55356

Distr.: GENERAL
30 August 2001

Original: English

ECONOMIC COMMISSION FOR AFRICA

Second Meeting of the Committee
on Development Information (CODI)

Addis Ababa, Ethiopia
4-7 September 2001

REPORT ON STATISTICAL ACTIVITIES

ETHIOPIA

Country Report of the Ethiopian Government Delegation For the Second Meeting of the Committee on Development Information (CODI) Sub-committee on Geoinformation (4-7 September 2001)

The Status of Cartographic Activities in Ethiopia

Ethiopian Mapping Authority
Addis Ababa, Ethiopia
SEPTEMBER 2001

ECONOMIC COMMISSION FOR AFRICA
First Meeting of the Committee on
Development Information (DODI)
Sub- Committee on Geoinformation
4-7 September 2001
Addis Ababa, Ethiopia

The Status of Cartographic Activities in Ethiopia
Report of the Ethiopian Government Delegation

1. Introduction

The Ethiopian Mapping Authority (EMA) is a government organization with the responsibility for surveying, mapping and remote sensing activities in Ethiopia. EMA has the task of producing basic geoinformation for a vast geographical area of the country. This is both a great challenge and a driving force for the continuous development and rationalization of the activities of the institution. In addition to availing basic topographic information at national level, EMA also addresses increasing user demands for customised products which include digital spatial data.

The demand by government for increased efficiency in the provision of products and services and for an increased level of cost recovery has led EMA to give more emphasis for marketing of products and services. Now customized products have become key elements in the range of map products.

Comprehensive production-oriented training programmes have been conducted to enhance the technical knowledge and skill of EMA's staff. These programmes have been implemented both in-house and abroad. Whereas in previous years priority was given to technical training, there has been a shift of focus to training within the management and administrative domains of the organization.

Despite our efforts there is still much left to be done before we can fully satisfy users demand for geo-information. There are many challenges ahead but the progress made has given us a stable foundation on which we can continue to build for the future.

2. Mapping and Related Activities

This report presents the highlights of the cartographic activities of the EMA since the 9th UN Regional Cartographic Conference for Africa in 1996. The activities are categorized under mapping and capacity building.

2.1 Mapping Activities

2.1.1 Primary data acquisition

EMA utilizes both aerial photography and satellite images as primary data sources for its basic topographic mapping activities or map revision programmes. Aerial Photography is flown every other year for the 1:50,000 scale topographic mapping. For instance, since July 1999 aerial photography covering an area of 72,576 km^2 (96 map sheets) has been flown in December and January in 2000/2001. Satellite imagery (spot) is acquired for the 1:50,000 scale orthophoto mapping for urgent customer needs (see report 1996). Spot/Landsat TM is acquired for the 1:250,000 map revision programme.

2.1.2 Geodetic surveys

Extension & densification of the national geodetic control network consisting of first, second and third order points is done on a continuous basis at an average rate of 30,000 km^2 per year for the 1:50,000 mapping project. Both classical and GPS survey methods are employed.

For instance in the last five years a total area of 250,000 Sq. km of land was surveyed with GPS of which 120,000 Sq. km was covered using 4WD vehicles and 130,000 sq.km. was covered by deploying 478 rented helicopter hours in the most inaccessible areas of the country.

Geodetic control networks are also extended in regions where large scale mapping and engineering survey data are required by users for irrigation, dam construction, road construction. town planning and other development schemes.

2.1.3 Topographic mapping

In topographic mapping, the activities of EMA continued to be the production of 1:50,000 scale and the revision of 1:250,000 scale topographic map series.

2.1.3.1 1:50,000 scale National Topographic Mapping project

The 1:50,000 scale topographic mapping project began in 1971. At the start, the objective was to cover the whole country (1.13 ml.sq.km.) with conventional mapping of this scale and that required the production

of 1580 map sheets. But later the whole approach was revised where by the 1:50,000 scale mapping was to continue for only the highland areas with high socio-economic potential for development and the lowlands (leaving the riverine belts for 1:50,000 mapping) with semi-arid and arid climatic zones that require less detail to be mapped with 1:100,000 scale orthophoto maps.

And now with the introduction of digital mapping technology, a shift is being made towards digital production of the 1:50,000 scale. Having been successful with the pilot it is now planned to produce 8 map sheets (6000 Sq. km) fully digital during 1999.

With regard to production 240 map sheets have been produced in the last five years This has brought the total number of map sheets produced under this scale to 1004 map sheets raising the national coverage to 63.5%. Of these 79 map sheets are orthophoto maps.

2.1.3.2 1:250,000 scale Map Revision Project

EMA started a map revision programme of the 1:250,000 scale topographic map series in 1993. This topographic map series was published between 1965 and 1972, about 25 years ago and the information contained in some of these maps was badly outdated. In the study of revision needs 30 (40%) of the 74 map sheets covering the whole country needed updating. The remaining, comprising the remote parts of the country, have undergone little changes that is below the minimum required for revision.

Based on this study a map revision project of 6 year duration was planned in two phases. The first phase was also a period of experience and as such 12 map sheets were planned for the first three years with 4 map sheets (72,600 Sq. km) each year. During the 2nd phase, considering the experience gained, it was planned to revise 18 map sheets in three years with 6 map sheets each year.

Satellite images (Spot & Landsat TM), latest aerial photographs and larger scale maps with current information (1:50,000) were used as data sources for the revision programme.

The revision programme was started in July 1993, exactly 6 years ago. The project was implemented and completed successfully by updating the planned 30 map sheets. Five more map sheet have also been revised after the completion of these project by using recent 1:50,000 maps. So now the 1:250,000 scale topographic map series is as good as any new map.

2.1.3.3 Digital maps

EMA has produced a 1:1000,000 digital map of Ethiopia with layers of contours, roads, hydrographic and settlement and this has enabled flexibility to address specific user needs. EMA has also produced digital city map of Addis Ababa at scale 1:30,000

2.1.3.4 Digital data Capture

Digital technology has been introduced in our organization to speed up production to increase the flexibility of topographic data and in order to meet specific users' needs, etc. Therefore, at the EMA data is captured digitally in two ways. First from aerial photographs at the scale of 1:50,000/1:40,000 using upgraded analytical stereo plotters using SOS-MAP & microstation software. This is also additional data source for the Topographic Mapping Project of 1:50,000 scale besides the conventional method and at the same time for the construction of topographic database of the country at this scale after cartographic processing in UNIX based ARCINFO.

The second method is by manually digitizing the existing analog revised line maps of 1:250,000 and other thematic maps using different programmes.

2.1.3.5 Application of Remote Sensing for Resource Studies

Remote sensing technology specifically that of satellite systems has brought new opportunity for resource management, analysis and monitoring. In addition

multitemporal images analysis has been playing an important role on environmental impact assessment and change detection.

Realizing the potential benefits of remote sensing the Ethiopian Mapping Authority has established the Remote Sensing Department with long term aim of expanding and rendering services to organizations dealing with natural resources, environment, mapping and etc. The EMA Remote Sensing Department tested the applicability through pilot projects and these days it is in the stage of practical application and service rendering for users of the technology. Currently the Department is equipped with image processing hardware, Software, digital satellite images and skilled manpower. It is possible to observe that most of organizations are interested in remotely sensed data because of the improvement of resolutions, growth of geoinformation need for natural resources management and improved digital mapping techniques. Among the major services rendered in the department include:-

- Landuse/cover analysis
- Image mapping
- Geological and mineral explorations;
- Change detection;
- Limineological studies;
- Environmental Impact assessment
- Production of image maps and so on

High demand areas are NGOs, researchers, private sectors and many government organizations. To satisfy the demand of users, there is significant effort from the side of EMA by upgrading the hardware and software, and training manpower, eventhough, there is limited resource.

2.1.3.6 Thematic and Other Mapping Activities

EMA annually prepares a good number of thematic as well as large scale topographic maps based on user demands. Its major customers are the Federal States, Government, non-government and private organizations. The heavy involvement of the Federal States in regional development based on the Federal Government's Rural Oriented Five Year Development Programme has

accelerated the demand for geoinformation. EMA on its part is trying its best to give adequate response.

Thematic maps covering a wide range of topics are also produced for projects such as National and Regional Atlases. Of Such projects, currently work on data collection for the Addis Ababa Atlas project, with data based at the level of districts /"Woreda"/ is underway.

Work on geographic gazetteer is also proceeding to facilitate identification and location of feature names. For this database has been designed and stored to digital record toponymys.

2. Capacity Building -

2.1 Digital Geoinformation Technology at EMA

Assessments of the Current situation

The introduction of digital mapping technology at EMA started in 1995 with Sida assistance under technical cooperation between EMA & Swedesurvey AB. Before that, there were only one mini computer basically used for survey and photogrammertic data processing and another 286 personal computers used for image processing. In terms of trained manpower there were only very few computer literate staff in the organization.

The first remarkable growth in digital geoinformation technology began in 1995 with the purchase of the then uptodate hardware and software. Soon local area network was installed and implemented. Along with this many personal computers, software and accessories were purchased and installed. Most analogue stereo plotters were upgraded, consultancy and training services were conducted. A pool of competent digital mapping and GIS operators were created and production also started.

This is the general overview of the current status and progress. But to provide an in-depth insight into the development of the digital geoinformation technology at EMA, it is proper to present a brief but thorough analysis of the system components under four categories: Hardware, Software, Trained manpower & Data

Hardware - Since the start of the digital mapping project different hardware were purchased and installed. The information flow within the organization was made as simple as possible. Digital data capturing, map making and building of data bases was also started.

Amongest the big tasks accomplished is the building of a Local Area Network System (LANS) that benefited EMA in terms of increased productivity, better use and management of resources and smooth flow of data/information .

Many data storage and networking materials were purchased and installed. To mention some of them RAID system with 80 GB hard disk capacity, DLT tape drive 40 GB capacity, CD-writer, Hubs and switches. These materials helped us to improve the data storage problems and boost productivity.

When we go directly to digital mapping, GIS and remote sensing activities, we realize that there is a remarkable growth not only in facilities and production but also in competence. Some of the hardware EMA has acquired to start the production line include different personal computers and workstations, different size digitizes, plotters, printers, GPS receivers, encoders and small format scanners.

Besides these, EMA has recently got one photogrammetric scanner and large format film writer. This is expected to shade light on the limitations of the existing production line. The scanner, for orthophoto generation, image mosaicking, DEM generation and related activities; the film writer, for mass production-both raster and vector.

Now one can easily understand that a fertile ground has been laid down for digital geoinformation production. It is also encouraging to see how the staff adapted and accepted the new technology. Having all these successes, there are still a number of deficiencies in hardware that should be overcomed to speed up the production line. Among the major items required are AO format color scanners, additional PCs, digitizers, plotters and photogtrammetric workstations.

EMA has now reached at a stage of finalizing the structure of the production line. Digital maps are produced and building of database are started. This is a good start and has got even better when the other end of the output, the film writer, got operational.

Software- EMA has acquired almost all the software necessary to run the production line. We have got and implemented all the commercially known system utility, image processing, GIS and digital mapping

software. One can easily appreciate the technological advancement made in EMA especially by looking at the system, GIS, mapping and image processing software installed and implemented. This is one of the reasons that enabled EMA to succeed in its IT project.

Many activities have also been carried out to have the current system. Upgrades, fixes and purchases of new systems have been accomplished since the start of the project and encouraging advancements were noticed in digital mapping and GIS activities.

Currently there are many systems that enable us to carry out simple to complex data processing activites. Some of the software heavily used in the production line include: SOS-MAP for data capturing, Arc/Info for building of GIS databases, analysis and map making, ArcPress for raster quality printing, ArcStorm for dataset storage, ArcView GIS for presentation, ERDAS Imagine for image processing, AtuoCAD for design and large scale mapping, Microstation for digital mapping, GPPS & Prism for GPS data processing, PATM-GPS for GPS controlled block adjustment, KORDAB for survey engineering and geodetic data processing and Capture NT for streoplotter and microstation interfacing.

In addition to these software, there are also other application software installed and implemented like Adobe publishing collection consisting of image composer, illustrator and page maker. Generally speaking, with the software EMA has currently now, it is possible to run the production line efficiently, build a central database, customize products and produce atlases and other geoinformation products. However, it should be noted that as the development in this field is very rapid the need for new, powerful and friendly systems always arise. Therefore it is necessary to upgrade if not replace frequently some of the existing systems.

Recently, EMA has undergone some physical changes of information access to the outside world. It is through the installation of Wingate software that different departments of the organization have access to the internet. This is believed to bring some behavioral changes to adapt, accept and improve the new environment of geoinformation technology in the organization.

Trained man power - Currently, it is encouraging to see how competent digital mapping and GIS operators are created in EMA. The less satisfactory part of this category is that the pool of competent operators created and involved are less in number compared to the work expected to be done.

As indicated there is need and anticipation to acquire new hardware and software configuration in the future. Large format map scanners, additional licenses of digital mapping software, Spatial Data Engine (SDE) software, additional workstations and accessories are among the systems that definitely require trained man power for their successful operations.

The structure of digital production line is not also finalized especially in the design and build of databases. This is the last and very important part of the whole project. To realize this task, still a considerable volume of training spread over a relatively longer period of time is required.

Data - Regarding the large volume of analog data EMA has, there is no question that it should be converted to digital data within a very short period of time. It is by converting these data and keeping the digital production line alive that EMA can keep abreast of the technology and fulfill the various geoinformation demands of the country.

Production of data sets and build of databases are started satisfactorily. In 1998 EMA started the production line and produced several map sheets of different series, 1:50,000, 1:250,000, 1:1000,000. Of course these are few in number compared to the large volume of data EMA has, but it is an encouraging start. This success is obtained as a result of the unlimited efforts made by EMA and Swedesurvey consulting staff.

EMA is now introduced even to better, dependable and commercially known digital mapping software. Upon full implementation and expansion of this software, it is believed to produce digital maps and build databases with full flexibility.

EMA has also acquired software for making atlases and coutomized products. The software configuration currently available at the organization is satisfactory to start the production line and produce any customized products including atlases. What is expected from EMA is to strengthen this task by providing enough trained man power to the digital part either by reallocation or recruiting new people.

2.2. Manpower Training

The importance of continuous training for human resource development is basic in capacity building. To this effect comprehensive and production oriented training is being conducted and training programmes formulated for implementation. Manpower training is done both in-house and abroad.

2.2.1 In-house Training

Starting from 1980 EMA has been providing six months in-house training annually in surveying and mapping for technical staff drawn from EMA and other user organizations. To date 452 trainees, at an average rate of 30 per year have participated in the programme.

2.2.2 Training Abroad

28 staff members were on long and short term trainings abroad since 1996 through the Netherlands, Sida and German Fellowships. Of these 3 were for MSc, 10 for postgraduate diploma, 2 for technologist and 13 for short term training courses in photogrammetry, cartography, remote sensing GIS and geodesy. At present almost all of them have returned.

3. Future activities

3.1 Technical Activities

As the situation regarding the basic map coverage at a scale of 1:50,000 shows, using a single basic scale or applying one standard map production method may not be feasible in the future. An alternative scale or method may have to be applied. Our experience so far has indicated that the use of satellite imagery is a fast and economical way of producing some types of maps at medium and small scales. This production method will continue to be used for mapping suitable areas.

A speedy transformation to the use of digital mapping methods will be continued for both the new mapping and map revision programmes. This will include a further acceleration of the programmes through the introduction of digital orthophotos and the allocation of resources for the creation of topographic databases.

The introduction of new systems and the upgrading of old systems will also be an un-avoidable task in all technical production environments as long as the technology is suitable for the EMA environment and the necessary funds can be made available

3.2 Training of Manpower

The management of EMA is very conscious of the importance of continuous manpower training and development if the Authority is to meet the challenges of product development, increased efficiency and higher levels of cost recovery. This requires training programmes across the full spectrum of the Authority's activities from senior management to technician. At present geoinformation technology, of which mapping is a key component, is changing with almost bewildering rapidity and it is difficult to estimate the life span of each of its components. To keep abreast of the technological innovation and growth, modern attitudes and open-mindedness amongst all of the staff are crucial. Efforts will be made to be efficiently prepared to meet the challenges of the future.