TCP/LEB/8924
Inception Report

FAO TECHNICAL COOPERATION PROGRAMME

PROJECT TCP/LEB/8924

LEBANON
MINISTRY OF AGRICULTURE

INFORMATION MANAGEMENT SYSTEM

Food and Agriculture Organization of the United Nations
June 2000

FAO TECHNICAL COOPERATION PROGRAMME - PROJECT TCP/LEB/8924

LEBANON MINISTRY OF AGRICULTURE INFORMATION MANAGEMENT SYSTEM

PROJECT RATIONALE AND OBJECTIVES

Rapid change in land cover and use, and subsequent environmental degradation, has a very high negative impact on the economy. In 1996, the World Bank estimated that the socio-economic cost of decreased agricultural productivity due to soil loss and fertility decline, loss of forests, damage to infrastructure, and the cost of infrastructure redesign and maintenance, was between 6% and 10% of Lebanon's GNP annually.

Attempts have been made to institute sustainable management of the country's renewable resource base, but these attempts lacked adequate coordination, local participation and institutional support, and especially lacked up-to-date information on the nature and extent of change. A more coordinated and broadly based effort was needed to report on the dynamics of change and the subsequent degradation of the natural resources, and at the same time to foster ecologically and socio-economically sustainable development. Timely and coordinated collection and analysis of data would greatly enhance the ability to support this process.

The Government of Lebanon requested FAO technical assistance, through the Technical Cooperation Programme, to assist its Ministry of Agriculture (MoA) and better enable it to monitor and provide advice on the nature and extent of change and on appropriate measures for protecting the elements of the agricultural resource base at risk. This capacity building would be valuable both as an independent contribution to spatial data management in MoA and also as a component extending and complementing the developing national spatial data infrastructure in Lebanon.

The longer-term objectives of the project were to assist the Government of Lebanon, through the Directorate for Special Studies, to fully account for changes occurring in agricultural land and associated ecosystems, as part of sector planning in agricultural development and management. A sound information base would facilitate strategic planning and strengthen institutional capacities in formulating, coordinating, monitoring and reviewing policies for sustainable agricultural development.

The immediate objectives of the project were:

- To verify MoA's user requirements for spatial data to monitor the dynamics of agricultural land cover and land use change, and to ensure that development complemented existing and planned programmes.
- To design and construct prototype data sets suitable for use by MoA for use in its programmes to regularly monitor agricultural land.
- To carry out short pilot projects for the selected applications to demonstrate the results that could be achieved, including preparation of suitable satellite-based remote sensing data sets for integration into the agricultural area frame programme, development of improved sampling strategies based on agricultural land stratification, preparation of a land systems

analysis, updating of the land cover map of the country, and preparation of products for complementary natural resources surveys.

- To conduct technology transfer activities to ensure that the capacity for development of future operational systems included active contributions from Lebanese partners well as an active technical cooperation programme with partners from other developing countries with relevant experience – e.g. Morocco and Egypt.
- To build a sustainable capacity in MoA to manage spatial data and integrate them into an effective reporting structure.

SECTION 1.
FAO'S APPROACH TO INFORMATION MANAGEMENT IMPLEMENTATION

WHAT IS AN INTEGRATED LAND INFORMATION MANAGEMENT SOLUTION?

An integrated land information management (IM) solution successfully combines leadership, people, computer hardware and software, and data into a framework that ensures the appropriate tools and rules are in place to maintain data and turn them into useful information products to support operations and decision making. An integrated land IM solution is needed for two key reasons: ***management capability*** and ***value and cost.***

Management capability

Public and private sector policy, planning, decision making and action all rely on good data and supporting systems. If the data and systems are not in place, management capability and economic growth do not achieve their maximum potential. An integrated solution ensures that good data are accessible, and that the appropriate applications are in the hands of the people who need them. An integrated solution also provides opportunities to do new things, and to improve the way current activities are done, in ways now not foreseen or possible.

Value and cost

Data – particularly geographic data – are expensive to collect, manage and maintain. The integrated system's framework and mechanisms enable and promote the sharing and distribution of data, thus reducing costs and increasing their value. An integrated system also promotes the development and acceptance of standards through the use of common data, systems and a participatory IM structure. This also reduces costs and increases the value of the data.

WHY IS AN INTEGRATED LAND IM SOLUTION IMPORTANT?

Organizations around the world are seeking to use and benefit from land information and associated technologies. Unfortunately, there is usually a barrier between what management and staff need and what they actually have. They need easy access to relevant information; tools that support the use of the data; understanding of the data through standards and metadata; clear direction for priorities; and training in the use of the technologies. What they most often encounter is data that are highly dispersed, not easily accessible, and not to a standard, coupled with complicated technologies, management and support components that do not make the job any easier to do. As a result, time, effort and money are wasted in duplicating efforts in data collection, management and analysis; results are not transferable or sharable; decisions are difficult to communicate; and management have difficulty assigning priorities and resources.

HOW HAS FAO RESPONDED TO THE NEED FOR AN IM SOLUTION?

FAO has a number of generic tools and concepts that can quickly facilitate an integrated solution that meets the organization's unique needs. These include:

- new, state-of-the-art information publishing and access tools that incorporate geographical information system (GIS) technology and run on desktop PC's under Windows and over the Internet; and
- database management tools for running integrated centralized databases in client-server and web environments.

These generic tools also reflect a new approach and new thinking about GIS tools and technologies. Probably 90% of most user needs can be met with easy-to-use software that provides quick access to the right information and tools to create maps and do basic analysis. Unfortunately, current corporate and off-the-shelf GIS packages and technologies are too complex and expensive for the broad user community. As a result, the majority of people do not use GIS, resulting in missed opportunity, wasted investment in data, and frustration.

The generic tools and new approach outlined here bring data access and basic analysis and mapping capability to this "spatially-challenged" majority at a cost, level of complexity, and level of functionality that meets their needs. These tools do not preclude the need for some specialized information technology products and skills. In fact, spatial data users can be divided into three types (see diagram): ***General Information Consumers***; ***Analytical Information Consumers***; and ***Data Administrators.*** In this 'world' everyone uses the same data with the tools best suited to their needs.

Along with the generic tools, FAO has a broad network of expertise in both IM and programme management delivery. These include:

- organizational capacity analysis and the development and delivery of training programmes;
- development and implementation of management structures and centres of excellence to support organizational information requirements;
- development and implementation of metadata standards, metadata input and reporting systems and data standards; and
- development and implementation of information policies to support the IM framework.

THE PHASED APPROACH

FAO has been actively involved in developing integrated solutions and, as a result, has many key components that can be leveraged and quickly introduced in other situations. Just as important, FAO also has a process for delivery that is effective, fast and inexpensive.

Often, a project of this scope can take several years and be very costly. FAO has developed a process that is participatory, rapid and effective. The approach builds quickly from the tools and components already available so that staff are up and running with the technology and the data very quickly. The phased approach is successful because it means rapid adoption and use of the data and systems, and buy-in for the project. The phased approach is also very manageable, ensuring clear objectives, deliverables and expectations.

This process involves two phases. Phase 1 puts in place the data, technology, core applications, and training for use within MoA. Phase 2, although largely undefined, sees the IM system mature. The approach is outlined in the diagram below. Note that, throughout the process, communications are a key element.

Phase 1

- An inception mission to determine the overall business, technology and data-related needs of the organization, along with the availability of data.
- Based on these findings, an implementation plan is developed that identifies fully the costs involved and the options available.
- A core database is built using the Knowledge Base - Information Management System (KB-IMS) (see Section 3 for description) and the data available.
- During these initial build stages, staff in the Resource Centre are trained in the use of basic technology tools – such as Microsoft Office – together with Microsoft Access, ArcView, GIS concepts, database management concepts, web and network management, FrontPage, ERDAS, remote sensing, etc., on an as-needed basis so that they are prepared for the implementation of the new technology.
- The generic technology tools are then introduced, providing access to the core database.
- Users are given training on the new tools.
- A basic web site or new component of the organization's existing web site is designed and built to provide a "home" for the web mapping and document systems, and to provide any important organizational Internet functionality (communications, feedback, etc.).
- An Information Management Steering Committee and an Information Management Technical Committee are created to oversee continuing policy and technical issues.
- The appropriate organizational structure is set up. Specifically this would involve establishing or enhancing a "Resource Centre" within the organization, with the appropriate systems administration and client-services skills.
- Introduction of draft policies – in particular with respect to information access – and draft standards, such as for metadata.
- Any new technology architecture components required will be purchased and installed.

Phase 2

Phase 2 represents the maturing of the overall solution. Its highlights include:

- The identification, development and implementation of custom business applications.
- Staff training will be completed, based on the capacity requirement analysis completed in Phase 1.
- The database will continue to grow with the addition of newly cleaned and/or collected data.
- The technology infrastructure will mature and any upgrades to the network and/or individual systems will be completed, again reflecting the priorities established by the steering committee.
- Data maintenance programmes will be put in place based on accepted data standards and potential collection and management partnerships with other agencies.

Benefits of this approach

Phase 2 does not really end, as the need for IM does not end. Phase 2 provides the organization with a logical and meaningful process for incorporating IM within its overall management scheme. As a result, FAO should be able to complete its role as the project facilitator without the risk of the system collapsing or becoming obsolete. Other benefits of this approach include:

- provision of tangible results quickly, and laying the foundation for future growth, e.g. development of standards, partnerships based on broad data access and sharing, and new working arrangements;
- basic technologies that are easy to use and inexpensive;
- identification, development and implementation of business-specific applications takes place within an environment that already works with the data; and
- by starting with basic technologies, the foundation is laid for future growth and use of more complex systems, thus easing the learning curve and expense.

THE RESOURCE CENTRE

The focal point and key to the success and long-term growth of the system is the Resource Centre. The Resource Centre supports the users largely through the maintenance of the core database and its "warehouses."

The Resource Centre also has several other important roles, such as:

- managing the rollout of Phase 2, i.e. the expansion of the system tools and data beyond MoA;
- implementing information sharing partnerships with other organizations;
- providing training and technical support; and
- "marketing" the data and systems and their services to other organizations.

THE FAO SOLUTION COMPONENTS IN BRIEF

The Desktop Information Access System

The Desktop Information Access System (DIAS) provides data and metadata access along with mapping and basic analysis capability. DIAS is open ended, so instead of predefined applications, users decide what they need to do with the data, and then use its built-in functions to deliver the answers. Analytical ability and flexibility are enhanced through its integration with ArcView, a desktop GIS from ESRI, as well as its integration with Microsoft Excel. To publish their map or analysis results, users can use DIAS' built-in mapping templates and functions, and/or import their product to Microsoft PowerPoint.

Web Information Access System – Mapping

With the Web Information Access System – Mapping (WIASMaps), MoA's spatial and tabular data can be made easily available to anyone, anywhere, via the web site, within specific "Topics." Users access the topic of their choice and can create maps, print maps, view metadata and access tabular data. If the data are updated in the core database, the changes are automatically reflected on the web site.

Web Information Access System – Documents

Web Information Access System – Documents (WIASDocs) is a simple but powerful document management system with a Windows-based front-end for document input, and a web-based back-end for document access and retrieval. It makes any document of any type immediately available to anyone, anywhere, via the web site. WIASDocs will organize MoA documents based on categories that reflect the organization's normal filing and library systems.

Internet Web Site

Both the web mapping and the document access systems will be accessible through an Internet web site. A web site will quickly be created which not only will host the new systems but will also provide the organization with a powerful communications vehicle for its programmes or other needs. Having an Internet presence can create a host of opportunities for partnership, client relations and service, marketing and communications.

The Core Database and Database Management

The Knowledge Base – Information Management System (KB-IMS) provides an easy-to-use front-end to update, maintain and describe the data sets in the database so that they are accessible to the user through DIAS, WIAS and any other custom-built applications.

The database will be dynamic. Changes will be made on an ongoing basis as existing data sets improve in quality, coverage and accuracy, and as new data sets are created and made available.

Land Cover Classification System

The recently developed Land Cover Classification System (LCCS) is a comprehensive, standardized *a priori* classification system, designed to meet specific user requirements. It was created for mapping exercises independent of the scale or means used to map. Any identified land cover anywhere in the world can be readily accommodated. The classification uses a set of

independent diagnostic criteria that allow correlation with existing classifications and legends. Land Cover Classes are defined by the combination of a set of independent diagnostic criteria, the so-called classifiers, which are hierarchically arranged to assure a high degree of geographical accuracy. Because of the heterogeneity of land cover, the same set of classifiers cannot be used to define all land cover types. The hierarchical structure of the classifiers may differ from one land cover type to another. Therefore, the classification is designed to operate through two main phases:

- an initial dichotomous phase, where eight major land cover types are distinguished; followed by
- a subsequent modular-hierarchical phase, where the set of classifiers and their hierarchical arrangement are tailored to the major land cover type. This allows the use of the most appropriate classifiers and reduces the total number of combinations of classifiers by eliminating impractical combinations.

Because of the complexity of the classification and the need for standardization, software – currently in beta version – has been developed to assist the interpretation process. This will reduce inconsistencies between interpreters and between interpretations over time. Because of the flexible manner in which the classification is set up – with creation of classes at different levels of the system and the optional use of modifiers, environmental attributes and specific technical attributes alone or in combination – and the tremendous number of classes possible, this innovative software program assists the user to select the correct class through a stepwise progression, i.e. classifier by classifier. This software will be available as a stand-alone product as well as integrated into a digital image interpretation software suite that will allow interpretation of imagery, followed by labelling of the mapping units with the land cover classes.

The classification system results in a mutually exclusive Land Cover Class, which comprises:

(1) a unique Boolean formula (a coded string of classifiers used);

(2) a standard name; and

(3) a unique numerical code.

Both the numerical code and standard name can be used to automatically generate a map Legend with the classes created grouped according to the main land cover categories and their domains, according to the level of detail. The nomenclature can be linked to a user-defined name in any language.

Further definition of the Land Cover Class can be achieved by adding attributes. Two types of attributes, which form separate levels in the classification, are distinguished:

- ***Environmental attributes*** These are attributes (e.g. climate, landform, altitude, soils, lithology, erosion, etc.) that influence land cover but are not inherent features of it, and so should not be mixed with 'pure' land cover classifiers.
- ***Specific technical attributes*** These attributes relate to the technical discipline (thus, for (Semi-)Natural Vegetation, the Floristic Aspect can be added; for Cultivated Areas, the Crop Type, and for Bare Soil, the Soil Type).

All *Primarily Vegetated* land cover classes conceptually that a consistent physiognomic-structural approach, combining the classifiers *Life Form*, *Cover* and *Height* (in (Semi-)Natural Vegetation) and *Life Form* (in Cultivated Areas) with *Spatial Distribution*. The *Primarily Non-Vegetated* classes take a similar approach, using classifiers that deal with surface aspects, distribution or density, and height or depth.

The advantages of the classifier, or parametric, approach are manifold. The system as developed is a highly flexible, *a priori* land cover classification in which each land cover class is clearly and systematically defined, thus providing internal consistency. The system is truly hierarchical and applicable at a variety of scales. Re-arrangement of the classes based on re-

grouping of the classifiers used facilitates the extensive use of the outputs by a wide variety of end users. An accuracy assessment of the end product can be generated by class or by the individual classifiers forming the class. Any occurring land cover can be accommodated in this highly flexible system, so the classification could serve as a universal applicable reference base for land cover, thus contributing towards data harmonization and standardization.

AIMS

Introduction

Within the framework of the Africover Programme for African countries, it was necessary to analyse and interpret a very large amount of satellite imagery to generate digital cartography at 1:200 000 or 1:250 000 scale (with 1:100 000 scale needed for some specific areas). For example, for the East Africa module (implemented under Italian Trust Fund project GCP/RAF/287/ITA) of the Africover Programme, approximately 400 images had to be processed and interpreted in order to extract around 1 000 map sheets. To enable easy, rapid and accurate satellite image analysis and interpretation, and integrated image processing and analysis, an efficient software tool was required.

Existing available commercial software packages did not fulfil all the required functions; it was therefore necessary to develop a system through the integration and upgrading of existing software. The system had to be based on an available Image Processing (IP) software program, modified to support special functions. As developed, it includes specific software program modules developed within FAO, and in particular it integrates the FAO-developed LCCS to help imagery classification and interpretation. The Africover Interpretation and Mapping System (AIMs) image processing software is a module devoted to on-screen image interpretation with specific functions, as described below.

The core of the standard IP package – the Multiscope software suite from MATRA Systems & Information – contains all the basic IP functions, with particular emphasis on the following functional capabilities:

- import various raster image formats and ancillary data;
- georeference, register and rectify imagery;
- apply radiometric corrections (atmospheric interference correction, functions that fix problems in images that result from scanner operations);
- radiometrically enhance imagery (contrast stretching, histogram equalization and histogram matching);
- spectrally enhance imagery (principal component analysis, etc.); and
- classify images.

Basic concepts of AIMs

1. ***Functions for working site and production management***

The AIMs module includes a database and interactive tools for data base management (creation, consultation, modification) of documents (maps) to be produced. The project activities envisage the application of the AIMs software through interactive designation either by sheet name or number, through pointing on a graphical worksite map or by designation of coordinates (geographic and cartographic systems). The database must make possible the display of the general overview of the project working area (up to 900 sheets), and provide a detailed view of a region. The display indicates geographic frames of sheets (maps) and existing original images and results files, vectorial and processed images. The working management tool guides the production sequence and launches map editing either directly from the working site or sub-working site, or organized in work packages for each operator.

2. ***Continuous georeferenced working space***

The AIMs module works on a predefined geographic area. When a working area is defined in geographic coordinates, all data (and only such data) that belong to this geographic area can be retrieved and used. The photointerpreter must be able freely to work in this "georeferenced working space" and be able to draw polygons in a multiple window environment from one image or ancillary data (scanned raster maps, vector polygons or lines) to another one without any limitation of data mosaicing, different data spatial resolution, or different type of localization systems used in different documents (cartographic or geographic).

3. ***User-defined working scale***

The user of the AIMs module is able to pre-set a user-defined working scale. A relation between size of the georeferenced working space, the data and screen resolutions, and the chosen scale is set up in order to allow the user to work on the screen, at the scale chosen, independent of the type of data (with different resolution) used. The user is able to roam, at the defined scale, inside the whole georeferenced working space, or to select one of the sub-areas into which the total working space is divided (defined by the system). It is possible at any point of the interpretation work to obtain an overview of how the total area (georeferenced working space) has been subdivided, to load new sub-areas or to identify those for which the work has been completed.

4. ***Basic digital image processing functions***

AIMS has all the basic image processing functions on line (mainly radiometric/spectral enhancement, filter and classifications functions).

5. ***Link with LCCS software***

The AIMS module must have a direct link with the LCCS developed by FAO. The LCCS is an expert system programmed in Microsoft Access that allows the user to create any type of land cover classes, saving them in a specific database called Legend.

The LCCS software is completely integrated in the AIMS module and will assist the user during the interpretation work for polygon encoding. The LCCS Legend Module must always be active in AIMS. When the user has generated a vector polygon, a simple double click on a specific class in the Legend will generate automatic encoding. To generate a Legend list, the user must have previously generated a number of classes in the LCCS Classification Module. This action, i.e. generation of a class, can be repeated at any time the user defines a new class that is not already present in the Legend list; in this case, the LCCS Classification Module is expected to be activated. The class is then generated and automatically saved in the Legend list. Subsequently, encoding of the polygon continues as explained above.

The other two modules of LCCS, namely the Field Data Module and the Translator Module, are also integrated.

SECTION 2 – PROJECT PLAN

PROJECT HIGHLIGHTS – EXECUTIVE SUMMARY

An "Information Management Solution"

The implementation of an IM solution will enable improvements in the operational and management effectiveness of MoA and provide new opportunities for programme efficiency and synergy. FAO has a great deal of expertise in quickly and effectively putting together an integrated land information management solution, and has a number of the key technology and management components available. The project plan indicates how an IM solution can be rapidly and inexpensively achieved.

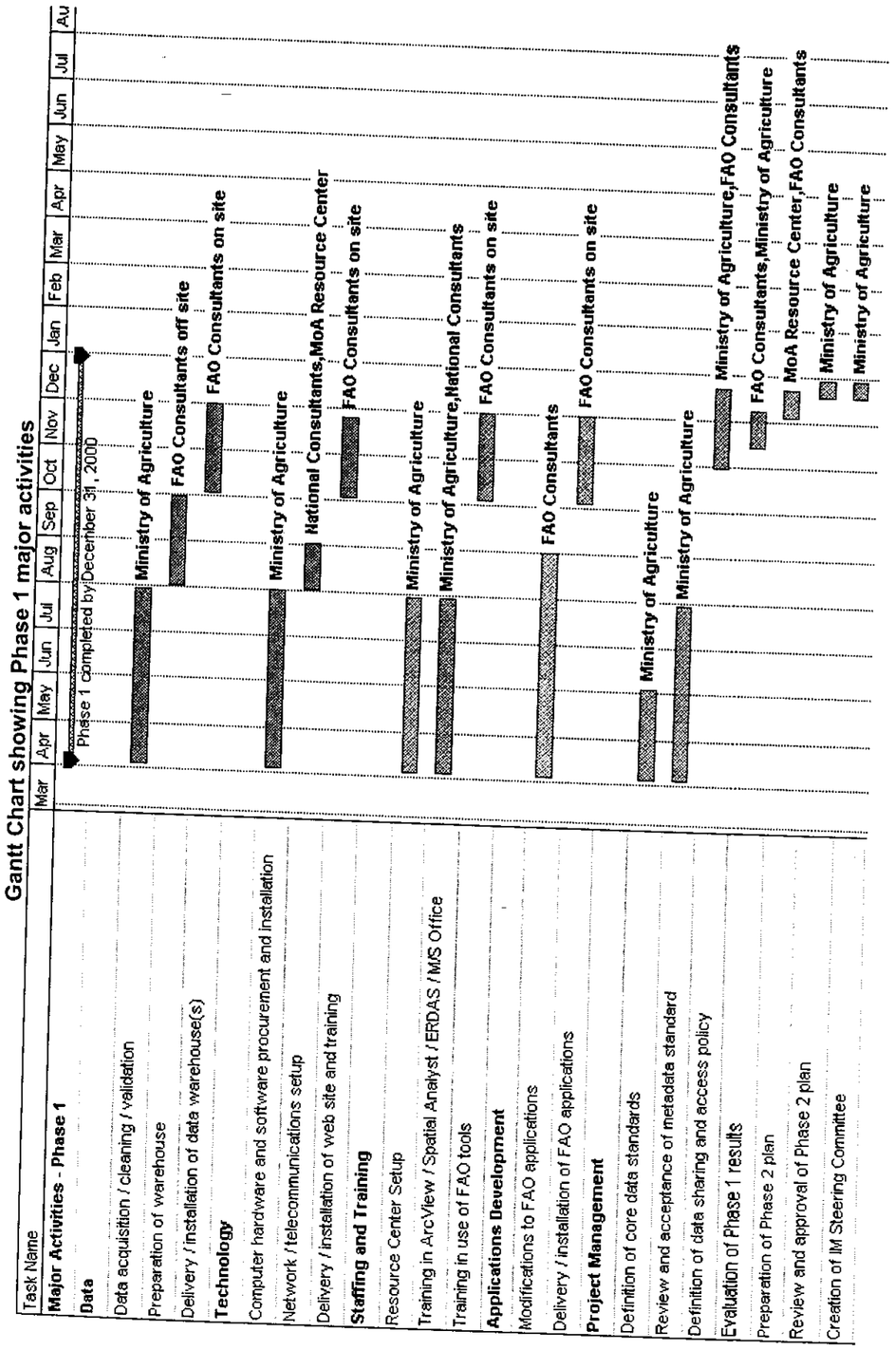
An IM Solution looks at a number of related components and aims to produce an integrated system. Specifically, this project will deal with:

- The data and information holdings available to and used within MoA and its partners.
- The technology applications and technology architecture available and required to enable publishing, access and sharing of the information.
- The staff capacity and overall management requirements to ensure the information and technology are used and useful in meeting business needs.

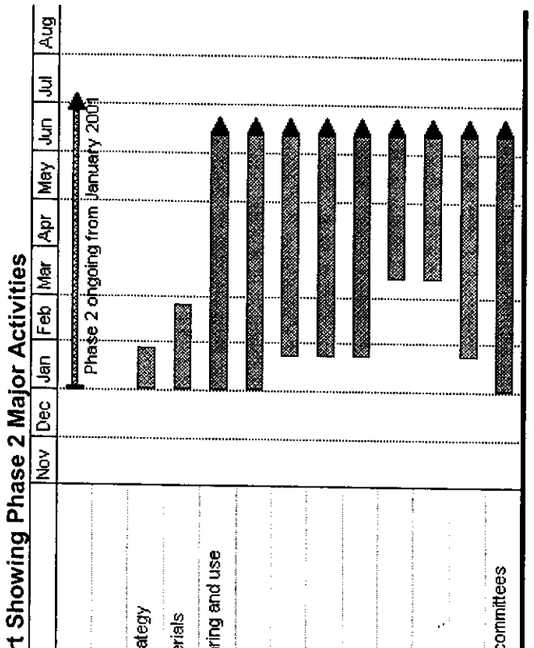
SUMMARY OF PROJECT DELIVERABLES

This table provides a summary of the expected project deliverables.

Phase	Deliverables	Timing
Phase 1 – Data	Data gathered for Core Database (vector data and raster imagery; Agricultural Census)	To May 2000
	Data conversion and validation	1 April – 31 July
Phase 1 – Custom Applications	Modification of FAO tools (DIAS & WIAS) to support Lebanon imagery data	1 April – 31 August
	Delivery and installation of FAO Tools: DIAS, DBA KB-IMS, WIASMaps, WIASDocs, AIMS, LCCS	September – November
Phase 1 – Training	Core technology training: ArcView, ArcView Spatial Analyst, ERDAS, MS Office	1 April – 31 July
	Training in use of FAO tools and custom applications	September – November
Phase 1 – Management Policy and Standards	Creation and staffing of the Resource Centre	1 April – 31 July
	Creation of Information Management Steering Committee	November – December
	Review and acceptance of metadata standard	1 April – 31 July
	Definition of core data standards (codes, names, etc.)	1 April – 31 May
	Definition of data sharing and information access policy	November – December
Phase 1 – Technology	Procurement and installation of system software, NT server, workstations, printers, plotter, scanner, network, etc.	1 April – 31 July
Phase 1 – Evaluation	The evaluation will, in part, be an ongoing process since open and frequent communications are a key principle in the project. A formal evaluation with report will be prepared following the installation of the database and FAO tools, and training.	15 November – 15 December 2000
Phase 2 – Data	Updates to core database	Begin January 2001
Phase 2 – Custom Applications	To be determined	Begin January 2001
Phase 2 – Generic Tools	To be determined	Begin January 2001
Phase 2 – Training	To be determined	To be determined.
Phase 2 – Policy and Standards	To be determined	Begin January 2001
Phase 2 – Technology	To be determined	Begin January 2001



Gantt Chart Showing Phase 2 Major Activities



Task Name
Major Activities - Phase 2.
Development of marketing / communications strategy
Preparation of marketing / communications materials
Partnership development in support of data sharing and use
New data collection
New data clean-up / validation / updates
Inclusion of new data into warehouse
Dissemination of data to partners
Dissemination of FAO tools to partners
Training in use of FAO tools
Development of new applications
Development of user support mechanisms and committees

Data

One of the first activities is building the core database using the data that are already available. The database will be delivered in Phase 1 with the FAO tools. The use of the data along with the metadata will help support the development and establishment of data standards. Data gathering, conversion, cleaning, validation and database build up should take place between 1 April and 31 July 2000.

The following table identifies several data sets that could form the initial core database, and the associated action items needed to create an integrated spatial and tabular database.

Data Set (G = geographic; T = tabular)	Description	Action and Responsibility
Land cover (G)	Converted into digital format.	Validate and quality control (QC) – MoA. Create metadata description – MoA. Transform to LCC map projection – Database (DB) Consultant. Load into Lebanon Warehouse – DB Consultant.
Land use (G)	Converted into digital format.	Validate and QC – MoA. Create metadata description – MoA. Transform to LCC map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.
Contours/Digital Elevation Model (DEM)	Converted into digital format.	Validate and QC – MoA. Create metadata description – MoA. Transform to LCCS map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.
Slope and Aspect		Generate layers from DEM – FAO. Create metadata description – MoA. Transform to LCC map projection – DB Consultant. Load into Lebanon DB – DB Consultant.
Road Network (G)	Converted into digital format.	Validate and QC – MoA. Create metadata description – MoA. Transform to LCC map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.
Rivers (G)	Converted into digital format.	Validate and QC – MoA. Create metadata description – MoA. Transform to LCC map projection — DB Consultant. Load into Lebanon Warehouse – DB Consultant.
Country boundary (G)	Converted into digital format.	Validate and QC – MoA. Create metadata description – MoA. Transform to LCC map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.
Mohafazall areas and names (G)	Converted into digital format.	Validate and QC – MoA. Standardize names and codes – MoA. Create metadata description – MoA. Transform to LCCS map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.

Data Set (G = geographic; T = tabular)	Description	Action and Responsibility
Caza areas and names (G)	Converted into digital format.	Validate and QC – MoA Standardize names and codes – MoA Create metadata description – MoA Transform to LCC map projection – DB Consultant Load into Lebanon Warehouse – DB Consultant
City and town sites and names (G)	Converted into digital format.	Validate and QC – MoA. Standardize names and codes – MoA Create metadata description – MoA Transform to LCCS map projection – DB Consultant Load into Lebanon Warehouse – DB Consultant
ReforII (G)	Converted into digital format.	Validate and QC – MoA Standardize names and codes – MoA Create metadata description – MoA Transform to LCCS map projection – DB Consultant Load into Lebanon Warehouse – DB Consultant
Composite imagery (G)	Converted into digital format.	Validate and QC – MoA Create metadata description – MoA Encode into MrSID format – DB Consultant Load into Lebanon DB – DB Consultant
Village areas (G)	Mapped onto 122× hardcopy base maps using clear film overlay.	Obtain price quotation for digitizing/purchasing – MoA/FAO Convert data into GIS-ready format and/or purchase existing data – Data Conversion Contractor Validate and QC – MoA Standardize names and codes – MoA Create metadata description – MoA Transform to LCCS map projection – DB Consultant Load into Lebanon Warehouse – DB Consultant
Soil maps (G; 1:200 000 scale)	Approx. 36× hardcopy maps.	Obtain price quotation for digitizing/purchasing existing data – MoA/FAO Convert data into GIS-ready format if necessary – Data Conversion Contractor Validate and QC – MoA Standardize names and codes – MoA Create metadata description – MoA Transform to LCC map projection – DB Consultant Load into Lebanon Warehouse – DB Consultant
Climatic zones (G)	1× hardcopy maps, 1:200 000	Obtain price quotation for digitizing/purchasing existing data – MoA/FAO. Convert data into GIS ready format if necessary – Data Conversion Contractor. Validate and QC – MoA. Standardize names and codes – MoA. Create metadata description – MoA. Transform to LCC map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.

Data Set (G = geographic; T = tabular)	Description	Action and Responsibility
Geological maps (G)	1× hardcopy maps, 1:200 000	Obtain price quotation for digitizing/purchasing existing data – MoA/FAO. Convert data into GIS-ready format if necessary – Data Conversion Contractor. Validate and QC – MoA. Standardize names and codes – MoA. Create metadata description – MoA. Transform to LCCS map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.
Hydrogeology map (G)	1× hardcopy maps, 1:200 000	Obtain price quotation for digitizing/purchasing existing data – MoA/FAO. Convert data into GIS-ready format if necessary – Data Conversion Contractor. Validate and QC – MoA. Standardize names and codes – MoA. Create metadata description – MoA. Transform to LCC map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.
Soil fertility map (G)	1× hardcopy maps, 1:200 000	Obtain price quotation for digitizing/purchasing existing data – MoA/FAO. Convert data into GIS-ready format if necessary – Data Conversion Contractor. Validate and QC – MoA. Standardize names and codes – MoA. Create metadata description – MoA. Transform to LCC map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.
Forestry maps (G)	27× hardcopy maps	Obtain price quotation for digitizing/purchasing existing data – MoA/FAO. Convert data into GIS-ready format if necessary – Data Conversion Contractor. Validate and QC – MoA. Standardize names and codes – MoA. Create metadata description – MoA. Transform to LCCS map projection – DB Consultant. Load into Lebanon Warehouse – DB Consultant.
Agricultural Census (T)	Data resides in proprietary format.	Complete data validation and clean-up – MoA. Standardize census unit naming and coding – MoA. Transfer data from proprietary format into MS Access DB. – MoA. Integrate tabular data with spatial data – DB Consultant.

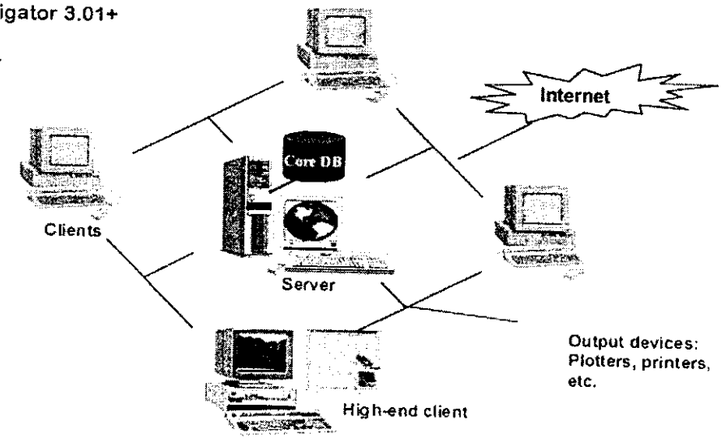
TECHNOLOGIES

Most system components will use commonly available and familiar technologies to ensure the system is inexpensive, and easy to integrate and upgrade. This emphasis on common formats ensures technology is readily available and supported, and it will not become obsolete as newer, better technologies are introduced, but can be easily upgraded to meet those new benchmarks.

Typical Client Configuration

- Windows '95+ operating system
- Pentium, 32+ Mb RAM, etc.
- Internet / network access
- Web browser: IE 4+ or Netscape Navigator 3.01+
- DIAS, WIAS
- MS Office '97+

Client – Server Architecture



Resource Centre software:

3× MS Windows NT Workstation Licences

1× MS Windows NT Server v.4 Licence with 10 Client Connects

3× ESRI ArcView v3.2 Licences

1× ESRI ArcView Spatial Analyst Licence

25× ESRI MapObjects Deployment Licences for DIAS

1× ESRI IMS Licence

4× M/S Office 2000 Professional Licences (includes FrontPage 2000)

1× Arcada Back-up Software Licence

Resource Centre Hardware:

1× Main Office Server

- Pentium 500+ MHz
- 256+ Mb RAM,
- 25+ Gb SCSI HD (1× 5 Gb, 1× 20 Gb or 2× 10 Gb))
- 8+ Mb SVGA
- 17" Monitor
- High-Speed Ethernet Card 10/100 Mb
- 1× 56 kbs modem
- UPS (30 minute capacity)

2× High-End Client Workstations

- Pentium III 500+ MHz
- 256+ Mb RAM
- 8+ Gb SCSI HD minimum or larger
- 21" Monitor, 8+ Mb SVGA
- 10/100 Mb High-Speed Ethernet Cards
- 2× 56 kbs modems

1× Medium Client Workstation

- Pentium III 450+ MHz
- 128 Mb RAM
- 8+ Gb IDE HD minimum or larger
- 19" Monitor, 8+ Mb SVGA
- 10/100 Mb High-Speed Ethernet Card
- 1× 56 kbs modem

Other Resource Centre Hardware

1× A3 colour ink jet printer (letter size)

1× External CD Writer (4× or better speed)

1× A0 size colour plotter with scanning head or separate scanner

2× Laser printers, minimum LaserJet 5 or equivalent

1× A0 digitizing table

3× UPS (15+ minute capacity)

1× Backup unit (20 Gb capacity)

1× Network hub – 8 connections

4× RJ45 Network Drops and Connections between Server and Clients (Using at a minimum Enhanced Category 5 cable)

1× Connect to existing MoA network.

1× Dial-up ISDN (56 kbs) Internet connection.

1× Internet Registration for 2 years of the web site name.

INFORMATION MANAGEMENT AND STAFFING

Information Policy

With the advent of the system and the new ability to access information, policy issues such as information access, dissemination, copyright, etc., will become very timely. This will translate into the establishment of information management committees in Phase 2.

Spatial data are more valuable when they are available for use, implying policies that support access. Leadership from senior levels in the government and MoA will be essential in ensuring that appropriate policies are put in place that support access and use, while ensuring appropriate security for those data that should not be shared. Generic information access policies that support data access and sharing among a partnership or more broadly can be quickly tailored to reflect the needs of the organization.

Clear information access policies not only mean the data are more likely to be used, but also support the development of partnerships, the acceptance of data standards, and the ongoing maintenance of the data set. Partnerships will be supported through policy and agreement, as well as through the generic information technology tools noted above.

Data standards will become more broadly accepted as the data themselves become more widely available and used.

Metadata are "data about data" and reflect the content, currency, contact, spatial extent, etc., of the information holding. Metadata are essential in developing a reliable catalogue of available data sets, maintaining and enhancing their value and use, and facilitating the establishment of data sharing and maintenance partnerships. The metadata standard being implemented in the system reflects all types of information holdings, including spatial data (image, raster and vector data sets), tabular data sets, and "document-type" information holdings – publications, audio-visual productions, paper maps, etc.

Management Framework

An Information Management Steering Committee drawn from senior management from all departments and agencies involved will provide ongoing overall priority setting and decision making.

An Information Management Technical Committee or sub-committees would address common requirements for data standards development, data collection, partnership and business synergy identification, training opportunities, web site development, etc.

A Resource Centre will provide database management and network administration. The Resource Centre would also take a lead role in client service – providing advanced mapping and information analysis functionality, client software trouble-shooting, capacity building, etc.

Staff capacity building and training

During the early part of Phase 1 and prior to the installation of the generic tools and core database, staff in the Resource Centre will be trained in the use of basic technology tools – such as Microsoft Windows, MS Office (MS Word; MS PowerPoint, MS Excel), along with Microsoft Access, ArcView, GIS concepts, database management concepts, web and network management, FrontPage, ERDAS, remote sensing, etc., on an as-needed basis so that they are prepared for the implementation of the new technology and the associated specialized training.

The second stage of the training in Phase 1will deal with training of Resource Centre staff and others in the use of the FAO technology tools. For some positions, there will be more advanced or application-specific training. The overall training programme is outlined below.

Staff Person	Training Requirements
Unit Coordinator	Project Planning and Management
	Financial Planning and Control
	Communications and Presentation
	MS Project, MS Excel, MS PowerPoint
	FAO Tools: DIAS, DBA KB-IMS, WIASMaps, WIASDocs, LCCS, AIMS
GIS Specialist	MS Windows (Intermediate)
	MS Excel, MS PowerPoint, MS Access (Intermediate)
	GIS Concepts (Advanced)
	Spatial data conversion, handling and structuring (Advanced)
	ESRI ArcView GIS, Spatial Analysis and Data Automation Kit (Advanced)
	FAO Tools: DIAS, DBA KB-IMS, WIASMaps, WIASDocs, LCCS, AIMS (Advanced)

Staff Person	Training Requirements
Database Management Specialist	MS Windows (Intermediate)
	MS Excel, MS PowerPoint, MS Access (Advanced)
	Relational database management concepts (Advanced)
	Tabular data conversion, handling and structuring (Advanced)
	FAO Tools: DIAS, DBA KB-IMS, WIASMaps, WIASDocs, LCCS, AIMS (Advanced)
Remote Sensing Specialist	MS Windows (Intermediate)
	MS Excel, MS PowerPoint, MS Access (Intermediate)
	Remote sensing and image processing concepts (Advanced)
	Image data conversion, handling and structuring (Advanced)
	ERDAS (Advanced)
	FAO Tools: DIAS, DBA KB-IMS, WIASMaps, WIASDocs, LCCS, AIMS (Advanced)
System and Network Administrator(s)	MS Windows administration (Advanced)
	Networking (Advanced)
	Web server administration (Advanced)
	Web site authoring using MS FrontPage (Advanced)
	MS Excel, MS PowerPoint, MS Access (Intermediate)
	FAO Tools: DIAS, DBA KB-IMS, WIASMaps, WIASDocs, LCCS, AIMS (Advanced)

Resource Centre staff roles and responsibilities

The Resource Centre will be the focal point for customer service, and for system and database maintenance. Staff will also be key facilitators in the development of data standards and policies.

The Resource Centre will be established as soon as possible (prior to 31 July 2000) to ensure that appropriate training and skills are in place for the delivery of the network and systems technology and applications.

Specifically, the roles and responsibilities of the Resource Centre and its staff will include:

- Being a "centre of excellence" to which MoA staff and eventually its partners will turn for advice and direction on the use of GIS and database-related technologies.
- Being a "centre of excellence" to which MoA staff and eventually its partners will turn for advice and direction on the use of data to support their information requirements.
- Being a "centre of excellence" to which MoA staff and eventually its partners will turn for advice and direction on the use of the FAO tools, the web site, and metadata to support their information requirements.
- Providing data and system administration and being responsible for maintaining the warehouse(s). This includes:
  - Registering or modifying map layers so that they are available to users of DIAS and the web site at a scale and with rendering properties that are most appropriate.
  - Creating new thematic map layers from the data available that enable trends and key features of the data to be easily shown.
  - Registering tabular data sets so that their records can be tied to the features of an individual map layer(s).
  - Creating topics for the web site that best reflect the end user's needs in terms of the map layers and data sets available for a particular topic.
- Maintaining and supporting the development of the web site.
- Maintaining and supporting the development of the categories ("filing system") used for documents within WIASDocs, along with supporting the use of WIASDocs within MoA for publishing information.

- Support the use and collection of data in MoA through the development and publication of standard codes and naming conventions and other means.
- Provide advanced information product generation – such as high quality maps – using advanced cartographic tools.
- Undertake special projects for MoA related to the sharing, maintenance and management of ministry information.

RESOURCE CENTRE POSITIONS AND FUNCTIONS

Resource Centre Coordinator

The Coordinator will be responsible for:

- managing all unit staff activities;
- identifying and scheduling staff activities;
- working with other ministry units to provide information management support on an as-needed basis;
- marketing the unit's services and capabilities to other ministry units;
- promoting the unit's activities and the use of GIS/DB technologies among other potential users and benefactors;
- creating appropriate staff training opportunities;
- implementing and managing various data standards and policies necessary to ensure data sharing and compatibility among the ministry units and across ministries;
- ensuring adequate resources are available to staff to perform their work; and,
- securing technical support for staff to complete tasks as required.

Skills should include:

- project planning;
- project management;
- communications and presentation;
- understanding of GIS and DB concepts and possibilities;
- working knowledge of ministry information requirements, organizational structures and processes; and;
- inherent knowledge of ministry data sets and their use by the ministry.

GIS Specialist

The GIS Specialist will be responsible for:

- compiling and converting existing and new spatial data sets and databases;
- processing various data sets to create required or requested map-based information products for unit clients;
- identifying and demonstrating how spatial data processing tools can be used to support MoA's information management needs;
- working with ministry programme units to define appropriate data standards to be used for data collection and management; and
- ensuring that the GIS technology is in proper working order and operational.

Skills should include:

- Advanced working knowledge of:
  - mapping and cartography;
  - GIS concepts and digital data handling;

  - data conversion and structuring;
  - MS Windows 98/NT, Excel, PowerPoint and Access;
  - ESRI ArcView GIS; and
  - custom FAO software tools, including: DIAS, DBA KB-IMS, WIASMaps, WIASDocs;
- ability to translate user information requirements into information products;
- ability to work with others and develop new ideas and ways of doing things; and
- supporting and working with other ministry GIS users.

Database Management Specialist

The Database Management Specialist will be responsible for:

- compiling and converting existing and new tabular data sets and databases;
- managing the integrated database for the ministry;
- processing various data sets to create required or requested tabular information products;
- identifying and demonstrating how database management tools can be used to support the ministry's information management needs;
- working with ministry programme units to define appropriate data standards to be used for data collection and management; and
- ensuring that the database management technology is in proper working order and maintained as per the manufacturers specifications.

Skills should include:

- Advanced working knowledge of:
  - relational database management;
  - MS Access;
  - tabular data conversion and structuring;
  - MS Windows 98/NT, Excel, PowerPoint; and
  - custom FAO software tools, including: DIAS, DBA KB-IMS, WIASMaps, WIASDocs;
- ability to translate user information requirements into information products;
- ability to work with others and develop new ideas and ways of doing things; and
- supporting and working with other ministry database users.

Remote Sensing Specialist

The Remote Sensing Specialist will be responsible for:

- compiling and converting existing and new remotely-sensed data sets;
- helping to manage the integrated database for MoA;
- processing various data sets to create required or requested map-based information products;
- identifying and demonstrating how remote sensing and image processing tools can be used to support the ministry's information management needs;
- working with ministry programme units to define appropriate data standards to be used for data collection and management; and
- ensuring that the image processing technology is in proper working order and maintained as per the manufacturers specifications.

Skills should include:

- Advanced working knowledge of:
  - remote sensing technology and concepts;

- image processing technology and concepts;
- ERDAS image processing software
- MS Windows 98/NT, Excel, PowerPoint, Access, and Paint Shop Pro;
- ESRI ArcView GIS; and
- custom FAO software tools, including: LCCS, AIMS, DIAS, DBA KB-IMS, WIASMaps, WIASDocs;

➢ ability to translate user information requirements into information products;
➢ ability to work with others and develop new ideas and ways of doing things; and
➢ supporting and working with other ministry remote sensing and image users.

System and Network Administrator

The System and Network Administrator will be responsible for:

➢ installing the unit's technology (hardware, software and networking);
➢ ensuring the server is properly administered and managed;
➢ ensuring the internet connection is maintained and working properly;
➢ developing and managing the project's web site.
➢ managing the unit's technology resources;
➢ ensuring that the unit's technology is in proper working order and maintained as per the manufacturers specifications;
➢ providing technical support to system users; and
➢ working with ministry programme units to define appropriate technology standards;

Skills should include an advanced working knowledge of:

➢ relational database management;
➢ MS Windows 95, 98 and NT Workstation and NT Server;
➢ MS Excel, PowerPoint and Access;
➢ MS FrontPage and web site authoring and management; and
➢ custom FAO web tools, including WIASMaps and WIASDocs.

NATIONAL CONSULTANTS

The project will hire national consultants to carry out various information management support functions – using, in part, the questionnaire in Section 5 of the workbook. These nationally recruited consultants will continue to be available to the project on an ongoing basis. Their work will have a particular focus and impact in Phase 2 of the project.

The work of the national consultants will help develop indigenous capacity for MoA to develop and support the implementation of the project. Specifically, their work will help determine:

➢ the current and potential user community for the new MoA data, information and the technology tools; and
➢ the availability and usefulness of key data sets outside MoA.

This will also provide a footing for projects of a national scale – such as a National Spatial Data Infrastructure initiative, if funding and interest are there, since such an initiative would need to know who is doing what, where, the overlaps in data management, and gaps.

The information gathered by the national consultants will enable Phase 2 of the project to be clearly established with appropriate priorities, and key players and data sources understood. It will also identify significant gaps in data and technology so that an appropriate remedial plan can be

put in place. This would also include identification of gaps in Earth Observation (EO) technology and capability within MoA and elsewhere.

The consultant will undertake the following activities:

➢ Determine "best bets" for contacts and interview, i.e. develop a potential list of people and departments to be interviewed from within the government and elsewhere.
➢ Meet government representatives and others to determine the types of data and technology in use and whether or not there are potential sources of data for the project or potential "markets" for the project's information or technology.
➢ As appropriate, collect spatial data used or created in either digital or hard copy format. This would apply both to imagery and vector data sets.
➢ As appropriate, collect tabular data used or created.
➢ Create, document or collect metadata related to the data sets (including such information as ownership, projection, timeliness, completeness, accuracy, constraints, etc.).

Outputs:

➢ A report outlining what ministries, departments and other partners are currently the users of information; and their key information holdings.
➢ A report outlining best bets for MoA and the Resource Centre regarding with whom to work from outside MoA in developing sharing agreements and co-management of data.
➢ A report outlining best bets for MoA and the Resource Centre regarding the marketing of data products, technologies and information services.
➢ Identification of potential problem areas constraining the effective implementation of Phase 2 of the project. This would include technology infrastructure considerations, EO data availability, and the status of hardware and software for retrieval, processing, GIS analysis and dissemination, and general organization. The assessment would focus on people and their familiarity with the tools. This overview will provide the necessary basis for identifying critical gaps in the existing infrastructure and identifying what training will be required beyond that being offered in Phase 1.
➢ Ascertain the status of baseline data and information on the natural resource base, with a view to identifying potential sources of data of use to the project, and also to identify important gaps in the existing information-base, the form that these take and the level at which they are encountered.

Skills and experience desirable

The consultant should:

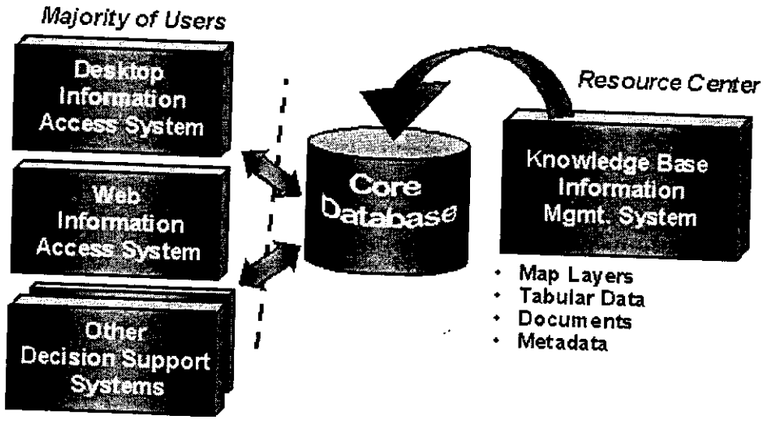
➢ Have experience in and understanding of modern database management, spatial data management, and remote sensing tools.
➢ Have experience in and understanding of identifying information management requirements.
➢ Have experience in and understanding of the businesses of the various sections within MoA.
➢ Have strong interpersonal and communications skills and the ability to identify information requirements, conduct interviews and meetings, and write reports in English.

SECTION 3 – FAO TOOLS AVAILABLE

INTRODUCTION

As a result of its mandated activities, FAO recognizes that needs of various organizations and jurisdictions throughout the world do not change much with respect to information management. Everybody needs easy and reliable access to information in a way that is user-friendly and inexpensive. Also, that information needs to be documented and managed so that it is understood and maintained to agreed standards. Hence FAO and it technology partner, Spatial Knowledge Engineering Inc., developed generic information publishing and access tools that enable organizations to publish, access and share their information, whether in the form of tabulated data, maps, or written documents.

These tools will form the backbone of the system to be implemented in support of MoA's information management needs. The tools and their technology and network architectures are outlined in more detail below.



The Knowledge Base - Information Management System

The database management tool known as the Knowledge Base - Information Management System (KB-IMS) is at the heart of the technology solution. Most other desktop mapping products and Internet publishing tools require the users to have an understanding of the underlying database structure and to know how to access the data. As a result, most people are unable to use them. With KB-IMS, database construction and management are done behind the scenes, so the user gets the data in a structured format without having to know where it is or how to read it.

With KB-IMS, the organization maintains virtually all its information in one structured corporate database, with one or many warehouses of data, thus promoting standards and data sharing. Once the data are registered, they are available for use on the desktop or through the Internet. All this takes place automatically, so there is no requirement to deal with computer languages (e.g.. HTML) and no need for e-mails to users to let them know new data are available and how to gain access to them.

KB-IMS is easy to learn and use. Each form indicates clearly what information is required, and on-line help is available for each field, together with a manual.

Specifically, KB-IMS and the Core Database handles:

- ***Spatial data and imagery,*** including tiled data sets and spatial "libraries." When spatial data are registered, their rendering characteristics are defined as well as the scale at which they should be rendered. In this way, the data appear in a logical colour, sequence, and at an appropriate scale when they are accessed through the desktop PC or the web. The user then chooses what map layers they want to see and use. KB-IMS handles spatial data in ESRI's coverage and shape file format and .tiff image files.
- ***Tabular data*** from popular databases, such as Oracle and Microsoft Access. The KB-IMS makes it easy to relate tabular data to spatial data so that users can easily use the link to identify spatial trends, create thematic maps, and undertake simple spatial analysis.
- ***"Documents"*** in any format. Any digital file can be published and made accessible, and because the system has built-in metadata, even documents in paper format can be made accessible via their digital descriptions (metadata). The Document Administration System is integrated within a web site and stores documents in meaningful categories that the organization defines and sets up. Staff use a simple Windows tool to upload their documents into a category(s) so that it is immediately available on the web site in its native form. No HTML coding is required.
- ***Metadata.*** KB-IMS enables all spatial, tabular and document data to have detailed and standardized descriptions (metadata) provided for them to support users' needs to understand the data they are using, and to support data standards development and sharing within and among organizations.
- ***Multiple "warehouses".*** Spatial data can have different projections or they can relate to completely different areas or features. KB-IMS enables separate warehouses of data as a way of logically and physically organizing "like" data together.

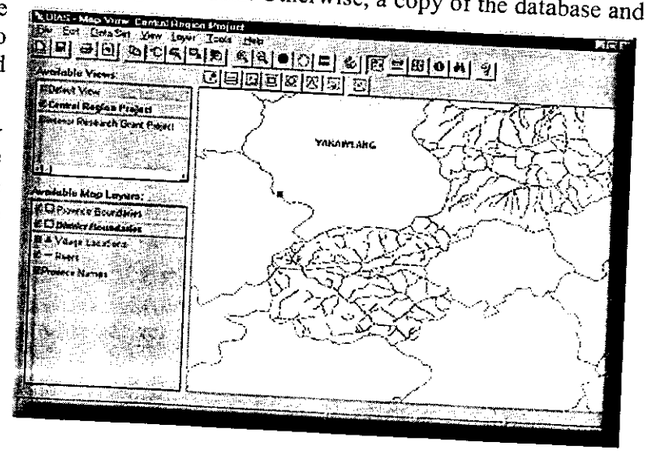
THE DESKTOP INFORMATION ACCESS SYSTEM

DIAS provides data and metadata access together with mapping and basic analysis capability under Windows 95, 98, and NT. In effect, it provides the mapping functionality required by most users in the majority of their business situations. DIAS has full on-line help features, as well as easy-to-read documentation, that help make it very straightforward to learn and use.

DIAS is generic, so instead of predefined applications, users decide what they need to do with the data – and then use its built-in functions to deliver the answers. DIAS provides easy access to and manipulation of geographic and associated tabular data presented in a spreadsheet format. With DIAS, the identification of map features and the generation of maps highlighting areas of interest are easily accomplished.

Specifically, DIAS:

- Runs on standard PCs. It can run in a standalone environment or on a Local Area Network (LAN) or Wide Area Network (WAN). When running on a network, DIAS simply looks to the Core Database to get the data. Otherwise, a copy of the database and the database management tool also need to be installed locally.
- Is generic, not business-specific, and therefore can be used by multiple disciplines for multiple data access, display and



manipulation requirements.

- Is easy to learn and use.
- Integrates directly with MS Excel for more advanced tabular data analysis.
- Integrates directly with MS PowerPoint for more advanced mapping output and easy integration of maps in slides and documents.
- Directly integrates with ESRI's ArcView for more advanced spatial analysis if necessary.

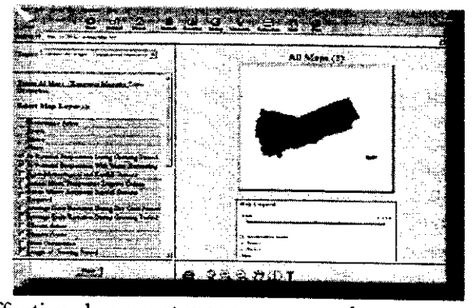
DIAS' built-in functionality enables users to:

- Access spatial data without having to know anything about the database and its structure.
- Create "views" of all or part of the geographic area of interest and its various features.
- Do simple geospatial analysis, such as finding map features, identifying features, measuring distance and measuring area.
- Select features and get associated tabular information without having to know anything about the database or how to connect to the tabular data.
- Query tabular data sets and see their associated map features highlighted, and vice versa.
- Do tabular analysis, such as selecting records, using basic mathematical functions and relationships, and sorting records.
- Design queries that quickly create subsets of the tabular database so that only particular records are left.
- Do "class rendering" of tabular data, to see spatial trends and produce thematic maps.
- Pass data seamlessly to Excel and ArcView for more sophisticated tabular and spatial processing and output.
- Render and label selected map features to emphasize their display.
- Quickly generate a hard-copy map.
- Send the map information to PowerPoint for advanced presentations.
- Get the metadata descriptions for the spatial and tabular data.

The Web Information Access System

WIAS brings the mapping and tabular data and metadata together on the Internet, thereby significantly enhancing the organization's ability to communicate with clients and share important information.

WIAS easily integrates with a web site to provide clients and staff with access to the core database, so that they can produce maps, identify features and determine what data are available and how to get them.



Map layers and tabular data sets are organized into "topics" so that the Internet client can quickly find the information needed or to create a map of particular interest. Before accessing any of them, clients can access metadata to determine what map layers and tabular data are potentially worthwhile retrieving. As the data change and are updated in the core database, these changes are immediately reflected on the web site.

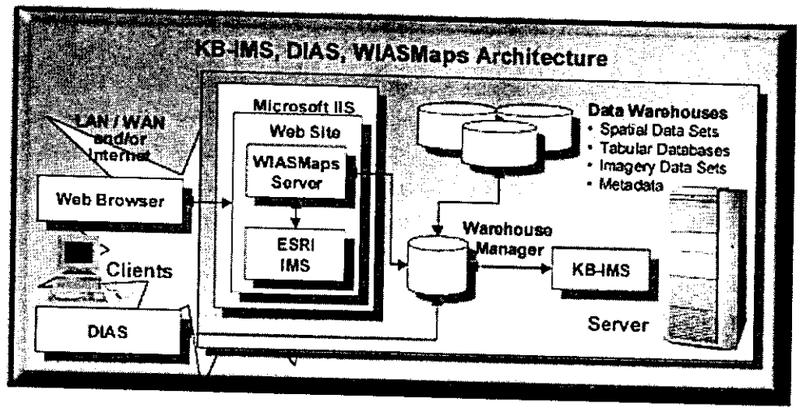
WIAS also includes a very simple and effective document management and access system that enables staff to create an electronic library. As a result, any document (be it a report, slide show, image, etc.), tabular database or spatial data layer can be made easily searchable and available online, anywhere. Clients search for the information using keywords or via special

categories that the organization established. Documents or any electronic file can be added to the system in their original format from anywhere in the organization using a simple Windows-based input tool, without requiring conversion to HTML. Even non-electronic documents can be registered via their metadata, providing clients and partners with a complete catalogue of information holdings.

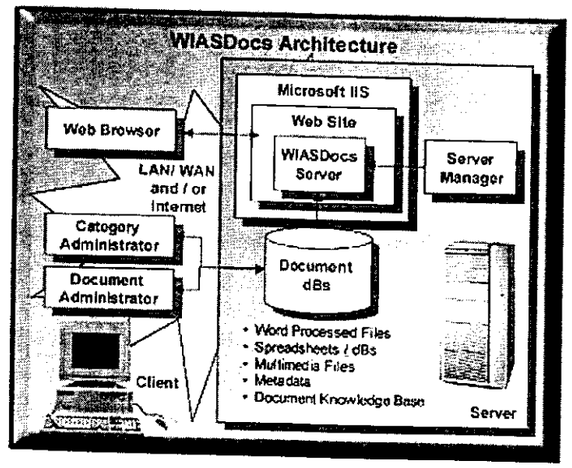
In addition, because WIAS runs on the corporate web server, no special software is required by the client to access the data, essentially rendering it a free service.

System architecture

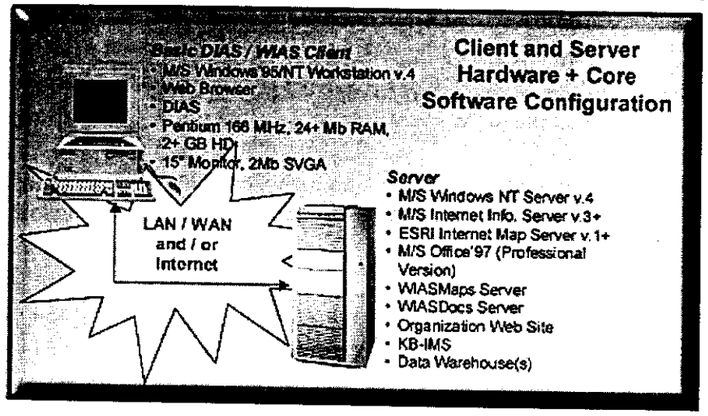
The next three diagrams help describe the system architecture. The first diagram illustrates the linkages among DB-KBIMS, DIAS and WIASMaps tools. The server is home to the data and the web-based technologies, as well as to some of the specific management tools. The client computers access the web site for WIASMaps and access the Warehouse Manager for DIAS. Both WIASMaps and DIAS access the same Data Warehouses.



For WIASDocs, a few more client software components are added, enabling the organization to maintain the categories in which the documents are stored (with the Category Administration tool) and upload and maintain the documents registered with the system (with the Document Administration tool). The documents themselves are accessed via the web site and a web browser over the Internet or Intranet.



The third diagram shows the basic client computer and server computer hardware and software configuration, purposely designed for easy access using today's common computing platforms.



SUMMARY:

FAO's integrated technologies provide:

A corporate database solution

Integrated spatial, tabular, and document data and metadata supporting generic desktop and web applications as well as any custom applications built to meet particular needs. The corporate integrated database also helps promote data sharing and establish standards.

A desktop solution

DIAS is an extremely useful and uncomplicated desktop solution, with a variety of features and powerful integration capabilities, bring to everyone the capability to use maps and tabular databases.

An Internet mapping solution

Integrated into the corporate web site, the spatial data are published and made easily accessible to anyone with a web browser. They are organized in topics so that visitors to the site can readily choose what maps and map layers they want to work with, and then they can zoom, pan, personalize the map, and print.

A document publishing and access solution

Users throughout the organization using the Document Administration tool can register any digital file immediately on the web site, making it available to a broad or select group of users.

SECTION 4 –METADATA STANDARD AND INPUT SYSTEM

INTRODUCTION

Metadata are summary descriptions of data sets and information holdings. They are important because they help promote the use of data standards, leverage partnerships, and make more achievable the vision of easy, one-window access for spatial data. However, metadata management can be difficult. Spatial data often come in large complex database structures with numerous object types. They come in a variety of different data formats. They come from different sources, each with its own way of describing things. They vary in spatial and temporal resolution. They range widely in quality. All these and more contribute to making difficult the documenting of spatial data in a consistent manner.

Metadata are data about data, and two common examples are:

- A **card catalogue** in a library brings together in a systematic way numerous cards that carry key information in standardized form about the books on the shelves – where to find them, title, subject, author, size, language, classification, etc.
- A **map legend** provides information about the map – of where it is, when produced, by whom, interpretation of key features, etc.

Metadata are an important ingredient in the overall success of an information management system, helping management and staff who use the data to find the data they need and determine how best to use it. Metadata will also benefit the organizations that produce the data. Undocumented data tend to lose their value over time, especially as people in an organization change. Staff later may not understand the contents and uses for the databases, and may not be able to trust results generated from these data. Not knowing about other organizations' data often leads to duplication of effort. So, although it means some work up front to generate metadata, it is worth it in the long run.

These complexities, though, also highlight the importance of metadata. Metadata can cut through the complexity to help describe what data sets and documents exist, their characteristics and their availability. Several jurisdictions around the world are working towards a successful metadata implementation. To do so means having:

- an accepted metadata standard;
- appropriate metadata input and search technology tools; and,
- a commitment for client and agency metadata collection and maintenance.

Benefits of the metadata standard

The metadata standard describes the format and characteristics of data elements to be used when collecting and describing information holdings, such as spatial data, tabular data and documents. It is not specific to a single organization or agency.

Having an accepted standard means that:

- Metadata are collected in a clear and systematic way.
- Metadata for a particular data set remain consistent over time as the data set is updated or added to.
- Similar data sets can be compared to determine their similarities and differences.
- The development of integrated access and input systems is encouraged.
- Others can understand and easily determine the potential usefulness of the data.

How the standard was determined

Three principles were important when developing the standard.

(i) ***Ease of input and use***. If the system and the standard are too bulky, too complex, have too many mandatory components, or are too difficult to understand, they will not be used.

(ii) ***Meet client needs***. What would they need to know about a data set if searching for information, such as What data are out there? What are they like? and How do I get them?

(iii) ***Collect adequate detail***.

In other words, developing the standard meant compromise and client consideration.

Relationship to other metadata standards

Other metadata standards exist and they all try to capture the key information relevant to the data set. For example, the FGDC spatial metadata standard created in the USA has received broad acceptance. Work is underway with other countries on the development, ratification and approval of the ISO Metadata Standard 19115. Other spatial metadata standards, such as ANZLIC (Australia) and the Dublin Core also do a good job in capturing key information.

With respect to metadata for tabular databases and document holdings, key elements of the GILS standard were used. In most cases, these matched exactly the metadata required for spatial data types (e.g. Contact Name; Creation Date; etc). Other fields, such as Document Identification Number, are unique among the three types of metadata standard (see the list of elements below).

The FAO system is set up to capture metadata for all three types of information (spatial, tabular and document), and therefore reflects a more uniform and universal approach to the development of a standard. The capture of metadata is built into the system rather than being an afterthought or secondary consideration. Also, this standard is much less bulky than the FGDC standard, and therefore should be much easier to adopt and use.

The key mandatory fields used in the FAO standard match the key mandatory fields required by other major spatial and non-spatial data metadata standards. This is very important in case, for example, you want to share metadata captured in another system. Although no database software has been developed to automatically permit this, an application could be developed, since the data captured are the important consideration.

Responsibilities for metadata

The FAO tools (KB-IMS and WIAS) have the metadata input capability built in. The metadata for spatial and tabular data are input into the system by the system administrator using the KB-IMS tool, although they are often not the best person to describe the data set. That is why the process needs to involve others in an organization. The typical process for metadata collection and input involves the following:

- Owners or custodians of the data set will use a standard input form to do the initial metadata input for the information holdings with which they are most familiar.
- Their completed forms will be received by the system administrator, via either e-mail, diskette or hard-copy paper.
- The system administrator checks the forms for completeness. In particular, all mandatory fields will need to be completed before KB-IMS will accept the metadata record. Mandatory fields include the contact name and geographic extent, together with some others.
- The system administrator inputs the metadata record for the data set into the database with the KB-IMS tool. The map layers and tabular data sets must themselves already be registered as part of the Core Database before the metadata can be input. This ensures that the metadata reflects actual data available.
- Once the metadata records are in the Core Database, they are then available to users of DIAS and WIAS.
- Note that the input process for providing metadata for registered documents does not need to involve the database administrator, since it is easily done by the user who inputs the document.

Metadata standard summary components

Standard Element	Map Layers	Tabular Data Sets	Documents
	Mandatory (M)	M	M
Data set name	M	M	M
Contact source (contact name or position; contact organization; telephone number)	Optional (X)	X	X
Contact source (postal address; email address; fax)	X	X	X
Originating organization (author, originating unit, parent organization)	M	M	M
Publication or creation date	X	X	X
Date comments	X	X	X
Status indicator			X
Publisher	X	X	X
Publication location	X	X	X
Link URL to other related information	X	X	X
Other information description			X
Document available elsewhere URL	M	M	M
Metadata date	M	M	M
Abstract			X
Document type			M
Document language			X
Document format			X
Document availability			X
Document Identification Number			X
Constraints	X	X	X
Data set size	X	X	X
Attribute reliability		X	
Geographic extent	X	M	
Positional accuracy	X		
Horizontal coordinate system	X		
Horizontal datum	X		
Map projection			

ANNEX 1
METADATA INPUT FORMS

MAP-LAYER METADATA INPUT FORM

This form should be distributed as an electronic file so as to take full advantage of its features.

Please read instructions:

(i) To go from field to field, use the {Tab} key or use your mouse.

(ii) Please make sure that ***all mandatory fields are answered.***

(iii) When complete, use "Save As" to rename the file to reflect the data set to which it refers.

(iv) Use as much space as necessary. To save time, cut and paste from other documents if available.

(v) For ***Help*** using any field, put your cursor in the field and press the {F1} function key.

Section 1. Map layer name and contact or originator information

Mandatory: Official name of the image or vector map layer.	Map Layer / Image Name
File name and format	File Name(s)
	Format of file
Mandatory: The name and / or position of the primary contact	**Primary Contact's Name and / or Position**
Contact's Organization	**Contact's Organization**
Postal Address	**Address**
Mandatory: Telephone number	**Telephone number**
Fax number	**Fax number**
Email Address	**Email address**
The name and / or position of the data set's **originator** (if same as contact, indicate "same".)	**Originator's Name And / Or Position**
Originator's Unit	**Originator's Unit**
Originator's Parent Organization	**Originator's Parent Organization**

Section 2. Important Date(s)

Mandatory: Creation / Update Date	**Update / Creation Date**	
Creation / Update Date details	**Date details**	
Status of map layer (choose one only)		**Complete**

Section 3. Related Information Holdings

Additional Information URL and description.	**URL**
	Description

Section 4. Content

Mandatory: Abstract	**Abstract**	
Constraints / liability	**Constraints**	
Should this map layer be available via the Web site?		Yes

Section 5. Spatial Information

Geographic extent	**Geographic Extent**
Average positional accuracy	**Average Positional Accuracy**
Datum	**WGS 80**
Horizontal Coordinate System	**Decimal Degrees**
Projection	**Geographic**

TABULAR DATA SET METADATA INPUT FORM

This form should be distributed as an electronic file so that its features can be taken advantage of.

Please Read Instructions:

1. **To go from field to field, use the {Tab} key or use your mouse.**
2. **Please make sure all mandatory fields are answered.**
3. **When complete, use "Save As" to rename the file to reflect the data set to which it refers.**
4. **Use as much space as necessary. "Cut and paste" from other documents if available to save time.**
5. ***For Help using any field put your cursor in the field and press the F1 function key.***

Section 1. Data Set Name and Contact / Originator Information

Mandatory: Official name of the tabular data set	**Tabular Data Set Name**
File name and format	**File Name(s)** **Format of file**
Mandatory: The name and / or position of the primary contact	**Primary Contact's Name And / Or Position**
Contact's Organization	**Contact's Organization**
Contact's Postal Address	**Address**
Mandatory: Telephone Number	**Contact's Telephone**
Contact's Fax	**Fax number**
Contact's Email Address	**Email address**
The name and / or position of the data set's **originator** (if same as contact, indicate "same".)	**Originator's Name And / Or Position**
Originator's Unit	**Originator's Unit**
Originator's Parent Organization	**Originator's Parent Organization**

Section 2. Important Date(s)

Mandatory: Creation / Update Date	**Update / Creation Date**	
Creation / Update Date details	**Date details**	
Status of information holding (choose one only)		**Complete**

Section 3. Related Information Holdings

Additional Information URL and description.	**URL**
	Description

Section 4. Content

Mandatory: Abstract	**Abstract**	
Data Set Reliability	**Reliability**	
Constraints / liability	**Constraints**	
Should this map layer be available via the Web site?		Yes

Section 5. Spatial Information

Mandatory: Indicate what map layer(s) should be used to georeference the data set (e.g. Districts, Constituencies, weather stations, etc.).	**Reference Map Layer**
Name the geographic features that the tabular data set reflects. Attach a list separately if necessary.	
Geographic extent comments.	**Geographic Extent Comments**

"DOCUMENT" DESCRIPTIONS INPUT FORM

Often users will have the WIASDocs Document Administrator application on their computer and hence will not need to register the document description in this way. This form can be used in those instances in which another person will register documents (such as the database administrator).

Instructions:

- **To go from field to field, use the {Tab} key or use your mouse.**
- **Please make sure all mandatory fields are answered.**
- **When complete, use "Save As" to rename your metadata description.**
- **Use as much space as necessary. "Cut and paste" from other documents if available to save time.**
- **For Help, put your cursor in the field and press the F1 function key.**

Your Name and Phone Number: _____

Tab 1. Identifier Information

Mandatory: Select the most appropriate **category / sub-category**.	**Category Name** If selection not available, provide new category name: **New Category**
Mandatory: The name of the document's digital file.	**File Name**
Author / Creator Name / Position	**Author / Position**
Originating Unit Name	**Originating Unit Name**
Parent Organization	**Parent Organization**
Mandatory: The name and / or position of the primary contact.	**Primary Contact's Name and / or Position**
Mandatory: Contact's Organization:	**Contact's Organization**
Postal Address:	**Address**
Mandatory: Telephone.	**Telephone number**
Fax:	**Fax number**
Email Address:	**Email address**

Section 2. Content Information

Mandatory: Abstract	**Abstract**
Constraints / liability	**Constraints**
Mandatory: Creation/Modification Date	**Creation/Modification Date**
Publication Status	**Status Indicator**
Publication Date Comments	**Date details**
Document Size	**Size**

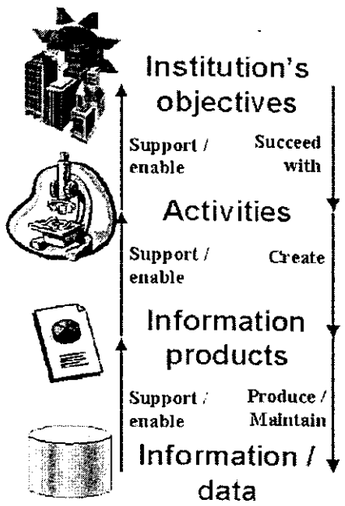
Tab 3. Document Information

Mandatory: Available language(s).	☒ **English;** ☐ **French;** ☐ **German;** ☐ **Spanish;** ☐ **Arabic;** **Other: Describe**
Document Type	**Document Type Choose 1.**
Document Format	**Document Format Choose 1**
Publisher Name	**Publisher Name**
Publication Location	**Publication location**
Document available online elsewhere?	**URL of Document or Site**
Additional Information URL and description.	**URL of additional information**
	Description

SECTION 5. SAMPLE INFORMATION MANAGEMENT QUESTIONNAIRE FOR THE MINISTRY OF AGRICULTURE

Your Name: Your Section: Department:

Introduction to the Questionnaire



In order to develop an information management strategy, your department's objectives, activities, products, and information sources need to be well understood. As illustrated in the diagram, the information or data you create and use supports the overall corporate goals. By improving this information and making it more accessible and useable, the Ministry of Agriculture, its departments and their sections as well as the clients you serve should all benefit. Realizing those improvements will be the ultimate goal of the information management strategy.

Please complete the following sections below. In many cases, you may already have some of these questions answered in other documents – such as in a Strategic Plan, Mission Statement, Work Plan, etc. If so, feel free to attach these or any other relevant document you feel would help us better understand what you do, why, and how.

SECTION 1. UNDERSTANDING YOUR SECTION'S OBJECTIVES

Please describe the key objectives of your section -- the main roles your section plays

1. _____
2. _____
3. _____
4. _____
5. _____

If this information is available instead in a document that you are attaching, please indicate the title of the document and where (page number or other reference).

Document Title: _____
Page(s) or Location: _____

SECTION 2. UNDERSTANDING YOUR SECTION'S ACTIVITIES

In order to meet your objectives and targets, your section probably has several ongoing activities and is likely involved in several projects.

Please list and briefly describe your section's Key Activities (for example: Budget Administration, Communications, Water Quality Testing, etc.) that reflect ongoing commitments.

Key Section Activity	Description

Please continue on another page if necessary.

If this information is available in a document that you are attaching, please indicate the title of the document and where (page number or other reference).

Document Title: _____;
Page(s) or Location: _____.

"Projects" usually have a specific timetable, objectives, and budget associated with them. Please outline the projects underway and/or planned in your section.

Section Projects	Description	Timing

Please continue on another page if necessary. If this information is available instead in a document that you are attaching, please indicate the title of the document and where (page number or other reference).

Document Title: _____;
Page(s) or Location: _____

Section Organization

Another good indication of what a section does can be obtained by looking at its organization. Please provide an organization chart, if available, and complete the following table:

Staff Position	# Staff in that Position	Primary Responsibilities

Please continue on another page if necessary. If this information is available instead in a document that you are attaching, please indicate the title of the document and where (page number or other reference).

Document Title: _____;

Page(s) or Location: _____

SECTION 3. UNDERSTANDING YOUR SECTION'S INFORMATION PRODUCTS

Both your ongoing activities and projects are likely producing "information products". Information products take the form of Tables, Maps, Sketches, Plans, Written Reports, Business Correspondents (Letters/Memos), Business Graphics (Pie Charts/Bar Graphs/Scatter Charts), Images (Photos/Video). In general they are an organized set of facts that are used to make business decisions, communicate ideas / results, etc.

Based on the activities and projects you provided above, please complete the following table outlining the information products your section creates and/or uses.

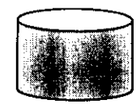
Information Product Name	Related Activity / Project (from Section 2.)	Product Type (report, table, etc)	Description (content, cost, frequency of production, etc.)

Please continue on another page if necessary. If additional information is available in a document that you are attaching, please indicate the title of the document and where (page number or other reference). Feel free to **provide an example** of the actual information product.

Document Title: _____;

Page(s) / Location: _____

SECTION 4. SUPPORTING DATA AND INFORMATION HOLDINGS



Your organization's information and data holdings can be one of its most valuable assets. Through your response to this section, we hope to get a good understanding of the type and quality of information that you need / produce / and use to support your section's information products, activities and overall objectives. Please spend a bit of time here, and feel free to attach ***examples of the data*** to help illustrate your responses to the chart below.

Data Set's Official Name	How Used	Who Creates / Maintains	Describe the main features of the data set -- its content, quality, accuracy, timeliness, etc.	Issues (high cost, gaps in completeness, poor quality, not available, etc.)

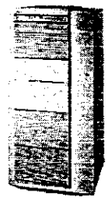
Please continue on another page if necessary. If additional information is available in a document that you are attaching, please indicate the title of the document and where (page number or other reference).

Document Title: _____;
Page(s) or Location: _____

Data "Gaps": Please indicate below or on a separate sheet whether or not you feel there are any gaps in the data / information you use or you need. In other words, are there key data sets missing and if so, what are they? Are they available elsewhere? Please describe.

SECTION 5. CURRENT SUPPORTING TECHNOLOGIES (HARDWARE AND SOFTWARE)

The Information Management Strategic Plan will address all components of an Information Management solution including the technology that uses the data to produce the information products. As a result, we need to understand the technology used by your section – the hardware and software as well as the network.



Please answer the following questions related to the computer technology of your section:

- How many and what type of computers are being used in your section?
- Are your computers networked? If so, what type of network is used?
- Are you / your staff connected to the Internet?
- What type of telecommunications are you using? (fax, voice-mail, modems, radio, etc.).
- How many and what type of printers and plotters do you have?
- If you / your staff collect data in the field, what type of field surveying equipment is currently used? (E.g. total stations/transits/electronic distance measurement/GPS, etc.)
- If you are using mapping / GIS technology, what mapping and drafting equipment is used?

List any commercial software products used by <u>most staff</u> (e.g. Word, Lotus Notes, etc.)

List any commercial software used by only a few staff for specialized purposes (e.g. ArcInfo)

List any software developed for use by your section/Institution. Please describe what it does.

SECTION 6. STAFF SOFTWARE CAPACITY SURVEY

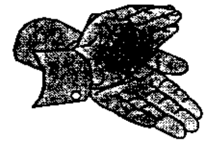
(**Note**: you may want to separate this from the rest of the questionnaire and have staff respond separately). A critical component to the success of the implementation of the Information Management solution will be staff ability to use the systems to their full advantage. Please provide an indication of their current capabilities in the table below:

To help make it easier to complete the chart, use a simple number rating from 1 to 5 where:

1 is excellent and **5 is poor.**

Name	Position	Proficiency in:					
		Windows 95/98	Word processing	Presentation	Spreadsheets	Database Mgmt	Other (please name)
e.g. Jane Doe	Secretary	2	1	3	3	5	FaxPro (3)

Thank you and Next Steps



Thank you for taking the time to complete this questionnaire. The information you provide will be critical in the development of a comprehensive information management solution for the Ministry of Agriculture. This plan will include both an overall strategic look at how information can be improved to better enable the center's activities, as well as a set of priority actions, timetable and potential costs.

Please return it and any supporting documents to:

الجمهورية اللبنانية
مكتب وزير الدولة لشؤون التنمية الإدارية
مركز مشاريع ودراسات القطاع العام

Republic of Lebanon
Office of the Minister of State for Administrative Reform
Center for Public Sector Projects and Studies
(C.P.S.P.S.)

Questionnaire designed by Spatial Knowledge Engineering Inc.

SKE Inc.