

STUDY OUTLINE AND RECOMMENDATIONS

1 Background

The Dakar Metropolitan Area occupies 200 square kilometers and its estimated population for 1999 is 1.9 million. The main concern in Dakar, as in many of African cities, is not only the size of the city itself but also its rate of growth, estimated at nearly 4% a year. Urban problems manifest themselves as governmental measures in providing facilities and services lag behind rapidly increasing population in such a way that almost 30% of the area is covered by illegal housing. Individual effort by responsible organizations has not yielded desired results as data preparation effort is duplicated among different organizations and data collected by them are often mutually incompatible. It is highly desirable that a common information system readily employable by organizations concerned in the provision of social infrastructure be established as soon as possible.

2 Study Implementation

The Japan International Cooperation Agency (JICA) dispatched a Study Team to Dakar in September 1999. In the ensuing 14 months, the Study Team spent a total of 9 months in 3 occasions in Dakar, while the remaining months were spent in Japan, for surveys, planning, design, and establishment of the Infrastructure Information Management System (IIMS) and technology transfer.

3 Technology Transfer

The major objective of this study is to establish an information system that would actually be used by related organizations in Senegal. Therefore, effort was made in technology transfer by means of seminars, workshops, and training sessions. In addition two counterpart officials were trained in Japan for 3 weeks each. System hardware and software were delivered and temporarily installed in a room at the Department of Geographic and Cartographic Works (DTGC) in late June 2000. During the following two and a half month period, almost every day, on-the-job training of officials of DTGC and DUA (Department of Urban Planning and Architecture) was carried out in the initial installation and break-in of the hardware, the installation of software, the establishment of IIMS, and the operation of IIMS.

4 Analysis of Urban Issues in Dakar

Ten issues of urban problems were identified as being particularly important in Dakar. A *carte* was prepared for each of the issues showing symptoms, diagnosis, and measures to rectify the problems.

5 Assessment of Existing GIS

Some 10 organizations in Senegal have established and are operating GIS at present. Virtually all of them have isolated installation and their contents and usage are not advanced.

6 Preparation of Spatial Data Infrastructure and Other GIS Data

Spatial Data Infrastructure and other GIS data with a digital map of the Dakar Metropolitan Area at its core was established by utilizing available aerial photos, existing maps, and field surveys. Basic maps are at a scale of 1:5,000.

7 IIMS Concept

In the process of formulating the concept of Infrastructure Information Management System (IIMS), emphasis was placed on related organizations in Senegal using it for the purpose of actual implementation of measures and immediately entering the learning process. The capacity and ability of DTGC and DUA at present and in the near future were also taken into account as well as availability of suitable data. The initial IIMS will have the following four sub-systems:

- (1) Sector Information Reference System: For reference to urban information by taking location as the reference key.
- (2) Urban Development Control System: To refer to particular information on a location during applications to DUA for a building permit or an urban planning certificate.
- (3) Urban Planning Support System: To support the analysis of public facility locations with respect to the population served and land use.
- (4) Residential Site Evaluation System: To comprehensively evaluate an area or areas in terms of suitability for residential purposes.

8 IIMS Design

The design of IIMS was undertaken to realize the system concept as shown above considering the results of preceding evaluation of the situation in Dakar. It was decided that two systems, instead of one at one place, were to be established in both DTGC and DUA. Reasons for this decision were that the premises of the two departments are located far apart and that each department has different purposes for using the system, i.e. DTGC would mainly act as the provider of information and DUA as the user. It was assumed that the system could be operated by the existing staff considering the near impossibility of hiring additional qualified staff and the state of operation of the existing GIS in the two departments. However, the system can be expanded in the future including networking.

9 Specifications of IIMS

For DTGC, ArcInfo NT was introduced with the main purpose of strengthening image processing functions and accommodating three-dimensional data. The software is supported by a PC with 512MbRAM/36GbHDD and 26 piece peripherals.

For DUA, it was decided that the existing Geoconcept software should continue its usage with a necessary version up in order to avoid confusion. The software is supported by a PC with 256MbRAM/18GbHDD and 25 piece peripherals.

10 Short Term Recommendations for IIMS Operation

System Management

There should be little difference in management structure between the two systems introduced in DTGC and in DUA despite the small differences in system configuration between them. A system manager directly under the Director should take responsibility in maintenance of equipment and the operating system, maintenance of software, external liaison and negotiation, and staff training. It would hardly be possible to hire additional qualified staff under the current extremely severe limitation on the new recruits for government organizations. Selected existing staff members should be appointed to take care of the system with clear definition of their responsibilities.

Data Management

(1) Spatial Data Infrastructure

Frequent updating is necessary for artificial information such as administrative boundaries and buildings information as changes occur. DTGC should collect most recent information and update the relevant data sets.

(2) Other GIS Data

Organizations responsible for urban facilities and services should report to DTGC when changes take place in their facility or service within their sphere of responsibility. The format of data associated with such change should be compatible with the IIMS.

(3) Strengthening of the National Map Committee

In order to implement (1) and (2) above, it is absolutely necessary to strengthen the existing National Map Committee in such a way that the committee meets every month to ensure accurate and timely exchange of information and coordination among various organizations.

(4) Standardization of Control Points

At present, two geographic coordinates co-exist in Senegal, ADINDAN and System 74. In the future, the world standard of WGS-84 system should be adopted, replacing the above two. The standardization work can be done starting from the WGS-84 compatible control point in the Dakar Airport. Field survey data obtained as a part of this Study will be useful for the work of future standardization of control points.

Operating Cost Sharing

(1) DTGC

After the presidential election in February 2000 and the subsequent change in government, DTGC has become under the Ministry of Equipment and Transport (MOET) and was authorized to retain revenues obtained from activities such as the sale of maps. The annual cost of operating IIMS in DTGC has been estimated at 20 million FCFA (US\$ 27,000). It is recommended that funding sources for the operating cost be as follows:

Personnel	Ordinary budget of MOET
Utilities and Communications	Ordinary budget of MOET
Supplies	Sales revenue of DTGC
Cost of large scale data input	Budget of external projects

(2) DUA

The annual cost of operating IIMS in DUA has been estimated at 16 million FCFA (US\$21,000). DUA does not have any independent revenue source and therefore the entire amount would have to be paid out of its budget. However, when DUA supports projects of external organization by utilizing IIMS, the associated cost should be borne by the external organization out of its project budget. It is recommended that funding sources for the operating cost be as follows:

Personnel	Ordinary budget of MOH
Utilities and Communications	Ordinary budget of MOH
Supplies	Ordinary budget of DUA
Cost of large scale data input	Project budget of DUA (including external projects)

New Activities and Independent Revenue Sources

It is recommended that DTGC provide new kinds of maps to general public taking advantage of its ability to produce various kinds of maps, which has been greatly enhanced by this Study project. Street maps and tourist maps can be produced by DTGC and sold to general public at reasonable prices, proceed of which can be used to further improve its operation. It is also conceivable that DUA would charge reasonable fees to applicants of building permit and urban planning certificate as the service level would greatly be improved by IIMS.

DTGC and DUA should hold seminars and training of officials of other agencies and general public on GIS utilizing equipment and manuals provided by this Study.

11 Long Term Recommendations for IIMS Operation

Networking

The initial IIMS is a stand-alone system at DTGC and at DUA. The Operating System used however is capable of networking. A national plan for developing an IT system in Senegal should be established in due course and an inter-agency information network should be gradually established following the national plan. Expansion of the IIMS should be carried out in line with such a direction. Nevertheless, the networking of the IIMS can be done in the following order:

- 1 - between DTGC and DUA
- 2 - between DUA headquarters and DUA branch offices
- 3 - between DUA and the municipality of Dakar
- 4 - between DUA and other municipalities
- 5 - between DTGC and agencies which request such connection

An important issue is security. Access to files kept at DTGC and DUA must be limited to read-only for the foreseeable future. Otherwise accidental or intentional alteration of the files by outsiders may take place, which cannot be properly controlled. Changes or updates to the original data files deemed necessary should be dealt with by sending such a request to DTGC by non-direct means.

Initially, networking can be done by telephone connection dial-up. For heavily used connections an exclusive connection can be installed. A server for each of DTGC and DUA will be necessary before the networking.

Updating and Expansion of Spatial Data Infrastructure

Establishment of the Spatial Data Infrastructure within the IIMS has made it possible for any information within the Dakar Metropolitan Region containing location coordinates to be stored and recalled. The initial IIMS contains about 120 data items with some attributes in addition to location data. Agencies can strengthen Spatial Data Infrastructure by providing more attributes and more information items during the course of carrying out their projects utilizing the IIMS. In this respect, periodical updating of data is an important requirement of the system, though the required precision of data should be appropriately controlled.

Spatial Data Infrastructure has characteristics of common goods, i.e. its consumption by one does not reduce consumption by others. On the contrary, its strengthening associated with consumption benefits all. The National Map Committee should act as a mechanism to encourage its use and its strengthening. The area covered by the IIMS should also be expanded as the Dakar Metropolitan Area expands beyond the area covered by this Study.

Strengthening of GIS Data

GIS data, defined in this study as data not included in Spatial Data Infrastructure, was collected in this Study only from readily available sources, without carrying out fresh surveys. This data also awaits updating in the future. More accurate and up to date data should be collected by actual surveys. This will be a continuous effort by all concerned, particularly DTGC which will be on the receiving end of such updated data. DTGC should make it compulsory for agencies requesting its services and products to provide GIS data concerned with their activities.

Human Resource Development for West Africa

DTGC and DUA could become the center of human resource development in the field of GIS technology for Francophone countries in Africa. DTGC and DUA can train not only their own personnel, but also those who are external through seminars and training sessions open to the public. When the number of these trained persons reaches a certain level, DTGC and DUA can organize seminars and workshops for the general benefit of the whole of Francophone Africa.