

# **The Role of Spatial Data and Infrastructure in an Information Society: Conflicts and Implications for Zanzibar**

**Rashid Mohammed AZZAN and Said Salmin UFUZOM Zanzibar, Tanzania**

**Key words:** Spatial Information Management (SIM), SMOLE

## **SUMMARY**

The case is made that Spatial Information Management (SIM) is highly relevant to developed as well as developing countries in terms of the working and living environment. However, information technology (IT) development and spatial management in least developed regions such as Africa and in particular Zanzibar<sup>1</sup>, has thus far been mainly connected to donor support initiatives. While local planners and administrators fully realise the value that SIM can bring to planning, they have remained committed to the existing traditional methods due to limitations such as manpower, lack of funds to buy and maintain new technology, and existing levels of local expertise. The question arises to what extent Zanzibar can adopt modern SIM systems considering its current realities and needs, and the current paper discusses obstacles that need to be overcome for this to happen.

The paper shows that in Zanzibar spatial data management has been deployed in a few institutions such as those dealing with lands, environmental management, communication and surveying, however only at minimal scale. For example, the Department of Surveys and Urban Planning is struggling to establish a land information system and computer aided cadastre, the Department of Land and Registration wants to develop a digital land registration system and the Stone Town Conservation and Development Authority has made a start to the Housing database for historical sites and houses. The local communities and higher economic levels in the private sector are less concerned with such matters due to the social and economical situation of the country.

Fortunately there is growing impetus throughout Africa to employ SIM for planning purposes and development in general. The Second Meeting of the Sub-committee on Geo-Information was held in Addis Ababa, Ethiopia, from 3<sup>rd</sup> to 7<sup>th</sup> September 2001, and one of the topics discussed was the development of Spatial Infrastructure Networking System for the entire sub-Saharan Africa. The meeting addressed the future orientation of spatial data systems in Africa, practical aspects of their application and future implications they may have. The major challenges identified were:

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<sup>1</sup> Zanzibar is an island state that is part of the United Republic of Tanzania. It is an archipelago consisting of the two major islands, Unguja and Pemba and several smaller ones.

- Lack of policy and awareness
- Lack of updated standardised data sets
- Poor telecommunication and utility infrastructure
- Lack of qualified human and financial resources
- Lack of capital investment for running cost for soft ware and hardware maintenance

Against the background of the 2001 meeting, this paper discusses the evolution of spatial management practices in Zanzibar from different land related and environmental institutions. It shows that, in spite of numerous attempts to create spatial information systems, many of them praiseworthy in terms of the dedication that went into them, there still does not exist one that is fully operational or fulfilling the needs for which it was created, or is being created. The picture that emerges is one of fragmentation and lack of coordination, if not a waste of effort and ultimately funding. The reasons for the achievements and problems thus far encountered are discussed and the need for policy driving IT development is highlighted. Practical examples of the Zanzibar experience are examined with the aim of making specific recommendations for Zanzibar in context of the prevailing local environment. Finally, a practical solution is proposed that can have far reaching implications for IT development in general and SIM in particular.

The paper is divided into five parts. Part one introduces and provides background to the islands that make up Zanzibar. Part two discusses the on-going practice of spatial information management in Zanzibar. Part three discusses IT Policy which is under development and possible implications of such a policy. The author's main observations are discussed in part four, while part five will provide the conclusions and recommendations for this paper.

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## 1. BACKGROUND

### 1.1 Introduction

Zanzibar is part of the United Republic of Tanzania but has its own autonomous system of land administration.

**Figure 1:** Map of Zanzibar



Zanzibar consists of two main islands with 52 small islets scattered around them.

The archipelago of Zanzibar is located in the Western Indian Ocean (East Africa) just off the coast of Tanzania. It lies between latitudes 4 and 5 degrees South and longitudes 39 and 40 degrees East (see Figure 1).

Like many other islands, the Zanzibar islands are fragile and paradise-like in appearance; the surrounding seas are clean with clear water that contains a myriad of marine life. The small hills and valleys are covered with a fertile mix of vegetation covers, including plantation and farmland. The groundwater is fresh and readily available and the climate is ideally suitable for agriculture though rather humid during the months of October to February.

The administrative and commercial headquarters of the islands are located in the Zanzibar Municipality. The older part of the town has significant historical and cultural heritage in the Stone Town buildings that were built in the early 18<sup>th</sup> century with a total area of 1 square km. Based on its unique history and architecture Stone Town was declared a World Heritage Site in 2000. With its unique nature and strategic position along the East Africa Coast, this heritage city of today retains its urban fabric and townscape virtually intact and contains many fine art structures that reflect its particular culture.

## 1.2 Population

In 1988 the population of Zanzibar was about 640,578 of which 204,477 (about 32%) lived in urban areas and 68% of it lived in rural areas. In 1995 the population was estimated to have grown to 792 000. 60% of this population lives in Unguja and 40% lives in Pemba. The 2002 census, Zanzibar reached a population of 984 625 with an annual growth rate of 3.1%.

## 1.3 Zanzibar's Economic Situation

Historically, Zanzibar's economy was mainly based on the production of cloves and spices. During early 1970s, the price of cloves dropped in the world market. In the 1980's and 1990's the World Bank and the European Union assisted the government of Zanzibar in the Economic Reform including *Land Policy Reform* from central planning to a trade liberation system.

With the assistance of the United Nations Development Programme (UNDP) the Government has recently produced and published two policies that are directing all governmental activities, being the Zanzibar Vision 2020 and Zanzibar Poverty Reduction Plan (ZPRP). These two documents are guiding instruments for Zanzibar's economic development.

Presently Zanzibar's GDP stands at about US \$ 204 per capita in which tourism industry contribute about 34% of the total national economy. The young generation engaged highly in trade and self employment activities while big investment is in tourism sector.

## **2. EXISTING PRACTICES AND ONGOING INITIATIVES IN IT AND SPATIAL DATA MANAGEMENT**

### **2.1 Introduction**

Information Technology in Zanzibar, especially the use of GIS is still small and mostly used for administrative purposes. Many government departments and the private sector are struggling to establish spatial information databases to ease the burden of processing and analysing information relating to land ownership, population parameters and the environment. The major challenge is how to create and maintain such as GIS system. As mentioned earlier all IT initiatives have their origins in donor programs. This implies that when the donor pulls out the host department fails to maintain the infrastructure due to limited budget allocations from the government's side. This is a major obstacle that needs to be overcome for spatial databases to be sustainable.

#### 2.1.1 Department of Surveys and Urban Planning

The Department of Surveys and Urban Planning is responsible for planning, drawing up land-use plans and the preparation of all kinds of maps in the Zanzibar islands, including topographic and other maps. This service previously was performed by the Directorate of Overseas Surveys of the United Kingdom. The last topographic map (before the Finnish Government financed the latest new topographic maps) was produced in the early 1970's and 1982. For the past twenty years no new topographic maps were produced. Yet, between 1982 and 2004, there have been major spatial changes especially in terms of land use change in both urban and rural settings, accompanied by rapid urban growth, and increase of informal settlements, and changes in the environment. The old topographic maps would no longer be useful as base maps since nearly a quarter of a century has passed without being revised. They do however provide valuable records against which change over a relatively short space of time can be measured.

From 2003 onwards, the Finnish Government has funded the government of Zanzibar to implement the Sustainable Management of Land and Environment Project. Among the programmes in the Project is to make new digitised topographic maps for the island of Zanzibar. Aerial photographs for both Unguja and Pemba and its 52 small islets are being produced. The work station for digitising and editing is installed in Zanzibar with the necessary infrastructure being created. Experts from abroad are currently stationed in Zanzibar to train staff in GIS. GPS, photogrammetry and other necessary training to complete the line map islands, rural areas, urban, and tourist zones are being conducted.

The analogue from 1982 topographic maps are still being used for different activities such as forestry, agriculture, land use planning because it will take time to complete the production of new digitised line maps. This creates a major set-back for private and public sectors that still use old maps to acquire spatial data and information for planning of development projects like major infrastructure networks, municipal works, local government and other projects.

Some survey works have been done using geographical information in digital format by using *LISCAD* in Unguja Island and *AUTOCAD* in Pemba. The software was used to create digital parcel maps. During the Zanzibar Integrated Land and Environment Management Program (ZILEM) test areas for systematic registration were used. One of the objectives was to establish a Digital Land Registration System in Zanzibar. Adjudication work and partial boundary demarcation was done. In Unguja Island adjudication and boundary demarcation was completed but no further progress was made using the digitised data. During this period only the basic functions of the soft-ware are used.

These procedures created in both islands have not replaced the conventional system but are supporting it by printing hardcopies used for drawings of the cadastral maps. The big problems include the failure to store planned cadastral data and the lack of maintenance of geographic data. Yet there exists much information in the department such as old maps, plans, cadastral maps, town master plans, and village plans that need very much to be digitised.

### 2.1.2 Department of Land Registration

The official land registration system does not exist in Zanzibar as Land Registrar has not been nominated. The main task of the Department of Land Registration is to allocate land for different uses such as for commercial, industrial, tourism and residential development. The department keeps records of all land related transactions. Recording is done manually and the computers of the department are mainly used for administrative work. Some experiments with data management system use *Ms Access* software to store cadastral ownership information that has been collected in Pemba. The legislative instruments have been established during 1990's to give mandate for proper department to make digital land registration. These are *The Land Registered Act, No10/1990*, *The Land Adjudication Act*, *the Land Tenure Act, No 12/1992*, and *the Land Survey Act No 12/1990*.

The department is currently seeking to introduce Computer Aided Cadastral Mapping as part of the Sustainable Management of Land and the Environment (SMOLE) initiative. The computer-based land registration will be based on the collection of field surveys and ownership data related to land parcels. The advantages of the computer-based cadastral system compared to traditional manual system are

- The registration process (systematic and sporadic) will become more efficient and registration will become faster
- The security will be improved in terms of checking, data storage and ownership information
- Seamless cadastral map data form is valuable data set for many other organisation and private sector
- Retrieving of information is faster.

### 2.1.3 Department of Environment

The department is handling all environmental related information using a traditional manual system. There exists no spatial data in digital format for environmental management. The following are some of environmental issues for which spatial interpretation is required:

- The ill effects of unplanned urban expansion
- The need to bring coastal zones areas under integrated management combining traditional uses, tourism and resources management and conservation
- The need to monitor key special zones such as coastal ecosystems, including reefs, marine parks, coastal erosion, forest cover, soil loss, etc.
- The threat of environmental degradation caused by human impacts, including economic development programs

Not much has been done yet in Zanzibar in terms of including spatial environmental information into a database. Many countries of Africa have started to establish such databases. They include Uganda which has started GIS to monitor rural community activities and mainland Tanzania, to monitor the development and threats of informal settlements.

## **2.2 Zanzibar Land Information System (ZALIS)**

From 1989 to 1996 the Finnish Government under the Finnish International Development Agency (FINNIDA) and the Government of Zanzibar started to implement the Zanzibar Integrated Land and Environmental Management (ZILEM) initiative. The ZILEM project proceeded under the umbrella of three leads Departments of Environment, Land and Registration and Department of Surveys and Urban Planning. The project aimed at seeking solutions to different problems of land tenure, uncontrolled land-use, coastal development and environmental management, sustainable use of natural resources.

During the process of identifying issues and challenges posing constraints on sustainable management of land and environment, it was recognised that Zanzibar lacks an up-to-date digital base map and an attribute database containing physical features such as infrastructure. Such an information layers would form an integral part of the Zanzibar Land Information System (ZALIS). The department of Surveys and Urban Planning is the sole official government organization responsible for the preparation of, and updating of maps of Zanzibar. During the six years of ZILEM implementation less was done in establishing this database as was planned by the Department of Surveys and Planning and the Department of Land Registration. The obstacle at the time was lack of technical expertise on how to create the framework and maintain the database for keeping ZALIS up to date.

In 2003, the Finish Government re-established ties with the Government of Zanzibar on land and environment issues. The strategy of Sustainable Management of Land and Environment (SMOLE), now in its preparation phase, was conceived as an approach that would address the issue of land information systems, both in the technical sense of establishing ZALIS and in a broader sense that would include all aspects of environmental management. The full implementation of SMOLE will take four years from 2005 and 2009, building on the earlier

ZILEM experience. The objective of SMOLE is to support the national authorities in the three departments involved to prepare a strategic plan for the management of land and environment. To meet this objective *Land Information System* is among the activities to be implemented during the planned period. The same lead departments are involved in the implementation of SMOLE.

In the establishment of ZALIS the departments will play coordinating role and other stakeholder organisations will provide and maintain information related to land use based on geographically linked characteristics such as ecological sensitivity, protected areas, land sets, utilities and others. The work station for ZALIS will be at the Department of Surveys and Urban Planning only. During this implementation phase the ZALIS will concentrate mostly on the three lead departments. For instance, the Department of Surveys and Planning will provide a basic topographical map with infrastructure and a cadastral map showing land ownership. The Department of Environment on the other hand, will provide layers of data that will include information on natural attributes, sensitivity atlas, land and marine protected areas, environmentally high-risk zones. The Department of Lands will provide attribute data related with land ownership and other land rights data. At the time being, the software *Arc GIS 9.0* is installed ready for processing of ZALIS. The software is new to most of the staff and the in-service training is continuing. Many other departments will be invited to contribute to ZALIS by providing and maintaining data layers that can be updated on an as-needed basis.

### **2.3 Zanzibar Sustainable Project (ZSP)**

The Zanzibar Sustainable Programme played a big role in the Zanzibar Municipality in terms of spatial data operation. The programme started in 1998 and with financial assistance from UNPD/UN-HABITAT and the Government of Zanzibar. It was implemented under one local authority, namely the Zanzibar Municipal Council. The major objective is to improve the living environment of the community by providing services to their inhabitants through community participation. Among the planned programs of the project item is to establish *Municipal Information Management Database*. The database includes spatial data layers like a basic map (digitalised from the old topographic maps), layers describing environmental features and some applications. The Arc View soft-ware based Environmental Information Management System was used to compile data. It operated on a minimal budget and provided the updated data about settlements that were badly needed. The UNDP stopped financing the project in 2000 and handed it over to government. Unfortunately all the well-planned programs then seized because the government allocated limited and insufficient funds to run the project, and scarcely enough for administrative purposes, paying salaries and current expenditures.

### **2.4 Institute of Marine Science (University of Dar as Salaam)**

The Institute has the facilities to digitise and scan marine ecosystem spatial data layers such as mangroves, corals, and other marine resources. It makes use of PC Info 3.5 using old topographic maps.



## 2.5 Stone Town Conservation and Development Authority

The Stone Town Conservation Authority is a government institution responsible for restoring the historical town of Zanzibar. It has started to establish a housing database relating housing tenants, and the status and condition of buildings.

The Housing Database Project is the Zanzibar Stone Town Tenancy Project administered by the Aga Khan Cultural Services in Zanzibar. The objective is to build sustainable relationship between the people who live in, and those who work in Stone Town (see Public Housing Database Project, 2002). The goal is to in cooperate with the housing authority to develop a database which currently does not exist in Zanzibar to administer and manage public housing sector.

The Stone Town database include information related to buildings as non-spatial data sets like usage, owner, etc. which later can be converted to geo-referenced data. The project uses *Ms-Access* as a common database tool and *AutoCAD* for digitising maps. There are not up-to-date, the major set of this project is using old maps of *imperial scale 1:480 and 1982 topographic maps* which are old. The major risks encountered by the project are the security and legislation regulating digitising and storage of data. The experience shows that major risks are related to the publication of information on computers, and legal restrictions on what type of information that can be collected on citizens.

## 2.6 Local Governments

There are ten District Councils, five provincial headquarters in Zanzibar islands, and four town councils. The local government are the focal of administration and contact to the community level. They need to be full equipped with necessary tools especially in the new innovation of Information Technology. At the moment most local governments are doing nothing with regard to spatial information management. Few of them use computers for administrative purposes. In addition to lacking the necessary infrastructure base they also lack the necessary IT skills.

## 3. INFORMATION TECHNOLOGY POLICY

Zanzibar has no IT policy and the mandate of creating it is vested in the Chief Minister's Office that also is the organisation responsible for information and broadcasting in Zanzibar.

Currently the Ministry is busy preparing the policy and has collected basic information and requirements from various governments and private institutions that have a role to play in the formulation of the policy. Through a participatory approach and with UNDP support, the Ministry has managed to prepare the first draft of the policy that will be discussed in the stakeholder workshops that will be conducted later this year.

### **3.1. Internet Network**

Based in Zanzibar, there are only two Internet Service Providers (ISP), (Zanlink and Zanzinet), the providers are found only in the Municipality of Zanzibar. The available internet services are supplied in three main ways:

- i. The dial-up service based telephone lines are usually slow, unreliable and expensive. This type is mainly used in the sister island of Pemba where internet cable network is still limited.
- ii. The live internet connection via internet cable is accessible to whoever wants it in Unguja.
- iii. The wireless services provided through wireless receiver. This type is mostly used in remote areas where alternative solution of dial-up or cable connection is not possible.

Apart from that, some Internet users receive internet service via servers based in Dar es Salaam like Raha.com and others receive internet services via global providers like Africa-online.

Numerous internet cafes now exist in Unguja, especially in the four towns, and they are accessible to everyone with the young generation leading. They also play big role in the commercial sector of tourism for marketing purposes. The internet cost to individuals users in cafes stands between US \$ 0.5 for 30-60 minutes (in Unguja) and 0.30\$ per minute in Pemba. The high cost in Pemba is due to the using of dial-up system where one also needs to pay for telephone service.

### **3.2 Information Technology Training Centres**

There is only one government computer training centre at Karume Technical College in Unguja. Private computer schools are mainly spread all over the towns. They only offer courses in *Windows, Word, Excel, Power Point and Ms Access*. Advanced computer training is conducted in Tanzania mainland at the University College of Lands and Architectural Studies at Dar es Salaam, Tanzania.

## **4. OBSERVATIONS AND REFLECTIONS ON THE CURRENT SITUATION**

From the information thus far presented, the following picture emerges that have high relevance for future directions in Zanzibar in terms of IT development and SIM:

### **4.1 Data Integrity and Duplications**

The existing systems of data capture is now in operation are prone to many errors and duplications. Due to incompatible and disjointed formats and uneven standards difficulties and risks prevent the sharing of spatial information between departments. There is no control or coordination among the institutions neither is there sharing of ideas on how to implement this interested but complicated technology.

## 4.2 Security and Accessibility of Data

Data or information in the current system often lacks security and some times gets lost due to badly maintained systems. Inadequate data back-up routines result in the loss of data. The prevailing hot weather conditions in Zanzibar increase the risk of the IT infrastructure base (hardware and software) decaying. Proper *legal instruments and copy right* governing data ownership, access and storage have not yet been established in Zanzibar and remain a major issue.

The missing of IT policy leads to many un-answered queries that include rights of data accessibility, up-dating, and editing as systems or sharing data/information

## 4.3 Awareness

Stakeholders are lacking awareness on Spatial Information Management (SIM) and Information Technology (IT) since they are new innovations in Zanzibar. Society in Zanzibar by and large lacks knowledge of information technology and simply is not aware of the potential benefits it can bring. There is much to be done to send a coherent message to the public and large. The local community which are key beneficiaries for future use should also be well informed. It is our hope that this International Conference will be a platform for sharing “lessons learned” and can assist in laying out proper strategies.

## 5. CONCLUSION AND RECOMMENDATION

### 5.1 Information Technology Policy

Zanzibar is still struggling to develop its own Information Technology Policy that will guide and regulate government database administration and will provide the necessary security as well as insure all government, private sectors and individual have access to it. The existing system which is in operation lacks coordination and has loopholes that can create fraud and misrepresentation of information.

### 5.2 Zanzibar Land Information System (ZALIS):

Historically, Zanzibar has established records for fiscal and legal purpose based on land ownership, parcels, landholding, natural resources or utilities. These records have been established and are kept separately and are often scattered. Clearly, land information management is an integral part of development among the private sector and the society. Fortunately, land information systems lie at the core of the SMOLE strategy. Thus there is new hope that ZALIS will be properly designed and implemented. An effective ZALIS will provide basic information for decision making in terms of land use for the entire islands over the base map, which now is in digital form. Favourably the existing conflict that caused by lack of consistency of mapping indexes would be solved since all institutions concerned with index formation would be using one reference that is ZALIS

The purpose ZALIS is to develop contemporary and applicable system that will facilitate the capturing, processing, storing and disseminating attribute and spatial land related data, environment and future utilities.

In the future SMOLE program should further expand beyond the three departments and include other institutions like the Department of Water that would provide a map of water sheds, water points and courses, and so forth, Department of Forestry, Fisheries, Local Governments, Agriculture, and Department of Roads the Commission for Tourism, Institute for Marine Science should also be included. Collaboration of these organisations will enhance the production of Land /Urban and Rural Information Systems formed from various layers that can be presented as thematic maps for overlaying purposes in ZALIS.

It is recommended that government should create an integrated technical group to coordinate between different agencies. Zanzibar may increase its revenues from selling data, services and other taxes. Well trained staff for processing and marketing ZALIS is essential to provide and utilize its products as far as possible.

### **5.3 Environmental Management Information System (ZEMS)**

Worldwide the question of environment concerns are being integrated into development and it becomes more crucial to those list developed countries that fight against absolute poverty due to the cause effect matters between poverty, survival strategies and environmental degradation. EMIS expectance is for quantifying pro and cons of human development activities towards free poverty society to the minimal environmental impacts as it was mentioned in the ZPRP goal. The Environmental Management for Sustainable Development Act no. 2 of 1996 is the basic tool set to insure the sound and healthy quality of life of the people of Zanzibar, present and future (S.4) Under this section any big development project including that of tourism hotels needed to conduct Environmental Impact Assessment in order to ensure all approved projects are safe for natural environment.

### **5.4 Local Authorities**

Local authorities are the centre sources of information ranging from land use, traditional norms, agricultural natural resources and administration. Most local governments in Zanzibar lack strong administration and technical capacities in IT. The knowledge of IT and particular Spatial Data Infrastructure is beyond to their reach. This paper proposes that local authorities should be given accesses to knowledge and infrastructure to establish database. It is easy to establish this service because of geographic nature tiny islands. Sustainable training programs through using the already existing manpower from central government should be transferred to the local level.

## 5.5 Revenue Collection

The financial sustainability of Zanzibar depends very much on the exploration of natural resources that are not properly administered. Zanzibar's economic development depends heavily on utilization of natural resources like tourism sector, which rely much on natural coastal resources. Spatial Data Infrastructure is a good planning tool for management of natural resources. The Zanzibar government may raise its revenues from the Spatial Data Infrastructure. In this world IT digital data is major tool of revenue collection, it can be sold to researchers, academics and private sector.

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## CONTACTS

Rashid Mohammed Azzan  
Department of Survey and Urban Planning  
P.O.Box No. 811 Zanzibar  
Tanzania  
Tel/Fax: +255 24 2237008  
E-mail: rashidazzan@hotmail.com  
E-mail: smole@zanlink.com

Said Salmin Ufuzo  
Department of Land and Registration  
P.O.Box No. 811 Zanzibar  
Tanzania  
Tel/Fax: +255 24 2237008  
E-mail: ufuzo\_us@hotmail.com  
E-mail: smole@zanlink.com