

AN ENVIRONMENTAL MANAGEMENT INFORMATION SYSTEM (EMIS) FOR IRINGA MUNICIPALITY, TANZANIA IMPLEMENTATION CHALLENGES

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ABSTRACT:

After the United Nations Conference on the Environment in Rio in 1992, UNCHS and UNDP jointly established a Sustainable Cities Programme (SCP) aimed towards improved Environmental Planning and Management (EPM) in demonstration city projects globally. Nine municipalities in Tanzania are among such Environment Planning and Management demonstration towns. Iringa Municipality is one of the municipalities in Tanzania in the Sustainable Cities Programme and is supported by DANIDA. The programme is known as the Sustainable Iringa Project (SIP).

Immediate objectives set for the project is that Iringa Municipal Council and other key stakeholders work in effective partnerships for the sustainable management of the environment in Iringa Municipality.. One of the important outputs is “ Increased capacity for collection, management and utilisation of environmental information”. Geographic Information System (GIS) has been identified and accepted as an important tool is implementing an Environmental Management Information System (EMIS) for Iringa Municipality.

InfoBridge Consultants Limited, a private GIS firm in Tanzania is participating in the EPM process with special assignment to design, develop and support the implementation of EMIS in Iringa. The design and development of the EMIS has been completed and EMIS is now being implemented in Iringa. It consists of the EMIS LM a land management module, EMIS RV a revenue management module, and EMIS TM a thematic management module.

This paper provides the design, development and implementation of Iringa EMIS, with emphasis on implementation approach and challenges.

1. BACKGROUND

1.1 The Sustainable Cities Programme (SCP)

Twelve municipalities in Tanzania are included in the Sustainable Cities Programme, and are in the processes of using the Environmental Planning and Management (EPM) Process as a new approach to planning and managing cities. Development objective of the Sustainable Cities Programme is: “Improved environmental and living conditions of the people in cities and the immediate objective of the project, is that within four years of the project, cities are able to identify and prioritise problems as well as formulate and implement policies for sustainable development in partnership with other public sector parties, private sector, and the community.

Information in any city is crucial to planning and management activities. Problems related to information include the following (UNEP/UNCHS, 2001): how to determine what data and information is needed for the purpose at hand; how to get hold of data if it exists or how to collect it if it does not; how to store it so that it is easily accessible and how to interpret the data and resolve underlying questions of for instance quality, contradictions and incompleteness. Other problems are: how to determine who needs the information, when and in what form and how to disseminate it as required.

1.2 Environmental Management Information System (EMIS)

Environmental Management Information System (EMIS) consists of formalised steps to capture information, as well as fixed procedures to retrieve this information. EMIS covers the gathering of all relevant information for the Environmental Planning and Management (EPM) Process. The EMIS includes the collection of information about various environmental issues facing a city, supports the Issue-Specific Working Group process, continues with supporting the strategy formulation and action planning, including the mapping, and last but not least covers the gathering of information necessary for institutionalisation of the EPM process. By its nature, EMIS is a participatory information system for managing the collective know-how of relevant stakeholders.

1.3 Iringa Municipality

Iringa is a municipality in the southern highlands of Tanzania about 600 kilometres south west of Dar Es Salaam city. Iringa is implementing a Sustainable Iringa Project (SIP) using the Environmental Planning and Management (EPM) approach and is supported by DANIDA (SIP, 2000). The EPM process seeks to engage all stakeholders in the city to identify problems that should be given priority in solving, suggest workable solutions and participate in the implementation of the solutions.

1.4 Issues - Specific Working Groups

After a Municipal Stakeholder Consultation Workshop a number of Issues listed below were identified as a priority issues and a Working Group was formed for each issue:

1. Liquid waste management
2. Solid waste management
3. Open space management
4. Urban Agriculture
5. HIV/AIDS
6. Unplanned settlements
7. Transport and transportation
8. Information Management

Concerning the Information Management Issue, the Iringa Stakeholders Workshop made the following key statements:

- That, Land is a scarce resource especially in urban areas that need to be properly managed.
- That, Urban Authorities need to know what land is available for development, who occupies a piece of land, and what are the conditions and rights of occupancy.
- That, Urban Authorities need to know how land is used and managed, need to know location, type and sources of revenue
- That, Urban Authorities need to know exact location, use, condition and value of buildings, and also they need to know where and what land is available for future expansion.
- That, Lack of correct information on land, buildings, natural resources and revenue result in the growth of unplanned settlements, poor service to citizens, low revenue to local authorities and poverty to citizens.

The task of a working group is to discuss, research and formulate bankable projects and action plans for solving a specific problem. In order to be able to collect, organise and use a lot of information that is needed to plan and implement environment-related problems, a GIS was an obvious tool to be used in the Environmental Management Information System (EMIS) for Iringa. InfoBridge Consultants Limited, a private firm based in Dar Es Salaam, was contracted to design, develop and support the implementation of the EMIS.

2. IRINGA EMIS DEVELOPMENT CONCEPT

After working for two years, InfoBridge has now developed the Urban GIS/EMIS implementation concepts and guidelines that could be applied to other municipalities and cities (Mugerezi, 2002).

2.1. An Information System

In order to develop and implement an EMIS for Iringa it was important for the management, staff and working group members to understand the scope, processes and activities of an Information System. It was made clear that, an Information System is not having trained staff and computer equipment only. It is about data collection, data processing, data manipulation, dissemination of information, and continuous updating of databases. They were made to understand that Information System is about people and knowledge, hardware, software and data. It is about *change management*.

A workshop with a theme “EMIS/GIS a Tool for Environmental Planning and Management” was organized and the components that make up an Information System were elaborated as follows:

People: Including Councillors who are the decision makers, Management Team (Municipal Director and Heads of Department), Technical officers in all departments, data collectors at ward level and citizens who need information from the municipality.

Data: All data that is needed by the working group and the departments in their day to day operations must be identified, collected, processed and used. Data sources are : Maps; aerial photographs; Satellite Images; Files and Documents; Fieldwork surveys; Interviews; Library and Internet.

Processes: All processes concerned with data collection, processing and analysis, processes concerned with information output and dissemination, as well as all processes concerned with making plans, making decisions and implementing plans.

2.2 EMIS Design

At the beginning a clients was interested in implementing an information system that will provide environmental-related data to all environmental priority issues as they are listed above. After going through the Information Needs Assessment, InfoBridge found out that such an information system could not be easily implemented because working groups exist only when the problem is in a priority list and they are therefore not a well defined permanent user of information.

A logical approach was recommended to start by establishing an information system that fits into, and supports the existing administrative set up. Such a system is saleable to the council and management and is also a base for an environmental management information system. The result of this approach is a EMIS application software having an emphasis to management of land information. The software is called InfoBridge EMIS LM.

The EMIS implementation philosophy consists of five main essentials:

Top Management Support: Councilors, Directors, Managers and Heads of departments must understand well what GIS is all about, its importance, costs and investment justifications. With this knowledge they are expected to support the GIS establishment. A two weeks awareness course was conducted.

Training Programme: A *Top Down Approach* in training was followed in order to establish a knowledge base for GIS support. Training was conducted as shown in Table 1.

Target Group	Duration
Councillors	3 days
Director, Heads of Department	3 weeks
GIS/EMIS Officers	8 weeks
Technical Officers and Working Group Members	3 weeks
Data Capture Technicians (Cartographers/Digitizers)	3 weeks
Ward Level data collectors	3 days

Table 1. Training duration for each target group

The GIS/EMIS courses for the above target groups have been formalized and are now offered at the InfoBridge Training Centre.

Take Off Funds: EMIS development and implementation is an expensive and is a long-term undertaking. It is not expected that a municipality will have enough funds for the whole operations at once. Since it is a long-term investment, a municipality needs just enough money to take off. Thereafter it should include in its annual budget, funds for GIS/EMIS development and maintenance. EMIS itself should be looked at as a new source of revenue to the municipality. This will reduce the dependence to donors.

GIS/EMIS Champion: There must be at least one person in a municipality who has the ICT/GIS/EMIS knowledge and who is committed and believes in it. We call such a person a champion. He/she is the heart of the development pushing forward the development, encouraging every one and is an important link between the Client and Consultants. A Champion in Iringa is a land surveyor and is doing a very good job.

Consultant's Support: A Municipality needs technical support from experienced and committed Consultants during and after the design, development and implementation phases. This support is important in order to *manage the change* and integrated the GIS/EMIS in the day-to-day municipal operations.

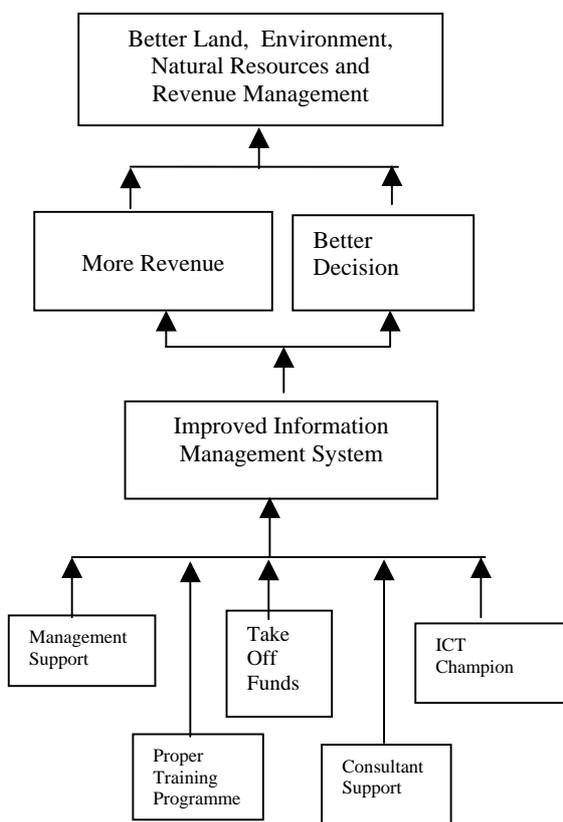


Figure 1. EMIS Development Philosophy

The above five essentials in Figure 1 will result into an *Improved Information Management System*, which in turn will result into *more Revenue* to the Council and *Better Decision Making* by decision-makers.

2.3 EMIS Spatial Database

EMIS for Iringa has the following main spatial databases (see Figure 3):

Topography, includes contours, rivers, roads and streets.

Buildings, includes all building structures as they are shown on the basic urban topographic map of scale 1:2,500 .

Land Parcels, include all land in planned and unplanned areas, public land, open spaces, institutions, etc. Land in unplanned settlements usually is not surveyed. For the purpose of EMIS, every building in unsurveyed land is “allocated” a land parcel on which it is occupying. In this way every piece of land in a municipality is accounted for (Figure 2).

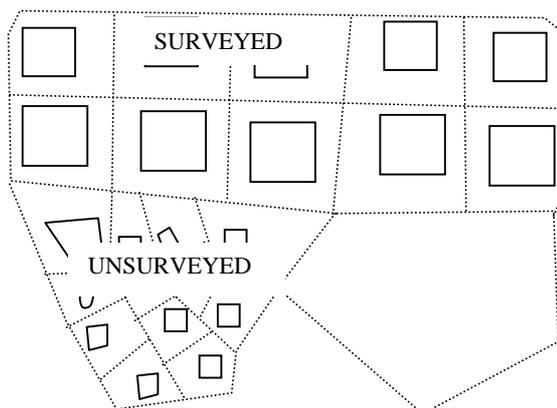


Figure 2. Accounting for every piece of land: unsurveyed land is digitized on screen

Natural Resources, include forests, game reserves, national parks, historical sites, etc.

Issue Specific/Thematic include all spatial information as identified by working groups and municipal departments.

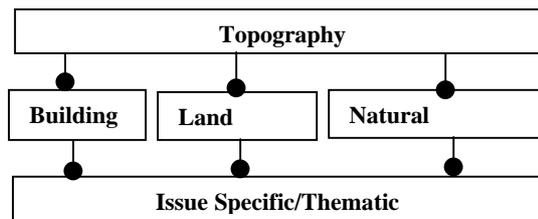


Figure 3. Main Spatial Databases

2.4 InfoBridge EMIS LM

The InfoBridge EMIS is developed using Visual Basic and MapInfo Professional tools. The database is SQL and is a network system. It runs on standard PC with Windows 95 (and above) operating systems.

The system is made up of three independent but integratable modules (see Figure 4):

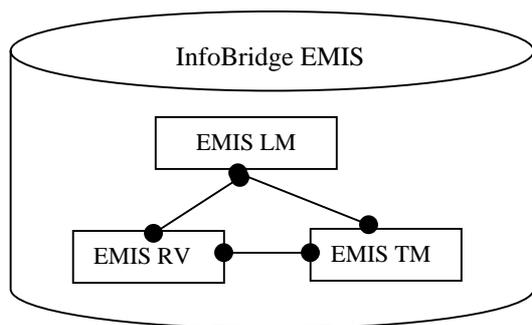


Figure 4. InfoBridge EMIS with three modules

Module 1: EMIS LM for Land Management. This module has been completed and is being implemented in Iringa municipality and Mwanza city. It contains four main registers with the interfaces designed to fit the existing sections which are dealing with land management issues. This helped to contain some resistances and misunderstandings among staffs, especially senior old staffs, to whom changes are not very welcome. The sections concerned directly with land issues are Lands, Town Planning, Valuation and Natural Resources.

EMIS LM registers is made up of the following registers:

- Basic Register, contains the basic topographic data, that is contours, rivers, administrative boundaries, streets and roads.
- Land Register, contains cadastral data, that is data on survey plans and plots, plot owner, and certificate of title. This register is used for Plot allocation, Preparation of Deed plans and Title deeds, Land use monitoring, Processing of Building permits, and Preparation of cadastral maps.
- Building Register contains building data, that is building maps, and particulars of owners. This register is used to know exact location of buildings and their owners in planned and unplanned areas, to know the use and value of buildings and to determine the town expansion and availability of social services. It is also used to monitor land use changes and to know the types, use and condition of central and local government buildings.
- Natural Resources Register, contains data about the location, size and extent of natural resources in a municipality. Natural Resources include: Forest, Game reserves, wetlands, mining sites, historical sites, etc.

Module 2: EMIS RV for Revenue Management is at the design stage. The fact is that, within a municipality, availability, accessibility and use of correct, complete and up-to-date data on taxable objects and taxpayers is vital for the efficient collection and management of taxes. Proper identification of the location of taxable objects, and being able to map and analyze tax collections, is a demanding task to the municipality.

The EMIS RV when is completed will be an important tool for municipal tax collectors. The system will organize and manage spatial data concerning taxable objects and subjects. This system will be used to manage revenue collections from land related sources which include: Property Tax, Billboard Tax, Business License, and others.

Module 3: EMIS TM for Thematic Information. These are information needed by individual municipal departments and EPM Issue-Specific Working Groups. EMIS TM is organized

according to the Sustainable Cities Programme (SCP) EMIS guidelines as contained in UNEP/UNCHS (2001).

It contains information on:

- Environmental settings which include natural resources and natural hazards.
- Development settings, which include administrative boundaries, land use, infrastructure and socio-economic patterns.
- Inventory of aerial photographs, satellite images, scanned images and other important site photographs.

3. IMPLEMENTING EMIS LM

3.1 EMIS LM is implemented in six steps

Step 1:

Create a Basic Spatial Register as part of a municipal environmental profile. This step involves the digitization of streets, contours, rivers, and other landscape features from the 1:2,500 topographical maps and entering their respective non-spatial data in the database. At this stage all streets must have street names.

Step 2:

Create a Land Register. This step involves the digitization of cadastral plots and entering non spatial data for plots, plot owner, certificate of title and encumbrances in the database.

Step 3:

Create a Building Register. This step involves digitizing all buildings from a topographical map and entering non spatial data for buildings and building owners. At this stage every building must be identified by a unique number.

Step 4:

Create a Natural Resources Register containing data on natural resources areas in a municipality, such as mining sites, forest areas, game parks, tree plantations, historical sites etc. At this stage a unique number must identify each natural resource site.

Step 5:

Create a Ward Information Register (WIRE). WIRE is a manual register kept and maintained at the ward level. Ward officers use Mtaa leaders (Mtaa is a lower level in a ward. It is made up of few streets) to collect basic data in the ward. These data are collected in the EMIS LM format and EMIS officers in the municipality supervise the data collection process. The WIRE is a very important lower level data collection facility.

Step 6:

Use the ENVIRON GFBD to Monitor the Environment Regularly. We have developed the Environ GFBD Grade to be a visual assessment of the environment. We define it as a measure of environmental assessment. Environmental assessment is made without pressure or influence and it is made within the prescribed period which may be quarterly, half yearly or yearly, during the normal EMIS data collection routines. Environ GFBD is based on the visual assessment and interpretation of an environmentalists, whereas, an environmentalist is a person who is interested in being in a good environment. Environ is a function of Profession, Experience, Interest, Maturity, Decision Making and it is a defensible opinion of mind. Environ GFBD Grade can be Good, Fair, Bad, Dangerous. It is expected that in the course of data collection and other municipal activities,

staffs and working groups will be able to give the ENVIRON Grade to various sites and the grades are entered in EMIS. At any particular time one is able to query the database and see locations that have scored for instance D(angerous) or G(ood) and recommend the necessary actions. This approach has proved to be very useful in identifying easily and faster, locations that are not environmentally friendly. In municipalities without EMIS, such locations are exposed by newspapers especially in most cases when the citizens have begun complaining, and it is already too late!

3.2 EMIS Data Collection Guidelines

The following are the guidelines for data collection:

- Professional responsibilities
Data must be collected and assessed by a professional in the relevant field. Data is organised in a database to be accessed according to the department or working group/theme.
- Department responsibilities
Each department or working group is responsible for updating its professional data. Each department or working group is responsible for the completeness and accuracy of its data, and is therefore responsible for collecting and verifying its data.
- GIS/EMIS Unit responsibilities
The GIS/EMIS Unit is responsible for supervising, creating and updating spatial databases, as well as the Ward Information Register (WIRE).

3.3 Important Suggestions on EMIS Implementation

Suggestion 1: Appoint a Lead GIS Consultant. It is clear from the GIS activities that more than one consultant and contractor are involved in the GIS development. Consultants and contractors are needed in the field of financial management, human resource development, training, data capture, public awareness, planning etc. In order to maintain a systematic approach and coordination, a municipality needs an overall Consultant.

Suggestion 2: Prepare an Information System Strategy. EMIS is one component of the Municipal Information Systems. An Information System Strategy is needed so as to guide the development and implementation of various information systems.

An information systems strategy involves a statement of direction from top management. It will be the municipal's commitment to the important task of developing and continuing role of information systems. The strategy will establish a framework in which to judge the existing and proposed systems infrastructure investments and determines a framework for setting priorities. It also identifies the major systems and supporting resources and investment required over the medium term, it identifies the management and technical policies that determine the means and the ground rules by which information systems will be developed and managed. The strategy outlines the migration plan (the means of transition from the current to the future information systems environment) needed to carry the work forward.

Avoid Piecemeal Approach: Without an Information System Strategy, a municipal is likely to adopt piecemeal approach. There are a number of problems associated with piecemeal approach. Some of the problems are:

- Inability to implement systems, which cross different functional areas because of different management policies and fragmented information technology ownership.
- Inability to achieve economies of scale in procurement, maintenance and support.
- Inability for information technology service providers to respond quickly to changing needs because there is no medium to long-term view of what is required.
- Inability of users to share data due to inconsistent data definitions
- Possibility of wide spread acquisition of personal computers unguided by any overall strategy.
- Difficulty in maintaining and retaining adequate skills base to plan and introduce new systems.

Why an Information Systems Strategy is recommended as a first step? The following are the potential benefits of having an Information System Strategy:

- Achievement of business and policy objectives by planning information systems to meet them.
- Development of new business opportunities and policies by making it possible to introduce new ways of carrying out business processes and proving access to new and more timely information.
- Improved management of the information resource through data sharing, data inter-change standards and data definitions.
- Improved allocation of human, financial and technical resources in line with business and policy objectives.
- Integrated use of information systems.
- Effective use of scarce resources by coordinating the approach to development, ensuring work is done in a logical sequence and using a standardized approach.
- Reduced costs of contingency planning and fewer missed opportunities.
- Improved services for clients.

Suggestion 3: Prepare Training Programme. Prepare Training Programme and undertake training within and outside the city or the country. Exact training requirements are known during the Strategy study. However, based on our good experience, the Top Down Training programme shown on the Table 1 is recommended, with regional study tours to other municipalities.

Suggestion 4: Acquire Hardware and Software and Furnish the EMIS Office. In Iringa we have the following in the EMIS unit: MapInfo Professional software, InfoBridge EMIS, two personal computers, one A0 digitizer, one A0 plotter, one A3 printer, and standard office automation software (Microsoft office).

Suggestion 5: Prepare the Basic Spatial Register and an Environmental Profile. Prepare a Digital spatial database from which you can create the Environmental Profile. It is important to have up-to-date base maps. This may involve taking aerial photographs or using ground surveying methods to update map features.

Suggestion 6: Create EMIS LM Registers. Basing on registers created in suggestion no. 5., create the Land, Building and Natural Resources Registers.

Suggestion 7: Create EMIS RV.

Suggestion 8: Create EMIS TM.

Suggestion 9: Use Internet Technology. Consultants to develop mechanism to support the municipality through the Internet technology in order to ensure that support is given faster and at low cost, and to ensure that databases are updated and backups made regularly. We are working on a design to have a Web-based Infobridge EMIS System that will be maintained from the our server. This will give us a control and support of the technology.

4. IMPLEMENTATION CHALLENGES

In implementing the EMIS LM in Iringa there are a number of challenges as listed below.

4.1 Training Programmes

Our first trial of implementing EMIS LM was in Mwanza city, and the training emphasis was put at training 4 staffs in GIS and EMIS concepts and practice for a period of two months.. Our expectation was that these staff would be able to disseminate the knowledge to other technical staffs and the management, and push forward the implementation process. The Municipal management Team (Municipal Director and Heads of Departments Managers) and Decision-makers (Councilors) only attended a two days GIS/EMIS awareness workshops. This approach proved a failure. The reason behind this failure was that the EMIS/GIS “experts” were not confident enough to bring the changes, and they were expected to build a case upwards to justify the investment to the top management. The top management could not generate enough interest and understanding from the two days workshop, yet they were expected to decide on heavy investments in GIS/EMIS.

Basing from this experience, in Iringa municipality we adopted the top-Down Training Programme approach.

We first conducted a 2 months GIS/EMIS course to 4 municipal staff “experts”, and then conducted a 2 weeks full time training for executives or top managers (Municipal Director and Heads of Departments – 10 participants). During the executive training, municipal GIS/EMIS “experts” participated in the course as counter-part trainers. Next in the training list were technical officers from municipal departments and working group members (10 in number), then the data capture/digitizing team (4 in number). Last in the list were the data collectors at ward level (the lowest administrative unit) who attended a 3 days data collection seminar. They were two from each ward, and there are 15 wards.

This Top-Down training approach was successful, because the management and councilors knew what technology was coming in their municipality, why and how much it will cost.

The contents of a 2-week course for Municipal Management Team/Executives are:

Day1: Review of the Information and Communication Technology ICT: Development, constraints and opportunities

Day 2: Review of the Windows Operating System and Word Processing using Ms Word

Day 3: Review of the Spreadsheet computations using Ms Excel (Budget preparation exercise)

Day 4: Information communication: Local Area Networks, Internet, Website, E-commerce

Day 5: Environmental Planning and Management (EPM) and Environmental Management Information System (EMIS) overview

Day 6: GIS basics (concepts: spatial (point, line polygon); non-spatial data; map coordinates; transformation; projection; layers; GIS software; Import/export; MapInfo operations.

Day 7: MapInfo operations: data capture (digitizing, scanning, vectorisation, editing); object properties; labels; distance measurement, area measurements; buffer; database query

Day 8: Environmental Management Information System with InfoBridge EMIS LM (creating registers: land, building, natural resources; data base queries)

Day 9: Environmental Management Information System with InfoBridge EMIS RV (Revenue Module: property tax, billboards, business licenses, natural resource taxes)

Day 10: ICT/EMIS management and implementation issues

4.2 Digitizing Plots from Cadastral Plans

In Iringa, and Tanzania in general a surveyor’s cadastral plan is submitted to the government and stored and an official record. Attempts to create a cadastral map from cadastral plan has not been very successful. As a result, a cadastral database is created by digitizing individual plans. The biggest challenge is that within a municipality in areas that were surveyed before the 1985 you find more that one coordinate systems, which are:

- (1) Iringa Local System
- (2) Isolated or local origin
- (3) Universal Transversal Mercator (Clarke 1860)

The Process of transforming all plots into one System –The UTM (Clarke 1860) was too difficult for Iringa GIS/EMIS experts and Consultants had to work hand in hand with Iringa staff to do the transformation. Also some plans were in bad condition and could not be digitized.

The transformation process first involved a field survey to extend UTM controls at strategic locations from which to fix important points. Cadastral plans were digitized in their existing coordinate Systems (non-earth) in MapInfo. Then 2 points were identified in a plan at corners of the blocks and were fixed in the fieldwork by UTM coordinates. Having two points with coordinated known in two systems was enough to use the MapInfo transformation process.

More problems were found on plans whereby digitized points could not occupy their ground positions and some could overlap with other plans in the neighbourhood.

Our experience is that this could be a very serious problem when creating a land register in other municipalities in Tanzania.

Following the introduction of EMIS/GIS and understanding the nature of the problem, Iringa will set a budget for extending UTM controls. It has been agreed that enough UTM Controls must be established in Iringa. The Surveys and Mapping

Division had already issued technical circulars to all surveyors to use the UTM system.

4.3 Managing Digital Layers and Maps

When the InfoBridge EMIS is operational with all the modules, there will be more than 100 individual map layers. Unless the files are well structured, it will be difficult to access and use them effectively. Systematic access of files during the working session is very important. Keeping track of old and updated versions of file is another challenge. The layers must be well structured to help users to easily access layers of interest.

InfoBridge has adopted the codes and filing structure of the Sustainable Cities Programme (SCP) as contained in the source book "Building an Environmental Management Information System (EMIS) (UNEP/UNCHS, 2001).

Digital data are stored in three main folders: Inventory, Archive and Working:

C:\ Inventory
Archive
Working

Inventory folder stores the EMIS metadatabase. This meta database is an Access.mdb file and stores information about a source map such as date of the map, quality, scale, projection and source. Also it stores information about the digital layer such as date of digitization, method, software, and persons who did the digitization.

C:\Inventory
Inventory.mdb

The metadatabase helps to keep track of existing maps and their origin, and allows non-EMIS people to come to EMIS office and to query the database on existing maps in a specific area of the town, or for a specific topic such as existing land use. The metadatabase is updated regularly either weekly or when a new map is obtained or created.

C:\Archive

This folder stores the up-to-date, finalised layers (tables) and workspace (collection of layers that make a complete map).

C:\Working

This folder stores current layers (tables).

Once a layer is finalised in the working layer it is transferred to the archive folder. In the same way, if a layer stored in the archive folder needs updating, the file is copied to the working folder, where the necessary changes are done. Once completed with updates, the old layer remaining in the archive is replaced with the new one. It should be remembered that the purpose of the archive folder is to be able to open ready made layers (tables) and workspace (maps) at once without changing layout scale or print Size.

4.4 Street Names and Building Numbers

Many streets in Iringa municipality and in deed in many towns in Tanzania, have no street names, and many buildings have no unique identification number. EMIS LM demands that streets and buildings must have unique identifications that are officially

recognised. This is because many databases in EMIS are linked to a street and a building. The process of street naming and building numbering has some political processes and thus does not happen as faster as we would like. This definitely slows down the implementation of EMIS, and such issues are usually underrated in the planning of the project.

The Council in Iringa now knows the importance of this issue and has resolved to have all streets named, and all buildings numbered.

4.5 Updating Digital Topographic Base Maps

Updating of all scale urban topographical maps in Tanzania is a task of the department of Surveys and Mapping at a national level. This set up was necessary in the past years due to the low capacity of staff and technology to undertake such a task at a municipal level. However, now the current technology of GPS, total station and GIS brings the capacity at the municipal level. EMIS LM has been designed to facilitate the map updating to be done at the municipal level, and the updating process is built-in the day-to-day management process. This will ensure that changes that are taking place on land are immediately reported and recorded in the EMIS system.

All data in the EMIS LM are linked to land or building directly or indirectly. Before any transaction is made, the system checks if a valid plot or building exists in the database. If it does not exist, the transaction or service will not take place. It should be noted that usually changes taking place on land takes weeks or months. Therefore there is enough time to capture and process the changes on land. For instance when the EMIS RV is completed, no business license will be issued on a business whose building does not appear on EMIS map. Also no property tax will be collected if the property is not appearing on the EMIS map. A person or institution that is benefiting from the service is expected to initiate the map updating process.

5. PARTNERSHIP AND CO-OPERATION

Many partners are involved in the Iringa EMIS development and Implementation.

5.1 UNCHS and UNDP

Has been supporting the Sustainable Cities Programme through the Urban Authority Support Unit (UASU) of the Ministry of Local Government and Regional Administration in Tanzania. UASU role is to facilitate the operations and activities of the EPM process in Tanzania municipalities. UASU has an EMIS Unit. The EMIS Unit organises short courses and workshop for municipal staffs, management and councillors.

5.2 DANIDA

Is supporting the Sustainable Cities Programme in Mwanza city and in Iringa, Arusha, Moshi and Tanga municipalities. Chief Technical Advisors (CTA) from abroad are managing the programmes with Project Coordinator being Tanzanians. DANIDA provides funds for purchasing hardware and software, training and consultancy services, which are all done by Tanzanian experts.

5.3 Municipal Councils

They are the beneficiary of the project. Support from the Council (specifically the Lord Mayor) and from the Management (specifically the Municipal Director) is vital. There is a very good support from top management in Iringa.

5.4 Tanzanian Private Sector

Provides consultancy services that need exceptional knowledge and experience InfoBridge Consultants Limited, a local company based in Dar Es salaam, Tanzania is coordinating and supervising the whole process of designing, developing and implementing the Iringa EMIS.

5.5 Tanzanian Learning Institutions

Are participating in the EMIS development process by providing basic and applied short courses. They include: VETA, a college in Iringa which conducted the basic computer course to Iringa staffs, and the University College of Lands and Architectural Studies (UCLAS) which provided GIS courses.

5.6 International Learning Institutions

Have participated in the Iringa EMIS project. A staff of Iringa municipality is soon joining the International Institute of Aerospace Surveys (ITC) in the Netherlands for the Postgraduate GIS course, and a staff of InfoBridge is attending a Masters course at Karlsruhe University in Germany, and while he is there he is developing a website sub-domain dedicated to EMIS in Tanzania. Visit site www.infobridgers.com (after March 2002).

5.7 International Companies

Are providing the high-tech services to the EMIS process. Kwena Air of South Africa and Swedesurvey of Sweden have taken aerial photograph of Iringa town.

5.8 Governmental Institutions

Have used their expertise in the project. The Surveys and Mapping Division of the Ministry of Lands and Human Settlements prepared digital topographical maps from aerial photographs taken by the Swedesurvey.

5.9 Neighbouring Countries

Have also benefited from the Iringa EMIS. The Nairobi City Council, Kenya invited Consultants from InfoBridge to give a presentation of Iringa EMIS and experiences, at the GIS Workshop in Nairobi on 18th January 2002.

5.10 The Public

Through their elected leaders and ward officers are providing data for the EMIS through the Ward Information Register (WIRE) and are getting reliable information faster from the Iringa EMIS.

Tanzanian environment. The Top Down training approach managed to rectify many implementation problems and created the support and demand of information from the management. Phased development of EMIS starting with EMIS LM for Land Management, then EMIS RV for revenue management and then the EMIS TM for thematic/working groups/departments is a development philosophy that addresses the needs and expectations of municipalities in Tanzania.

The EMIS that is being implemented in Iringa provides a good example of the interpretation and application of the UNEP/UNCHS EMIS in supporting the Sustainable Cities Programme through the Environmental Planning and Management (EPM) Process. Municipalities in Tanzania are learning from the Iringa experience, like wise other cities from developing countries could learn from Iringa.

Internal and external collaboration has been very good and is necessary. This is possible by having a well-organized local Consultant who coordinates the ICT, GIS and EMIS technologies. InfoBridge Consultants have successfully played this role. There are still many challenges ahead and the collaboration and partnership must be maintained.

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6. CONCLUSION

The development of the InfoBridge EMIS has been a very exciting and worthy experience. Design concepts and development philosophies have been developed that fits into the

