

ENABLING CAPACITY BUILDING IN GEOSPATIAL INFORMATION PRODUCTION AND MANAGEMENT FOR SUSTAINABLE LAND, ENVIRONMENT AND NATURAL RESOURCES MANAGEMENT IN AFRICA THROUGH NORTH-SOUTH EDUCATION NETWORK

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ABSTRACT:

Capacity building in any activity involves making available the critical mass of skilled manpower, the necessary equipment and an enabling infrastructure. In geospatial information production and management, advances in space and information technologies have impacted positively on critical capacity globally through availability of geospatial information technology (GIT) tools. To be fully utilized however, the acquisition of GIT must be fully complemented by readily available skilled manpower and an enabling infrastructure. Unfortunately, in Africa at the moment, more than 90% of all professionals, technologists and technicians in various organizations involved in geospatial information activities were trained in the obsolete methods of map production whereas, the introduction of GIT demands a critical mass of well-trained staff at all levels in a reasonable time frame. This has led to the widening of the digital divide between the developed countries (generally referred to as the north) on one hand and African countries (referred to as the south) on the other. Noting that many organizations in African countries can no longer afford to send their members of staff abroad for long-duration training due to financial constraints, especially considering the number of persons to be trained before achieving capacity utilization, it is necessary to provide alternative solution through educational networking of institutions in developed and African countries. This paper examines ways of improving manpower development in Africa, especially for personnel of national mapping organizations and gives an example of a north-south collaboration effort aimed at addressing this problem of manpower development in African countries.

1. INTRODUCTION

The need for capacity building in geoinformation production and management in Africa cannot be over-emphasised as geospatial information is definitely the sine-qua-non for sustainable national development. Unfortunately, it is convincingly clear that geoinformatics education and practice in many African countries are lagging behind in the area of modern technology as more than 90% of all professionals, technologists and technicians in various organizations involved in geospatial information activities were trained in the obsolete methods of map production whereas, the introduction of GIT demands a critical mass of well-trained staff at all levels in a reasonable time frame.

African geoinformatics practitioners must be necessarily well prepared to face the challenges of the new knowledge-driven millennium, where knowledge of the geography of the country will continue to be the driving force behind socio-economic development. This requires thorough knowledge of geospatial information technology (GIT), awareness of the many sources of data for input into a geospatial information system (GIS), and an understanding of the way in which the data can be handled and analyzed to solve problems associated with management of the environment and land and water resources. This calls for the combination of traditional skills with those of new technology and spatial data handling skills. These can be achieved only

through a curriculum that is adaptive to changes. This means that appropriate geoinformatics education and training schemes must be immediately put in place in order not to be left behind with the 20th century.

The geoinformatics education should be strong at conceptual level so that the graduates of the course can be versed not only in the use of GIS packages but also in spatial reasoning and GIS development. In short, apart from the basic knowledge required for surveying and mapping, other subject areas are now required for geoinformatics education. Four broad specialized areas can be identified and have been generally implemented in various forms by notable institutions all over the world, e.g. ITC (Kraak, 1997; Kainz, 1997; Groot, 1997; Groot and Kraak, 1999; Kufoniyi and Bouloucos, 2000). These four areas are:

- (a) Spatial data acquisition
 - (i) Computer-aided Surveying (land and hydrographic)
 - (ii) Digital Photogrammetry and Remote sensing
 - (iii) Conversion of analogue map and other geospatial data into digital form by digitizing and scanning
 - (iv) Attribute data collection methods.
- (b) Spatial data management, which requires knowledge of database design and creation, database management systems, data transfer and exchange, spatial query development, spatial statistics, etc.

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- (c) Cartography and Geoinformation Visualization, dealing with data formats, generalization, information presentation, etc. and
- (d) Geospatial information infrastructure and management, dealing with aspects such as spatial data standard, GIS policy, implementation issues, optimization of geoinformatics processes, metadata structure and clearing house issues, etc.

These four broad areas were also adequately incorporated in the new geoinformatics curriculum of the Regional Centre for Training in Aerospace Surveys (RECTAS), Nigeria (Kufoniya, et al., 2001). Relevant to each of the four broad areas are fundamental subjects such as mathematics (including set theory, graph theory and topology), computer science, artificial intelligence and expert system (Kainz, 1997; Molenaar, 1998; Groot and Mclaughlin, 2001).

Thus, it is necessary to design new surveying and mapping curricula that would address the four groups above as well as the fundamental subjects to be able to train geoinformatics practitioners who will be able to produce on timely basis the required geospatial information for national development.

2. CONSTRAINTS TO RAPID AFRICAN MANPOWER DEVELOPMENT IN GEOINFORMATICS

Slow rate of manpower development in geoinformatics in Africa has been attributed to many factors (Rüther, 2001). These include:

- Low enrolment in geoinformatics education in African institutions of learning.
- Even with the low enrolment, few institutions run geoinformatics courses.
- Obsolete curriculum and inadequacy of modern equipment
- Rigid curriculum that does not give room for intake of serving personnel to undergo short term courses as part of the long duration courses.
- Many organizations in African countries can no longer afford to send their members of staff abroad for training due to financial constraints, especially considering the number of persons to be trained before achieving capacity utilization.
- Absence of uniform academic standard and lack of networking to facilitate sharing of human and other training facilities.

To overcome some of these constraints, it is necessary to redesign the course curriculum and encourage networking of educational institutions.

3. LEVELS OF TRAINING REQUIREMENTS

The required geoinformatics education and training programmes should be geared towards the following four levels (Kufoniya, 1999):

- (a) High-level policy-makers: This can be achieved through short-term intensive training in the fundamental aspects of

geoinformatics particularly when GIS implementation is being initiated.

- (b) Management and Professional staff: New employees in this category should be already educated in the modern technology while opportunity must be also provided for mid-career (re)training of those already in employment for the purpose of broadening their outlook and keeping up to date on modern developments in geoinformatics.
- (c) Technical Support Staff: Education and (re)training of technicians and technologists for efficient production, management and use of geospatial information.
- (d) General Public: through mass media and public lectures, to sensitise the public on the benefits derivable from GIS and geospatial information production.

4. WAYS OF ACHIEVING THE TRAINING NEEDS

The education and training needs indicated above can be undertaken in a University, polytechnic, or specialized institution. Examples of the specialized institution are the regional centers (e.g. Regional Centre for Training in Aerospace Surveys (RECTAS) and Regional Centre for Mapping of Resources for Development (RCMRD)) and the national survey training institutions (e.g. Federal School of Surveying, Oyo, Nigeria, Ghana Survey School, etc.).

While the Universities and Polytechnics concentrate mainly on regular education courses mostly leading to the production of new graduates, the specialized institutions focus more on manpower development through the education and retraining of serving officers. Furthermore, flexibility is possible in the specialized institutions, facilitating running of their programmes in short modules to permit continuing education of serving officers through short courses that are part and parcel of the regular programmes.

5. EDUCATIONAL NETWORKING

It would appear from the previous section that the two categories of educational facilities should be able to satisfy African training needs in geoinformatics, but this is not really so as many of the institutions are not adequately equipped to provide efficient training. Some of the obstacles militating against their efficiency have been mentioned in the previous sections. These obstacles can be minimized through educational networking, which can be categorized into two:

- South-South collaboration
- North-South collaboration

5.1 South-South Educational Network

The south-south education network is limited to collaboration among two or more institutions of learning in geoinformatics training, carrying out joint research and training programmes thereby sharing facilities. The collaboration can be among institutions that are located in the same country (intra-national) or in different countries (international) but only in developing countries, African countries in this case. Examples of intra-national collaborations exist in various countries. In Nigeria for example, working collaborations exist between RECTAS and various Nigerian Universities and Polytechnics while similar ones are being developed with institutions in other member states of RECTAS.

Nkambwe (2001) also gave two examples of south-south education network: the South African Network for Training on the Environment (SANTREN) and the SADC EIS Training and Education sub-programme (SETES), both of which cuts across many countries in Southern Africa.

5.2 North-South Educational Network

This involves the collaboration of one or more institution(s) in the south and one or more institution(s) in the developed countries. This type of network has the advantage of regular update of curriculum including north-south staff and student exchange programmes.

An example of this network is the expansion of an earlier initiative on collaboration between the Federal School of Surveying (FSS), Oyo, Nigeria, and the International Institute for Geo-information Science and Earth Observation (ITC) (Kufoniyi and Bouloucos, 2000) to include the Regional Centre for Training in Aerospace Surveys (RECTAS), Ile-Ife, Nigeria, and the Groupement pour le Développement de la Télédéttection Aérospatiale (GDTA), Toulouse, France. This network has also taken advantage of a previous partnership among RECTAS, ITC and GDTA.

The network initiative has been packaged under the name: Capacity Building for Geoinformation Production and Management for Sustainable Land, Environment and Natural Resources Management (CABGLEN).

The network will contribute to rapid national and regional development by:

- Providing qualified graduates for immediate employment and productivity.
- Retraining existing personnel for improved productivity and introduction of modern production techniques.
- Retraining academic staff of other institutions so as to be able to modernize their curricula in line with modern trend.
- Significant saving in foreign exchange through efficient local training.
- Assisting production organizations through well-equipped consultancy services.

The network is focusing on education and training in geoinformatics at the MSc and Professional Masters (PM) levels including refresher courses of duration of one to four weeks. Under this programme, a refresher course of two weeks in digital photogrammetry was conducted in November 2001 for seventeen (17) middle-level officers of national mapping organizations from eight West African countries (Nigeria, Benin, Cameroon, Ghana, Niger, Mali, Burkina Faso and Senegal). Similarly, four lecturers of RECTAS and FSS were sponsored for different refresher courses of three months duration at ITC in 2001.

6. CONCLUSION

To achieve a rapid manpower development in geoinformatics in African countries, it is essential to put in place education networks at national level (intra-national network) and international level with the latter involving both south-south

and north-south networks. Example of a north-south network under implementation has been presented in this paper. Such collaboration will facilitate the training and retraining of personnel at various levels in order to bridge the digital divide between the developed countries on the one hand and developing countries on the other hand.

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