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ESTABLISHING GIS IN AFRICA: PROBLEMS AND CHALLENGES

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BY

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INTRODUCTION

A Geography Information System (GIS) comprises of an integrated collection of computer hardware and software which are specially designed to input process, manipulate, integrate, model, retrieve, store and manage geographically referenced data. It is a tool that has a capability to integrate complex data sets (physical, economic and social) in order to facilitate the rational exploitation of such data in decision making, development planning , environmental monitoring and resource management. Users of GIS include diverse interest groups such as educational institutions, government departments, non-governmental organizations, the business community and many development agencies. The numbers of these users are increasing.

Despite the numerous advantages that accrue from the use of GIS, the acceptance and implementation of this technology especially in Africa still faces a lot of impediments. In this paper, the problems that hinder the use of GIS technology in Africa are briefly discussed. This is followed by suggestions on how these problems can be resolved. Lastly, the role of regional centres in the promotion of the use of the technology is highlighted with a particular reference to the Regional Centre for Services in Surveying, Mapping and Remote Sensing (RCSSMRS), which is based in Nairobi, Kenya.

PROBLEMS AND CHALLENGES

The main problems that hinder the use and establishment of GIS technology in Africa include among others lack of awareness on the part of decision makers, lack of financial resources, inadequate human resource and infrastructure, lack of appropriate training facilities, lack of data and information, lack of information and experience exchange programmes etc.

Lack of Awareness

While GIS technology has been relatively successful in capturing the attention of technical and middle management personnel, it has

not been successful in capturing the attention of decision makers. As such majority of decision makers and planners including politicians and senior officials in Africa are still unaware of the potential uses of the GIS technology in decision making and development planning. Lack of awareness in the use and importance of GIS technology by decision makers has greatly hampered its establishment on the continent. Decision makers are key players in the adoption of any technology or policy in any country. These are the people who make decisions about future direction and without their involvement, no decision can be taken or implemented regarding any technology or policy.

Apart from lack of awareness on the part of decision makers, overall there is general lack of awareness on the importance and availability of the technology among the general public and even in majority of academic institutions in Africa.

Lack of Financial Resources

Lack of financial resources significantly contribute to the slow establishment of GIS technology in Africa. To establish a GIS facility that has a capacity to meet national planning needs requires substantial investment. Most of the investment is in foreign currency especially for the purchase of hardware, software and computer stationery. Since most countries in Africa suffer from a multitude of economic problems, most of them are unable on their own to establish and maintain a GIS operation even if they were willing to do so.

Inadequate Human Resources and Infrastructure

Overall there are extremely few professionally trained personnel in the use of the GIS technology on the African continent. Most people have only had short courses in GIS technology or have only attended seminars or workshops on GIS applications. The few who have had formal training in GIS have in many cases been trained in overseas institutions. However, on return to their respective countries, most of them have been unable to practice and use GIS technology due to lack of GIS facilities or have been assigned different duties.

Lack of Appropriate Training Facilities

There are very limited training facilities on GIS technology in Africa. Thus most of the training has to be undertaken from abroad. Most of the universities and academic institutions on the continent do not have GIS in their curricula. It is only recent that some universities i.e. University of nairobi have started developing GIS curriculum for later implementation in both graduate and post-graduate courses.

Most of the GIS training on the continent has been undertaken mainly by regional institutions and GEMS/UNITAR on ad hoc basis. Among the regional institutions which are involved in GIS training is the RCSSMRS. Other UN organizations and donor agencies have also been involved in the organization of short courses or workshops on GIS. Most of the training has been undertaken based on individual country or regional needs. As such no standard training programmes for different cadre of trainees have been developed which could be adopted by other institutions.

Lack of Data and Information

Majority of the countries in Africa lack basic data required for the establishment of GIS. There is a serious lack of data on most of the Africas natural resources. Where data exists, it is quite often out of date or fragmented. Due to lack of financial resources most African countries are unable to collect the required data on a regular basis. Establishment of GIS requires availability of comprehensive data on physical, economic and social parameters. Without adequate data, the capabilities of GIS as a planning tool cannot be fully exploited. Therefore, any consideration for establishment of GIS facility must include the availability and continued generation of required data inputs.

Lack of Information and Experience Exchange programmes

There is a serious lack of exchange of information and experience concerning GIS applications in Africa. A number of countries e.g Kenya are already advanced in the use and application of GIS technology in decision making and development planning. While it could be more advantageous for countries wishing to establish GIS technology to seek and share experience with those which already have acquired and are using GIS, in practice this does not happen often. In many cases, countries wishing to establish GIS do so without seeking any advice or information from the already established GIS installations. As such many mistakes and wrong decisions that could have been avoided in the first instance had advice been sort are repeated. This has a net effect of slowing down the overall establishment of GIS and results in GIS operational problems and minimum utility of the system. Due to lack of both information exchange and clearly defined objectives, quite often inappropriate GIS are installed which cannot perform effectively the intended tasks.

GIS Technology "Push"

GIS technology is developing very fast. As such we currently have different types of GIS software on the market and more are still under development and are expected to be available on the market anytime. Due to availabiltiy of a number of GIS softwares on the market, there is an increasing tendency by the software vendors to vigorously market them in Africa. Since GIS technology in Africa

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is still at its infancy, many prospective users are being influenced by GIS vendors to establish differnt types of GIS without being given a chance to evaluate their capabilties and compare them with other GIS on the market. This GIS technology "push" is further being catalysed by a number of donor agencies who recommend what type of GIS to be used in the projects they are funding in Africa. This is resulting in the introduction of differnt GIS in Africa some of whose capability and viability is unknown. Thus the uncoordinated and increasing introduction of different types of GIS in Africa is hampering the state and rational establishment of the technology.

PROPOSED FRAMEWORK FOR ESTABLISHMENT OF GIS IN AFRICA

Due to the above problems, the establishment of GIS in technology in Africa has generally been slow. To enhance the prospects of establishing the technology, a number of strategies need to be adopted. The first step should be to sensitize the importance of the technology to decision makers who include senior development planners, business community and non-governmental organizations. The sensitization programmes should be initiated by middle level professionals in respective countries who already understand the technical aspects of the technology. The awareness drive should be conducted in form of luncheon, meetings, briefs, short but practical demonstration on how GIS can be used a planning tool. The United Nations agencies i.e ECA, UNDP, UNEP, UNESCO etc and donor agencies should also participate in the sensitization process in different national and international forums. A part from creating awareness among decision makers, there is also a need to create awareness among institutions of higher learning and the general public.

The second step should be for individual countries to accept the technology and commit themselves to its establishment and development. The acceptance of the technology should culminate in the choice and designation of a particular government department or institution the responsibilities of establishing GIS facilities. To establish these facilities, the countries will need both technical and financial support which should be solicited from donor agencies. There will be need also to seek technical advice from other African countries where the technology is already established. The type of GIS facilities to be established will depend on both short-term and long-term objectives of the intended utilities of the system.

The third step in the promotion GIS technology on the continent is for each country to formulate training programmes for its nationals. There are different levels of training that need to be considered. First and foremost is the training of professionals and technicians. The training of professionals should both be local (on job training) and international. The technicians should

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mostly be trained on the job, although short courses in overseas or regional institutions will also be necessary. It is envisaged that regional institutions should play a great role in training of the nationals from the continent. The regional institutions will need to develop GIS training packages for different cadre of trainees to fulfil this task. To make the regional institutions develop or have GIS training capacity, there is a need to strengthen the centres financially. This strengthening should be borne by member states and donor agencies and in the long run the Centres should be able to generate their own resources through consultancies and money earned from training fees.

There are a number of advantages for having the regional institutions as the main GIS training centres in comparison to the training offered outside Africa. First, it costs relatively less to train an individual in a regional institution in comparison to an overseas institution. Second, students will be more exposed to local and relevant situations unlike in overseas institutions. Third, the regional centres can cost effectively supervise students undertaking individual or country projects. The centres should also be in position to offer regular internships to professional GIS experts from the continent. Apart from the regional centres, different universities should develop curriculum in GIS and start training students both at undergraduate and post graduate levels. Post-graduate students should be encouraged to make use of facilities at the regional centres. The teaching of the technology should in the long run be considered for introduction in other institutions of higher learning and in high schools.

To enhance the promotion of the technology on the continent, there is a need for exchange of information and experiences. This can be promoted on regular basis through workshops, seminars, data exchange, internships, professional visits, etc. There is also a need to form a forum or society which can coordinate the promotion of the technology. The recently formed African Society of Remote Sensing of the environment could be expanded to incorporate GIS.

Lastly, if the establishment of GIS in Africa has to succeed, there is a great need for availability of reliable and up-to-date data. Currently, most countries are seriously deficient in basic data required for development planning. To enhance data collection, respective countries must support their institutions which are involved in collecting different data sets, particularly data on natural resources. To promote rapid and continuous collection of data on natural resources, the countries will need to incorporate remote sensing technology in their data collecting mechanisms. Thus the development of GIS should not be considered in isolation from the promotion and use of remote sensing technology in resource inventory, environment assessment and monitoring.

THE ROLE OF RCSSMRS IN THE PROMOTION OF GIS TECHNOLOGY IN AFRICA

The Regional Centre for Services in Surveying, Mapping and Remote Sensing which is an inter-governmental organization covering 22 countries of Eastern and southern Africa subregion, has a developed modest GIS capability to handle and process all types of resource data. The Centre also provides consultancy and training services in the field of GIS within its region of operation and elsewhere.

In the field of training the Centre has conducted a number of courses, majority being short-term (up to three months duration). Among the courses conducted are:

1. **GIS for Food Security**

    This course was conducted in 1987. The total number of trainees was 20. The trainees came from Kenya (6), Ethiopia (1), Tanzania (2), Uganda (4), Zambia (3), Burundi (1), Congo (1), Mozambique (1), and Somalia (2).

2. **GIS Application to Agriculture and Land Use**

    This course was conducted in 1989. The number of participants was 22. The participants came from Kenya (5), Lesotho (1), Somalia (1), Sudan (2), Swaziland (1), Tanzania (5), uganda (5) and Zambia (2).

3. **Environment Information System (Networks for Africa)**

    This was a three months course which was conducted between 1989 and 1990 and was jointly sponsored by UNITAR, UNEP and the Centre. In total 9 people participated in the course. They came from Lesotho (3), Uganda (3), Ghana (3).

4. **Early Warning for Food Security**

    This course was conducted between 1990 and 1991. The total number of participants was 81 and they came from kenya (18), Ethiopia (17), Djibouti (4), Somalia (8), Sudan (16), and uganda (18).

The main objectives of conducting the above courses and others not listed were as follows:

Immediate Objectives

-   To introduce the capabilities of GIS in data analysis, integration, management and storage.

- To initiate multi-displinary approach to data analysis for decision making.

Medium to Long-term Objectives

- To encourage and promote the creation of national environmental data bases.

- To promote the use of GIS in resource assessment food security and early warning and environmental monitoring.

- To encourage gradual evolution of the National GIS units whose main objectives should be to collate, analyze, store and manage resource data.

Apart from training, the Centre is also involved in the implementation of projects where GIS is applied. These projects include forest change monitoring, land use changes, identification of tsetsefly habits, environmental monitoring, natural resource assessment etc. An example of a project where GIS technology was used is the assessment of forest area change is Mabira and Mt. Elgon of Central Forest Reserve in Uganda. The GIS technology was used to transform topographic, soil and time series forest cover maps into digital formats. Using the data in the GIS environment, it was possible to analyze forest area change over a period of 30 years. A similar study was conducted on Mt. Elgon but with emphasis on the agricultural encroachment. The results revealed that a total loss of 28% (8,021 ha) of Mabira forest land had been lost to agriculture and 16% (4472 ha) had been transformed into degraded forest.

Although the Centre has developed a GIS capability, there is a need to strengthen its capabilities particularly in terms of hardware, software and infrastructure. The strengthening will enable the Centre to carry out its training activities more efficiently. It will also make it possible for professionals working on particular projects to use the facilities without interfering with the training activities.

In summary, the Centre's emphasis on the current and future GIS activities is basically geared to benefit the member countries of the sub-region by making available information base and manpower through training nationals, project implementation and consultancy services. It is hoped that the availability of such information in a readily accessible form to the planners and decision makers can make a tremendous positive impact on the environmental protection policies and economic development planning activities in the sub-region. Other beneficiary groups are specialized users such as education institutions, parastatals and non-governmental organizations, intergovernmental organizations and international agencies operating in the sub-region.

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