AD-HOC EXPERT GROUP MEETING ON "STUDY ON THE FUTURE ORIENTATION OF GEOINFORMATION ACTIVITIES IN AFRICA"
Addis Ababa 6-10 Nov. 2000

REPORT OF THE WORKING GROUPS

A. WORKING GROUP NO 1: POLICY AND INSTITUTIONAL ISSUES

1. The Working Group No1 was constituted by the following members:

- L.L. Mollel (chairman)
- G.C. Mulaku (rapporteur)
- André Bassolé
- Abraham Mnzava
- Alioune Ka
- Abdullah Yusuf
- Joseph Mama
- O. Nino-Fluck
- "Dozie" Ezigbalike
- P.O. Adeniyi
- Muftah Unis

2. The Working Group dealt with the policy and institutional aspects of the key issues identified by the plenary. In doing so it, the WG looked at policy vision, policy principles, policy guidelines, and at the functions of a National Geoinformation Committee.

Vision

3. The geoinformation management vision is to make appropriate geospatial data and information available and easily accessible to the entire community of spatial data users to support decision making in socio-economic development.

Principles

4. National policies of Geoinformation should be based on the following principles:

(a) Spatial data and information are essential to economic planning and development, and are much a part of the nation's infrastructure as its other elements (e.g., the transportation network, the health care system, telecommunication) and should be accorded the same level of support.

(b) It is axed around the concept of a network of producers and users of spatial information, encompassing government agencies, academia, research institutions and the private sector, where data and information is collected, managed, processed, shared and used in a coordinated manner, identifying priority needs, ensuring complementarity of efforts and maximizing the use of resources. Ownership is shared among all participants.

(c) All data collected with public funds form part of the nation's corporate data resources

and the individual agencies involved in their collection and management are viewed as custodians, and not owners, of such data.

(d) The cost of collecting geospatial data using public funds should not be charged to any consumer who should only be charged the costs of distribution, customizing or value-addition.

(e) The private sector is encouraged to be a partner of the public sector in the management of geoinformation, and its rights will be recognized and respected.

(f) National agencies, producers and users of geospatial data and information should support the geoinformation management vision enunciated here and shall cooperate in the implementation of its objectives.

(g) The state should endorse, own and commit itself to the vision stipulated above.

Policy Guidelines

5. There shall be established a national geoinformation framework to enable the following:

(a) The setting up of a national geoinformation committee whose functions are specified in Annex I and with broad representation from the wider society.

(b) Communication between institutional producers and users of data and information to develop partnerships.

(c) Easy access to geoinformation resources by the entire community of spatial data users, employing appropriate information and communication technologies.

(d) Development and maintenance of fundamental data sets.

(e) Establishment and maintenance of a comprehensive geospatial metadata system according to the guidelines based on appropriate national, regional and international standards.

(f) Development of a critical mass of skilled personnel to maintain the framework and data sets.

(g) Development of appropriate levels of knowledge and skills in the community to effectively use geoinformation products.

(h) Development of appropriate pricing mechanisms for geoinformation products.

6. Every publicly funded development plan shall include a section detailing the geoinformation requirements for its implementation.

7. Every public project proposal dealing with infrastructure development and maintenance, environmental and natural resource management, and spatial facilities shall include an information budget detailing:

(a) The data sets required and their likely sources
(b) Expected processing and analyses
(c) Anticipated Information products

Functions of the National Geoinformation Committee

8. The functions of the National Geoinformation Committee are:

(a) Advise government on necessary reorganization of government functions to achieve the geoinformation management vision.

(b) Oversee the development and management of geoinformation products.

(c) Promote the expansion of all sectors of the geoinformation industry, including the identification of new applications.

(d) Liaise with all professional bodies concerned with the geoinformation industry to harmonize their activities.

(e) Promote awareness about geoinformation products and services at all levels of society.
(f) Arrange for the production and maintenance of fundamental data sets.

(g) Facilitate the production, maintenance and sharing of various geospatial data sets.

(h) Develop guidelines on the appropriate methodology for setting up geoinformation infrastructures.

(i) Ensure the nation’s active participation in regional and international geoinformation activities.
(j) Advise the government on changing trends in the geoinformation industry.

Conclusion

9. Countries are encouraged to adopt the vision, principles and policy guidelines set out in this report.

B. WORKING GROUP 2: DATA ISSUES

10. The Working Group was constituted by the following members

- Dr Sami Faïz, (Chair)
- Gottfried Konecny, (Rapporteur)
- Benjamin Akuetteh
- Han Friedeander
- Hadgu G. Medhin
- Les Whitney

Lack of Spatial Data Standards (foundation or basic data) and mechanism of sharing and marketing the data sets (*issue No 4*)

11. Standards and norms are important to facilitate exchange of data compiled by various data providers for common use. General GIS standards have been drafted under ISO-TC 211. There is a need to adapt these standards to the various scale dependent data bases required.

12. At the global scale range 1:1 Million used for environmental and climate dependent issues the standards need to be global. At the continental or regional scale range 1:250000 or 1:200000 they need to be designed in harmony with a group of counties on a continent. At the national scale 1:50000 and the local scales or larger they are of national concern.

13. Graphic standards should be applied to both raster and vector type of information, but also to non-graphic data and metadata.

14. Common to all should be a geocoding geometric reference (for example, the reference ellipsoid used, its relation to the International reference frame), so that the particular dataset can easily be converted by existing conversion programs into a desired geometric fit of all datasets to be combined.

15. This also pertains to the digital elevation model in raster and vector form, so a digital image resulting from differentially rectified satellite image or from a digital orthophoto. It applies to the various elements of the topographic information (road network, railways, buildings, hydrography, administrative boundaries). At large scale, the parcel layout with parcel boundaries and uniquely identifiable parcel numbers, the buildings and district features, as well as toponomy need to be included.

16. These should be the base for information to be added by a user. In order to do that, the basic data must identified with structured rules and procedures for their integration and up dating.

17. To facilitate generalisation between scales and agglomeration of information it is preferred to organize the georefernced data in an Object Oriented structure.

18. Taking more of these observations national standards need to be developed for the required datasets with ISO 211 as a model.

19. The WG took more of one of the CODI-resolutions of 1999, which recommended the

establishment of a geodetic African reference frame (AFREF), in compliance with work completed on other continents (e.g. EUREF in Europe, reference systems in Latin America and South East Asia). Via donors support it should be possible to quickly establish AFREF as an absolute geodetic reference with 2 cm precision to which all countries can be connected via GPS observations. AFREF would serve the needs of a uniform reference system which all georeferencing on the continent could be accomplished.

Definition of mapping scales that are suitable for development needs (*issue No 5*)

20. In the digital age it is necessary to consider mapping scale not as a matter of a pictorial representation on a printed maps, but as a set of objects, which may be represented at a particular scale. This should be combined with the consideration of required pixel sizes of digital images and raster scanned maps.

21. At the global scale these scale ranges should be 1:1 Million with 1km pixels for climatologically influenced data such as status of vegetation, soil moistures, agricultural productions, etc. At the continental scale or at regional scale the datasets should be in the order of 1:200000 to 1:250000 concentrating on land cover (e.g. Africover), using pixel sizes of about 30m. At the national scale 1:50000 usable for the monitoring of renewable and non-renewable resources the equivalent pixel size should be 5m. At the local level urban planning requires data in the 1:10000 scale range with pixel sizes of 1m. Depending on parcel size scales used to be expanded to 1:2000 or more for the inclusion of cadastral parcel data equivalent to pixel sizes of 20cm.

22. The WG noted, that it is not only required to establish the relevant dataset at the required accuracy, but to include a regular updating system within a specified time frame depending on priorities in that region.

23. The world average in map updates 1:50000 is still at the rate of 50 years, but it needs to be decreased to at least 10 years. For the update of relevant features (e.g. roads, settlements, vegetation) an appropriate cost-and time- effective technology needs to be chosen. This is easier for small scales (e.g. 1/250000), but more difficult for 1:50000 and particularly for urban data.

24. Basic topography mapping has too few feature categories (e.g. 15, such as roads, hydrography, elevations, toponomy, settlements, etc.) to be of use for land cover data users (who uses up to 100 categories). Land cover data are of high environmental and economic significance, and they therefore also need an update cycle of 10 years.

25. All data compiled and updated at different time periods need archival for the monitoring of change.

Constraints in data acquisition, accuracy, access and updating (*issue No 11*)

26. The WG noted that the most serious constraint is the lack of funding to be able to modernize national mapping agencies. Therefore, they generally do not have access to apply modern cost-effective and time saving technology.

27. ECA could arrange for a workshop to raise awareness and motivation with the national mapping agencies for the modernization of base data provision. Wherever possible, the provision

of base data should be in digital form with optional paper printout not vice versa. The agencies should be made aware of a paradigm shift to digital orientation, making it advisable to stop slow, costly and ineffective production on outdated instrumentation, which does not permit them to reach the required production goals. Technology transfer by local short courses is an effective means to change the situation.

28. The WG noted that some countries have access restrictions to data due to security reasons. Nevertheless, it is recommended for purposes of the national economy to allow free, uncomplicated and if necessary conditional access to data for development needs in all areas which are not highly sensitive.

29. One of the suggestions of the WG group was to improve the method of acquiring satellite data since the establishment of own African reception antenna systems is very costly, the need for African stations would at least warrant a centralized acquisition of satellite data on a regional basis by a data centre from the international data suppliers.

Lack of national review of available spatial datasets (*issue No. 13*)

30. The WG noted that it was necessary to create a national inventory of existing data. The inventory should be compiled by a lead agency or a national point of contact in the country by a form has been drafted by the last GSDI conference in South Africa.

31. ECA should assist in the modification of this questionnaire. The questionnaire should particularly address the large-scale data not easily accessible to data base development.

32. The inventory compiled from the questionnaire should be compiled into a metadata base describing not only the origin and type of data but also its up-to-dateness, its reliability and accuracy.

Need for Metadata structure (*issue No. 17*)

33. Metadata (MD) are data about existing data, in form of a dictionary. Metadata serve the user to select from the eventually great number of datasets collected the relevant one’s to be utilized for his analysis.

34. For this analysis, it is first important to survey the existence of all collected data in the various organizations, enterprises or projects in a country. They should be characterized in a genealogy identifying the producer of the data, the one who is responsible for its creation by his request, the scale and the layers contained.

35. Of further importance are:

Description:

- The name of the geographical databases
- Overall aims of the project or programme
- Abstract
- Purpose

The geographical area
- Bounding coordinates

Duration of the programme:
- Start date
- Publication date

Spatial data distribution
- Access Constraints
- Use constraints
- Availability or Pricing

Data Quality Information
- Genealogy
- Actuality
- Spatial Accuracy
- Semantic Precision and Exhaustiveness
- Logical Consistency

Spatial Data format
- Vector or Raster
- Projection System
- Horizontal and Vertical Datum
- Ellipsoid

Distribution Information:
- Contact Information (person or agency)
- Contact Address
- Telephone
- Fax
- E-mail

36. These MD will be used to develop a National Geospatial Data Clearinghouse. This clearinghouse means a distributed network of geospatial data producers, managers, and users linked electronically, depending on the existing facilities. The clearinghouse shall be established by an official enquiry by a lead agency or a national point of contact.

37. Each agency holding data shall document (MD) all old geospatial data by the questionnaire, and new data it collects or produces, directly or indirectly. Each agency shall before expending new funds determine whether the information has already been collected by others using the clearinghouse. Procedures are to be established to make geospatial data available to the public.

38. Data warehouses are an instantaneous view of integrated information. In a spatial data warehouse, data can be combined from many heterogeneous sources to obtain decision support tools.

39. Spatial Data mining techniques refer to the extraction of implicit, previously unknown, and potentially useful information from the spatial data warehouse.

C. WORKING GROUP 3: CAPACITY BUILDING

40. The Working Group was constituted by the following members

- Michael Collins
- Victor Odenyi
- Wilbur Ottichilo
- Olajide Kufoniyi
- Desiree Nadaud
- Yalacé Kaboret
- Caxton Matarira

41. **Barriers I:**

- Lack of experienced and professional HR
- Lack of continuing Education & training in Geoinformatics

42. **Recommendations:**

(a) Establish an African Geoinformatics curriculum of a modular system of short courses. These courses are aimed at users as well as professionals/developers. African institutes of higher learning should modernize their geomatics curricula in modular form to be responsive to long-term education at various levels (PhD, MSc, PGD, Technologist, Technician) as well as short-term training and re-training in geoinformatics. To Enhance post graduate Education we should explore and set up articulated MSc and PhD degree programmes consisting of African universities and foreign universities.

(b) Conduct a baseline survey of universities and institutions that have the capability to deliver the modular geoinformatics curriculum (MGC). A survey of the ad hoc, user oriented short courses being offered outside the traditional geoinformatics community should also be conducted.

(c) The MGC will be run on a cost recovery basis to allow participating institutions to sustain the facility.

(d) Establish a network of African universities and training facilities that will deliver the MGC. An attempt should be made to achieve some level of uniformity across the network to allow greater access to the latest geoinformatics technology: *African Network of Geoinformatics Education*.

(e) Ensure that the MGS is marketed effectively. To help ensure access and avoid duplication

(f) Include foreign affiliates in the network to share curriculum ideas and logistical experiences.

43. **Barriers II:**

- Lack of coordinated program in Africa on applied research and development in geoinformatics.
- Lack of a professional forum across Africa on Geoinformatics.
- Lack of awareness of the power of geoinformatics within decision-makers, potential users.

44. **Recommendations:**

(a) Establish a Network of African Associations of Geoinformatics (NAAG) to facilitate the exchange of ideas within and between the land surveying and remote sensing communities. Explore the possibility of establishing a Geoinformatics journal (*African Journal of Geoinformatics*) to serve as a tool for distributing information and to build a larger sense of community between the many active national, regional and specialist communities. The journal will be in English and French (c.f. Geomatica, the journal of the Canadian Institute of Geomatics). Explore the possibility of making the journal an on-line entity to achieve cost-effectiveness. Explore the possibility of expanding the existing biannual Africa GIS conference. Include selected training modules.

(b) The establishment of the educational network and then AAG and their associated activities may be coordinated by the regional centres of the ECA (RECTAS, Ile-Ife; RCMRD, Nairobi); AOCRS, Algiers; and other similar organizations.

(c) The GEOEdNet (Geoinformatics Education Network) will establish an outreach program. The raise the awareness of Geoinformatics in potential user communities. Create a kiosk that includes posters, leaflets and computer demonstrations of Geoiformatics applications take the kiosk to symposia and meetings of potential user groups, medicine, agriculture transportation.

(d) Establish a set of pilot applications of GIT in areas of particular relevance. These will be carried out by nodes in the GeoEdNet. The applications will be used in a GIT applications module. The applications will be documented in as African Geoinformatics casebook. This can be use in the Geo-kiosk, distributed to selected decision-makers.

45. **Barrier III**

- Lack of understanding on how to assess the outcome of GIT projects/implementations.

46. **Recommendation:**

(a) Establish research projects that (a) benchmark GIT vs. traditional methods for applications (b) assess the economics of geoinformatics.
(b) Introduce a Geoinformatics Project Management module to GeoEdNet. (c.f. University of Laval course)

47. **Barrier IV**

- Many of the Enabling Technologies are in various stages of development.

48. **Recommendation**

Ensure that training modules and demo applications are matched to available technologies, e.g.: Internet and computer hardware.

D. WORKING GROUP 4: ECONOMIC ASPECTS OF GEO-INFORMATION

49. Participants:
- Jacob Gyamfi-Aidoo (chair)
- Liz Gavin (rapporteur)
- Dick Groot
- Pal Foyn Jespersen
- Helge Donnum

50. Two main points:

(a) Political and economic justification for investment by government in the collection and management of fundamental geo-information as component of National Information and Communication Infrastructure (NICI)
(b) Cost-efficient development, production and dissemination of geo-information

51. A shift in perspective:

(a) *from* focussing on the need for mapping and generation of spatial data,
to the use of information describing the country's assets and potential in terms of its geography,
in order to gain the attention of policy makers and potential local and foreign investors.
(b) Knowledge of the geography of one's country is one necessary but not sufficient condition for good governance.
(c) Essential to government in order to provide services effectively and efficiently
(d) Needed to attract investment e.g. mining companies will not make investments unless there is documented and accessible knowledge of the geology of the country
(e) Wider dissemination of knowledge about one's country constitutes better marketing

52. More on knowledge:

(a) Unlike other assets, knowledge appreciates in value through use and depreciates in value through lack of use
(b) Knowledge cannot be lost through sharing
(c) New knowledge may be derived through integration of different sets of geographic information from different sources
Question: Have any studies been made to estimate these benefits. What about the work of Kenneth Arrow on the contribution of knowledge to the economy?

53. The marketplace for geoinformation

(a) In a perfect market, supply and demand determine pricing
(b) Imperfections in the market lead to higher prices and hence not as wide a distribution of information and knowledge
(c) Identify supply (I.e. data producers) and demand (I.e. data users)
Question: Is it possible to quantify the inefficiencies due to market

imperfection?

54. Suppliers ("data producers")

(a) Government: at national, provincial, local levels
(b) Private Sector – data, technology, knowledge transfer
(c) Donors, foreign government and business
(d) Suppliers of (high resolution) remotely sensed imagery
(e) NGOs

55. Suppliers ("data producers")

(a) Government (internal) at national, provincial and local levels
(b) External governments; donors
(c) Parastatals, utilities
(d) NGOs, CBOs
(e) Private companies
(f) national,
(g) foreign
(h) Private citizens

56. Role of government (1)

Foundation/framework data needed for building national infrastructure as part of NICI, to facilitate access, responsible use and integration at affordable costs: traditionally government co-ordinates and funds the development of national infrastructure

57. Role of government (2)

(a) The creation of "positive externalities" and the reduction of "transaction costs" (see 60,61)?
(b) Transparency of access rules, pricing and conditions of use
(c) Knowledge of competitive advantage needed for growth
(d) provide the motor for developing further information products and services

Question: can externalities be quantified? Do estimates exist for the market of value added products and services?

58. Benefiting from donor participation

A possible problem:
— the effect of uncoordinated donor interventions may be to create an artificial demand or undermine economies of scale by duplicating supply

59. Recommendations concerning donor contribution

(a) The co-ordination of donor interventions is needed
(b) Donors should be encouraged to contribute to building foundation/framework data within the framework of national policy concerning the systematic building of information infrastructure (NICI plans)

(c) Data products emerging from donor-funded projects should be incorporated into the national information infrastructure

60. Transaction costs

These are the costs associated with obtaining and using a product, apart from the actual price paid, e.g.

— cost of finding where to obtain information

— cost of turning the data obtained into a product which is fit for intended use

61. Reducing transaction costs

(a) Making information more easily accessible, I.e. establishing a clearinghouse

(b) Reducing effort needed to ensure that the product is fit for use:

— setting standards for geographic information

— provision of metadata describing data quality, lineage etc.

(c) Providing complete information to potential investors

Question: Is it possible to estimate reduction in transaction costs?

62. Cost recovery ?

(a) Question 1:

— if a government is funding the gathering and management of foundation/framework data, should there be attempted cost recovery against demand from parties outside government?

(b) Question 2:

— if cost recovery is not attempted, even in the longer term, what mechanisms can be used to ensure that a data producer is producing products on public money for which there is a real demand?

63. Factors to consider with respect to embarking on cost recovery

(a) Higher costs leads to lower demand, i.e. the audience receiving knowledge which could drive further investment or the creation of information products and services is narrowed

(b) There are administrative costs associated with cost recovery

(c) There is little point to this exercise unless revenue returns to the agency bearing the cost of generating the information, the dissemination and the administration

64. Framework data sets

Def.: geographic data needed by more than one government agency for fulfilling its service delivery obligations

— Cost effective to have this captured once for use by several government agencies, I.e. economy of scale

65. Re-engineering of production process by data producers (e.g. NMAs)

(a) Technology makes it possible to be able to create many different products, customized

to the needs of individual demanders

(b) A “just-in-time” (JIT) philosophy can be adopted: I.e. products are produced on demand; don’t stockpile - there is a cost associated with this

(c)Even if production is outsourced, capacity needs to be retained within the outsourcing institution (avoiding “asymmetric knowledge”) which may cause inefficiencies.

Question: Are there any studies of the cost of asymmetric knowledge in transactions in the economics literature?