computing platform prevent its use as a foundation for a CCO-wide MIS serving a central administration. A different computing platform would be needed to handle central administration.

The software has been in continuous use now for several years with good results. Much of the success of this effort is due to the application of a simple technology model and sound systems analysis and implementation by a local private sector company. Because of this approach, the software is still being supported as needed by the original developer long after the end of the project.

3.2 Child Survival Project

A major activity of the Child Survival Project , which ended in 1996, was development of a Health Information System (HIS). Important groundwork for HIS development was done by the National Health Statistics System (NHSS) project carried out under the U.S.-Egypt Cooperative

Health Program. Work on the HIS under the Child Survival Project began in 1993. Work on the HIS resumed under the Healthy Mother Healthy Child (HMHC) component of the MotherCare project with many of original team members.

The HIS collects information weekly, monthly, and yearly from most MOHP facilities. The frequency of collection varies depending on the type of information being collected. The forms collect information on facility infrastructure, personnel, expenditures, materials consumption, training, and service delivery for all facilities and offices reporting to the governorate health directorate. Until early 1996, the HIS did not include any expenditure data. Following a workshop ending the first phase of the DDM Project's Budget Tracking System (BTS) activity, DDM worked with the HIS team to modify existing forms and add new forms reflecting BTS and facility costing requirements.

Data are currently collected on forms from each facility. Data from these forms are entered into a computer in the Health Information Center (HIC) of the governorate. The system can accommodate district-level data entry. Current plans are to implement entry at the district level over the next two years. Standard reports can be generated at the governorate level for use by district and sector managers. Data are transferred to a central project system in Cairo on diskette. Standard reports are also available at this level for distribution to various health care sectors. The design calls for feedback reporting to governorate and district levels, but this has not been implemented.

The HIS is a stand-alone database application written in FoxPro for DOS. The user interface is in Arabic. The HIS team realizes the application must be transferred to Windows at some point due to market shift. The application is well-documented with user, technical, and coding guides. It is normally installed on a single PC in each governorate HIC. Due to frequent disputes over data and PC ownership, this PC is normally set-aside for the HIS only. Other PCS in health information centers are used to provide data to the Documentation, Information, and Decision Support Center at MOHP headquarters, and for general word processing and spreadsheet work.

As of March 1996, the HIS team was implementing twenty-four standard data collection forms. The HIS team estimates that as much as 70 percent of the requested data were collected and processed in some governorates, such as Alexandria, Giza, and Ismailia. The total number of HIS forms and the number implemented has varied over time. As of January 1997, there were forty-seven forms, with only fourteen forms relating to the activities of the MotherCare project being implemented in the governorates. HIS plans always called for phased development, beginning with a reduced set of forms. Also, neither the Child Survival Project nor the MotherCare project have had the mandate or resources to implement the entire set of forms. Significant time and human resources are necessary to train data providers and processors. More immediate project objectives and limited resources aimed at HIS implementation have forced the HIS team to focus on forms immediately useful to the project.

The HIS is currently installed in twenty-one of twenty-seven governorates, but is actually operating in perhaps only six. Most governorates have received introductory training and the software, but have implemented few if any of the reporting formats. The system is most mature in Alexandria and Giza. As of July 1995, the HIS team considered three governorates: Alexandria, Ismailia, and Giza, to be fully implemented. The HIS team is experiencing serious difficulty in two or three governorates, primarily due to personnel and political problems.

A Governorate Information Center (GIC) was established in each governorate as part of the Cabinet Information and Decision Support Center (CIDSC) Governorates Program. These GICs are now largely independent, reporting directly to the governor in each governorate. CIDSC continues to provide GICs with training and technical support. Each GIC provides basic information on each major government sector monthly to the governor and the CIDSC. Separate data collection by GICs and other sectoral information centers duplicates effort and causes confusion among data providers. For several years GICs and the CIDSC have been getting education statistics directly from the Education Management Information System of the Ministry of Education. The CIDSC recently asked the HIS team whether the system could provide the health planning and budget information now obtained by the CIDSC from each GIC. In return, the CIDSC offers training, help with software development, and if necessary, computer hardware. The HIS team has agreed to cooperate with the CIDSC in this effort.

The HIS effort is the most complete and well-conceived hierarchical system among existing projects. It provides a sound foundation for a unified information system for the MOHP. Building on and adopting the work of the NHSS project, the HIS team has an excellent understanding of the problems facing an effort to apply a uniform standard information system in all twenty-seven governorates. They are enthusiastic about cooperating with other related efforts.

Despite this understanding and significant resources applied to this effort, implementation problems remain. These are well documented by the HIS team and include the following:

- distances between units in some governorates make data collection difficult
- managers seek to control data for their sector
- the role of the governorate Health Information Center is not clear and widely recognized
- data entry and processing personnel require incentives
- governorate operating budgets have no provision for basic supplies
- governorate HIC and statistics personnel are often unqualified
- governorate personnel have very low levels of computer literacy

Field reports prepared by Dr. Moharram Khalifa describe these and other problems, including the following:

- inadequate training of HIC personnel
- insufficient training for persons filling HIS forms
- no provision for repair of computer hardware
- arguments over computer ownership
- shortages of consumable supplies
- insufficient supplies of HIS forms
- need for a medical supervisor in some HICs
- reports not regularly disseminated by governorate HICs
- no feedback reports to district level
- not enough follow-up and supervision at governorate and district levels

Few, if any, of these problems are technical. Most are organizational, procedural, and human resource development problems. The effort required to institutionalize the system in twenty-seven governorates was seriously underestimated. Significantly greater sustained contact with governorate HICs and decision-makers is necessary. Organizational development and training efforts to date have not been enough to implement a system like this nation-wide.

3.3 Data for Decision Making Project

The Data for Decision Making (DDM) Project began at the end of 1994 under Component 1 of the Cost Recovery for Health Project. The project team is lead by the Harvard School of Public Health and includes the Research Triangle Institute. The technical assistance portion of DDM is currently scheduled to end in June of 1997. Among DDM activities has been design and construction of a system for tracking MOHP expenditures by broad medical functions. The Author has been responsible for this effort under the direction of Dr. A. K. Nandakumar of the Harvard School of Public Health. A significant portion of the work has been done by staff of the Directorate of Planning, including Dr. Mahmoud Abdel Latif, Dr. Samir Fouad, and others.

The Budget Tracking System (BTS), as it is called, is a well-defined system for collecting expenditure data from individual facilities and classifying it by function. The results are then available by type of facility, district, governorate, and national total. Software developed by the project consists of several spreadsheet applications in Quattro Pro for Windows. The central spreadsheet application has been useful in managing data and presenting results in the initial phase. It also allowed DDM to concentrate its limited resources on collecting and analyzing data and developing sound methodology. However, spreadsheet software is too rigid and its capacity too limited for national implementation. DDM is aware of this and is working to add the BTS to the well-defined database architecture developed or the HIS.

Beginning in late 1995, the project started working with the Child Survival Project HIS effort to integrate the two systems. HIS forms were modified and added to collect data necessary for the BTS. At the same time, DDM began defining and creating the database tables necessary to add BTS capabilities to the HIS architecture. Closure of the Child Survival Project and limited DDM resources has delayed this work. With renewed support of the HIS through the MotherCare project, efforts towards HIS/BTS integration have been renewed.

The first phase of BTS development determined location and availability of data necessary for classifying expenditures. DDM analyzed existing forms used for payroll, drug inventory control, and general accounting. DDM also evaluated forms being used to collect HIS data. They found a profusion of often overlapping forms at lower organizational levels, and estimated massive data entry requirements at higher levels. The DDM team noted that much of the required data would be byproducts of facility management systems. Relevant facility management systems include the following:

- drug inventory control system
- personnel/payroll
- general accounting

DDM spent time in central and hospital pharmaceutical stores to determine whether they could operate a computer-based drug inventory control system. The project concluded that a pilot test should be made in several locations using low-cost, stand-alone PC systems. DDM evaluated the drug inventory control program developed by DPS and in use in CCO hospitals for four years. They concluded that the software was technically sound, well-tested, and could meet BTS needs with minor changes. DPS, the original developer, was retained to modify the software, as well as to modify existing personnel/payroll and general accounting software to meet governorate health directorate and BTS requirements. These three applications are to be in place and tested by the end of June, 1997.

The same three facility management applications being modified and tested by DDM for the BTS could also serve the needs of the HIS, replacing many forms and providing value to data providers. The relationship of facility management systems to hierarchical information systems like the HIS and BTS, and the role of the private sector in providing them is discussed in Chapters 4 and 5.

In addition to the BTS, DDM has developed several other spreadsheet systems. These include an elaborate system for detailed costing of individual health care facilities, and a system for analyzing and tracking budgets for Chapter 3 (Bab III) investment projects. These applications have been developed entirely by DDM staff in the Directorate of Planning. Their impressive spreadsheet application development skills are largely self-taught, beginning with reverse engineering the BTS phase one application. Development of these applications in Quattro Pro is unfortunate. Versions of Microsoft Excel with similar capabilities are now available in Arabic and dominate the market. Future development work should be done in Microsoft Excel.

3.4 Health Insurance Organization (HIO)

Automation efforts in the Health Insurance Organization have focused on registering and authorizing beneficiaries and basic facility management systems. Work began with a pilot project in the late 1980's. The current contracting team, lead by MAXIMUS and including Chemonics and Arabsoft, began work in 1993. The overall objectives of the effort have been to improve access to and quality of HIO services, and to reduce their cost.

Software modules developed under the project include the following:

- Beneficiary Registration
- Medical Records
- Admission/Discharge/Transfer
- Periodic Medical Examination
- Cost Accounting
- Drug Control
- Contracted Pharmacy
- Contracted Providers
- Medical Quality Assurance
- Management Reporting

Entities to be automated include pharmacies, polyclinics, hospitals, branch offices, and HIO headquarters. Much effort has been focused on the problem of beneficiary registration and authorization. This requires checking the number on a patient's identification card against a central database. The size of the database, which contains entries for millions beneficiaries, and the need for polyclinics and hospitals to get a quick answer, presents special problems. The MAXIMUS team segmented the database among branch offices and implemented on-line queries through the EGYPTNET X.25 network. If necessary, an additional query is made against a complete master database at HIO headquarters. *Figure 1* illustrates the basic architecture of the system.

The MAXIMUS team estimated the capacity requirements of the beneficiaries database and the overall scale of the system and selected Oracle database software as the foundation. With more than 60 percent of the World database market, and mature multiplatform product, it was a

reasonable choice. In 1993, HIO beneficiaries increased from six million to more than 20 million with the unexpected addition of all primary school children. The selection of a mature, large systems database platform was fortunate.

All applications have been developed for multiuser UNIX host computers and are accessed via dumb terminals. The UNIX hosts vary in scale. Polyclinics and hospitals are equipped with an industry standard Pentium PC running the UNIX operating system and supporting from five to twelve dumb terminals. Initial cost for each facility nears $50,000, while maintenance and supply costs are estimated to be $4,000 to $5,000 each year. Branch offices are equipped with a larger capacity system with two Pentium processors supporting thirty-two terminals. Intial cost is over $100,000, while maintenance and supply costs are estimated to be nearly $10,000 a year. HIO headquarters is equipped with $100,000 of hardware and software, with maintenance and supplies estimated at $4,000 a year. The HIO MIS center is equipped with more than $650,000 of computer hardware and software costing an estimated $54,000 a year to maintain and supply. These operating cost figures do not include more than $230,000 in annual licensing fees for Oracle across the system, and more than $660,000 in annual fees for X.25 telecommunications lines. Site preparation, which is included in these initial cost figures, was significantly higher than originally estimated.

The decision to use a multiuser host platform with dumb terminals rather than a networked system of servers and intelligent workstations was based on several factors. The MAXIMUS team felt that over time, a multiuser host platform would cost less to operate and would be more reliable. They also determined that most user workstations would serve only one function, and that simple inexpensive dumb terminals and character-based user interfaces would meet this need. A notable exception is Management Reporting. This module, originally developed for dumb terminal access, has been moved to networked Windows-based PCS. It now has a graphical user interface and gains access to the HIO database using Structure Query Language (SQL) and other client/server technologies.

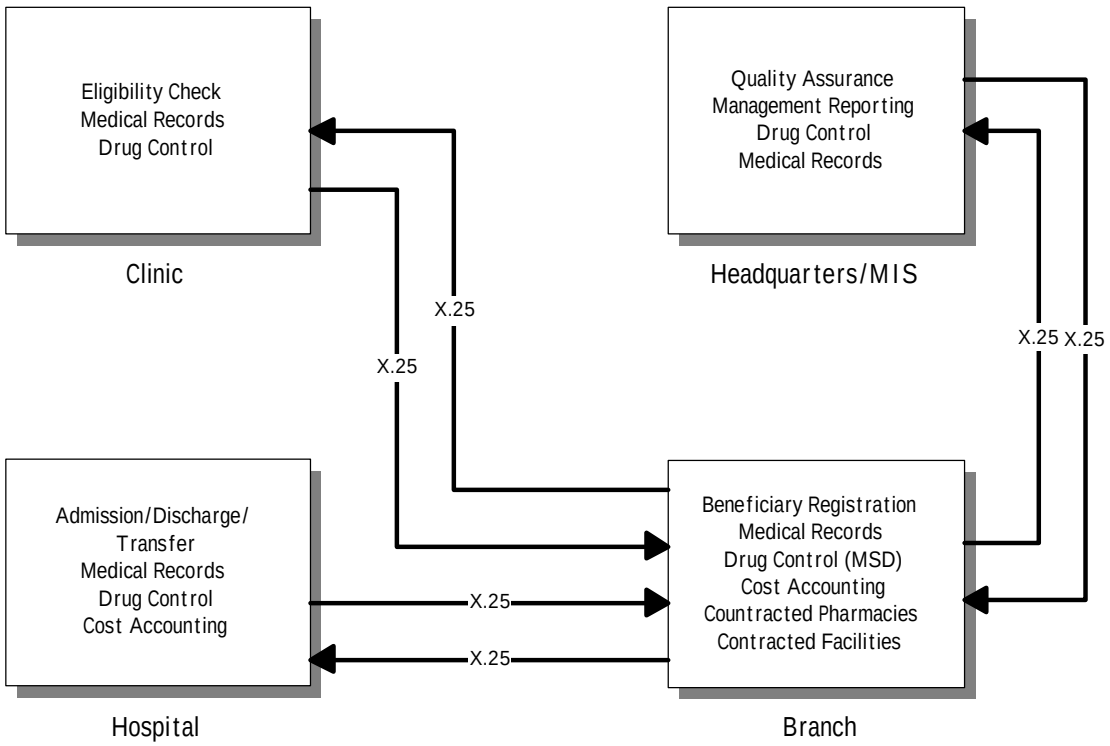
Now in year four of a five year project, sixteen hospitals, sixty-three polyclinics, six pharmacies, and four branch offices have been automated. This represents roughly only half of HIO operations. Not including organizational development and training, about 40 percent of HIO project expenditures, $5.7 million, have gone to information technology.

The MAXIMUS team highlights several issues endangering sustainability of the HIO MIS, including the following:

- reliability of the EGYPTNET X.25 network
- weak MIS organizational structure and staffing

Figure 1

The General Architecture of the HIO Information System



- lack of a competitive pay scale for technical support personnel
- inadequate funding for equipment maintenance and supply.

Though reliability of EGYPTNET has improved over time, technical support is difficult to mobilize when needed. Despite virtually equal numbers of project and HIO personnel working on the project, independent organization and staffing of the HIO is weak. Like other public sector organizations in Egypt, HIO cannot pay required technical personnel competitive salaries without outside help. Finally, the project has paid most operating costs to date. Despite discussions with the HIO about assuming operating costs after the project, MAXIMUS is concerned about their willingness and ability to do so. In addition to these issues, HIO lacks managers who demand information from the MIS and know how to use it.

The MAXIMUS team recognized early in the project that HIO management deficiencies were a serious constraint to using information effectively for planning. In 1995 they requested and received a contract amendment providing increased resources for management development. An analysis of institutional capacity funded by USAID in June 1996 concluded that the HIO lacked any institutional framework for policy development and planning. Projects working at MOHP headquarters and governorate levels have found similar weaknesses. Used to a decisionmaking environment where information on performance, resource allocation, and service delivery is almost nonexistent, managers are not accustomed to using it. In the absence of good information on performance, incentive systems are based on other values. The CRHP mid-term evaluation in February 1996 noted a lack of skilled consumers for the products of the HIO MIS. Project design focused on information system development. Comparable resources were not directed at creating information demand from skilled managers.

The CRHP mid-term evaluation recommended applying HIO software and training programs to other CRHP components providing facility management systems to hospitals. Since then there has been increased interest in cooperation between HIO and other CRHP components. However, HIO software development and training programs are heavily entrenched in the HIO project. Though Arabsoft has provided the project with twenty-two programmers and analysts, the software applications are not commercialized. The training program is also project-based, not commercial. Both efforts would require a new project funding mechanism to be applied to other project components. They would not outlast the next project-based mechanism unless given new life through another project. Experience in public sector information systems in Egypt argues against relying on other public sector organizations for critical training and technical support elements. Continuing the trend towards cost recovery hospitals requires native, non-project-based capability to provide and support the necessary facility management software. At the same time, this trend generates a significant market for commercial products and services.

3.5 CRHP Component 1 Cost Recovery Hospitals

Under this CRHP component, University Research Corporation (URC) has been developing automated hospital management systems. Under "Phase A" these systems have been deployed in Embaba, May 15, Shark El Madina, Kafr El Dawar, and Kantara Gharb hospitals. Five more hospitals are to be automated under "Phase B." *Table 2* shows the current domains and applications.

The Hospital MIS Advisor, Mediha Abdalla, joined the project in October of 1995 and has managed the development of the applications. Engineer Mediha has long experience,

beginning with Unisys and including work with DPS and Birch & Davis developing hospital management applications for CCO hospitals.

In April of 1995, a Technical Review Committee consisting of USAID, MAXIMUS, and the CRHP Project Directorate (PD) recommended that HIO software and training systems be applied to this project component. The CRHP mid-term evaluation in February 1996 made this same recommendation independently.

Table 2

CRHP Component 1 Applications Developed by URC

Domain	**Application(s)**
Management Reporting	
Engineering and Maintenance	Biomedical Equipment Assets and Maintenance
Personnel	Personnel/Payroll
Pharmacy	Drug Inventory Control (Material Management)
Finance	
Training and Library	Training Programs and Participants
Stores	Supplies Inventory Control (Material Management)
Medical Records (inpatient, outpatient)	Patient Master Index Inpatient Module (ADT)

Before beginning, URC evaluated HIO/MAXIMUS hospital applications then under development. Most HIO/MAXIMUS applications have terminal interfaces. The URC team felt strongly that all applications should have a Windows graphical user interface, and that workstations should be able to support common office automation applications such as word processing. Technical solutions available to accomplished these objectives using the existing HIO/MAXIMUS investment were as follows:

- use of terminal emulation on networked PC workstations
- conversion to client/server architecture using Oracle tools and Oracle Developer 2000

Use of terminal emulation does not appear to have been seriously considered. HIO/MAXIMUS had no budget or reason to convert all HIO applications to client/server architecture. The URC team also judged that their budget and contract would not support conversion to client/server architecture. They were also concerned about the stability of Oracle Developer 2000 and the added technical complexity of dealing with client/server applications. Finally, URC team members had no experience with Oracle, and knew that experienced Oracle 2000 developers would be difficult to find. Based on these issues, the URC team decided to develop their hospital management systems using Microsoft Access, a common PC database system.

HIO/MAXIMUS has since converted several Oracle applications from host/terminal to client/server using Oracle 2000. The conversion has gone smoothly, leaving the database under Oracle 7 on an Intel-based UNIX host and producing a graphical user interface under Microsoft Windows. HIO/MAXIMUS believes this is justified for executive management applications, where a multipurpose intelligent network workstation is needed. They do not believe the extra cost and complexity is justified for single-purpose workstations. The difference of opinion is professional.

All URC Phase A hospital applications have been developed in Microsoft Access for use on stand-alone PCS. Much development was reportedly done in Phase A hospitals with early and close collaboration with end users. The applications are attractive and appear professional. The URC team of three programmers appears to have excellent development skills in Access for stand-alone applications. No local private sector developer has been involved. There do not appear to be any plans to commercialized any of the applications or transfer development to a private sector company. Personnel in the hospitals themselves are expected to maintain the software after the end of the project.

The choice of an end-user PC database appears to be successful in applications with moderate data handling requirements, such as drug inventory control and facility personnel/payroll. However, it is beginning to encounter capacity problems in applications with large data handling requirements, such as patient records. In addition, coordination of software and data coding table updates is complicated when systems are not networked and do not share a single common pool of information. Coordination can be done using diskettes, but this quickly becomes impractical as the number of installations increases. Human organizational and management capabilities become important factors, as does transportation. It is critical to balance the technical support required by the computing platform, the complexity of maintaining a uniform code base, and the difficulty of collecting and consolidating data from separated sites.

Two Phase A sites, Shark El-Madina and May 15th, currently have six workstations on a 10Base-2 peer-to-peer Windows for Workgroups LAN. Current plans are to equip each hospital with a single dual-processor (Intel) server running Window NT/AS and from three to ten PC workstations and one to seven laser printers interconnected with a 10BaseT local area network. Workstations are equipped with office automation software as well as vertical applications specific to the various work areas. The same platform is planned for the additional five Phase B hospitals.

Initial automation began with development of a biomedical equipment assets database with the URC biomedical team. This has been enhanced to include automated equipment inspection sheets, and preventive and corrective maintenance. This module is in use in all five Phase A hospitals. The application could be useful in other hospitals and polyclinics with significant biomedical equipment.

The Inpatient Module (ADT) is currently in use at Shark El Madina hospital in Alexandria. The Patient Master Index originally handled patient registration only. The application has been expanded to record the service given and the physician's diagnosis. A separate application has been developed to help the medical secretary or physician locate the correct ICD-9 code for diagnosis. To build this application, URC purchased the ICD-9 code base. This code base and the application could be useful to related projects, such as the HIS and the HIO/MAXIMUS efforts.

The database at Shark El Madina currently includes approximately 100,000 records. Database capacity is beginning to be a problem, affecting response time and reliability. Recent changes to the structure of the database have improved the situation, but the software engineering team hope to move the application to a client/server platform, probably Microsoft SQL Server, retaining the current Microsoft Access user interface. Current procurement plans support this general platform, but do not include the necessary database engine. Movement to a client/server configuration does not appear to have been anticipated by the developers, who do not appear to have client/server development experience.

The Personnel/Payroll system was originally written in Clipper using Musa'ad Al Arabi Arabization. It has been rewritten in Microsoft Access. It produces full reports of base salary, adjustments, incentives and bonuses. Reports showing base salary and adjustments are printed between the 18th and 19th of the month so that checks can be issued between the 20th and 25th of the month. Reports of incentives are printed during the first ten days of the month, with bonus reports printed at any time. Reports are currently printed on wide-carriage dot-matrix printers, using 120 print columns at 12 characters per inch. The printers are medium-speed (220cps to 330cps). These reports have been accepted in the hospitals for official review, signature, and stamp.

In Embaba hospital, the database currently covers all 607 personnel, including 470 physicians. Shark El Madina, with 350 personnel, has implemented only the bonus portion of the system. A training module to track training programs and participants has been integrated with the personnel module. Because of limited hardware, the payroll module is in operation only in Embaba. Reassignment of trained personnel by hospital administrators has also been a problem.

The training database was built to keep a record of providers, courses, and participants. This is a common need of all projects with a training component. It is repeatedly filled by developing a unique application for each project. The URC implementation is integrated with the personnel module.

The URC team has taken a broad approach to drug and supplies control, developing a general Material Management System application used for both drugs and medical supplies, and for non-medical supplies. Configured for pharmaceuticals, vaccines, medical supplies, and laboratory chemicals, it is used in the hospital pharmacy. Configured for non-medical supplies and spare parts, it is used for the hospital store. The drug and material coding system has been developed by the URC team and is not based on any international or external standard. The URC team provides training and guidance on the entry, classification, and assignment of new items, but there is no central control of a master table. Material pricing in the system is still under discussion with the project's financial team.

Other than the ICD-9 codes, all coding systems used by URC-developed hospital applications appear to be unique to the project. Codes for cost centers within each facility are similar to codes used by CCO applications. Codes for job specialties, position, and degree, as well as codes for pharmaceuticals and supplies, are unique to the project.

3.6 Family Planning Project

The Family Planning Project collects information on contraceptive consumption and supply. This information is collected from MOHP Family Planning clinics, as well as from Non-Governmental Organizations (NGOs). Monthly data from MOHP Family Planning clinics collect in district offices, then are forwarded to the governorate office of the National Population Council (NPC). The governorate NPC office enters data into a stand-alone PC database, adds NGO data, then sends the data to NPC headquarters in Cairo on diskette. A printed copy of the same data is sent to MOHP headquarters.

The Population and Family Planning Sector of the MOHP is currently building an expanded system. In some cases PCS with modems have been placed in governorate HICs for this purpose.

Larson's report of 17 July 1995 notes that the Family Planning Project database could provide information on materials consumption required by the DDM Budget Tracking System. In 1996, the DDM project used this data in Alexandria for the first phase of the Budget Tracking System. As with the Budget Tracking System, the Family Planning information system could and should be integrated into the HIS.

3.7 Tuberculosis Control Project

Funded by the Government of the Netherlands, the Tuberculosis Control Project is a well-developed example of how simple and effective a health information system can be. The project is being supported through technical assistance of the Royal Tropical Institute in Amsterdam. Data are collected quarterly on forms from MOHP chest hospitals and dispensaries under the direction of governorate coordinators. Governorate coordinators are often directors of a chest hospital. Data collected includes case detection (finding), case pending (holding), case outcome, and performance figures for diagnostic laboratories responsible for identifying cases. All forms are delivered quarterly so a single national center for entry into a system of Excel spreadsheets on a single PC. Results are analyzed using Excel and specialized epidemiological software. Data entry forms and documentation are available in English and Arabic. Data collection, analysis, and results reporting conforms to standards set by the World Health Organization (WHO).

Interesting aspects of this effort are its efficiency, its well-defined procedures, and its focus on analysis, interpretation, and use of results. No data is collected that is not needed for analysis and decisionmaking. Clear international standards, policies, and procedures are used to collect data, interpret results, and recommend changes in treatment practice. Data collection and processing elements of this project could be incorporated into the HIS. Its focus on use of results for monitoring and adjusting specific interventions, and its basis in clear treatment standards, can serve as a model for other HIS elements.

3.8 Cabinet Information and Decision Support Center

The Cabinet Information and Decision Support Center (CIDSC) serves the executive branch of the national government and reports directly to the Prime Minister. It is one of the most active and technically capable organizations working in information systems in Egypt. Early in 1996, CIDSC helped create some thirteen commercial Internet Service Providers (ISPs) in Egypt. Currently, all ISPs except one connect through CIDSC for Internet access. Under their Egypt Information Highway Project, CIDSC has created a series of Websites providing information on Egyptian culture, tourism, business, governorates, and health care.

HealthNet, CIDSCs Website for health care information, has been physically moved to a Web server at MOHP headquarters. MOHP currently does not have the capacity to manage the site, which is designed for public rather than internal use.

Among CIDSC's many projects are programs to support information systems efforts in the ministries and governorates. The CIDSC helped establish a Governorate Information Center (GIC) in each governorate as part of their Governorates Program. These GICs are now largely independent, reporting directly to the governor in each governorate. The CIDSC continues to provide training and technical support. Each GIC provides basic information on each major government sector monthly to the governor and the CIDSC. Separate data collection by GICs and other sectoral information centers duplicates effort and causes confusion among data providers. When reliable information is available from ministry information systems, CIDSC prefers not to duplicate the data collection effort. For several years GICs and the CIDSC have been getting education statistics directly from the Education Management Information System of the Ministry of Education.

Recently CIDSC approached the MOHP offering training and technical assistance to build the necessary information system in health. Although there are several good private sector training providers, CIDSC training programs have become a significant resource to many ministries. Because they pay competitive salaries, they also have some of the best technical talent in the country. As mentioned earlier, the HIS team is now coordinating efforts with the CIDSC.

CIDSC has been criticized for overstepping its mission and effectively trying to nationalize information systems development in Egypt, an area that should be supported by a healthy private sector. There is ample evidence of CIDSC political ambition. An awkward political turf battle erupted when CIDSC attempted to provide technical assistance to the Parliament. However, at a technical level CIDSC provides some of the best resources in the country. CIDSC technical personnel are dedicated to their work and are eager to cooperate with other initiatives. In health care, more would be gained than lost by cooperating with CIDSC efforts.

4.0 MIS Conceptual Framework

Existing information systems fall into two major categories, facility management systems and hierarchical information systems. Following sections describe the general characteristics of each, and how they relate to each other.

4.1 Facility Management Systems

Facility management systems include database management systems commonly found in large inpatient facilities, such as Admission/Discharge/Transfer, Medical Records, Medical Materials Control or Drug Inventory Control, Personnel/Payroll, General Accounting, and so on. These database subsystems are often, though not always, integrated so that appropriate information is passed horizontally from one subsystem to another. *Figure 2* is a simple example of how these systems are often related.

4.2 Hierarchical Information Systems

Hierarchical information systems collect data at one level and pass it to a higher level, where information from similar units is consolidated and processed. This process may be repeated at the next level, so that information becomes increasingly consolidated as it passes up through the hierarchy until reaching the top executive level. A pyramid, as shown in *Figure 3-1,* is often used to depict this kind of system. As indicated, information consumers at different levels need different kinds of information presented in different ways. In a hierarchical organization with multiple management units and levels, this general concept is often replicated in tiers, as shown in *Figure 4*. Such a system is designed to support managers and decision-makers at different levels and in different locations. There are executive decision-makers at many levels, each needing information. A system meeting these needs is not a single pyramid with a single apex, but a hierarchy of information pyramids, each serving decision-makers at one level while providing information for use at the next.

4.3 Combined Systems

Facility management systems are often an important component of hierarchical information systems. They collect data as a part of routine operations, providing essential resource consumption and performance monitoring data as a byproduct. Implementing these systems replaces a multitude of forms for collecting data. Often these forms provide no value to the facility itself.

Figure 5 is a simple diagram showing a combination of facility management and hierarchical information systems mapped to the MOHP context. It is a combination of systems being implemented and systems being planned under various projects. It illustrates important concepts and issues discussed in following sections.

Figure 2

A Bubble Diagram of an Integrated Facility Management System

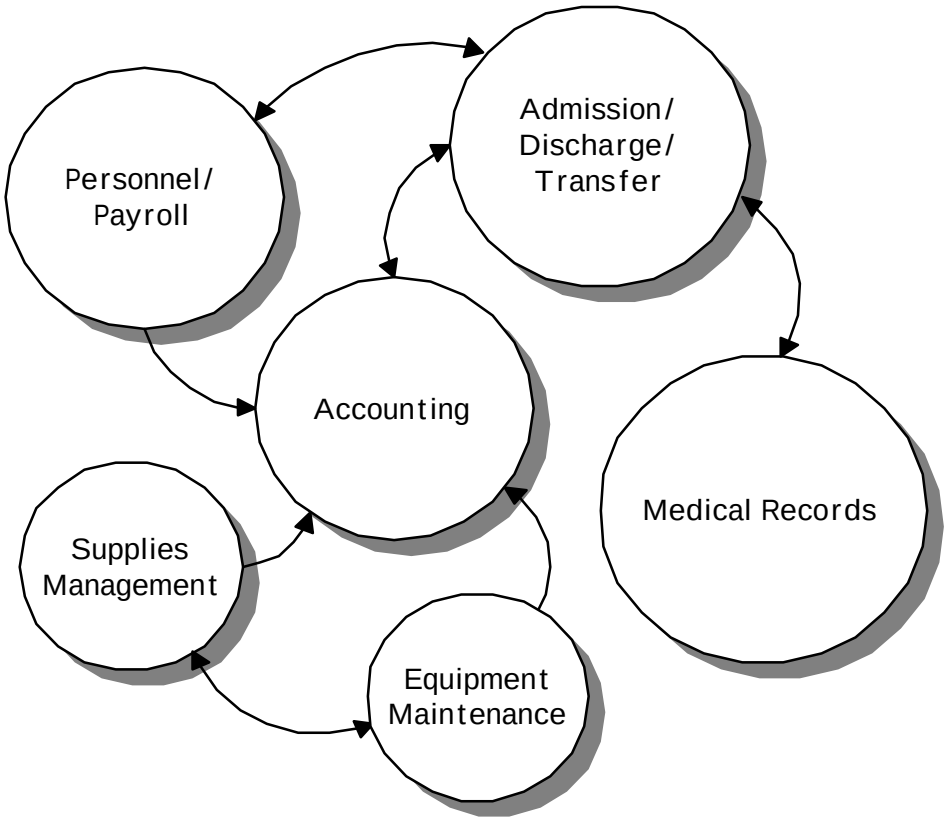


Figure 3

The Management Information System Pyramid

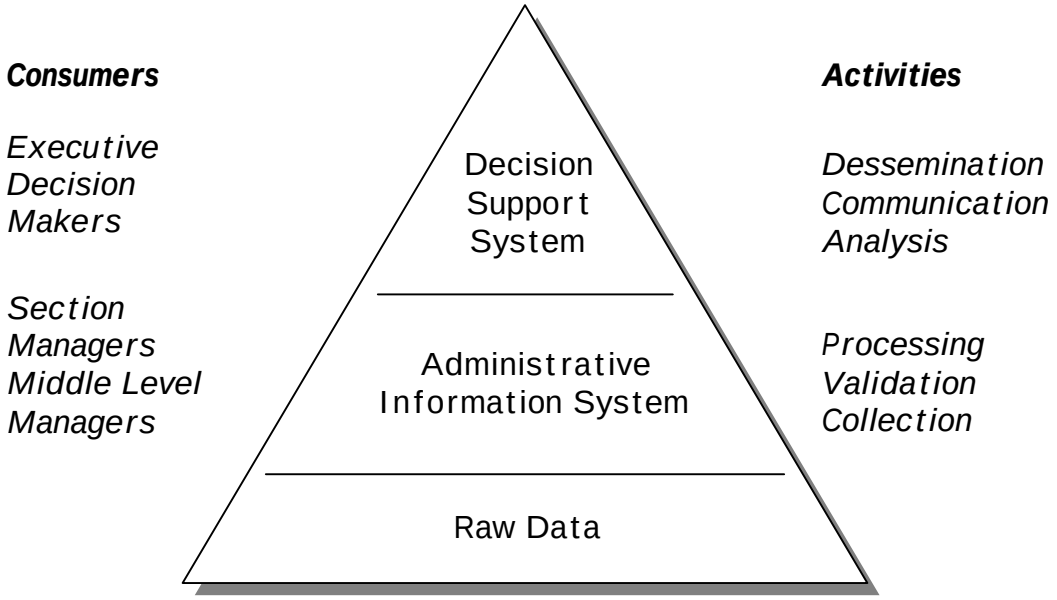


Figure 4

A Hierarchical Management Information System

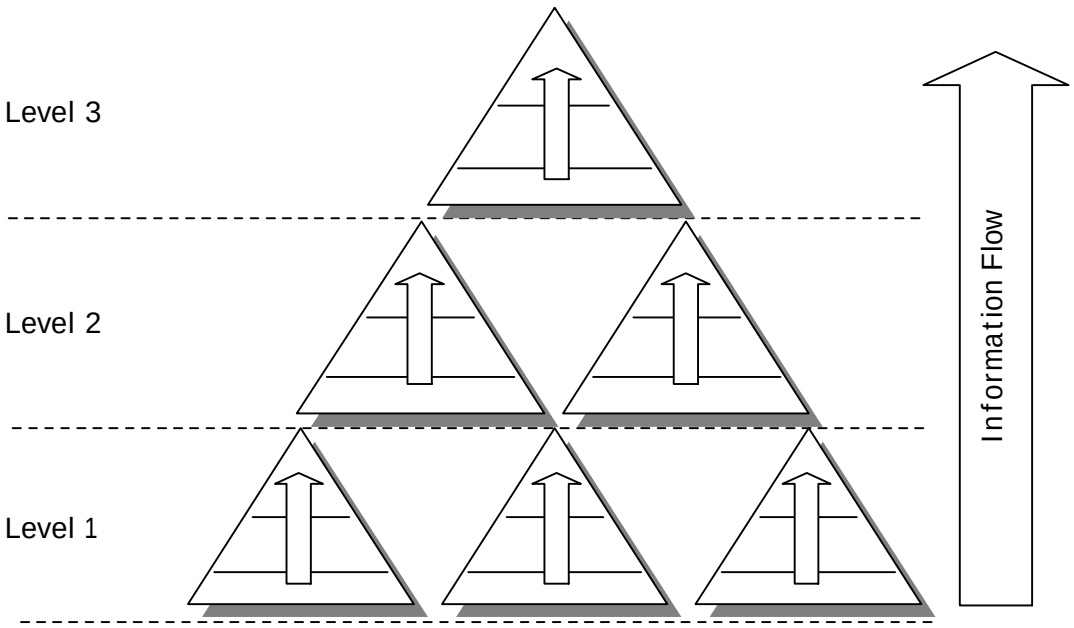
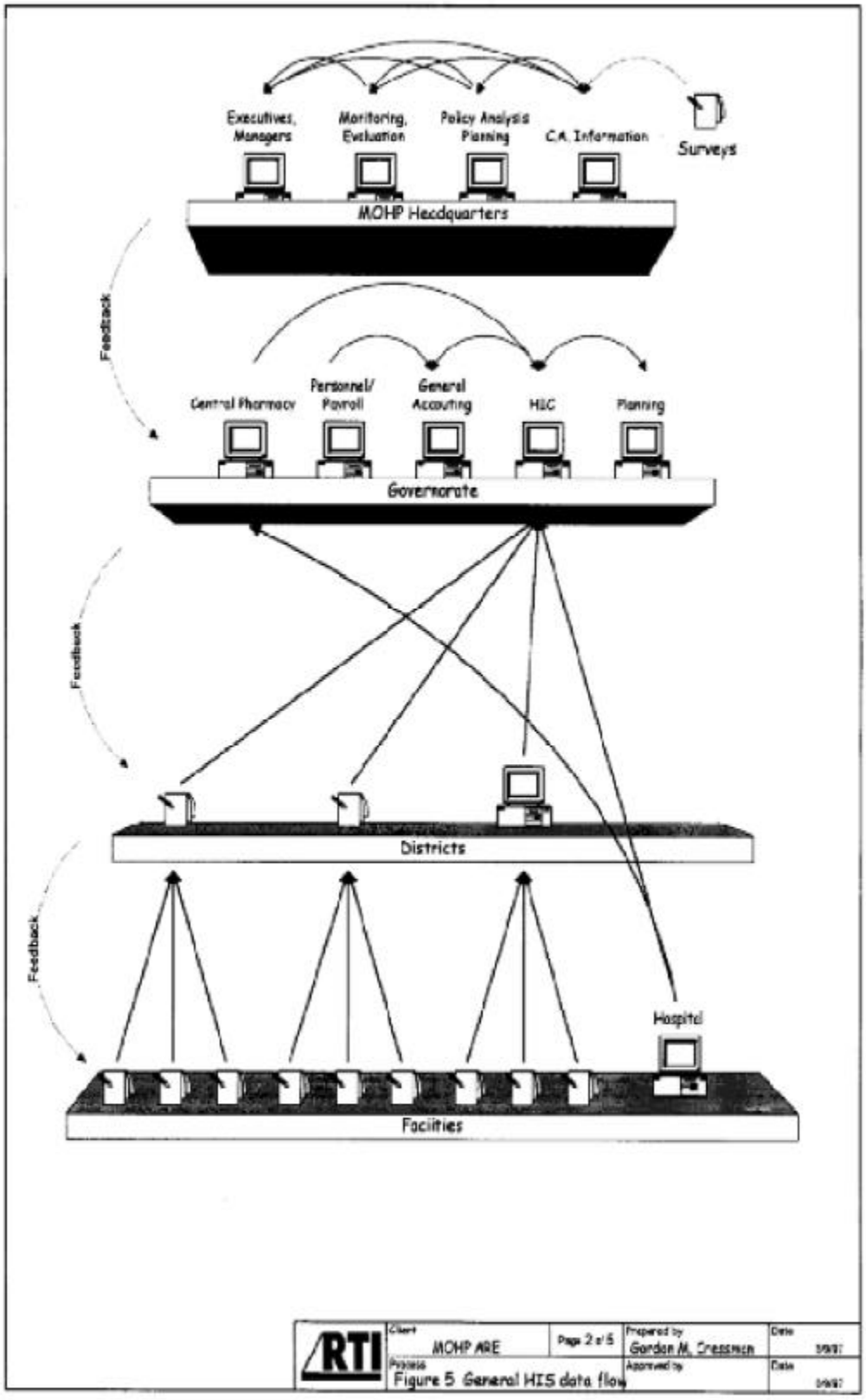


Figure 5

General HIS Data Flow



4.3.1 Data Collection, Entry, and Consolidation

Figure 5 is very similar to diagrams in Health Information System and Budget Tracking System design documents. Family Planning Project and Tuberculosis Control Project systems are similar.

Data is collected at the lowest level from individual health care facilities. In large in-patient facilities with significant management overhead, primarily hospitals, facility management systems provide the necessary data as a byproduct of routine operation. Introduction of facility management systems eliminates forms and provides motivation for the facility to maintain better quality data. With some changes, CCO, HIO, and URC Component 1 systems could all play this role. Smaller facilities, which are numerous, provide data by periodically filling out and submitting forms, as intended for the HIS and BTS systems. Hospitals without automated management systems can provide data this way also.

Data from individual facilities can be consolidated at the district or governorate levels. In either case, facility level data is necessary at the governorate level for analysis. In small governorates, such as Port Said, South Sinai, North Sinai, and Suez, it is practical to collect and enter data at the governorate level. Results can be reported back to district managers. In large governorates, such as Cairo, Dakhalia, Sharkia, and Behera, data entry volume exceeds any reasonable capacity for one location. In these governorates, where district administrations have increased management responsibility, facility data collection and entry will need to be decentralized to the district level, providing results directly to district administrations.

4.3.2 Vertical Flows

Data transfer from one level to the next can be done in the following ways:

- manual delivery on paper forms
- manual delivery on diskettes or
- electronic delivery via telecommunications

Existing systems rely primarily on manual delivery of paper forms or diskettes. Though not as elegant as telecommunications, these systems can be established quickly and are less subject to technological failures. Paper systems have several weaknesses. They are inflexible and provide little if any inherent value to data providers. This last point is critical. Data providers get nothing for filling out a form, unless paid an incentive, and are normally not directly affected if the quality of the data is poor. Consequently forms may be filled in, signed, and stamped, and still contain significant inaccuracies. An exception are payroll ledgers, large complicated forms filled out faithfully once a month and carefully reviewed at several levels before checks are issued. Data on these forms directly affect everyone involved. Paper systems relying on the good will of poorly paid personnel who are not affected by the results are not likely to produce accurate information.

Data entry volume can also become a problem. Data entry volume increases dramatically as paper moves up the system. At some point, the number of forms to be entered at a level exceeds the time and resources available at that level. Both HIS and BTS teams have concluded that entry of at least some facility data at the district level will be necessary in governorates with large numbers of facilities, such as Dakhalia. Data entry at the governorate level is not practical in these governorates because of the number of forms that must be processed.

Another important weakness of paper and diskette transfer systems is heavy reliance on human organization and reliability. With a good supporting and monitoring organization, they can work quite well. The Tuberculosis Control project has been operating a paper transfer system successfully. The Ministry of Education has been receiving data on diskettes four times a year from all twenty-seven education mudiriyya for more than four years successfully.

Telecommunications are often seen as the solution to weaknesses of paper and diskette systems. Data can be transmitted when necessary; no one needs to travel; data are moved from one system to another without re-entry. The HIO system uses this method to transmit information from polyclinics and hospitals to branch offices and HIO headquarters, as shown in *Figure 1*. Of course telecommunications also relies to some extent on human organization and reliability. As mentioned in Section 3.4, reliance on EGYPTNET may prove to be a problem due to unreliable technical support. Also, recurrent costs for high-speed dedicated connections can be high, exceeding the funding capacity of the organization. As with all information technology, telecommunications technology must be matched to data volume, transmission frequency, organizational capability, and the organization's operating budget.

4.3.3 Horizontal Flows

Horizontal flows in the governorate health directorate are particularly important. The horizontal flows shown at the governorate level in *Figure 5* do not exist. Current projects have done little to establish them. Dr. Moharram Khalifa, June 1995, noted that HIS development in governorate Health Information Centers had not reached governorate statistical offices. BTS development has involved governorate planning offices, but has not involved statistical offices or HICs. Like the central Directorate of Planning, governorate planning offices are currently responsible for planning Chapter 3 (Bab III), capital investment projects. Yet many important operational decisions are made at the governorate level. Increased decentralization and increased focus on preventive and primary health care will increase the importance of decisions made by governorate health directorates.

The roles, divisions, and relationships of information system departments at the governorate level are not well defined. These offices include the following:

- the Health Information Center (HIC)
- the Statistical Office
- the Planning Office

No department at the governorate level is clearly responsible for training of data providers or for data quality control. There is a direct parallel at the MOHP headquarters level, with almost no data and information exchange among the Documentation, Information, and Decision Support Center, the General Administration of Statistics, the Directorate of Planning, and the General Administration of Follow-up. The horizontal flows shown at this level in *Figure 5* do not exist. An effective MIS must clearly define the functions and relationships of each governorate office with information collection, processing, and analysis responsibilities.

4.3.4 Return Flows

On the left, *Figure 5* shows vertical information flows from top to bottom. This information includes statistics and graphs showing how units of the same type compare in resources, service delivery, and performance. This allows decision-makers to identify problem areas, and to identify successes that might be copied in other units. Carefully chosen comparative measures can also create competition among facilities to improve specific aspects of performance. These return flows of information are crucial if decentralized decision-makers are to make rational judgments.

Return flows and comparative reports were a design feature of the National Health Statistics System (NHSS), and were subsequently incorporated into the design of the HIS. These return flows still do not exist. Comparative reports should be designed for different types of facilities, for districts, and for governorates. These reports should be issued routinely by governorate health directorates and MOHP headquarters.

5.0 Strategy

Despite significant challenges, there are positive signs. There is increasingly strong political support for health sector reform. There is widespread recognition that a working information system is necessary to undertake and monitor this reform. Reorganization of key information system departments is underway. Despite low salaries, there are bright, capable people in the MOHP. Existing projects contain many important elements of the information system. These include a very complete, well-designed system to collect information from preventive and primary health care facilities, several hospital management systems in various stages of development, and management components for governorate health directorates. The telecommunications environment is improving, with a proliferation of Internet Service Providers in major urban areas, and a VSAT system now being installed in the governorates by the CIDSC. There is broad interest in coordinating all these elements. Before beginning, it is important to define the most basic elements of a Management Information System.

5.1 Basic Elements

A good Management Information System provides timely, accessible, relevant and accurate information to decision-makers. The MIS should do the following:

- provide managers with the right information at the right time. Information must be current.
- provide the information required by the type of decision being made. Information must be relevant.
- ensure that decision-makers have access to information they need. Having access means having the formal authority to get the information, as well as getting the information in an appropriate format.
- ensure that the information is accurate. The less accurate the information, the less useful it is.

For a system to achieve these goals, its development must take into account three critical ingredients:

- people
- processes
- technology

Focusing on only one of these three ingredients yields poor results. Under the label of MIS, many organizations do a good job collecting and computerizing large amounts of information, but fail to deliver useful information to decision-makers. Much of the effort is spent collecting unused data.

Often the focus is on information technology at the expense of human resource and organizational development. Though technological problems exist, they are far easier to resolve than human resource and organizational problems. HIO and HIS development are good examples; most remaining concerns are human resource and organizational problems.
Required human resources can be classified in three categories:

- information providers
- information consumers
- technical support personnel

Information providers collect, process, and analyze data to extract information. They report that information in appropriate ways to information consumers. Information consumers (managers and decision-makers at various levels) use that information to set policy and formulate plans. Technical support personnel make sure information technology continues to support providers and consumers.

Keeping these basic elements in mind, following sections give specific development guidelines and recommend roles for key players.

5.2 Development Guidelines

There are a few basic guidelines to be followed by the Technical Assistance Element with respect to information systems development. These include the following:

- Avoid creating another MIS project
- Play a coordinating role
- Think globally, act locally
- Define and prioritize objectives
- Build organizational capacity
- Strengthen human resources
- Do not exceed absorptive capacity
- Match operating costs to carrying capacity
- Transfer operating costs in phases
- Define and increase information demand
- Use the private sector

Following sections discuss each of these points in more detail.

5.2.1 Avoid Creating Another MIS Project

Nearly all existing information systems are project-based. They depend on projects not just for equipment and software, but for operating costs including technical personnel, maintenance and repair, and even consumable supplies. Hopes for sustainability of many of these efforts often rest on new projects. The technical assistance element of program assistance should avoid this scenario. It should not create yet another project office in the MOHP.

5.2.2 Play a Coordinating Role

Based on separate uncoordinated projects, MIS efforts are fragmented, uncoordinated, and duplicative. Each project has its own set of objectives and its own resources to achieve them. Significant resources required to work with other projects towards a common goal are not explicitly included. The common goal is not defined. No single project is mandated to provide overall vision and to coordinate efforts towards making it real. USAID, technical advisors, and the MOHP are aware of the situation, but have not found a solution.

The technical assistance element should provide the missing ingredients. It should help the MOHP develop its vision of an integrated information system. It should help coordinate the work of USAID, other donor projects, other agencies such as the CIDSC, and efforts of the MOHP to make this vision reality. The technical assistance element should help the MOHP build the capacity it needs to lead MIS development.

5.2.3 Think Globally, Act Locally

USAID, MIS technical advisors, and the MOHP have a good grasp of certain elements of the MIS, but not how they fit together. The technical assistance element should help the MOHP develop the overall architecture, defining major components, relationships between them, and exactly what data is transferred from one to another. It is important that the MOHP lead this effort.

Information systems professionals know good system design avoids complexity, and large problems must be broken into smaller problems before solving. At the highest level, information systems should be composed of discrete modules, each simple enough to be understood completely and designed efficiently by a separate team. Thus small computers with several microprocessors have replaced larger, more expensive single processor computers. The key is getting separate simple components to work together. The technical assistance effort should help the MOHP break the problem into manageable components and make them work together.

5.2.4 Define and Prioritize Objectives

Complex information systems should be built in phases, allowing adjustment between them. System components should be built in order of priority. This should provide the most critical information first, while allowing time for organizational and human resources development.

Objectives must be well-defined and prioritized, beginning with general goals and proceeding to specific information products. Overall system design should consider the following general goals:

- support decentralized decisionmaking by hospitals and governorate health directorates
- support conversion of hospitals to a cost recovery model

Design and implementation should focus immediately on measuring specific benchmarks defined by USAID program assistance. Measurement of expected end-of-program status requires the information system effort to do the following:

1. routinely measure aggregate MOHP expenditures on curative services, on preventive medicine, and on primary health care
2. routinely measure aggregate MOHP expenditures on personnel
3. routinely measure aggregate MOHP expenditures on pharmaceuticals, including vaccines and contraceptives
4. determine current and appropriate staffing for each health facility
5. create appropriate hospital MIS systems for use by an increasing number of cost-recovery hospitals

6. construct a comprehensive national health information system (HIS) supporting an economic and policy analysis unit in the MOHP, operational in all regional offices hospitals, and polyclinics

Time and resource constraints call for focusing first on objectives one through five. It is necessary to achieve these to execute the program assistance plan and its broader objectives of health sector reform. Environmental constraints: organizational, fiscal, and cultural, call for a flexible strategy using technologies that can be implemented, absorbed, and supported by the MOHP early in the project. At the same time, it must be possible to scale the design up to meet increasing capacity requirements, and to adapt it to use more advanced technologies as they become available and appropriate.

There is no time to build systems from scratch. Existing project-based systems must be coordinated and developed. Not all these systems are relevant, and choices must be made to strengthen support for some and drop support for others.

5.2.5 Build Organizational Capacity

More than half of all Technical Assistance Element resources should go to capacity building at governorate and MOHP headquarters levels. Help should come in the form of support for reorganizing the information sectors at both levels and through design and execution of training programs.

The problem must be addressed at both major levels at once. Reorganization should place key information offices under a common head reporting directly to the executive at that level. These offices are responsible for collecting and processing data, distributing routine status reports to all sectors, analyzing policy alternatives, formulating plans to achieve the objectives of the Ministry, and monitoring progress towards these objectives. In addition, a designated office at each level must support the information technology used for automation. These functions support each other, and in turn should provide needed information services to each sector of the health care system. Conducting this reorganization at headquarters and governorate levels at the same time will allow each to reinforce the other; they will have much in common. It also allows vertical relationships to be established between like offices at these two levels, further reinforcing the system.

5.2.6 MOHP Headquarters

The Directorate of Planning (DOP) is formally charged only with responsibility for Chapter 3 (Bab III) of the budget. The mission of the Directorate of Planning should be expanded formally to include policy analysis and planning for all elements of the pubic health sector. Though DDM has strengthened this unit considerably, much remains to be done. Most importantly, the Ministry needs to adopt the work and support the skilled personnel needed to carry it out in the service of the MOHP. Without this capacity, there is no point in having an information system. Returning to *Figure 3*, the MIS pyramid would have no cap stone. The Technical Assistance Element can help by offering experienced technical advisors to build staff skills in policy analysis, planning, and presentation of results to MOHP decision-makers.

MOHP headquarters should establish and maintain standards necessary for an integrated system, should provide training to personnel in governorate HICs, and should be responsible for overall quality control and operation. Clear, uniform, and widely recognized standards are

necessary for consolidating and comparing data from facilities, districts, and governorates. Only the MOHP can ensure that personnel in governorate headquarters have received the training they need to operate the system and to support the personnel in their districts. Finally, independent monitoring is vital to detect data quality control problems and to identify needs for additional training, and needs for changes in data collection, entry, and processing procedures. The MOHP is positioned to apply good data quality control procedures to all governorates uniformly.

There is no department responsible for managing and supporting information technology in the MOHP headquarters or making sure that information technology in governorate health directorates is compatible, allocated, and maintained to support the information system. The MOHP must have the capacity to plan and manage MIS development. No significant investment in computer hardware and software should be made until a department with this mission formally exists. There is no evidence that simply supplying information technology will generate such a department.

Annex D contains a reasonably accurate organizational diagram of MOHP headquarters. As indicated by the arrows, the Documentation, Information, and Decision Support Center currently reports to the Preventive Sector, while the Directorate of Planning currently reports to the Curative Sector. The Department for Follow-Up and Monitoring reports to the Central Administration for the Minister, but consists of only two persons. Thus three key information system departments report to different sectors.

A revitalized MIS committee, chaired by Dr. Nabil Nassar, First Undersecretary for Preventive Care, has been working on these issues since Larson's visit. This has produced a plan for reorganizing the information system elements of the Ministry. The reorganization elevates the Documentation, Information, and Decision Support Center, the Directorate of Planning, and the department of Follow-Up and Monitoring so that they formally report to the Central Administration of the Minister. It also merges the department of Follow-Up and Monitoring with the Directorate of Planning, and gives the Directorate of Planning expanded responsibilities that include planning for all budget chapters. This reorganization is a major step forward. The MOHP should be given full credit for this initiative.

Several steps might strengthen the reorganization effort. Implied plans call for much more deployment and use of information technology. USAID has already issued a procurement for a network server, networking components, and network workstations for MOHP headquarters. There is no one there to manage or support this system. A separate unit should be created at this level to manage and maintain this technology. This service unit should support the work of all other information system components by keeping the computing platform running smoothly. The unit could be created as a separate department, or as a separate functional unit within the information services department. Meeting this need is more important than the name of the unit and whether it exists as a separate department.

Annex D contains a plan similar to that proposed by the MOHP. It shows a Monitoring and Evaluation Unit independent from Policy and Planning to strengthen its independent mission. It adds an Information Technology unit. Its mission is to support the continuing and effective use of information technology by all other units of the MOHP headquarters. It is also responsible for setting basic technical standards, for communication linkages with the governorates, and for coordinating with and supporting governorate information centers. The Information Processing and Dissemination unit is responsible for collecting, validating, and consolidating data from different parts of the system. It is also responsible for generating and distributing routine reports to all sectors. Returning again to *Figure 3*, the Information Processing unit is the middle of the

MIS pyramid. It is important that all four of these units be lead by someone competent and experienced in the appropriate technical areas.

The MIS organization in Annex D shows all four units reporting to a single leader who reports directly to the chief executive. That person is responsible for overall planning and coordination of the information system, and must have appropriate technical skills and experience. It is vital that this person also understand the health sector and the needs of MOHP decision-makers. Once this chief information officer is in place, he or she should be charged with sole responsibility for making sure the information system serves the needs of the Ministry. This should be done through a formal advisory committee of information consumers, and through feedback solicited regularly from users. MIS planning and implementation should not be done by committee.

5.2.7 Governorate Health Directorates

For district level data entry, each district must be provided with the necessary data processing equipment. The computing platform must be maintained and provided with consumable supplies. More importantly, personnel responsible for this operation must be identified, trained, and retained.

An increasingly decentralized decision model argues against a support system centralized in Cairo. Transportation, communication, and personnel constraints make this difficult. It is simply not practical or desirable for MOHP headquarters to provide training and technical support to all 232 districts. Variations in availability of local technical support and reasonable response time argue for governorate-level control where possible. Equipment and personnel at the district level must be trained, supported, and sustained by the governorate health directorate. HIS and BTS teams have already realized this and are planning to build capacity at the governorate level.

Each effort to build a hierarchical system has and continues to expend resources to build necessary organizational capacity at governorate, and sometimes district levels. These efforts may include reorganization, staff strengthening, formal training courses, and informal on-the-job training. The approach varies depending on whether the capacity is built solely for the life of a project, or built to operate the information system without project help.

To date, most projects have built capacity dependent on project resources. This is well known. Obstacles to building sustained capacity are enormous. They include the following:

- a history of project-specific, project-dependent information systems
- insufficient project resources dedicated to organizational development and training
- demand for information technology beyond current MOHP carrying capacity

- information technology introduced on project schedules exceeding absorptive capacity
- civil service pay scales that cannot compete with private sector opportunities
- lack of a strong information systems organization

Faced with these obstacles, most projects have chosen an approach designed to meet more immediate project objectives.

Larson, 1995, emphasized the need for capacity building at governorate and district levels. The Technical Assistance Effort should help the Ministry copy reorganization of the headquarters information sector to governorate health directorates. At the governorate level, the Health Information Center, Statistical Office, and Planning Office should be combined to report to a single executive. Their missions with respect to information consumers and each other should mirror the mission of similar departments at MOHP headquarters.

5.2.8 Strengthen Human Resources

Human resources need significant strengthening at governorate and central levels. Without this, they will not be able to use and operate an information system effectively. *Table 3* outlines the human resource development domains. The Technical Assistance Element can help develop the necessary human resources by doing the following:

- designing integrated training programs
- identifying and coordinating efforts with other public sector providers such as CIDSC
- arranging appropriate training through local private sector providers
- bringing experienced international public health care specialists to provide specialized training

More than half of all resources should be allocated to organizational and human resource development efforts. Training can be provided through formal classes, workshops, and seminars, and through informal on-the-job mentoring. Though each has its advantages, sustained close contact is necessary to transfer skills efficiently and completely. Personal mentoring and on-the-job training should be emphasized.

Data quality is an important issue. Low salaries motivate data providers to exert minimum efforts to provide requested numbers. Lack of understand of how the numbers are used and whether their accuracy affects the provider contributes to poor quality data. Facility management systems provide immediate value to the user if designed and implemented carefully. Forms to be filled and submitted to the HIC monthly do not.

Feedback to the facility, particularly showing performance compared to like facilities, can motivate providers, but does not guarantee accurate results. Introducing an information system influences organizational dynamics and human behavior. As information systems are introduced at each level, from facility to district to governorate to headquarters, there are opportunities to improve processes and change the way people behave. A good designer knows this. Care must be taken in how the system measures performance. Measured subjects can be creative in producing desired results. An independent data quality control system is

Table 3

Human Resource Development Domains

Table 3 Human resource development domains.

Role	Party	HRD Domains
Consumers	Governorate Health Directorates • Director General • Planning Officer • Statistical Officer MOHP headquarters • Minister • First Undersecretary, Undersecretary of Central Administration • Director of General Administration	• Data interpretation and use • Policy analysis and strategic planning in public health • Resource allocation in health care management • Health information systems design, implementation, use, and management
Producers	Governorate Information Systems[3] • General Director • Planning Officer • Statistical Officer • Computer specialists • Data processing specialists MOHP Information Systems[4] • General Director • Planning Officer • Public Health Planning Specialist • Statistician • Computer specialists • Data processing specialists	• Data quality control • Information management • Public health data analysis and interpretation • Information presentation • Health information systems design and implementation • Information systems management • Use of custom and commercial facility management and health information system software • Use of commercial office automation and data presentation software • Basic computing skills
Technical Supporters	Governorate Information Systems • General Director • Computer specialists • User Support Specialist • Data processing specialists MOHP Information Systems • General Director • Computer specialists • User Support Specialist • Data processing specialists	• Information systems management • Information technology planning and management • Data center management • Data communications • Local Area Networking • Hardware/software problem diagnosis • Contract vendor management

necessary at the governorate level. Also, users of facility management systems, persons filling in and submitting forms, and persons responsible for data quality control all need training.

Permanent capacity for training data providers, processors, and quality control personnel, must be developed at the governorate level. Good private sector resources and some public sector resources exist for training in basic computing skills and commercial software. Training in proper use and processing of forms, interpretation of results, data quality control, and other areas must be provided by the governorate. New teams may need to be created for this. Existing personnel cannot be expected to take on this added responsibility without added compensation. Compensation must be independently sustainable if the training capacity is to be sustained.

Issues at MOHP headquarters are similar, though access to existing training resources is much better. As with other information systems elements, the role of the MOHP should be to establish basic training standards, provide a uniform training framework, help governorates put this system in place, monitor governorate efforts, and provide help where necessary. The Technical Assistance Element should help the MOHP to establish this system.

5.2.9 Do not Exceed Absorptive Capacity

Information technology should not be introduced faster than capacity is developed to use it. Development should proceed in phases. Information technology depreciates rapidly, even in developing countries. If introduced too far in advance of organizational and human resource development, its value may reach zero before it can be used. System design should take this into account; required human resources capacity can be lowered by simplifying the design. Newly automated systems are normally run in parallel with existing manual systems while problems are resolved, and organizational and human resource capacity is strengthened. Local technical support and telecommunications may also improve during the program assistance effort. Careful design and phased implementation should allow the Ministry to take advantage of these improvements.

Annex E contains three diagrams showing ideas for gradually phasing in automation for the Budget Tracking System being developed by DDM. The same diagrams can apply to the HIS.

In Phase 1, the system consists of a few stand-alone PCs. Information is transferred between PCs on diskettes. Paper forms are still used to collect data from all facilities and from district pharmaceutical supply centers. In Phase 2, information is automatically collected each month from governorate HICs over existing telephone lines using low-cost modems and software. If the PCs shown in the governorate HIC and general accounting office are close enough, they can be connected in a simple peer-to-peer Local Area Network (LAN). In Phase 3, data collection by modem is introduced at governorate and possibly district levels. PCs are introduced in district offices and general hospitals. Introduction of information technology is coordinated with human resource and general infrastructure development.

5.2.10 Match Operating Costs to Carrying Capacity

The Technical Assistance Element must match information technology to the needs and carrying capacity of the MOHP. Carrying capacity is the organization's ability and willingness to spend its own resources to keep the system running. Information technology carries significant operating costs. These include hardware maintenance, software maintenance (corrections, updates, licensing), consumable supplies, technical support salaries, and training. There is a direct

relationship between the selection of the computing platform and operating costs. Annual maintenance costs for hardware alone are normally seven to twelve percent of the original purchase price. Based on estimates provided by MAXIMUS, five-year operating costs for HIO hospital systems total more than 60 percent of initial investment. This figure, which does not include salaries, training, or communications, is virtually the same as the Author calculated for systems proposed for the Ministry of Education. The larger and more complex the computing platform becomes, the more difficult and more expensive it is to operate. It is possible for operating costs to exceed an organization's willingness or ability to pay, though a less expensive design may do the same job.

Figure 6 illustrates these relationships. The shaded rectangle shows the range of operating costs for all feasible technical solutions. The curve shows the amount the organization is willing to pay. The higher the demand for information, the more the organization is willing to pay to operate a system that provides it. Of course, there is a limit to how much any organization will pay regardless of information demand. As shown, it is possible to design a system with operating costs outside this range. It is also possible that demand is so low the organization will not pay minimum operating costs. The smaller arrows show two possible adjustments: select a system with lower operating costs, or increase demand for information. Either one or both can find a matching point along the demand curve.

Technical design and information demand both determine acceptable operating costs. The only way to find a design with sustainable operating costs is to communicate with the organization during design. The MOHP should be presented with the operating costs of various options and should understand the relationship between the two before significant quantities of hardware arrive.

5.2.11 Transfer Operating Costs in Phases

The MOHP should have an immediate stake in containing operating costs. The proportion of operating costs paid by the MOHP should increase over the life of USAID program assistance so that all operating costs are assumed by the MOHP before assistance ends.

In the scenario shown in *Figure 7,* all operating costs are paid by the project during the project. The MOHP doesn't have to pay until the project ends. The span of time is so long that few people would worry about operating costs in year one, when they are determined by the design of the computing platform.

In the scenario shown in *Figure 8,* the counterpart pays 20 percent of operating costs in year one, and 20 percent more each year. By year five, the last year of assistance, the counterpart is paying all operating costs. This gives the counterpart time to get necessary funds into this budget line item, and gives the donor time to observe progress towards operating independence. The only way the counterpart can agree to this is if operating costs are judged by the counterpart to be reasonable and within the means of the organization. The counterpart should understand the relationship between computing platform and operating costs, and should review operating cost estimates. Technical support contracts with vendors

Figure 6

Relationships Between Solutions, Operating Costs, and Information Demand

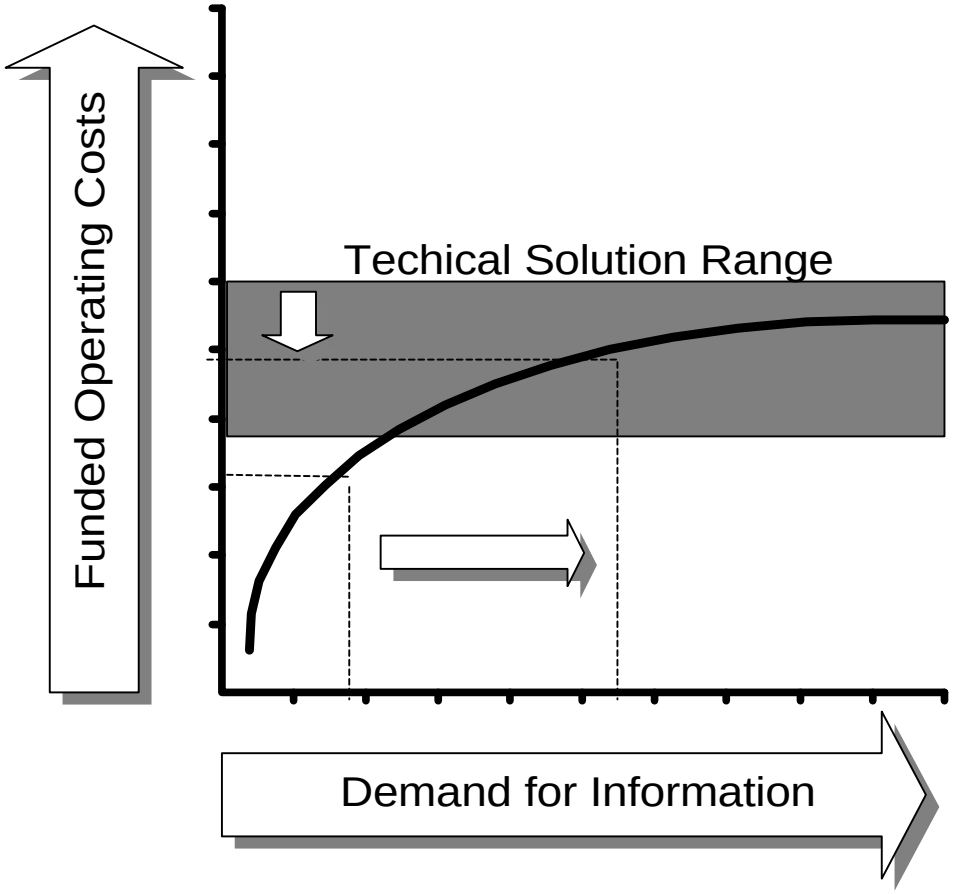


Figure 7

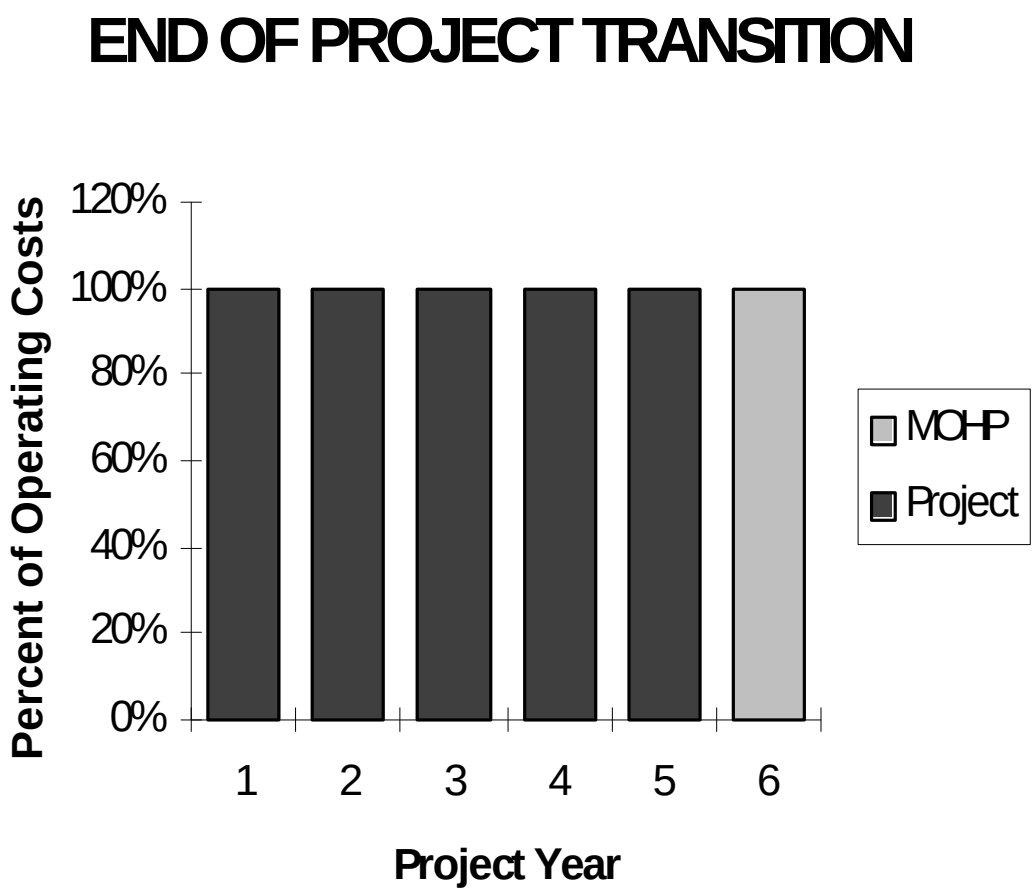
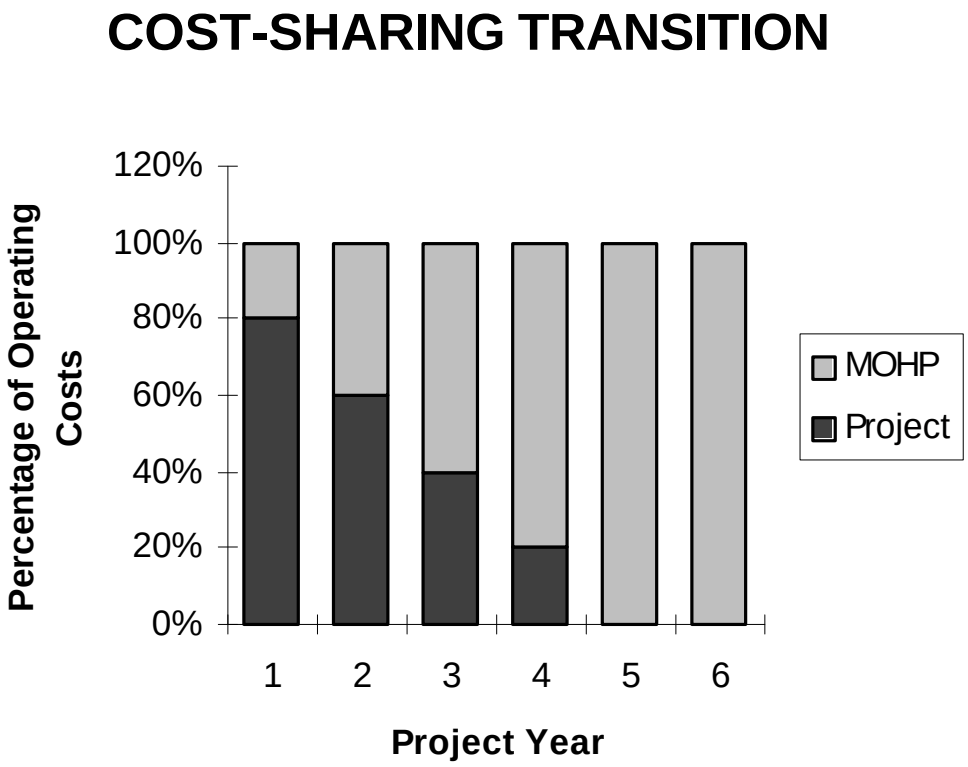

END OF PROJECT TRANSITION
Percent of Operating Costs
120%
100%
80%
60%
40%
20%
0%
1
2
3
4
5
6
Project Year
MOHP
Project

Figure 8


COST-SHARING TRANSITION
120%
100%
80%
60%
40%
20%
0%
Percentage of Operating Costs
1
2
3
4
5
6
Project Year
MOHP
Project

should be negotiated by the counterpart with technical assistance if necessary. Vendors negotiate different conditions and rates when the donor, not the counterpart, pays the full cost. The question remains whether demand for information is high enough to justify payment of minimum operating costs.

5.2.12 Define and Increase Information Demand

The graph in *Figure 6* explains why supply-side only MIS development strategies fail. Without an increase in information demand, counterparts don't value MIS products enough to keep the system running. MAXIMUS realized this element was missing in the HIO project and requested resources to add it. Good information system design is driven by user demands. Users are not concerned with information technology, only that it meets their needs. The Technical Assistance Element must allocate significant resources to define MOHP information needs and increase MOHP ability to use MIS products.

The first step in this effort should be to work closely with MOHP decision-makers to define their needs precisely and design products to meet these needs. Initial efforts should use existing data sources and include indicators listed in Objectives 1 through 5. Establishing procedures to deliver these reports routinely to MOHP decision-makers will establish vital information flows, refine information demand, and guide further system development. Prototype reports and presentations should guide development of the information system called for in Objective 6.

5.2.13 Use the Private Sector

An information system depending on information technology cannot be sustained without required technical support personnel. More elaborate and complex systems require more technical support personnel with more critical and marketable skills. Hiring and retaining competent technical personnel is a critical problem for Egyptian public sector institutions. Information technology must be selected and introduced with this in mind.

Government salaries relative to private sector and respectability of government service have declined significantly since the 1960s. Young men, who are particularly mobile, can be expected to move on to better opportunities as soon as they have some training and experience. Three strategies have been attempted as follows:

1. find and train married middle-age women whose children are grown, who have technical aptitude, and who have been in public service for some time.
2. create a special salary classification for the required technical positions.
3. obtain critical technical staff through a site management contract with a private sector provider.

The USAID/Cairo LD II Project and Egypt Education Planning Project (EEPP) were both successful to a degree by applying the first strategy. Persons fitting this description are not primary income earners, and are content in public service. Special circumstances may have contributed to success in the two cases cited. In the EEPP, core personnel were already in place, though personnel matching the same general description were added during the project.

The second strategy is being pursued by the HIO project. This approach introduces serious inequities by creating a special salary scale for personnel who have special technical skills, but normally junior positions. Supervisors cannot be expected to manage the work of staff making

several times their own salary. Introduction of special pay scales for project staff creates similar inequities and stress within the organization.

The last strategy, commonly referred to "outsourcing," may have the best chance of long-term success. In this application, a private sector provider is contracted to fill two or three critical technical positions having well-defined responsibilities. These positions are those the MOHP must fill, but cannot pay competitive salaries for under civil service rules. Suitable technical positions deal with general information technology management and support, such as a Local Area Network Administrator and a Network Support Technician. These are filled through a Site Management Contract between the MOHP and a private sector provider, transferring the responsibility of recruiting, training, and retaining the necessary personnel. This avoids disrupting the MOHP salary scale, since contract personnel are paid by the contracted vendor. Care must be taken in executing this approach. The terms of the Site Management Contract and its careful management are critical to success. Also, the contract site management market in Egypt is immature.

There are other areas in which private sector working relationships are necessary to support the information system. These can be grouped into two areas: hardware and software development and maintenance, and basic skills training. *Table 4* lists functions that can be provided through private sector resources. An appropriate internal coordinator is listed to monitor the work of the private sector in each area. The private sector market in these areas is well-developed in Egypt. Public-private sector relationships have a history of difficulty in most countries, including Egypt, due to changing political priorities (particularly across changes in administration), weak public sector management skills and practices, and performance demands exceeding constrained budgets. Consequently private sector providers are especially cautious when negotiating work with the public sector. For public sector organizations, the challenge is to negotiate an agreement providing the required services and necessary performance, to protect the organization, and to manage the contract effectively. The Technical Assistance Element can help the MOHP in each of these areas.

Table 4

Division of Maintenance and Support Functions

Function	Internal Coordinator	External Provider
Maintenance and repair of hardware	System Manager Hardware Technician	Local equipment vendor (warranty Local contracted provider (post-warranty)
Maintenance of custom software	Analyst/Programmer	Original developer (warranty) Contracted developer (post-warranty)
User training in custom software	User Support and Training Coordinator	Original developer
User support for packaged software	User Support and Training Coordinator	Contracted provider
User training for basic computing skills	User Support and Training Coordinator	Contracted provider

5.3 Major Steps

The following major steps should be taken to capitalize on existing information system efforts:

- converge hierarchical Systems,
- commercialize facility management systems, and
- establish recognized official standard coding systems.

The steps are discussed in more detail in the following sections.

5.3.1 Converge Hierarchical Systems

Hierarchical, information systems, those collecting data from facilities and consolidating them at various levels of the health system, need coordination badly. These include the following existing and planned systems:

- Information, Documentation, and Decision Support Center (IDDSC) System
- Health Information System (HIS)
- Budget Tracking System (BTS)
- Family Planning System
- Tuberculosis Disease Control System

Each of these systems faces similar problems, including the following:

- collecting data from various facilities in the governorate
- entering data into a computer
- consolidating data from different sources
- producing and disseminating routine reports
- transferring consolidated data to a higher level in the system

All existing efforts collect data on forms from various facilities and offices in the governorates. Data entry, processing, and reporting strategies vary, largely depending on data processing requirements and available resources. Some efforts enter data from forms into computers in the Health Information Center (HIC) of the governorate. Others collect and enter data at a single national location. Most of these systems have similar needs for capacity at district, governorate, and MOHP headquarters levels for data collection, entry, processing, and distribution. Each has similar needs for data transfer from one level to the next. There are common needs for horizontal information flows at governorate and MOHP headquarters, and for return flows to governorate and district levels.

Larson, 17 July 1995, noted that it is expensive to maintain multiple systems with similar needs. Larson called for a united approach, coordinating and merging existing hierarchical systems. The HIS provides the only reasonable foundation for merging these systems. The technical assistance element should help the MOHP to begin to integrate them at all levels, technical and organizational. At the same time, facility management systems should be coordinated so they provide data easily to an integrated HIS, eliminating unnecessary forms.

5.3.2 Commercialize Facility Management Systems

At least three overlapping facility management systems have developed by various projects. Of these, only one, the CCO system, is now supported locally through the private sector without project support. HIO systems, developed with significant numbers of personnel from Arabsoft, could by supported by Arabsoft after the HIO project. CCO and HIO hospitals have nearly identical requirements for facility management systems. USAID program assistance for health sector reform calls for increasing the number of MOHP hospitals under cost recovery to 100. This creates a significant market for hospital information management systems in Egypt.

The private sector should be encouraged to provide solutions for key hospital management systems. Competition in this market is healthy and should provide better, cheaper products, as well as resources to sustain them. Project-based efforts should encourage development of competitive commercial products, not a monopoly. Private sector enterprises should bid competitively against common requirement specifications, and should be encouraged to market resulting products. Competitive support from private sector enterprises is the only way to sustain these systems.

Even if commercialized, hospital management systems must produce comparable information for MOHP monitoring and policy analysis. This requires development and authoritative control of national coding standards for key data elements and indicators. The MOHP has the leverage necessary to require commercial providers to meet such standards.

5.3.3 Establish Recognized Official Standard Coding Systems

With no apparent official coding standards for facilities, personnel, or materials, project-based MIS efforts have created their own. Use of the International Code for Disease is the only recognized standard in widespread use. Even within project efforts, changes in coding are seldom coordinated among facilities. Consolidating and cross referencing data from different facilities and different components of the information system requires consistent coordinated use of recognized official standards. Coding standards should be established at set for the following elements:

- governorates
- districts
- heath facilities
- divisions or departments within facilities
- health care functions
- medical specialties
- personnel position,
- pharmaceutical supplies, including vaccines
- family planning materials
- laboratory chemicals
- blood bank supplies
- vector control chemicals

Table 9 in Annex C summarizes use of coding systems for these elements by current projects. Suitable coding systems are available in most areas. The Technical Assistance Element should help the MOHP develop a uniform official standard coding system. This should be done by:

- selecting a single standard for each element
- selecting or designating an authority to manage and disseminate the standard
- if necessary, enabling the authority to do this
- requiring all information system components, public and private, to use these standards

Perhaps most curious is the lack of a national standard for coding pharmaceutical standards. Well-developed coding systems are used by CCO and HIO drug inventory control software, but these systems differ. The HIO/MAXIMUS effort is unique in maintaining its pharmaceutical coding system centrally, and distributing updates using telecommunication. The HIO/MAXIMUS project is the current authority for this system. Several unsuccessful attempts have been made by various projects to help the MOHP develop and maintain a standard system. Within the MOHP, the Central Authority for Pharmaceutical Affairs is the logical authority for this system. Outside the MOHP, the National Organization for Drug Control and Research (NODCAR) is the logical organization.

NODCAR is the governmental official control authority in Egypt. It is responsible for quality control of all marketed pharmaceutical products in Egypt, whether locally produced or imported. This includes pharmaceutical and biological products, cosmetics, raw materials, veterinary products, household insecticides, medical devices, medicinal plants, and natural products, filling and packaging materials. NODCAR includes the Pharmaco Information and Training Center, a specialized scientific information source serving the needs of the medical and pharmaceutical community by providing updated information on all aspects of drugs. NODCAR offers CD-ROM information databases, on-line access to information networks, internal databases. They recently established an information network to serve the MOHP hospitals and units on a 24-hour basis.

The master drug list can be put on a single networked computer. Facilities can periodically receive an updated master drug list through the Internet using ftp, or through dial-up modem access. Information on side effects and interactions can be provided also. Access can be controlled easily to prevent any unauthorized changes to the standard. Facilities can be given a single call-in or electronic mail contact point to request changes and additions to system.

Software such as Drug Inventory Control, can be design to allow users to assign a temporary code for a new drug until an official code is assigned. Reports can be printed listing drugs with temporary codes. Software can alert users periodically to contact the central control point for official classification and code assignment for new drugs.

6.0 Implementation

6.1 System Development Domains

Table 5 outlines the major domains of the system envisioned by this report. The table lists the set of components required in each domain, and the tasks these components need to perform.

6.2 Steps to be Taken

It is not reasonable to develop a master plan for a system this large and complex in enough detail to accurately specify all necessary tasks and resources before beginning work. Projects designed and executed this way are typically behind schedule and over budget. Complex problems should be broken into smaller problems before attempting solution. Development should proceed in well-defined stages against a general design and general work plan. A separate work plan should be written for each stage, detailing tasks and resources for that stage. This will allow schedules and resources to be estimated with greater precision.

Though development should be done in phases, it is not strictly linear. Major steps are listed below roughly in the order in which they should be done. Most steps must be taken at governorate and central levels. There should be room for adjustment in order and emphasis as the effort proceeds.

- Identify specific information needs at governorate and central levels for each sector.
- Conduct workshops with decision-makers to define information needs and develop information demand.
- Help information consumers draft example reporting instruments and reporting plans.
- Use example reporting instruments to guide system development
- Reorganize and strengthen the information sector to operate the system, provide needed policy analysis and planning services, and disseminate information.
- Formally define the role and responsibilities of the information sector.
- Take an inventory of systems and personnel to establish a base line.
- Develop a rough draft procurement plan, with phases contingent on organizational, human resource, and technical support system development.
- Work with MOHP to show the relationship between the information technology platform and operating costs.
- Agree on progressive cost-sharing plan to transfer all operating costs to MOHP before end of project.
- Help the MOHP design and develop technical support systems for information technology.
- Help the MOHP in the process and details of procuring technical support services from private sector providers.
- Develop a detailed training plan coordinated with information technology development.
- Draw on local training providers whenever appropriate.

Table 5

Major MIS Domains, Components, and Tasks

Table 5 Major MIS domains, components, and tasks.

Domain	Component	Task
Facility	• Data reporting (district, governorate) • Automated management systems (hospitals)	• Fill in forms • Operate automated management systems (hospitals)
District	• Data collection system (facilities) • Data processing system • Automated management systems (supplies, personnel) • Data quality control system	• Distribute forms • Collect forms • Fill in forms • Enter data • Process/consolidate data • Monitor data quality
Governorate	• Data collection system (districts, facilities) • Data processing system • Automated management systems (supplies, personnel) • Technical support system • Training system • Data quality control system • Results Reporting system	• Distribute forms • Collect forms • Fill in forms • Collect data • Enter data • Process/consolidate data • Monitor data quality • Analyze results • Analyze policy alternatives • Construct plans • Produce routine reports • Distribute results
MOHP Headquarters	• Data collection system (governorates) • Data processing system • Technical support system • Training system • Data quality control system • Results Reporting system	• Establish standards • Coordinate components • Distribute forms • Collect forms • Collect data • Enter data • Process/consolidate data • Monitor data quality • Analyze results • Analyze policy alternatives • Construct plans • Produce routine reports • Distribute results

- Design and develop training units at central and governorate levels.
- Increase efforts to train managers at governorate and central levels to use information for policy analysis and planning.
- Increase efforts to train governorate personnel in HICs, district offices, and facilities.
- Increase monitoring of governorate information system development. Increase contact with governorate health directorates and HICs. Observe and monitor data collection at facilities.
- Provide motivation and resources for DDM, MotherCare, and Family Planning, to converge hierarchical systems through close cooperation.
- Increase and support private sector competition to provide integrated facility management systems
- Work with the MOHP to establish official coding systems with clearly recognized authorities.
- Monitor the relationship between users and authorities to make sure the system functions.

6.3 Required Resources

The activities listed above require at least one full-time resident technical advisor and short term technical advisors in the following areas dealing with information systems design and implementation:

- health information systems design
- automated hospital management information systems
- decision support and policy dialogue tools and techniques
- information presentation and reporting techniques
- information technology strategic planning
- personal computing technologies
- local area networking
- telecommunication/wide area networking
- systems integration
- procurement
- technical support systems
- information system management and operation
- training systems
- services contracting and vendor management
- database design and integration
- executive information systems
- geographical information systems

A continuous presence is necessary to advise the Ministry, coordinate existing project efforts, coordinate and monitor local private sector providers, define needs for and coordinate short-term technical assistance, monitor progress, and make sure things move forward. There should be at least one full time resident technical advisor with experience in health information systems development in developing country environments. The recommendation of a single resident advisor assumes existing USAID projects will have resources to coordinate with and participate in this effort.

Annex A: Persons Contacted

Ministry of Health and Population

Dr. Nabil Nassar, First Undersecretary for Basic and Preventive Care
Dr. Magda Sherbini, First Undersecretary for Curative Care
Dr. Moushira El Shafa'i, Undersecretary for Population and Family Planning
Dr. Wagida Anwar, Consultant to the Minister, Technical Office
Eman Abdel Aziz El Aasar, MIS Consultant, Technical Office
Dr. Ashraf Ismail, Consultant to the Minister, President, Development Systems International
Dr. Samir Guirguis, Director, Information, Documentation, and Decision Support Center
Dr. Hassan El Gebaly, Executive Director, Family Planning Systems Development Project

Tuberculosis Control Project
Government of the Netherlands
Royal Tropical Institute, Amsterdam

Pieter J.M. Van Maaren, Senior Technical Coordinator

Healthy Mother Healthy Child Project/MotherCare
Clark Atlanta University

Dr. Esmaat Mansour, Executive Director
Dr. Hala Safwat, Director, Health Information Systems Development
Gamal Hassan, Senior Programmer

Data for Decisionmaking Project
Harvard School of Public Health
Research Triangle Institute

Dr. A. K. Nandakumar, Project Director for Egypt
Dr. Hassan Salah, Representative
Dr. Mahmoud Abdel Latif

Health Insurance Organization Project
MAXIMUS, Chemonics, Arabsoft

Charles I. Gustafson, Director, International Division, MAXIMUS
Felix Meyer, Chief of Party
James F. Meere, Application Development Manager
Mohamed H. El Alfy, Computer Operation Manager
Maralee DeMark, Implementation Manager
Mary Tailor Hassouna, Training Manager

Partnerships in Health Reform (PHR) Project
Abt Associates
Harvard School of Public Health
University Research Corporation

Dr. James C. Knowles, Project Director, Egypt
Cheri A. Rassas, Deputy for Operations

Cabinet Information and Decision Support Center

Dr. Sherif Hashem, Information Highway Project
Dr. Tarek M. Kamel, Head of Communications Department

United States Agency for International Development

Mellon Tanamly, Director, Office of Health
Dr. Sameh El-Saharty, Senior Program Management Specialist, Health and Population
Richard Ainsworth, Program Management Specialist, Office of Health
Dr. Sameh El Gayar, Program Management Specialist, Office of Health
Carl Abdu Rahman, Program Management Specialist, Office of Health

Cost Recovery for Health Project
University Research Corporation (URC), Birch & Davis International

Dr. Tisna Veldhuyzen van Zanten, Vice President and Director, International Division
Dr. Thomas Hayes, Task 1 Coordinator
Dr. Robert Snyder, Acting Chief of Party, Deputy Chief of Party for Planning
Phil Schrafer, Managed Care Practice Advisor, Task 4 Coordinator
Mark Wilcox, Consultant, Managed Care
Mediha Abdallah, Hospital MIS Advisor
Gerald Giebink, MIS Advisor

Data Processing Services

Dr. Samir Eliesh, Managing Director
Eng. Baheya El Zayat, Systems Analyst/Programming Manager
Eng. Inas Hindman, Systems Analyst/Programmer

Ministry of Education

Hamdi M. El Mihy, General Manager, Information, Statistics, and Computer Department
Fatma Abbas, System Manager, Information, Statistics, and Computer Department
Naglaa Saad, System Operator, Information, Statistics, and Computer Department

Giza Systems Engineering

Mahmoud Sherif, Sales Manager, Education and Government

Cairo University, Abu Reesh Pediatric Teaching Hospital
MedNet Health Information Service

Dr. Assem El Fiky, Professor of Pediatric Surgery

Annex B: Documents Reviewed

Analysis of the Institutional Capacity for Health Sector Reform in Egypt. USAID/Cairo. Draft Report. June 1996.

Budget Tracking System, Egypt, Phase I: Final Report. Cressman, Gordon M. and Mahmoud Abdel Latif. Research Triangle Institute and Harvard School of Public Health, Data for Decisionmaking Project, USAID/Cairo. 14 November 1996.

Budget Tracking System, Egypt, Phase I: Software Guide. Cressman, Gordon M. Research Triangle Institute, Data for Decisionmaking Project, USAID/Cairo. 15 October 1996.

Data Communications with the Governorates. Cressman, Gordon M., Research Triangle Institute. Concept paper for the Data for Decisionmaking Project, USAID/Cairo. Unpublished. 22 October, 1996.

Development of a Performance Based Health System.Walsh, Julia A. Concept paper. Egypt Health Sector Reform program assistance, USAID/Cairo. Unpublished. 15 January 1997.

Draft Results Matrix of the Projected Benchmarks for Tranche One. Health Policy Support Program, USAID/Cairo. Working Draft. January 1997.

Egypt: Strategies for Health Sector Change, DRAFT. Berman, Peter, et al, Harvard School of Public Health, Data for Decisionmaking Project, USAID/Cairo. Working Draft. January 1997.

Fact Sheet on HIO Management Information System. MAXIMUS, Health Insurance Organization, Cost Recovery for Health Project, USAID/Cairo. Unpublished. 31 December 1996.

Field Activity Reports, Dr. Moharram Khalifa. Field Epidemiology Training Unit, Child Survival Project, Ministry of Health and Population. June 1995.

Health Information System, Manual of Procedures. Khaled Abdel-Fattah Mohamed. Arabic Software Engineering for Clark Atlanta University, Child Survival Project, USAID/Cairo. March 1996.

Health Insurance Organization Management Information System. Presentation to USAID. Health Insurance Organization, Cost Recovery for Health Project, USAID/Cairo. Unpublished. 8 January 1997.

Measuring the Performance of Hospitals and Health Centres. Montoya-Aguilar, C., University of Chile. Division of Strengthening of Health Services, District Health Systems, World Health Organization. February 1994.

MIS Role During Institutionalization of Cost Recovery. Madiha Abdallah. University Research Corporation, Cost Recovery for Health Project. Discussion paper (draft). Unpublished. January 1997.

National Health Accounts for Egypt. Rannanoeliya, Ravindra P. and Peter Berman. Harvard School of Public Health, Data for Decisionmaking Project, USAID/Cairo. Working Draft. 20 October 1995.

National Health Sector Policy Reform Agenda. Health Policy Support Program, USAID/Cairo. Working Draft. January 1997.

Talking Paper, HIO MIS Sustainability: Current and Projected Issues. Meyer, Felix, MAXIMUS, Health Insurance Organization, Cost Recovery for Health Project, USAID/Cairo. Unpublished. 10 November 1996.

The HIO Management Information System: A Breakthrough in Egyptian Healthcare Management. Health Insurance Organization, Cost Recovery for Health Project, USAID/Cairo. July 1996.

The National Organization for Drug Control and Research (NODCAR). Eman Abdel Aziz El Asaar. Ministry of Health and Population. Description prepared for the HealthNet Website. Unpublished. 28 January 1997.

Trip Report - Cairo, Egypt, June 17 - July 2, 1995. Larson, David L. Acting Director, Division of Data Processing, ODPS, Centers for Disease Control and Prevention, U.S. Department of Health and Human Services. 17 July 1995.

Annex C: Tabular Summary of MIS Applications

Table 6 Technical platform of existing computer applications.

No.	Project	Application	Hardware	System Software	Base Application
	CRHP Component 1				
1	MOHP/URC	Biomedical Equipment Assets, Preventive & Corrective Maint.	Stand-alone IBM -compatible PC	Arabic MS-DOS/Windows 3.1/3	Database: Arabic MS Access 2.0
2	MOHP/URC	Patient Master Index	Stand-alone IBM -compatible PC	Arabic MS-DOS/Windows 3.1/3	Database: Arabic MS Access 2.0
3	MOHP/URC	Admission/Discharge/Transfer (in-patient module)	Stand-alone IBM -compatible PC	Arabic MS-DOS/Windows 3.1/3	Database: Arabic MS Access 2.0
4	MOHP/URC	Personnel/Payroll	Stand-alone IBM -compatible PC	Arabic MS-DOS/Windows 3.1/3	Database: Arabic MS Access 2.0
5	MOHP/URC	Material Management (drugs, medical supplies, non-medical supplies, spare parts)	Stand-alone IBM -compatible PC	Arabic MS-DOS/Windows 3.1/3	Database: Arabic MS Access 2.0
6	MOHP/URC	Training Administration	Stand-alone IBM -compatible PC	Arabic MS-DOS/Windows 3.1/3	Database: Arabic MS Access 2.0
7	MOHP/Child Survival, MotherCare	Health Information System (HIS)	Stand-alone IBM -compatible PC	Arabic MS-DOS	Database: MS FoxPro
8	Data for Decision Making (DDM)	Budget Tracking System	Stand-alone IBM -compatible PC	Arabic MS-DOS/Windows 3.1/3.11	Spreadsheet: Borland Quattro Pro for Windows 5.0 or later
9	Data for Decision Making (DDM)	Facility Costing System	Stand-alone IBM -compatible PC	Arabic MS-DOS/Windows 3.1/3.11	Spreadsheet: Borland Quattro Pro for Windows 5.0 or later
10	Data for Decision Making (DDM)	Drug Inventory Control	Stand-alone IBM -compatible PC	Arabic MS-DOS	Database:
11	Data for Decision Making (DDM)	Personnel/Payroll	Stand-alone IBM -compatible PC	Arabic MS-DOS	Database:
12	/Data for Decision Making (DDM)	General Accounting	Stand-alone IBM -compatible PC	Arabic MS-DOS	Database:
	CRHP Component 2				
13	HIO/MAXIMUS	Beneficiary Registration	Multi-user hosts, dumb terminals	UNIX V4 R3.02.1	Database: Oracle 7
14	HIO/MAXIMUS	Patient Records	Multi-user hosts, dumb terminals	UNIX V4 R3.02.1	Database: Oracle 7
15	HIO/MAXIMUS	Admission/Discharge/Transfer	Multi-user hosts, dumb terminals	UNIX V4 R3.02.1	Database: Oracle 7
16	HIO/MAXIMUS	Periodic Medical Examination	Multi-user hosts, dumb terminals	UNIX V4 R3.02.1	Database: Oracle 7
17	HIO/MAXIMUS	Cost Accounting	Multi-user hosts, dumb terminals	UNIX V4 R3.02.1	Database: Oracle 7
18	HIO/MAXIMUS	Drug Control	Multi-user hosts, dumb terminals	UNIX V4 R3.02.1	Database: Oracle 7
19	HIO/MAXIMUS	Contracted Pharmacy	Multi-user hosts, dumb terminals	UNIX V4 R3.02.1	Database: Oracle 7
20	HIO/MAXIMUS	Contracted Providers	Multi-user hosts, dumb terminals	UNIX V4 R3.02.1	Database: Oracle 7
21	HIO/MAXIMUS	Medical Quality Assurance	Network server, PC workstations	UNIX, Arabic MS-DOS/Windows 3.1/3.11	Database: Oracle 7/Oracle Developer 2000
22	HIO/MAXIMUS	Management Reporting	Network server, PC workstations	UNIX, Arabic MS-DOS/Windows 3.1/3	Database: Oracle 7/Oracle Developer 2000
23	CCO	Drug Inventory Control	Stand-alone IBM -compatible PC	Arabic MS-DOS	Database: dBASE IV
	Other				
24	Family Planning Project	FP materials consumption and supply	Stand-alone IBM -compatible PC	Arabic MS-DOS	Database: (unknown)

Table 7 Characteristics of existing computer applications.

No.	Project/Source	Application	Local Partner	Data/Indicators	Target Organization	Comments	Arabic Code Page	Coding Systems
	CHRP Component 1							
1	MOHP/URC	Biomedical Equipment Assets, Preventive & Corrective Maint	None	Available equipment, condition, and maintenance schedule	Five Phase A MOHP hospitals	Installed and operating in five hospitals	Arabic MS-DOS/Windows	Unique
2	MOHP/URC	Patient Master Index	None	Patients registered	Five Phase A MOHP hospitals	Installed and operating in five hospitals; plans to add diagnosis and service rendered	Arabic MS-DOS/Windows	Unique
3	MOHP/URC	Admission/Discharge/Transfer (in-patient module)	None	Entry and exit of patients	Five Phase A MOHP hospitals	Installed and operating in five hospitals; capacity problems in Shark El Medina Hospital	Arabic MS-DOS/Windows	Unique
4	MOHP/URC	Personnel/Payroll	None	Personnel characteristics, assignments, salaries	Five Phase A MOHP hospitals	Installed and operating in five hospitals	Arabic MS-DOS/Windows	Unique
5	MOHP/URC	Material Management (drugs, medical supplies, non-medical supplies, spare parts)	None	Supply, consumption, inventory of drugs and other materials	Five Phase A MOHP hospitals	Installed and operating in five hospitals	Arabic MS-DOS/Windows	Unique
6	MOHP/URC	Training Administration	None	Persons trained, courses delivered	Five Phase A MOHP hospitals	Installed and operating in five hospitals	Arabic MS-DOS/Windows	Unique
7	Child Survival, Healthy Mother Healthy Child	Health Information System (HIS)	Arabsoft/HIO	Primary and MCH service delivery, personnel, drug consumption, etc.	governorate district facility	Deployed in 21 governorate HICs; perhaps six operating; three mature installations, plans to decentralize to districts	Arabic MS-DOS	CAPMAS (governorate, district, job specialties)
8	Data for Decision Making (DDM)	Budget Tracking System (BTS)	MOHP/DOP	Expenditures by budget category and broad health care function categories	governorate, district, facility	Documented spreadsheet system; requires aggregate inputs; no built-in provision for historical trend analysis or inter-governorate comparison	N/A	Unique

No.	Project/Source	Application	Local Partner	Data/Indicators	Target Organization	Comments	Arabic Code Page	Coding Systems
						English-only; efforts underway to coordinate and integrate with HIS		
9	Data for Decision Making (DDM)	Facility Costing System	MOHP/DOP	Detailed costing of facilities by department	facility	System of interconnected spreadsheets; undocumented; primarily English; some Arabic	Arabic MS-DOS/Windows	Unique
10	Data for Decision Making (DDM)	Drug Inventory Control	DPS	Drug supply, consumption, inventory, price	governorate, district, facility (hospital)	Modification of software in use by CCO for four years; Arabic; being coordinated with BTS/HIS development; to be deployed by DDM to three or more governorates	Naftha	CCO (drugs) CAPMAS (governorates, districts) HIS (facilities, facility types)
11	Data for Decision Making (DDM)	Personnel/Payroll	DPS	Personnel, specialties, work location, salaries, bonuses, adjustments	governorate	Modification of software in use by CCO; Arabic; being coordinated with BTS/HIS development; to be deployed by DDM to three or more governorates	Naftha	CAPMAS (governorates, districts, job specialties) HIS (facilities, facility types)
12	Data for Decision Making (DDM)	General Accounting	DPS		governorate	Modification of software in use by CCO; Arabic; being coordinated with BTS/HIS development; to be deployed by DDM to three or more governorates	Naftha	CAPMAS (governorates, districts, job specialties)
	CHRP Component 2							
13	HIO/MAXIMUS	Beneficiary Registration	Arabsoft/HIO	Beneficiary eligibility	HIO headquarters, branch offices, polyclinics	Software complete. Fully deployed in clinics of Cairo Branch. Partially deployed in clinics in NWD Branch.	ASMO 708	Unique

No.	Project/Source	Application	Local Partner	Data/Indicators	Target Organization	Comments	Arabic Code Page	Coding Systems
14	HIO/MAXIMUS	Medical Records	Arabsoft/HIO	Reason for use of HIO services, treatment received, length and outcome, dispensation of optical and prosthetic devices	HIO hospitals, polyclinics	Software complete. In-patient module fully deployed in Medinet Nasr Hospital, Cairo	ASMO 708	Unique
15	HIO/MAXIMUS	Admission/Discharge /Transfer	Arabsoft/HIO	Reason for beneficiary admission, discharge, or transfer to/from facility	HIO hospitals	Software complete. Fully deployed in Medinet Nasr Hospital, Cairo	ASMO 708	Unique
16	HIO/MAXIMUS	Periodic Medical Examination	Arabsoft/HIO	Triggers for scheduled examinations based on beneficiary condition or occupation	HIO branch offices	Beta test just finished, Cairo Branch	ASMO 708	Unique
17	HIO/MAXIMUS	Cost Accounting	Arabsoft/HIO	Tracks costs for all aspects of HIO business	HIO headquarters, branch offices, polyclinics, and hospitals	Beta to be completed mid-February for hospitals (Medinet Nasr)	ASMO 708	Unique
18	HIO/MAXIMUS	Drug Control	Arabsoft/HIO	Drug supply, consumption, inventory, price	HIO headquarters, branch offices, hospitals, polyclinics, stores	Beta to be completed in mid-February for hospitals (Medinet Nasr)	ASMO 708	Unique
19	HIO/MAXIMUS	Contracted Pharmacy	Arabsoft/HIO	HIO prescriptions filled by contracted pharmacies	HIO branch offices	Completed and used in Cairo Branch, implemented in NWD Branch, level of use not determined	ASMO 708	Unique
20	HIO/MAXIMUS	Contracted Providers	Arabsoft/HIO	HIO services provided by contracted physicians, clinics, and hospitals	HIO branch offices	Completed and used in Cairo Branch	ASMO 708	Unique
21	HIO/MAXIMUS	Medical Quality Assurance	Arabsoft/HIO	Outcome of medical care	Polyclinics, hospitals	Completed for polyclinics. Beta to be completed in hospitals mid-	ASMO 708 Arabic MS-DOS/Windows	Unique

						February, complete by end of February		
22	HIO/MAXIMUS	Management Reporting	Arabsoft/HIO	Cost and quality of care	HIO headquarters, branch offices	Beta to be completed in mid-February	ASMO 708 Arabic MS-DOS/Windows	Unique
23	CCO	Drug Inventory Control	DPS	Consumption, inventory, and supply of pharmaceuticals	CCO hospitals	In use for four years	Naftha	Unique

No.	Project/Source	Application	Local Partner	Data/Indicators	Target Organization	Comments	Arabic Code Page	Coding Systems
	Other							
24	Family Planning Project	Family Planning Materials	Family Planning Project	Consumption and supply of family planning materials	MOHP FP clinics	In use for several years.	(Unknown)	Unique

Table 8 General description of existing computer applications.

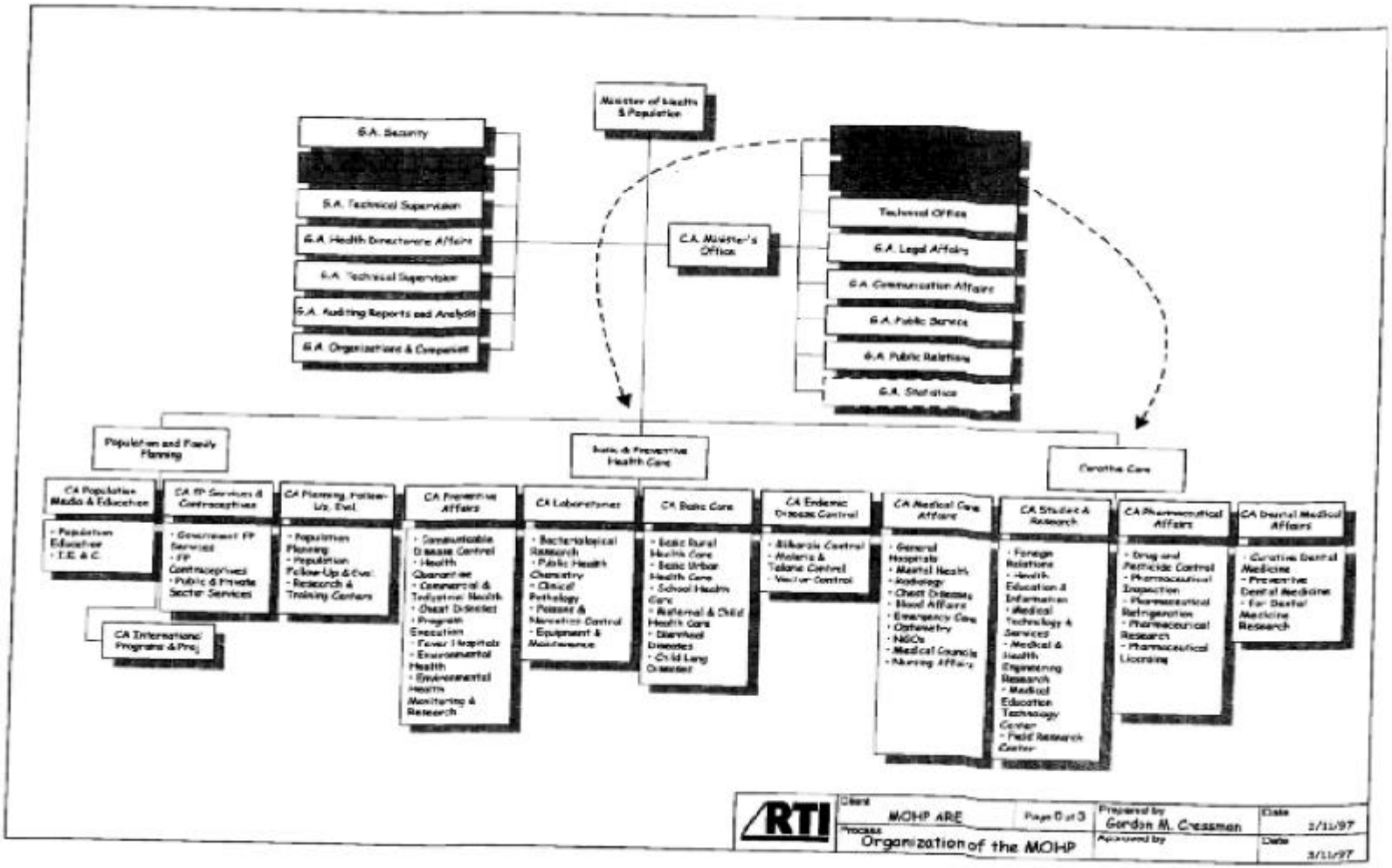
No.	Project/Source	Application	Description	UI Language	Documentation
	CRHP Component 1				
1	MOHP/URC	Biomedical Equipment Assets, Preventive & Corrective Maint.	Database application for stand-alone PC systems; generalized system; used on all Phase A hospitals.	Arabic	Unknown
2	MOHP/URC	Patient Master Index	Database application for stand-alone PC systems;	Arabic	Unknown
3	MOHP/URC	Admission/Discharge/Transfer (in-patient module)	Database application for stand-alone PC systems; originally handled registration only; now includes doctor's diagnosis; capacity problems emerging with 100K records; plans to move it to client/server LAN.	Arabic	Unknown
4	MOHP/URC	Personnel/Payroll	Database application for stand-alone PC systems; well-designed interface and reporting; appears very complete; in use in hospital with 607 personnel.	Arabic	Unknown
5	MOHP/URC	Material Management (drugs, medical supplies, non-medical supplies, spare parts)	Database application for stand-alone PC systems; broad design approach handles pharmaceuticals and non-medical supplies	Arabic	Unknown
6	MOHP/URC	Training Administration	Database application for stand-alone PC systems; interfaces with personnel system	Arabic	Unknown
7	Child Survival, Arabsoft, MotherCare	Health Information System (HIS)	Documented database application: small stand-alone systems; well-defined and documented; in place in several governorates; plans for district-level entry; no data transmission	Arabic	User and technical manuals (Arabic)
8	Data for Decision Making (DDM)	Budget Tracking System	Documented spreadsheet system; requires aggregate inputs; no built-in provision for historical trend analysis or inter-governorate comparison; English-only; efforts underway to coordinate and integrate with HIS	English (some design provision for Arabic UI)	User and technical manual (English)
9	Data for Decision Making (DDM)	Facility Costing System	System of interconnected spreadsheets; undocumented; primarily English; some Arabic	English (some Arabic)	None
10	Data for Decision Making (DDM)	Drug Inventory Control	Modification of software in use by CCO for four years; Arabic; being coordinated with BTS/HIS development	Arabic	User and technical manuals (Arabic)
11	Data for Decision Making (DDM)	Personnel/Payroll	Modification of software in use by CCO; Arabic; being coordinated with BTS/HIS development	Arabic	User and technical manuals (Arabic)
12	Data for Decision Making (DDM)	General Accounting	Modification of software in use by CCO; Arabic; being coordinated with BTS/HIS development	Arabic	User and technical manuals (Arabic)
	CRHP Component 2				
13	HIOMAXIMUS	Beneficiary Registration	Documented database application; communication among sites via TCP/IP tunneled through X.25 network; database segmented among branches with master at headquarters	Arabic	User Guide (Arabic), technical documentation (English)
14	HIOMAXIMUS	Patient Records	Documented database application	Arabic	User Guide (Arabic), technical documentation (English)

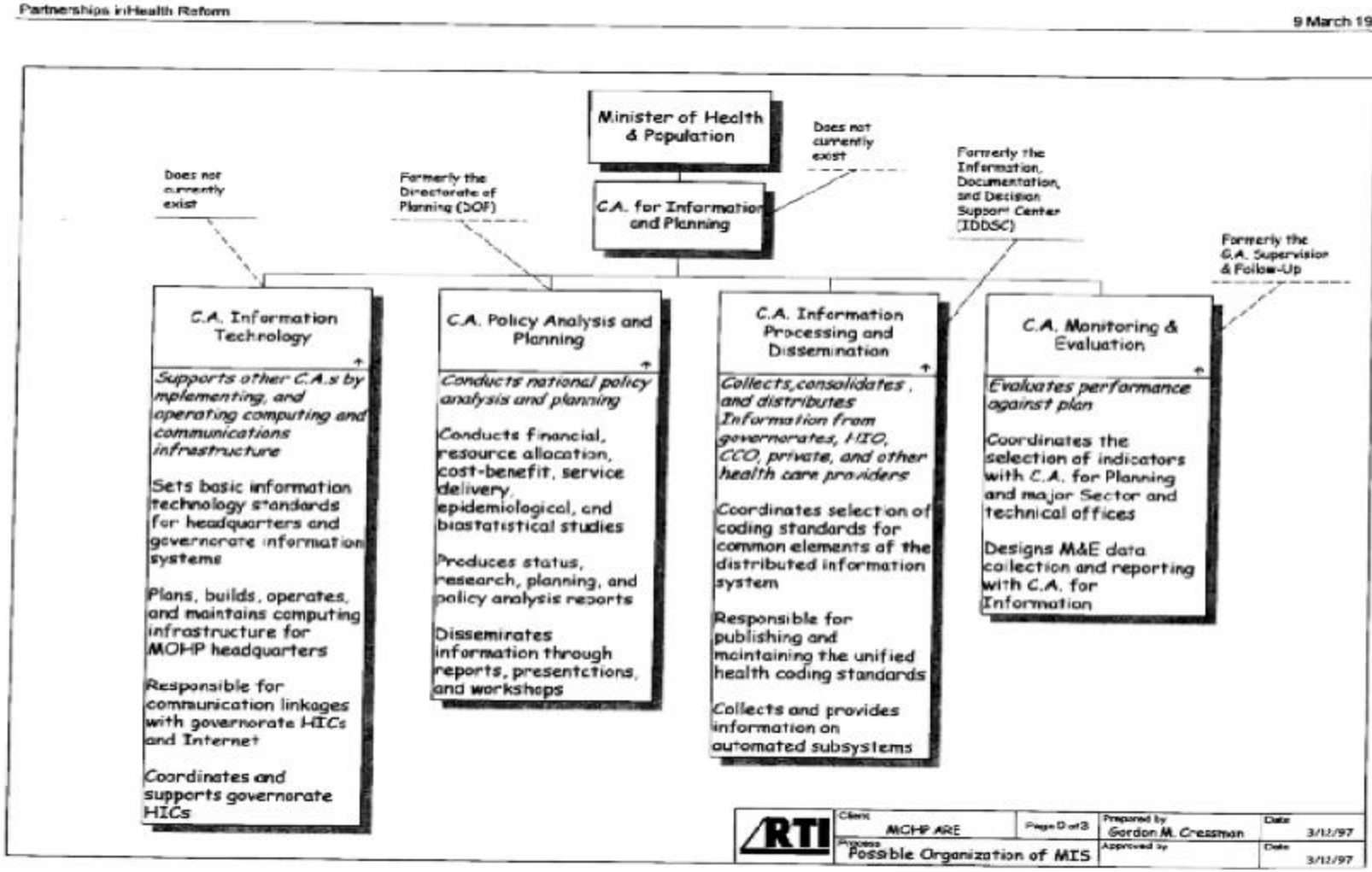
No.	Project/Source	Application	Description	UI Language	Documentation
15	HIO/MAXIMUS	Admission/Discharge/Transfer	Documented database application	Arabic	User Guide (Arabic), technical documentation (English)
16	HIO/MAXIMUS	Periodic Medical Examination	Documented database application	Arabic	User Guide (Arabic), technical documentation (English)
17	HIO/MAXIMUS	Cost Accounting	Documented database application	Arabic	User Guide (Arabic), technical documentation (English)
18	HIO/MAXIMUS	Drug Control	Documented database application; drug master very complete; drug master updated via telecommunication from central authority	Arabic	User Guide (Arabic), technical documentation (English)
19	HIO/MAXIMUS	Contracted Pharmacy	Documented database application	Arabic	User Guide (Arabic), technical documentation (English)
20	HIO/MAXIMUS	Contracted Providers	Documented database application	Arabic	User Guide (Arabic), technical documentation (English)
21	HIO/MAXIMUS	Medical Quality Assurance	Documented database application	Arabic	User Guide (Arabic), technical documentation (English)
22	HIO/MAXIMUS	Management Reporting	Documented database application	Arabic	User Guide (Arabic), technical documentation (English)
23	CCO	Drug Inventory Control	Documented data base application	Arabic	
	Other				
24	Family Planning Project	Contraceptive use and supply	Database application	Unknown	Unknown

Table 9 Current coding systems for key data elements.

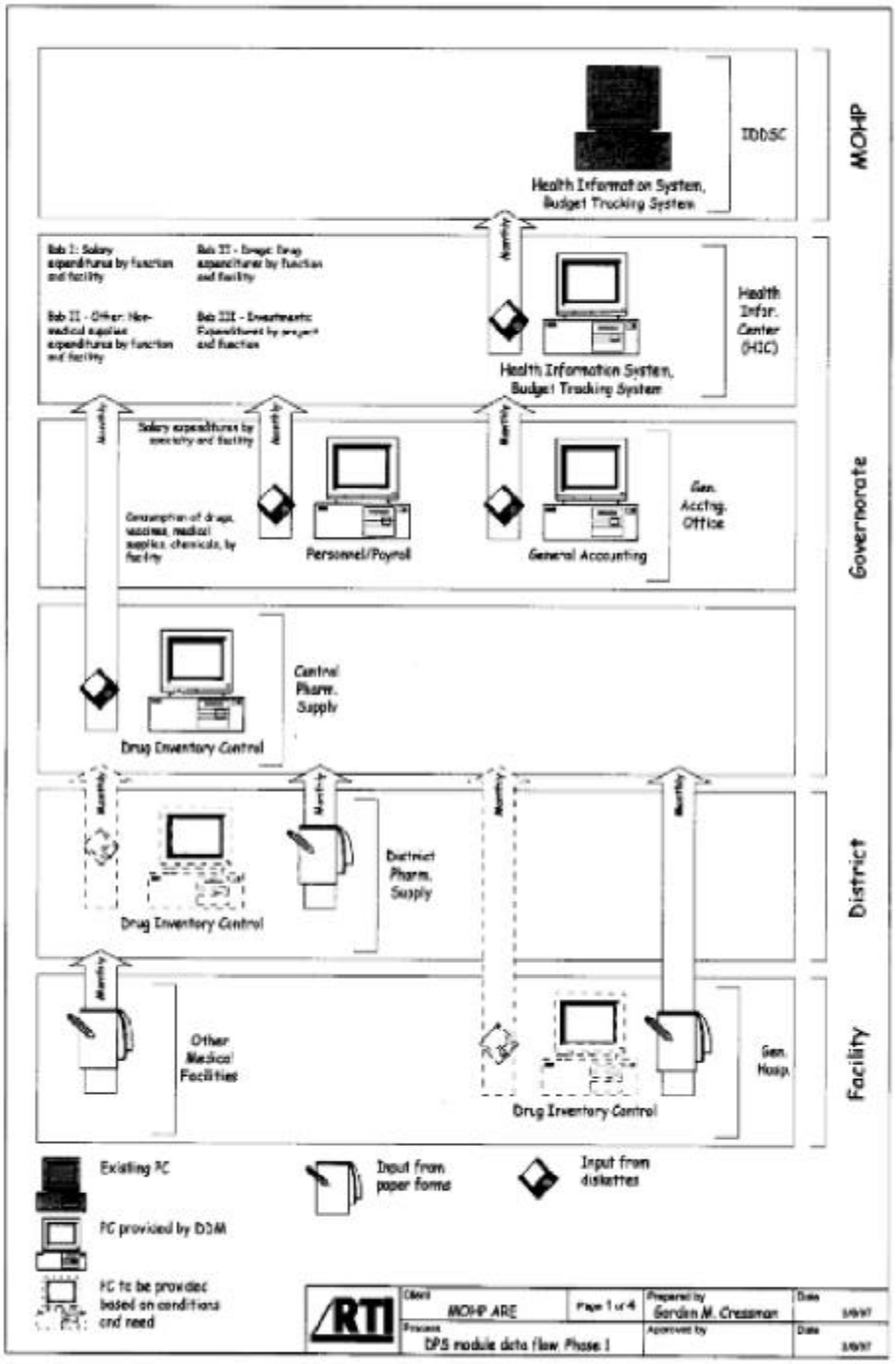
Code System	Project	Source	Maintenance	Description
Personnel Specialties (Positions)	CRHP/CS/HIS	CAPMAS	CAPMAS	Extensive six-digit civil service position coding system; the HIS uses only those codes appropriate to MOHP personnel
Governorate	CRHP/CS/HIS	CAPMAS	CAPMAS	Two-digit code
Districts	CRHP/CS/HIS	CAPMAS	CAPMAS	Two-digit code
Type Facility	CRHP/CS/HIS	HIS	Centraly maintained by HIS project team	Three-digit digit code
Facility	CRHP/CS/HIS	HIS	Centraly maintained by HIS project team	Composite six digit code: two-digit facility type + four-digit serial
Facility Division	CRHP/CS/HIS	HIS	Centraly maintained by HIS project team	Three-digit code indicating internal departmen: or cost center
Pharmaceuticals and Medical Supplies	CCO	CCO	Drug table maintained separately at each installation; no central control. Date prices updated separately by each installation, no central control	Six-digit code; two digits for form; four digits for serial Currently includes 3,800 items. International group and subgroup; unique automatically generated drug serial; manufacturer/vendor; trade name; generic name; active ingredients; form; unit; package; units/package; price Includes drugs; chemicals medical supplies; does not include family planning materials or vector control chemicals; may not include some medical supplies and laboratory chemicals
Pharmaceuticals and Medical Supplies	HIO/MAXIMUS	CCO/HIO/MAXIMUS	Master drug and price tables centraly updated and distributed to installations via ftp file transfer over EGYPTNET (X.25) Dated prices updated weekly or biweekly from MOHP C.A. for Pharmacy Affairs	Six-digit code: two digits for form; four digits for serial Currently includes 4,000 items. International group and subgroup; unique automatically generatec drug serial; manufacturer/vendor: trade name; generic name: active ingredients; form; unit; package; units/package; price composing physician rank Includes drugs; chemicals medical supplies; does not include family planning materials or vector control chemicals: may not include some medical supplies and laboratory chemicals
Pharmaceuticals and Medical Supplies	CRHP/URC	URC	Separately maintained by each facility; no central control	Unique
Family Planning Materials	Family Planning Project	Family Planning Project	Centraly maintained, Family Planning Project team	Unique
Vaccines	CRHP/CS	HIS	Centraly maintained, HIS team	Unique

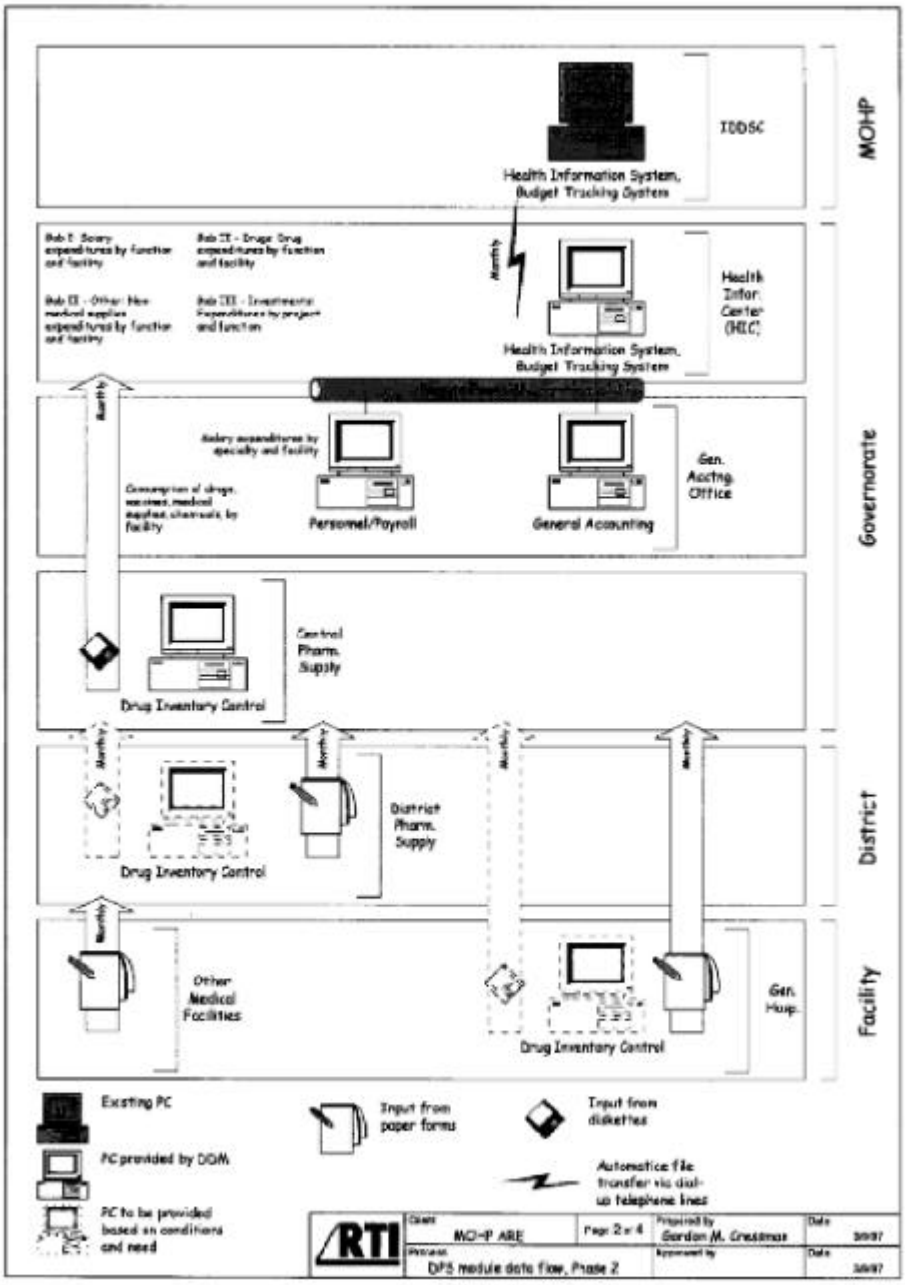
Annex D: Organizational Diagrams

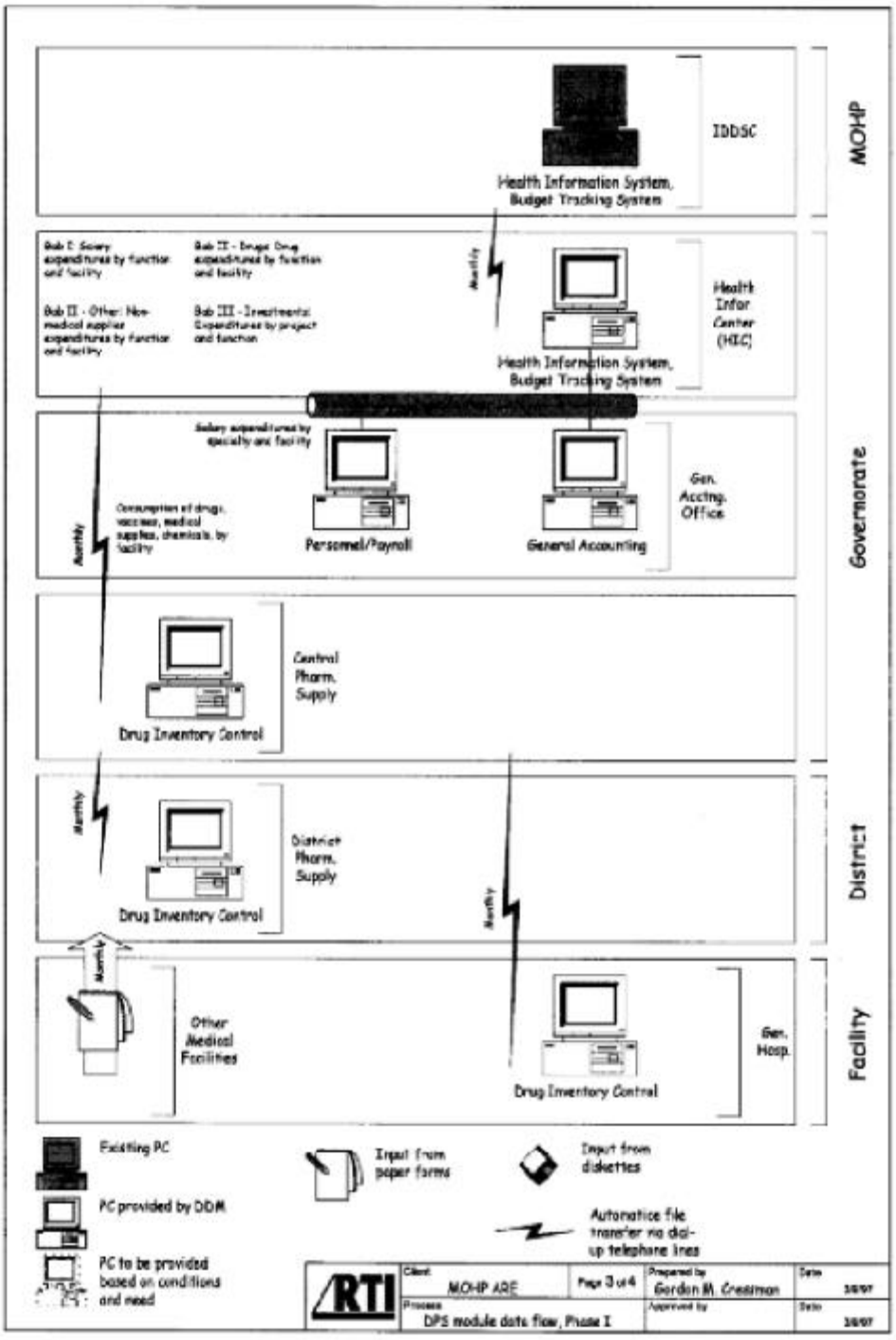

Minister of Health & Population
G.A. Security
G.A. Technical Supervision
G.A. Health Directorate Affairs
G.A. Technical Supervision
G.A. Auditing Reports and Analysis
G.A. Organizations & Computer
C.A. Minister's Office
Technical Office
G.A. Legal Affairs
G.A. Communication Affairs
G.A. Public Service
G.A. Public Relations
G.A. Statistics
Population and Family Planning
Basic & Preventive Health Care
Curative Care
CA Population Media & Education
CA IEC Services & Contraceptives
CA Planning, Follow-Up, Eval.
CA Preventive Affairs
CA Laboratories
CA Basic Care
CA Endemic Disease Control
CA Medical Care Affairs
CA Student & Research
CA Pharmaceutical Affairs
CA Dental Medical Affairs
CA International Programs & Proj.
RTI
Client
MOHP ARE
Page 0 of 3
Prepared by
Gordon M. Cressman
Date
3/11/97
Process
Organization of the MOHP
Approved by
Date
3/11/97


Partnerships in Health Reform
9 March 1997
Minister of Health & Population
Does not currently exist
Formerly the Information, Documentation, and Decision Support Center (IDDSC)
Does not currently exist
Formerly the Directorate of Planning (DOF)
C.A. for Information and Planning
Formerly the G.A. Supervision & Follow-Up
C.A. Information Technology
Supports other C.A.s by implementing, and operating computing and communications infrastructure
Sets basic information technology standards for headquarters and governorate information systems
Plans, builds, operates, and maintains computing infrastructure for MOHP headquarters
Responsible for communication linkages with governorate HICs and Internet
Coordinates and supports governorate HICs
C.A. Policy Analysis and Planning
Conducts national policy analysis and planning
Conducts financial, resource allocation, cost-benefit, service delivery, epidemiological, and biostatistical studies
Produces status, research, planning, and policy analysis reports
Dissemirates information through reports, presentations, and workshops
C.A. Information Processing and Dissemination
Collects, consolidates, and distributes information from governorates, HIO, CCO, private, and other health care providers
Coordinates selection of coding standards for common elements of the distributed information system
Responsible for publishing and maintaining the unified health coding standards
Collects and provides information on automated subsystems
C.A. Monitoring & Evaluation
Evaluates performance against plan
Coordinates the selection of indicators with C.A. for Planning and major Sector and technical offices
Designs M&E data collection and reporting with C.A. for Information
RTI
Client: MOHP ARE
Page 0 of 3
Prepared by: Gordon M. Cressman
Date: 3/12/97
Process: Possible Organization of MIS
Approved by:
Date: 3/12/97

Annex E: BTS Module Data Flow Diagrams


MOHP
Governorate
District
Facility
IDDSC
Health Information System,
Budget Tracking System
Health
Infor.
Center
(HIC)
Health Information System,
Budget Tracking System
Personnel/Payroll
General Accounting
Gen.
Acctng.
Office
Central
Pharm.
Supply
Drug Inventory Control
District
Pharm.
Supply
Drug Inventory Control
Other
Medical
Facilities
Drug Inventory Control
Gen.
Hosp.
Existing PC
PC provided by DDM
PC to be provided
based on conditions
and need
Input from
paper forms
Input from
diskettes
RTI
MOHP ARE
DPS module data flow Phase I
Gordon M. Cressman


MOHP
Governorate
District
Facility
TDDSC
Health Information System, Budget Tracking System
Health Infor. Center (HIC)
Health Information System, Budget Tracking System
Monthly
Personnel/Payroll
General Accounting
Gen. Acctng. Office
Central Pharm. Supply
Drug Inventory Control
District Pharm. Supply
Drug Inventory Control
Other Medical Facilities
Drug Inventory Control
Gen. Hosp.
Existing PC
PC provided by DOM
PC to be provided based on conditions and need
Input from paper forms
Input from diskettes
Automatice file transfer via dial-up telephone lines
RTI
MOH-P ARE
Gordon M. Crassmon
DPS module data flow, Phase 2


MOHP
IDDSC
Health Information System, Budget Tracking System
Governorate
Health Infor Center (HIC)
Health Information System, Budget Tracking System
Monthly
Gen. Accting. Office
Personnel/Payroll
General Accounting
Monthly
Central Pharm. Supply
Drug Inventory Control
District
Monthly
District Pharm. Supply
Drug Inventory Control
Monthly
Facility
Monthly
Other Medical Facilities
Gen. Hosp.
Drug Inventory Control
Existing PC
PC provided by DDM
PC to be provided based on conditions and need
Input from paper forms
Input from diskettes
Automatice file transfer via dial-up telephone lines
RTI
Client: MOHP ADE
Page 3 of 4
Prepared by: Gordon M. Crestman
Date: 3/8/97
Process: DPS module data flow, Phase I
Approved by:
Date: 3/8/97