GEOINFORMATION AND SUSTAINABLE LAND MANAGEMENT

O. Nino-Fluck
Senior Cartographic Officer
Development Information Services Division
Economic Commission for Africa

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SUMMARY:
ECA has been implementing activities for more than three decades in the area of Geoinformation as part of its efforts to assist African countries to attain socio-economic development. Adequate land management is crucial to sustainable development, sound information systems are crucial to land management systems and geographic information systems are crucial to land information systems. Given the magnitude of the problem of assessing land phenomena and its resources, modern science and technology are the keys to acquiring and analyzing the basic data needed to achieve the extensive knowledge required to understand the actions and interactions related to land. For the first time in history technology has advanced to the point where man now has the capacity to measure the Earth's resources, monitor the environment on a regular basis, and use this information to develop strategies that will achieve sustainable development while preserving the environment. However, while Africa has not been left behind from these technologies, its effective use to support decision-making has proven elusive. At the beginning of this millennium, there is a number of well defined challenges confronting the effective use of Geoinformation in the decision-making process, such as gaps in spatial data and information, lack of datasets, the capacity to apply new technologies to bridge spatial data gaps and to transform the data in information and knowledge, geoinformation emerging as a commodity, internet access and particularly awareness and commitment by decision-makers. While there is no a unique formula or recipe that can accommodate the needs and peculiarities of all countries or regions, Geographic Information Infrastructures (often referred as Spatial Data Infrastructures or SDIs), the way they are being conceptualized are, without any doubt, a robust response to the above challenges. They contain key elements that are practical solutions to the major constraints for the use of geoinformation in development: The Economic Commission for Africa will intensify its efforts to encourage African governments and societies to invest in the production, maintenance and management of geospatial data and information

INTRODUCTION: ECA AND GEOINFORMATION

ECA is the regional arm of the United Nations mandated to support the economic and social development of its 53 member States, foster regional integration, and promote international cooperation for Africa's development. Established in 1958 and based in Addis Ababa, Ethiopia, ECA is one of the five regional economic commissions under the administrative direction of UN headquarters. It reports directly to the UN Economic and Social Council through the Conference of African Ministers Responsible for Economic and Social Planning, and convenes a number of intergovernmental organs and Committees.

Since its inception, the Economic Commission for Africa has been implementing activities in this field of Geoinformation, initially through its former Cartographic and Remote Sensing Unit of the Natural Resources Division, and now through the Geoinformation team of the Development Information Division, in its efforts to assist the African countries to improve the management and their natural resources and the environment, as part of the Commission's overall mandates. Back in the early eighties, the Commission set up a regional remote sensing programme based in the concept of regional cooperation and integration, who led to the establishment of the African Remote Sensing Council, now subsumed by the African Organization or Cartography and Remote Sensing, and three regional training and service Centres in the area of mapping and remote sensing.

Geographic information activities have featured regularly in the biannual work-programme of ECA: assessment of the status of the technology, technical studies on policies and strategies, organization of workshops, seminars and ad-hoc expert group meetings to streamline regional policies, exchange of information, promoting cooperation, and advisory services to member States and sub-regional groupings, are among a few of these activities. It is worth quoting the organization of the United Nations Regional Cartographic Conferences for Africa (UNRCCA), where policy and technical issues are addressed, now subsumed by the Committee on Development Information (CODI). The Commission also liases with member States and the regional and sub-

regional institutions in various related fields of geographic information to which it provides advice on administrative, technical and policy matters.

LAND MANAGEMENT AND DEVELOPMENT: THE ROLE OF GEOINFORMATION

Land, including water, is certainly the most valuable physical asset of mankind and probably the most important resource of the countries. Socio-economic development, in particular sustainable development, depends largely on the manner this resource is managed.

Major natural aspirations of well-being of peoples, translated in the political objectives of sustainable development of most countries, such as poverty alleviation, agriculture and food security, sustained population growth, adequate shelter and housing, utilities and services, both rural and urban, equitable and secure access to land, natural resources and environmental management, gender equality, etc, are all closely linked to factors of land and land management.

Without sound land management systems it will be very difficult to meet the goals of development. In turn, the quality of these systems will depend on the quality and extent of the information available on the issues to be managed, and in the capacity to process it so that better decisions are made. Adequate land information systems are prerequisites to land management and administration.

Countries in the region probably have to revise their strategies in planning for development as well as to adopt new criteria of information management that will allow them to understand and address the problems related to sustainable land management. Compounded by population growth, decertification, warfare, mismanagement and other factors, the problems of today in Africa are so overwhelming and pressing that governments, political leaders, civil society, etc, can not wait to obtain the information they need in the traditional way, usually tardive and incomplete. Complexity has also increased dramatically, and nowadays we cannot manage one particular discipline in isolated manner as we used to do in simpler times, without studying the interrelationships among the distinct disciplines and sectors involved.

Given the magnitude of the problem of assessing land phenomena and its resources, modern science and technology are the keys to acquiring and analyzing the basic data needed to achieve the extensive knowledge required to understand the actions and interactions related to land. For the first time in history technology has advanced to the point where man now has the capacity to measure the Earth's resources, monitor the environment on a regular basis, and use this information to develop strategies that will achieve sustainable development while preserving the environment. Within the past two decades, a mere twenty years, scientists have adapted satellites and computers into a system for collecting and analyzing data pertaining to all aspects of land and its resources without which man could not hope to acquire the information necessary to make the decisions required to achieve sustainable development.

Now there are almost no limits to the kind and quantity of data that can be collected and analyzed through the use of a multiplicity of systems. Satellite systems have been designed to image objects as small as a few centimetres in size to covering whole continents or whole hemispheres on a single scene. Furthermore, imaging devices carried on satellites can "see" more than the human eye because they can record energy reflected from objects on the earth in wave lengths that are beyond the range of human sensors. For example, recording data in the near infrared range of the electromagnetic spectrum (just beyond the visible range) provides more information about the condition of vegetation than can be seen by the unaided human eye. Near infrared is also better for distinguishing between moist and dry soil, an important feature for agricultural applications. Cloud penetrating radar is useful in perpetually cloud-covered areas of the tropics. Ground penetrating radar can be used for collecting information about the layers of soil and rock below the earth's surface. These data can then be transmitted directly to ground processing stations or relayed by satellite communication systems to any point on earth for processing and distribution to those who have to make decisions about how the earth's resources shall be utilized.

Computers can turn these billions of bits of data into picture-like images or process them to enhance virtually all natural and man-made features on or near the surface of the earth for ease of interpretation and better understanding. Geographic Information Systems (GIS) have been devised to arrange this information into single themes or complex combinations for accurate analysis. They are extremely valuable tools for both research and application activities, as well as for the decision-making process. As a practical example, a parcel of land may be considered

suitable for agriculture if layers of favourable soil, aspect, rainfall, temperature and accessibility all converge to that parcel. Another layer showing tse-tse infestations may, however, invalidate the previous suitability determination but this information is vital to investors.

The power of these tools depends not only on the technical characteristics, but also on the quality of input data, particularly the "age" of that data. They are built to allow for the continual updating of their database through additional ingesting of new data at any time. In this context, as mentioned before, earth observation from space provides a coherent, objective and regular source of input data for information systems, at various degrees of details that would suit most applications of land management, which otherwise would require extreme time-consuming and expensive operations and processes.

CHALLENGES CONFRONTING THE USE OF GEOINFORMATION IN DEVELOPMENT FROM THE PERSPECTIVE OF THE AFRICAN REGION.

At the beginning of the millennium, there are a number of clearly well defined challenges confronting the rational utilization of geographic information technologies in the socio-economic development process of African countries. Many of these challenges are not new and have been in existence for many years; some derive from dramatic advances in technology; and some are the consequence of the globalization process and the pressures imposed by the need to compete in global market economies. An attempt to briefly identify and examine some of these challenges is made in the succeeding paragraphs:

While developed countries have successfully incorporated geographic information technologies in their land management infrastructures, in developing countries, particularly African countries, with notable exceptions, the effective use of Geoinformation disciplines in the decision-making process has proven elusive. While Africa has not been left out from this rapid changing technology, and there are well establish remote sensing centres in most countries and many national agencies use, to a greater or lesser extent, digital mapping procedures, there are, however, still many problems confronting the utilization of Geoinfomation in Africa. An assessment made a few years ago by ECA in the eastern, southern and western African subregions, found that with few exceptions, these technologies have not been incorporated in a systematic manner in the implementation of national programmes. Applications are normally done on an ad-hoc basis and are limited, or are project driven. A major limitation in the use of geographic information systems (GIS) in support of decision making lies in the fact that the geographic datasets needed to understand and solve a particular problem are simply not available. Moreover, a big constraint lies in the gaps in spatial base-line information that prevails in most African countries. These gaps do not seem to be receding, and in some cases, there was evidence that they are expanding. National mapping coverage, presumably the primary and most obvious source of information on natural resources, land and the environment, are, for a great portion of the African territories, outmoded, obsolete or non-existent.

Concerning remote sensing from space, a major indicator of the utilization of this technology is the purchase of satellite imagery by both national and regional organizations. In this regard, African organizations are purchasing far less satellite imagery than similar organizations in other developing countries throughout the world. The experience of the portable receiving Station established in Nairobi in 1995, and which was dismantled after one year of successful operation as a consequence that not a single scene was sold, raises the crucial question concerning the capacity of African countries to apply the new technologies. Lack of demand for satellite imagery is not necessarily a lack of interest in remote sensing but rather an indication that resource development has not yet generated a strong demand for land resource and environmental data.

Probably the major obstacle accounting for the above situations, is the lack of awareness and commitment by policy-makers with regard to the potential benefits of geo-information. Its real value is not understood and priced. As a result, financing geographic data is seen as costly expenditure and not as an investment.

A big challenge will be, therefore, changing this conception and raising the required awareness of decision and policy-makers, so that adequate national policies are established, geographic datasets are seen as assets and not as expenses, and appropriate funding is provided for the purchase of hardware, software and data.

Many countries in Africa are enthusiastically developing and establishing National Information Communication Infrastructures Policies and Plans, called NICIs, as the major objective and component of their National Information policies. Lamentably, contrary to what happens in other parts of the World, these policies do not incorporate Geographic Information Infrastructures (GIIs). We can assert that practically there are no coherent policies in the area of geoinformation at national level. These are normally fragmented, contradictory and embedded in the mandates of national institutions responsible for the production of spatial data.

New developments in GIS not only offers unprecedented opportunities for the interaction between social information scientists and geographic information scientists, but have also opened a wide area for the integration of GIS technology and spatial models into the day-to-day activity of institutions and individuals. Such developments have brought substantial changes in the conception itself of what spatial information is, and, consequently, in the way the products are produced, stored, accessed and used. These changes have originated a wide range of new applications, with new producers and users, and new commercial markets for spatial data and information. Some examples of the new markets are tourism, real state, networks and distribution chains (e.g. food), road navigation, and so forth.

We have seen these markets emerge and consolidate in the developed world. Data from digital base-maps has been drawn into commercial, educational, administrative and private geographic information systems. Whereas national public agencies will continue to maintain their role in ensuring that base-maps will keep to common specifications, a great number of layers of data will be provided and maintained by other stakeholders, many of which will belong to the commercial/business sector, as we can observe from the Internet which is increasingly carrying maps and other spatial datasets of varying nature.

Geographic Information Systems are part and parcel of the globalization phenomenon. There is now a vast amount of spatial data in digital form, stored by several organisations at various locations across the globe. The integration, and subsequent querying of spatial datasets, locating and obtaining of datasets across various networks and maintaining interoperability among dissimilar spatial datasets has become a challenge.

Access to Internet enable users to access the deluge of data and information that is available in the so called Information Highways; and among their dramatic benefits, allows to share selected data and information among users within countries and around the world. In the developed countries, Intra/Internet technology is being found invaluable for users to identify and locate geographic data from a wide number of producers, and for producers to disseminate their services and data and assess user's needs. In Africa this seems a very distant dream. Not only the datasets are not available, but national information policies normally do not incorporate the geoinformation component.

CONCLUSION: WHAT TO DO? WHAT ARE THE ANSWERS?

We do know too well that there is no a unique formula or recipe that can accommodate the needs and peculiarities of all countries or regions. Yet, I have no doubts that sound Geographic Information Infrastructures (often referred as Spatial Data Infrastructures or SDIs), the way they are being conceptualized are, without any doubt, a robust response. They contain key elements that are practical solutions to the major constraints for the use of geoinformation in development: In those infrastructures we find the access to the data through classified catalogues of existing data, or metadatabase; we find the integration and interoperability of data and its smooth flow among producers and users; we find the partnership and networking among stake-holders, encompassing government agencies, academia, research institutions and the private sector, where data and information is collected and managed in a coordinated manner, identifying priority needs, ensuring complementarity of efforts and maximizing the use of resources; we also have the development of reputable nation-wide core datasets for multiple use. But most importantly, they contain the policies and strategies that are crucial to their successful implementation and sustainability.

The Economic Commission for Africa will continue its efforts to assist member States to have and use geographic data and information in the decision-making process. At the conclusion of this paper, I deem worth to quote the Medium Term Plan of the Commission for the year 2002-2005, approved by the General Assembly, which reads as follows:

> "Attention will be concentrated on **raising awareness of the importance of geographic information** systems to encourage African governments and societies to invest in the production, maintenance and management of geospatial data and information; as well as **promoting the development of integrated datasets and data standards** in order to make relevant information available to governments and the public. In this context, assistance will be provided to member States to in **developing national geographic information infrastructures** that respond effectively to the needs of the various sectors of development".

Under this medium term plan the programme of work of the Commission will focus on promoting the development of national/regional geographic information infrastructure policies and plans (NGIIs). As the main strategy, Geoinformation activities will be developed as part of the overall AISI implementing strategies and will be developed jointly with activities in the area of ICT. In particular, modern concepts of NGIIs will be incorporated within –or will complement - the formulation and development of National Information and Communication Infrastructures (NICIs) as important components of National Information Infrastructures at large. Extensions to regional infrastructures will be considered to address regional spatial data needs and to enforce regional co-operation and integration.