

7 IIMS OPERATION AND MANAGEMENT

7.1 System Operation and Management

The Infrastructure Information Management System (IIMS) will serve as a useful tool for urban infrastructure management, urban planning support and decision making among concerned parties. The initial system will be installed in the Department of Geographic and Cartographic Works of the Ministry of Equipment and Transport (DTGC), and in the Department of Urban Planning and Architecture of the Ministry of Urban Planning and Housing (DUA). IIMS can expand its users to various governmental agencies, utility management companies and other private companies in the future.

At this stage, it is essential to establish the institutional framework for better use of IIMS taking the future expansion into consideration.

The IIMS will consist of the following elements:

- 1 Hardware,
- 2 Software,
- 3 Data (spatial data infrastructure and GIS data).

The operation and management of IIMS must be planned and carried out appropriately according to each element.

7.1.1 System Administration

The initial IIMS in DTGC and the one in DUA have slightly different specifications. However, regarding the administration of the system, there will be little difference between each other. A system manager must be assigned and he will take care of the following responsibilities:

- a) System Management
 - Set up the environment for the system (hardware, software, OS and network)
 - User management to protect the illegal usage by personnel
 - Security management (file supervision, measures against virus and log management)
- b) System Maintenance
 - Data backup (system and data)
 - Troubleshooting of system
 - Consumables administration (Control and procurement)

The data media such as diskette, ZIP, CD-R, etc., and expendable supplies such as plotter ink, printer ink, toner, etc. must be kept safely with consumption record.

- Annual maintenance of system (Regular hardware maintenance and software version-up)
 - Facilities management (Power supply, cabling, air conditioning and dust removal)
- c) External Relation
- Coordination among related organizations including representation of the National Map Committee,
 - User Service and Data Management: Service for the external users in data use; existing data management and planning of new data creation.
 - 1) Customer information management
 - 2) Customer service and marketing plan (Marketing, campaign and demonstration of system)
 - 3) Update history management (GIS data and database update history management)
 - 4) Data source management (meta-data management for data sources)
- d) Training
- Appropriate manual for operation must be provided, and
 - Appropriate program for training must be scheduled for the internal technology transfer and data processing of GIS in both counterpart agencies capable of expansion to the steering committee member.

The system manager will take immediate and appropriate action when the system encounters problems or requires attention.

System Development is generally expected to apply to the following tasks:

- Production of theme maps and evaluation maps
- Database development for the design of GIS data and data maintenance
- Data backup
- Training
- Application development including future uses and customizing
- Database management accompanying the data maintenance and software updating (and version-up)

Both agencies are expected to apply the wide-range of GIS data to mapping activities and thus to practical planning. It is therefore necessary for them both to instruct potential users on which operations the GIS data can be utilized through marketing and consulting activities. This is also necessary for the wide use of data that hardware and software engineers will be provided. Therefore, it is expected

that both agencies will be the appropriate organizations to embody demand arising from other governmental agencies

7.1.2 Software Administration

(1) DTGC

The initial IIMS in DTGC provides software suitable for the spatial data infrastructure for the system and image processing in order to prepare the base map. In particular, the preparation of geographic elevation is a specific function of DTGC. As the supplier of such base maps to various future users, the data format exchange is also important.

Within the software functions of DTGC mapping and editing functions with graphics, data must be considered to supply the base map and to produce the GIS data with topological structures. Understanding the GIS data structure and system management helps to perform the data exchange and implement GIS more smoothly.

Staff must be assigned to software management and will take care of the following responsibilities:

- Establishment of GIS data processing method,
- Database design and maintenance of base map and relational database,
- Customization of software according to the demand:
 - i) The internal demand regarding the necessary data management and record management in DTGC in order to manage data such as geodetic information, record management of production of published maps and existing digital mapping data, aerial photos, and so on.
 - ii) The external demand regarding the client users of GIS data as well as production of thematic maps and assistance in spatial data analysis.
- Periodical version-up according to the software supplier's notice.

(2) DUA

The initial IIMS in DUA provides software suitable for preparation of thematic maps, display and analysis related to urban planning and urban problem solution. In addition, as the various socio-economic data will be incorporated in the urban planning process, the function of data import with necessary data exchange will gradually become more important.

In the software function in DUA, thematic mapping on the base map is important to produce a series of thematic maps with spatial database for system management of urban planning with the mapping function and editing function. Relational database

management is useful for database development to arrange the existing information of database in DUA and related agencies such as the building permission control as the facility management in DUA planning. Especially statistic information concerning to the maps must be important for the urban planning to analyze the status of urbanism to the past, present and future. Tabulation and overlay operation in data analysis is useful for the identification of urban status and the estimation of planning effect.

A system manager must be assigned to software and data management and will take the following responsibilities:

- Design and maintenance of database
- Database management of attributes in building permission control:
 - Data information concerning the sector map
 - Attributes for the permission control, location information including name of place, street, address, administrative information etc.
 - Information on ownership
 - The necessary information in the relevant agencies to compile and accumulate the database in DUA.
- Application development for tabulation and overlay to prepare for spatial data analysis
- Periodical version-up according to the software supplier's notice.

7.1.3 Data Management

(1) Spatial Data Infrastructure

The spatial data infrastructure of the initial IIMS is basically prepared by the photogrammetry process as described before. This means the DTGC will broadly be the manager responsible for the spatial data infrastructure.

However, in the case of administrative boundaries, the competent agency is not DTGC but the Department of Land Development of the Ministry of Economy, Finance and Planning (DAT). In this case, DTGC should collaborate with DAT in defining the exact geographic locations of administrative boundaries and provide them with geographical coordinates.

The above case can be applied in the case of roads and railroads, power supply lines, public facilities, vegetation and built-up area. When taking into consideration their attributes, collaboration is essential as the DTGC cannot identify the attributes except their location or size.

DTGC will also serve as an agency to collect and store the maps and information related to GIS. In undertaking this, DTGC will utilize the National Mapping

Committee and act as an organization for supplying thematic maps by carrying out works related to GIS for and on behalf of other governmental agencies.

DUA will play a pioneering role in the administration using the GIS and promotion of it. The GIS will be put into practical use in city planning management and presentation campaign in a form of persuasion or agreement of the residents in implementation of the city plan and the basic study for it.

For improved use of IIMS, the spatial data infrastructure must be updated periodically. Therefore, coordination among agencies is essential for the spatial data infrastructure management. As the existing National Map Committee is chaired by the DTGC, this committee must be efficiently utilized and its role must be enhanced for this purpose. The committee will play a central role in creating a system that facilitates sustainable data updates and/or system expansions in addition to ensuring that relevant organizations conform to it. The system will refer not only to technical issues including quality control of contents, standardization of data format and data update/exchange methodologies, but also to institutional coordination including role clarification.

(2) Other GIS Data

The initial IIMS includes other GIS data such as utilities (sewage, drainage and water supply), public services (transportation, garbage collection) and land use plans (urban plan, zoning, etc.). The latter one is partly DUA's responsibility, however, the former are not. The data preparation of utilities is the responsibility of each utility company and routes of public services are also under responsible organizations.

In many other cases of GIS data, the responsibility lies among various agencies and, as identified in the existing data inventory, the form and media of data varies. Therefore, for the smooth integration of other GIS data, whether updating the existing or incorporating new data according to necessity. The coordination of relevant agencies is also important here. In the case of new data integration, the assignment of data code will be a critical issue to be discussed and determined. The standards of projection method, UTM28-N and CLARK1880, which DTGC have adopted for their maps, should be embraced as the standard for the map coordination system in the IIMS.

Table 7.1.1 indicates the responsibility of each data set in data management, including its updating.

(3) Data Management in DTGC and DUA

Regarding data management in the limited sense, a data manager must be assigned at both DTGC and DUA. He will take the following responsibility:

- Data back-up, update, modification, etc.

Table 7.1.1 Responsibility of Data Management

	Code	Layer of geographic feature	Class of Geographic feature	Sub-Class of geographic feature	Data Structure	Responsible Agency
1	100	Built up area				
2	101		Settlement	Rural Settlement	Polygon	DUA-MUH
3	102			Settlement Regular	Polygon	DTGC-MET
4	103			Settlement Irregular	Polygon	
5	104			Planned Settlement (medium)	Polygon	
6	105			Planned Settlement (large)	Polygon	
7	106			Commerce and Residence	Polygon	
8	107		Industry	Plant	Polygon	
9	108			Warehouse	Polygon	
10	200	Administration				
11	201		Boundary	National	Polygon	DAT-MEFP
12	202			Region	Polygon	Municipalities
13	203			Department	Polygon	DTGC-MET
14	204			Commune d'Arrondissement	Polygon	
15	205		Quartier	Quartier	Point	
16	300	Basic infrastructure				
17	301		Electricity	High voltage line	Line	SENELEC
18	302			Middle voltage line	Line	DTGC-MET
19	303			Equipment	Line	
20	304		Water supply	Water pipe	Line	SONES
21	305			Equipment	Polygon	SDE
22	306		Sewage	Main Sewer pipe	Line	ONAS
23	307			Sub-Sewer pipe	Line	
24	308			Sewer pipe	Line	
25	309			Equipment	Polygon	
26	310		Drainage	Drain	Line	DTP-MET,
27	311			Drainpipe	Line	Municipalities
28	400	Road and Railroad				
29	401		Road	National Road	Line	DTGC-MET
30	402			Region Road	Line	DTP-MET
31	403			Department Road	Line	
32	404			Road in city	Line	
33	405			Farm road	Line	
34	406		Railroad	Railway	Line	
35	407			Railway Station	Line	
36	408		Bus	Bus Route	Line	DTT-MET
37	409			Bus Terminal	Polygon	
38	410		Garbage	Garbage Collection Route	Line	Municipalities

Source: JICA Study Team

Table 7.1.1 Responsibility of Data Management (Continued)

	Code	Layer of Geographic feature	Class of geographic feature	Sub-Class of geographic feature	Data Structure	Responsible Agency
39	500	Vegetation				
40	501		Vegetation	Forestry	Polygon	DTGC-MET
41	502			Swamp area	Polygon	
42	503			Grassland	Polygon	
43	504			Farmland	Polygon	
44	600	Water surface				
45	601		Water	Sea	Polygon	DTGC-MET
46	602		surface	Lake	Polygon	
47	603			River	Polygon	
48	604			River	Line	
49	700	Topography				
50	701		Topography	DTM (10 m)	Grid	DTGC-MET
51	702			DTM (100 m)	Grid	
52	800	Control Points				
53	801		Control	Triangulation Point	Point	DTGC-MET
54	802		Points	Bench Mark	Point	
55	900	Public Facilities				
56	901		Public	Administrative Office	Polygon	DTGC-MET
57	902		Facilities	International Organization	Polygon	DUA-MUH MH, MEN, etc,
58	903			Embassy	Polygon	
59	904			Education	Polygon	
60	905			Health Facility	Polygon	
61	906			Security	Polygon	
62	907			Sports	Polygon	
63	908			Culture	Polygon	
64	909			Tourism	Polygon	
65	910			Information	Polygon	
66	911			Religion	Polygon	
67	912			Market	Polygon	
68	1000	Orthophoto				
69	1001		Orthophoto	Orthophoto	Image	
70	1200	Natural Disaster				
71	1201			Flood	Polygon	MH

Source: JICA Study Team

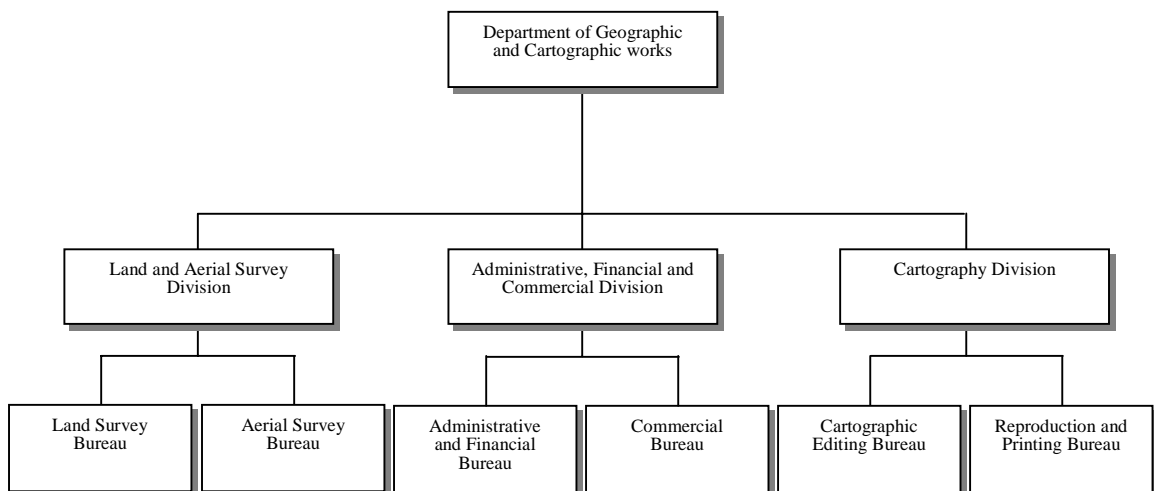
7.2 Structure of DTGC and DUA for Operation of IIMS

At present, DTGC assigns about 5 persons to GIS operation, and DUA about 4 persons. Both systems are currently operated on a daily basis but with difficulties as operational expenses are insufficiently funded. Maintenance and updating of the database are carried out when other agencies commission them to make digital maps or drawings, in order to cover, at least partially, running costs.

7.2.1 DTGC

Following the last presidential election in February 2000, DTGC can save the proceeds from the sale of maps and other products in the DTGC's bank account and utilize the funds in its own right. Accordingly, DTGC is planning an organizational reform for the purpose of enhancement of commercial functions and public relations. The proposed organization chart of DTGC to the Ministry of Equipment and Transport is shown in Figure 7.2.1.

Figure 7.2.1 Proposed Organization Chart of DTGC



Source: DTGC

(1) Role of DTGC in IIMS

The DTGC is expected to play the following roles in the established IIMS:

- Coordinator of IIMS in relation to spatial data infrastructure, GIS data, overall data code, data attributes, system, data exchange, etc. as the chair agency of the National Map Committee,
- Provider and manager of the spatial data infrastructure (base map), and
- Secretariat of IIMS.

(2) Operating Structure in DTGC

As the digital maps are currently produced under two different technical divisions, who are in close collaboration but have different objectives, the existing structure will remain. However, it is strongly recommended to centralize the GIS materials and utilize them jointly.

Currently, DTGC is extending its laboratory to have a common computer center. This must be realized as soon as possible.

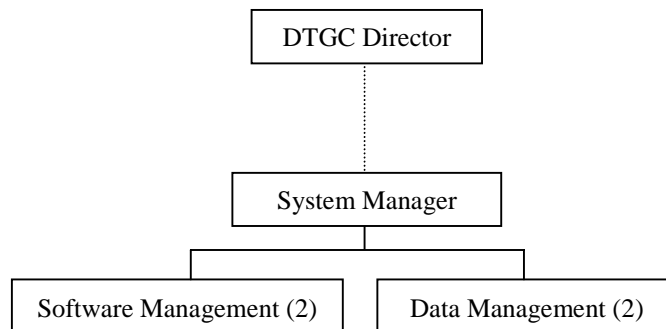
Assuming these circumstances, IIMS will be operated under the following conditions:

- a system manager must be assigned,
- two software management officers must be assigned,
- two data management officers must be assigned,
- external liaison should be assigned to the system manager,
- IIMS should be understood by all the staff of DTGC,
- IIMS can be manipulated by all the technical staff of DTGC,
- the existing DTGC map shop will include IIMS data as a product to cover the expendable supplies,
- public relations must be enhanced to have better coordination with related agencies and organizations.

The proposed organizational structure for the operation of IIMS in DTGC is shown in Figure 7.2.2.

The government maintains a policy of severely limiting new recruits. There is also a lack of computer experts in Senegal. It is very unlikely that DTGC can newly hire experienced personnel for the IIMS in operation in the near future. Therefore, the IIMS will have to be operated by the existing personnel. Currently, there are 5 people taking care of the computerized mapping programs. These same people will have to be assigned to the above work. Although each of them will 'double up' to take charge of the work described above, there must be clear understanding of what is expected of them for the operation of IIMS.

Figure 7.2.2 Operating Structure in DTGC



Source: JICA Study Team

7.2.2 DUA

The DUA does not have any particular source of funding. The operation of IIMS in DUA must be entirely covered as an administration service, which is paid from the national budget. The existing “urban planning tax”, imposed with the application of the building permission or urban planning certificate (see Chapter 4), may be reformed as an earmarked tax.

DUA currently has a so-called GIS unit of its own. Their experience in utilizing GIS or computers for urban planning has already accumulated more than ten years. It is now appropriate to review their organizational structure and introduce wider applications in the department for more efficient urban development support.

(1) Roles of DUA in IIMS

The DUA’s role in the initial IIMS is as GIS user and the following are expected:

- Generation of useful thematic map by request of DUA itself, regional urban planning offices under the Ministry of Urban Planning and Housing, various municipalities, and other organizations and private companies related to the urban development,
- Urban development management by means of examination of building permission, application of urban planning certificates and all other inquiries related to the urban development.

(2) Operating Structure in DUA

It is recommended that the existing GIS unit, “Cellule base de données urbaines et cartographiques” will continuously take care of the IIMS. However, for improved performance of IIMS, real users or manipulators must be expanded to include more urban planners who themselves design detailed plans, and urban administrators

who examine the application of building permission or urban planning certificate, etc.

DUA is also planning to renovate the existing design room “salle de dessin” into a “computer aided urban planning room”. The plan has already prepared and submitted to the Ministry. However, because of the opacity of budget availability, it is still not sure when the room will be ready.

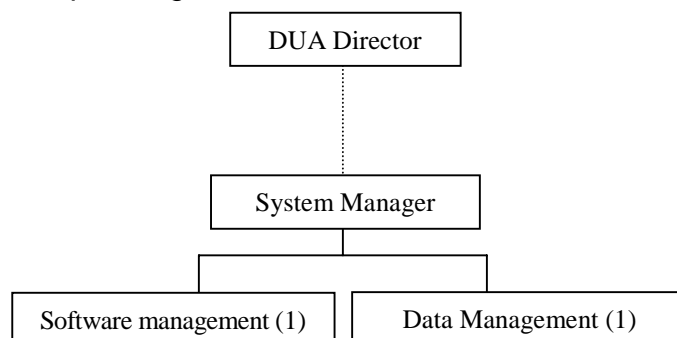
Assuming the above, IIMS in DUA will be operated under the following conditions:

- a system management officer must be assigned,
- a data management officer must be assigned,
- a software manager must be assigned,
- IIMS should be understood by all technical staff of DUA: for this purpose the Study Team has conducted “IIMS introduction workshop” during the Study and a textbook has been prepared for DUA,
- IIMS can be used by whoever requires it for urban planning or management.

The proposed organizational structure for the operation of IIMS in DUA is shown in Figure 7.2.3.

The government maintains a policy of severely limiting new recruits. There is also a lack of computer experts in Senegal. It is very unlikely that DUA can newly hire experienced personnel for the IIMS in operation in the near future. Therefore, the IIMS will have to be operated by the existing personnel. Currently there are 4 people involved in the operation of the existing GIS system. These same people will have to be assigned to the above work. Although each of them will ‘double up’ to take charge of the work described above, there must be clear understanding of what is expected of them for the operation of IIMS.

Figure 7.2.3 Operating Structure in DUA



Source: JICA Study Team

7.3 Future Prospects of IIMS

(1) Increased Role of National Map Committee

All issues within IIMS will relate to the coordination among related organizations, and the role of the existing National Map Committee needs to be enhanced. The official meeting of once a year is not sufficient for the purpose and a monthly meeting will be necessary when the number of users is increased.

The main issues to be discussed and decided are:

- 1 Management of the data code,
- 2 Data form and attributes,
- 3 Data updating,
- 4 Addressing or determination of location,
- 5 System of coordinates and its conversion method, etc.

(2) Standardization of Control Points

Senegal has two coordinate systems, ADINDAN and System 74. Their use, depending on whether it is a large-scale map or a small-scale map, gives rise to confusion. At present, countries around the world are planning to change, or have already changed, to the world geodetic system. Marine charts and nautical charts already use a uniform coordinate system. The world geodetic system should be used in Senegal too. The data obtained from the present survey is recorded and stored in digital form, and will be useful in future when changing to the world geodetic system (WGS-84).

Leveling was carried out in 1952-54 and 1980-81, but it was not possible to find a number of 1st order benchmarks located along national highway Route 1. The benchmarks are located on structures such as bridge piers and buildings as well as stone marks, but they may have been lost with the passage of time due to destruction or rebuilding. As road works are presently under way on Route 1 in suburbs to widen roads, due attention should be paid to such benchmarks. If benchmarks are in danger of being destroyed, consideration should be given to moving them in advance.

In order to conform to the world geodetic system, it is necessary to form an international geodetic network, but in Senegal, as there is a control point required for the world geodetic system at Dakar Airport, it will be necessary to combine it with the System 74 starting point in HANN.

(3) System Networking

While the initial IIMS is stand-alone, it is capable of networking and an inter-agency information network can be established. A national plan for

developing an IT system could set out such expansion plans. Networking could link DTGC and DUA, and DUA with its branch offices and municipalities, as well as linking other concerned agencies although security will be an important issue.

7.4 Operating Cost of IIMS and Cost Recovery

7.4.1 Current Budget for GIS Operation at DTGC and DUA

As described in the preceding section, the proposed IIMS will be operated without major changes in the respective organizations. Personnel costs and utility costs will remain the same and are therefore excluded from further considerations. Major cost items for the operation of IIMS will be:

- maintenance of GIS hardware;
- procurement of consumables; and
- air-conditioning.

Budget figures for 1999 for DTGC and DUA indicate the following:

- Budget for the maintenance of PCs and GIS hardware is secured.
- DTGC carries out hardware maintenance every two months whereas DUA spends little on hardware maintenance.
- No budget is reserved for the repair of hardware. Repairs are done on the basis of emergency allocation.
- Maintenance of air-conditioning is budgeted and costs 35,000 per time.
- No budget is allocated for consumables, external projects normally pay for them. Reliance on the PADDEL Project is particularly high.
- Among consumables, prominent items are ink-cartridges for A4 color printer, roll papers for A0 color plotter and four kinds of ink-cartridges. Estimated consumption is shown below.

Table 7.4.1 Consumption of Ink-Cartridge and Plotter Papers

Ink-Cartridge	BW	Color
DTGC	12	6
DUA	20	20

Plotter	A0 Roll Paper	Ink
DTGC	20 rolls	15 sets
DUA	50 rolls (estimated)	10 sets BW 4 sets, Color 2sets

Note: DTGC's budget for consumables in 1999 was 992,000 FCFA.

Data backup is done once or twice a year. Backup media has not been acquired. CD-ROM (Read Only) has not been utilized often.

Frequency of customer services is shown below.

Table 7.4.2 Customer Services

DTGC	Map Sales Service at the Customer Window	More than 10 users per day, More than 50 users per week including GIS Data service
DUA	Map Data and Documents Preparation Services	At least 300 / year

7.4.2 Market Prices

(1) Hardware Maintenance

Suppliers of IIMS equipment gave indicative prices for maintenance and consumables. Annual cost of hardware maintenance is shown below.

Table 7.4.3 Equipment Maintenance Cost

Equipment	Quantity	Unit Price	Total Price	Contract Type
Printer Laserjet 5000N	2	350,000	700,000	Parts and Labor
HP Design Jet 750C plus	2	700,000	1,400,000	Parts and Labor
Workstation 610/550 DELL	2	450,000	900,000	Parts and Labor
DELL Ecran 21"Action	2	150,000	300,000	Parts and Labor
Printer Deskjet 1120C	2	985,00	1,970,00	Parts and Labor
Total amount		3,497,000	3,497,000	Not including VAT of 20%

As for peripheral equipment, the following table is based on data provided by DTGC.

Table 7.4.4 PC and Peripheral Maintenance Costs

Equipment	Unit Price (FCFA)
PC Micro-computer IBM Compatible	90,000
PC Micro-computer Apple Macintosh	90,000
Laser Printer	75,000
Ink-jet Printer	60,000
Plotter	140,000
Scanner A0	60,000
Digitizer	40,000
Others	20,000

(2) Software Customer Support Charges

Annual charges for software customer support are shown below.

Table 7.4.5 Software Customer Support Charges

No.	Software	Distributor	Price	FCFA	Note
1	ArcInfo8.02	ESRI FRANCE	32,950FrF	3,295,000	
2	TIN module of ArcInfo	ESRI FRANCE	10,300FrF	1,030,000	
3	GeoConcept4.1expert	GeoConcep Corporation	796Euro	522,168	18% of the marketing price 4,420(Euro)
4	Idrisi32 and CartaLinxV1.2	Clark University, USA	200US\$	300,480	
	Total Amount (FCFA)			5,147,648	

(3) Market Prices of Consumables

Prices of consumables for the procured equipment are shown in Table 7.4.6.

Table 7.4.6 Prices of Consumables

No.	Name of equipment and specification	Unit price (FCFA)	Agent
1	The media of ZIP(100Mb and 2 Mb	13,432	Buhan &Teisseire
2	The media for CD-R (74 mm)	2,052	Buhan &Teisseire
3	A0 size of roll paper for HP 750C plus	22,048	Buhan &Teisseire
4	The ink cartridge of Black and white for HP 750C plus	26,224	Buhan &Teisseire
5	The ink cartridge of Magenta	42,779	Buhan &Teisseire
6	The ink cartridge of Cyan for HP 750C plus	42,779	Buhan &Teisseire
7	The ink cartridge of Yellow for HP 750C plus	42,779	Buhan &Teisseire
8	Toner of the laser printer for HP5000N	109,092	Buhan &Teisseire
9	A4 size copy paper (500paper/sheet)	2,592	Buhan &Teisseire
10	A size copy paper (500paper/sheet)	9,246	Buhan &Teisseire
11	The ink cartridge of black and white for HP 1120C	33,415	Buhan &Teisseire
12	The ink cartridge of 3 color for HP1 20C	28,939	Buhan &Teisseire
13	A4 size coating paper paper/sheet	20,715	Buhan &Teisseire
14	A3 size coating paper paper/sheet	33,800	Buhan &Teisseire

7.4.3 System Maintenance Cost Estimation

The hardware maintenance cost and cost of consumables were separately estimated. Estimates are compared with the annual budget of DTGC of 4,086,000 FCFA for the year 2000.

(1) Hardware

The values indicated in Table 7.4.3 indicate a total of 3,497,000 FCFA, which is an unrealistic figure. Using actual budget values shown in Table 7.4.4 gives estimates shown in Table 7.4.7.

Table 7.4.7 Maintenance Cost Estimates for PC and Peripherals

Equipment	Unit Price (FCFA)	DTGC		DUA	
		Quantity	Total (FCFA)	Quantity	Total (FCFA)
PC Micro-computer IBM Compatible	90,000	1	90,000	1	90,000
Laser Printer	75,000	1	75,000	1	75,000
Ink-jet Printer	60,000	1	60,000	1	60,000
Plotter	140,000	1	140,000	1	140,000
Scanner A0	60,000	1	60,000		
Digitizer	40,000	1	40,000	1	40,000
Others	20,000	2	40,000	2	40,000
Total amount not including 20% of VAT			505,000		445,000

(2) Annual Cost of Customer Support

The cost of annual support, as claimed by suppliers, sums to 5,147,648 FCFA, an unrealistic figure considering the current level of the annual budget.

(3) Annual Cost of Consumables

Including data provision to other agencies and data backup, 50 CD-ROMs and 10 ZIP media will be needed annually. Other consumables were costed from the experience of DTGC. Table 7.4.8 shows the results. The annual total is estimated at 4,038,049 FCFA.

Table 7.4.8 Cost Estimates for Consumables

No.	Name of equipment and specification	Quantity	Unit price FCFA	Total amount FCFA
1	The media of ZIP(100Mb and 2 Mb	10	13,432	134,320
2	The media for CD-R (74 mm)	50	2,052	102,600
3	A0 size of roll paper for HP 750C plus	20	22,048	440,960
4	The ink cartridge of Black and white for HP 750C plus	15	26,224	393,360
5	The ink cartridge of Magenta	15	42,779	641,685
6	The ink cartridge of Cyan for HP 750C plus	15	42,779	641,685
7	The ink cartridge of Yellow for HP 750C plus	15	42,779	641,685
8	Toner of the laser printer for HP5000N	2	109,092	218,184
9	A4 size copy paper (500paper/sheet)	10	2,592	25,920
10	A size copy paper (500paper/sheet)	5	9,246	46,230
11	The ink cartridge of black and white for HP 1120C	10	33,415	334,150
12	The ink cartridge of 3 color for HP1 20C	5	28,939	144,695
13	A4 size coating paper paper/sheet	5	20,715	103,575
14	A3 size coating paper paper/sheet	5	33,800	169,000
			Total amount	4,038,049

7.4.4 Operating Cost Projections

The total cost of operating IIMS in DTGC and DUA were estimated by combining the figures in the preceding sections and assuming an annual growth rate of 3%. Table 7.4.9 and Table 7.4.10 show indicative cost streams for DTGC and for DUA in operating respective IIMS.

Table 7.4.9 Operation Cost Projection in DTGC

	1 st Year	2 nd Year	3 rd year	4 th Year	5 th Year
Personnel	10,000,000	10,300,000	10,610,000	10,930,000	11,260,000
Electricity, Telephone	240,000	247,000	255,000	262,000	270,000
Consumables	4,039,000	4,160,000	4,285,000	4,414,000	4,546,000
Software Maintenance	4,626,000	4,765,000	4,908,000	5,055,000	5,207,000
Hardware Maintenance	505,000	521,000	536,000	552,000	569,000
Total	19,410,000	1,993,000	20,594,000	21,213,000	21,852,000

Unit: F CFA

Source: JICA Study Team

Table 7.4.10 Operation Cost Projection for DUA

	1 st Year	2 nd Year	3 rd year	4 th Year	5 th Year
Personnel	10,000,000	10,300,000	10,610,000	10,930,000	11,260,000

Electricity, Telephone	240,000	247,000	255,000	262,000	270,000
Consumables	4,039,000	4,160,000	4,285,000	4,414,000	4,546,000
Software Maintenance	823,000	848,000	874,000	900,000	927,000
Hardware Maintenance	445,000	459,000	473,000	487,000	501,000
Total	15,547,000	16,014,000	16,497,000	16,993,000	17,504,000

Unit: F CFA

Source: JICA Study Team

7.4.5 Cost Recovery

Regulatory reforms, which took place after the presidential election in February 2000, made it possible for DTGC to retain revenues from the sale of maps and charges of services to other organizations. DTGC can earn a substantial amount by gaining the trust of users through the quality upgrading of its map products. Such new products may include a street map of Dakar showing street names and area names, residential map, tourist map, and so on.

DUA, however, has not as many options for new business as DTGC. It is desirable that users of information including thematic maps produced by DUA should be charged for the cost of such services. In order for the users to readily accept such charges, the quality of the services should be improved.

In order to meet the above objectives, it is important that the National Map Committee should be strengthened and revitalized.