MODELS FOR CAPACITY BUILDING IN ENVIRONMENTAL INFORMATION SYSTEMS IN SUB-SAHARAN AFRICA: NECESSITY FOR COORDINATION

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ABSTRACT:

This paper looks at the history of capacity building for using environmental information systems (EIS) in sub-Saharan Africa and the models that have been used over time to carry this out. It points out the current strengths and weaknesses of each of the models and suggests a new model under which co-ordination in capacity building might be achieved using the strengths of each the models already developed. The early stages in the 1980's and early 1990's were focused on building awareness of the potential of geographical information systems and remote sensing in improving decision making. Those from the mid-1990's to late 1990's were meant to increase skills in the personnel using EIS in general. Although both increased awareness and increased skilled personnel have continued into the twenty first century, the focus from the late 1990's to date has been to develop skills that bring EIS to the decision maker and to build coordinated spatial data infrastructure. In the current effort, coordination of various institutions and the private sector that traditionally have used different models for capacity building is essential.

1. INTRODUCTION

Literature in reviews at ten year intervals on the development of Environmental Information Systems (EIS), (including geographical information systems (GIS) and remote sensing (RS)), have suggested that at the end of each ten years the previous decade had been for building up capacity but that actual use of EIS-related technology in decision making would henceforth be the focus of the development of the technology. Taylor (1991), in summarising reviews of development for the Third World in general, and Hastings and Clark (1991) looking at developments of GIS in Africa in particular, had this view for the 1980's. Similarly, Prevost and Gilruth (1997) had the same view on EIS development in sub-Saharan Africa in the 1990's. Current views, however, seem to give the impression that the building of infrastructure for spatial information systems in general is required to make EIS effective in decision making over the next decade (Ezigbalike, 2001). In spite of these claims over a thirty-year period, spatial information science has remained rudimentary in decision-making in many parts of sub-Saharan Africa and the fastest models for building capacity are essential to make it effective. Different views have been given on the origins of EIS, in sub-Saharan Africa and what players have had the greatest impact on its development (Batty, 1990; Yeh, 1991; Prevost and Gilruth, 1997; Gavin and Gyamfi-Aidoo, 2001). In general various categories of institutions and sponsors have tried to over-emphasise their contribution to justify their existence and have not clearly focused at the special areas of their contributions *vis-à-vis* those of others. Consequently, sub-Saharan Africa has not seen the kind of collaboration essential, in view of limited resources, to make each group (e.g. universities, regional centers, national institutions, institutions of higher learning outside Africa) contribute uniquely with a focus in those areas of capacity building where it makes the greatest impact. This paper is intended to start a debate on which areas each group of contributors has the greatest advantage. It makes the preliminary suggestions as the starting point of the debate.

2. EARLY INTERNATIONAL EFFORTS AND THE CREATION OF REGIONAL CENTERS AND NATIONAL INSTITUTES

The development of EIS and the skills to use this technology have had a long history of international goodwill since the early 1970's. This support has been used in developing models for capacity building for using the technology and will continue to be critical in coordinating efforts. The most important and critical change in the availability of spatial data followed by the demand for skills to interpret and organize it came in the early 1970's when orbiting satellites were first launched in 1972 by the United States. The potential of using satellite imagery available at much higher temporal resolution to replace aerial photography for mapping large areas of Africa were recognized but skills to use the technology were very limited. |The United Nations Environment Program (UNEP) formed in the early 1970's with its headquarters in Nairobi was among the earliest organizations to try and promote EIS in various parts of Africa. Several incentives were given and many projects in various countries were conducted by donors to assist governments to build capacity for interpreting satellite images (Prevost and Gilruth, 1997, p. 7; Prince et al., 1990). Concurrently, regional centers were created with donor funding to boost interest and build skills primarily in satellite image interpretation. Characteristically, a group of countries would come together and draw up a charter that made each member of the group a financial contributor to the running of the center. The four regional centers in Nairobi, Kenya (Center for Services, Mapping and Remote Sensing (RCSSMRS) established in 1975); Ile-Ife, Nigeria (Regional Center for Training in Remote Sensing in Aerospace Surveys (RECTAS) established in 1975); and Ouagadougou, Burkina Faso (Centre Regional de Teledetection (CRTO) established in 1977) have all survived with strong outside financial and technical assistance.

The most important single event for demanding capacity for the use of EIS, however, was the United Nations Conference on Environment and Development in Rio de Janeiro in 1992 which introduced new concepts that stressed major concerns in development. The concept of sustainable development, very

strongly endorsed at the conference, required that development should be integrated with environmental values. Decision making within such a framework demanded better techniques and improved skills in organizing information on the environment.

Chapter 40 of Agenda 21 focuses on the importance of information as the mainstay of all "development and environment" issues. It underscores the need to deal with the fundamental problems in "environment and development" planning caused by inadequate availability, analysis, and use of relevant information; and provides a framework for action by governments, regional organizations, international agencies and the private sector. As many studies and syntheses on sustainable development have shown since Agenda 21, Africa has had the greatest challenge to relate environment and development (UNEP, 1991, 1993, 2000; Darkoh, 1993; UNECA,1997; Fritz,1998; Bagnoli et al., 1996). The various programs and projects started throughout the continent required skill and institutions to support improved handling of data on the environment and emphases were put on building capacity to use EIS for regular decision making. For example SADC's Regional Policy and Strategy for Environment and Sustainable Development (SADC, 1996) expressed a need for the region and its constituent member to address such issues as "institutional strengthening and capacity building", the development of environmental information systems, and education and training for the improved management of natural resources.

In the early days of this development, regional centers played a leading role in capacity building in addition to training and education given outside Africa. The development throughout their history has given them two major advantages which may be used in a collaborative and coordinated effort in capacity building in sub-Saharan Africa. Firstly, they have operated at regional (rather than national) levels, working with several Governments. As the importance of transboundary natural resources management spatial databases are recognized in the sub-continent, the history of regional centers that has given them intergovernmental cooperation in the various regions of Africa becomes the major strength in contributing to capacity building. Probably this may not be in giving general short courses but in targeting specialists who may require additional skills in geographical information science to carry out projects designed to cover several countries. An added advantage to this approach is that the regional centers may operate on a commercial basis in providing consultancy services where it is demanded by governments, NGO's, the private sector, et. etc., a potential point for their financial sustainability. All the regional centers listed above are already turning in this direction and this should be encouraged as the focus of their unique contribution to capacity building. Secondly, regional centers have worked in close collaboration with institutions from outside Africa that have had long experiences in capacity building and have contributed tremendously over several years to the development of spatial information systems in sub-Saharan Africa. The working relationship between the ITC (Netherlands) and RECTAS is a very good example. These links have been and should continue to be used in working on projects stated above but with less financial donation being expected from European or American donors.

3. NATIONAL CENTERS SPECIALIZING IN AN ASPECT OF EIS

There are a number of national centers specializing in some aspect of EIS and performing different functions some of which include capacity building. A few were established in the early 1980's as national centers of remote sensing (e.g. the National Remote Sensing Facility, now the Environmental Remote Sensing Institute (ERSI) in Zimbabwe; the National Remote Sensing Center (NRSC) in Sudan). Others grew with the assistance of UNEP (e.g. the Kenya Rangeland Ecological Unit (KREMU) developed with the assistance of UNEP's Global Environmental Monitoring Center (GEMS); Senegal's Ecological Monitoring Center (CSE); Mozambique's National Remote Sensing Center (CENACARTA); and Uganda's National Environmental Information Center (NEIC). The role national centers play in capacity building have varied, changing even for individual centers. For example, ERSI focuses on training in short courses and conducting projects, while CSE is a dominant center in building up institutions throughout the country. Almost every country with a successful EIS program in sub-Saharan Africa now has a national center, a focal ministry, department or institution driving various aspects of institutional capacity building of EIS. This has become very important in more recent periods with emphases on the development of spatial data infrastructure throughout the sub-Saharan Africa. In a co-ordinated effort national centers may be expected to collaborate with other institutions at the national level in giving direction to the overall development as is the case with Senegal's CSE and Uganda's NEIC with particular emphasis on developing national spatial data infrastructure.

4. INSTITUTIONS OF HIGHER LEARNING

Institutions of higher formal learning (polytechnics and Universities) in sub-Saharan Africa, (except South Africa) were in general originally by-passed in many countries in the development of capacity for EIS development. Characteristically, trainees were selected from ministries and taken to a national or regional center, or to an institute of higher learning outside Africa, and then returned to work on a specific project. In Swaziland and Lesotho, for example, personnel who have been trained over the years have carried out projects on reforestation and soil erosion respectively and in both countries skills in EIS are strong in Government Departments but are only emmerging at the national universities. While this approach to capacity building contributed greatly to the increase of skills in EIS in sub-Saharan Africa, it had a number of defects. Firstly, it lacked the multiplicative effect associated with training trainers and educators who may then multiply their skills by educating or training others. By-passing universities in the effort to develop capacity in EIS has slowed the rate at which the capacity to use the technology has developed in sub-Saharan Africa. In a co-ordinated collaborative effort to develop capacity to use EIS, institutions of higher learning would have the advantage of producing large numbers of trained personnel on a continuous basis by including EIS courses in their regular curricula. In addition, institutions of higher learning may conduct research and offer general short courses and to people who may require EIS skills to improve their productivity in all research fields on EIS problems.

5. THE PRIVATE SECTOR AND VENDOR COMPANIES

The private sector and vendors have played an important role in capacity building for EIS development in sub-Saharan Africa. Commonly they have provided training as part of software or hardware sold to institutions, NGO's or other private companies. A few (e.g. ESRI) have regular short courses for which individuals or groups of people may be registered. It is rare that vendors.

6. MULTI-LEVEL NETWORKING AS THE BEST APPROACH TO EIS DEVELOPMENT IN SUB-SAHARAN AFRICA

With time, the range of activities required and skills necessary to have teams that will effectively build spatial databases and carry out EIS projects have grown. Numbers of data operators, scientists and technologists with different backgrounds, researchers in different fields, decision makers sufficiently aware of the potential of EIS in different areas of operation, all these have grown. With common constraints on financial resources, no institution, organization, or branch of Government can be expected to meet all that is required to produce teams in sufficient numbers to run national and international programs. It is to the advantage of all, if each group of players in capacity building for EIS development were given the opportunity to focus its contribution on a unique aspect of capacity building where it has the most advantage in a multi-level network of networks. The areas in which various players have the best advantage may be debated, and this paper only makes preliminary suggestions. Overall direction of the networks might come from organizations, associations or institutions with responsibilities that cover the whole sub-continent such as the UN Economic Commission for Africa (UNECA) or EIS-AFRICA. Networking may be done at different levels. The first may be based on regional centers which are already in existence as mentioned above. So far very little networking exists among regional centers and their major contacts outside their regions of operation is with institutions outside Africa. While the history of the latter contacts has proved its worth in capacity building for EIS development, it would be useful for different regional centers to share information on experiences they have had in the field and to co-ordinate their efforts in a formal sub-Africa wide network. What this author thinks the network should focus on in capacity building has been discussed above.

The second type of networks may be among national centers. While, as argued above, national centers might focus on issues and problems of national importance, EIS-AFRICA's lessons learned and challenges investigated by looking at best practices in a selected number of countries (Gavin and Gyamfi-Aidoo, 2001) show that national centers would learn a lot by networking and sharing experiences. Where regional centers exist as discussed above, it would be advisable for national centers to link up with the regional centers network through their own regional center.

The institutions of higher learning may be looked at as a third type of networking. Networking is a common feature in developing academic programs and in conducting research. Adding EIS capacity building in this case would therefore be easier than might be the case with other networks discussed above. Networking among institutions of higher learning to develop curricula is a critical element in EIS capacity building. EIS-AFRICA has developed a model for education institutions to use in EIS capacity building. While there is no set model that

may be appropriate for all situations for universities to adopt in this effort, a summary description of the EIS –AFRICA model may give readers some ideas of what might be a probable model to adopt. The overall objective of the EIS-AFRICA model for training and capacity building is to develop a method that will provide the fastest way of developing skills in EIS while at the same time anchoring the skills developed to local teaching materials and practice. As discussed by Nkambwe (2001), the already existing networks have shown other advantages besides providing the fastest rates of capacity building. For example they provide a basis for:

- the standardization of procedures and data, two of the most difficult problems in the development of EIS in SSA;

- the development of co-ordinated syllabi with individual institutions contributing in those areas of EIS where they may be strongest;

- an entry point that spreads throughout a region for financial assistance from partners in development and technical assistance from northern institutions of higher learning for training and research in EIS throughout sub-Saharan Africa.

Co-ordinated research and development of training and education programs of the nature proposed in this paper have been successfully tried elsewhere (e.g. the National Center for Geographic Information Analysis focussed on Santa Barbara, Calirfonia and working with other Universities in USA).

7. CONCLUSION

Since the introduction of EIS in sub-Saharan Africa in its current form, the range of skills and the number of skilled personnel and institutions required to sustain its development has grown tremendously. In the early periods, building awareness of the potential of EIS was the main aim. Current efforts are directed at providing teams that can build effective spatial data infrastructure and are able to have significant impacts on decision making. In view of perennial shortages of funds for development throughout the sub-continent, networking of the effort to build capacity in EIS is advisable with each group of players contributing to this effort what they are best suited to contribute. What the best contribution for each category of contributors to the development of EIS is what may be debated.

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