

## Article



### Exploring GIS in Tanzania

#### *Addressing Bottlenecks in GIS Development*

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GIS is well accepted in the management of spatially related information in the world. Like many other developing countries, Tanzania cannot afford to be left behind in the use, application and development of GIS. The authors address issues related to GIS in their country: awareness, applications, development and constraints.

GIS was introduced in Tanzania in line with global developments in IT applications. All over the world GIS is influencing the performance and functions of many organisations, be they governmental or private, due to its unique capability in handling spatial and non-spatial data. The use and application of this technology in Tanzania is inevitable and has already begun. The beauty of GIS is that it provides a mechanism that allows the user to visualise information in new and revealing patterns, relationships and trends not feasible with other information systems.

#### **Applications Problems**

In Tanzania, the use of GIS technology is still in its infancy. Many organisations in Tanzania are now using IT facilities and a considerable amount of money has been spent on the procurement of hardware, software and training in Information Technology. However, very little has been realised in terms of effective use of these investments. GIS technology, which underlies IT facilities, has not come into wide organisational use. The role of GIS in data management and decision-making is yet to be explored by poten-

tial end-users. It is therefore thought that technical barriers exist to adoption, implementation and management, due in part to lack of GIS knowledge or awareness and understanding of the technology and its functional capabilities.

There are a few GIS projects in the country led by local or overseas organisations. These too are hampered by problems ranging from non-existent expertise, little IT experience and lack of awareness from upper management to low-level users of geo-database concepts. Generally speaking, there is very little understanding and awareness of GIS technology in the country as a whole. No adequate efforts were initiated to make GIS available to the extent this has been done for the Information and Communication Technology sector in Tanzania.

#### **Current Trends**

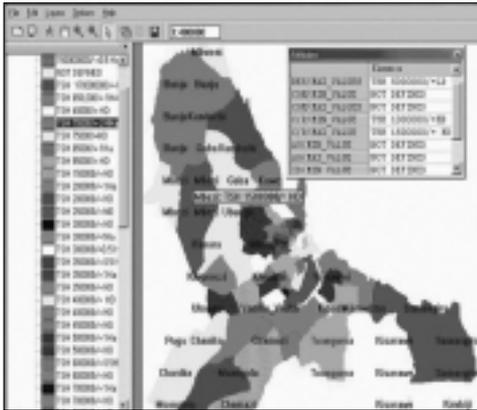
In Tanzania the 1990s witnessed the first use of GIS by several agencies for the purpose of providing support to urban planning management processes. Some organisations adopted it for spatial databases, data input and retrieval and for data manipulation, analysis and decision-making. Areas where GIS is currently being used in Tanzania include the following: natural resources, water management (irrigation and hydrology), ecological monitoring, tourism, agriculture, land information systems, demography and census. There are, however, many other organisations that use GIS in areas not mentioned above. Geo-



Students in GIS laboratory at UCLAS (Source: CICT,UCLAS).



GIS Expert from ITC The Netherlands on the GIS training activities at UCLAS in Tanzania (Source: CICT,UCLAS).



Dar es Salaam map with class domain showing land values. This is a spatial database, one of the GIS initiatives in Tanzania.



GIS awareness training for executives: former UCLAS Principal Prof. Nikundiwe is given details about GIS at UCLAS (Source: CICT,UCLAS).

graphic Information Systems are becoming more prevalent in both day-to-day and strategic decision-making in many sectors. There is little published work available on GIS implementation, use and application to provide an overview of the Tanzanian situation.

**GIS in Projects**

Several projects may be cited as good examples of GIS applications in Tanzania. Some municipalities and a district council have applied GIS in environmental management projects. These are Iringa Municipality, Mwanza City and Kahama District Council. All these have environmental management information systems. The National Bureau of Statistics has established a GIS unit for keeping census data and to help reduce the cost of area boundary delineation. Many uses and applications of GIS can be traced in the Tanzanian game reserves and national parks, where the management has contracted foreign GIS consultants to establish GIS for ecological monitoring, land management, tourism and wildlife migration movement. Examples of these are Tarangire National Park, Serengeti National

Park, Mkomazi game reserve, Ngorongoro Conservation Area, Mikumi, Rungwe and Amani.

**Barriers to Application**

This use of GIS in Tanzania is still rather exploratory and ad hoc in nature, although there are some signs of growing maturity in GIS application in diverse fields such as public planning, agriculture, environmental management, civil engineering, surveys and mapping. However, there are considerable barriers to be dealt with if GIS is to become fully embedded in these areas. Major issues concerning awareness and understanding, data quality, data sharing and management need to be addressed. Lack of suitably qualified personnel to manage GIS is another obstacle to GIS implementation. Whereas GIS is now taught in secondary education, colleges and universities in developed countries, Tanzania has only limited teaching of GIS in at higher education levels. Only the University College for Architectural Studies (UCLAS) at the University of Dar es Salaam, Tanzania (UDSM) has GIS professional training in its undergraduate curriculum. Its Department of Land



A GIS technologist explaining a point regarding remote sensed images as data source in GIS activities (Source: CICT,UCLAS).



*The Computer Laboratory at UCLAS for students and other trainees.*

Surveying is the only one of the country's universities to have a full GIS teaching programme in its undergraduate degree course in land surveying. The UDSM, in its post-graduate course in computer science, has GIS as an optional subject, while geology, geography and environmental studies offer some GIS possibilities. This makes the problem of availability of qualified personnel for sustainable GIS implementation not easy to solve.

### **GIS End-users**

A general survey of users indicates that GIS was initiated in their organisations under foreign assistance that provided IT facilities and personnel training. One such case is the Dar es Salaam City Council, which started to use GIS in city projects in the 1990s under the Urban Sector Rehabilitation Project (USRP). Since then, other projects have followed, one being the Sustainable Cities Project funded by the UN-Habitat, UNDP and the Prime Minister's office. This project involved GIS in urban planning and management.

GIS is nowadays moving slowly due to a lack of awareness and understanding on the part of decision-makers. A private company from Kenya (Geomaps) once conducted an awareness demonstration for city councillors on the usefulness of GIS and how it can be used in tax collection and utility management. Decision-makers have yet to give this full support, especially as it translates into needed financial resources.

### **Adoption Bottlenecks**

GIS users admit the existence of problems facing its use in their organisations. Most GIS is not as fully operational as to include many departments. This makes information sharing between departments within one organisation problematic. To summarise, the most critical problems facing GIS in Tanzania are the following:

- *Lack of awareness and understanding of GIS by decision-makers.* Awareness is a major problem facing the adop-

tion and use of GIS in Tanzania. More awareness creation and training need to be done to include all decision-makers and policy makers in government and private organisations. Without an increase in realisation of the need to adopt GIS, nothing can be achieved to increase effectiveness of decision-making in these organisations, especially where spatial information is involved

- *Lack of IT experience*, including the use of IT facilities, is widespread. This means that basic skills in the use of computers are lacking among many staff members

### **Further Bottlenecks**

- *Lack of financial resources*

GIS requires heavy initial investment in terms of hardware, software and training. Decision-makers are usually afraid to invest in any expensive projects when they can not be sure of the benefits. Only when these people become aware of and understand the real power of GIS will they fully support it. The majority of GIS activities are dependent on external financing. This results in a threat to local sustainability of GIS once foreign aid is exhausted

- *Lack of qualified personnel*

To use GIS one needs to have learned to completely master it through basic or professional training. There are currently not enough GIS-ready personnel to manage GIS

- *Large cost approach*

There is a costly approach to GIS which makes its adoption impossible. An appropriately low-cost approach to GIS would be suitable in the Tanzanian context. High costs involved in GIS hinder its adoption and use in Tanzania

### **Recommendations**

The following recommendations are advanced for effective and prompt dissemination of GIS technology in Tanzania:

1. A countrywide awareness campaign is required to disseminate understanding of the technology, especially amongst policy and decision-makers at all levels: local government, central government, private companies and individual members of the public
2. Specialised training for technical specialists in the use of GIS tools as part of their work
3. Maintenance of the existing GIS in the organisations that have it, requiring the allocation of proper financial resources
4. Large 'top-down' GIS programmes should not necessarily be seen as good solutions to specific local needs. Appropriate GIS technology should be applied in Tanzania. A low - cost approach to GIS is the best solution
5. National success with GIS applications can be achieved through sharing skills, facilities and, perhaps

most important of all, data. Now that Internet access is so easy in major Tanzanian towns and cities, the obvious way to begin here would be an on-line national register of GIS projects and geographical information datasets. Further, to spearhead the development of GIS in Tanzania it is proposed that a National Geographical Information Centre (NGIC) be established capable of acting as overseer and custodian of the national register of this information. With this it will become possible to disseminate the technology easily to many users and to have local forum for all GIS users in the country; it would become possible to develop GIS using the latest technology

**Further Reading**

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